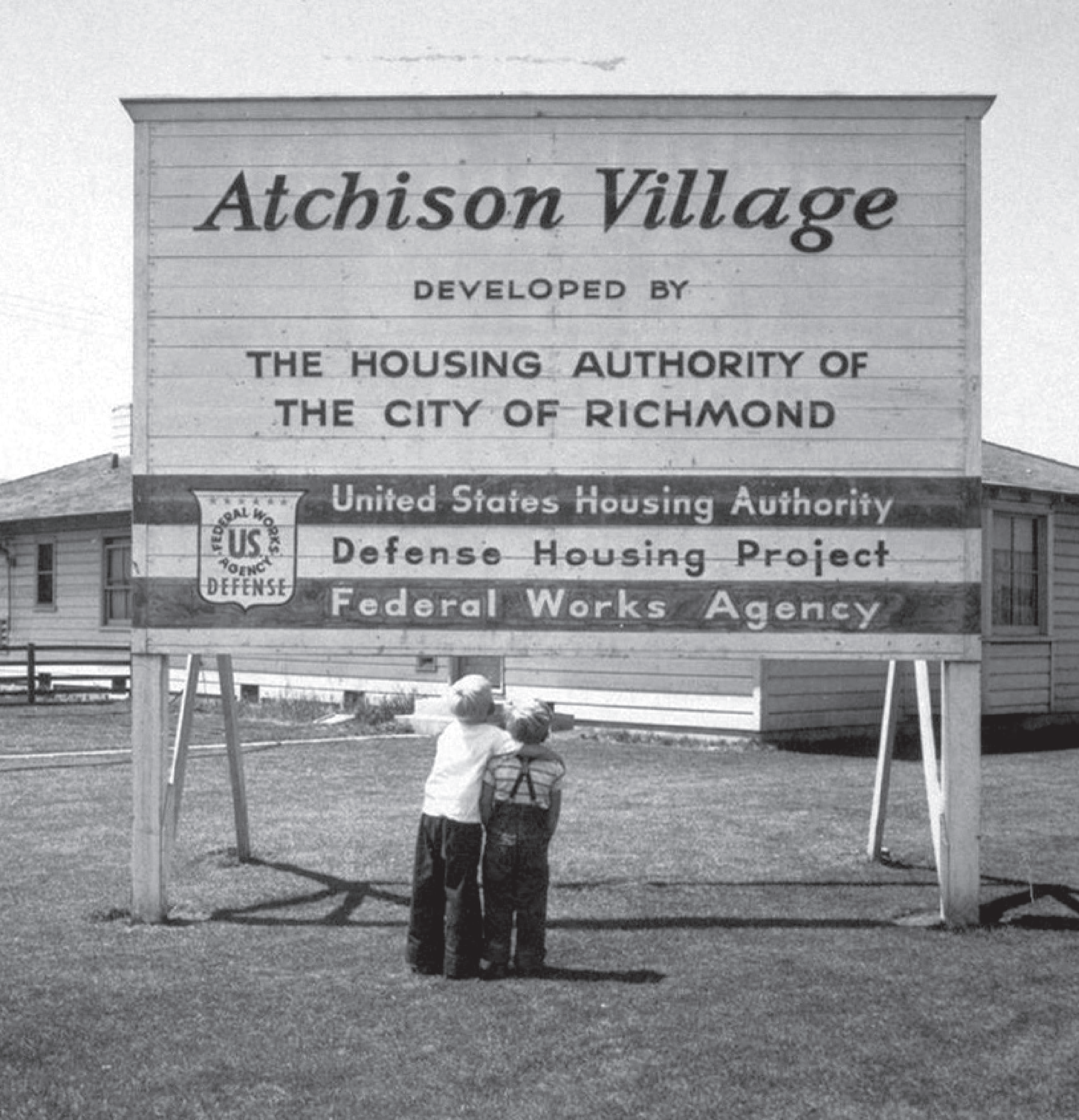


# ATCHISON VILLAGE

Mini-Historic Structure Report
& Preservation Plan

September 30, 2009

PAGE & TURNBULL

The activity which is the subject of this HSR has been financed in part with Federal funds from the National Park Service, Department of the Interior, through the California Office of Historic Preservation. However, the contents and opinions do not necessarily reflect the view or polices of the Department of the Interior or the California Office of Historic Preservation, nor does mention of trade names or commercial products constitute endorsement or recommendation by the Department of the Interior or the California Office of Historic Preservation.

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# PART I: INTRODUCTION

## PROJECT OVERVIEW

The City of Richmond, Atchison Village Mutual Homes Corporation (Atchison Village), the National Park Service, and the California Office of Historic Preservation have initiated this Mini-Historic Structures Report (Mini-HSR) and Preservation Plan in order to inform future rehabilitation planning for the Atchison Village neighborhood.

The Atchison Village Defense Housing Project (Cal. 4171-X) was constructed in Richmond, California, in 1941 as permanent housing for workers in World War II defense industries. Six decades after construction, the development, now called the Atchison Village Mutual Homes Corporation (Atchison Village), is a district within the Rosie the Riveter/World War II Home Front National Historical Park, established through an act of the United States Congress and signed into being by President Clinton on October 24, 2000. Because Richmond presents a critical mass of extant structures that were built solely for the World War II home front effort, the National Park Service found the city to be the best location in the nation for a home front national park. Atchison Village not only plays an integral role in the Rosie the Riveter National Historic Park, but also stands as a prime example of one of the only public defense housing projects remaining in the United States.

Atchison Village was one of three permanent housing developments constructed in Richmond, California during World War II; many other Richmond defense housing projects were constructed as temporary housing. Today, Atchison Village is one of only two remaining defense housing projects in Richmond, and is the best example to convey the importance of these building typologies in the history of the World War II home front effort.

Atchison Village was listed in the National Register of Historic Places (National Register) in 2003. The development was determined to be a historic district of national significance under Criterion A (Event) for its association with federal and local governmental efforts to "provide low-cost family housing for workers involved in the defense shipbuilding industry during World War II." In order to better inform this Mini-HSR, the client requested that the 2003 National Register nomination be reviewed and updated in specific areas. Under a separately funded project, Page & Turnbull completed an evaluation of the Atchison Village property under National Register Criterion C.

A draft study of the property's eligibility under National Register Criterion C was completed by Page & Turnbull in March 2009. (See Draft Atchison Village National Register Evaluation in Appendix for detailed information). This study provided additional historic context information on the architecture and planning of Atchison Village and an evaluation of the property under Criterion C (Design/Construction). The context explored earlier developments in the design and planning of public housing projects that influenced the design of Atchison Village, beginning with the Garden City movement at the turn of the 20th century and continuing to World War II. This study found the district to be eligible for the National Register under Criterion C at the local level as a property type associated with the architecture, and community planning and development themes. The Mini-HSR recommends that the Criterion C evaluation be used in the future to update the existing National Register nomination to include evaluation of the property under Criterion C. For the purposes of the Mini-HSR, character-defining features were identified as associated with both Criterion A and Criterion C, and recommendations focus on the preservation and rehabilitation of all identified character-defining features according to the Secretary of the Interior's Standards of the Treatment of Historic Properties (The Standards).

## PURPOSE

The Atchison Village site and buildings are in good to fair condition and the historic integrity of the district is intact. However, some recent repairs, alterations, and additions have been carried out on a project-by-project basis. If this practice is left to continue, these changes may eventually threaten the district's original fabric, character-defining features, and overall historic integrity. Many existing conditions are in need of remediation in order to halt continuing deterioration, which threatens historic fabric.

As a National Register listed property that contributes to the Rosie the Riveter/World War II Home Front National Historical Park, Atchison Village should be preserved and maintained in a manner that allows it to continue to convey its importance as an historic district. This Mini-HSR is the first step toward accomplishing this goal; it summarizes the history and development as defined by previous studies, evaluates existing conditions for the site and buildings, and identifies appropriate approaches to the treatment of this historic neighborhood.

It is important that an HSR be prepared in advance of any anticipated rehabilitation, restoration or major maintenance work. Past studies and reports have fully documented the history, historic context and significance of Atchison Village. The purpose, therefore, of this Mini-HSR is to focus on identifying existing conditions and provide guidance for treatment of the buildings and site, with a simultaneous goal of increasing sustainable "green" measures in the neighborhood. This Mini-HSR is principally for the use of the City of Richmond and the Atchison Village Mutual Homes Corporation, as well as maintenance staff and community residents.

## METHODOLOGY

Page & Turnbull and its consultant team surveyed Atchison Village during a site visit conducted on February 24th and 25th, 2009. Prior to the site survey, the team reviewed all known reports supplied by the City of Richmond and the National Park Service (NPS), and reviewed the original drawings for the site and buildings. Preparation for the assessment included summarizing for all consultant disciplines the results of a community meeting on February 19, 2009 whereby more than 30 residents of Atchison Village provided input into the problems and issues that they wanted the Mini-HSR to address.

Throughout the preparation of this Mini-HSR, the project team sought to cover all relevant issues in as much detail as our scope and resources allowed. Our goal was to create a practical and comprehensive document that would continue to be useful for many years.

## EXECUTIVE SUMMARY

The purpose of the Mini-HSR is to document the property and provide useful guidance for the treatment of the buildings and landscape elements of the district. This Mini-HSR was produced at the request of the City of Richmond and the Atchison Village Mutual Homes Corporation, and will principally be used by these two parties. The Mini-HSR will also be used by residents and private contractors hired to perform restoration, rehabilitation, preservation and maintenance work at Atchison Village. The document is meant to provide baseline information to guide management decisions and aid in establishing prioritized maintenance and rehabilitation strategies for the district.

Atchison Village is part of the Rosier the Riveter/World War II Home Front National Historical Park. The property is located on a flat 30-acre site bounded by Macdonald Avenue, 1st Street, West Ohio Avenue, and Garrard Boulevard. Atchison Village was listed in the National Register of Historic Places in 2003 as a district with the following contributing features: Community Center, park, and five residential building types. Architectural features within the district include 162 one- to two-story residential buildings and a one-story Community Building designed in a simple utilitarian style. Landscape features within the district include the overall layout of the site, specimen trees, screening vegetation at property boundaries, and walkways. The site plan of Atchison Village does not continue the rectilinear street grid of the City of Richmond, and instead features curved and diagonal streets. Buildings are oriented to the street or grouped around small courtyards. The Community Building and an open playing field are located at the center of the development near the entrance.

# ADMINISTRATIVE DATA

## Project Information

The City of Richmond, Atchison Village Mutual Homes Corporation (Atchison Village) the National Park Service, and the California Office of Historic Preservation have initiated this Mini-HSR in order to inform future rehabilitation planning for the Atchison Village neighborhood. The purpose of the Mini-HSR is to establish guidelines for future preservation, maintenance and rehabilitation of the Atchison Village buildings and landscape. This Mini-HSR provides a summary of the historical and architectural background for the district as well as recommended treatments and a prioritized preservation plan to guide future work on the site.

This Mini-HSR is funded jointly by the City of Richmond Planning & Building Services Department, Richmond Community Redevelopment Agency, and a Certified Local Government Grant from the National Park Service and the California Office of Historic Preservation.

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## LOCATION

Atchison Village is located on the eastern shore of the San Francisco Bay in the southwest portion of Richmond, California, adjacent to the right of way for the Burlington Northern Santa Fe Railroad. Historically, the site of Atchison Village sat along the eastern shore of extensive tidal marshes that once separated Point Richmond from the higher ground to the east. The property consists of 162 residential buildings, a community center and associated park.

### Boundary Description

The Atchison Village property is bounded by West Macdonald Avenue to the north, West Ohio Avenue to the south, First Street to the east, and Garrard Boulevard to the west.

## PREVIOUS REPORTS/RELATED STUDIES

### General Management Plan/Environmental Assessment

The Rosie the Riveter/World War II Home Front National Historical Park was The Rosie the Riveter/World War II Home Front National Historical Park was added to the national park system on October 24, 2000. The purpose of the General Management Plan/Environmental Assessment (GMP/EA) for the Rosie the Riveter/World War II Home Front National Historical Park is to present and analyze alternatives for guiding the management of the park for the next fifteen to twenty years. The GMP/EA was released in January of 2009. The plan explores three different alternatives for developing and managing the new national park in Richmond, California.

The alternatives include Alternative A: No Action, Alternative B: Explore Richmond to Understand the National Home Front Story, and Alternative C: The Home Front Visitor/Education Center Tells the National Home Front Story. Alternative B, Explore Richmond to Understand the National Home Front Story, has been identified as the "preferred alternative." This alternative focuses on making the park accessible to park visitors by creating opportunities throughout the City of Richmond for visitors to explore World War II home front sites, structures, and stories. The alternative would include programs for both the rehabilitation of historic resources and interpretation of these resources. Atchison Village would be a cooperating interpretation partner under this alternative for its role as a home front community during World War II. The official comment period on the GMP/EA closed on April 29, 2009.


Figure 1.1 - Location Map.

## Cultural Resource Data: National Register of Historic Places Documentation[1]

### *Summary*

The Atchison Village Defense Housing Project was entered in the National The Atchison Village Defense Housing Project was entered in the National Register of Historic Places (National Register) on May 30, 2003. The National Register documentation for Atchison Village states:

The former Atchison Village Defense Housing Project, presently known as Atchison Village Mutual Homes Corporation, consists of 162 separate buildings comprising 450 dwellings units in addition to the Community Center Building and the 'playing field.' The community sits on a flat 30 acre site in central Richmond, California, between an industrial region, the Burlington Northern Santa Fe Railroad yard, and low income housing. This mid-twentieth century vernacular housing project reflects the typical construction and design practices of the United States Housing Authority (USHA) pre-World War II. The building assemblies include concrete foundations, light-weight wood stud frames, and vinyl over weatherboard siding.

All of Atchison Village's significant features, including the 162 domestic buildings of five different designs, the Community Building and the four-acre park, maintain a high degree of their historic appearance. The deed to the defense housing project transferred in 1957 from the Federal Housing Administration (FHA) to the non-profit Atchison Village Mutual Homes Corporation. The corporation supports strict development restrictions regarding any changes made to the community. Thereby the integrity of the project has been strenuously guarded.

### *Statement of Significance*

According to the National Register documentation:

Atchison Village Defense Housing Project is eligible for the National Register of Historic Places [at the national level] under criterion A because it represents an important effort by both the federal and local governments to provide low-cost family housing for workers involved in the defense shipbuilding industry during World War II. Just prior to and during the war, the Lanham Act of 1940 provided $150 million to the Federal Works Administration, which built approximately 625,000 units of housing in conjunction with local authorities nationwide. Brigadier General Philip B. Fleming, then Federal Works Administrator, selected the Richmond Housing Authority (RHA) to be the first authority in the country to manage a defense project. Atchison Village represents one of twenty public housing projects built in Richmond before and during World War II. Constructed in 1941 as Richmond's first public defense housing project, it is the only project funded by the Lanham Act extant in Richmond and one of the few in the nation that was not destroyed. Atchison Village has already been designated a Richmond 'Historic Resource' and has been listed as a 'theme-related site' in conjunction with the Rosie the Riveter/World War II Home Front National Historical Park.

In addition to the property's significance under Criterion A, an evaluation of the property's significance under Criterion C was completed by Page & Turnbull to inform the recommendations of the Mini-HSR. Following is a brief summary of the conclusions that were developed for the Criterion C evaluation.

1 The following information is summarized from the existing National Register Nomination for the Atchison Village Defense Housing Project, Cal, 4171-X, entered May 30, 2003.

*Evaluation under Criterion C*

Atchison Village appears to be significant at the local level under National Register Criterion C (Design/Construction) as a Public Housing Project property type and under the Architecture and Community Planning & Development themes. It is one of two remaining defense housing projects in Richmond, a city that held the largest World War II federal housing program in the U.S. Furthermore, it represents a local example of how national trends in public housing were applied to wartime defense housing developments. (For detailed information, see the Atchison Village National Register Evaluation: Criterion C in the Appendix).

*Period of Significance*

The period of significance for Atchison Village begins in 1941, the year the district was constructed, and ends in 1950, the year the U.S. government began the process of conveyance of the property.

*Integrity*

According to the National Register documentation:

> Through the years the Atchison Village Mutual Homes Corporation established development regulations that serve to guide any changes to the community structures. Therefore, modifications have been minimal and strictly guarded. The most significant alterations to the buildings include the addition of metal security bars over many of the windows and doors, and the installation of vinyl siding over the extant, historic redwood boards. The vinyl siding replicates the size, profile, and colors of the original cove rustic siding, and does not obscure any architectural features of the structures. Thereby, the integrity of the district was not damaged by the addition of the new siding. The original wood-encased chimneys have since been replaced with prefabricated insulated metal chimney flues. Regulations also allowed for storage sheds to be located on the back patios with a maximum coverage of 50 percent of the area, not to exceed 120 square feet in size, and for new fences or hedges, at a maximum height of six feet, to enclose back and side yards. The corporation permitted one unit to construct an accessible concrete ramp to the front entrance. The majority of original doors and windows remain intact.
>
> A few alterations affect the entire village such as the addition of parking spaces, primarily located behind structures, to provide individual units with more than the original one allocated space. In 1992, the City of Richmond constructed a sound wall along the western edge of the village to dampen the noise from the recently expanded Garrard Boulevard as part of the new Richmond Parkway project. This wall blocks access to the village from the western intersections of Garrard and Bissell Avenue to the north and Chanslor Avenue to the south. In conjunction with this project, Public Services also formed new cul-de-sacs at the road ends. In November of 1998 the city government introduced two street-wide gates, at the eastern Bissell Avenue and Chanslor Avenue entrances, as a crime reducing measure. Now only one entrance to Atchison Village remains available to the public.

Overall, the integrity of Atchison Village has not changed since the National Register nomination was completed in 2003. Several individual rehabilitation projects have introduced incompatible garages, replacement windows, fencing and landscape elements, outbuildings, and other features. The landscape of Atchison Village has changed over time with the replacement of trees, addition of parking, and other similar changes. However, the major character-defining features of the site remain, including the overall site layout with a central park, vehicular and pedestrian circulation patterns, front yards with central paths, and minimal foundation plantings. Although alterations have been made changes to individual features of Atchison Village, overall these changes do not diminish the integrity of the district. Currently, the district retains sufficient integrity to convey its significance as an example of an important effort by both the federal and local governments to provide low-cost family housing for workers involved in the defense shipbuilding industry during World War II. However, it is important to note that if incompatible changes continue to occur on a case-by-case basis, the integrity of the district could be compromised and affect the National Register eligibility of the district.


Figure 1.2- Atchison Village Building Types Site Map.

*Contributing Site Features (as identified in the National Register Nomination)*
According to the National Register nomination form, the following features contribute to the significance of the Atchison Village Defense Housing Project:

**Playing Field**
The Playing Field is a four-acre park located at the center of the district. In 1957, the title for the triangular green space was transferred to the City of Richmond, which maintains the playing field as a public park. The park includes a baseball diamond in the southeast corner and children's playground equipment enclosed by a chain link fence south of the Community Building.

**Community Building**
The Community Building sits in a prominent location at the intersection of Collins and Curry Streets in the northern-most portion of the district. The Community Building includes a social room, crafts room, general, managerial and custodial offices, a repair shop, and storage rooms. The building is generally L-shaped in plan and contains approximately 7,000 square feet. The National Register documentation described the building as follows:

> Built at grade, the structure sits on a concrete foundation. The central, pitched shingled roof over the Social Room rises up one-and-one-half stories to a height of 22 feet, which the rest of the structure remains one story with a low-pitched composite roof standing at only 11 feet. Redwood, cover rustic wood siding historically clad the structure, punctuated by wood double-hung sash windows. Typical features include wood-sash windows aligned in horizontal rows, wood paneled doors, some with glass insets, wood boxed chimneys, corner boards, and linear roof lines accented with wood cornices and a two-foot overhang. The north elevation is the primary façade. It serves as the entrance both to the building, as well as to the village.

**Residential Buildings**
The 162 residential buildings at Atchison Village are divided into five different typologies that range from one to two stories in height and two to four units per building (see Figures 1.4 - 1.8).

Figure 1.3 - Playing Field/Park. Source: PGAdesign, 2009.

Figure 1.4 - Building Typology 1. Source: Page & Turnbull, 2009.

Figure 1.5 - Building Typology 2. Source: Page & Turnbull, 2009.

Figure 1.7 - Building Typology 4. Source: Page & Turnbull, 2009.

Figure 1.6 - Building Typology 3. Source: Page & Turnbull, 2009.

Figure 1.8 - Building Typology 5. Source: Page & Turnbull, 2009.

## Character-Defining Features[2]

Character-defining features are defined as the essential physical features that enable the property to convey its historic identity. Distinctive character-defining features are the physical traits that commonly recur in property types and/or architectural styles.

*Neighborhood and Site*

Symmetrical site layout and cluster arrangement of building
Buildings oriented towards the street or grouped around shared courtyards
Centrally located park/playing field*
Centrally-located Community Building
Courtyards
Side yards
Interior small play areas
Lack of fences
Efficient use of space planning in buildings (demonstrated by lack of dining rooms, short hallways, etc.)*
Standardized parts and building materials*
Parking stalls*
Curvilinear and diagonal streets
Separate pedestrian and automobile routes
Straight walkways throughout site and curved walkways in park

2 Note: * Indicates character-defining features identified in the 2003 National Register Nomination for the property. Additional character-defining features were identified as a result of on-site survey conducted as part of the HSR project and additional research conducted for the separately funded Criterion C evaluation.

*Landscape*

Plantings, including lawns and trees*
Very limited plant palette – five species of trees and twelve species of shrubs. Of the trees, two are used approximately 85% of the time in all areas.
Single species of tree planted along entire length of each block.
The placement of trees near sidewalks and pathways leaving large expanses of open space.
Use of Pines to define the entire perimeter of the park and the community building block.
Low ground (or lot) coverage
Use of hedges to screen rear yards and parking bays.

*Community Building*

Simplified architectural style
Wood-sash windows aligned in horizontal rows*
Wood-paneled doors (some partially-glazed)*
Wood-boxed chimneys*
Corner boards*
Linear roof lines*
Siding patterns and colors (original redwood siding has been covered by stucco)*

*Residential Buildings*

Five residential building types
Common design and materials for building interiors
Simplified architectural style with lack of architectural ornamentation
Double-hung wood-sash windows*
Partially-glazed, paneled doors*
Covered concrete porches*
Shingled roofs*
Exposed rafter tails*
Siding patterns and colors (original redwood siding has been covered by vinyl siding)*
Interior finishes: tongue-and-groove wood flooring, linoleum flooring, gypsum lath and plaster walls, stained wood trim*

# PART II: DEVELOPMENTAL HISTORY

## BACKGROUND AND CONTEXT

Built in 1941 to house defense workers in the local Kaiser shipyards, Atchison Village was the first defense housing development in the country to be built under the Lanham Act, and Richmond's first public defense housing project. It included 450 units in 162 residential buildings, plus a central Community Building. The project provided spacious, clean, highly desirable dwellings during the war and was called "Richmond's most coveted wartime housing project" by a 1954 city report.[1] The development was purchased in 1957 by a resident-formed housing cooperative, which still owns the property. Atchison Village has not sustained any major physical changes since its original construction.

### Construction

Because Atchison Village was intended to be permanent housing, it was constructed with relatively high-quality materials and construction techniques. This was unusual among wartime housing developments and especially projects funded by the Lanham Act, which required most projects to be temporary housing. Like other wartime housing, though, time and cost efficiency were critical in building Atchison Village (see Figure 2.1 and 2.2).

Standardized elements kept costs lower and sped up construction—a necessary challenge due to the Lanham Act's cost ceiling of $3,500 per unit. Five plan types were repeated throughout the development, lowering design and construction costs. All buildings featured hip roofs and redwood cladding, and the residential buildings included matching paneled doors, double-hung wood-sash windows, and covered concrete porches. The dwelling units had identical interior finishes, with wood and linoleum flooring, gypsum lath and plaster wall and ceiling finishes, and stained wood trim.

1 *Atchison Village and Annex Housing Projects: Brief Historical Review and Alternate Methods of Future Operation*, Richmond, Office of the City Manager, October 25, 1954, D6, qtd. in "Atchison Village Defense Housing Project," National Register of Historic Places Registration Form, 1003: 16.


Figure 2.1 - View of Atchison Village during construction, ca.1941.
Source: Richmond Museum.

It has not been determined whether any of the new prefabrication techniques utilized by the war-time building industry were used during the construction of Atchison Village.

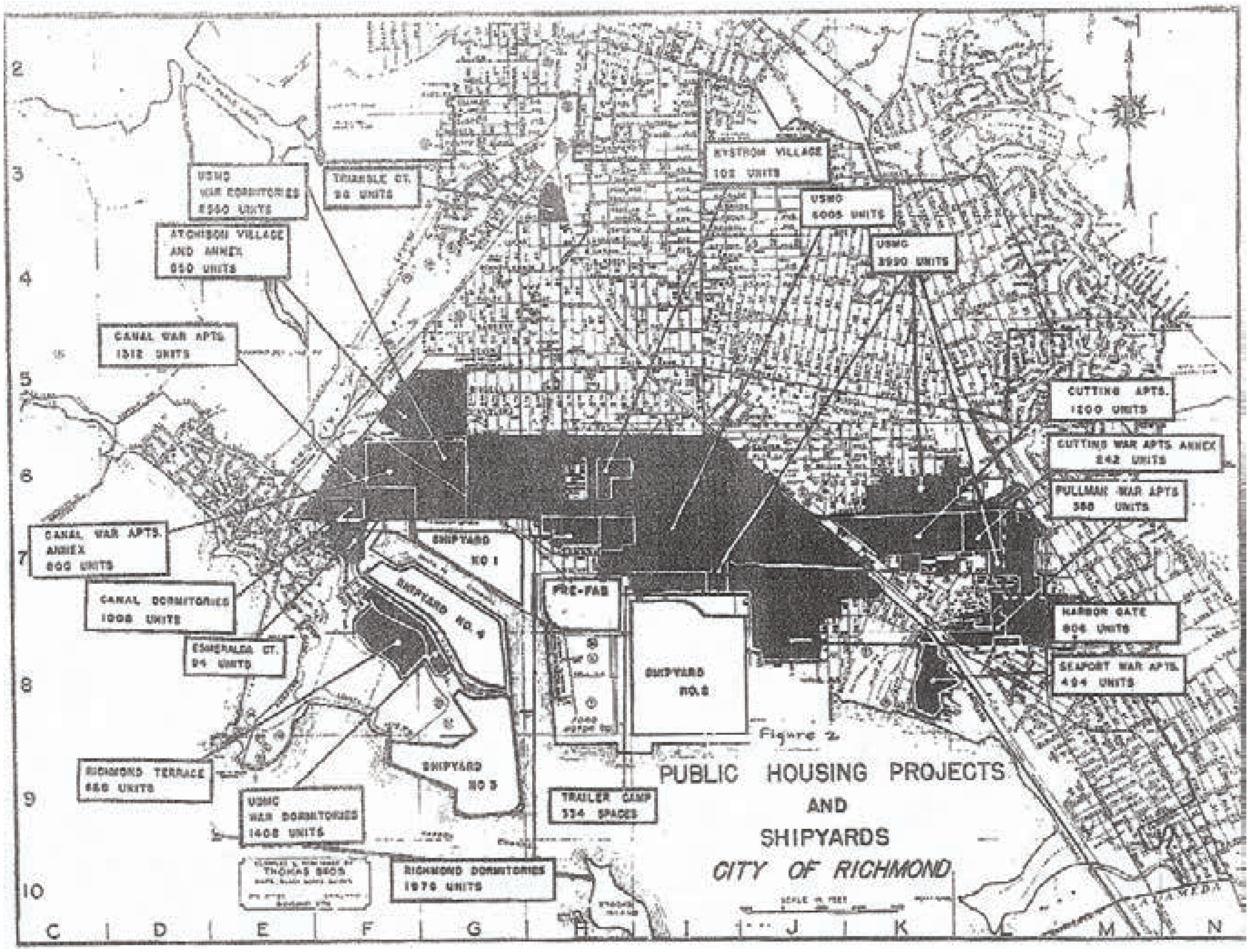



Figure 2.2 - War housing in Richmond. Source: Kaiser Company, Inc.


Figure 2.3 - Original Landscape Plan. Source: United States Housing Authority.

## Site Plan

The layout of Atchison Village drew inspiration from the Garden City concept, the design ideals manifested in World War I housing, and the public housing site plans of the 1930s. A superblock layout incorporated curvilinear streets, landscaping, and shared outdoor spaces ranging from small courtyards to a large park in the center (see Figure 2.3).

The superblocks proposed by the Garden City movement and promoted by the FHA and USHA formed the basis of Atchison Village's site plan. The curved and diagonal streets of Atchison Village echoed garden suburbs and early public housing's emphasis on natural, park-like settings. As with 1930s housing projects, landscaping was an integral part of the site. The prolific and prominant Floyd Mick was the landscape architect of the project. Landscape plans were developed concurrently with building plans and arranged the extensive open spaces in a variety of sizes that varied from small courtyards to the large central playing field.

The social ideals of garden suburbs, which had been translated to public housing in the 1930s, were expressed in Atchison Village. Building cohesive communities was a goal of the Garden City and later public housing projects. This was typically expressed by locating a prominent Community Building near the project's entrance and clustering houses around shared courtyards. Attention to self-improvement and safety was manifested in the large central playing field and separated pedestrian and automobile routes. Buildings were sited and conFigured to ensure that each dwelling unit received a healthy amount of light and ventilation, satisfying the question, "How can some of that deep driving desire of American families to improve their home environment be transformed into a dynamic push for more and better community housing?"[2]

The Atchison Village design also acknowledged the need for economy. Public housing designs of the 1930s recognized that superblocks lowered infrastructure costs, and this—in addition to social ideals—probably played a part in the project's design.

2 Catherine Bauer and Samuel Ratensky, "Planned Large-Scale Housing." *Architectural Record* 89 (May 1941).

Figure 2.4 - Atchison Village, 1940s. Source: Bancroft Library/Online Archive of California.

Figure 2.5 - View of Atchison Village Community Building, 1940s. Source: Richmond Public Library/Online Archive of California.

## Building Design

Architects Carl I. Warnecke and Andrew T. Hass designed Atchison Village with five types of 1- to 2-story buildings. As in other defense housing developments, the architectural style was utilitarian, featuring hip roofs, redwood siding, and small covered porches. Ornamentation consisted solely of exposed rafter tails and corner boards and simple porch detailing. However, despite their simplicity and economy, the architecture expressed convictions about community life and individual quality of life that developed from the Garden City movement and the World War I and 1930s housing projects that followed (see Figure 2.4 and 2.5).

The idea of a housing project as a whole community rather than isolated dwelling units appeared in WWI-era defense housing projects and, more strongly, in 1930s housing policy. Atchison Village incorporated this concept with similar designs of 1- to 2-story buildings capped by hip roofs of identical pitch. Standardized materials like exterior siding, doors and windows, and sparse architectural details like corner boards and exposed rafter tails were repeated in every building and visually unified the development.

The common aesthetic did not extend to homogeneity. In keeping with the "village" model of WWI defense housing developments and garden suburbs, Atchison Village comprised a landscape with small-scale buildings of varying size and heights. The five building types were scattered throughout the project to avoid visual monotony. As in garden suburbs, residential buildings were clustered rather than aligned in rows, to avoid the appearance of rowhouses or large apartment buildings.

Quality of life for residents was also considered. Earlier designers emphasized the importance of providing every dwelling unit with light and ventilation. In Atchison Village, dwelling units were arranged in a linear configuration that provided every habitable room with at least one window to the outdoors and allowed air to circulate through living areas. Direct access to the outdoors aimed to connect residents to nature.

As with previous public housing developments and contemporary defense housing projects, the design expressed its utilitarian purpose of housing people quickly and inexpensively. Residential buildings were designed with the cost-saving advice of earlier public housing designers who advised against including full dining rooms, long hallways, and any interior area that might be wasted space.

## CHRONOLOGY OF DEVELOPMENT AND USE

| | |
|---|---|
| **1940** | The Lanham Act is passed and provides $150 million to the Federal Works Administration to build approximately 625,000 units of housing in the U.S. |
| **1941** | The United States Government and Henry J. Kaiser begin construction of the Kaiser Shipyards, the first shipyard in Richmond. |
| **1941** January 24 | The Richmond City Council forms the Housing Authority of the City of Richmond "to represent the community in carrying out the Federal Public Housing Administration programs for low-income families."[9] |
| **1941** | Atchison Village is constructed as Richmond's first defense housing project. |
| **1954** | Atchison Village residents form the Mutual Homes Corporation in efforts to save Atchison Village from disposal in accordance with the Lanham Act. |
| **2000** October 25 | Rosie the Riveter/World War II Home Front National Historic Park is established through an act of Congress. |
| **2003** | The Atchison Village Defense Housing Project is listed in the National Register of Historic Places. |

## PHYSICAL DESCRIPTION

### Site

The layout of Atchison Village follows an irregular-shaped plan with curving streets that were designed to fit within the constraints of the site. Within the curving streets are a series of axially aligned lots and shared courtyards. The project site is bounded by West Macdonald Avenue to the north, West Ohio Avenue to the south, First Street to the east, and Garrard Boulevard to the west. Circulation within the site consists of four roads that divide the site into seven distinct sections, including a triangular park with a Community Center building in the center. Residential units are clustered within the seven sections and are linked via pedestrian walkways and separated by landscaping. Only 15 percent of the site is covered with buildings, the remainder of the site consists of the large central park, private lawns and gardens, and shared open space.

### Building Typologies

The 162 residential buildings at Atchison Village are divided into five different typologies that range from one to two stories in height and two to four units per building.

According to the National Register documentation:

> The elevations are simple, with no ornament, revealing only the building's necessary functions. The doors are wood, with a one-foot-high inset panel below four feet of window, comprising two stacked lites. The front and back doors correspond in type, yet the back doors fill a frame of only two-and-one-half feet wide, whereas the front doors span three feet. Also, two varieties of double-hung, two-pane-wide, wood-sash windows were employed throughout the project. The first extends to a width of three-and-one-half feet, while the second only reaches three feet. Both maintain a height of five feet. Single-pane-wide, double-hung, four-foot-by-two-foot windows occur in some locations.
>
> All residential structures employ the same interior finishes. One-inch tongue-and-groove stained wood flooring covers the bedrooms, living rooms, separate dining spaces, halls, stairs, and 'yard stations' pr exterior maintenance closets. The bathrooms, kitchens, and utility closets feature linoleum over 3/8-inch plywood flooring. Gypsum lath and plaster were used to coat the majority of interior walls and ceilings. Two-by-four studs at 16-inches-on-center frame the walls, with sound insulation dressing both sides of the walls between units. All the trim consists of stained wood. A two-and-5/8-inch wood board caps the bathroom wainscot.[3]

3 "Atchison Village Defense Housing Project," National Register of Historic Places Registration Form, 7.

*Residential Building Type 1*

Residential building type 1 includes four, one-bedroom units that are one-story and linear in plan. This housing type represents roughly 10 percent of the total dwelling units within Atchison Village.

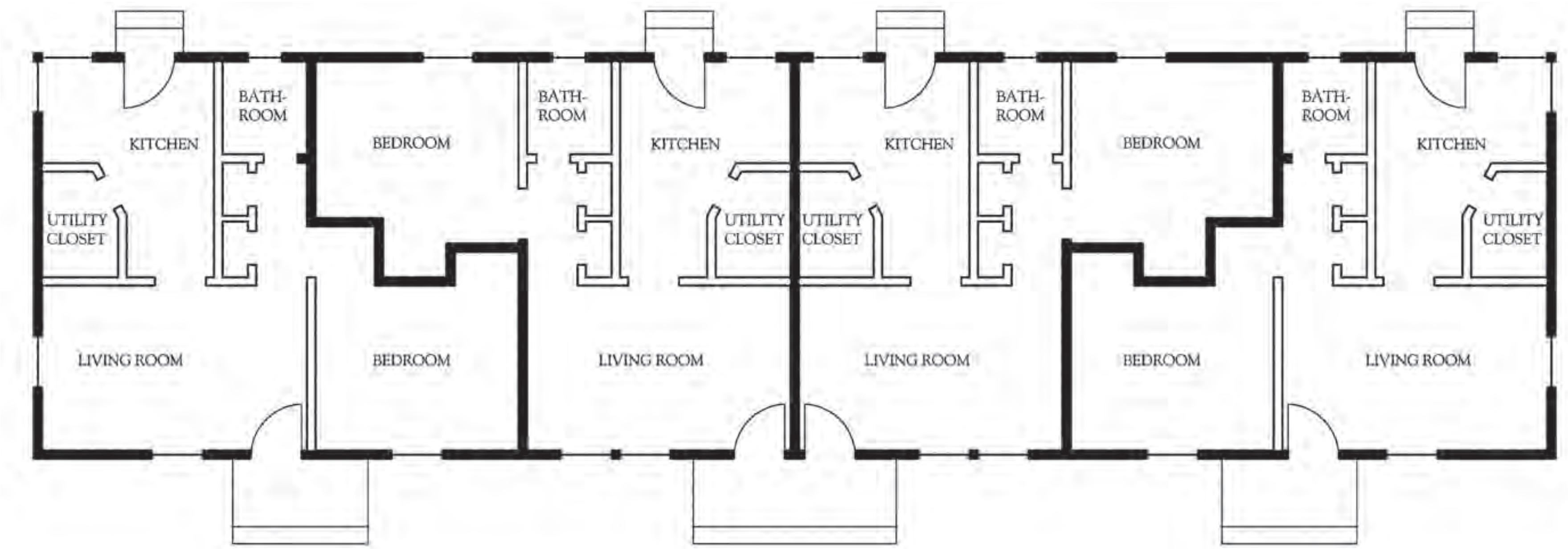



Figure 2.6 - Source: Atchison Village Defense Housing Project, Cal, 4171-X, National Register Nomination, entered May 30, 2003.

*Residential Building Type 2*

Residential building type 2 includes two, two-bedroom units that are one-story and linear in plan. This housing type represents roughly 15 percent of the total dwelling units within Atchison Village.

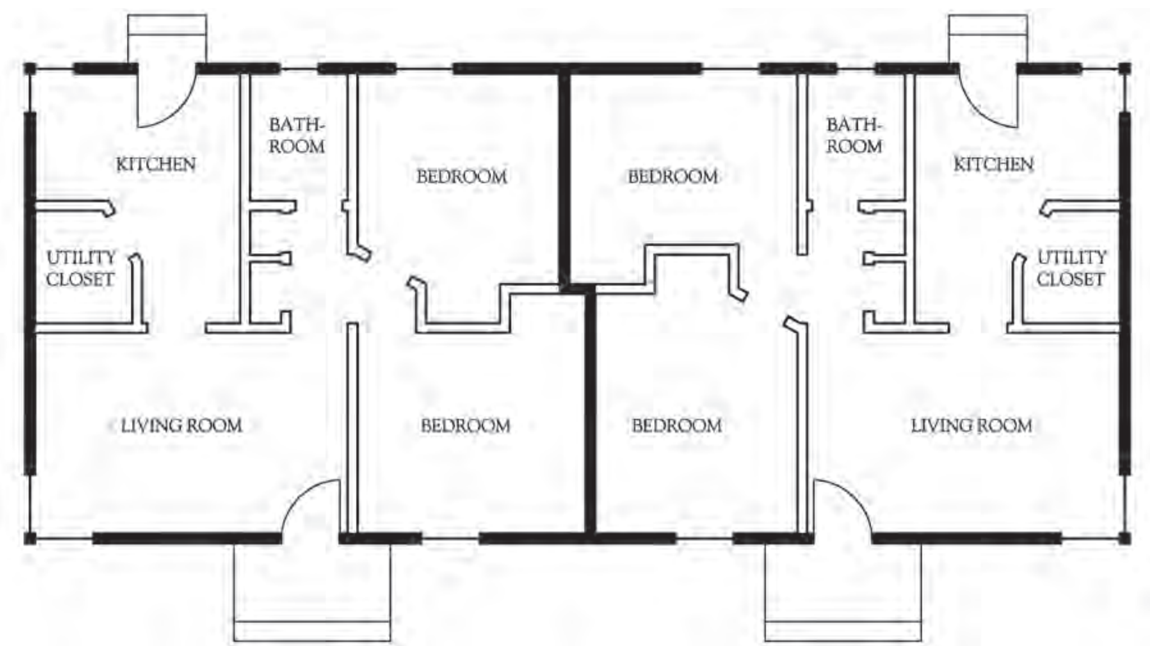



Figure 2.7 - Source: Atchison Village Defense Housing Project, Cal, 4171-X, National Register Nomination, entered May 30, 2003.

*Residential Building Type 3*

Residential building type 3 includes a three bedroom configuration that is one-story and linear in plan. This building type contains two reflected units that abut at the central bedroom wall. This housing type represents roughly 34 percent of the total dwelling units within Atchison Village.

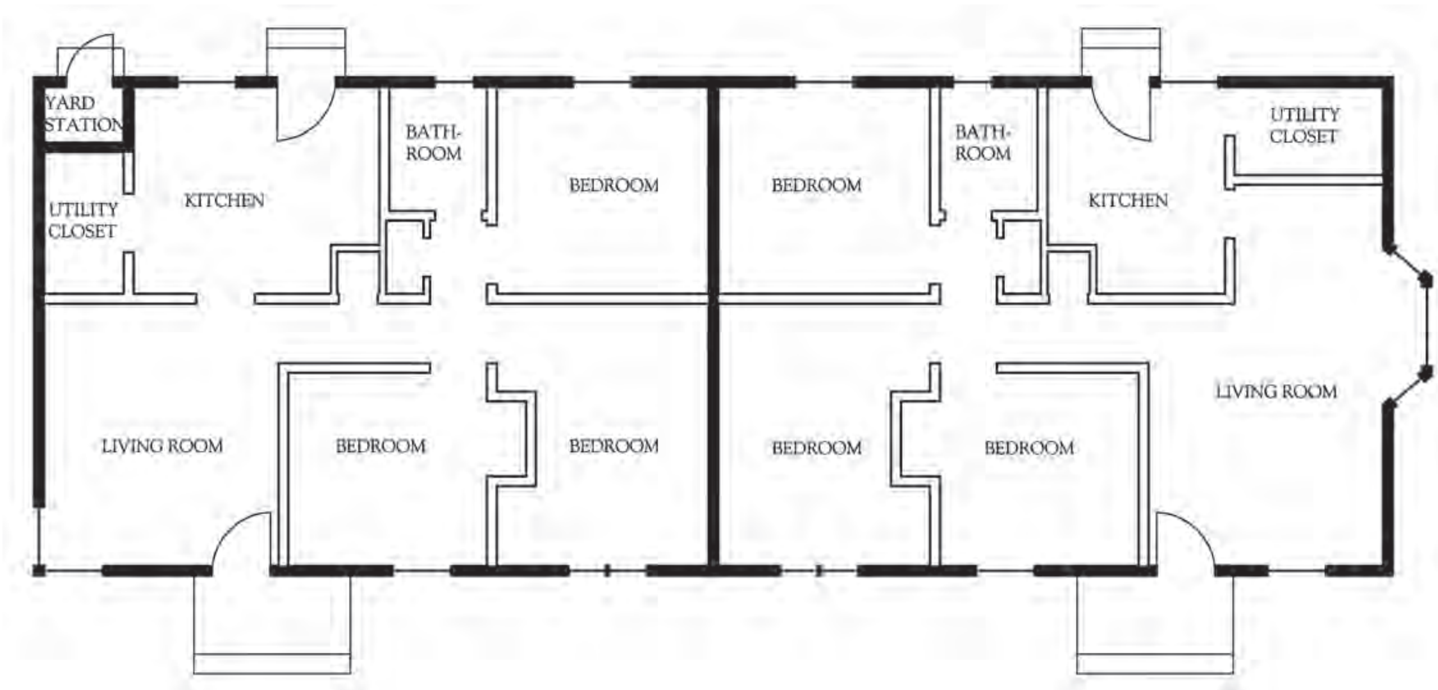



Figure 2.8 - Source: Atchison Village Defense Housing Project, Cal, 4171-X, National Register Nomination, entered May 30, 2003.

*Residential Building Type 4*

Residential buildings type 4 includes four, two bedroom units in a two-story, linear arrangement. This housing type represents roughly 28 percent of the total dwelling units within Atchison Village.

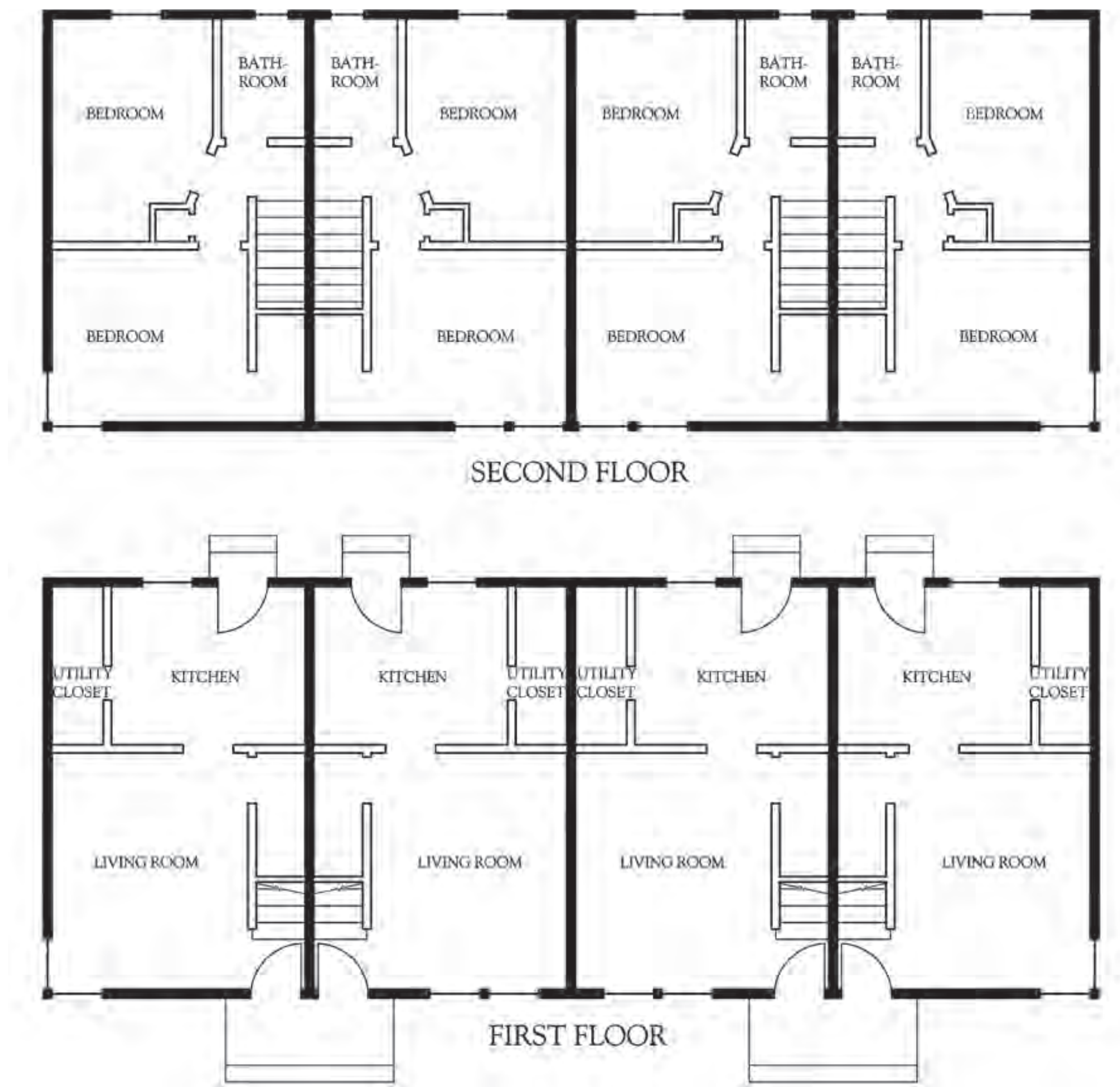
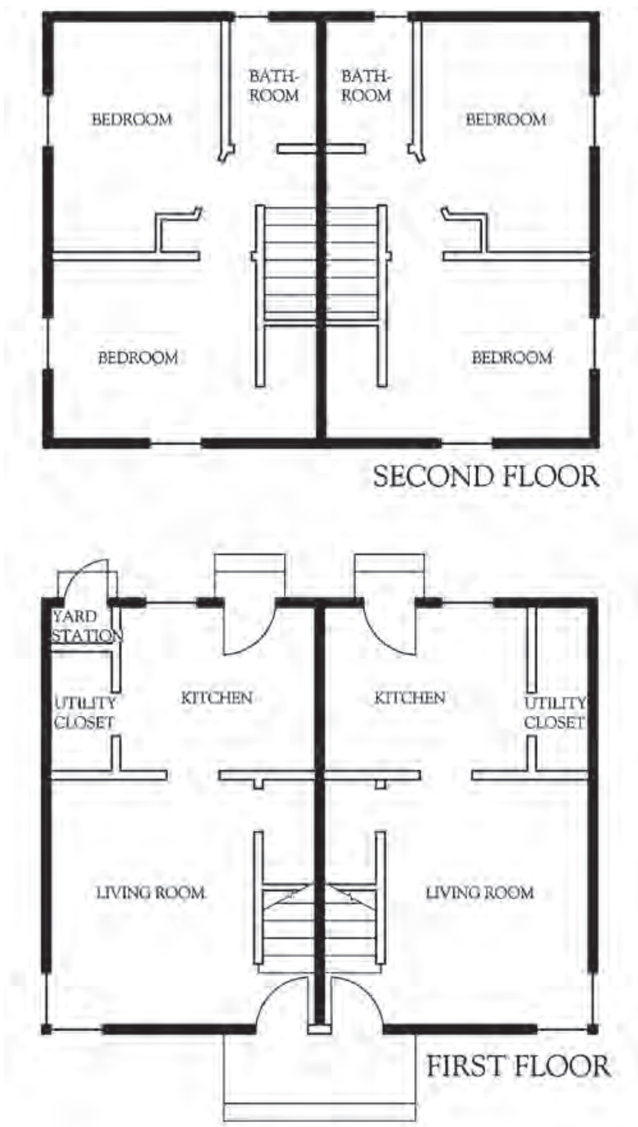



Figure 2.9 - Source: Atchison Village Defense Housing Project, Cal, 4171-X, National Register Nomination, entered May 30, 2003.




*Residential Building Type 5*

Residential building type 5 includes two, two bedroom units that are two-story and rectilinear in plan. This housing type represents roughly 12 percent of the total dwelling units with Atchison Village.

Figure 2.10 - Source: Atchison Village Defense Housing Project, Cal, 4171-X, National Register Nomination, entered May 30, 2003.

# PART III: EXISTING CONDITIONS

## SUMMARY OF EXISTING CONDITIONS

### Methodology

The following assessment identifies current conditions of the Atchison Village neighborhood, site and structures. The outlined conditions were observed during on-site investigations in late winter and spring 2009. The purpose of the investigation was to document and assess the condition of the existing site and structures, identify areas of immediate concern and make general recommendations for the overall treatment of the site and structures. This conditions assessment will serve as a primary tool for future maintenance and planning.

Architectural investigations were conducted on site February 24th and 25th. Methodologies for investigation were primarily visual using basic tools, such as tape measure and metal probes/picks. Documentation was taken in the form of written notes, hand notated drawings and digital photography. Follow-up assessment by a civil engineering firm was conducted after the project team observed the magnitude of on-site drainage problems. The assessment is included in this report.

The Existing Conditions section of this HSR is broken into two sections; Neighborhood Site and Landscape, and Buildings and Structures. Neighborhood Site and Landscape includes an assessment of both softscape and hardscape elements and also addresses site drainage issues. Buildings and Structures includes an assessment of the Community Center and the Residential Units. The buildings were assessed by each discipline, including architecture, structural, mechanical, electrical plumbing, and civil engineering. Each site and building element is described and its condition is given an assessment rating of Good, Fair, or Poor.

### Condition Definitions

Page & Turnbull uses the following NPS definitions for evaluating the conditions at Atchison Village:

**GOOD (G)**
The structure and significant features are intact, structurally sound, and performing their intended purpose. The structure and significant features need no repair or rehabilitation, but only routine or preventative maintenance.

**FAIR (F)**
The element is in fair condition if either of the following conditions is present:

- There are early signs of wear, failure, or deterioration though the structure and its features are generally structurally sound and performing their intended purpose; or
- There is failure of a significant feature of the element.

**POOR (P)**
The element is in poor condition if any of the following conditions is present:

- The significant features are no longer performing their intended purpose; or
- Significant features are missing; or
- Deterioration or damage affects more than 25% of the feature; or
- The structure or significant features show signs of imminent failure or breakdown.

## NEIGHBORHOOD SITE AND LANDSCAPE

### Site Drainage

Description:

Historically, the site of Atchison Village sat along the eastern shore of extensive tidal marshes. As a result of its location and elevation, the storm drainage system servicing this area is subject to tidal influence. Drainage from the site is retarded by this influence as well as extremely flat terrain. Many areas of Atchison Village were built upon filled marsh land, which inhibits stormwater infiltration and exacerbates poor drainage conditions.

In the mid-1990's, improvements were made in conjunction with the Marina Bay development, and site drainage from Atchison Village was improved significantly (personal communication, Mitch Meyers).

Observed Conditions:

Atchison Village is plagued by both minor and major drainage deficiencies. The minor variety result from lack of positive drainage across the site and low soil infiltration capacity. There are pockets of ponded water that persist for days after a storm event. Stormwater runoff from these areas can neither gravity drain freely nor infiltrate into the ground.

The major drainage deficiencies onsite are due to inadequate storm drain infrastructure given the combination of poor soils, extremely flat terrain, and tidal backwater. The collective result is significant localized flooding when large storm events happen concurrent to high tide. On such occasions, the storm drain system becomes backlogged, and stormwater runoff surcharges from low-lying catch basins. This results in flooding around the catch basins at the intersection of Curry Street and Chanslor Avenue. These catch basins service almost all of Atchison Village as well as some area east of the site. Drainage patterns and the existing storm drain infrastructure are shown in Appendix E.

During particularly severe storms, flood waters can extend into yards and up to housing foundations. In 1986, there was a large storm event that caused flood waters to reach up to window level on cars (personal communication, Mitch Meyers). More common flooding inundates the streets, but is typically contained within the curbs. Most recently, as the result of a storm event in late 2008, W. Chanslor and Curry Streets were temporarily closed until flooding subsided and residents could safely regain vehicle access (personal communication, Liberty Village Apartments).

The following are observed conditions related to drainage:

- Most of the park, ball field and skinned area were flooded during the site visit. Most of the tree wells within the park lawn area were flooded (Figure 3.1).
- A portion of the basketball court floods.
- Pea gravel topdressing is being installed in some locations to raise the grade in areas that flood. See units 212-214 (Figure 3.2).
- The only ADA ramp at the community building was flooded.
- There was a lot of flooding surrounding the triangular planter at the main entry.
- The vehicular curb cuts at the service yard were flooded (Figure 3.3).
- A large area inside the fenced area off the southeast corner of the community building was flooded.
- Several walkways south of McDonald Avenue and east of "W" Street were flooded (Figure 3.4).
- The play area drainage is good (Figure 3.5).
- Some portions of the off-street parking areas are flooded.

Figure 3.1 - Typical flooding at baseball field.

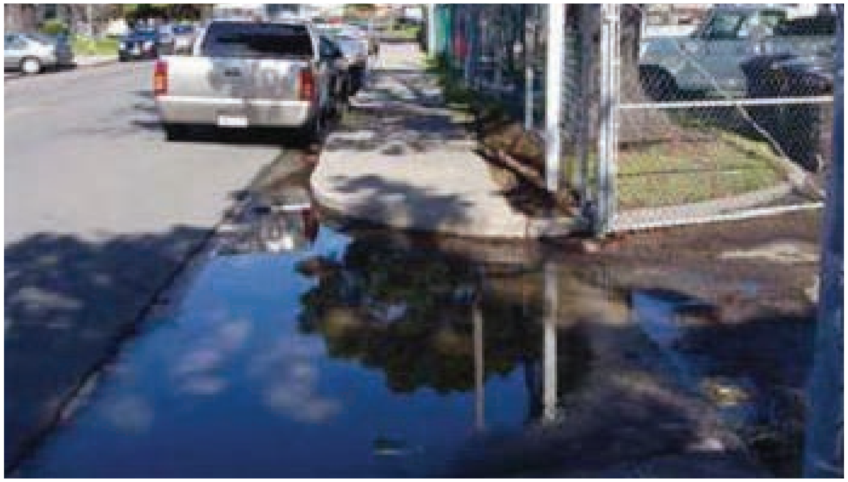


Figure 3.3 - Typical water ponding at curb cuts.

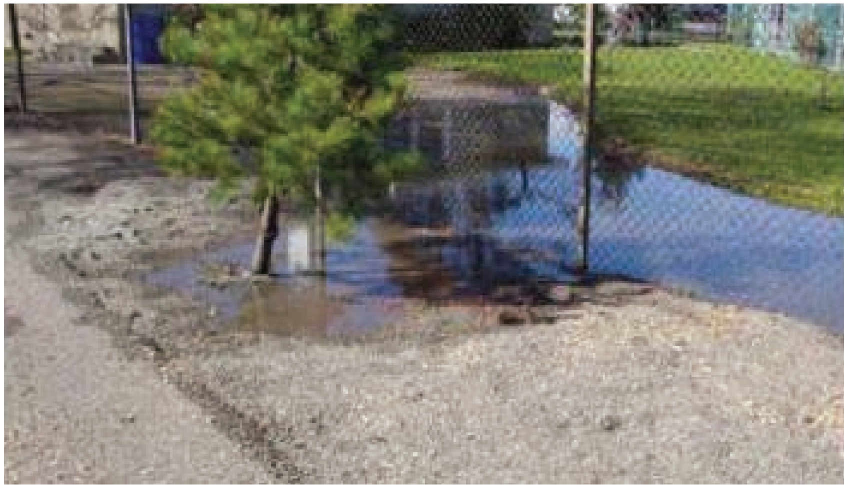


Figure 3.2 - Pea gravel used to raise grade in areas of flooding.

Figure 3.4 - Typical flooding at walkways.

Figure 3.5 - Typical ponding at off street parking areas.

Drainage Analysis:

In an effort to estimate the frequency of flooding within Atchison Village, a hydrologic and hydraulic (H&H) analysis was performed. Peak stormwater runoff was calculated for different frequency storms using the Rational Formula with rainfall data input from the nearby Richmond City Hall. Manning's Equation was used to evaluate the capacity of the storm drain pipes to convey the stormwater flows resulting from those storms. The resulting hydrologic burden on and hydraulic capacity of the storm drain pipes were analyzed to determine flooding frequency.

It was assumed that all site drainage from Sub basins 1, 2, and 3 occurs through the twin 27" pipes leading from the catch basins located at the intersection of W. Chanslor Avenue and Curry Street; the 12" sump line leading from that same location is assumed to be used as a dewatering tool once flooding has occurred. Sub basin 4 on the Chanslor Row cul-de-sac is serviced by its own drainage line with unknown size and slope, and so that small area was not included in the larger analysis.

Assuming a Runoff Coefficient (C) value of 0.30 for pervious surfaces (i.e. landscaped areas) and a C value of 0.90 for impervious surfaces (i.e. rooftops and pavement), the weighted site-wide C value was calculated to be 0.603. This value was, in turn, used to calculate the Time of Concentration (TOC) using the FAA Equation, which yielded a value of 74 minutes for the design storm duration. Design storms of this duration were analyzed ranging from 2-year to 100-year return intervals.

Summary results indicate that the hydraulic capacity of the existing site storm drain system is approximately 26 cubic feet per second (cfs), assuming no blockages or other impediments to free flow. For point of comparison, the peak flow rates for a range of design storms are presented in the following table:

| Q-2yr (cfs) | Q-5yr (cfs) | Q-10yr (cfs) | Q-25yr (cfs) | Q-50yr (cfs) | Q-100yr (cfs) |
|---|---|---|---|---|---|
| 17.79 | 24.00 | 29.80 | 35.87 | 40.26 | 44.62 |

Drainage Analysis Table

These results indicate that the storm drain system should be adequate to convey runoff offsite from the 5 year storm, but the 10 year storm and other larger, less frequent storms are expected to cause localized flooding. Tidal influences were not included in this analysis, but flooding is expected to be more prevalent during high tide when the local storm drain system experiences a backwater condition. Full calculations and results of the H&H analysis are presented in Appendix E.

The California Climate Action Team projects that sea level will rise between 20 and 55 inches (0.5 and 1.4 meters) by the year 2100. Barring comprehensive upgrades to the storm drain system, a rise in sea level can be expected to exacerbate localized flooding when high tides and large storm events coincide. It is beyond the scope of this study to analyze the full impact of projected sea level rise on site drainage conditions.


Figure 3.6 - Original trees lining street.


Figure 3.7 - Original Monterey Pines.

## Landscape Features: Softscape

**Trees (Character Defining Feature)**

Character Defining Features:

The following are considered to be character defining features associated with trees:

- Very Limited Plant Palette - five species of trees.
- Single species of tree planted along entire length of each block.
- Use of Pines to define the entire perimeter of the park and the community building block.
- Placement of trees near sidewalks and pathways leaving large expanses of open space.

Description:

Except for several Monterey Pines, few of the original trees remain. A large variety of new trees have been planted throughout the site, including Pyrus, Redwoods and Casurina around the perimeter of the park (Figures 3.6 and 3.7). Several fruit-bearing trees have been planted by residents and are producing fruit (Figures 3.8 and 3.9).

Observed Conditions:

The following are observed conditions for trees:

- The original Monterey Pines that remain are mature and generally appear to be in fair condition, particularly considering their age (Figure 3.10). Some show evidence of pitch canker (Figure 3.11). Pitch canker is a common disease that is fatal to Monterey and other species of pines. Dieback in the tips of branches is an indicator as well as pitch on the trunk.
- The large pine north of the community building is half-dead.
- Some of the Monterey Pines are causing sidewalk damage (Figure 3.12).
- A few of the large trees were planted too close to buildings and other structures (Figure 3.13). If left to grow to maturity these trees will damage these buildings.
- Many trees are planted in lawn areas and require trimming (Figure 3.14).
- A small grove of Redwoods has been planted in the southeast corner of the park; most trees are thriving, but some have died and should be replaced.

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Figure 3.8 - Typical fruit-bearing tree.


Figure 3.9 - Typical fruit-bearing tree.


Figure 3.10 - Mature Monterey Pines.


Figure 3.11 - Mature Monterey Pines showing signs of pitch canker.

Figure 3.12 - Sidewalk damage due to tree root system.

Figure 3.13 - Tree plantings located too close to the building foundation.

**Shrubs (Character Defining Feature)**

Character Defining Features:

The following are considered to be character defining features associated with shrubs:

- Very Limited Plant Palette - twelve species of shrubs.
- Use of hedges to screen rear yards and parking bays.

Description:

Shrubs are planted at building foundations, are used to screen areas, and are used to accent and individualize properties. The amount of shrub planting varies tremendously, from essentially none to an excessive abundance and variety of species. The triangular planting bed north of the community building is planted with a variety of low shrubs. There are a few examples of California Privet hedges that screen trash and rear-yard areas. Building 351 has a good example of this (Figures 3.15 and 3.16). In some locations shrubs are used to screen street parking areas.

Areas marked with a "T" on the original plans were to be planted by tenants. In many cases low walls or edging have been installed in these areas to create foundation planting beds. These beds are planted with a variety of small shrubs and perennials. Edging materials include brick, concrete pavers, poured-in-place concrete, header boards and stone walls (Figure 3.17).

Many tenants have built square or circular planting beds within the front common areas and planted them with shrubs and perennials. These can be in raised planters or flush with the lawn and defined by edging.

Observed Conditions:

The following are observed conditions for shrubs:

- Generally, the condition of shrubs is good. Shrubs are being maintained and hedges are being pruned.
- Some shrubs are being pruned that do not require pruning; their appearance would be improved if left to grow naturally.

Figure 3.14 - Tree located in lawn area.

Figure 3.15 - California Privet hedges that screen rear-yard areas.

Figure 3.16 - California Privet hedges that screen rear-yard areas.

Figure 3.17 - Typical foundation planting bed edged with a low brick wall.


Figure 3.18 - Open space with healthy lawn.


Figure 3.19 - Typical un-mown lawn in need of maintenance.

**Lawns (Character Defining Feature) and Ground Cover**

Character Defining Features:

The following are considered to be character defining features associated with lawns:

- Open lawn space.

Description:

Lawn is planted throughout the site and in general is well maintained. Most lawns were uniformly green on the day of observation; this may change in fall (Figure 3.18). Very few ground cover plants were observed. Ground cover is not a character defining feature.

Observed Conditions:

The following are observed conditions for lawns and ground covers:

- Most lawns are infested with a variety of weeds; some are perfect, without weeds.
- Most lawns are well-mown and trimmed; some are not being maintained, i.e., they are left un-mown (Figure 3.19).
- Trees are planted in tree wells of varying sizes that require mowing/trimming.
- The fence around the community building does not have a mow strip which requires extra trimming (Figure 3.20).

**Mulch**

Description:

Mulch is not a character defining feature. Except in a few isolated locations, mulch is not present. There are a few examples where lawn has been removed and replaced by mulched beds. Unit 351 has an example (Figure 3.21).

Rating:

FAIR. Exists only in isolated locations.

Figure 3.20 - Lack of mow strip adjacent to the Community Center fence requires extra trimming.

Figure 3.22 - Typical walkway enclosed by tall fencing.

Figure 3.21 - Typical lawn replaced with mulch bed.

Figure 3.23 - Opening in fence.

Figure 3.24 - Chainlink fence with gate.

**Weeds**

Description:

Weeds are not a character defining feature. Except in lawn areas, the site is relatively free of serious weed problems. Weed barriers have been installed in some common areas with good but not perfect success in controlling weeds. Unit 351 has an example. Weeds are more extensive in some rear yards.

Rating:

FAIR to GOOD.

## Landscape Features: Hardscape

**Fences & Gates**

Description:

Fences are not a character defining feature. There are three types of fences at Atchison Village: chain link, wood and ornamental iron. In some areas fences create narrow passageways with zero visibility (Figure 3.22).

Chainlink - The chain-link fence at the community building is six feet high, topped with three strands of barbed wire (Figure 3.20). The fabric is green. There is a manual, rolling gate at the front entry and two narrow, swing gates at the sides. The chain-link fence at the ball field is low (four feet high). There is a mow strip on both sides. There are openings in the fence in lieu of gates (Figure 3.23). There is some chain-link fencing in private rear yards, typically six feet high (Figures 3.24. 3.25, 3.26 and 3.27).

Wood - There are many types of wood fences. Most are solid 1x6 board fences. Of these, some are cut straight at the top; others have each board trimmed with beveled edges. Most are six feet high; others are four feet or five feet (Figure 3.28). Some wood fences are painted or stained; some are untreated. Wood fences have a variety of styles of gates, from simple to elaborate (Figures 3.29 and 3.30). There are low, wooden picket fences; painted and untreated. Unit 351 has an example (Figures 3.31 and 3.32). There are five-foot-high picket fences. See unit 353 (Figure 3.33).

Figure 3.25 - Chainlink fence with wood.

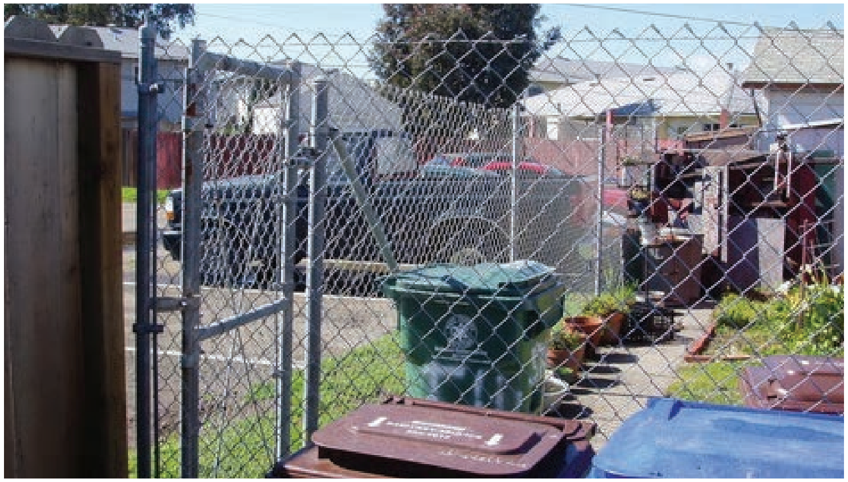

Figure 3.26 - Typical chainlink fence at rear yard.

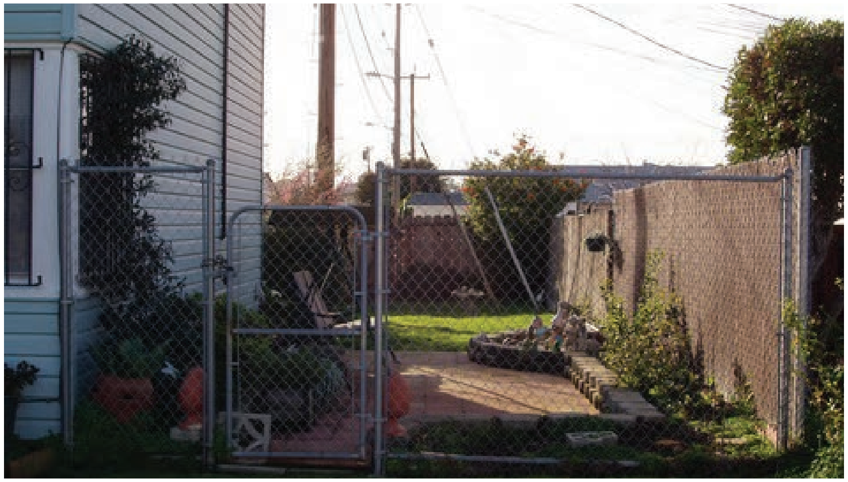

Figure 3.27 - Typical chainlink fence enclosing side and rear yard.

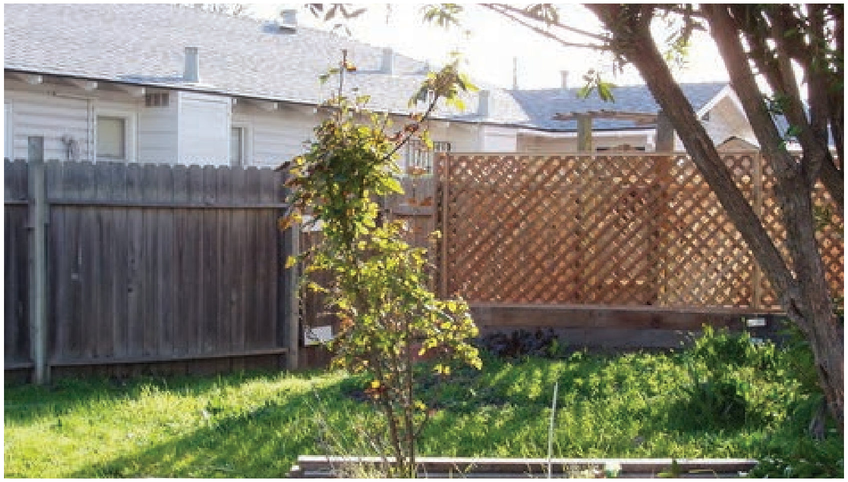

Figure 3.28 - Typical wood fence types.

Figure 3.29 - Typical wood fence with decorative detailing.

Figure 3.31 - Low untreated picket fence.



Figure 3.30 - Typical painted wood fence.

Figure 3.32 - Low painted picket fence.

Figure 3.33 - Typical tall painted picket fence.

Figure 3.35 - Community center fence in good condition.

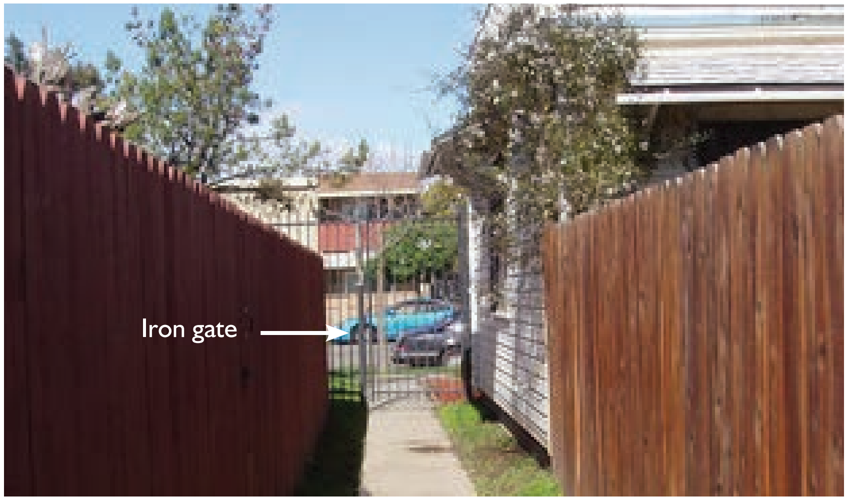


Figure 3.34 - Ornamental iron fence and gate.

Figure 3.36 - Rusted fence at community center.

Figure 3.37 - Damaged fence at southeast corner of the community center.


Figure 3.38 - Typical private driveway.

**Fences & Gates Cont.**

Ornamental Iron - Very little ornamental iron fencing is used on site. Where observed, it was painted black and six feet high (Figure 3.34). There is an ornamental iron fence with brick columns where the east end of Bissell Avenue was blocked off. One off-street parking area (parking 16) is surrounded by four types of wood fence; some painted and some not, plus chain link.

Rating:
GOOD to POOR

Observed Conditions:
The following are observed conditions for fences and gates:

- The fence at the community building is in good condition (Figure 3.35).
- The fence at the ball field is in good condition.
- The 12-foot chain-link fencing at the basketball court is rusted and loose.
- The chain-link fencing at the service yard is rusted (Figure 3.36).
- There is a hole in the fence near the southeast corner of the community building (Figure 3.37).
- The condition of the wood fences varies from good to poor.

**Parking (Character Defining Feature) & Vehicular Paving**

Character Defining Features:
The following are considered to be character defining features associated with Parking:

- Original parking stalls.

Description:
Parking occurs in four typical conditions: parallel parking at curbs; 90-degree parking in parking bays; within parking lots and courts in rear yards; and in private driveways (Figure 3.38). The condition of the parking areas generally varies from fair to poor. On-site parking for residents and guests is inadequate. Some parking areas have been repaved recently, with new pavement markings. Unit 7-9 is a good example (Figure 3.39).

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Figure 3.39 - Resurfaced parking area.


Figure 3.41 - Service yard paving in poor condition.

Figure 3.40 - Typical crown in road.


Figure 3.42 - Sidewalk damage due to tree root system.

Figure 3.43 - Typical curb in good condition.

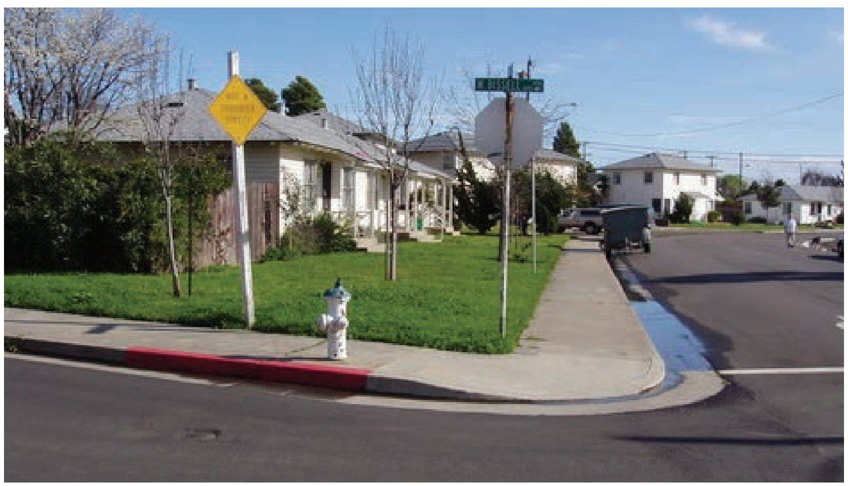

Figure 3.44 - Typical curb cut for accessible ramp.

**Parking & Vehicular Paving cont.**

Rating:

GOOD to POOR.

Observed Conditions:

The following are observed conditions for parking and paving:

- Paving in the streets is new and in good condition. Roads are crowned and drain to the gutters at either side of the road (Figure 3.40).
- Most of the paving in the parking bays is in poor condition and was not improved when roads were repaved.
- Paving in most of the off-street parking areas is in poor condition.
- Paving in the service yard is in poor condition (Figure 3.41).
- There are some but not a great number of places where tree roots have damaged the pavement (Figure 3.42).

**Curbs and Curb Cuts**

Description:

Although not identified as a character defining feature, curbs were an original design to the streets of Atchison Village. Curb cuts are provided at various locations throughout the site.

Rating:

GOOD to POOR.

Observed Conditions:

The following are observed conditions for curbs and curb cuts:

- Except where damaged by tree roots, curbs are generally in good condition (Figure 3.43).
- The number of handicap curb cuts is inadequate. At Bissell Avenue and Collins Street there were ADA ramps allowing travel from north to south, but none for the east-west path of travel (Figure 3.44)
- Vehicular curb cuts vary from good to poor.


Figure 3.45 - Typical concrete walkway in good condition.


Figure 3.47 - Typical brick paving at rear yard.


Figure 3.46 - Original layout of courtyard paths still intact.


Figure 3.48 - Dead end sidewalk at north side of community center.

Figure 3.49 - Typical patching of concrete sidewalk.

Figure 3.50 - Asphalt path at north side of the park.

**Walkways & Pedestrian Pavement (Character Defining Feature)**

Character Defining Features:

The following are considered to be character defining features associated with walkways:

- Separate pedestrian and automobile routes.
- Straight walkways through site and curved walkways in park.

Description:

Generally the original concrete walkways throughout the site are in good condition (Figure 3.45). The layout of the original paths appears to be intact (Figure 3.46). Some additional asphalt and concrete paths have been added. Many walkways are very narrow, less than 36 inches wide. Most private rear yards include some paving, typically concrete and sometimes brick. Paving generally covers one-quarter to one-half of the rear yard outdoor space (Figure 3.47). On the north side of the community building a new concrete path has been added that dead ends and does not connect to the path on the east side (Figure 3.48). Some pedestrian walks have been patched (Figure 3.49).

Rating:

GOOD to FAIR.

Observed Conditions:

The following are observed conditions for walkways:

- The asphalt path across the north side of the park is in good condition, except near the trees, and is in fair condition near the play lot (Figure 3.50).
- The paving at the basketball court is cracked but not severely displaced; it is useable (Figure 3.51).

Figure 3.51 - Cracking at basketball court.

Figure 3.53 - Rear entrances to units are not accessible.

Figure 3.52 - Typical play structure in the play area.

Figure 3.54 - Typical ramp at residential units.


Figure 3.55 - Typical ramp at residential units.

Figure 3.56 - Ramp with handrail at community center entrance.

**Accessibility**

Description:

While a number of accessible features have been added to the original plan, additional improvements are needed to comply with access codes. Both structures in the play area have accessible play features (Figure 3.52). The fiber safety surface in the play area meets federal accessibility standards. There are very few handicap ramps anywhere on site.

Observed Conditions:

The following are observed conditions related to accessibility:

- Some handicap ramps are poorly located and some flood.
- Back yards are not accessible from units that typically have two steps down into the yard (Figure 3.53).
- A few units have wooden ramps built to the front and rear doors; some comply with ADA while others do not (Figures 3.54 and 3.55).
- There is no curb ramp at the main entry to the community building nor at the secondary entry on the east side.
- There is a ramp with handrail at the main entry to the community building (Figure 3.56).

**Play Equipment and Site Furnishings**

Description:

Play equipment and site furnishings are not character defining features. Play equipment and site furnishings occur in the park and tot lot near the community building, and in some of the common areas throughout the site. The type and amount of fiber safety surface is generally adequate, though in some spots vandals have displaced the chips and pulled up the filter fabric. There is an assortment of garden furniture in the small park spaces and other common areas, including an assortment of chairs and tables. There are steel bollards and steel drum trash cans along the asphalt walk on the north side of the park. Some are painted and some not (Figures 3.57 and 3.58). The original concrete pads for trash containers are not being used. Trash and recycling bins are left in a variety of places, including some inside rear yard fences (Figures 3.59, 3.60 and 3.61).


Figure 3.57 - Steel bollards at north side of park.

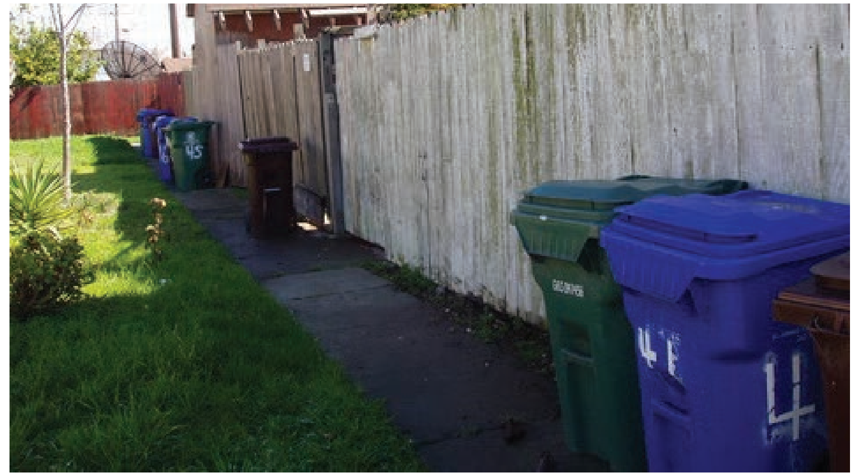
Figure 3.59 - Trash cans in open area.


Figure 3.58 - Unpainted and rusted trash can at north side of park.

Figure 3.60 - Trash cans in open area.

Figure 3.61 - Trash cans in open area.

Figure 3.62 - Deteriorated basketball stop in need of repair.

**Play Equipment and Site Furnishings cont.**

Rating:

GOOD to POOR.

Observed Conditions:

The following are observed conditions for play equipment and site furnishings:

- One of the two basketball backstops is missing. The remaining backstop needs painting, as does the pole and support structure (Figure 3.62).
- Site furniture at the community building includes a rusted barbecue, four metal chairs, one plastic chair, one webbed chair, one metal and glass table, and two wood benches.
- The fence behind the basketball court is rusted and detached from the top rail in places.
- The condition and variety of play equipment in the tot lot / play area is generally good. It does include accessible play features.
- The curb/seat wall surrounding the play area is in good condition and succeeds in containing the safety surface material and in providing seating at the perimeter (Figure 3.63).
- The skinned infield at the softball diamond is flooded and appears to be unusable in winter.
- The bleachers and players benches have some broken and missing boards. The frames are rusted (Figure 3.64).
- The softball backstop wood and chain-link fabric is in poor condition; wood members are rotted and fence fabric is rusted (Figure 3.65).
- A few rear yards and some common areas have clothes lines in good to poor condition (Figure 3.66).
- The flag pole and flag at the community building appear to be in good condition. The pole needs painting.
- The condition of the site furnishings at the community building is poor (Figure 3.67).

Figure 3.63 - Perimeter wall at play area in good condition.

Figure 3.64 - Deteriorated bleachers at ball field.

Figure 3.65 - Backstop to ball field in poor condition.


Figure 3.66 - Typical clothes line.


Figure 3.67 - Miscellaneous site furnishing at the community center.


Figure 3.68 - Typical street lighting.

**Lighting**

Description:
Lighting is not a character defining feature. Other than a few street lights there is essentially no landscape lighting at Atchison Village (Figure 3.68).

Observed Conditions:
The following are observed conditions for lightings:

- The light at the park fence near the southeast corner of the community building is in the canopy of the tree; much of the illumination is blocked by the tree when it is in leaf. The laminar is broken (Figure 3.69).

**Irrigation**

Description:
All units have hose bibs provided in the front and rear yards. Other than in the park near the community center there does not appear to be any automatically irrigated common areas. Some homeowners have added drip and other types of irrigation. Unit 351 has drip irrigation (Figure 3.70). Irrigation remote control valve boxes and what appears to be a controller were observed near the tot lot (Figure 3.71).

Rating:
The condition of the irrigation equipment was not evaluated.

Figure 3.69 - Light blocked by tree limbs.

Figure 3.71 - Control box for irrigation system at community center.

Figure 3.70 - Installed drip irrigation system at residential unit.

Figure 3.72 - Typical metal shed in poor condition.

Figure 3.73 - Typical shed in poor condition.

Figure 3.74 - Materials being stored outside in open view.

**Miscellaneous Observations**

There are a variety of storage structures in rear yards; some are painted wood while others are aluminum or plastic prefab portable structures (Figures 3.72 and 3.73 ). Storage buildings are not a character defining feature. There is evidence that these storage areas are inadequate, with accumulations of building materials and miscellaneous items stacked nearby (Figure 3.74). There is inadequate storage space in the service yard of the community center as well (Figure 3.75).

A variety of elements have been added to the original landscape to individualize properties, including:

- Planters and hedgerows perpendicular to buildings to define property lines (Figure 3.76).
- Planters built within lawns near front doors (Figures 3.77 and 3.78).
- Plantings parallel to walks to the front porch (Figure 3.79).
- Garden ornaments and sculpture (Figure 3.80).

Overhead power lines on deteriorated poles are unsightly (Figure 3.81).

Small play areas are a character defining feature. Some of the small play areas are very nice spaces. The play area near Unit 23 is away from cars and traffic. It is entirely fenced, with multiple access points. It was quiet and felt safe. Some garden chairs and tables were available for use by residents. The space appeared to be accessible (Figure 3.82).

Some of the areas originally designated as play areas have been converted to parking.

Figure 3.75 - Materials being stored out in open view at community center.

Figure 3.76 - Typical planter.

Figure 3.77 - Typical planter.

Figure 3.78 - Typical planter.


Figure 3.79 - Plantings within walkway area.


Figure 3.81 - Overhead power lines.


Figure 3.80 - Typical garden ornamentation.


Figure 3.82 - Small play area within residential courtyard.

Figure 3.83 - Concrete stair, landing and ramp located at community center's main entrance.


Figure 3.84 - Secondary entrance to community center.

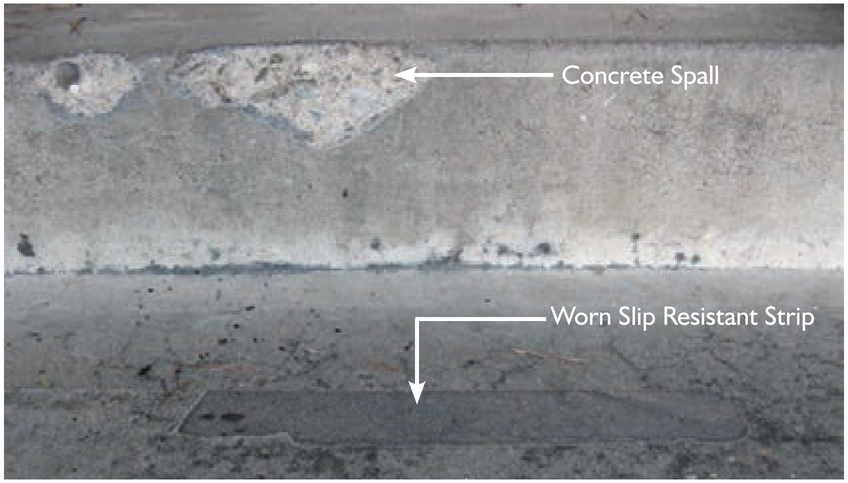

Figure 3.85 - Chipping of stair and missing slip resistant strips.

Figure 3.86 - Deteriorated stucco at bottom edge.

## BUILDINGS AND STRUCTURES

### Community Center

*Architectural: Exterior*

**Stairs, Landings & Railings**

Description:

Stairs, landings and railings are not character defining features. A concrete stair and landing is located at the primary façade at the main entrance to the community center (Figure 3.83). Secondary entrances are located at the east and west facades and are used primarily as service entries. The east entrance includes a set of concrete stairs and landing. (Figure 3.84). None of the entrances include a handrail.

Rating:

GOOD

Observed Conditions:

The following are observed conditions of the concrete stairs:

- Concrete spalls and pitting of the surface, observed primarily at the stair nosings and edges (Figure 3.85). Typical spalls are less than 1 SQFT in size.
- Deteriorated and/or missing slip resistant strips (Figure 3.85).
- No handrail as required by CBC code 1012.

**Ramps & Railings**

Description:

The ramp and railings are not character defining features. An accessible ramp is located at the main entrance on the north façade. The ramp is constructed of concrete with a metal pipe handrail.

Rating:

GOOD

Observed Conditions:

No deficiencies of the ramp and railings were observed.

**Wood Siding (Character Defining Feature)**
It is understood from interviews with maintenance staff that the historic wood siding is intact underneath the existing stucco layer. The wood siding is identified as a character defining feature. Visual confirmation was not made and its condition is unknown.

**Stucco Wall Finish**
Description:
The stucco wall finish is not a character defining feature. The exterior walls of the community center have been covered over with a layer of stucco. The finish is textured.

Rating:
GOOD

Observed Conditions:
The following are observed conditions of the stucco:
- Deteriorate edging where the stucco meets grade (Figure 3.86).
- Minor cracking, localized at building corners and windows (Figure 3.87).

**Vents**
Description:
Vents are not a character defining feature. Wood-frame screened vents are located at the base of the building within the foundation wall (Figure 3.88). These vents serve as ventilation for the crawl-space beneath the building.

Rating:
GOOD

Observed Conditions:
The following are observed conditions of the wood vents at the crawl-space:
- Minor deterioration of wood frames.
- Vents obstructed by landscaping material.

In addition to observing the physical condition of the vents, the existing ratio of vent area to crawl-space area was calculated and verified with code requirements. CBC code 1203.3.1 requires that the "minimum net area of ventilation openings shall not be less than 1 square foot for each 150 square feet of crawl-space area". The ventilation opening area was found to be inadequate to ventilate the crawl-space of the community center. See the table below for existing ventilation area.

| Existing Crawl-space Area | Code Required Ventilation Area | Existing Ventilation Net Area | Compliance |
|---|---|---|---|
| 4,920'-3" | 32.8 SQFT | 17.7 SQFT | Deficient |

Community Center Ventilation Calculation Table


Figure 3.87 - Deteriorated stucco at building corner.

Figure 3.88 - Typical wood framed vent.

Figure 3.89 - Original double doors and side lites at main entrance.

**Doors (Character Defining Feature)**

<u>Character Defining Features:</u>
The wood-paneled door (some partially glazed) are identified as a character defining feature.

<u>Description:</u>
The main entrance doors shown on the historic drawings are a set of glazed wood double doors with sidelight panels and a transom (Figure 3.89). The glazing is divided into two vertical lights with a wood muntin. The original units are still present. Secondary entrances from the main stair are located at the east and west walls of the landing. The glazed, wood door at the west wall is original (Figure 3.90). The glazed wood door at the east wall is not original (Figure 3.91). This opening was created as an entrance into the bank. Service entrance doors are metal and/or wood (Figure 3.92).

<u>Rating:</u>
GOOD

<u>Observed Conditions:</u>
The following are observed conditions of the doors:

- The threshold at the main entrance double doors does not meet accessibility requirements. CBC code 1133B.2.4 requires "the floor or landing shall not be more than 1/2 inch lower than the threshold of the doorway." The threshold is currently 1 inch above the landing (Figure 3.93).
- The threshold at the entrance to the bank does not meet accessibility requirements. The threshold is currently 1.75 inches above the landing.

**Windows (Character Defining Feature)**

<u>Character Defining Features:</u>
Wood-sash windows aligned in horizontal rows are identified as character defining features.


Figure 3.90 - Original door at entrance to office space.

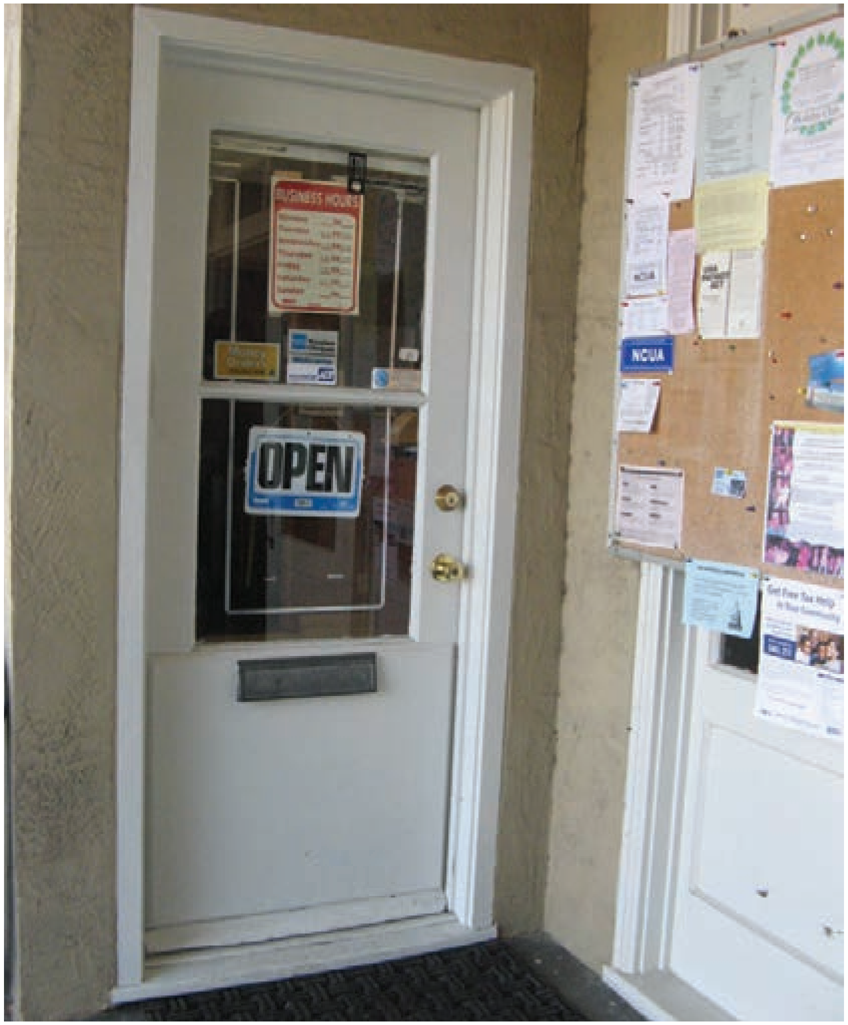


Figure 3.91 - Non-historic door in a new opening.


Figure 3.92 - Metal doors at maintenance area.

Figure 3.93 - Threshold not accessible.

**Windows (Character Defining Feature) cont.**

Description:

The windows throughout the community center are predominantly single hung, wood-sash and frame windows (Figure 3.94). Many of these windows include an aluminum frame screen while other windows are covered by a security metal mesh. The south windows at the auditorium are a row of five single hung, wood-sash and frame windows with a transom above (Figure 3.95). These windows also contain security screens.

Rating:

GOOD

Observed Conditions:

The following are observed conditions of the windows:

- Lack of drip edge at the wood sill due to addition of stucco layer. Some sills have a metal drip edge installed as flashing to protect the stucco (Figure 3.96). At other sills there is no flashing, leaving the stucco susceptible to water damage and staining.
- Deteriorated window putty is cracked and/or missing (Figure 3.97).

**Roof Shingles (Character Defining Feature)**

Character Defining Features:

The following are character defining features associated with the roof:

- Wood-boxed chimneys.
- Linear roof lines.

Description:

The community center roof is composed of asphalt shingles over wood decking. The roof is scheduled to be re-roofed in 2009. The project will include:

- Installation of 30 year, 3-tab asphalt shingles over existing shingles;
- Installation of flashing at eaves and roof penetrations and;
- Inspection of decking.


Figure 3.94 - Typical wood sash windows.


Figure 3.96 - Window with install flashing drip edge.


Figure 3.95 - Typical wood sash windows at auditorium.


Figure 3.97 - Deteriorated window putty.


Figure 3.98 - Typical soffit showing paint deterioration.


Figure 3.99 - Typical downspout.

**Roof Soffit**

Description:

The roof soffit is composed of wood boards at the underside. The boards are spaced with a quarter inch gap to allow for ventilation (Figure 3.98).

Rating:

FAIR

Observed Conditions:

The following are observed conditions:

- Deteriorated paint coatings in the form of delaminating paint (Figure 3.98).

**Gutters and Downspouts**

Description:

Roofs drain to a flat wood cornice with a flashed outlet to a downspout. Downspouts are galvanized metal pipe draining to a concrete splash pad at grade (Figure 3.99).

Rating:

GOOD

Observed Conditions:

The following are observed conditions:

- Clogged downspouts (Figure 3.100).
- Missing splash pad at outlet of downspout (Figure 3.101).

Figure 3.100 - Typical clogged downspout.

Figure 3.101 - Downspout without splash pad to direct water away from foundation.

*Structural*

Structural systems are not a character defining feature. However, access to structural systems may impact character defining features.

**General**

The existing wood-frame Community Center building is, generally, one story over crawlspace, with a high bay roof structure over the auditorium. The west repair shop and storage space has a concrete slab-on-grade at the first floor level.

The structural system description for the Community Center building is similar to that summarized for the Residential Units, Buildings 1 through 3. One exception is that the long span roof over the auditorium is supported by large wood-frame roof trusses spaced at approximately 14 feet on center that span approximately 30 feet across the auditorium. Also, the original horizontal wood siding shown on the 1941 drawings on the exterior walls was either replaced by or was overlain with cement plaster at all exterior walls.

All general comments made for the Residential Units regarding the existing condition of the structural elements, as well as existing site conditions such as site grading and perimeter drainage, are also applicable to the Community Center building.

**Code Considerations**

A preliminary seismic analysis of the Community Center building was completed based on known structural information. This analysis was based on the lateral load regulations of Section 8-706 of the 2007 California Historic Building Code (CHBC), including Tables 8-8-A and 8-8-B, allowable capacities for existing materials. The seismic lateral force level for evaluation of existing historic buildings required by this code section is equivalent to approximately 75% of the 1995 California Building Code (1994 Uniform Building Code) seismic force level for new buildings.

As we understand it, seismic strengthening of the Community Center building would not be triggered or required based on any proposed remodeling or repairs. However, as anticipated, based on the age of the existing construction, analysis indicated that there are several structural deficiencies. It would be prudent to address these on a voluntary basis if any future remodeling is proposed. This would provide additional seismic protection for the building consistent with the 2007 CHBC provisions.

The structural deficiencies noted are summarized below. The proposed strengthening to address these deficiencies is covered in the TREATMENT RECOMMENDATIONS section of this report.

Roof Diaphragm Capacity:
The existing 1x skip sheathing, which was part of the original 1941 construction, does not have adequate capacity to transfer the code-required wind or seismic forces to the interior and exterior shearwalls or to brace the walls out-of-plane. The roof plywood added at the time of the recent re-roofing of the Community Center building has adequate capacity to strengthen the roof diaphragm, if properly nailed. Documentation of the nailing used to attach this plywood was not available.

Floor Diaphragm Capacities:
The existing typical 1x6 wood diagonal sheathing and finished wood flooring has adequate capacity for transfer of the code required wind or seismic forces to the existing interior and exterior foundations. However, the connections of the floor diaphragms to the concrete foundation walls were found to be deficient, in some cases.

Existing Shearwall Capacities:
In general, the existing cement plaster and plaster walls have adequate capacity, in some locations, to resist the code required wind or seismic forces. The following are the exceptions:

- The interior walls around the high roof perimeter do not extend to and connect to the roof diaphragm.
- The interior and exterior walls, in some locations, have inadequate capacity to resist the code required wind or seismic forces without supplemental strengthening by the addition of new plywood.
- The perimeter walls and interior demising walls are not adequately connected (bolted) to the existing concrete foundations to transfer the code required wind or seismic forces.

Existing Foundations:
A detailed analysis was not possible without some additional concrete testing. However, our preliminary analysis indicates that the existing unreinforced concrete foundations likely have adequate capacity to resist their tributary code required dead, live and wind or seismic forces without additional strengthening.


Figure 3.102 - One of two furnaces that service the community center.

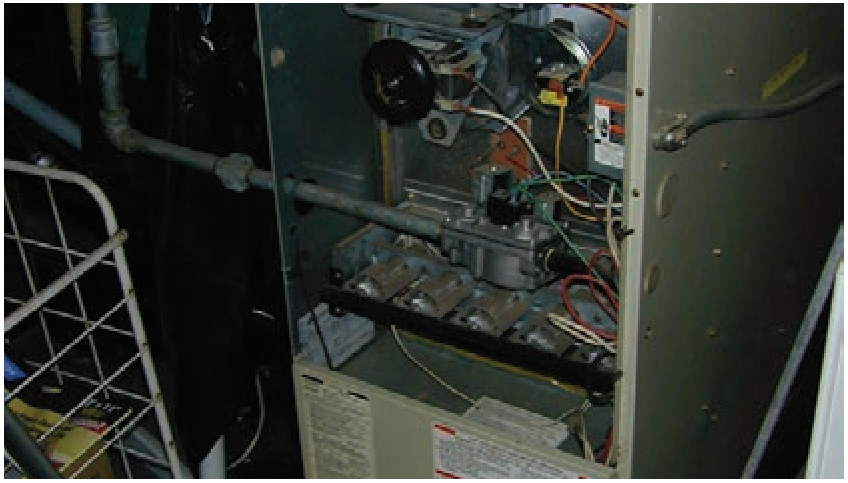
Figure 3.103 - One of two furnaces that service the community center.


Figure 3.104 - Lack of clearance at path of travel in front of furnace.

Figure 3.105 - Water heater that services the community center.

*Mechanical*

**Heat**

Description:

Heating is provided by two gas furnaces located in the shop room.

Rating:

FAIR

Observed Conditions:

The following are observed conditions of the furnace:

- One of the furnaces serves the Auditorium (Figure 3.102). The furnace is a 95,000 Btuh BDP 395BAW04808C installed in 1983. The second furnace serves the Offices, Credit Union, and Kitchen. The second furnace is a 110,000 Btuh Carrier WeatherMaker 8000 model 58WAV111-12 installed the 1990s (Figure 3.103).
- Mechanical access clearance of 30" is not provided per California Mechanical Code section 305.0 Access (Figure 3.104).
- The vent for the furnace appears to be in fair condition.
- Combustion air openings could not be found. The building would not be considered tight construction. The available outside air should be adequate.

**Water Heater**

Description:

Water heater is a 30-gallon standard efficiency unit (Figure 3.105). The water heater serves the restrooms, Office, and Kitchen. It was installed in 2006 and is in good condition.

Rating:

GOOD

Observed Conditions:

No deficiencies of the water heater were observed.

**Exhaust & Ventilation**
Exhaust was provided for the commercial Kitchen but not for the Restrooms. The following are observed conditions of the Exhaust & Ventilation system:

Kitchen:

- A commercial exhaust hood and fan has been provided for the Kitchen. The cooking range appears to have been changed. The hood no longer overhangs at least 6" beyond the cooking surface on all sides. (Figure 3.106) See California Mechanical section 508.4.1.
- Make-up air for the commercial hood does not appear to have been provided.

Restroom:

- Exhaust fan was not provided for the Restrooms. The restrooms had operable windows that used to open to the exterior. The addition of a passageway has enclosed the ventilation window (Figure 3.107).
- A new accessible restroom is under construction. The new restroom has been provided with an exhaust fan.
- There are no signs of mold in the occupied space.

Figure 3.107 - Lack of exhaust fan in restroom and operable windows that no longer vent to the exterior.

Figure 3.106 - Code deficient hood over kitchen range.

Figure 3.108 - Typical overhead electrical service.

*Electrical*

**Service**

Description:

A PG&E meter and the 100A main circuit breaker are provided for the building. The main circuit breaker feeds the main panel.

Observed Conditions:

The following are observed conditions of the electrical service:

- The electrical service for the building is via overhead service (Figure 3.108).
- The main circuit breaker is rated for 100 amps. The main circuit breaker is located in the Shop (Figure 3.109).
- The main circuit breaker feeds the main panel. The utility meters and main circuit breakers are in fair condition.
- The wiring between the meter and the electrical panel meets current codes.

**Panels**

Description:

The electrical panels are distributed throughout the building. The panels are in fair condition.

Observed Conditions:

The following are observed conditions of the electrical panel:

- The 100A electrical panel is located in the Shop and is in good condition.
- The 100A service seems to be low based on the size of the building and the use. The facility engineer indicates that at times the breakers do trip.
- The wiring is in conformance with current codes.

**Receptacles**

Description:

The Community Center has been provided with grounding type receptacles.

Figure 3.109 - Main circuit breaker.


Figure 3.110 - Typical toilet fixture.

**Lighting**
Description:
Most of the lights in the Community Center are fluorescent.

Observed Conditions:
The following are observed conditions of the lighting:
- Most ceiling lights are fluorescent.
- Light fixtures are in good condition.

**Fire Alarms and Smoke Detectors**
The Community Center does not have an operable fire alarm system or smoke detector.

## Plumbing and Fire Protection

**Gas**
Description:
The PG&E gas meter is located at the back of the residential units.

Observed Conditions:
The following are observed conditions of the gas service:
- The utility gas meter is located by the Shop and provides gas to the furnaces and the Kitchen. The gas meter is in fair condition.
- Gas seismic isolation valves have not been provided at the gas meters.

**Water**
Description:
The cold water services are delivered to the front of the residential units. The water heaters provide domestic hot water for the residential units.

Observed Conditions:
The following are observed conditions of the water service:
- The service pipes for the all the residential units were replaced with copper in 1994. A 1-1/2" cold water service pipe enters the building by the Shop. The cold water service pipe is copper.
- Water heater 30 gallons is located in the Shop (Figure 3.105).

**Sewer**
Description:
Sewer pipes are cast iron and enter from the back of the residential units.

Observed Conditions:
The following are observed conditions of the sewer:
- The 4" sewer main exits the building by the restrooms. Double cleanouts have not been provided as the sewer pipe leaves the residential units. Trap pipes are brass.

**Fixtures**
Description:
The majority of plumbing fixtures are original fixtures with the exception of the toilets.

Observed Conditions:
The following are observed conditions of the plumbing fixtures:
- Toilets are 1.6 or 3.5 gallons per flush toilets depending on the age (Figure 3.110).
- The kitchen sink is in good condition
- Some of the lavatories are new. Others are existing and in fair condition (Figure 3.111).
- None of the plumbing fixtures have been provided with pressure independent valves to prevent scalding.

**Fire Sprinkler**
Fire sprinklers have not been provided for the residential units at Atchison Village.

Figure 3.111 - Modern restroom.

Figure 3.113 - Typical rear entrance and landing.

Figure 3.112 - Typical main entrance stair and landing.


Figure 3.114 - Typical deterioration of concrete stair and landing.

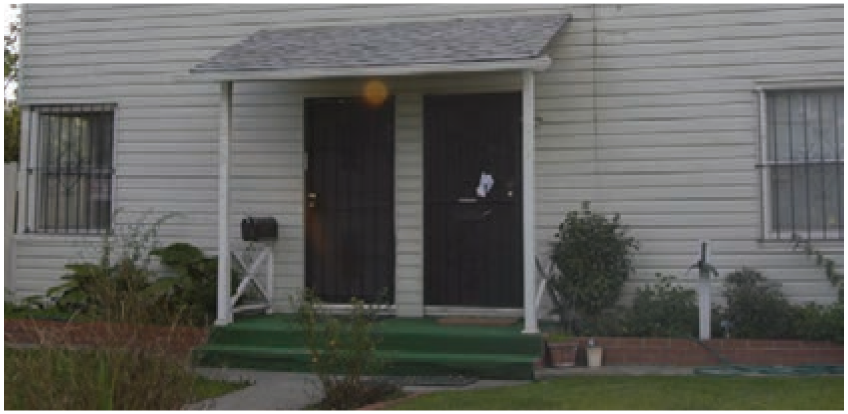
Figure 3.115 - Typical stair covered with outdoor carpet.

Figure 3.116 - Typical covered porch with railings and columns.

## Residential Units

*Architectural: Exterior*

**Stairs & Landings**

Description:

Stairs and landings are not a character defining feature, however they are a part of the covered porch area which is identified as a character defining feature. Concrete stairs are located at the primary and secondary façades of each residence (Figure 3.112 and 3.113). In some cases the rear entrance stair has been removed and/or covered over with a new deck/porch.

Rating:

GOOD

Observed Conditions:

The following are observed conditions of the concrete stairs:

- Concrete spalls and pitting of the surface, observed primarily at the stair nosings and edges (Figure 3.114). Typical spalls are less than 1 SQFT in size.
- Minor cracking of the concrete surface (Figure 3.114). Observed cracking does not appear to compromise the structural integrity of the stairs or landing.
- Deteriorated coatings and coverings, including delaminating paint, deteriorated traffic coating, and deteriorated outdoor carpet (Figure 3.115). Destructive investigation of the outdoor carpet was not conducted; therefore, the condition of the concrete in these areas was not observed.
- The concrete stairs are integral with the adjacent foundation. No evidence of separation of the stair/foundations was noted.

**Railings and Columns (Character Defining Feature)**

Character Defining Features:

The following are character defining features associated with the covered porches:

- Wood railings.
- Wood columns.

Description:

Original porch railings are constructed of dimensional wood with 2 x 4 cross bracing (Figure 3.116) and 4 x 4 vertical porch columns supporting the porch overhang. Many of these original elements are present.

Rating:

GOOD

Observed Conditions:

The following are observed conditions of the wood railings:

- Loose attachments and connections.
- Some missing components.
- Deteriorated paint coatings in the form of worn finishes and delaminating paint that is exposing the wood to solar and water deterioration (Figure 3.117).
- Minor wood decay and surface deterioration.
- Wood decay at the union of the vertical post and concrete porch.
- Exposed and rusting nails at areas of wood decay.

**Ramps**

Description:

Ramps are not a character defining feature. The need for ADA accessibility into residential units has led to the addition of ramps at both the primary and secondary façades. The general construction material for ramp additions is wood.

Rating:

GOOD to POOR

Figure 3.117 - Deterioration of porch column due to paint failure.

Figure 3.118 - Typical ramp addition.

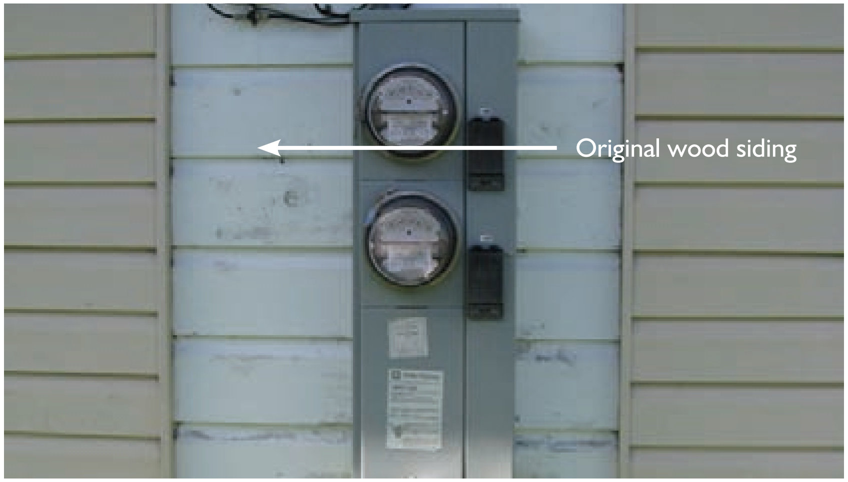

Figure 3.119 - Area of exposed wood siding.

Figure 3.120 - Original wood siding at storage blisters.

**Ramps cont.**

Observed Conditions:

The following are observed conditions of the ramps:

- Ramp and railing dimensions do not always meet ADA requirements.
- Some ramps do not include railings as required.
- Deterioration or inadequate construction of ramp footings and structural supports create unstable conditions for the ramp (Figure 3.118).
- Wood decay ranging in severity from surface deterioration to component failure.
- Deteriorated paint coatings in the form of worn finishes and delaminating paint that is exposing the wood to solar and water deterioration.

**Foundations and Crawlspaces**

Description:

Foundations and crawlspaces are not identified as character defining features. Each residential unit sits on a perimeter wall and piers foundation. Further description of the foundation is given in the Structural section. The perimeter foundation wall encloses a crawlspace that ranges from 2 to 3 feet in height.

Rating:

FAIR to POOR

Observed Conditions:

The following are observed conditions of the crawlspace:

- Standing water ranging from 2 feet to several inches of pooling around the piers.
- Mildew or musty smell of stagnant water.
- Residents using sump pumps in an effort to remove water from the crawlspace.

**Wood Siding (Character Defining Feature)**

Description:

It is understood from interviews with maintenance staff that the historic redwood siding is intact underneath the existing vinyl siding. Visual confirmation was made and the siding appears to be intact, however its condition is unknown. At localized areas the wood siding is exposed. For example, approximately 10 SQFT is left exposed where utility service is located at a secondary façade (Figure 3.119). These areas are generally in good condition with only minor paint delamination. The storage blisters at the rear of the building are constructed of the original wood siding (Figure 3.120). Many of these blisters are intact and in good condition.

Rating:

UNKNOWN

**Vinyl Siding**

Description:

The vinyl siding is not a character defining feature, however it is protecting the historic wood siding underneath. A neighborhood project to re-side all residential units with vinyl siding was completed in the early 1990s.

Rating:

GOOD to FAIR

Observed Conditions:

The following are observed conditions:

- Cracking and/or broken trim pieces. Damage is generally located at building corners near the foundation (Figure 3.121).
- Organic growth and soiling (Figure 3.122).
- Improper sealing at window and door surrounds.

Figure 3.121 - Damaged vinyl siding.

Figure 3.122 - Organic growth on vinyl siding.

Figure 3.123 - Typical wood frame vent.

Figure 3.124 - Typical louvered vent at kitchen area.

**Vents**

Description:

The vents are not identified as character defining features. Wood frame, screened vents are located at the base of each building within the foundation wall (Figure 3.123). These vents serve as ventilation for the crawl-space beneath the building. Additionally there are original wood framed, louvered vents located at the rear wall just above the foundation (Figure 3.124). Historically these vents served as ventilation for a cooler closet located in the kitchen. These vents are typically abandoned and many are sided over with vinyl siding.

Rating:

GOOD to FAIR

Observed Conditions:

The following are observed conditions of the wood vents at the crawl-space:

- Wood decay ranging in severity from surface deterioration to component failure (Figure 3.125).
- Separation at corner joints of the wood frame.
- Frame loose or detached from the concrete foundation wall opening.
- Vents obstructed by landscaping material and backfill earth (Figure 3.126 and 3.127).
- Loose and/or lack of screens or rodent deterrents.

| | Existing Crawl-space Area | Code Required Ventilation Area | Existing Ventilation Net Area | Compliance |
|---|---|---|---|---|
| Type 1 | 2160'-0" | 14.4 SQFT | 14 SQFT | Deficient |
| Type 2 | 1344'-0" | 9 SQFT | 9.7 SQFT | Borderline |
| Type 3 | 1725'-0" | 11.5 SQFT | 10.6 SQFT | Deficient |
| Type 4 | 1528'-0" | 10.2 SQFT | 8.8 SQFT | Deficient |
| Type 5 | 771'-0" | 5.2 SQFT | 7 SQFT | Adequate |

Residential Units Ventilation Calculation Table

Figure 3.125 - Typical deteriorated wood sash vent.


Figure 3.127 - Typical vent obstructed by planting bed.

Figure 3.126 - Typical vent obstructed by plantings.


Figure 3.129 - Deteriorated wood threshold at door.

Figure 3.128 - Typical historic wood door.

**Vents cont.**

In addition to observing the physical condition of the vents, the existing ratio of vent area to crawl-space area was calculated and verified with code requirements. CBC code 1203.3.1 requires that the "minimum net area of ventilation openings shall not be less than 1 square foot for each 150 square feet of crawl-space area". The ventilation opening area was found to be inadequate to ventilate the crawl-space of several of the building types. See the table below for existing ventilation area per building type.

**Doors (Character Defining Feature)**

Description:

Original doors are identified as character defining features. The original doors shown on the historic drawings are wood framed with a wood panel beneath a fixed glass pane. The glazing is divided vertically into two lights with a wood muntin (Figure 3.128). Original wood doors are present at several locations. All other doors are modern replacements of various material and style. Storm doors have been added to most entrances.

Rating:

GOOD

Observed Conditions:

The following are observed conditions of the doors:

- Deteriorated wood threshold in the form of wood decay and worn edges (Figure 3.129).
- Deteriorated paint coatings in the form of worn finishes and delaminating paint that is exposing the wood to solar and water deterioration.
- Lack of weather-stripping.
- Broken or deteriorated glass, often replaced with wood (plywood) infill.

Figure 3.130 - Typical historic wood window.

Figure 3.131 - Typical deterioration of wood sill and frame.

Figure 3.132 - Typical aluminum sash replacement window and security grill.

**Windows (Character Defining Feature) & Security Grills**

Description:

Double-hung wood sash windows are identified as character defining features. There are three general window types within residential units, single or paired double-hung windows, a cantilevered bay window and a pair of double-hung corner windows. The original windows shown on the historic drawings are wood-framed with double-hung wood-sashes, except for bay windows which contain a fixed middle pane. Kitchens and bathrooms were to have exterior screens. Original wood-frame and wood-sash windows are present at some units (Figure 3.130). However, most wood-sashes have been replaced with aluminum-sash single-hung windows within the original wood frame (Figure 3.132).

Many windows have metal security grills installed at the exterior frame of the windows (Figure 3.132). Grills are typically iron however some are more modern in style. These grills detract from the character of the windows and may threaten the integrity of the resource.

*Wood Sills and Frame:*
Rating:
GOOD to FAIR

Observed Conditions:
The following are observed conditions for the wood sills and frames:

- Deteriorated wood sill in the form of wood decay.
- Deteriorated paint coatings in the form of worn finishes and delaminating paint that is exposing the wood to solar and water deterioration.
- Deteriorated and/or lack of sealant at sill/frame interface with vinyl siding. This condition is allowing water to penetrate into the wall cavity (Figure 3.130).
- Lack of drip edge at sill due to installation of vinyl siding (Figure 3.131). This condition is causing deterioration of the wood sill.

*Wood-Sash Windows:*
Rating:
GOOD

Observed Conditions:
The following are observed conditions for the wood-sash windows:

- Deteriorated paint coatings in the form of worn finishes and delaminating paint that is exposing the wood to solar and water deterioration.
- Lack of weather-stripping.
- Unbalanced weight system makes window operation difficult.
- Inoperable condition due to improper painting.

*Aluminum-Sash Windows:*
Rating:
FAIR to POOR

Observed Conditions:
The following are observed conditions for the aluminum-sash windows:

- Installation of aluminum-sash is positioned too far back from the exterior face, causing water to pool on the exterior wood sill. This condition is causing wood decay and deterioration of the wood sill (Figure 3.131).
- Condensation at the interior side of the window glazing.
- Lack of weather-stripping.
- Vegetation and plant growth make maintenance difficult and keep moisture in contact with window components.
- Security grill coverings installed at the exterior make maintenance difficult.
- Design mechanics of the window operation make it difficult to open and close the bottom sash.

*Corner Windows:*
Past repair of the corner windows was described in interviews with the maintenance staff. Water infiltrating the wall cavity at the corner windows was causing structural failure to the wall and window structure. The repair was to remove the siding and rebuild the corner wall. This work has not been completed to all corner windows and will likely be required at other locations in the future. Some locations show beginning signs of water infiltration. Past repair work included:

- Replacing deteriorated wood members;
- Installing additional supports;
- Rebuilding the window frame and sill; and
- Reinstallation of the windows and siding.
- Some corner windows were observed to be in poor condition, but no destructive methods were used to further investigate the window and wall structure (Figure 3.133).


Figure 3.133 - Typical corner window in poor condition.


Figure 3.134 - Typical bay window in poor condition.


Figure 3.135 - Typical shingle roof.


Figure 3.136 - Typical attic vent.

*Bay Windows:*
Past repair of the bay windows was described in interviews with maintenance staff. Water infiltrating the wall cavity at the bay windows was causing structural failure to the wall and window structure. The repair was to remove the siding and rebuild the bay window, wall and floor. This work has not been completed to all bay windows and will likely be required at other locations in the future. Some locations show beginning signs of water infiltration. Past repair work included:

- Replacing deteriorated wood members;
- Installing additional supports;
- Rebuilding the window frame, sill, walls and floor; and
- Reinstallation of windows and siding.
- Some bay windows were observed to be in poor condition, but no destructive methods were used to further investigate the window and wall structure (Figure 3.134).

**Roof Shingles (Character Defining Feature)**
<u>Character Defining Features:</u>
The following are character defining features associated with the roof:

- Shingled roofs.
- Exposed rafter tails.

A neighborhood wide roof replacement project was described in interviews with the maintenance staff. All residential units were re-roofed in 2008. The project included:

- Installation of 30 year, 3-tab asphalt shingles over existing shingles;
- Installation of flashing at eaves and roof penetrations; and
- Inspection of decking.
- Two layers of existing shingles are currently on the roofs.
- Roof shingles are in good condition (Figure 3.135).

<u>Rating:</u>
GOOD


Figure 3.137- Typical paint failure at underside of soffit.


Figure 3.139 - Typical replacement aluminum gutter at main entrance.


Figure 3.138 - Typical historic wood gutter at rear entrance.


Figure 3.140 - Typical deteriorated gutter in need of maintenance.


Figure 3.141 - Typical detachment at downspout connection.

**Roof Soffit**

Description:
The roof soffit is composed of wood boards at the underside, supported by exposed wood rafter tails. Exposed wood rafter tails are identified as a character defining feature. Vents to the attic space are located between the rafter tails and are wood framed with screened openings (Figure 3.136).

Rating:
GOOD to FAIR

Observed Conditions:
The following are observed conditions for the roof soffit:

- Vents obstructed by fill insulation within the attic space.
- Lack of proper drip edge flashing.
- Deteriorated paint coatings in the form of worn finishes and delaminating paint that is exposing the wood to solar and water deterioration (Figure 3.137). In some instances this is being caused by the existing drip edge condition.

**Gutters and Downspouts**

Description:
Gutters and downspouts are not identified as character defining features. Historically the only gutters on the residential units were located at the entry porches. These gutters were constructed of wood and contained no downspout. Water was intended to run off the open ends onto the landscape below (Figure 3.138). Some of these wood gutters are still present and are in good condition. Many wood gutters have been replaced with aluminum gutters, also with no downspout (Figure 3.139). Additionally, some units have added gutters to the eaves at all sides of the building.

*Wood Gutters:*
Rating:
FAIR

The gutters were observed visually from ground level. The following are observed conditions for the wood gutters.

- Minor wood decay and deterioration.
- Deteriorated paint coatings in the form of worn finishes and delaminating paint that is exposing the wood to solar and water deterioration.

*Other Gutters:*
Rating:
FAIR to POOR

Other, non-historic, gutters are constructed of metal or vinyl. The gutters were observed visually from the ground level. The following are observed conditions for the gutters:

- Sagging gutters due to clogged downspouts that add stress to the eave and rafter tails (Figure 3.140).
- Detachment at downspout connections (Figure 3.141).

*Structural*

**General**

The existing wood-frame residential buildings include five different building types. Building Types 1 through 3 are similar in construction and detailing, and feature one story over crawlspace. Building Types 4 and 5 are similar in construction and detailing, and feature two stories over crawlspace.

The structural system for Building Types 1 through 3 consists of the following: 1x skip sheathing at the roof overlain by new plywood which was added at the time of a re-roofing of all the buildings. The nailing of the new plywood to the existing framing and existing interior and exterior stud wall blocking is unknown. The roof sheathing is supported by sloping 2x6 roof rafters spaced 16 inches on center, and 2x4 flat ceiling joists also spaced 16 inches on center.

The first floor framing system over the crawlspace consists of finished wood flooring over 1x6 diagonal sheathing. Flooring is supported by 2x8 floor joists spaced 16 inches on center. Floor joists span between the exterior foundation walls and interior 6x8 girders on support posts.

The continuous exterior foundation wall is constructed of unreinforced concrete. The wall extends from grade up to the underside of the first floor joists. The interior beam and post lines are supported by unreinforced concrete pier footings at approximately 5 feet 8 inches to 6 feet 4 inches on center.

Interior wood stud bearing walls which support the roof/ceiling structure are aligned with, and bear on, the 6x8 girder lines in the crawlspace below the first floor.

The structural system for Building Types 4 and 5 is similar to that described above for Building Types 1 through 3, except that the second floor framing consists of finished wood flooring over 1x6 diagonal sheathing supported by 2x10 floor joists spaced 12 inches on center spanning between the exterior walls and an interior wood stud bearing wall line.

Lateral (wind or seismic) loads, for all residential buildings, are resisted primarily by the exterior wood sheathing/siding and interior plaster on the exterior stud walls in combination with the double sided plaster on the interior stud walls. The plywood roof sheathing and the existing 1x diagonal sheathing and finished flooring at the floor levels act as diaphragms to transfer the lateral loads to these shearwalls, which are then transferred to the existing foundations.

Based on limited walkthrough observations of selected units, most residential buildings appear to be in good condition, have been well maintained, and appear to have performed well over their life, including in past earthquake events. Little or no evidence of significant foundation cracking or settlements or variations in floor levelness was noted during the site visit. A more element – specific summary is provided below.

The exceptions noted were the lack of proper site drainage around many buildings, resulting in standing water observed in several crawlspaces, combined with insufficient crawlspace ventilation. This condition is discussed in more detail in other parts of this report. The extent of damage, if any, to the existing wood-framing in the crawlspace areas due to this long term condition is unknown without a more detailed field review.

**Foundations**

Concrete Walls, Piers and Grade Beam:

The existing interior and perimeter concrete foundations appear to be unreinforced based on the 1941 structural drawings. No independent field testing to verify this or to verify the compressive strength of the existing concrete was possible within the scope of this report. These foundations, as well as the interior concrete piers, where observed, appeared to have performed well over their life. Unreinforced concrete foundations, although not allowed by current codes, are acceptable under the 2007 California Historic Building Code if evaluated for their existing loading conditions. This is addressed in more detail under the Code Considerations section below.

**Grading**
In many instances the exterior soil grades were high relative to the code wood-earth separation requirements, in some cases resulting in soil contact with the perimeter wood stud wall sill plates and siding. Even where exterior soil grades were low, in most locations surveyed, the adjacent soil was not properly graded to slope away from the perimeter foundations.

**Perimeter Drainage**
This is discussed in more detail in other sections of this report. Standing water, including immediately adjacent to existing perimeter foundations, was noted throughout the site during the assessment visit. This lack of proper perimeter foundation drainage contributes to the observed standing water in many of the crawlspaces and likely contributes to long term foundation movements and moisture damage to the existing crawlspace wood-framing.

**Wall Structure**
The existing interior and exterior wood stud walls appear to be in good condition, including the existing plaster finishes. Seismic deficiencies noted in the existing walls and their connections to the floor and roof diaphragms, particularly in the lower level of Building Types 4 and 5, are addressed under the Code Considerations section below.

**Roof Structure**
Limited areas were observed in the attic spaces of two units. The existing roof framing, including the exterior, exposed rafter ends, appeared to be in good condition, with little or no evidence of moisture or dryrot damage observed. Any seismic deficiencies noted in the existing roof diaphragms are addressed under the Code Considerations section below.

**Floor Structure**
Only limited access to observe crawlspace framing was possible during the site visit. Review of additional photos provided to us indicated that the crawlspace framing, in the areas photographed, was in fair to good condition. A more detailed survey would be required to confirm this.

**Code Considerations**
A preliminary seismic analysis of Building Types 1 through 5 was completed based on known structural information. This analysis was based on the lateral load regulations of Section 8-706 of the 2007 California Historic Building Code, including Tables 8-8-A and 8-8-B, allowable capacities for existing materials. The seismic lateral force level for evaluation of existing historic buildings required by this code section is equivalent to approximately 75% of the 1995 California Building Code (1994 Uniform Building Code) seismic force level for new buildings.

As we understand it, seismic strengthening of the existing residential buildings would not be triggered or required based on any proposed remodeling or repairs. However, as anticipated, based on the age of the existing construction, analysis indicated that there are several structural deficiencies. It would be prudent to address these on a voluntary basis, if any future remodeling is proposed or if the Owners wish to provide additional seismic protection for their units.

The structural deficiencies noted are summarized below. The proposed strengthening to address these deficiencies is covered in the TREATMENT RECOMMENDATIONS section of this report.

**Roof Diaphragm Capacity**
The existing 1x skip sheathing, which was part of the original 1941 construction, does not have adequate capacity to transfer the code required wind or seismic forces to the interior and exterior shearwalls or to brace the walls out-of-plane. The plywood added at the time of the recent re-roofing of all the residential buildings has adequate capacity to strengthen the roof diaphragm, if properly nailed. Documentation of the nailing used to attach this plywood was not available.

**Floor Diaphragm Capacities**
The existing typical 1x6 wood diagonal sheathing and finish wood flooring has adequate capacity to transfer the code required wind or seismic forces to the existing interior and exterior shearwalls. However, the connections of the floor diaphragms to these walls were found to be deficient, in some cases.

**Existing Shearwall Capacities**
In general, for Building Types 1 through 3, the existing wood siding and plaster walls have adequate capacity to resist the code required wind or seismic forces with the following exceptions:

- The interior demising walls do not extend to and connect to the roof diaphragm.
- The perimeter walls and interior demising walls are not adequately connected (bolted) to the existing concrete foundations to transfer the code required wind or seismic forces.

For Building Types 4 and 5, the existing wood siding and plaster walls have adequate capacity to resist the code required wind or seismic forces, except at the lower level, where additional supplementary strengthening of selected walls with new plywood is recommended. The two exceptions noted above for Building 1 through 3 shearwalls would also apply to Building Types 4 and 5.

**Existing Foundations**
A detailed analysis was not possible without some additional concrete testing. However, our preliminary analysis indicates that the existing unreinforced concrete foundations likely have adequate capacity to resist their tributary code required dead, live and wind or seismic forces without additional strengthening.

*Mechanical*

**Heat**
Description:
Heating is provided by a gas wall heater located in the living room.

Rating:
FAIR

Observed Conditions:
The following are observed conditions of the wall heater:

- The heaters are original installation. The heaters do not have safety circuits (Figure 3.142).
- The vent for the heater could not be observed, but the vent appears to be of heavy construction.
- Combustion air openings could not be found. Current code requires vent openings within 12" of the floor and ceiling.

**Water Heater**
Water heaters are 30 to 40 gallon standard efficiency units (Figures 3.143 and 3.144). The condition of the water heaters vary depending on the age of the equipment. As each unit deteriorates, the water heater is replaced.

Rating:
FAIR to GOOD

**Exhaust & Ventilation**
Exhaust was not provided for the residential units. The following are observed conditions of the Exhaust & Ventilation system:

Kitchen:
Exhaust fan was not provided for the Kitchen.
Natural ventilation is provided for the Kitchen. There are no signs of mold in the occupied space.

Figure 3.142 - Original wall heater.

Figure 3.143 - Typical water heater within unit.

Figure 3.144 - Typical water heater located within storage blister at exterior.

Figure 3.145 - Typical electrical service into unit.

Figure 3.146 - Typical meter and main circuit breaker.

Bathroom:
Exhaust fan was not provided for the Bathroom.
Natural ventilation is provided for the Bathroom. There are no signs of mold in the occupied space.

Laundry:
Most residential units do not have laundry units. One residential unit visited did have a washer and dryer. The laundry area did not have an exhaust system. Natural ventilation is provided for the laundry area. There are no signs of mold in the occupied space.

*Electrical*

**Service**

Description:
PG&E meters and the 80 A main circuit breakers are located at the end of each building containing 4 units. The main circuit breaker feeds the panel in the residential unit.

Rating:
GOOD

Observed Conditions:
The following are observed conditions of the electrical service:

- The electrical service for the building is via overhead service (Figure 3.145).
- The utility meters and main circuit breakers are located at the end of quad units (Figure 3.146). The main circuit breakers feed the electrical panels in the residential units. The utility meters and main circuit breakers are in good condition.
- The main circuit breaker is rated for 80 amps.
- The wiring between the meter and the electrical panel meets current codes.

**Panels**

<u>Description:</u>
The electrical panels are located in the residential units. The wiring for the residential units are original "Knob and Tube" wiring.

<u>Rating:</u>
GOOD

<u>Observed Conditions:</u>
The following are observed conditions of the electrical panel:

- The 80A electrical panel has 8-12 circuit breakers (Figure 3.147). The panel is in good condition.
- The electrical panel has spare breakers.
- "Knob and Tube" wiring was used (Figure 3.148). The "Knob and Tube" wiring used copper Hot and Neutral conductors. The conductors had asphalt soaked cloth sheath. The conductors are supported on ceramic posts called "Knob" and routed through concealed spaces with ceramic "Tube" penetrating wood studs.
- "Knob and Tube" conductors rely on the surrounding air for cooling. The conductors should not be covered by building insulation. The insulation will restrict cooling for the conductors and overheat.
- The residential unit wiring only has Hot and Neutral conductors. A ground wire is not installed.

Figure 3.147 - Typical electrical panel


Figure 3.148 - Typical wiring at attic space.

**Receptacles**

Description:

Most residential units have two-prong receptacles. The receptacles are old and do not meet current codes.

Rating:

POOR

Figure 3.149 - Typical two-prong type receptacle.

Observed Conditions:

The following are observed conditions of electrical receptacles:

- Most receptacles are two-prong type (Figure 3.149). The receptacles are old and past their useful service life.
- Two-prong receptacles do not have a grounding wire. Current code requires grounding wire.
- Receptacles are not located at maximum 12 feet on center per the electrical code. Living rooms have two 20A receptacles and one receptacle at the light switch. Kitchens have three 20A receptacles. Bedrooms have two 20A receptacle and one receptacle at the light switch. Bathrooms have one 20A receptacle at the light switch.
- Residential units do not have "Ground Fault Interrupt" (GFI) receptacles. GFI are required by code for areas with water. GFI receptacles prevent people from being electrocuted. The GFI receptacle can sense when electricity may be going through people instead of the equipment. The GFI receptacle trips to protect people from electrical injury.
- Residential units do not have "Arc-Fault Circuit-Interrupter" (AFCI). AFCI are required by current code. The AFCI senses electrical arcing between wires. Upon detection of arcing the AFCI trips the electricity to prevent fire.

**Lighting**

Description:

Lights in residential units are incandescent.

Rating:

FAIR

Observed Conditions:

The following are observed conditions of the lighting:

- Most ceiling lights are incandescent (Figure 3.150). Some ceiling lights have been converted to fluorescent.
- Exterior front door lights are incandescent (Figure 3.151).

PART III

**Fire Alarms and Smoke Detectors**

Description:

Most residential units do not have a fire alarm system or smoke detectors.

Observed Conditions:

The following are observed conditions of the fire alarm and smoke detector systems:

- Residential units do not have fire alarm systems.
- Most residential units do not have smoke detectors. One residential unit did have a battery operated smoke detector in the bedroom.

*Plumbing and Fire Protection*

**Gas**

Description:

The PG&E gas meter is located at the back of the residential units.

Rating:

FAIR

Observed Conditions:

The following are observed conditions of the gas service:

- The utility gas meters are located at the back of the residential units (Figure 3.152).
- Gas seismic isolation valves have not been provided at the gas meters.

**Water**

Description:

The cold water services are delivered to the front of the residential units. The water heaters provide domestic hot water for the residential units.

Rating:

FAIR to POOR

Figure 3.150 - Typical light fixture at interior.

Figure 3.151 - Typical light fixture at exterior.

Figure 3.152 - Typical gas meter.

Figure 3.153 - Typical hose bib and water service.

Observed Conditions:
The following are observed conditions of the water service:

- The service pipes for all the residential units were replaced with copper in 1994. A 1" cold water service pipe is located at the front of the residential units (Figure 3.153). The cold water service pipe is copper.
- The residential unit water pipes are original galvanized steel from 1941. The condition of the water pipe is fair. Several residential units showed signs of inadequate water pressure caused by corrosion in the pipe. Many pipes show signs of rust in the water.
- Hose bib is provided at the supply main at the front of the residential units. A copper pipe was also extended to the back of the residential units for a second hose bib.
- Water heaters are located either in the kitchen or in a shed at the back (Figures 3.143 and 3.144).

**Sewer**
Description:
Sewer pipes are cast iron and enter from the back of the residential units.

Rating:
FAIR to POOR

Observed Conditions:
The following are observed conditions of the sewer:

- Sewer mains are 3" cast iron pipes. Cleanouts for the sewer are located in the crawl space. Double cleanouts have not been provided as the sewer pipe leaves the residential units.
- Trap pipes are brass or PVC (Figure 3.154).

**Fixtures**

Description:

A majority of plumbing fixtures are original fixtures with the exception of the toilets (Figure 3.155).

Rating:

The condition of the plumbing fixtures varies between residential units.

Observed Conditions:

The following are observed conditions of the plumbing fixtures:

- Most toilets are 1.6 gallons per flush toilets (Figure 3.155).
- Most kitchen sinks are original installation (Figure 3.156). The kitchen sink is in fair condition.
- Most tubs are original installation (Figure 3.157). The faucet for the shower is dual handle controls – hot and cold valves. The tub is in fair condition.
- Some of the lavatories are new. Others are existing and in fair condition.
- Some of the residential units have converted the bath tub to a combination bath shower unit (Figure 3.157).
- None of the plumbing fixtures have been provided with pressure independent valves to prevent scalding.

**Fire Sprinkler**

Fire sprinkler have not been provided for the residential units at Atchison Village.

Figure 3.154 - Typical trap pipes.

Figure 3.156 - Typical kitchen sink.


Figure 3.155 - Typical toilet fixture.


Figure 3.156 - Typical tub/shower fixture.

# PART IV: TREATMENT RECOMMENDATIONS

## ULTIMATE TREATMENT & USE

### Treatment Options

Treatment of historic structures is divided into four categories: preservation, rehabilitation, restoration, and reconstruction. These categories parallel those used in planning for the ultimate treatment of historic structures. They are also the same as those outlined in Management Policies and the Secretary of the Interior's *Standards for the Treatment of Historic Properties*, commonly referred to as the *Standards*.

*Preservation* as an ultimate treatment maintains the existing integrity and character of a historic structure. This alternative precludes uses that would require major additions or demolition. It should always receive first consideration.

*Rehabilitation* maintains the existing integrity and character of a historic structure, but allows major additions or alterations to accommodate a compatible contemporary use. Rehabilitation does not apply to prehistoric structures, ruins, monuments, or outdoor sculpture, nor should it be the ultimate treatment for historically furnished historic structures even though they may require major modifications to perform as such.

*Restoration* reestablishes the form, features, and character of a historic structure at a specific past period. Restoration may be comprehensive or focus on the exterior. Complete restoration is done primarily to Category Ia structures and structures containing historic furnishings, although secondary aspects of their interiors may be adaptively used. Exterior restoration applies primarily to Category Ib structures and some Category Ia structures that are integral to the historic settings of parks. Treatment and use of their interiors must meet corresponding standards and must not affect the desired exterior appearance. Management Policies permits restoration only if (a) it is essential for public understanding of the cultural associations of a park and (2) it can be accomplished with minimal conjecture based on sufficient data. Restoration of prehistoric or historic ruins is prohibited.

*Reconstruction* produces a new structure identical in form, features, and details to a historic structure that no longer exists. Management Policies permits reconstruction only if (a) it is essential for public understanding of the cultural associations of a park established for that purpose, (b) the structure can be built at full scale on the original site with minimal conjecture, and (c) significant archeological resources will be preserved in situ or their research values will be realized through data recovery. Meeting the first criterion requires a demonstration that no other interpretive media or techniques can render the park's primary theme comprehensible to visitors. Reconstruction will be undertaken only upon specific written approval of the director after policy review in the Washington office.

## Recommended Treatment

Page & Turnbull recommends the adoption of rehabilitation as the treatment option for Atchison Village. Rehabilitation improves the utility or function of a historic structure, through repair or alteration, to make possible a compatible contemporary use while preserving those portions or features that are important in defining its significance. The following standards based on the Secretary's *Standards* apply:

- A historic structure is used as it was historically or is given a new or adaptive use that maximizes the retention of historic materials, features, spaces, and spatial relationships. Adaptive use of prehistoric structures is prohibited.
- The historic character of a historic structure is retained and preserved. The replacement or removal of intact or repairable historic materials or alteration of features, spaces, and spatial relationships that characterize a structure is avoided.
- Each historic structure is recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features from other structures, are not undertaken. Work needed to stabilize, consolidate, and conserve historic materials and features is physically and visually compatible, identifiable upon close inspection, and properly documented for future research.
- Changes to a historic structure that have acquired historical significance in their own right are retained and preserved.
- Historic materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a historic structure are preserved.
- Deteriorated historic features are repaired rather than replaced. Where the severity of deterioration requires repair or replacement of a historic feature, the new feature matches the old in design, color, texture, and, where possible, materials. Repair or replacement of missing features is substantiated by archeological, documentary, or physical evidence.
- Chemical or physical treatments that cause damage to historic materials are not used.
- Archeological and landscape resources are protected and preserved in place. If such resources must be disturbed, mitigation measures are undertaken including recovery, curation, and documentation.
- Additions, alterations, or related new construction do not destroy historic materials, features, and spatial relationships that characterize the historic structure. New work is differentiated from the old and is compatible with the historic materials, features, size, scale and proportion, and massing of the structure.
- Additions and adjacent or related new construction are undertaken in such a manner that if removed in the future, the essential form and integrity of the historic structure would be unimpaired.

## NEIGHBORHOOD SITE & LANDSCAPE: TREATMENT RECOMMENDATIONS AND ALTERNATIVES

### Site: Drainage

There is an array of potential strategies that could be employed to mitigate the drainage problems experienced within Atchison Village. Minor drainage deficiencies, which result in ponding in local depressions, can be addressed by small-scale regrading efforts to ensure positive drainage away from structures and facilities into the curb and gutter drainage system. These simple improvements can be made on a lot-by-lot basis and are not explored further in this report.

Addressing major drainage deficiencies at Atchison Village is a step-wise process. The first step is to introduce runoff reduction strategies in order to decrease the amount of stormwater runoff at its source. The second step is to construct stormwater management facilities that capture surface runoff and attenuate peak flow rates and volumes. The final step is to enhance the storm drain network as necessary to adequately convey off-site runoff from larger storms.

1. Runoff Reduction
2. Stormwater Management Facilities
3. Storm Drain System Enhancement

Successfully implemented, the host of strategies proposed herein can decrease peak runoff rates and total runoff volume, help prevent flooding, reduce water pollution, create habitat for birds and other pollinators, and enhance the natural function and overall environment of the Atchison Village community.

**Produce Drainage Masterplan**

The following recommendations have the potential to impact the integrity of the resource if not done sympathetically and with great care. Therefore the first recommendation under the drainage section is to study and produce a drainage masterplan. The Atchison Village neighborhood should be analyzed and areas of potential work identified. The goal of the masterplan is to protect the integrity of the resource while mitigating the drainage issues of Atchison Village. The Drainage Masterplan should address the following:

- Outline recommended options including design and materials options
- Discuss potential impacts to the resource
- Identify on a site plan areas where recommended options may be installed
- Generate cost estimate for options
- Include recommended soils analysis (see below)

**Conduct Soil Analysis to Inform Masterplan**

Conducting a soils analysis will better inform the future project for mitigating drainage issues at Atchison Village. Recommended test should include but is not limited to the following:

- In-situ Percolation Testing - This test involves digging a pit to a depth of approximately 18", filling it up with water, then measuring the rate at which water infiltrates into the ground. It is important that the test be performed according to a good set of specifications. The City of Seattle has developed some thorough specs for the test.
- Establish the Seasonal High Water Table - This test can take several month to complete. However, once complete it will identify the location of the water table at its maximum height.

**Pervious Pavement for Pocket Parking Stalls**

Figure 4.1 - Typical candidate within Atchison Village.

Figure 4.2 - Example installation.

**Interlocking Pavers for Roadside Parking**

Figure 4.3 - Typical candidate within Atchison Village.

Figure 4.4 - Example installation.

**Implement Runoff Reduction Strategies**

Discussion

Runoff reduction focuses on minimizing impervious surfaces and maximizing vegetation, especially mature tree canopy. A full canopy can intercept and absorb up to the first half inch of rainfall. All vegetation works to stabilize the soil, absorb and cleanse stormwater runoff, and provide a multitude of other environmental benefits.

Impervious surfaces should be reduced or replaced with pervious alternatives wherever feasible. Atchison Village has an abundance of designated parking areas found throughout the site. These areas include parallel parking on the street, roadside pocket lots, and full parking lots located behind some residences. Much of the parking capacity appeared to be under utilized, in which case these excess parking areas are good candidates for conversion from impervious to pervious surfaces.

Pervious Paving Systems

Pervious paving systems may be used for parking surfaces (Figures 4.1 and 4.2). Interlocking permeable pavers, which are set with sand or another porous material to fill the gaps in between, are a flexible option because they come in a variety of colors and shapes and are easily repaired by replacing individual pavers (Figures 4.3 and 4.4). Other options include grass paving systems and pervious concrete or asphalt (Figures 4.5 and 4.6). One major benefit of these systems is that they can be installed with a deep gravel subbase which would provide extensive stormwater detention capacity. Constraints include poorly drained soils, relatively high cost of installation, and increased maintenance requirements over traditional pavement.

*Potential Impact on Resource*

An additional constraint to a pervious paving system is its effect on the integrity of the resource. For example, installing a paver system at parking areas along roadways would introduce a new material that was never intended to be a part of Atchison Village. The recommended Drainage Masterplan should study the design and materials so as to lessen the impact to the resource.



**Grass Paving System for Parking Lots**

Figure 4.5 - Typical candidate within Atchison Village.

Figure 4.6 - Example installation.

**Urban Rain Garden**

Figure 4.7 - Typical candidate within Atchison Village.

Figure 4.8 - Example installation.

**Roadside Swale**


Figure 4.9 - Typical candidate within Atchison Village.


Figure 4.10 - Example installation.

**Implement Low Impact Development (LID) Stormwater Facilities**

Discussion:

LID is a philosophy of stormwater management that seeks to repair hydrological and ecological function to urbanized watersheds. In a retreat from decades of centralized, hard-pipe solutions that treat stormwater as a burden and ship it offsite as quickly as possible, LID represents a paradigm shift wherein stormwater is kept onsite for longer periods and utilized as a resource.

LID design aims to mimic natural hydrologic processes by making green space function to control stormwater near its source. These functional green spaces manifest as a distributed, interconnected system of bioretention cells and vegetated drainage ways integrated into the existing landscape that incorporate vegetal interception, evapotranspiration, infiltration, and other natural processes to manage stormwater.

Rain gardens and swales are landscape-based stormwater management facilities that, upon proper installation, would help rehabilitate the current drainage conditions. These facilities reduce stormwater runoff volume and rates, while increasing the aesthetic quality of their surroundings. Installation is inexpensive and causes minimal disturbance. Opportunities to locate these facilities exist within the landscaped public areas located along the perimeter of the site, sidewalk and roadway edges, and interior public open space.

Rain Gardens:

Rain Gardens are flat-bottomed landscaped depressions, usually large with irregular shapes and natural side slopes. Also known as 'bioretention cells', they are designed to allow water to pond up to a certain depth (around 3") so that it has a chance to settle and infiltrate into the soil. They reduce the peak discharge rate from a site via detention, which provides flood control benefits, but will not significantly decrease total runoff volume due to poor soil conditions. In addition to drainage benefits, water quality improvements are achieved through particle settling, nutrient uptake, and biofiltration. Rain gardens offer a versatile solution for amorphous spaces because they can be built to any size or shape. The triangular planter at the main entry is a good candidate location for a rain garden.

Swales:

Swales are shallow, formalized drainage ways that employ landscaping to stabilize the soil while providing water quality treatment via bio-filtration. Also known as 'bioswales', they are designed to provide conveyance function while removing silt and sediment-associated pollutants. Swales are relatively inexpensive, easy to construct, and widely used. They can be planted with a variety of grasses, sedges, rushes, and shrubs. Swales are linear in shape and could be widely employed as surrogates to the curb and gutter drainage system currently onsite.

*Potential Impact on Resource*

One constraint to installing swales is its effect on the integrity of the resource. For example, sidewalks thought out Atchison Village are directly adjacent to the roadway. Installing a swale at this area would require relocation of the sidewalk closer to the residential units. The recommended Drainage Masterplan should study the design and materials so as to lessen the impact to the resource.

Curb Extensions:

Curb extensions, as the name suggests, are spaces created by extending the existing sidewalk curb out into a roadway. This allows for the conversion of non-essential asphalt into landscape space that can be used for traffic control, improved pedestrian experience, and stormwater management. The curb extension itself actually just provides the housing for either a rain garden or swale, which should be chosen depending on the particular site opportunities and constraints. Curb extensions are ideally suited for residential settings where improved street amenities, access to alternative transportation, traffic control, and stormwater management can be combined into a single street design element.

*Potential Impact on Resource*

One constraint to installing curb extensions is its effect on the integrity of the resource. For example, the historic design for streets through Atchison Village was carefully planned in terms of its visual appeal. The recommended Drainage Masterplan should study this design and materials so as to lessen the impact to the resource.

**Curb Extensions**


Figure 4.11 - Typical candidate within Atchison Village.

Figure 4.12 - Example installation.

**Lowered Park Land**

Figure 4.13 - Typical candidate within Atchison Village.

Figure 4.14 - Example installation.

Centralized Detention:
During larger, less frequent storm events, the baseball field and park area could be used as an emergency detention facility. By lowering the surface elevation of the park and ball field, a depression would be created that could receive runoff and detain stormwater during the storm then be pumped dry immediately afterwards. This strategy would essentially designate the park area as sacrificial land that would be flooded during severe storm events in order to protect residential property and structures. The emergency detention facility would also function to improve water quality through sedimentation and pollutant removal. The park would remain dry between storm events to allow for ongoing recreational use.

*Potential Impact on Resource*
One constraint to rehabilitating the ball field as a detention area is its effect on the integrity of the resource. Lowering the grade of the park would visually alter the open space. The recommended Drainage Masterplan should study this design and materials so as to lessen the impact to the resource.

**Enhance Storm Drain System**
Discussion:
Pending determination of the extent of implementation and evaluation of the effectiveness of the first two recommended treatment options, additional measures may still be required to safeguard against onsite flooding. Once the need for additional treatment options (if any) is established, SDE recommends a cost-benefit analysis be performed and community input be solicited in order to determine the preferred option between enhancing the storm drain system and converting the play field into a detention facility.

Storm Drain System Recommendations:
As noted in the existing conditions section, virtually the entire site drains to three catch basin inlets, and outlets to a main storm drain line through two 27-inch pipes. Hydraulic analysis of the infrastructure and observed flooding concluded that pipe capacity is inadequate for rainfall events larger than the 2-year storm. Supplementing the current storm drain system with a third pipe would help attenuate flooding. Depending on the extent of backwater conditions in the local storm drain network, additional force mains with pumps may be necessary to prevent the localized flooding that periodically strikes this area.

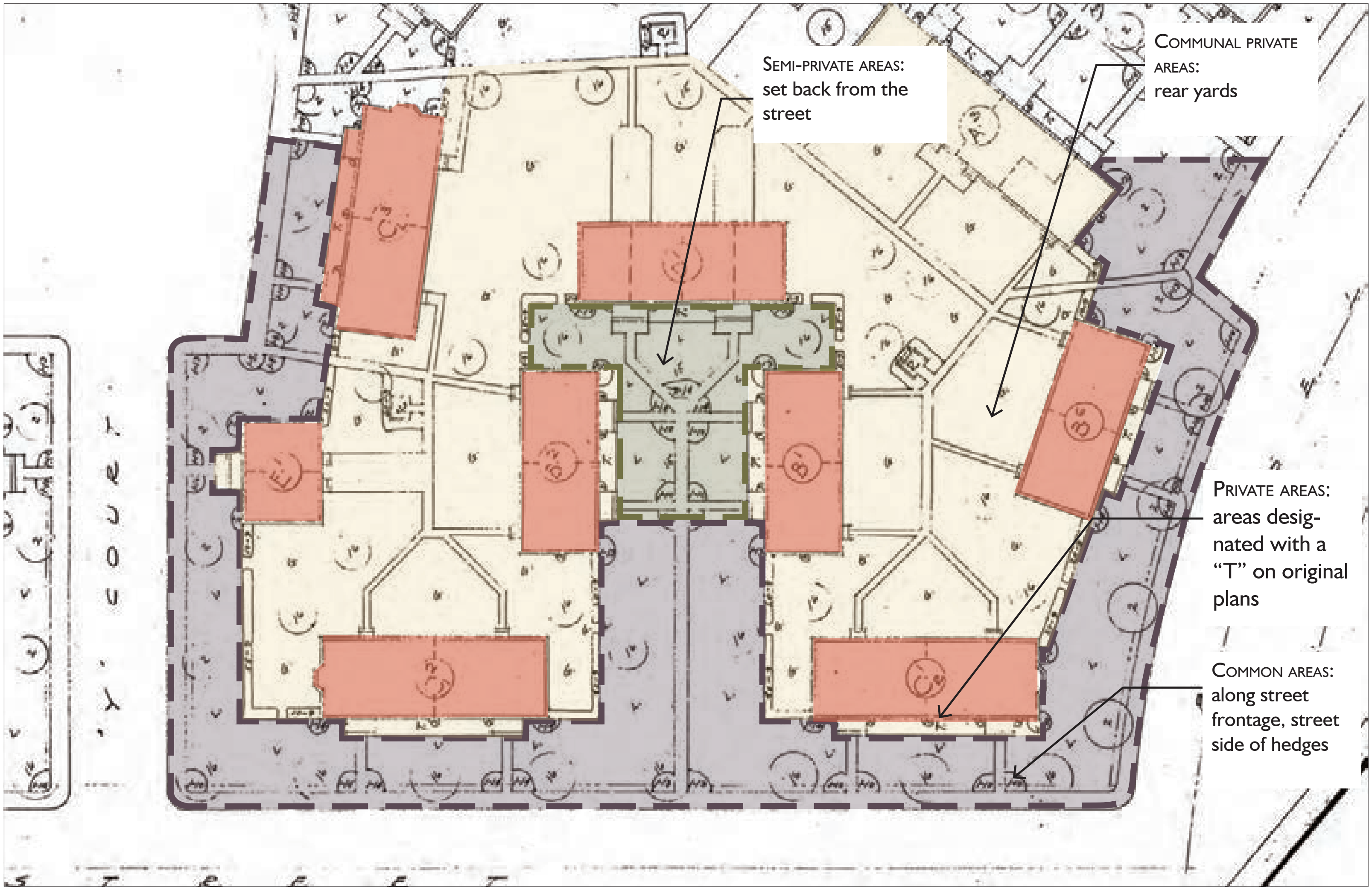


Figure 4.15 - Typical Common, Semi-private and Private Areas at Residential Cluster.

## Landscape: Softscape

**Maintain Existing Trees (Character Defining Feature)**

Discussion:

The original planting design for Atchison Village specified only four species of trees, including two conifers, one evergreen and one deciduous tree. The Monterey Pine and Black Acacia are very fast-growing, which was appropriate for a temporary housing development. But fast-growing also means that these trees are short-lived. Today most of the original trees have died and been replaced. The layout of trees was very simple and consistent. For example, one species of street tree was used consistently along entire blocks. Monterey Pines were planted around the entire perimeter of the park, and only one other species — Chinese Elm — was used along the interior path. This limited plant palette is a character-defining feature of the landscape.

Maintenance:

- Evaluate the health and structure of all trees.
- Identify hazardous trees and develop a schedule for their removal and replacement.
- It is recommended that the pine in front of the community building be replaced with another Monterey Pine or with a different species of conifer of a similar form and size.

**Develop a Tree-planting Master Plan and Design Guidelines for Atchison Village**

Master Plan:

Have a tree-planting master plan prepared for the property to guide future tree planting and maintenance. This master plan should include:

- A tree-planting master plan showing what species should be planted where, with the goal of restoring the simplicity of the original plan
- Selection of a limited number of appropriate, long-lived species for tree replacement
- Guidelines for tree planting in common, semi-private and private areas (Figure 4.15)
- A tree-planting detail that includes large wells to facilitate easy mowing

Design Guidelines:

- Not more than six species of trees should be selected for planting in the common and semi-private areas, and these should include a combination of conifers, evergreens and deciduous trees. One of the conifers should be Redwood/Sequoia sempervirens, which has been planted and is performing well.
- One species of street tree should be selected for each block, and changes in species should emulate the pattern that is shown in the original plans (Figure 4.16).
- It is recommended that the trees surrounding the park consist of a single coniferous species — Redwood is a good choice — and that the deciduous trees be removed.
- A greater variety of species is recommended in private areas, including fruiting trees, in small or medium sizes
- No trees should be planted close to the building foundations. Recommended distance between the foundation and the tree varies depending on species. Consult with a landscape specialist prior to planting.

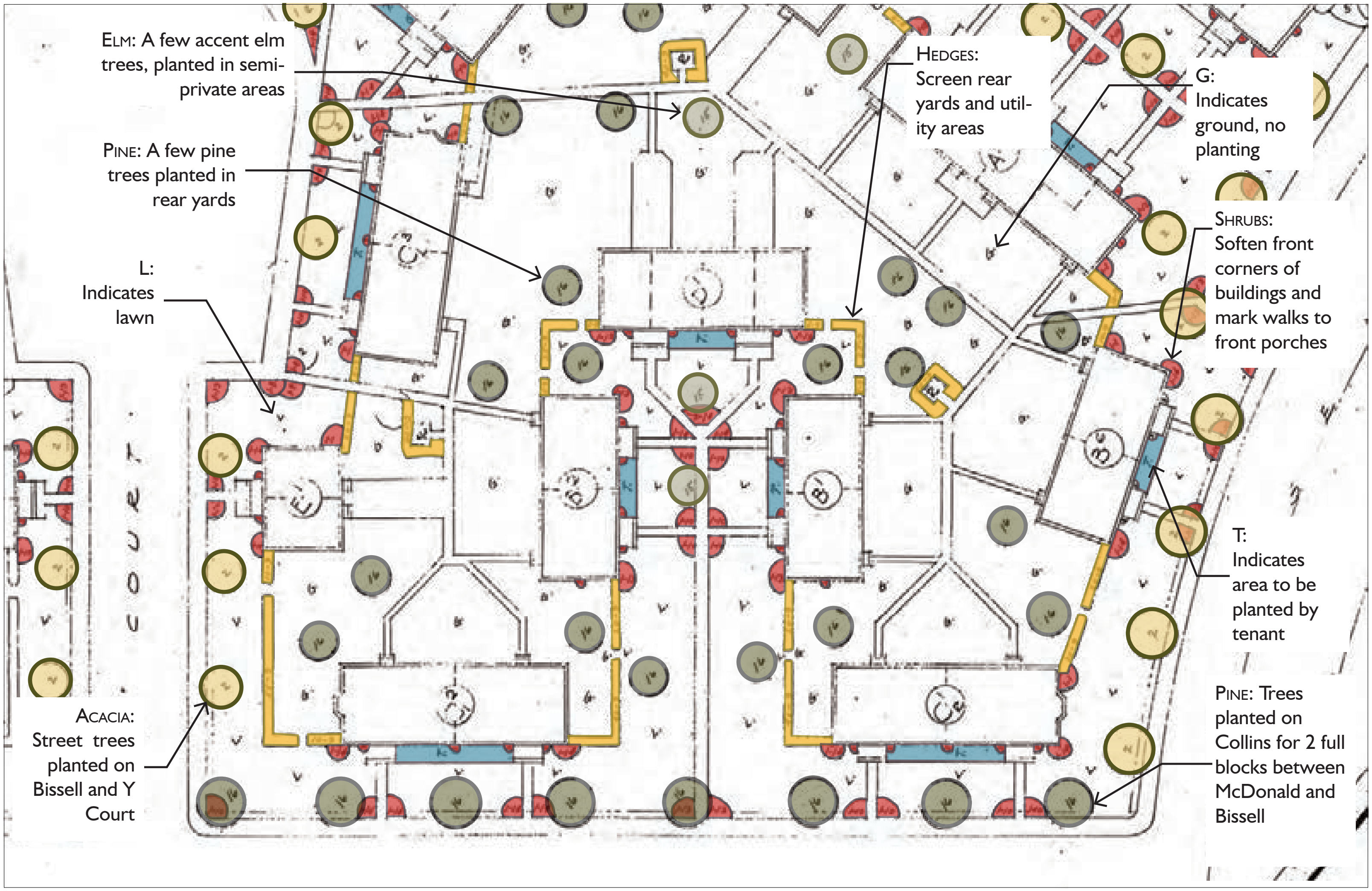


Figure 4.16 - Typical Planting Design Concept for Residential Cluster.

0ft 15ft 30ft 60ft

**Develop Guidelines for Shrub Plantings (Character Defining Feature)**

Discussion:

Guidelines for shrub planting in common, semi-private and private areas should be developed (Figure 4.15).

In the original planting design shrubs were used in the following ways:

- Vines were planted at either side of front porches.
- Shrubs marked where individual front walks broke off the central path. There were no other shrubs planted along street frontages.
- Shrubs were planted at building corners in the front yards only.
- Hedge plants were used to screen all rear yards, parking bays and utilities.
- Small areas between front porches were shown to be planted and maintained by tenants. Species were not indicated.
- No shrubs were planted in rear yards except where needed to screen utilities. These areas were left unplanted.
- Foundation shrubs were planted around the community building.
- The triangular planting bed at the village entrance was planted exclusively with ivy.
- Shrubs were planted at either side of the central paths that divided the park into three areas.

Today, most of the hedge plantings that screened rear yards have been replaced with fences. All of the hedges at parking bays are gone. While many additional shrubs have been planted in rear and front yards, in most cases the area along the street frontage remains as originally planned, with few if any shrubs.

Design Guidelines

Guidelines should be developed to describe appropriate shrub plantings and should include the following:

- What type of shrub planting is appropriate for each zone — private, semi-private and common areas (Figure 4.16).
- A list of appropriate plant species for the common areas. See Appendix H for lists of native plants suitable for planting at Atchison Village.
- Use shrubs to screen off-street parking lots (Figures 4.17 and 4.18).

General Maintenance Guidelines:

- It is recommended that shrub planting within the common areas be limited to marking where front walks break off the primary path. Other shrubs in this zone should be removed.
- It is recommended that shrub planting in semi-private areas also be limited to emulate planting as it was shown on the original plans (Figures 4.19 and 4.20). If shrub planting is added in other locations, it should be kept low and planted in beds flush with the lawn. Curbed planting beds and low planter walls should be removed from the common semi-private areas.
- It is recommended that shrub planting in communal private rear yards be kept to building foundations, leaving most of the remaining space planted with lawn. A portion of these areas could also be used for community garden plots (Figure 4.21).

Figure 4.17 - Example for screening parking lot.


Figure 4.18 - Existing example of screened parking lot.


Figure 4.19 - Existing example of shrubs in semi-private area.


Figure 4.20 - Existing example of shrubs in semi-private area.


Figure 4.21 - Existing example of garden in communal space.

**Maintain Lawns (Character Defining Feature)**

Discussion:

The original planting plans show lawns planted along street frontages, in the park, and in the semi-private common areas at front yards. Today, lawn remains in those areas and has been added to most of the rear yard spaces and small park areas. The following treatments should be applied to lawns and ground covers.

Maintenance

- Maintain lawn in all areas where it was originally planted. Maintenance should include watering, mowing, fertilizing and periodic renovation.
- Attempting to eliminate weeds in lawn areas would require extensive and regular applications of herbicides, and is not recommended.
- If additional areas of ground cover are desired, they should be limited to rear yards and should include measures to inhibit weed growth. New ground cover beds should be heavily mulched to keep weeds down until the ground cover forms a solid covering.
- Install mowing edges at trees and fences (Figure 4.22).

Figure 4.22 - Example of fence with mowing edge.

**Control Weed Growth**

Discussion:

Continue to control weeds and use mulch to improve soil and help control weeds. Weeds, except in lawns, are not a serious problem at Atchison Village. The following treatments should be implemented.

Maintenance

- Remove weeds by hand-pulling. Where weed infestation includes invasive perennial species, apply organic or chemical herbicides in accordance with manufacturer's recommendations.
- Apply mulch in shrub beds to retain soil moisture and help control weed growth. Mulch should be applied a minimum of two inches deep; deeper mulch is better. Mulch will bio-degrade relatively rapidly, which will enrich the soil. Mulch should be re-applied annually, or more frequently as needed. Maintaining a minimum depth of mulch will prevent weed growth by blocking the light needed for seed germination.

## Landscape: Hardscape

**Develop Guidelines for Fences and Gates**

Discussion:

No fencing was included in the original plan for Atchison Village. Fences have been added for security and privacy. Much on the fencing detracts from the designed open spaces within the neighborhood. Continued use of fencing throughout Atchison Village may affect the integrity of the historic resource.

Design Guidelines:

Design guidelines for fence construction should address the following:

- Identify where fences are allowed and not allowed.
- Develop strategies for restoring the sense of openness in common areas, for example using ornamental iron fencing in lieu of solid wood fencing.
- Identify an acceptable height and style of fences.
- Identify an acceptable design, size and treatment for gates.
- Develop specifications for materials, including types of wood, hardware, and wood treatments such as stains or paint.

General Recommendations

- It is recommended that fences in the communal private rear yards be removed and that the common open space be restored (Figure 4.23). To provide security, fences with gates could be added at the perimeter of these spaces similar to the way hedges were laid out on the original plan.
- If additional privacy and security is desired, individual units should be permitted to enclose small areas immediately adjacent to their back doors. The size of these private spaces will vary by unit and should consider the size and configuration of the communal private rear yard.

Figure 4.23 - Typical common space enclosed by fence.

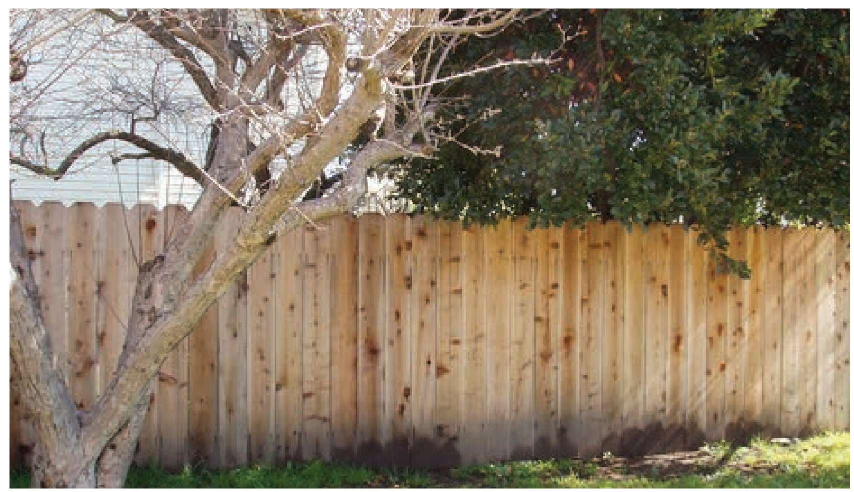

Figure 4.24 - Example of appropriate wood fence.

- It is recommended that the chain-link fence surrounding the community building be replaced with a more attractive, high-quality, ornamental iron fence. Chain link at the service yard and play areas is appropriate and may remain.
- It is recommended that fencing in other areas be wood. (Figures 4.24 and 4.25) All wood fences should:
  1. Be six feet in height
  2. Be constructed of wood
  3. Be stained with a natural-color stain
  4. Have beveled trim cuts at the tops of fence boards
  5. Have simple, matching gates


Figure 4.25 - Example of appropriate wood fence.

**Protect and Maintain Original Curbs and Install Additional Curb Cuts**

Maintenance

Existing curbs should be maintained. Maintenance measures should include the following:

- Remove trees that have damaged curbs and replace them with species less likely to cause damage. Plant replacement trees further away from curbs. Trim tree roots before they damage curbs or pavement.
- Paint curbs to indicate parking or non-parking as appropriate.
- Install new curb cuts to align with logical pedestrian crossings and accessible crosswalks.

Accessibility

- Additional curb cuts should be provided and installed to meet accessibility code compliance.
- Identify locations and priority rankings for where curb cuts are needed to comply with accessibility codes, and develop a schedule for construction.

**Protect and Maintain Original Parking and Vehicular Areas**

Discussion:

Parking bays, off-street parking lots and curbside parallel parking are all shown on the original plans. As such they are character-defining features that should be retained.

Maintenance:

Develop a maintenance program and schedule for vehicular paving that includes roadways, parking bays and off-street parking lots. Maintenance should include:

- Resurfacing and re-striping roadways and parking areas at regular intervals.
- Maintaining and replacing gutters.
- Correcting drainage problems that impact vehicular pavements.
- Resist expanding parking lots into areas shown as parks on the original plans; restore parks where feasible.

**Protect and Maintain Original Walkways (Character Defining Feature) and Pedestrian Pavements**

Discussion:

The original plan for Atchison Village provided for sidewalks along streets and a regular pattern of pedestrian paths to each front porch. Additional paths were installed in rear yards to provide access from back doors to small communal play areas and refuse-collection pads.

Maintenance:

Maintenance of pedestrian pavements should include:

- Removing trees that have damaged sidewalks as described above under vehicular paving.
- Identifying locations where pedestrian pavements are cracked and displaced one-quarter inch or greater, and develop a schedule for replacing or repairing damaged pavement.
- Replacing the asphalt paving in the park with concrete to match other original pedestrian pavements.

Design Guidelines:

Develop guidelines for pedestrian paving that address the following:

- Identify where new pedestrian paving is allowed and not allowed.
- Identify what materials are acceptable in common areas and private yards.
- Providing a connecting concrete path to fill the gap in the walk, to connect the front and east side of the community building (Figure 4.26).
- It is recommended that no new paths be added, and that replacement paths match the original in material and details.

**Develop Guidelines for Site Lighting**

Discussion:

No site lighting is shown on the original planting plans for Atchison Village. Treatment should include:

- An evaluation of existing lighting and development of recommendations and costs for improvements.

Figure 4.26 - Area where connection path is needed at community center.

**Retain and Maintain Play Equipment and Site Furnishings**

Discussion:

Play equipment, sports equipment and site furnishings were not included in the original plan for Atchison Village. Treatment should include the following:

Retain, Repair and Maintain:

- There are two play structures in the play area. These structures should be checked annually for damage and safety hazards by a certified playground inspector, and necessary corrections implemented (Figure 4.27).
- The fiber safety surface material needs to be checked routinely and replenished whenever minimum depths are less than 12 inches, or 24 inches at swings.
- Paint the basketball backstop and support structure, the softball bleachers frame, players' benches frame, metal bollards, and trash cans (steel drums) with matching paint. Clean, prime and apply two coats of paint suitable for metal.
- Paint the flagpole and the softball bleacher and bench wood members with paint suitable for wood.
- Skinned infield material at the softball field.

Replace:

- Broken wood members on softball bleachers, players' benches and backstop
- Rusted chain-link fabric at the basketball court and softball backstop
- Chairs, tables and barbecue at the community building
- Missing basketball backstop and support pole and structure

Figure 4.27 - Typical play structure within play area.



**Evaluate Benefits and Cost for Installing an Irrigation System**

Discussion:

Automatic irrigation offers the potential to save water and money while improving the appearance of plants by providing optimal levels of water needed to sustain growth. Cost savings result not only from reduced labor needed to irrigate manually, but also from reduced consumption achieved by equipment that monitors soil moisture and applies irrigation only when needed. An evaluation should consider the following:

- What areas of the site to include
- The cost implications of using a solar controller vs. electrical
- A cost-benefit analysis showing how many years will be required to recoup the installation cost

**Implement Site Drainage Improvements at Landscaped Areas Surrounding Residential Units**

Protect and Maintain:

- Large areas of lawn and other permeable surfaces that allow water to soak into the ground.
- Continue to install pea gravel in small areas, to raise the grade and alleviate wet spots.
- Hold plantings away from building foundations. Install fast-draining, gravel-filled trenches at building foundations.
- Ensure that grade slopes away from foundation wall.
- Ensure the grade is, at minimum, six inches below the vent sill (Figure 4.31).

**Preserve Existing Accessible Features and Provide New Facilities to Improve Accessibility**

Discussion:

Accessibility was likely not considered at the time Atchison Village was constructed. Installing improvements to provide access should be done in a manner that minimizes impacts to historic features.

Retain and Preserve Accessible Features:

Existing features that provide access should be retained and preserved. These include:

- Handicap ramps at sidewalk corners
- Ramp and handrail at the community building entrance
- Rear yard paths and off-site parking that is essentially level and without ramps, steps or other grade changes greater than five percent
- The entry openings and concrete paths into the play area, as well as grab bars and accessible platforms in the play area

Provide Facilities to Improve Accessibility:

The number and location of existing handicap ramps is inadequate. New facilities should include:

- Additional handicap curb cuts and/or ramps in sufficient numbers to provide accessible paths of travel along pedestrian routes throughout the site.
- Two new handicap ramps to the community building — one near the front door and another at the gate on the east side (Figure 4.28).
- Provide curb markings to prevent parking at these locations. Locate, design and detail all ramps to avoid flooding.

Figure 4.28 - Location where handicap curb ramp is needed.

**Resolve Need for Storage Space in Common and Private Areas**

Discussion:

Additional space and guidelines for storage are needed in common areas and for private units.

- It is recommended that additional storage facilities be built to enclose or screen supplies and materials currently stored outside in the service yard parking area of the Community Center.
- Guidelines should be established that define what type, material, size and location of detached storage enclosures be installed within the communal private rear yards. It is recommended that well-constructed wood structures be used to serve this purpose, similar to that seen in the rear yard of unit 351 (Figure 4.29).

General Recommendations for Private Storage:

- It is recommended that storage sheds be rectangular in massing with a gable type roof.
- New storage units in the communal private rear yards should be constructed of wood walls, concrete pier foundation and metal or composition shingle roof.
- The size of private storage units should not exceed 50 square feet, with no single dimension exceeding 10 feet in one direction.
- Height of storage structures should not exceed 8 feet to roof ridge.

**Evaluate Benefits and Cost for Locating Power Utilities Underground**

Evaluate the cost and benefits of under grounding power utilities.

- It is recommended that PG&E be consulted to determine the feasibility of undergrounding power throughout the site and eliminating unsightly power poles and overhead wires.

Figure 4.29 - Example of appropriate storage shed.

## BUILDINGS AND STRUCTURES TREATMENT RECOMMENDATIONS AND ALTERNATIVES

### Community Center

*Architectural: Exterior*

**Make Necessary Safety and Accessibility Improvements at Public Entrances**

Repair and Replace:

The following repairs and replacements should be made to the main public entrance at the north facade:

- Patch concrete spalls at horizontal and vertical surfaces.
- Replace deteriorated slip resistant strips with new.

New Construction:

The following work is new construction required to meet current code and accessibility requirements. The following work should be carried out at the main entrance at the north façade:

- Install a new handrail at the stair to meet code specifications. Railing should be compatible with the architectural character of the entryway.
- Install ramp at the threshold of the main entrance and the Credit Union entrance. Neither entrance meets accessibility code requirements. A suggested ramp design should follow that of the ramped entrance to the Community Center Office (Figure 4.30).


Figure 4.30 - Example of appropriate alteration to landing to accommodate for threshold height.

**Maintain Stucco for Eventual Restoration of Wood Siding (Character Defining Feature)**

Discussion:

The stucco siding is not identified as a character-defining feature. However, the original wood siding and its historic paint colors are identified as character-defining. The stucco siding was installed over the existing wood siding at an unknown date. While uncovering the existing wood siding would restore integrity to the historic structure, it is recognized that this project may not be feasible at this time. The following are recommendations for treatment of the exterior wall finish.

Recommendation 1: Maintain Stucco Siding Through its Service Life:

In the short term, the stucco siding should be maintained and repaired on an as-needed basis. Although the stucco is not identified as historic, reference *Preservation Brief #22*: Preservation and Repair of Historic Stucco for further guidance on repair methodologies. The following guidelines and methods should be followed for repairs of the stucco:

- Inspect stucco annually for cracking and damage. Repair cracks and broken elements to ensure that water can not penetrate through to the wood siding and structural elements beneath.
- Inspect sealant at window and door surrounds or any other wall openings. Replace deteriorated sealants to ensure that water can not penetrate through to the structure beneath.

Recommendation 2: Restore Historic Wood Siding:

Long-term planning for the eventual restoration of the historic wood siding should be considered. Issues to be addressed include:

- Confirm if removal of the stucco can be accomplished without harm to the wood siding. Testing of a small area should be completed prior to work.
- Restoration should be undertaken in accordance with the Secretary of the Interior's *Standards*. See *Preservation Brief #8* for additional information on restoration of original wood siding.
- Develop a maintenance plan to properly maintain the wood siding after it is restored

**Install Additional Crawlspace Vents to Meet Code Requirements**

Discussion:

The wood framed vents are not identified as character-defining features, however they are part of the existing historic fabric of the building. As discussed in Part III Existing Conditions, ventilation to the crawl-space of the community center is deficient by current code standards. This deficiency is inhibiting adequate evaporation of moisture in the crawl-space. Adding additional ventilation will not resolve the issue of flooding at the crawl-space (as discussed later). However, it will increase the airflow and allow water to evaporate more efficiently and rapidly. Reference *Preservation Brief #39: Controlling Unwanted Moisture in Historic Buildings.*

Recommendation 1:

*Free Existing Vents of Obstruction from Landscaping and Built-up Earth.*

An immediate step to more efficient ventilation is to ensure that existing vents are not blocked or obstructed by plantings and earth. The following steps are recommended:

- Remove landscaping so that plant bases are no more that 18 inches from the face of the vent (Figure 4.31)
- Prune plantings so that vegetation is no more than 6 inches from the face of the vent (Figure 4.31)
- Remove earth from the face of the vent opening

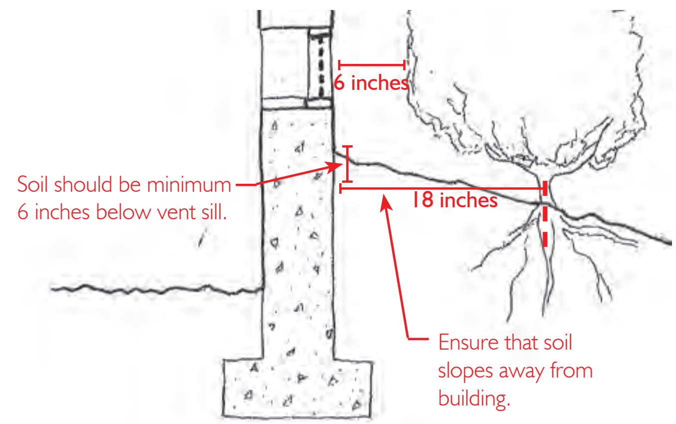


Figure 4.31 - Appropriate placement of platings at vent opening.

<u>Recommendation 2</u>

*Install New Vents or Enlarge Existing Vents at Recommended Locations.*

Installing new vents or enlarging the existing ones will bring the community center up to code for crawl-space ventilation. The following steps for installing new vent openings are recommended:

- Demolish or enlarge existing openings in the foundation wall for additional ventilation openings.
- New vents should be located under existing windows so as not to compromise the seismic integrity of the wall system.
- Construct a new ventilation wood frame, wood-sash, and screen for each additional opening. Style of the new vents should differ from existing vents, so as to be easily identified as a new feature.
- Maintain landscaping as described in the previous recommendation.

<u>Recommendation 2 Alternative:</u>

Install Ventilation Fans Activated by Relative Humidity Switch.

Installing a ventilation fan into an existing opening is an alternative to installing new ventilation openings. A ventilation fan is a motorized fan designed to circulate outside air through the crawl-space to reduce moisture. The fan can be operated off of a temperature or humidity switch so that the fan would turn itself on and off when the temperature or relative humidity reaches a certain level. The following should be considered:

- Installing a vent fan eliminates the need to install new ventilation openings. Installing new openings is an alteration to the historic structure that may impact historic fabric.
- Installing a vent fan requires installation of electrical work at the crawl-space. Given the excessive amount of water within the crawl-spaces at Atchison Village a vent fan operated on a humidity switch may run consistently throughout the rainy months.
- Installing a vent fan would require annual maintenance to an additional piece of mechanical equipment that currently does not exist.

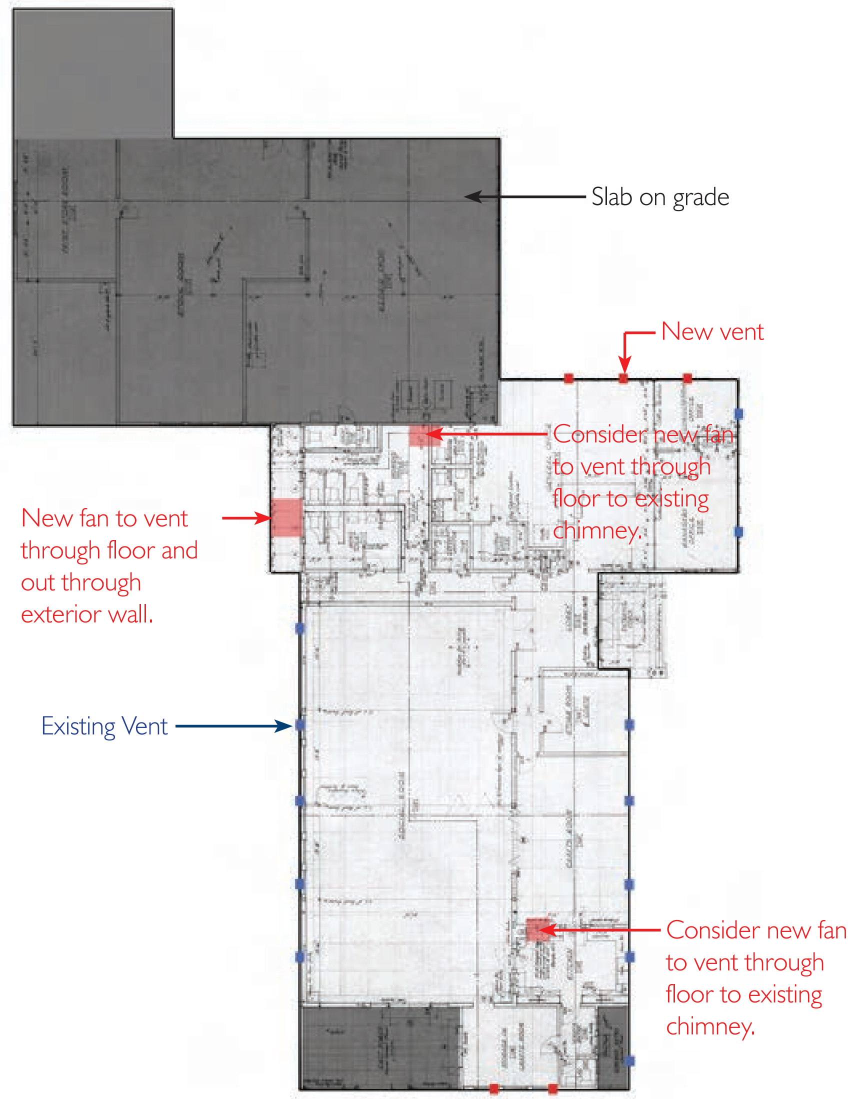


Figure 4.32 - Appropriate locations for new vents at community center.

**Preserve or Restore Historic Wood Doors (Character Defining Feature) and Maintain All Others**

Discussion:

The original partially-glazed, paneled wood doors are identified as character-defining features of the community building. These original doors are to be protected, maintained, and preserved. Non-original doors also exist; these should be maintained through their life expectancy and then replaced with doors to match the original design.

Recommendation 1:

*Identify, Retain and Preserve Original Doors*

- Conduct a survey to determine where original doors exist and where they have been replaced.
- Develop a methodology for replacing non-original doors based upon condition and anticipated life expectancy.

Recommendation 2:

*Protect and Maintain Original Doors*

Original doors should be protected and maintained. Maintenance of these doors includes the following:

- Annual inspection of wood and glazing, identifying maintenance, and repair needs. The following should be inspected:
  1. Delaminating paint;
  2. Wood decay;
  3. Deteriorated putty at the glazing;
  4. Deteriorated and/or lack of weather-stripping; and
  5. Operation of door hardware.
- Paint wood elements that show signs of worn finishes and delaminating paint. If peeling paint is present inspect the bare wood for signs of decay. If decay is present see the following Repair section. If no decay is present take the following steps for re-application of paint coatings:
  1. Prep the surface by scraping off any loose paint. Be careful not to gouge or damage the wood surface.
  2. Lightly sand the surface (reference *Preservation Brief #37: Appropriate Methods for Reducing Lead-Paint Hazards in Historic Homes*); and repaint the area using exterior primers and paints. The final coat should match the existing in color and finish.
  3. Reference *Preservation Brief #10 Exterior Paint Problems on Historic Woodwork*.
- Remove deteriorated weather-stripping and replace with new.
- Remove deteriorated glazing putty and replace with new.

Recommendation 3:

*Repair or Replace Original Door Components*

Repair:

The following guidelines and methods should be followed for repairs to door elements:

- Treat split, checked and decayed areas with an antifungal chemical coating;
- Fill cracks and holes with restoration grade wood putty; and
- Consolidate areas of wood decay with epoxy patching compound.

Replace:

Limited replacement in-kind is an acceptable treatment for extensively deteriorated elements of the door construction. Replacement pieces should match the historic feature in material, dimension and profile.

Recommendation 4:

*Treatment for Non-Historic Doors*

In the short term, existing non-historic doors should be maintained on an as-needed basis. The following guidelines and methods should be followed:

- Follow the same recommendations for maintenance, inspection and repairs as outlined in the previous section; and
- Should replacement of a non-historic door become necessary, the following should be considered:
  1. Install a partially-glazed, paneled wood door that replicates or closely matches the original door in material, dimension and profile. Historic drawings or surviving prototypes should be consulted for replication.
  2. Install a replacement door that is compatible with the historic character and style of the building.

**Preserve Historic Wood Windows (Character Defining Feature)**

Discussion:

The original double-hung, wood-sash windows are identified as character-defining features of the community center. These original windows are to be protected, maintained, and preserved. Reference *Preservation Brief #9 The Repair of Historic Wooden Windows* for further guidance on repair approaches and methodologies.

Recommendation 1:

*Identify, Retain and Preserve Historic Wood Windows*

- Conduct a survey to determine where original windows exist and where they have been replaced.
- Develop a methodology for replacing non-original windows based upon condition and anticipated life expectancy and then replace with window to match original design.

Recommendation 2:

*Protect and Maintain Historic Wood Windows*

Original windows should be protected and maintained. Maintenance of these windows includes the following:

- Annual inspection of wood and glazing, identifying maintenance, and repair needs. The following should be inspected:
    1. Delaminating paint;
    2. Wood decay;
    3. Deteriorated putty at the glazing;
    4. Deteriorated and/or lack of weather-stripping;
    5. Operation of window; and
    6. Condition of window hardware.
- Paint wood elements that show signs of worn finishes and delaminating paint. If peeling paint is present inspect the bare wood for signs of decay. If decay is present see the following Repair section. If no decay is present take the following steps for re-application of paint coatings:
    1. Protect glazing prior to prep work.
    2. Prep the surface by scraping off any loose paint. Be careful not to gouge or damage the wood surface.
    3. Lightly sand the surface (reference *Preservation Brief #37: Appropriate Methods for Reducing Lead-Paint Hazards in Historic Homes*).
    4. Repaint the area using exterior primers and paints. The final coat should match the existing in color and finish.
    5. Remove deteriorated weather-stripping and replace with new.
    6. Remove deteriorated glazing putty and replace with new.

Recommendation 3:

*Repair Historic Wood Windows*

The following guidelines and methods should be followed for repairs of window elements:

- Treat split, checked and decayed areas with an antifungal chemical coating;
- Fill cracks and holes with putty; and
- Consolidate areas of wood decay with epoxy patching compound.

Recommendation 4:

*Replace Historic Wood Windows*

The following guidelines and methods should be followed for replacement of window elements:

- Limited replacement in-kind is an acceptable treatment for extensively deteriorated elements of the window construction.
- Replacement pieces should match the historic feature in material, dimension and profile.
- Reglazing with insulated glass may be considered if the original sash can be altered to accept thicker glazing.
- Consider installing low-e film to the existing glazing.

**Maintain Gutters and Downspouts**

Discussion:
Gutters and downspouts are original to the design of the community center. These elements should be protected and maintained.

Recommendation 1:
*Protect and Maintain Gutters and Downspouts*
Maintenance includes the following:

- Inspection of gutters and downspouts twice a year; (fall and spring are recommended seasons for inspection) to identify maintenance and repair needs. The following should be evaluated during inspection:
    1. Screened roof drains into gutter systems are free and clear of debris;
    2. Seal around gutter/roof penetration is functional and not allowing water to penetrate through to the roof structure;
    3. Downspouts are free and clear of debris;
    4. Connections at downspout joints are sound and functional; and
    5. Splash pads at downspouts are present and properly located so as to direct water away from the building foundation.
- Should any of the previously mention list of inspection items be identified as deficient, see that repairs are made in a timely manner to prevent further damage to building elements.

## Structural

Reference Appendix G for sketch details of typical repairs.

**Protect Foundations and Crawlspace Framing**

- Provide proper grading to direct site water, including roof runoff, away from existing foundations.
- Provide overall site and foundation drainage to keep site water away from the existing foundations and to prevent water infiltration and accumulation in the crawlspaces.
- Provide proper, code required, wood-earth separation between the existing exterior wall sill plates and crawlspace framing and the adjacent soil grades.

**Strengthen Roof Diaphragm**

- Improve both high and low roof diaphragm connections to existing exterior and interior shearwalls.

**Improve Existing Interior and Exterior Wall Shearwall Connections to Roof and Floor Diaphragms**

- Extend selected interior wall shearwalls through attic/ceiling space to attach to roof diaphragms.
- Improve connections of interior wall shearwalls to floor diaphragms.
- Provide additional Simpson framing clips and anchor plates to improve the connections of the existing floor diaphragms to existing blocking, and the foundation sill plates to the existing foundations.

**Improve Floor Diaphragms to Foundation Connections**

- Provide additional Simpson framing clips and anchor plates to improve the connections of the existing floor diaphragms to existing blocking, and the foundation sill plates to the existing foundations.

**Improve Existing Shearwall Strength**

- Provide new plywood sheathing on inside face of selected interior and exterior walls and new Simpson anchor plates or anchor bolts to the existing foundations, as applicable, to improve overall building seismic resistance.

## Mechanical

**Protect and Maintain Furnace for Eventual Replacement**

Protect and Maintain:

The following guidelines and methods should be followed for furnace maintenance:

- Check filters monthly.
- Ensure access clearance of 30" is maintained on a monthly basis.

Replace:

The following guidelines and methods should be followed for replacement of wall heaters:

- The furnace that serves the Assembly room is over 30 years old. The old furnace should be replaced with a high efficiency furnace.
- The furnace that serves the Offices and Credit Union room is approximately 15 years old. The furnace still has approximately 5 years useful service life.
- The furnace should be replaced after its useful service life with a high efficiency furnace.

**Maintain Water Heater for Replacement in 2019**

The water heater was recently replaced and should have approximately 10 years of useful service life. Maintain as specified by manufactures recommendations.

**Retain Existing Ventilation and Replace Exhaust Where Required**

Identify, Retain and Preserve:

Use windows to ventilate the Community Center. Ventilation reduces possibility of mold.

Replace:

The following replacements should be implemented:

- The kitchen hood does not meet current code. The range was replaced recently and a larger unit was installed. The range is now too large for the kitchen hood. The kitchen hood must be replaced with a larger unit. The grease exhaust fan should be replaced with one sized for the kitchen hood.
- The public restrooms should be provided with a toilet exhaust fan. The exhaust rate should be sized to provide 10 air changes per hour. The exhaust fan will remove odors and moisture.

## Electrical

**Maintain and Replace Panel and Wiring as Required**

Protect and Maintain:

On a monthly basis, verify that panel access clearance of 36" is maintained (Figure 4.33).

Replace:

The following guidelines and methods should be followed for replacement of Panel and Wiring:

- Request for a contractor or consultant to install a power meter to trend the electrical use for the building. Base of meter information and PG&E utility usage report, determine if an increase in electrical service is required.
- Recommend installing Photovoltaic (PV) Panels to offset existing electrical loads. A potential site for the PV panels would be the west end of the building depending on the structural integrity of the building framing (Figure 4.34).

**Replace Receptacles**

Replace:

Provide Ground Fault Interrupt (GFI) for all receptacles located by water. For example restooms and kitchen receptacles.

**Maintain Light Fixtures and Consider Replacement**

Protect and Maintain:

The lighting fixtures have been changed to fluorescent fixtures. Owner should maintain condition of lighting. Any lighting that is to be replaced shall be T8 energy efficient light fixtures.

Replace:

Consider replacing the auditorium lighting system with one that meets functional requirements for conferences, meeting and receptions. A lighting system that can be tailored to the rooms use would make the space more functional and appealing for rental and leasing purposes.

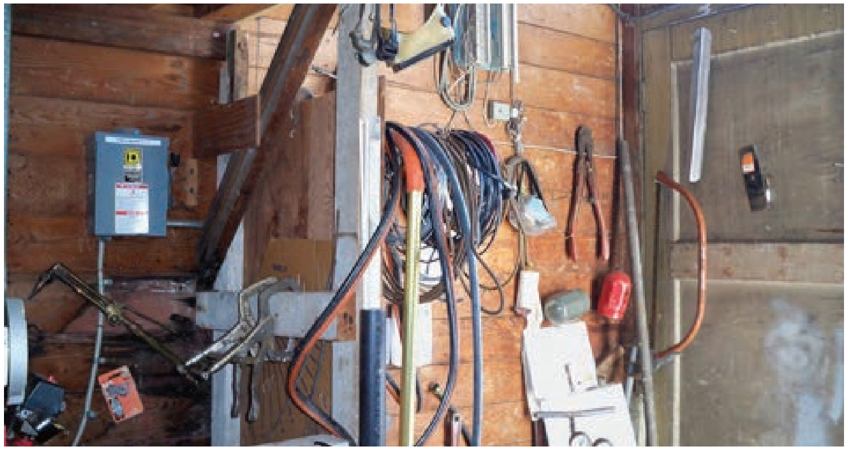

Figure 4.33 - Area where verification of electrical clearance is needed.

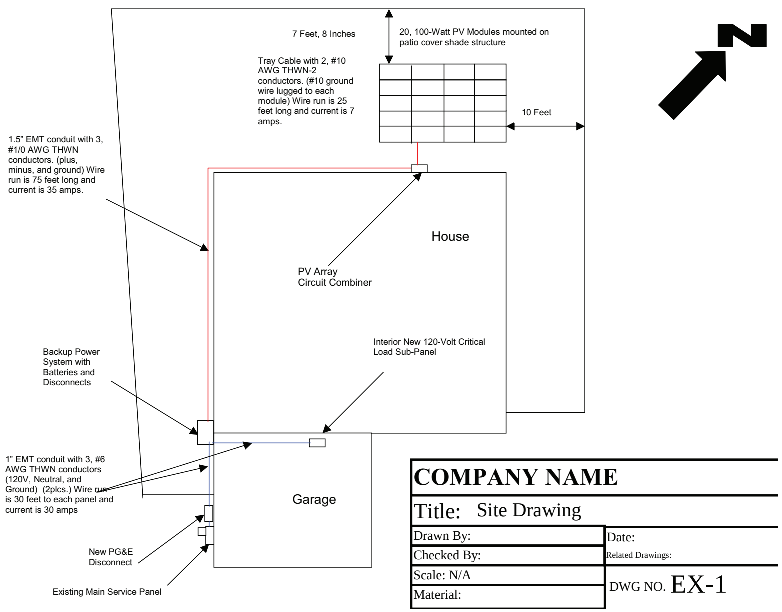


Figure 4.34 - Typical PVC installation.

**Replace Fire Alarm System and Smoke Detectors**

Replace:

Based on the fire hazard potential of the building, a new fire alarm system should be installed. The new system shall conform to current local and state codes. When designing and installing a new fire and safety system, consider minimizing visual impact to the interior spaces.

## Plumbing and Fire Protection

**Repair Water Piping**

Repair:

Provide pipe insulation for hot water pipes that are accessible (Figure 4.35).

**Repair Sewer Piping**

Repair:

Clear sewer pipe as necessary. Install double cleanouts where pipe exits the building (Figure 4.36).

**Replace Plumbing Fixtures**

Replace:

The following guidelines and methods should be followed for replacement of fixtures:

- Replace fixtures for proper operation.
- Recommend installing pressure balance valve for sinks, and lavatories (Figure 4.37). During cold water use at other fixtures, the cold water volume can drop, leaving mostly hot water at showers and sinks. The hot water can cause scalding. The pressure balance valve cuts back the hot water to match the cold water.
- Recommend replacing existing 3.5 gallon per flush toilets with dual flush toilets. Dual flush toilets have low flush volumes of 0.8 gallons per flush for liquid and 1.28 gallons per flush for solids (Figure 4.38).
- Recommend providing 0.5 gallon-per-minute low-flow aerators for all sinks and lavatories.
- Recommend providing flow restrictor for shower fixture.


Figure 4.35 - Typical Pipe insulation.


Figure 4.36 - Typical double cleanout to be installed in sewer pipe.

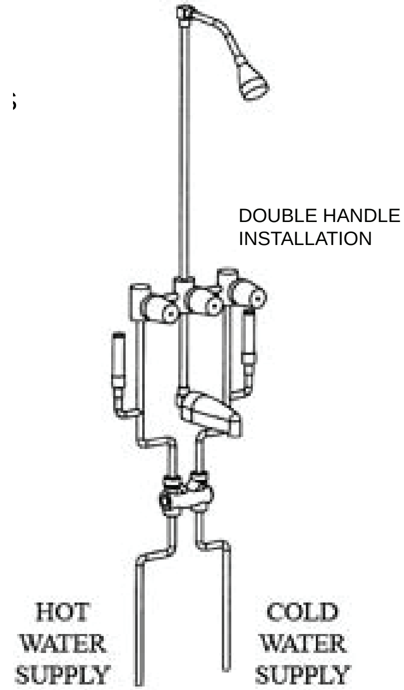

Figure 4.37 - Typical pressure balance valve.


Figure 4.38 - Typical 1.28 gallons/ flush toilet fixture.

## Residential Units

*Architectural: Exterior*

**Preserve Entrances and Porches (Character Defining Feature)**

Identify, Retain and Preserve:

The covered concrete porches on the main façade are identified as character-defining features of the residential units. Important features of the porches include:

- Open volume of the porch space
- Concrete stair and landing, including existing dimensions
- Wood porch columns
- Wood porch railings and cross supports
- These original features are to be protected, maintained, and preserved. Reference *Preservation Brief 45: Preserving Historic Wood Porches*.

Protect and Maintain:

Porches should be protected and maintained. Maintenance of important porch features includes the following:

- Annual inspection of wood and concrete materials, identifying maintenance, and repair needs. For wood features inspect for the following:
  1. Termite damage or other infestation;
  2. Delaminating paint;
  3. Wood decay; and
  4. Loose connections at railings and columns.
  5. For concrete inspect for the following:
     a) Organic growth on the concrete surface in the form of moss or algae
     b) Cracking and spalling of the concrete surface.
- General cleaning of the concrete with mild detergent and brush. If algae and moss growth is present and persistent a biocide may be used to kill organic material and prevent future growth. This would be advised at locations of foot traffic, like stairs and landings, where slip risks are high. Using products that are low VOC emitting and environmentally friendly is recommended.
- Paint wood elements that show signs of worn finishes and delaminating paint. If peeling paint is present inspect the bare wood for signs of decay. If decay is present see the following Repair section. If no decay is present take the following steps for re-application of paint coatings:
  1. Prep the surface by scraping off any loose paint. Be careful not to gouge or damage the wood surface;
  2. Lightly sand the surface (reference *Preservation Brief #37: Appropriate Methods for Reducing Lead-Paint Hazards in Historic Homes*); and
  3. Repaint the area using exterior primers and paints. The final coat should match the existing in color and finish.

Repair:

The following guidelines and methods should be followed for repairs of porch elements:

- Patch concrete spalls at horizontal and vertical surfaces;
- Treat split, checked and decayed wood areas with an antifungal chemical coating;
- Fill cracks and holes in wood with putty; and
- Consolidate areas of wood decay with epoxy patching compound.

Replace:

Limited replacement in-kind is an acceptable treatment for extensively deteriorated or missing elements. Replacement pieces should match the historic feature in material, dimension and profile. Historic drawings or surviving prototypes should be consulted for replication of pieces and/or entire features.

**Maintain Vinyl Siding for Eventual Restoration of Wood Siding (Character Defining Feature)**

Discussion:

The vinyl siding is not identified as a character-defining feature. However, the original wood siding and its historic paint colors are identified as character-defining. The vinyl siding was installed over the existing wood siding in the early 1990s. This work was completed in an effort to lower maintenance cost for the residential units. While uncovering the existing wood siding would restore integrity to the historic structures, it is recognized that this may not be feasible at this time. Reference *Preservation Brief #8: Aluminum and Vinyl Siding on Historic Buildings* for further information and discussion about the negative impacts of vinyl siding over historic wood. The following are recommendations for treatment of the siding.

Maintain Vinyl Siding Through its Service Life:

In the short term, the vinyl siding should be maintained and repaired on an as-needed basis. The following guidelines and methods should be followed for repairs of porch elements:

- Inspect siding annually for cracking and damage. Repair broken elements to ensure that water can not penetrate through to the wood siding and structural elements beneath.
- Inspect sealant at window and door surrounds or any other wall openings. Replace deteriorated sealants to ensure that water can not penetrate through to the structure beneath.
- Clean siding annually to remove organic growth, soiling and mildew build-up. Take the following steps for cleaning vinyl siding:
  1. Rinse siding with garden hose. Use of a power wash system is not recommended.
  2. For soiling and mildew build-up use a stiff bristled brush to scrub areas clean. Use of a metal or wire brush is not recommended.
  3. For stubborn stains, use of a natural, non-bleach cleaner may be used to treat and clean heavily soiled areas. An example product would be Back to Nature Mold and Mildew Remover (Note: this is an environmentally-friendly recommendation).

Restore Historic Wood Siding:

Long-term planning for the eventual restoration of the historic wood siding should be considered. A project such as this could easily be phased. For example, a commitment could be made to restore a certain number of residences per year. Phasing the restoration project would also allow for sequential phasing of future maintenance programs.

**Install Additional Crawlspace Vents to Meet Code Requirements**

Discussion:

The wood framed vents are not identified as character-defining features, however they are considered existing historic fabric. As discussed in Part III Existing Conditions, ventilation to the crawl-space is deficient by current code standards. This deficiency inhibits adequate evaporation of moisture in the crawl-space. There are multiple causes for water infiltration into the crawl-space that are discussed in the next recommendation; adding additional ventilation will not resolve the issue of flooding at the crawl-space. However, it will increase the airflow and allow water to evaporate more efficiently and rapidly. Reference *Preservation Brief #39: Controlling Unwanted Moisture in Historic Buildings*.

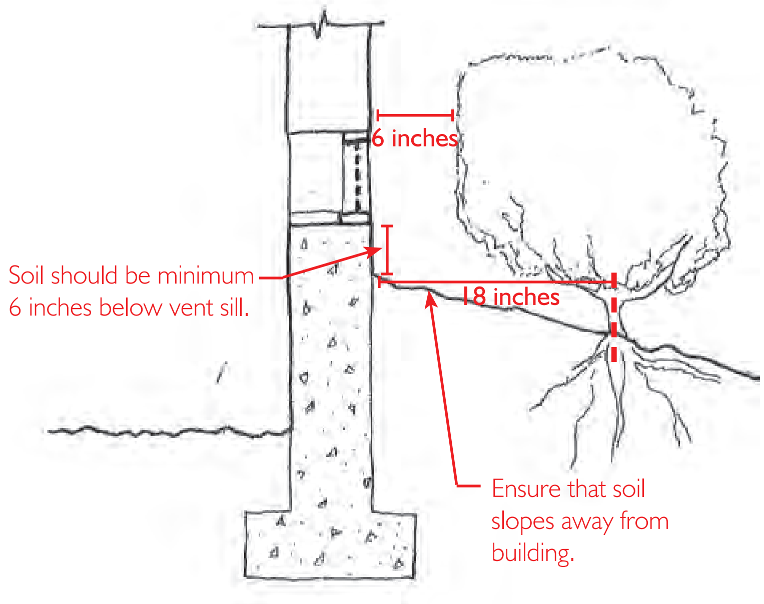


Figure 4.39 - Appropriate placement of platings at vent opening.

Recommendation 1:

*Free Existing Vents of Obstruction from Landscaping and Built-up Earth*

An immediate step to more efficient ventilation is to ensure that existing vents are not blocked or obstructed by plantings and earth. The following steps are recommended:

- Remove landscaping so that plant bases are no more that 18 inches from the face of the vent (Figure 4.39)
- Prune plantings so that vegetation is no more than 6 inches from the face of the vent (Figure 4.39)
- Remove earth from the face of the vent openings

Recommendation 2:

*Install New Vents or Enlarge Existing Vents at Recommended Locations.*

Installing 4 new vents will bring each residential unit up to code for crawl-space ventilation. Note that residential unit type 5 is already at code and does not require additional vents to be installed. Unit types 1 and 2 are borderline and may be acceptable as is in locations where moisture is not an issue. Unit types 3 and 4 are deficient and should be upgraded to meet code requirements. The following steps for installing new vent openings are recommended:

- Demolish or enlarge existing openings in the foundation wall for additional ventilation openings.
- New vents should be located under existing windows so as not to compromise the seismic integrity of the wall system. See Figure 4.40 for recommended locations of new vents for typical building types.
- Construct a new ventilation wood frame, wood-sash and screen for each additional opening.
- Maintain landscaping as described in the previous recommendation.

<u>Recommendation 2 Alternative:</u>

*Install Ventilation Fans Activated by Relative Humidity Switch*

Installing a ventilation fan into an existing opening is an alternative to installing new ventilation openings. A ventilation fan is a motorized fan designed to circulate outside air through the crawl-space to reduce moisture. The fan can be operated off of a temperature or humidity switch so that the fan would turn itself on and off when the temperature or relative humidity reaches a certain level. The following should be considered:

- Installing a vent fan eliminates the need to install new ventilation openings. Installing new opening is an alteration to the historic structure that may impact historic fabric.
- Installing a vent fan requires installation of electrical work at the crawl-space.
- Given the excessive amount of water within the crawl-spaces at Atchison Village, a vent fan operated on a humidity switch may run consistently throughout the rainy months.
- Installing a vent fan would require annual maintenance to an additional piece of mechanical equipment that currently does not exist.

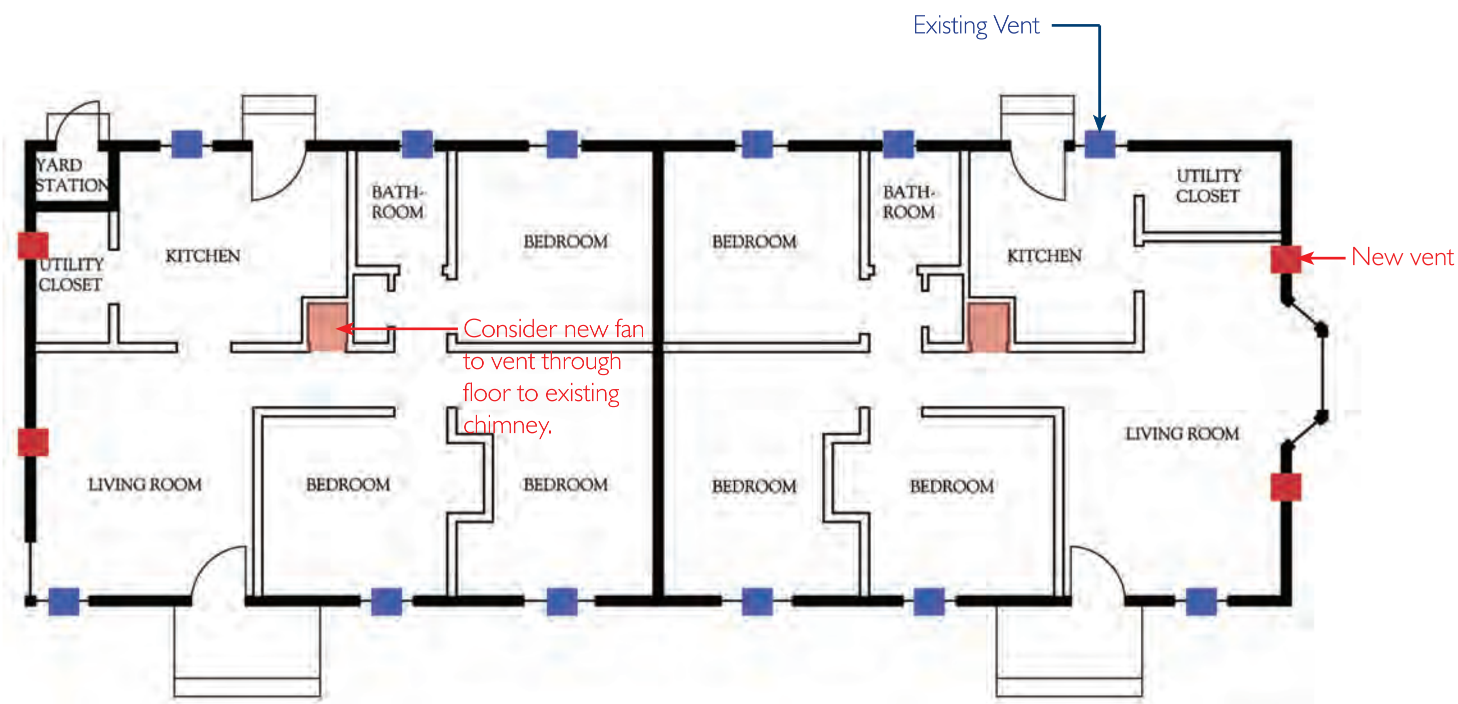


Figure 4.40 - Appropriate locations for new vents at building types 1, 2 and 3.

**Preserve or Restore Historic Wood Doors (Character Defining Feature) and Maintain All Others**

Discussion:

The original partially-glazed, paneled wood doors are identified as character-defining features of the community building. These original doors are to be protected, maintained, and preserved. Non-original doors also exist throughout the residential units; these should be maintained through their life expectancy and then replaced with doors to match the original design. Additionally, screen doors have been installed at many locations. Though screen doors are not original to the residential units, they serve an important function by naturally ventilating the interior. Natural ventilation is a sustainable solution for maintaining a comfortable interior environment.

Recommendation 1:

*Identify, Retain and Preserve Original Doors*

- Conduct a survey to determine where original doors exist and where they have been replaced.
- Develop a methodology for replacing non-original doors based upon condition and anticipated life expectancy.

Recommendation 2:

*Protect and Maintain Original Doors*

Original doors should be protected and maintained. Maintenance of these doors includes the following:

- Annual inspection of wood and glazing, identifying maintenance, and repair needs. The following should be inspected:
  1. Delaminating paint;
  2. Wood decay;
  3. Deteriorated putty at the glazing;
  4. Deteriorated and/or lack of weather-stripping; and
  5. Operation of door hardware.
- Paint wood elements that show signs of worn finishes and delaminating paint. If peeling paint is present inspect the bare wood for signs of decay. If decay is present see the following Repair section. If no decay is present take the following steps for re-application of paint coatings:
  1. Prep the surface by scraping off any loose paint. Be careful not to gouge or damage the wood surface;
  2. Lightly sand the surface (reference *Preservation Brief #37. Appropriate Methods for Reducing Lead-Paint Hazards in Historic Homes*).
  3. Repaint the area using exterior primers and paints. The final coat should match the existing in color and finish.
  4. Reference *Preservation Brief #10 Exterior Paint Problems on Historic Woodwork*.
- Remove deteriorated weather-stripping and replace with new
- Remove deteriorated glazing putty and replace with new

Recommendation 3:

*Repair or Replace Original Door Components*

Repair:

The following guidelines and methods should be followed for repairs of door elements:

- Treat split, checked and decayed areas with an antifungal chemical coating;
- Fill cracks and holes with putty; and
- Consolidate areas of wood decay with epoxy patching compound.

Replace:

Limited replacement in-kind is an acceptable treatment for extensively deteriorated element of the door construction. Replacement pieces should match the historic feature in material, dimension and profile.

Recommendation 4:

*Treatment for Non-Historic Doors*

In the short term, existing non-historic doors should be maintained on an as-needed basis. The following guidelines and methods should be followed:

- Follow the same recommendations for maintenance, inspection and repairs as outlined in the previous section; and
- Should replacement of a non-historic door become necessary, a new replacement door should consider the following:
  1. Installing a partially-glazed, paneled wood door that replicates or closely matches the original door in material, dimension and profile. Historic drawings or surviving prototypes should be consulted for replication.
  2. Installing a replacement door that is compatible with the historic character and style of the building.

**Preserve Historic Wood Windows (Character Defining Feature)**

Discussion:

The original double-hung wood-sash windows are identified as character-defining features of the residential units. These original windows are to be protected, maintained, and preserved. Reference *Preservation Brief #9 The Repair of Historic Wooden Windows* for further guidance on repair approaches and methodologies.

Recommendation 1:

*Identify, Retain and Preserve Historic Wood Windows*

- Conduct a survey to determine where original windows exist and where they have been replaced
- Develop a methodology for replacing non-original windows based upon condition and anticipated life expectancy

Recommendation 2:

*Protect and Maintain Historic Wood Windows*

Original windows should be protected and maintained. Maintenance of these windows includes the following:

- Annual inspection of wood and glazing, identifying maintenance, and repair needs. The following should be inspected:
  1. Delaminating paint;
  2. Wood decay;
  3. Deteriorated putty at the glazing;
  4. Deteriorated and/or lack of weather-stripping;
  5. Operation of window;
  6. Condition of window hardware.
- Paint wood elements that show signs of worn finishes and delaminating paint. If peeling paint is present inspect the bare wood for signs of decay. If decay is present, see the following Repair section. If no decay is present, take the following steps for re-application of paint coatings:
  1. Protect glazing prior to prep work.
  2. Prep the surface by scraping off any loose paint. Be careful not to gouge or damage the wood surface.
  3. Lightly sand the surface (reference *Preservation Brief #37: Appropriate Methods for Reducing Lead-Paint Hazards in Historic Homes*).
  4. Repaint the area using exterior primers and paints. The final coat should match the existing in color and finish.
- Remove deteriorated weather-stripping and replace with new.
- Remove deteriorated glazing putty and replace with new.

Recommendation 3:

*Repair Historic Wood Windows*

The following guidelines and methods should be followed for repairs of window elements:

- Treat split, checked, and decayed areas with an antifungal chemical coating;
- Fill cracks and holes with putty; and
- Consolidate areas of wood decay with epoxy patching compound.

Recommendation 4:

*Replace Historic Wood Windows*

The following guidelines and methods should be followed for replacement of window elements:

- Limited replacement in-kind is an acceptable treatment for extensively deteriorated elements of the window construction.
- Replacement pieces should match the historic feature in material, dimension and profile.
- Reglazing with insulated glass may be considered if the original sash can be altered to accept thicker glazing.
- Consider installing low-e film to the existing glazing.

**Maintain Existing Aluminum-Sash Windows and Preserve Historic Wood Frames (Affects Character Defining Feature)**

Discussion:

The aluminum-sash windows are not identified as character-defining features. However, the wood frames are part of the original double-hung wood-sash window systems, which are identified as character-defining features. As discussed in the Existing Conditions section, the aluminum-sash windows cause a number of negative effects. The general recommendation for the aluminum-sash is replacement, but, it is recognized that replacing all windows may not be feasible at this time. The wood frames and sills are to be protected, maintained, and preserved. Reference the previous section for recommendation on the preservation and maintenance of historic frames and sills. The following are recommended steps for maintaining the aluminum-sash windows until such time as they can be replaced in phases.

Recommendation 1:

*Maintain Aluminum-Sash Windows*

In the short term, the aluminum-sash windows should be maintained and repaired on an as-needed basis. The following guidelines and methods should be followed:

- Annual inspection of windows, identifying maintenance, and repair needs. The following should be inspected:
  1. Delaminating paint of the wood frame and sill;
  2. Wood decay of the frame and sill;
  3. Deteriorated and/or lack of weather-stripping;
  4. Ensure that weep holes are open and free from blockage; and
  5. Inspect sealant joint between the window and the exterior siding.
- Inspect sash edges and track for debris or damage. If the tracks and edges are obstructed, take the following steps:
  1. Vacuum the track or side jambs thoroughly.
  2. Wipe with a sponge, mild soap and water.
  3. Rinse and let dry.
  4. Using a dry cloth, wipe the track and side jambs with a silicone spray. Do not apply spray to weather-stripping.
  5. Slide sash up and down to check operation.
  6. Clean aluminum surface with mild soap and water with a sponge or soft bristled brush. Take care not to scratch the finished surface.
- If weep holes are blocked with debris ensure they are clear of blockage by taking the following steps:
  1. Vacuum the track and wipe thoroughly with a sponge and water.
  2. At the interior pour approximately 1 cup of water into the track. If the water drains out to the exterior, the weep holes are clear. If water remains or drains slowly, continue with the remaining steps.
  3. Locate the weep holes and insert a small wire into the hole (an unfolded paper clip would work well).
  4. Repeat step 3 until holes are clear and water runs through the weep hole to the exterior.
  5. Replace deteriorated sealant and weather-stripping as needed. This will ensure that windows are water tight and air tight, reducing risk of deterioration and energy loss.

**Replace Existing Aluminum-Sash Windows and Preserve Historic Wood Frames (Affects Character Defining Feature)**

Discussion:

Because of the problems related to the installation and detailing of the aluminum-sash units, the long term recommendation is to replace the aluminum-sash windows. The following guidelines and methods should be followed:

- The wood frame and sill should be retained, if permitted based on their existing condition.
- For maintenance and repair of the wood frame and sill, follow the same recommendations for maintenance, inspection, and repairs as outlined in the Preserve Historic Wood Windows section.
- A new replacement window should consider the following:
    1. Install a double-hung, wood-sash window that replicates or closely matches the original window in material, dimension and profile. Historic drawings or surviving prototypes should be consulted for replication.
    2. Install a replacement window that is compatible with the historic character and style of the building. A single hung window that can be installed into the existing wood frame is recommended. The replacement window should include either faux or true divided lites, in the same pattern as the historic windows. Further details for acceptable window replacements should be identified in the neighborhood design guidelines.
- Creating new openings and/or enlarging existing openings should not be permitted.

**Maintain Existing Roof and Preserve Rafter Tails and Soffit (Character Defining Feature)**

Identify, Retain and Preserve:

The shingled roof and exposed rafter tails are identified as character-defining features of the residential units. These features are to be protected, maintained, and preserved.

Protect and Maintain:

Roofs and rafter tails should be protected and maintained. Maintenance of these features includes the following:

- Annually inspect asphalt shingles and flashing to identify maintenance, and repair needs
- Inspect roof for missing and/or loose asphalt shingles
- Inspect flashing to ensure secure attachments and proper function;
- Annually inspect wood rafter tails, trim and soffit boards to identify maintenance, and repair needs for:
    1. Termite damage or other infestation
    2. Delaminating paint
    3. Wood decay
    4. Re-secure any loose asphalt shingles
- Paint wood elements that show signs of worn finishes and delaminating paint. If peeling paint is present inspect the bare wood for signs of decay. If decay is present, see the following Repair section. If no decay is present, take the following steps for re-application of paint coatings:
    1. Prep the surface by scraping off any loose paint. Be careful not to gouge or damage the wood surface.
    2. Lightly sand the surface (reference *Preservation Brief #37: Appropriate Methods for Reducing Lead-Paint Hazards in Historic Homes*).
    3. Repaint the area using exterior primers and paints. The final coat should match the existing in color and finish.

Repair:

The following guidelines and methods should be followed for repairs to the roof:

- Install new shingles at areas were shingles are missing;
- Treat split, checked and decayed wood areas with an antifungal chemical coating;
- Fill cracks and holes in wood with putty; and
- Consolidate areas of wood decay with epoxy patching compound.

Replace:

As stated in the Existing Conditions section, the roof shingles were replaced in 2008. Maintenance staff stated that this was the third layer of shingles on the roofs. Roofs should be stripped of all layers at the time of the next roofing project. If structural upgrades to the roof system have not yet been completed, they should be done so at this time. Reference the Structural section for recommendations on roof upgrading and repair.

Limited replacement in-kind is an acceptable treatment for extensively deteriorated or missing wood sheathing or elements. Replacement pieces should match the historic feature in material, dimension, and profile. Historic drawings or surviving prototypes should be consulted for replication of pieces and/or entire features.

**Preserve Historic Wood Gutters at Porch Entrances and Maintain All Others**

Identify, Retain and Preserve:

The wood gutters at entrance porches are original to the residential units. Where they remain, wood gutters are to be protected, maintained, and preserved. Reference *Preservation Brief #10 Exterior Paint Problems on Historic Woodwork*.

Protect and Maintain:

Original gutters should be protected and maintained. Maintenance of these gutters includes the following:

- Annual inspection of wood and flashing, identifying maintenance, and repair needs. The following should be inspected:
  1. Ensure that gutters are free and clear of debris;
  2. Inspect wood for delaminating paint; and
  3. Inspect for wood decay.
- Paint wood elements that show signs of worn finishes and delaminating paint. If peeling paint is present inspect the bare wood for signs of decay. If decay is present see the following Repair section. If no decay is present take the following steps for re-application of paint coatings:
  1. Prep the surface by scraping off any loose paint. Be careful not to gouge or damage the wood surface.
  2. Lightly sand the surface (reference *Preservation Brief #37: Appropriate Methods for Reducing Lead-Paint Hazards in Historic Homes*).
  3. Repaint the area using exterior primers and paints. The final coat should match the existing in color and finish.

Repair:

The following guidelines and methods should be followed for repairs of door elements:

- Treat split, checked and decayed areas with an antifungal chemical coating;
- Fill cracks and holes with putty; and
- Consolidate areas of wood decay with epoxy patching compound.

Replace:

- Replacement of extensively deteriorated wood gutters is an acceptable treatment.
- Install New Downspout at Entry Porch.
- Installing a carefully designed downspout for the entrance gutters should be considered. Careful attention to its attachment and placement should be made to lessen the physical and visual impact of the added feature.

Treatment for Non-Historic Gutters:

Non-historic gutter should be maintained on an as-needed basis. The following guidelines and methods should be followed:

- Follow the same recommendations for maintenance, inspection, and repairs as outlined in the previous section.

**Prohibit Installation of New Gutters**

Discussion:

It is not recommended that new gutters be installed at the eaves of residential roofs for two primary reasons:

1. Gutters are not original and obscure rafter tails, which are character-defining features.
2. Gutters add maintenance requirements and pose risk to other building components.

The exposed rafter tails are identified as a character-defining feature. Installing gutters would hide this feature and impact the historic integrity of the building. At various buildings across the neighborhood, modern gutter systems were observed at roof eaves. Many of these observed gutters are deteriorated due to lack of maintenance. As described in the Existing Conditions section, these gutters are clogged, sagging, and deteriorated. A gutter system requires annual maintenance and repair that, at this time, is not being conducted. When gutters are not maintained there is an increased risk of damage to other building components. For example, clogged gutters collect water and add a substantial amount of weight to the roof eave and structural system. These types of risks could lead to costly repairs. Adding an additional building element that requires a high level of maintenance and poses a risk to the building is not advised.

The concern for water runoff management is a valid one. However it is recommended that water control take place at the ground level, through improved drainage and grading. This would eliminate the need for the addition of gutters at the eaves.

Recommendation 1:

Modern gutters installed at the roof edge should be removed and the wood eave and rafter tails repaired as required.

Recommendation 2:

Design a standard detail to ensure adequate drainage at building perimeters. Detail should address grading issues as well as planting bed design.

**Develop Guidelines for Making Residential Units Accessible (Affects Character Defining Feature)**

Discussion:

Changes to residential units should be allowed in order to meet accessibility needs. Atchison Village's unified architectural vocabulary is an important character-defining feature, and changes to the architecture should not interrupt the visual cohesion of the neighborhood. Standard designs and details specific to each residential typology should be developed for new ramps and kitchen and bathroom layouts. With these guidelines, owners can improve access without negatively impacting important architectural features. Recommended projects include:

- Develop Guidelines for Accessibility at Atchison Village and adopt these as design standards.
- Install an accessible ramp at entrances, when needed. Ramps should follow these guidelines:
  1. Be constructed of wood;
  2. Be constructed in such a way that a ramp addition can be reversible and not impact historic fabric and character-defining features;
  3. Ramp design shall not remove historic wood railings and porch columns; and
  4. Ramp shall meet code requirements for dimensions, slope and all other required specifications.
- Retrofit the existing kitchen layout for required accessible upgrades. This may include installing base cabinets that meet wheelchair requirements in regards height and dimensions.
- Retrofit the existing bathroom layout for required accessible upgrades. This may include an accessible shower/bath, toilet and sink. Some walls may require additional structural supports for required grab bars.

## Structural

Reference Appendix G for sketch details of typical repairs.

**Protect Foundations and Crawlspace Framing**

- Provide proper grading to direct site water, including roof runoff, away from existing foundations.
- Provide overall site and foundation drainage to keep site water away from the existing foundations and to prevent water infiltration and accumulation in the crawlspaces.
- Provide code-required wood-earth separation between the existing exterior wall sill plates and crawlspace framing and the adjacent soil grades.

**Provide Required Structural Strengthening and Connections for Residential Building Types 1 through 3**

<u>Roof Diaphragm Strengthening:</u>
Improve roof diaphragm connections to existing exterior walls and interior demising walls.

<u>Wall Connections:</u>
Improve existing interior demising wall shearwall connections to roof and floor diaphragms:

- Extend interior demising wall shearwalls through attic space and attach to roof diaphragms.
- Improve connections of interior demising wall shearwalls to floor diaphragms.

<u>Foundation Connections:</u>
Improve floor diaphragm to foundation connections:

- Provide additional Simpson framing clips and anchor plates to improve the connection of the existing floor diaphragms to existing blocking, and the foundation sill plates to the existing foundations.

**Provide Required Structural Strengthening and Connections for Residential Building Types 4 and 5**

<u>Roof Diaphragm Strengthening:</u>
Improve roof diaphragm connections to existing exterior walls and interior demising walls.

<u>Wall Connections:</u>
Improve existing interior demising wall shearwall connections to roof and floor diaphragms:

- Extend interior demising wall shearwalls through attic space and attach to roof diaphragms.
- Improve connections of exterior wall and interior demising wall shearwalls to floor diaphragms.

<u>Foundation Connections:</u>
Improve floor diaphragms to foundation connections:

- Provide additional Simpson framing clips and anchor plates to improve the connection of the existing floor diaphragms to existing blocking, and the foundation sill plates to the existing foundations.

<u>Shear Walls:</u>
Improve lower-level shearwall strength at exterior walls:

- Provide new plywood sheathing on inside face of selected lower level exterior walls and new Simpson anchor plates to the existing foundations to improve overall building seismic resistance.

## Mechanical

**Replace Heaters**

Replace:

The following guidelines and methods should be followed for replacement of wall heaters:

- Have wall heater inspected by a licensed mechanical contractor. Contractor shall check to see if safety circuit is working. Replace wall heater if safety circuit is faulty.
- Inspect residential unit for combustion air vents. If vents do not exist, install vents per the California Mechanical Code. Vents shall be sized for both the wall heater and the water heater.
- Do not install exhaust fans in a residential unit until the combustion air vents have been installed. The combustion air vents ensures that enough air is available for the heaters. Without the combustion air vents, the exhaust fan can draw carbon monoxide gases from the heater vent.

**Repair and/or Replace Water Heaters**

Recommendation 1:

*Inspect and repair water heater vent*

- Vent should be continuous with no holes.
- Replace water heaters as they fail. Water heaters shall be installed per manufacturer instructions and the California Mechanical Code.

**Retain Existing Ventilation and Replace Exhaust Where Required**

Recommendation 1:

*Identify, Retain and Preserve*

- Use windows to ventilate residential units. Ventilation reduces possibility of mold.

Recommendation 2:

*Replace*

- Do not install exhaust fan until the combustion air vent for wall heaters are installed. Exhaust fan operation could draw carbon monoxide fumes from the wall heater vent duct.

## Electrical

**Repair and/or Replace Electrical Panel and Wiring**

Recommendation 1:

*Repair*

The following guidelines and methods should be followed for repair of Panel and Wiring:

- Wiring shall not be covered by building insulation. "Knob and Tube" conductors rely on the surrounding air for cooling. Building insulation could cause the circuit to overheat and be a fire hazard. If the "Knob and Tube" conductors are covered by insulation, have licensed contractor expose the wiring.
- Replace: The following guidelines and methods should be followed for replacement of Panel and Wiring:
  1. Have "Knob and Tube" wiring inspected by a licensed electrical contractor. If wiring show signs of degradation, the wiring shall be replaced per California Electrical code.
  2. The "Knob and Tube" should be replaced with wiring meeting current codes Hot conductor, Neutral conductor, and grounding wire.
  3. Install "Arc-Fault Circuit-Interrupter" (AFCI) for circuits supplying receptacles. AFCI can detect arcing in the circuit and shutdown the circuit (Figure 4.41).
  4. Ideally, the "Knob and Tube" wiring should be replaced with wiring conforming to the National Electric Code. New wiring will have the proper sheath and will have a ground wire for equipment.

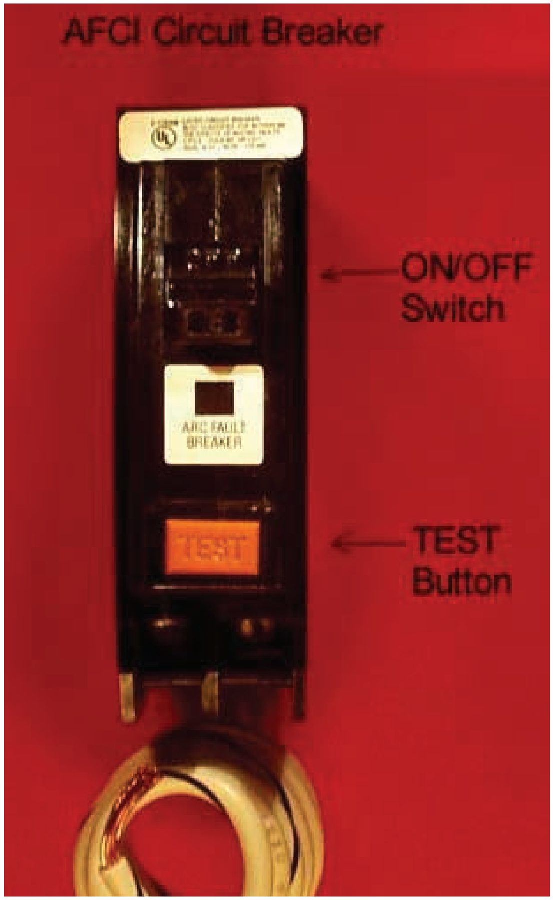


Figure 4.41 - Typical Arc-Fault Curcuit-Interrupter.

**Replace Receptacles**
<u>Recommendation 1:</u>
*Replace*
The following guidelines and methods should be followed for replacement of Receptacles:

- Have licensed electrician replace receptacles in the Kitchen and Restroom with "Ground Fault Interrupt" (GFI) receptacles. Label GFI receptacles "No Equipment Ground." (Figure 4.42)
- Install "Arc-Fault Circuit-Interrupter" (AFCI) for circuits supplying receptacles. AFCI can detect arcing in the circuit and shutdown the circuit.
- An alternative to above, install dual listed GFI and AFCI circuit interrupter for receptacle circuits per National Electric Code Article 406.3.D.(3).(c). The receptacle circuit will be protected by the AFCI and a ground wire would not be required for the 3-prong grounding type receptacle. The 3-prong receptacle would not need to be provided with a grounding wire. The receptacle shall be marked "GFCI Protected" and "No Equipment Ground"

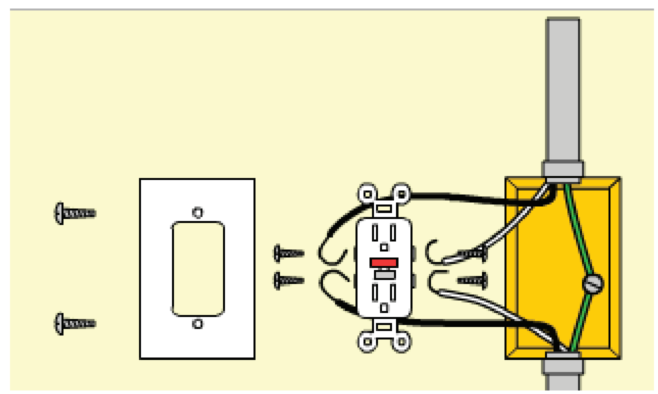

Figure 4.42 - Typical Ground Fault Interrupt receptacle.

**Replace Exterior Light Fixtures and Light Bulbs**
Recommendation 1:
*Replace*
The following guidelines and methods should be followed for replacement of Lighting:

- Replace exterior light fixtures with energy-efficient fluorescent light fixtures
- Replace all incandescent light bulbs with fluorescent bulbs. The fluorescent bulbs use 25% of electricity for the same level of light.

**Replace Fire Alarms and Smoke Detectors**
Recommendation 1:
*Replace*
The following guidelines and methods should be followed for replacement of Smoke Detectors:

- Test smoke detectors monthly. As necessary, replace battery for smoke detectors.
- Install new battery-operated smoke detectors in all residential units.

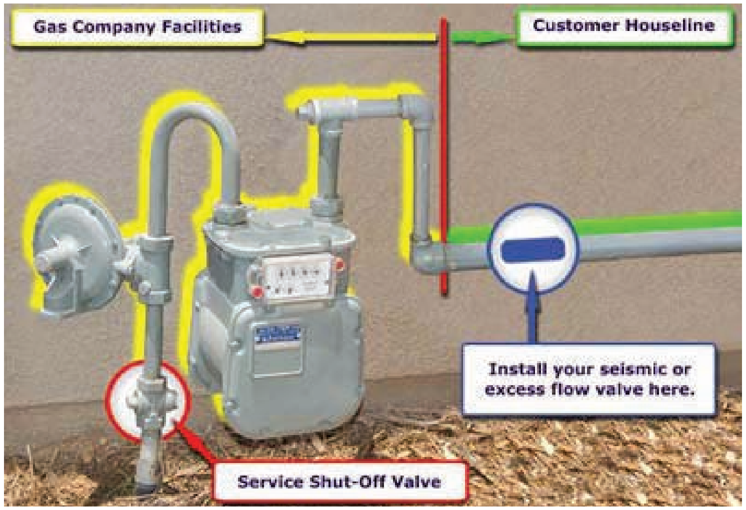

Figure 4.43 - Typical seismic isolation valve location at gas meter.

## Plumbing

**Install Seismic Isolation Valve to Gas Line**
Install seismic isolation valve after the gas meter. The seismic isolation valve will isolate the gas line during an earthquake. Installation should be installed by a licensed mechanical contractor (Figure 4.43).

**Repair and/or Replace Water Piping**
Recommendation 1:
*Repair*

- Provide pipe insulation for hot water pipes that are accessible.

Recommendation 2:
*Replace*
The following guidelines and methods should be followed for replacement of water pipe:

- The cold water main entering residential units are copper pipes
- The branch pipes to individual pipes are galvanized steel. If water pressure or rusty water is a problem, replace branch pipe with copper pipe (Figure 4.44). The replacement of the galvanized steel pipe may require opening up the wall. All hot water pipes shall be insulated.
- Reaming clogged galvanized pipes is an alternative. Eventually, the pipe will leak and the pipes will have to be replaced.

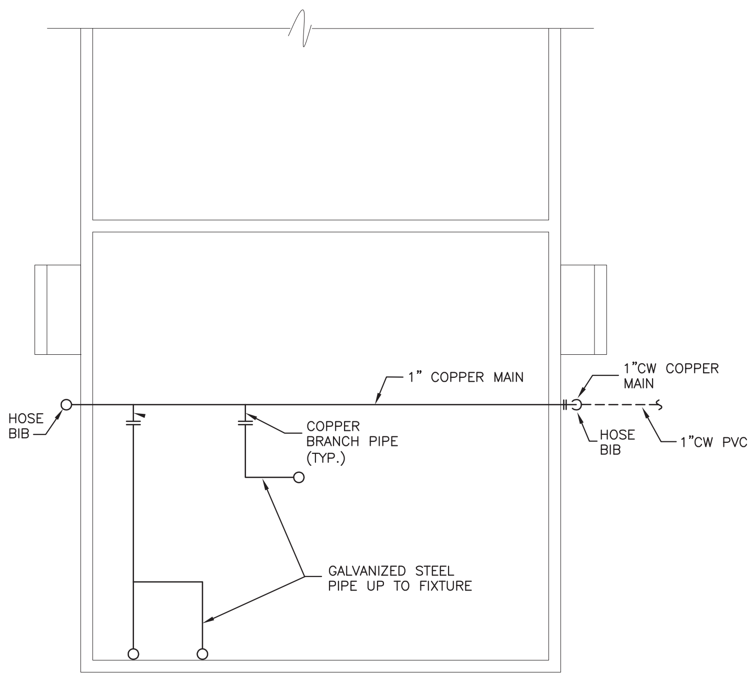

Figure 4.44 - Typical replacement of branch water pipes.

**Clean Sewer Piping**
Clear sewer pipe as necessary. On an as-needed basis, install double cleanouts as pipe exits the building.

**Replace Plumbing Fixtures**
Recommendation 1:
*Replace*
The following guidelines and methods should be followed for replacement of fixtures:

- Replace fixtures for proper operation.
- Install pressure balance valve for showers, sinks, and lavatories (Figure 4.45). During cold water use at other fixtures, the cold water volume can drop, leaving mostly hot water at showers and sinks. The hot water can cause scalding. The pressure balance valve cuts back the hot water to match the cold water.
- Replace existing toilets with dual-flush toilets. Dual-flush toilets have low flush volumes of 0.8 gallons per flush for liquid and 1.28 gallons per flush for solids (Figure 4.46).
- Provide 0.5-gallon-per-minute low-flow aerators for all sinks and lavatories.
- Provide flow restrictor for shower fixture.

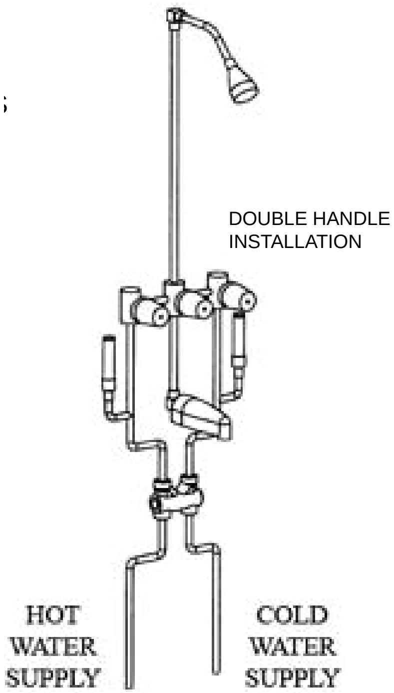


Figure 4.45 - Typical pressure balance valve.

Figure 4.46 - Typical 1.28 gallons/ flush toilet fixture.

# PART V: SUSTAINABILITY

> *"Historic buildings give society an important sense of tradition and education about the past. Preservation of existing structures also offers a way to reuse and recycle materials and related infrastructure. By rehabilitating older buildings, communities can save energy and materials and establish a sense of continuity."*
>
> –President's Council on Sustainable Development[1]

Sustainability is the practice of living in a way that is sustainable, or that could continue indefinitely. The sustainability movement acknowledges that natural resources are finite, and works to conserve them through "green" practices like innovative design to reduce pollution, promote consumption, and reuse of existing products. Green ideas include the 3 R's—Reduce, Reuse, and Recycle—which can be applied to many areas of life.

This section presents a number of options for saving energy, conserving water, and making maintenance more environmentally friendly. Many of the suggested steps are small, but they can make a big impact when implemented throughout Atchison Village.

## HISTORIC PRESERVATION AND SUSTAINABILITY

Though historic preservation and sustainability advocacy both emerged decades ago, the synergy between them is just now being widely recognized and explored. It is a natural partnership: Historic buildings use less operating energy than many contemporary buildings and are an enormous source of embodied energy. Buildings represent cultural values and layers of community history, which contribute to the long-term vitality of a community. Historic neighborhoods are often compact developments that provide close and convenient amenities without reliance on a car.

1 President's Council on Sustainable Development, *Sustainable America: A New Consensus for the Prosperity, Opportunity and a Healthy Environment for the Future*, <http://clinton2.nara.gov/PCSD/Publications/TF_Reports/amer-chap4.html>.

Historic buildings include many features of modern green buildings. They are deliberately sited and oriented to take advantage of daylighting, local climactic conditions, and shade plantings. They use natural ventilation and lighting systems like operable windows and transom windows, passive heating and cooling, and high ceilings. These measures mean that commercial buildings built before 1920 use less energy per square foot than buildings built up to 2000. In terms of residential properties, historic houses are generally smaller than modern houses, thereby requiring less energy for lighting, heating, and cooling. Additionally, historic buildings were constructed with local, durable, high-quality materials with high-level craftsmanship.

A new building—however green—takes a significant input of energy and materials. New construction requires raw materials; energy for harvest, processing, transportation, and assembly of those materials; and potentially energy to demolish an existing building and dispose of the construction waste. In fact, a new building must operate for twenty years to offset the energy and materials used in its construction.[2] Renovating a building produces 30 to 50 percent fewer greenhouse gas emissions and creates 20 percent more jobs as new construction with an equal investment.[3]

Historic neighborhoods are also naturally green beyond the merits of individual buildings. Most of these neighborhoods sit in areas with public transportation systems, stores, services, and schools. Since many historic neighborhoods developed before widespread automobile ownership, residents can move between houses, work, and school without a car, further reducing greenhouse gas emissions and reducing expensive infrastructure maintenance. Efficient land-use patterns mean less time in the car and more time in an interesting environment with a mix of uses and people.

2 United Nations Energy Programme, qtd. in Jean Carroon, Testimony of Jean Carroon, FAIA, Executive Summary, "Improving Energy Efficiency, Increasing the Use of Renewable Sources of Energy, and Reducing the Carbon Footprint of the Capitol Complex," June 18, 2008. <http://www.preservationnation.org/take-action/advocacy-center/additional-resources/Jean_Carroon_testimony_061808.pdf>

3 Carnegie Mellon Green Design Institute, qtd. in Carroon.

For Atchison Village and thousands of other historic properties across the country, the greenest buildings and neighborhoods are the ones already built: the places that bring character, vitality, and history to cities. Of course, energy efficiency upgrades can still be made to historic buildings and developments, with care taken to preserve the character defining features that make them significant. The rest of this section describes green, preservation-friendly measures to make Atchison Village a community that is historic *and* sustainable.

## SUSTAINABLE MAINTENANCE RECOMMENDATIONS

At Atchison Village, most of the energy has already been spent through construction. Making the buildings more energy- and water-efficient will lower ongoing costs and reduce the neighborhood's environmental impact. Using local, sustainable resources for maintenance will further reduce the environmental impact.

At the discretion of the Mutual Homes Corporation, a green or sustainability committee should be created to follow through with improving the sustainability of Atchison Village, through these small projects and the larger infrastructure projects described in the next section.

**Save Energy**

- Do an energy audit to determine where and how heat is being lost. *PG&E offers an online energy audit, the SmartEnergy Analyzer. It can be found online at www.pge.com/myhome/saveenergymoney/analyzer/en/index.shtml. Other organizations and businesses that perform on-site audits are listed at the end of this section.*
- When replacing burned-out light bulbs, use fluorescent bulbs. *The fluorescent bulbs use 75% less electricity and produce the same level of light.*
- Inspect windows and doors for air gaps and stop air flow by weather-stripping. *Gaps at windows and doors can lead to a great amount of heat and energy loss in buildings. Where sealant is needed, always seal windows from the exterior side.*
- Use drapes/curtains at windows to control heat loss and heat gain. *Drapes are an inexpensive way to add thermal insulation to window systems without impacting historic fabric. Today's market offers energy efficient window treatments designed to keep your home warm in the winter and cool in the summer.*
- When replacing appliances, install Energy Star units that conserve energy and lower electric bills. *PG&E offers rebates for energy-efficient clothes washers, dishwashers, air conditioning units, and water heaters. PG&E also gives rebates for recycling old refrigerators, freezers, and air conditioning units. If you organize neighbors to replace appliances in bulk quantities, many retailers will offer bulk discounts for unit costs, delivery and installation.*
- Wrap your water heater with a water heater blanket, especially if it is located in an unheated area, such as a blister at the rear of the residential units.
- Insulate your attic and walls. *The vast majority of heat loss in homes is through the attic or uninsulated walls.*[4] *PG&E offers rebates of up to $150 per 1,000 square feet for insulating attics and walls.*
- Repair windows instead of replacing them. *The energy needed to manufacture a new energy-efficient window is more than the energy saved by the new window over its entire lifecycle, and historic windows have a proven track record of durability and performance.*[5] *Historic windows that have been properly repaired may have nearly the same insulation ability as new weatherized windows.*[6]

4 Donovan D. Rypkema, "Economics, Sustainability, and Historic Preservation," National Trust Annual Conference, Portland, October 1, 2005 <http://www.preservationnation.org/issues/transportation/additional-resources/rypkema-speech-sustainability-portland-10012005.pdf>
5 "Historic Wood Windows," National Trust for Historic Preservation <www.preservationnation.org/issues/sustainability/additional-resources/July2008WindowsTipSheet.pdf>; Walter Sedovic and Jill H. Gotthelf, "What Replacement Windows Can't Replace: The Real Cost of Removing Historic Windows," *APT Bulletin, Journal of Preservation Technology* 36, no. 4 (2005), 25-29 <www.apti.org/publications/Past-Bulletin-Articles/Sedovic-36-4.pdf>.
6 Donovan D. Rypkema, "Historic, Green, and Profitable," Traditional Building Conference, Boston, March 8, 2007.

**Conserve Water**

- Install 0.5 gallon-per-minute low-flow aerators for all sinks and lavatories.
- Install a flow restrictor for shower fixtures.
- Replace existing toilets with dual flush toilets. Dual flush toilets have low flush volumes of 0.8 gallons per flush for liquid and 1.28 gallons per flush for solids.
- Install instantaneous water heaters to provide hot water on demand at showers and sinks.

**Green Repairs and Construction**

- Use materials with a high percentage of recycled content.
- Give preference to locally-produced materials and products.
- Use low- or no-VOC (volatile organic compound) paints, adhesives, and carpet.
- When using wood, ensure that materials are harvested from certified sustainable forests.
- Eliminate the use of asbestos, lead and PCBs in all products.

## SUSTAINABLE INFRASTRUCTURE RECOMMENDATIONS

Larger projects cost money up front—but they lower long-term maintenance and operating costs, reduce the environmental impact of Atchison Village, and increase quality of life for all residents.

**Construct Neighborhood Solar Photovoltaic System**

To be researched. What would the scale, costs, payback time be?

**Develop Water Management Plan**

Proper implementation of the holistic stormwater management strategies outlined in this report offers direct benefits in terms of reducing peak flows and volumes as well as providing water quality treatment through natural biochemical and physical processes. Additional benefits, as compared to solely increasing hard-pipe infrastructure, are manifold:

*Environmental*

- Improved air quality
- Groundwater and aquifer recharge
- Soil preservation
- Improved aesthetics
- Wind and noise reduction

*Ecological*

- Habitat creation for birds, butterflies, and other pollinators, and overall increased biodiversity
- Provides critical links in hydrologic and nutrient cycles

*Economic*

- Can be less expensive to install than conventional management systems
- Increased property values up to 15%
- Energy savings via shading and local climate stabilization

*Social*

- Traffic calming
- Passive recreation
- Stress reduction

**Install Bicycle Racks**

Bicycling is one of the greenest forms of transportation: it doesn't produce any greenhouse gas emissions at all! Providing bicycle racks in secure, convenient places in Atchison Village can encourage residents and visitors to bicycle as a way to get to work or school, do errands, and move around the city. Atchison Village should be well-connected to the nearby Richmond Greenway to promote people to bike or walk to and from the neighborhood.

**Implement Car-Sharing Program**
Car-sharing programs provide easy access to a car without ongoing car payments, maintenance, and gas costs. If you don't need to drive every day, a car-sharing program allows you to reserve and pay for a car only when you need it, picking it up from a location convenient to you. Car-sharing programs in the Bay Area include City CarShare and Zipcar. Neither program currently has cars in Richmond, but Atchison Village could volunteer to host one or two cars with dedicated parking spaces.

- Zipcar: http://www.zipcar.com/
- City CarShare: http://www.citycarshare.org/

**Investigate and Apply for Programs and Assistance**
Public agencies, utility companies, and private organizations provide incentives and guidelines for sustainable measures. These include steps as small—but significant—as weatherizing your home, and larger projects such as remodeling. California's Low-income Home Energy Assistance Program (LIHEAP) reduces heating and cooling costs by improving the energy efficiency of qualified homes. The PG&E Energy Partners Program also provides income-qualified customers free weatherization measures and energy-efficient appliances.

In terms of green remodeling, the GreenPoints and LEED guidelines can both be applied in California. Rehabilitation projects can utilize practices recommended by LEED for Homes or the GreenPoint rating system, thus using incremental steps to achieve cumulative environmental sustainability. More information on GreenPoints, LEED, and other programs can be found in the Appendix.

- Apply for LIHEAP weatherization program.
- Apply for PG&E Energy Partners Program: http://www.pge.com/energypartners/.
- Use the GreenPoints *Home Remodeling Green Building Guidelines* in rehabilitation projects or as references for making buildings more sustainable.
- Reference LEED practices during rehabilitation work.
- Use the LEED for Neighborhood Development rating system as a template for sustainable changes within Atchison Village.

## SUSTAINABLE SITE RECOMMENDATIONS

**Site and Landscape**

- Use leaves and chipped material to mulch planting beds.
- When trees need to be removed, require that the wood be chipped for use on site.
- Provide compost bins in communal rear yards and have an on-site training for making compost. Apply compost to planting beds.
- When planting new shrubs, consider using species that will encourage birds, butterflies and other beneficial wildlife.
- Plant trees to provide shade and reduce heat island effect.
- Avoid planting invasive species.
- Avoid adding impervious surfaces; where feasible, remove pavement in areas that were planned as parks or common rear yards.
- Capture storm water and graywater for use as summer irrigation.
- Remove and store topsoil before any grading or excavation work is done at the site.
- Protect soil from compaction by topdressing with mulch and preventing heavy vehicles from driving over curbs. Aerate lawns as part of annual maintenance program.
- Add organic compost to soils whenever doing new planting.
- Use sheet mulch to control weeds.
- Use salvaged and recycled construction materials when available.
- Purchase site furnishing made from post-consumer-content materials when available.
- If new street lighting is installed, use LED fixtures.
- Install a water conserving automatic irrigation system with hydro-zoning.
- Avoid the use of toxic herbicides and insecticides and use organic methods instead. Use Integrated Pest Management practices.
- Do not plant shrubs that require regular shearing.
- Plant drought-tolerant plants.

# PART VI: CONCLUSIONS

The site and structures that make up the Atchison Village neighborhood are in good to fair condition and in general the historic integrity of the neighborhood is intact. However, recent repairs, alterations, and additions are beginning to threaten the site's original fabric, character-defining features, and overall historic integrity. Many existing conditions are in need of remediation in order to halt continuing deterioration which threatens historic fabric. If action is not taken to arrest some of the most serious conditions outlined in this report, the neighborhood's historic integrity may be lost.

The purpose of this section (*Part VI: Conclusions*), is to outline routine maintenance needs and priorities for repair. Included in this section is a Prioritized List of Repairs Matrix (the Matrix). The Matrix lists all repair items outlined in section *Part IV: Recommendations* and assigns each item with a priority level: Immediate Action, High Priority, Low Priority and Annual Maintenance. Character-defining features are also identified where applicable and all items are cross referenced to the page number where the recommendation is explained in *Part IV*.

## IMPACT TO INTEGRITY

Although not all items listed in the Matrix are considered character-defining, it should be noted that any project within the neighborhood could impact the integrity of the site as a whole. For example, making public entrances to the Community Center accessible is not identified as a character-defining feature. However, if the project to make the building accessible is not done in a manner that is sensitive to the character of the building, then the integrity of the site may be threatened. Therefore, all projects within Atchison Village must be considered relative to their potential impact on the integrity of the neighborhood and character-defining features when scoping the work. Following recommendations in this report, as well as developing Design Guidelines for the neighborhood, will help to inform future projects and assure that the historic integrity of the site is retained.

## IMMEDIATE ACTION ITEMS:

The most serious issues are noted as Immediate Action items in the Matrix. These issues are identified as such because of their current or potential impact to the site and buildings that make up the Atchison Village neighborhood. The recommended time frame for completion of these projects is within one year from the date of this report. Immediate Action items include:

- Develop design guidelines for the Atchison Village historic neighborhood (see following discussion);
- Produce drainage masterplan;
- Conduct soils testing;
- Implement runoff reduction strategies to increase effectiveness of site drainage; and
- Replace fire alarm system and smoke detectors within all buildings.

### Design Guidelines

Design guidelines should be developed prior to the start of any projects. The guidelines in this document, as well as the *Secretary of the Interior's Standards for the Treatment of Historic Properties*, could be adopted as interim guidelines until comprehensive design guidelines are developed. The full design guidelines document should include, as a minimum, the following:

- Explanation of the application and design review process;
- Historic overview and context statement;
- Site maps identifying boundaries and building types;
- Architectural description of buildings and site;
- Summary of character-defining features;
- Design Guidelines for architectural/character-defining features;
- Design Guidelines for Additions;
- Design Guidelines for streetscapes;
- Design Guidelines for site lighting;
- Design Guideline for accessibility;
- Design Guidelines for plantings;
- Design Guidelines for fences and gates; and
- Design Guidelines for storage/outbuildings.

## HIGH PRIORITY ACTION ITEMS:

High priority items should be completed within one to four years from the date of this report. High priority action items include the following:

- Implement low impact development (LID) stormwater facilities;
- Implement site drainage improvements at landscaped areas surrounding residential units;
- Preserve existing accessible features and provide new facilities to improve accessibility;
- Make necessary safety and accessibility improvements at public entrances to community center;
- Install additional crawlspace vents to meet code requirements;
- Replace receptacles within all structures;
- Repair and/or replace water piping;
- Repair and/or replace sewer piping;
- Replace existing aluminum-sash windows and preserve historic wood frames at all residential buildings;
- Repair and/or replace water heaters at all residential units;
- Retain existing ventilation and replace exhaust where required at all residential units;
- Repair and/or replace electrical panels and wiring at all residential units; and
- Install seismic isolation valves at all residential units.

## LOW PRIORITY ACTION ITEMS:

Low priority action items should be completed within five to ten years from the date of this report. Low priority action items include:

- Submit and update National Register for Criteria C;
- Evaluate benefits and cost for installing an irrigation system;
- Resolve need for storage space in common and private areas;
- Evaluate benefits and cost for locating power utilities underground;
- Strengthen roof diaphragm at community center;
- Improve existing interior and exterior wall shearwall connections to roof and floor diaphragms at community center;
- Improve existing shearwall strength at community center;
- Replace plumbing fixtures for all structures;
- Provide required structural strengthening and connections for all residential units; and
- Replace residential furnaces.

## ANNUAL MAINTENANCE ITEMS:

Many items are listed in the Matrix as annual maintenance items. These items should be included in the neighborhoods general maintenance plan. Items are intended to be maintained on an annual basis unless noted otherwise. The following items are to be included in an annual maintenance plan:

- Maintain existing trees;
- Maintain lawns;
- Control weed growth;
- Protect and maintain original curbs and install additional curb cuts;
- Protect and maintain original parking and vehicular areas;
- Protect and maintain original walkways and pedestrian pavements;
- Retain and maintain play equipment and site furnishings;
- Maintain stucco for eventual restoration of wood siding;
- Preserve or restore historic wood doors and maintain all others;
- Preserve historic wood windows;
- Maintain gutters and downspouts;
- Protect foundations and crawlspace framing;
- Protect and maintain furnace for eventual replacement at the community center;
- Maintain water heater for replacement in 2019 at the community center;
- Retain existing ventilation and replace exhaust where required at the community center;
- Maintain and replace panel and wiring as required at the community center;
- Maintain light fixtures and consider replacement at community center;
- Preserve entrances and porches;
- Maintain vinyl siding for eventual restoration of wood siding;
- Maintain existing aluminum-sash windows and preserve historic wood frames until replacement of aluminum-sash is completed;
- Maintain existing roof and preserve rafter tails and soffit at all buildings;
- Preserve historic wood gutters at porch entrances and maintain all others;
- Prohibit installation of new gutters; and
- Replace exterior light fixtures and light bulbs at residential units.

## PRIORITIZED LIST OF RECOMMENDATIONS

| Neighborhood Site & Landscape: Treatment Recommendations and Alternatives | CHARACTER DEFINING FEATURE? | | PRIORITY | | | | REFERENCE |
|---|---|---|---|---|---|---|---|
| | YES | NO | IMMEDIATE ACTION | HIGH PRIORITY | LOW PRIORITY | ANNUAL MAINTENANCE | PAGE # |
| **National Register Nomination Form (NR)** | | | | | | | |
| - Submit and Update NR Form for Criteria C | | | | | * | | 6, Appendix |
| **Site: Drainage** | | | | | | | |
| - Produce Drainage Masterplan | | | * | | | | 24 - 26, 97 |
| - Conduct Soils Testing | | | * | | | | 24 - 26, 97 |
| - Implement Runoff Reduction Strategies | | ✓ | * | | | | 24 - 26, 99 |
| - Implement Low Impact Development (LID) Stormwater Facilities | | ✓ | | * | | | 24 - 26, 101 |
| - Enhance Storm Drain System | | ✓ | | | * | | 24 - 26, 103 |
| **Landscape: Softscape** | | | | | | | |
| - Maintain Existing Trees | ✓ | | | | | * | 27, 105 |
| - Develop a Tree-planting Master Plan and Design Guidelines for Atchison Village | ✓ | | * | | | | 27, 105 |
| - Develop Guidelines for Shrub Plantings | ✓ | | * | | | | 29, 107 |
| - Maintain Lawns | | ✓ | | | | * | 31, 109 |
| - Control Weed Growth | | ✓ | | | | * | 33, 109 |
| **Landscape: Hardscape** | | | | | | | |
| - Develop Guidelines for Fences & Gates | ✓ | | * | | | | 37, 110 |
| - Protect and Maintain Original Curbs & Install Additional Curb Cuts | ✓ | | | | | * | 39, 111 |
| - Protect and Maintain Original Parking & Vehicular Areas | ✓ | | | | | * | 39, 111 |
| - Protect and Maintain Original Walkways & Pedestrian Pavements | ✓ | | | | | * | 41, 112 |
| - Develop Guidelines for Site Lighting | | ✓ | * | | | | 47, 112 |
| - Retain and Maintain Play Equipment & Site Furnishings | | ✓ | | | | * | 43, 113 |
| - Evaluate Benefits and Cost for Installing an Irrigation System | | ✓ | | | * | | 47, 113 |
| - Implement Site Drainage Improvements at Landscaped Areas Surrounding Residential Units | | ✓ | | * | | | 71, 114, 117 |
| - Preserve Existing Accessible Features and Provide New Facilities to Improve Accessibility | | ✓ | | * | | | 43, 114 |
| - Resolve Need for Storage Space in Common and Private Areas | | ✓ | | | * | | 49, 115 |
| - Evaluate Benefits and Cost for Locating Power Utilities Underground | | ✓ | | | * | | 49, 115 |

Buildings and Structures Treatment Recommendations and Alternatives

| | CHARACTER DEFINING FEATURE? | | PRIORITY | | | | REFERENCE |
|---|---|---|---|---|---|---|---|
| | YES | NO | IMMEDIATE ACTION | HIGH PRIORITY | LOW PRIORITY | ANNUAL MAINTENANCE | PAGE # |
| **Community Center** | | | | | | | |
| Architectural: Exterior | | | | | | | |
| - Make Necessary Safety and Accessibility Improvements at Public Entrances | | ✓ | | * | | | 53, 55, 116 |
| - Maintain Stucco for Eventual Restoration of Wood Siding | ✓ | | | | | * | 54,117 |
| - Install Additional Crawlspace Vents to Meet Code Requirements | | ✓ | | * | | | 54, 117 |
| - Preserve or Restore Historic Wood Doors and Maintain All Others | ✓ | | | | | * | 55, 119 |
| - Preserve Historic Wood Windows | ✓ | | | | | * | 55, 57, 120 |
| - Maintain Gutters and Downspouts | | ✓ | | | | * | 59, 121 |
| Structural | | | | | | | |
| - Protect Foundations and Crawlspace Framing | | ✓ | | | | * | 60 - 61, 121 |
| - Strengthen Roof Diaphragm | | ✓ | | | * | | 60 - 61, 121 |
| - Improve Existing Interior and Exterior Wall Shearwall Connections to Roof and Floor Diaphragms | | ✓ | | | * | | 60 - 61, 121 |
| - Improve Floor Diaphragms to Foundation Connections | | ✓ | | | * | | 60 - 61, 121 |
| - Improve Existing Shearwall Strength | | ✓ | | | * | | 60 - 61, 121 |
| Mechanical | | | | | | | |
| - Protect and Maintain Furnace for Eventual Replacement | | ✓ | | | | * | 63, 122 |
| - Maintain Water Heater for Replacement in 2019 | | ✓ | | | | * | 63, 122 |
| - Retain Existing Ventilation and Replace Exhaust Where Required | | ✓ | | | | * | 64, 122 |

Buildings and Structures Treatment Recommendations and Alternatives

| | CHARACTER DEFINING FEATURE? | | PRIORITY | | | | REFERENCE |
|---|---|---|---|---|---|---|---|
| | YES | NO | IMMEDIATE ACTION | HIGH PRIORITY | LOW PRIORITY | ANNUAL MAINTENANCE | PAGE # |
| **Community Center** | | | | | | | |
| Electrical | | | | | | | |
| - Maintain and Replace Panel and Wiring as Required | | ✓ | | | | * | 65, 122 |
| - Replace Receptacles | | ✓ | | * | | | 65, 122 |
| - Maintain Light Fixtures and Consider Replacement | | ✓ | | | | * | 67, 122 |
| - Replace Fire Alarm System and Smoke Detectors | | ✓ | * | | | | 67, 123 |
| Plumbing and Fire Protection | | | | | | | |
| - Repair Water Piping | | ✓ | | * | | | 67, 123 |
| - Repair Sewer Piping | | ✓ | | * | | | 67, 123 |
| - Replace Plumbing Fixtures | | ✓ | | | * | | 67, 123 |
| **Residential Units** | | | | | | | |
| Architectural: Exterior | | | | | | | |
| - Preserve Entrances and Porches | ✓ | | | | | * | 69 - 71, 125 |
| - Maintain Vinyl Siding for Eventual Restoration of Wood Siding | ✓ | | | | | * | 72, 126 |
| - Install Additional Crawlspace Vents to Meet Code Requirements | | ✓ | | * | | | 73, 127 |
| - Preserve or Restore Historic Wood Doors and Maintain All Others | ✓ | | | | | * | 75, 129 |
| - Preserve Historic Wood Windows | ✓ | | | | | * | 76 - 79, 130 |
| - Maintain Existing Aluminum-Sash Windows and Preserve Historic Wood Frames Until Replacement of Aluminum-Sash is Completed | | ✓ | | | | * | 76 - 79, 131 |
| - Replace Existing Aluminum-Sash Windows and Preserve Historic Wood Frames | | ✓ | | * | | | 76 - 79, 132 |
| - Maintain Existing Roof and Preserve Rafter Tails and Soffit | ✓ | | | | | * | 79, 81, 133 |

**Buildings and Structures Treatment Recommendations and Alternatives**

| | CHARACTER DEFINING FEATURE? | | PRIORITY | | | | REFERENCE |
|---|---|---|---|---|---|---|---|
| | YES | NO | IMMEDIATE ACTION | HIGH PRIORITY | LOW PRIORITY | ANNUAL MAINTENANCE | PAGE # |
| **Residential Units** | | | | | | | |
| Architectural: Exterior | | | | | | | |
| - Preserve Historic Wood Gutters at Porch Entrances and Maintain all Others | ✓ | | | | | * | 81, 134 |
| - Prohibit Installation of New Gutters | | ✓ | | | | * | 81, 135 |
| - Develop Guidelines for Making Residential units Accessible | | ✓ | * | | | | 70, 135 |
| Structural | | | | | | | |
| - Protect Foundations and Crawlspace Framing | | ✓ | | | | * | 82 - 84,136 |
| - Provide Required Structural Strengthening and Connections for Residential Building Types 1, 2 and 3 | | ✓ | | | * | | 82 - 84, 136 |
| - Provide Required Structural Strengthening and Connections for Residential Building Types 4 and 5 | | ✓ | | | * | | 82 - 84, 136 |
| Mechanical | | | | | | | |
| - Replace Heaters | | ✓ | | | * | | 84, 137 |
| - Repair and/or Replace Water Heaters | | ✓ | | * | | | 84, 137 |
| - Retain Existing Ventilation and Replace Exhaust Where Required | | ✓ | | * | | | 84, 137 |
| Electrical | | | | | | | |
| - Repair and/or Replace Electrical Panel and Wiring | | ✓ | | * | | | 84, 137 |
| - Replace Receptacles | | ✓ | | * | | | 89, 138 |
| - Replace Exterior Light Fixtures and Light Bulbs | | ✓ | | | | * | 89, 139 |
| - Replace Fire Alarms and Smoke Detectors | | ✓ | * | | | | 90, 139 |
| Plumbing and Fire Protection | | | | | | | |
| - Install Seismic Isolation Valve | | ✓ | | * | | | 90, 139 |
| - Repair and/or Replace Water Piping | | ✓ | | * | | | 90, 139 |
| - Clean Sewer Piping | | ✓ | | * | | | 91, 140 |
| - Replace Plumbing Fixtures | | ✓ | | | * | | 92, 141 |

# APPENDIX A

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# APPENDIX B

## HISTORIC PHOTOGRAPHS


1941 - Atchison Village under construction, Richmond Museum

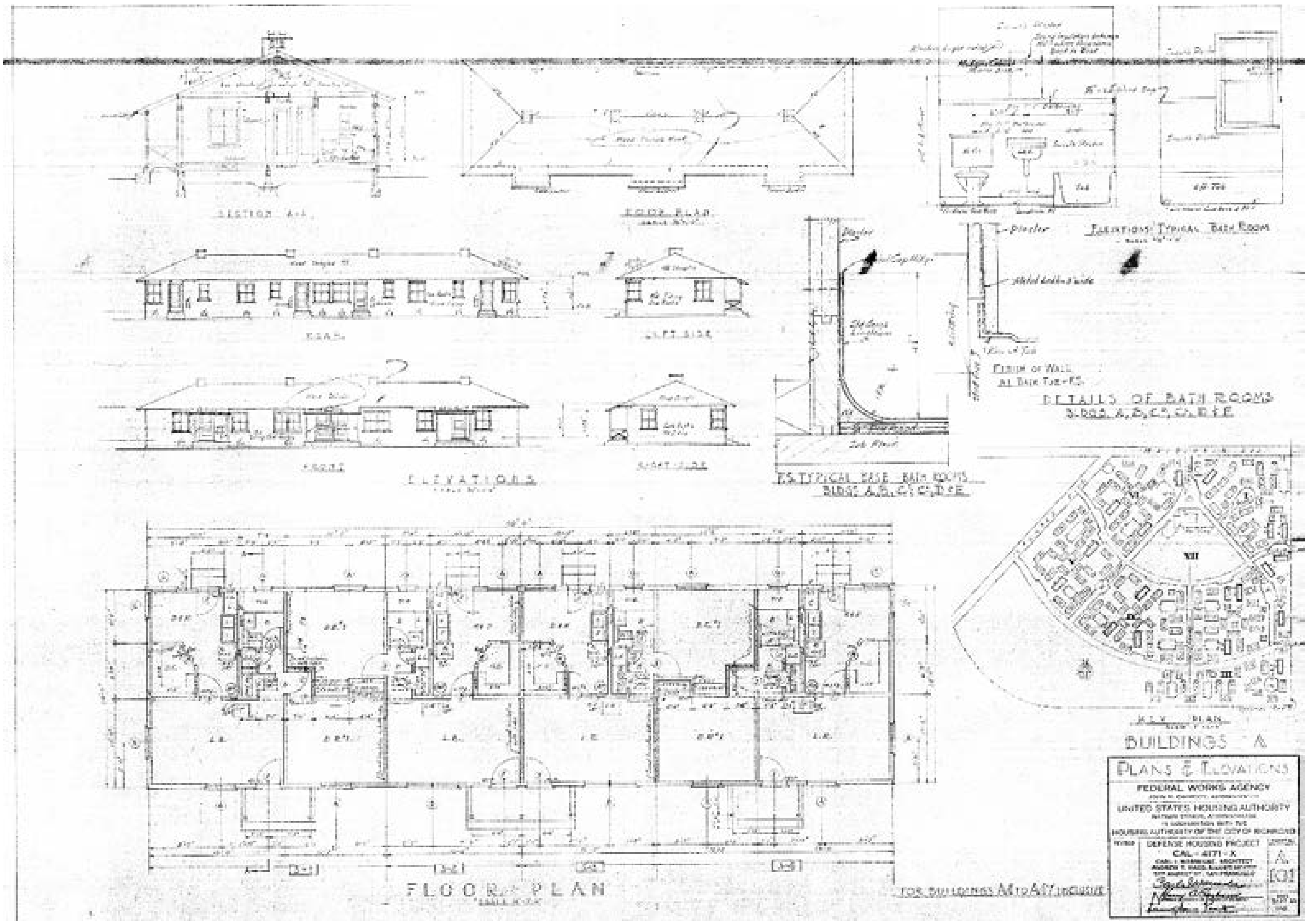

No Date - Atchison Village sign, Bancroft Library University of California

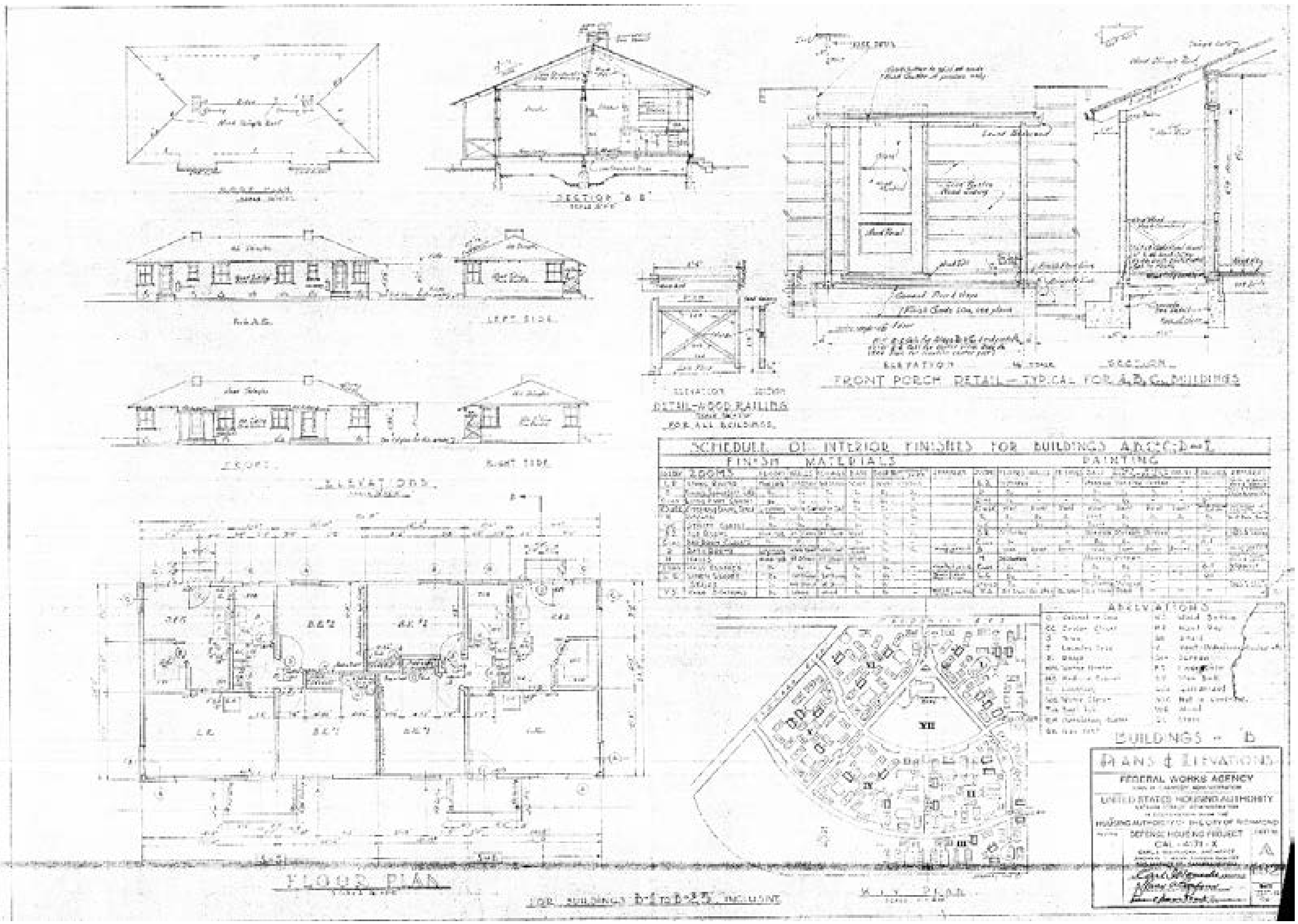
No Date - Atchison Village, Bancroft Library University of California

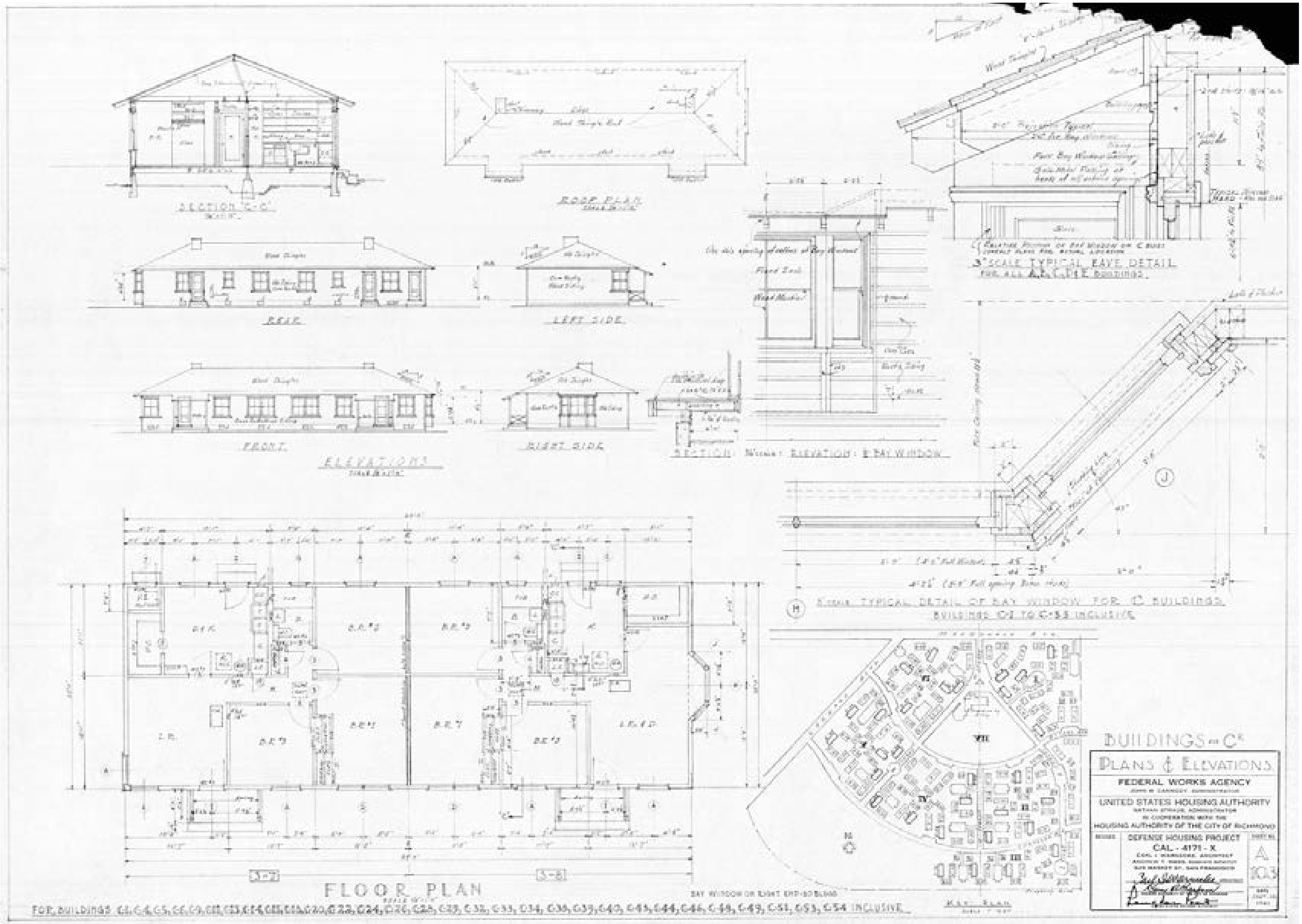
c. 1940 - Atchison Village Community Center, Bancroft Library University of California

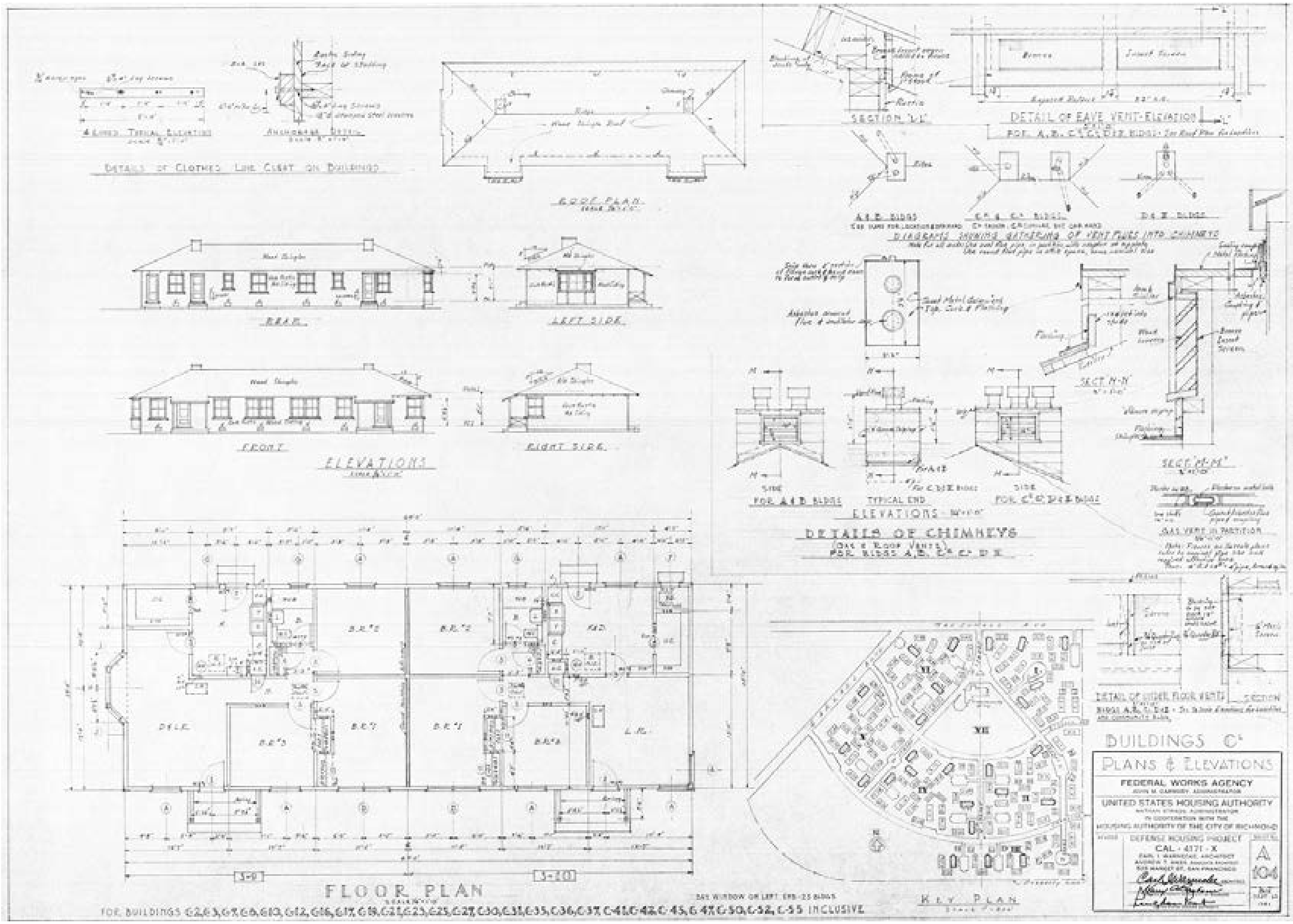
# APPENDIX C

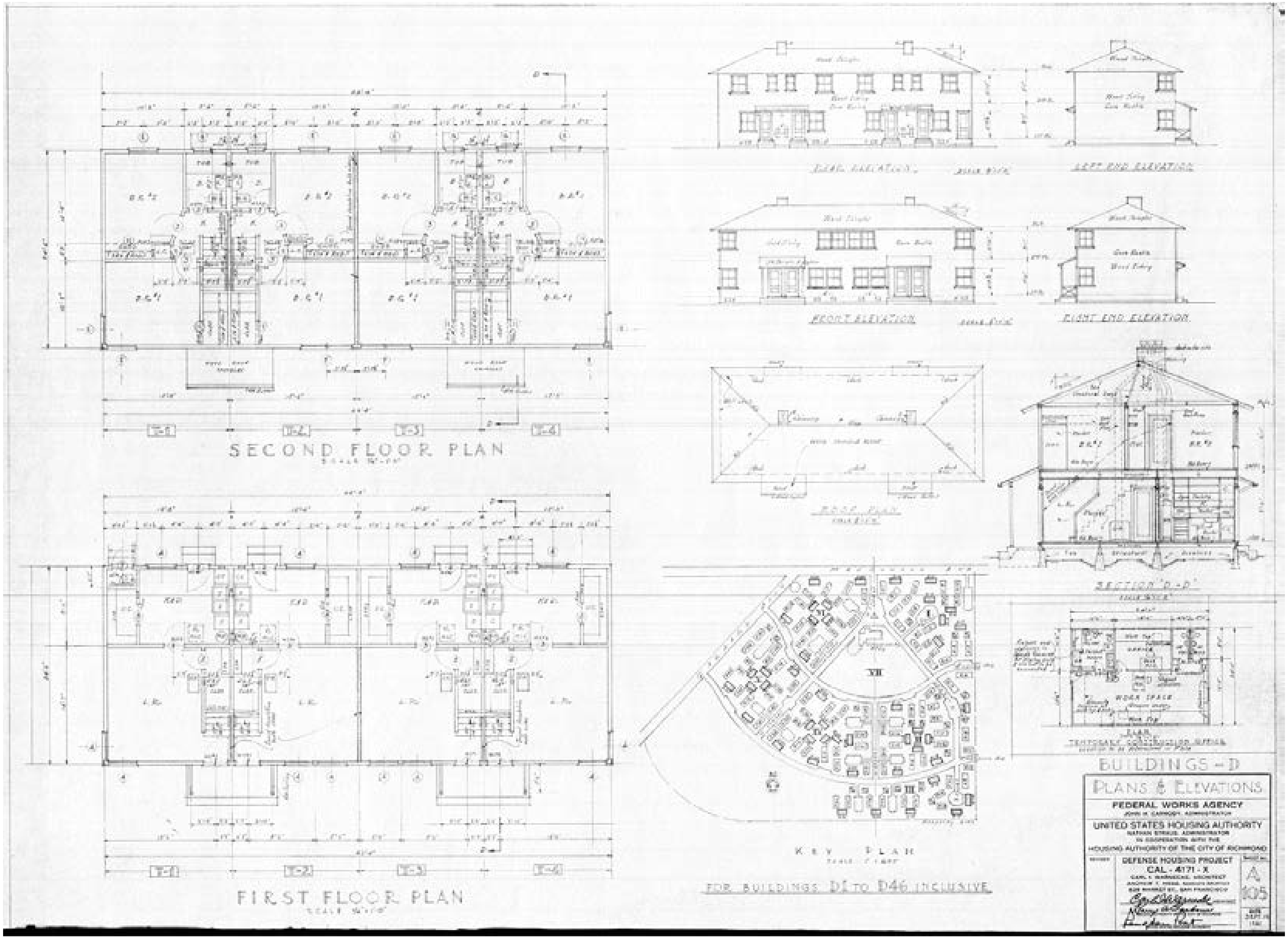
# HISTORIC DRAWINGS


ELEVATIONS
DETAILS OF BATH ROOMS
ELEVATIONS TYPICAL BATH ROOM
FLOOR PLAN
KEY PLAN
BUILDINGS A
PLANS & ELEVATIONS
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
DEFENSE HOUSING PROJECT
CAL-4171-X


SECTION "A-B"
REAR
LEFT SIDE
FRONT
RIGHT SIDE
ELEVATIONS
FRONT PORCH DETAIL - TYPICAL FOR A, B, C, BUILDINGS
DETAIL - WOOD RAILING
FOR ALL BUILDINGS
SCHEDULE OF INTERIOR FINISHES FOR BUILDINGS
FINISH MATERIALS
PAINTING
ABREVIATIONS
BUILDINGS
PLANS & ELEVATIONS
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
DEFENSE HOUSING PROJECT
FLOOR PLAN
KEY PLAN


SECTION "C-C"
ROOF PLAN
REAR
LEFT SIDE
FRONT
RIGHT SIDE
ELEVATIONS
3" SCALE TYPICAL EAVE DETAIL
FOR ALL A, B, C, D & E BUILDINGS
SECTION · ELEVATION · BAY WINDOW
TYPICAL DETAIL OF BAY WINDOW FOR "C" BUILDINGS
BUILDINGS C-2 TO C-55 INCLUSIVE
FLOOR PLAN
KEY PLAN
BUILDINGS C
PLANS & ELEVATIONS
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
HOUSING AUTHORITY OF THE CITY OF RICHMOND
DEFENSE HOUSING PROJECT
CAL. - 4171 - X
A
103


DETAILS OF CLOTHES LINE CLEAT ON BUILDINGS
ROOF PLAN
REAR
LEFT SIDE
FRONT
RIGHT SIDE
ELEVATIONS
SECTION "L-L"
DETAIL OF EAVE VENT-ELEVATION
DIAGRAMS SHOWING GATHERING OF VENT FLUES INTO CHIMNEYS
SECT. M-M
DETAILS OF CHIMNEYS
(GAS & ROOF VENTS)
FOR BLDGS A, B, C², C³, D, E
GAS VENT IN PARTITION
DETAIL OF UNDER FLOOR VENTS
FLOOR PLAN
FOR BUILDINGS C2, C3, C7, C8, C10, C12, C16, C17, C19, C21, C23, C25, C27, C30, C31, C35, C36, C37, C41, C42, C45, C47, C50, C52, C55 INCLUSIVE
KEY PLAN
BUILDINGS C²
PLANS & ELEVATIONS
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
DEFENSE HOUSING PROJECT
CAL - 4171 - X
A
104


SECOND FLOOR PLAN
FIRST FLOOR PLAN
REAR ELEVATION
LEFT END ELEVATION
FRONT ELEVATION
RIGHT END ELEVATION
ROOF PLAN
SECTION "D-D"
KEY PLAN
FOR BUILDINGS D1 TO D46 INCLUSIVE
BUILDINGS - D
PLANS & ELEVATIONS
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
HOUSING AUTHORITY OF THE CITY OF RICHMOND
DEFENSE HOUSING PROJECT
CAL - 4171 - X
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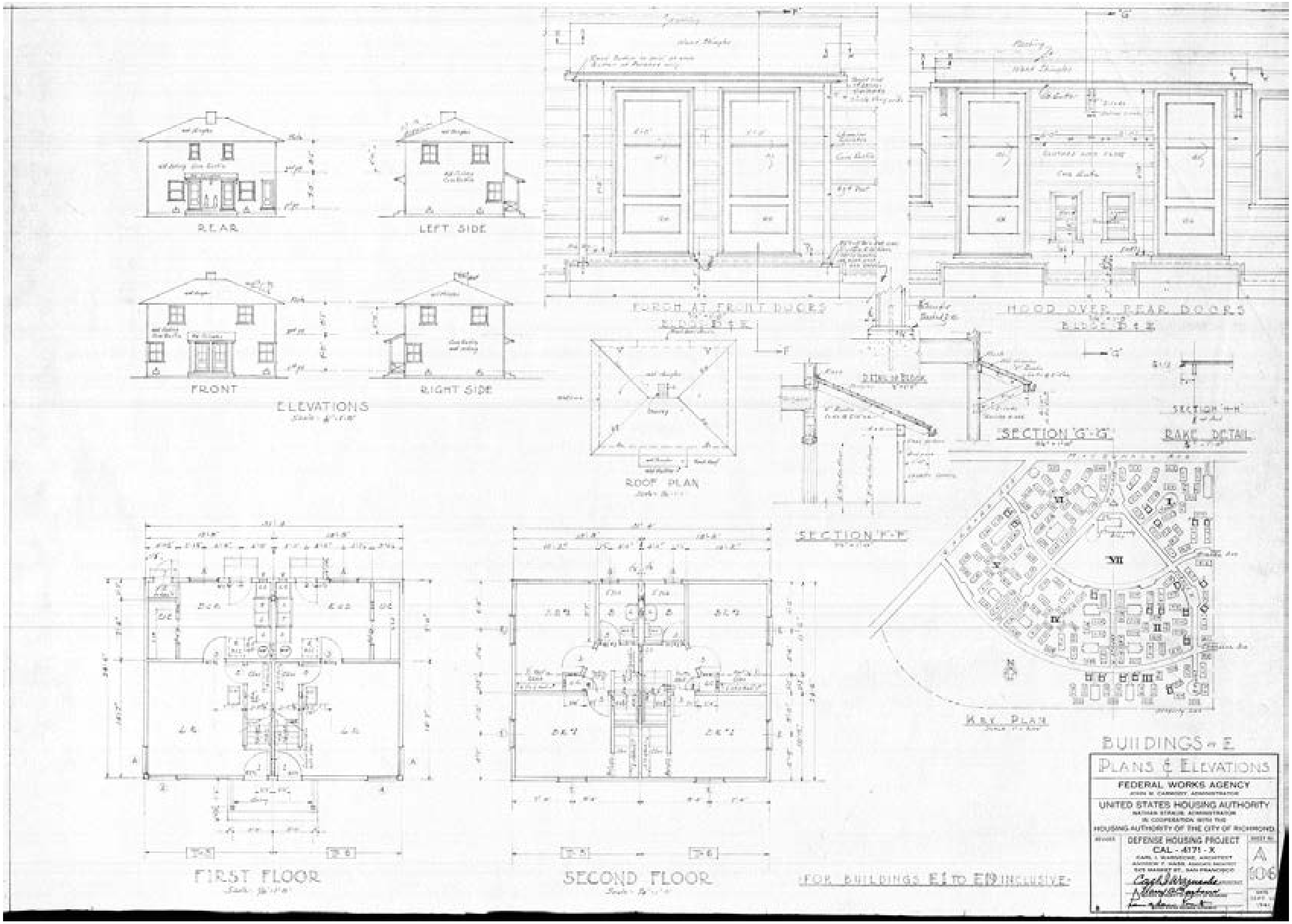
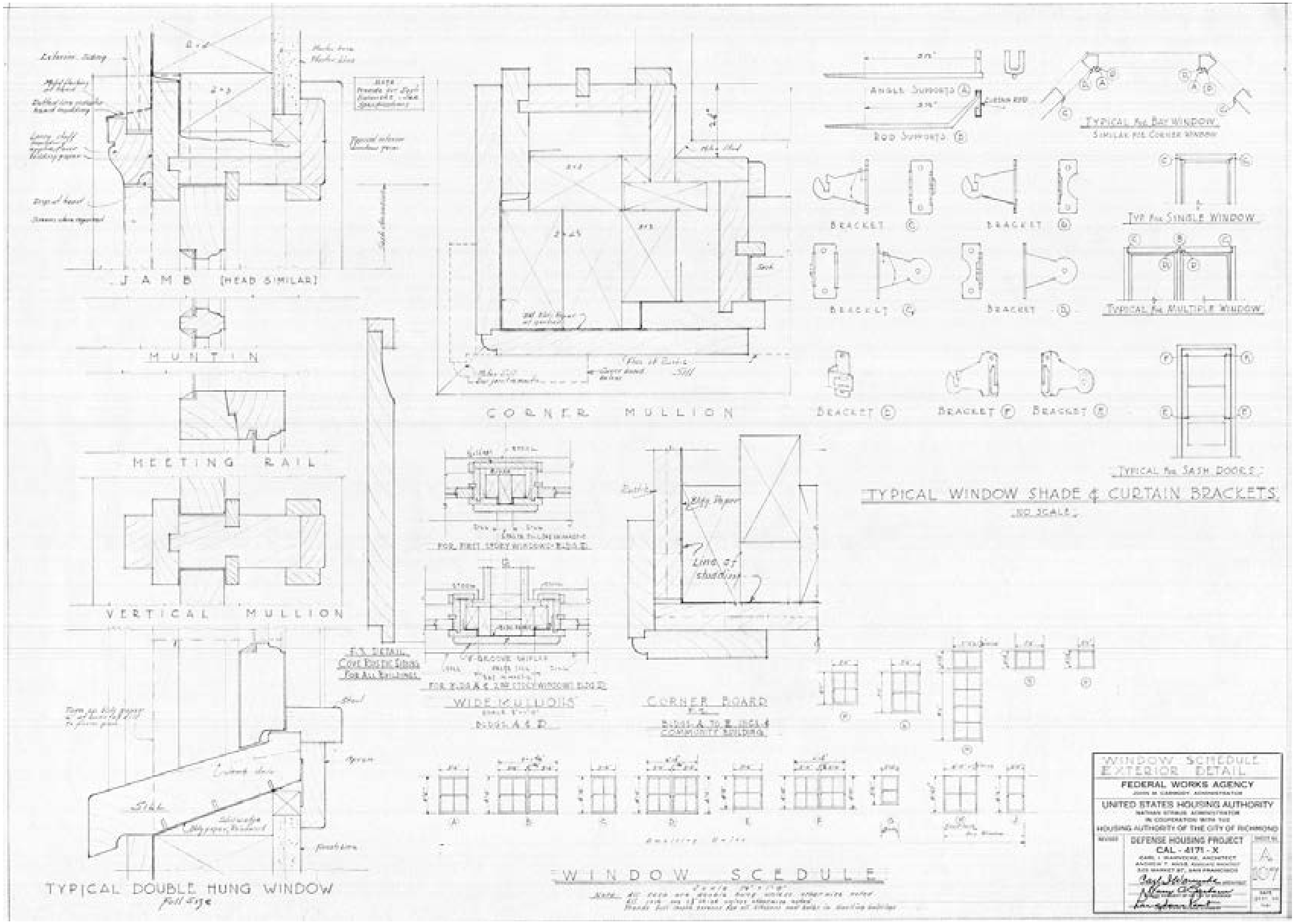
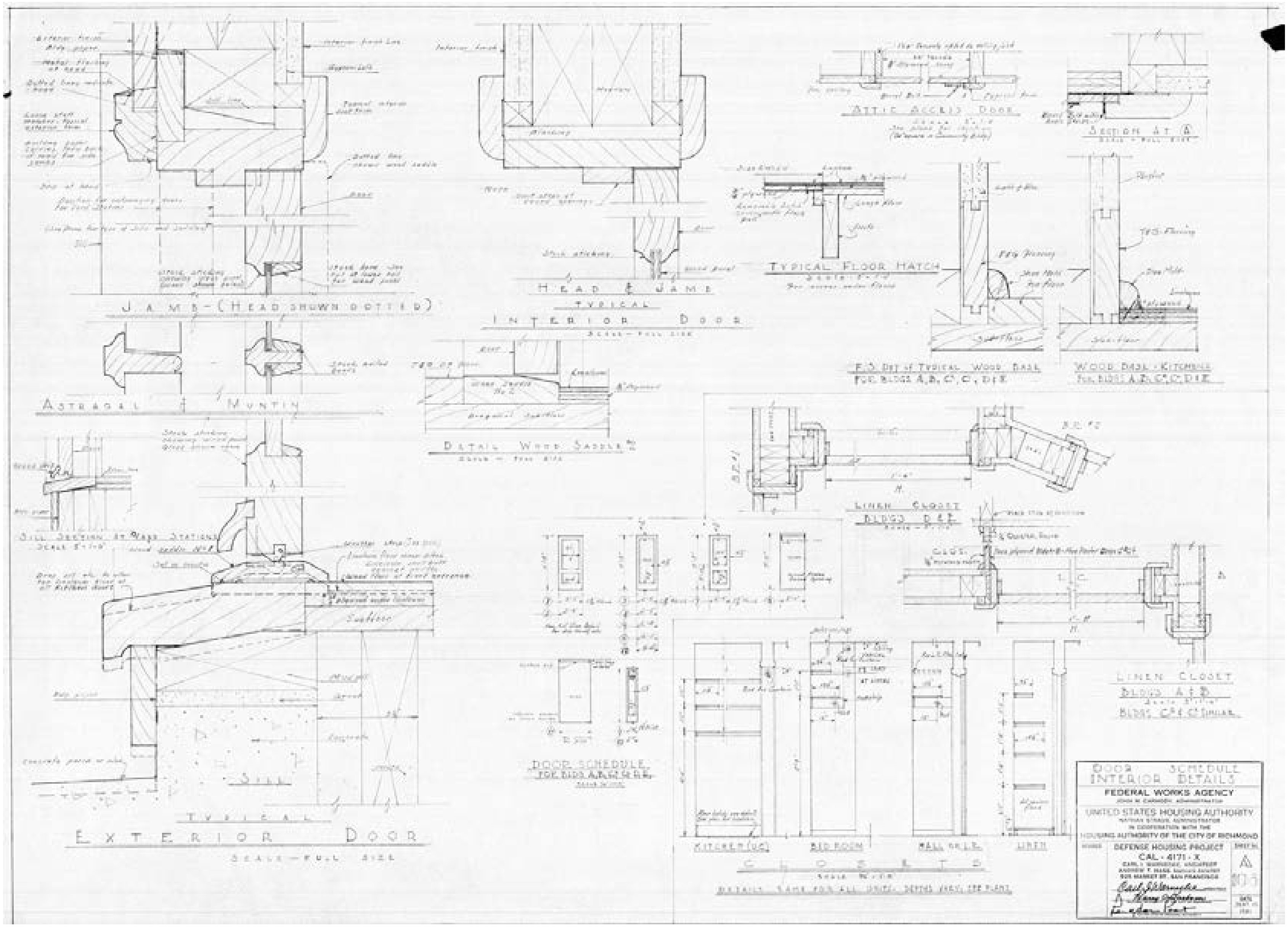
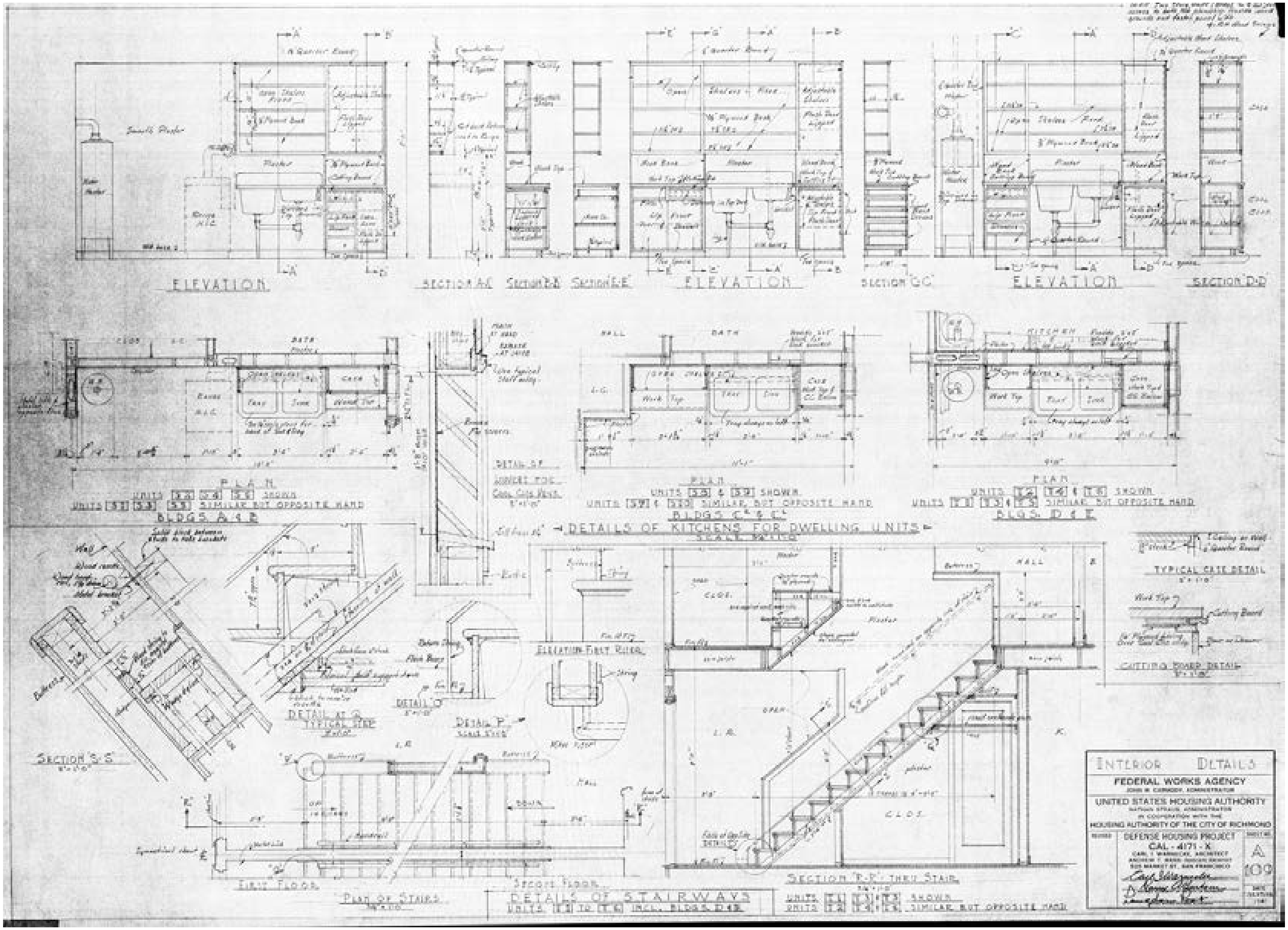
105


REAR
LEFT SIDE
FRONT
RIGHT SIDE
ELEVATIONS
PORCH AT FRONT DOORS
HOOD OVER REAR DOORS
ROOF PLAN
SECTION "F-F"
SECTION "G"-"G"
SECTION "H-H"
RAKE DETAIL
KEY PLAN
FIRST FLOOR
SECOND FLOOR
FOR BUILDINGS E1 TO E19 INCLUSIVE
BUILDINGS - E
PLANS & ELEVATIONS
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
HOUSING AUTHORITY OF THE CITY OF RICHMOND
DEFENSE HOUSING PROJECT
CAL - 4171 - X
A
106


JAMB (HEAD SIMILAR)
MUNTIN
MEETING RAIL
VERTICAL MULLION
TYPICAL DOUBLE HUNG WINDOW
CORNER MULLION
WIDE MULLIONS
CORNER BOARD
TYPICAL WINDOW SHADE & CURTAIN BRACKETS
NO SCALE
BRACKET
WINDOW SCEDULE
WINDOW SCHEDULE EXTERIOR DETAIL
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
DEFENSE HOUSING PROJECT
CAL - 4171 - X


JAMB - (HEAD SHOWN DOTTED)
HEAD & JAMB
TYPICAL INTERIOR DOOR
ATTIC ACCESS DOOR
SECTION AT A
TYPICAL FLOOR HATCH
ASTRAGAL & MUNTIN
DETAIL WOOD SADDLE
LINEN CLOSET
DOOR SCHEDULE
TYPICAL EXTERIOR DOOR
CLOSETS
KITCHEN
BED ROOM
HALL
LINEN
DOOR SCHEDULE INTERIOR DETAILS
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
HOUSING AUTHORITY OF THE CITY OF RICHMOND
DEFENSE HOUSING PROJECT
CAL-4171-X


ELEVATION
SECTION A-A
SECTION B-B
SECTION E-E
ELEVATION
SECTION C-C
ELEVATION
SECTION D-D
PLAN
BLDGS. A & B
PLAN
BLDGS. C & C
PLAN
BLDGS. D & E
DETAILS OF KITCHENS FOR DWELLING UNITS
TYPICAL CASE DETAIL
CUTTING BOARD DETAIL
SECTION S-S
DETAIL AT TYPICAL STEP
DETAIL "O"
DETAIL "P"
ELEVATION FIRST RISER
FIRST FLOOR
PLAN OF STAIRS
SECOND FLOOR
DETAILS OF STAIRWAYS
SECTION "R-R" THRU STAIR
INTERIOR DETAILS
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
HOUSING AUTHORITY OF THE CITY OF RICHMOND
DEFENSE HOUSING PROJECT
CAL-4171-X
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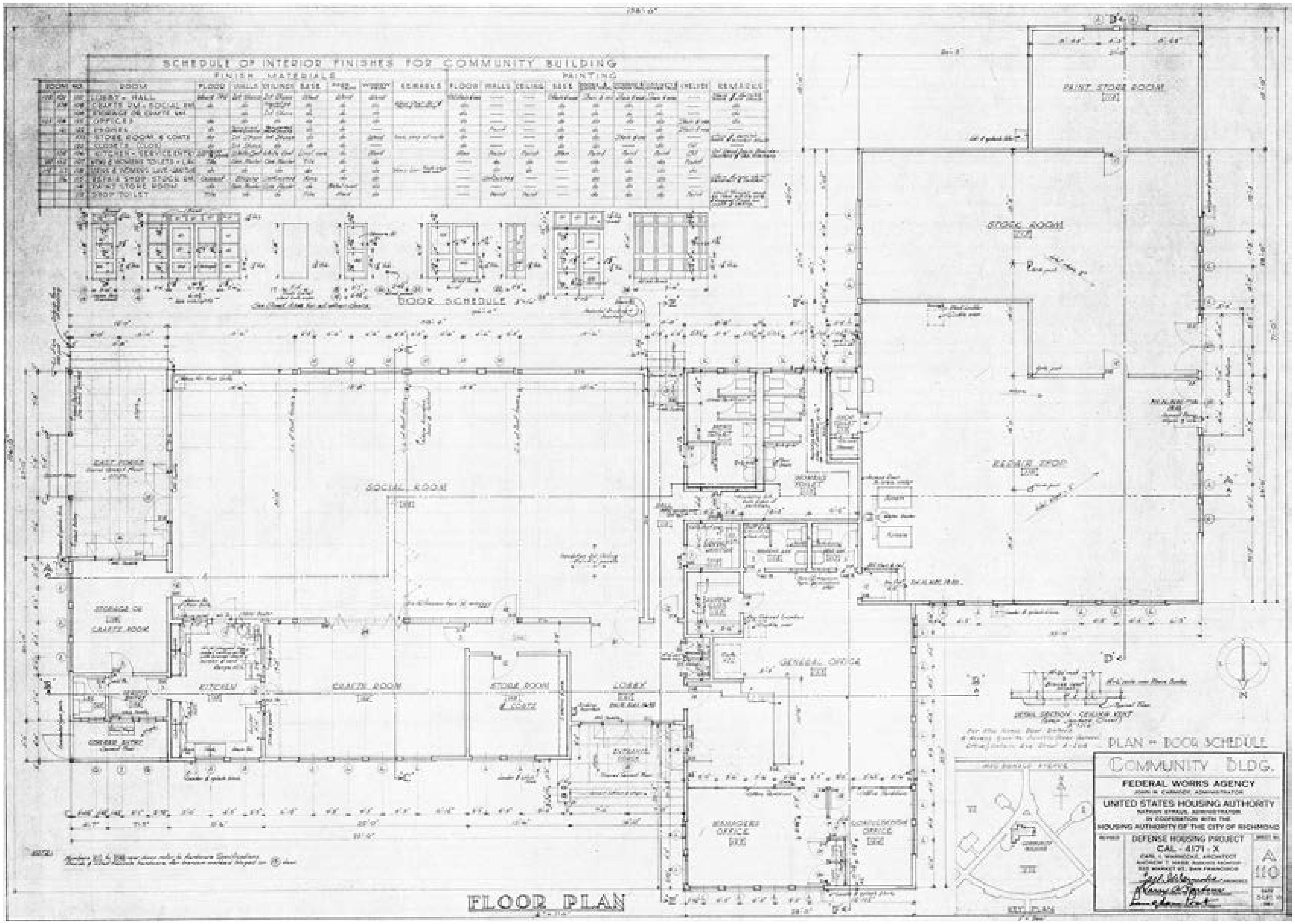
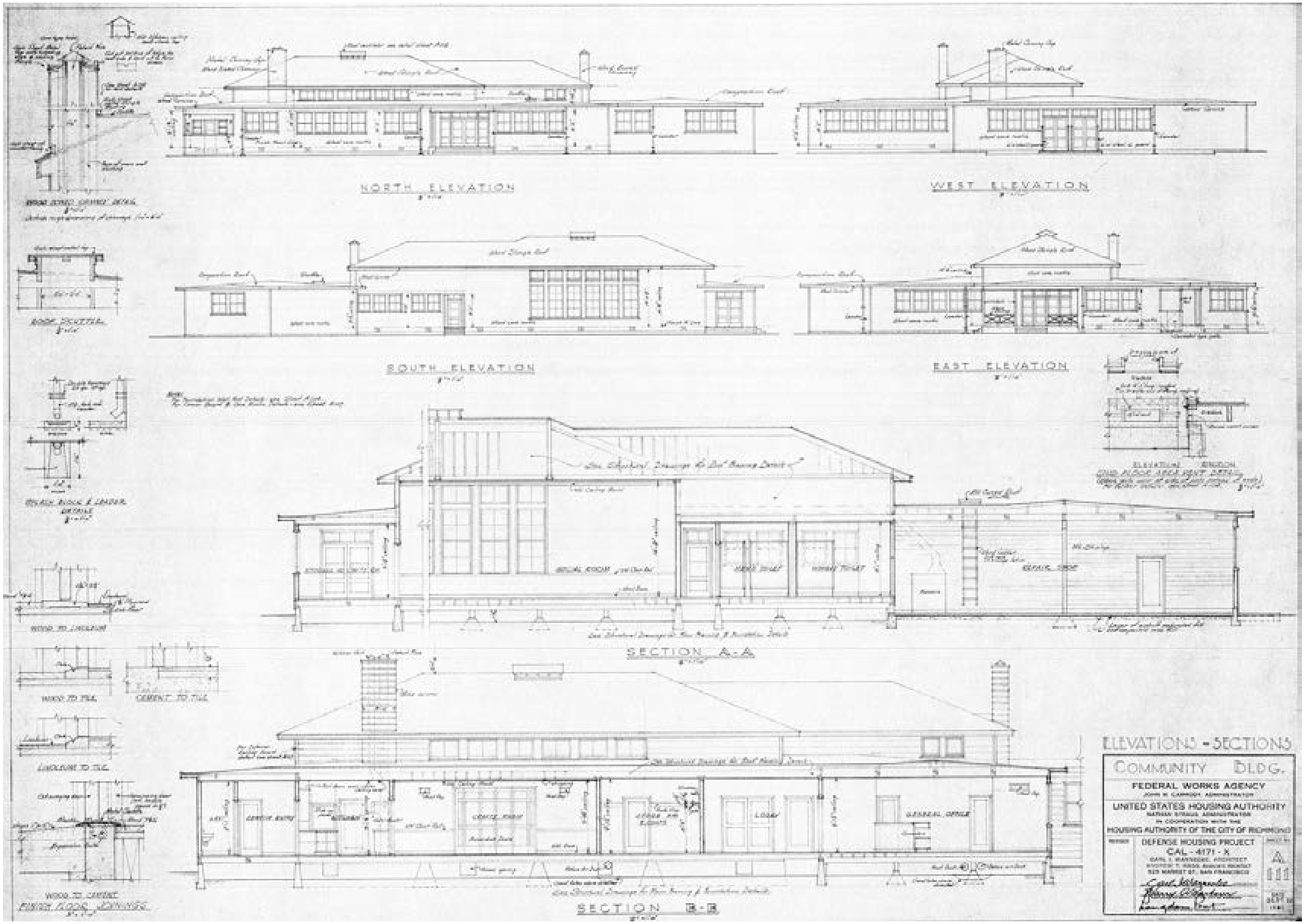
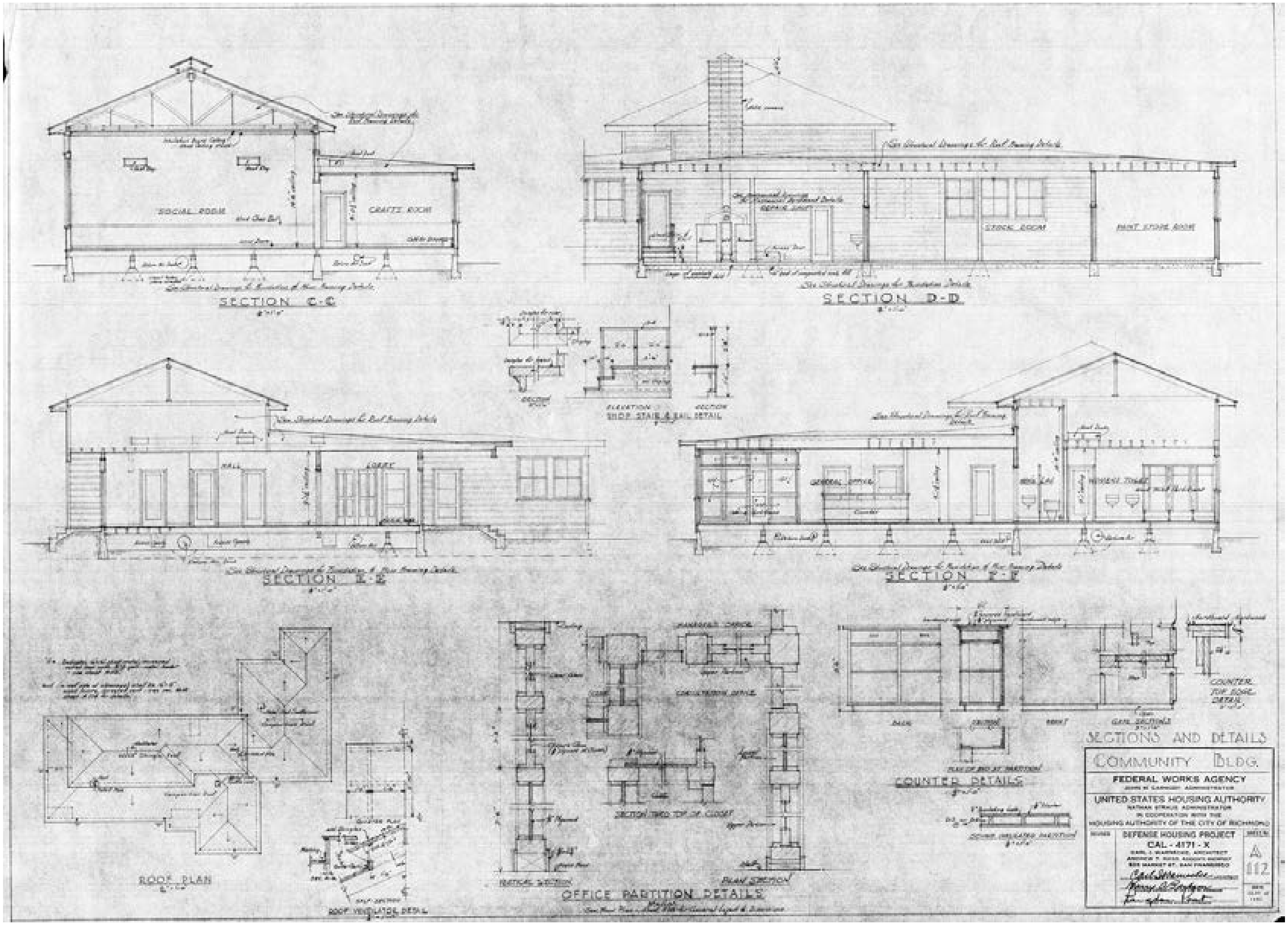
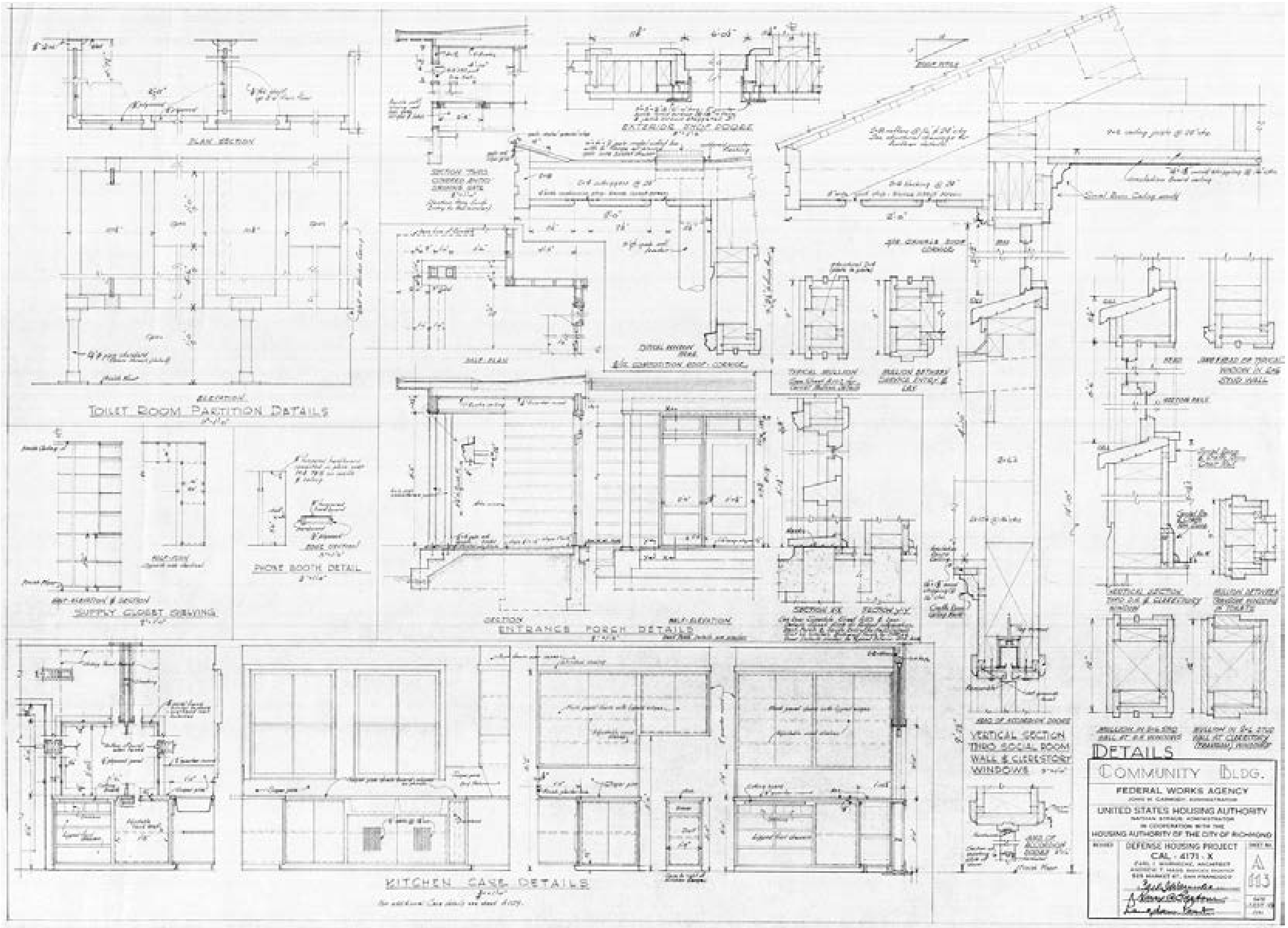
109


SCHEDULE OF INTERIOR FINISHES FOR COMMUNITY BUILDING
DOOR SCHEDULE
SOCIAL ROOM
STORE ROOM
REPAIR SHOP
PAINT STORE ROOM
CRAFTS ROOM
KITCHEN
LOBBY
GENERAL OFFICE
MANAGERS OFFICE
FLOOR PLAN
PLAN + DOOR SCHEDULE
COMMUNITY BLDG.
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
IN COOPERATION WITH THE
HOUSING AUTHORITY OF THE CITY OF RICHMOND
DEFENSE HOUSING PROJECT
CAL - 4171 - X
A
110
KEY PLAN


NORTH ELEVATION
WEST ELEVATION
SOUTH ELEVATION
EAST ELEVATION
SECTION A-A
SECTION B-B
ELEVATIONS - SECTIONS
COMMUNITY BLDG.
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
HOUSING AUTHORITY OF THE CITY OF RICHMOND
DEFENSE HOUSING PROJECT
CAL - 4171 - X


SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
ROOF PLAN
ROOF VENTILATOR DETAIL
OFFICE PARTITION DETAILS
COUNTER DETAILS
SECTIONS AND DETAILS
COMMUNITY BLDG.
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
DEFENSE HOUSING PROJECT
CAL - 4171 - X


TOILET ROOM PARTITION DETAILS
SUPPLY CLOSET SHELVING
PHONE BOOTH DETAIL
EXTERIOR SHOP DOORS
ENTRANCE PORCH DETAILS
KITCHEN CASE DETAILS
VERTICAL SECTION THRU SOCIAL ROOM WALL & CLERESTORY WINDOWS
DETAILS
COMMUNITY BLDG.
FEDERAL WORKS AGENCY
UNITED STATES HOUSING AUTHORITY
HOUSING AUTHORITY OF THE CITY OF RICHMOND
DEFENSE HOUSING PROJECT
CAL - 4171 - X

# APPENDIX D

# NATIONAL REGISTER NOMINATION FORM

NPS Form 10-900
(Oct. 1990)

OMB No. 10024-0018

**United States Department of the Interior**
**National Park Service**

# National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register* of *Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "NA" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

## 1. Name of Property

historic name Atchison Village Defense Housing Project, Cal. 4171-X

other names/site number Atchison Village Mutual Homes Corporation

## 2. Location

street & number 7 blocks bound by Macdonald Ave to the north, Ohio St to the south, First St to the east and Garrard Blvd to the west ☐ not for publication

city or town Richmond ☐ vicinity

state California code CA county Contra Costa code 013 Zip code 94801

## 3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this ☐ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the properly ☐ meets ☐ does not meet the National Register criteria. I recommend that this property be considered significant ☐ nationally ☐ statewide ☐ locally. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title Date

State or Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title Date

State or Federal agency and bureau

## 4. National Park Service Certification

I hereby certify that the property is: Signature of the Keeper Date of Action

☐ entered in the National Register.
☐ See continuation sheet.
☐ determined eligible for the National Register
☐ See continuation sheet.
☐ determined not eligible for the National Register.
☐ removed from the National Register.
☐ other, (explain:)

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# National Register of Historic Places Continuation Sheet

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Atchison Village Defense Housing Project
Contra Costa County, California

Narrative Description (continued)

**Summary**

The former Atchison Village Defense Housing Project, presently known as Atchison Village Mutual Homes Corporation, consists of 162 separate buildings comprising 450 dwellings units in addition to the Community Building and the "playing field". The community sits on a flat 30 acre site in central Richmond, California, between an industrial region, the Burlington Northern Santa Fe Railroad yard, and low income housing. This mid-twentieth century vernacular housing project reflects the typical construction and design practices of the United States Housing Authority (USHA) pre-World War II. The building assemblies include concrete foundations, light-weight wood stud frames, and vinyl over weatherboard siding.

All of Atchison Village's significant features, including the 162 domestic structures of five different designs, the Community Building and the four-acre park, maintain a high degree of their historic appearance. The deed to the defense housing project transferred in 1957 from the Federal Housing Administration to the non-profit Atchison Village Mutual Homes Corporation. The corporation supports strict development restrictions regarding any changes made to the community. Thereby the integrity of the project has been strenuously guarded.

**Original Layout**

On October 16, 1941, the Federal Works Agency (FWA) issued an order to proceed for National Defense Project Cal. 4171-X. Just prior to this date, John M. Carmody, then Federal Works Administrator, visited Richmond and confirmed the Richmond Housing Authority's selection of the site for Atchison Village.[1] The chosen property is bound to the north by Macdonald Avenue from First Street to Garrard Boulevard, and to the south by Ohio Street. This land worked well for the new housing development not only for its level grade, but also for its close proximity to the Kaiser shipyards, about two miles to the south, and to the commercial downtown to the east. Similar to other federal housing projects to be built in Richmond, the site was in a lowland industrial area, where no clear neighborhood pattern had been established. The property was purchased from the Atchison Topeka and Santa Fe Railroad, hence the name "Atchison Village" in honor of the railroad's former president.

The original defense housing plans, provided by the Mutual Homes Corporation, reveal that the layout of the village was an irregular four-sided plan with a curved base that fit within the constraints

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Narrative Description (continued)

of the purchased property. Four roads bisected the site into seven sections established by the architects, and allowed for entry from all directions except from the south. Curry and Collins Streets, transversing the site from east to west, arc to the south mid-way through the property, diverging from the typical orthogonal grid of Richmond. Curry Street aligns with the established angle of Garrard Boulevard and the railroad tracks, and Collins Street mirrors this angle, forming the centrally located triangular playing field.

Serving as a visual mark of entry from the north, the one-and-one-half-story Community Building, framed by the fork in the roads, stands on the northern tip of the playing field. The housing structures are dispersed throughout the site on meandering, tree lined roads. The majority of the soft-tone buildings face the 50-foot-wide streets. Several units, however, align to form grassy courtyards that are themselves oriented towards the road.

Structures cover only 15.4 percent of the land. Therefore, the village provides an ample of amount green space for both public and private use. Not only do courtyards grace the public fronts of the project, but also smaller, private back and side yards adjoin each dwelling. At a minimum, each building retains a 15-foot setback from the interior line of the sidewalk and at least a 20-foot distance from neighboring structures.

The open space has allowed for a significant amount of project landscaping. Original landscaping consisted of lawns and trees including Monterey pines, Australian black acacias, and weeping willows. Today in addition to these plantings, now matured, are resident-planted shrubs and flowering plants at porches and building perimeters.

The original plans provided ample parking, for the car was quickly becoming the primary means of transportation. Niches were carved out of the street boundaries for head-in parking, and several small lots dot the area between structures so as not to be visible from the road. At its completion, each unit was allotted one parking stall.

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Narrative Description (continued)

## CONTRIBUTING SITE FEATURES

### Playing Field

A four acre park, originally referred to as the "playing field", serves as the central element of the site. Triangular in plan, this contributing site began simply as a large green space lined with trees. On August 21, 1957, the Public Housing Administration turned over the title for the park to the City of Richmond.[2] The area remains a public park, but has undergone a few alterations. The city formed a baseball diamond in the southeast corner and placed children's playground equipment enclosed by a chain link fence in the northeastern segment just south of the Community Building.

## CONTRIBUTING BUILDINGS

### Community Building

Situated on the most prominent central location of the site, the Community Building served many functions. It housed a social room, crafts room, general, managerial and consultation offices, a repair shop, and storage rooms. Generally "L"- shaped in plan, the building has a 138' by 106' footprint and contains approximately 7,000 square feet. Built at grade, the structure sits on a concrete foundation. The central, pitched shingled roof over the Social Room rises up one-and-one-half stories to a height of 22 feet, while the rest of the structure remains one story with a low-pitched composite roof standing at only 11 feet. Redwood, cove rustic wood siding historically clad the structure, punctuated by wood double-hung sash windows. Typical features include wood sash windows aligned in horizontal rows, wood paneled doors, some with glass insets, wood boxed chimneys, corner boards, and linear roof lines accented with wood cornices and a two-foot overhang.

The north elevation is the primary facade. It serves as the entrance both to the building, as well as to the village. Although the structure is proportionally asymmetrical, the covered, recessed entrance stands in the center of the facade. The central portion of the building sits two feet above grade, requiring three concrete steps for access to the scored concrete entrance porch. Two vertical side lights flank the double, wooden, two-lite entry doors, topped by five single-lite transom windows. All of the double-hung windows on this facade begin at five feet above grade and ascend to a height of ten feet. Not one window stands alone, as wooden trim encompasses sets of at least two. This grouping reads as horizontal window banding consistent with the horizontal wood siding and low linear lines of the eaves.

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Narrative Description (continued)

The protruding volume above the Social Room rises up five feet above the typical ceiling height throughout the building. This height allows for a row of six clerestory windows to provide natural diffused light into the space below. Two more clerestory windows punctuate the raised volume on the western side of the north facade. These windows allow light into the enclosed office restrooms below. Rising up from both the east and west ends of the pitched roof are two chimneys clad in cove rustic siding. A centered roof ventilator caps the building.

The flanking Repair Shop at the west end sits on grade, recessed from the public areas of building, while maintaining the horizontal lines of the facade. The windows sit at the same heights, and the wood cornice serves to unite the entire lower level of the north facade. On the far east corner of the north elevation a partial-height wall historically obscured the kitchen service entrance. This porch is now fully enclosed.

The south facade is similar to the north, but is quite clearly a less important elevation. Unlike on the north side, the lower cornice on the south is broken by the elevated central mass. Six 11-foot window sections with 10 lites each accent this expanse of wall. To the west of these windows a door with two window panes originally provided a service entrance, and five double hung windows in groups of two and three provided natural light to the public restrooms. Further west only two windows penetrate the south wall of the store room. A porch, now enclosed, initially carved out the southeastern corner of the building under the continuous roof overhang. The same type of wood double doors as at the main entry, with glass insets and a three-lite transom above, graced the now hidden south wall of the scored concrete porch.

The original side porch also affected the east elevation of the structure. Six-by-six posts, between which a wooden railing was located, framed the recessed veranda. Three more concrete steps led up to a door configuration exactly like the one at the north entrance, including the flanking windows. To the south of the porch an extant grouping of five wood-sash windows at the standard height pierce the wall of the repair shop and stock room. To the north, three double-hung windows provide light to the former crafts room. At the northeastern corner, the covered service entrance to the kitchen was initially concealed by a partial height gate, but today solid walls form this corner.

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Narrative Description (continued)

At the west elevation, two sets of double doors are centered in a group of six double-hung windows. The only other fenestration on this elevation is a row of seven wood-sash windows at the end. Service parking flanks only this side of the building.

The Social Room, also known as the auditorium, acts as the primary space within the plan. The rectilinear room originally filled the rear of the building, with an area of almost 1,800 square feet that could be divided through the center by an accordion door. An exterior covered porch could be accessed by the double doors on the east wall of the auditorium. The rooms to the front of the building, north of the Social Room and east of the main entrance, were programmed for use, from west to east, as a store room, crafts room, kitchen, service entrance, and restroom. Another storage area fit between the service entry and the east porch. To the west of the small entry lobby are offices projecting north beyond the entrance porch. Both an exterior door from the porch and an interior door from the lobby access the office area, including a supply closet and both men's and women's restrooms. The door at the lobby's southwest corner connects to a 27-foot-long hall accessing the two large public restrooms and a rear exit. Large open spaces, programmed as a repair shop, stock room, paint store, and a small shop restroom, occupy the building's westernmost portion.

The Community Building maintains its primary proportions and most of its significant features. However, a few alterations were made in the late 1950s and early 1960s, including the enclosure of the southeastern porch and the northeastern service entry.[3] At this time, the redwood siding was covered with a stucco finish, except for the north, east, and west clerestory walls, which were covered with vinyl siding in the past decade. Also, a small paint closet now covers the south service entrance, and a one-car garage sits on the southwest corner in the service yard. For security reasons, a chain link fence now surrounds the entire building and its adjacent parking lot.

The interior configuration and room functions remain essentially the same. The crafts room, however, has been converted into the credit union office, which has also taken over some of the auditorium space. Finishes also are essentially intact.

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Narrative Description (continued)

**Residential Buildings**
Atchison Village includes five different residential building types. Much of their design stems directly from the USHA guidelines and Lanham Act conditions including, the low average cost of $3,300 per dwelling unit, the efficent use of space planning, and a standard means of production by using similar parts and materials throughout the project. They feature shared characteristics that unify the district. Historically, one-by-ten cove rustic redwood siding, with corner boards at the edges, clad each dwelling.[4] The siding colors on each structure adhered to a simple palette of light blue, yellow, beige, gray and white. The structures maintain a shingled roof with a pitch of 5:12, and present exposed rafters at the eaves. Every unit's front and rear entrances display covered concrete porches raised one foot off grade. Four-by-four posts support the awnings and provide a frame for wood side railings. Each residence is built on a continuous concrete foundation with narrow crawl spaces beneath.[5]

The elevations are simple, with no ornament, revealing only the buildings' necessary functions. The doors are wood, with a one-foot-high inset panel below four feet of window, comprising two stacked lites. The front and back doors correspond in type, yet the back doors fill a frame of only two-and-one-half feet wide, whereas the front doors span three feet. Also, two varieties of double-hung, two-pane-wide, wood-sash windows were employed throughout the project. The first extends to a width of three-and-one-half feet, while the second only reaches three feet. Both maintain a height of five feet. Single-pane-wide, double-hung, four-foot-by-two-foot windows occur in some locations.

All residential structures employ the same interior finishes. One-inch tongue-and-groove stained wood flooring covers the bedrooms, living rooms, separate dining spaces, halls, stairs, and "yard stations" or exterior maintenance closets. The bathrooms, kitchens, and utility closets feature linoleum over 3/8-inch plywood flooring. Gypsum lath and plaster were used to coat the majority of interior walls and ceilings. Two-by-four studs at 16-inches-on-center frame the walls, with sound insulation dressing both sides of the walls between units. All the trim consists of stained wood. A two-and-5/8-inch wood board caps the bathroom wainscot.

**Type 1**
The first residential building type offers four one-bedroom units. One-story and linear in plan, this design measures 24 feet by 90 feet. This housing group represents 17, or roughly 10 percent, of the

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Narrative Description (continued)

dwelling structures within Atchison Village. The majority of the Type One buildings stretch lengthwise, north to south. Each interlocking "L"-shaped unit provides about 540 square feet of living space.

The front elevation is symmetrical. The two end unit entrances maintain their own porches, while the center units share a single veranda. Wood-sash, double-hung windows, typical of this project, penetrate the walls in an 'a b b a' rhythm. The end units mimic each other with each door flanked by windows. The middle units each have two windows beside the entry doors.

The side facades feature a window near the front and one at the back corner. A series of doors punctuates the rear facade in the same manner as the front. Although not noted on the original drawing, small aluminum awnings cover most rear porches. Smaller, two-foot-by-four-foot, double-hung windows penetrate the bathroom walls.

Remarkably, a window illuminates every room, except for the utility closets. Warnecke accomplished this by devising "L"-shaped, interlocking plans that provide maximum exterior wall space for each unit. All living rooms address the front, while the bedrooms may reside to the front or the rear of the plan, serving as the interconnection between two units. The combined dining and kitchen area always occupies the space behind and adjacent to the living room, and offers the only egress to the rear porch. The bathroom fits next to the kitchen and can be directly accessed from the bedroom or the living room, as stipulated by USHA standards.[6] Each unit features a bedroom closet, hall closet, linen closet and a large utility closet.

**Type 2**

The second housing type provides two, two-bedroom units. Linear in plan, this design covers a footprint of 24 feet by 56 feet. Twenty-five, or 15 percent of buildings within the site take on this form. These units all face either the street or the surrounding structures, and lack a uniform angle. Almost square in plan, the units encompass about 672 square feet.

Four double-hung windows penetrate the symmetrical front facade. In the center, two frames sit 12 feet apart between the entry porches. The other two windows adjoin with the side window frames. Only two windows punctuate the two side facades. Each opening occurs at a corner, allowing an

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Narrative Description (continued)

expanse of wall between. The rear facade is also balanced. A corner window hangs to the outside of each back door. Two small bathroom windows and two standard windows fill the area between the porches.

The plan places the living room at the front, outside corner of each unit. From the living area every other space can be accessed directly. The combined kitchen and dining area contains the utility closet, in the back outside corner, and a door to the rear yard. Bedrooms occupy the building's center. In each unit, one bedroom sits to the front and the other to the back. The separation wall between the units jogs slightly to allow each bedroom to have a closet four feet wide. The compact bathroom falls between the kitchen and rear bedroom. The hall leading to the bathroom contains both a coat closet and a linen closet.

**Type 3**
The third type of residential building accounts for 34 percent of housing structures. This three-bedroom configuration appears 55 times in the community. Linear in plan, the building contains two reflected units that abut at the central bedroom wall. The perimeter measures 69 feet by 25 feet, and each unit offers about 860 square feet. This one-story building features a centered bay window on either the left or right end wall, depending on building orientation. In all cases that the building sits perpendicular to the road, the bay window faces the street.

Type three presents the only asymmetrical front facade of the residential buildings. In the center, two sets of two, three-foot wide windows hang four-and-one-half feet apart, flanked by a three-and-one-half foot wide window. Outside of one entry porch sits a large window that adjoins with the side frame, while the opposite end presents the same window not at the corner, but equidistant from the door and the edge of the building.

The side elevations differ. One facade simply presents a corner window. The opposite side centers the bay window on the wall. The protruding seven-foot high bay begins at one-foot off grade, fills an eight-foot-five inch wide space, and extends out two feet. Siding covers the bay to the height of the window sill. The central five-foot-seven-inch wide panel holds a four-lite fixed-sash wood window. The other two-and-one-half foot sides contain a two-lite double-hung wood window.

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Narrative Description (continued)

The rear elevation features symmetrical fenestration between the two kitchen doors. Two wider, central windows are flanked by two smaller windows. To the outside of the bay-window-unit's porch, one narrow double-hung window abuts the door. On the opposite end a standard window hangs centered between the kitchen door and the wood paneled "yard station" door.

The unit plans each have two bedrooms at the front next to the living room, and one at the rear adjacent to the bathroom. However, the living, kitchen, and dining layout differs slightly. One residence combines the living and dining rooms into one large area before the bay window, and access to the kitchen occurs through a door at the end of this space. The kitchen, as in other units, contains a utility closet and a door to the rear patio. The facing unit features a solitary living room and a combined kitchen and dining area connected to a utility closet. A "yard station", accessed from the exterior only, fills the space of the rear corner of this residence.

**Type 4**
Type Four provides four two-bedroom units in a two-story, linear arrangement that measures 62-feet-four inches by 24-and-one-half feet. This plan affords a per unit area of 764 square feet. The community includes 46 Type Four structures, which represent 28 percent of the total construction.

The symmetrical front elevation features two sloped awnings projecting five feet to cover the two sets of entry doors. On the first floor two groups of two windows hang two feet apart between the porches, while on the facade edges a standard window punctuates the wall. A corner window occurs directly above on each end of the second floor. Four additional windows create a horizontal band in the center of the second floor to complete the facade. The second floor windows are shorter than those on the first.

The two side elevations are identical. Both display only one window per floor, on the front edge. Many windows punctuate the rear elevation. Double-hung windows flank the two sets of two covered back doors. On the far left of the elevation stands a "yard station" door. Two small bathroom windows are centered above each awning, flanked by a total of four larger windows.

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Narrative Description (continued)

The plans offer a simple allocation of space. The stairs stand directly across from the front door and adjacent to the living area. A closet fits just under the stair. The combined kitchen and dining room sits to the back of the building with access through the living room. The kitchen has a back door and a utility closet. The second floor provides two bedrooms, one to the front and one to the back, and a bathroom located at the top of the stair.

**Type 5**
Rectilinear in plan, this two-story structure provides two, two-bedroom units, and measures 31-feet-four-inches by 24-feet-six-inches. The Type Five unit plan is the same as Type Four, and also contains 764 square feet of space. The 19 buildings of this variety equal roughly 12 percent of the total housing.

The front elevation presents a covered porch that unites the two front doors under one eleven-foot-wide awning. One large double-hung window rests on the edge of each wall at the first floor. Only two smaller bedroom windows punctuate the upper level of the elevation.

The two side facades are identical, with two shorter windows, eight feet apart, centered on the second floor, and one standard window at the front corner. The rear elevation contains two kitchen doors under one 13-foot awning. A standard window hangs to the outside of each door, with two small bathroom windows above. The "yard station" door on the right side completes the elevation.

The Type Five plan is one-half of building Type Four. The living rooms reside to the front of the unit, with the combined kitchen and dining area to the back. The stair stands directly across from the front door and ascends to the bathroom. The bedrooms sit on the second floor in the outside corners.

**INTEGRITY**
Through the years the Atchison Village Mutual Homes Corporation established development regulations that serve to guide any changes to the community structures. Therefore, modifications have been minimal and strictly guarded. The most significant alterations to the buildings include the

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Narrative Description (continued)

addition of metal security bars over many of the windows and doors, and the installation of vinyl siding over the extant, historic redwood boards. The vinyl siding replicates the size, profile, and colors of the original cove rustic siding, and does not obscure any architectural features of the structures. Thereby, the integrity of the district was not damaged by the addition of the new siding. The original wood-encased chimneys have since been replaced with prefabricated insulated metal chimney flues. Regulations also allowed for storage sheds to be located on the back patios with a maximum coverage of 50 percent of the area, not to exceed 120 square feet in size, and for new fences or hedges, at a maximum height of six feet, to enclose back and side yards. The corporation permitted one unit to construct an accessible concrete ramp to the front entrance. The majority of original doors and windows remain intact.

A few alterations affect the entire village such as the addition of parking spaces, primarily located behind structures, to provide individual units with more than the original one allocated space. In 1992, the city of Richmond constructed a sound wall along the western edge of the village to dampen the noise from the recently expanded Garrard Avenue as part of the new Richmond Parkway project.[7] This wall blocks access to the village from the western intersections of Garrard and Bissell Avenue to the north and Chanslor Avenue to the south. In conjunction with this project, Public Services also formed new cul-de-sacs at the road ends. In November of 1998 the city government introduced two

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Narrative Description (continued)

street-wide gates, at the eastern Bissell Avenue and Chanslor Avenue entrances, as a crime reducing measure. Now only one entrance to Atchison Village remains available to the public.

**ENDNOTES**

1. "First Annual Report of the Richmond Housing Authority." (Richmond: Richmond Housing Authority, 1941), 10.

2. "Richmond Gains Title to Atchison Village Park." *Richmond Independent*, August 21, 1957.

3. Orien Fitch, telephone conversation, 4 February 2002.

4. Bradley Inman, "Bay Area's Absolute Best Bargain in Housing?", *San Francisco Sunday Examiner and Chronicle*, 1990, Living In section.

5. Burgess S. Poole to Edwin S. Howell, Memorandum, December 8, 1954, "Report on Atchison Village and Atchison Village Annex," Richmond Collection, Richmond Public Library.

6. "Plan Standards for Defense Housing." *Architectural Record*, 90 (November 1941): 72.

7. Siamak Etevadi, City of Richmond Public Services Engineer, telephone conversation, 6 February 2002.

**END.**

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Architect/Builder (continued)

Epp, Leo, Builder

Narrative Statement of Significance

**Summary**
Atchison Village Defense Housing Project is eligible for the National Register of Historic Places under criterion A because it represents an important effort by both the federal and local governments to provide low-cost family housing for workers involved in the defense shipbuilding industry during World War II. Just prior to and during the war, the Lanham Act of 1940 provided $150 million to the Federal Works Administration, which built approximately 625,000 units of housing in conjunction with local authorities nationwide. Brigadier General Philip B. Fleming, then Federal Works Administrator, selected the Richmond Housing Authority to be the first authority in the country to manage a defense project. Atchison Village represents one of twenty public housing projects built in Richmond before and during World War II. Constructed in 1941 as Richmond's first public defense housing project, it is the only project funded by the Lanham Act extant in Richmond and one of the few in the nation that was not destroyed. Atchison Village has already been designated a Richmond "Historic Resource"[1] and has been listed as a "theme-related site" in conjunction with the Rosie the Riveter National Historic Park.[2]

Atchison Village should be considered at the national level of significance as it is a site within the Rosie the Riveter National Historic Park that was established through an act of the United States Congress and signed into being by President Bill Clinton on October 25, 2000.[3] Being that Richmond presents a critical mass of extant structures that were solely built for and dedicated to the World War II home front effort, the National Park Service found the city to be the best location in the nation for a home front national park.[4] Atchison Village not only plays an integral role in the Rosie the Riveter National Historic Park, but also stands as a prime example of one of the only public defense housing projects remaining in the United States.

**World War II Defense Housing in Richmond, California**
Even before the attack on Pearl Harbor, the city of Richmond began to feel the effects of the war. In January 1941 the United States Federal government, in conjunction with Henry J. Kaiser, began

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Narrative Statement of Significance (continued)

construction on the first shipyard in the then semi-rural, small town of Richmond, selected for its deep-water ports and unoccupied land. The shipyards, as well as 55 other war related industries, attracted a massive influx of migrant workers, mostly from the southern and midwestern states. The Kaiser company brought almost 38,000 workers to their shipyards, while over 60,000 made their own way to the Bay.[5] In April of 1940 only 23,000 people resided within the municipality, but by 1943 the population had increased to over 100,000.[6] Richmond was completely unprepared to become a bourgeoning metropolis. The city lacked both sufficient infrastructure and housing needed to support the immense population increases.

Logically, the city with "perhaps the greatest growth in population of any wartime center in the United States" would become quite prosperous.[7] However, all the federally controlled defense industries were exempt from local taxation, which led Richmond into a steep decline of property tax revenues. The municipal government sought much-needed financial relief through Federal government programs. Under the Lanham Act the government authorized "payments in lieu of taxes" to cities requesting aid for specific wartime programs.[8]

The Lanham Act provided federal funding for vital temporary defense housing. As many American politicians of the time were concerned with the socialist implications of public housing, the Act stipulated involvement of local authorities in the management of these projects. The federal government also emphasized the impermanence of the housing units, as a means to appease local builders and developers. According to the Lanham Act, temporary war housing was to be removed within two years after the war ended. An exception was made for housing found necessary for the war effort demobilization.[9]

In early 1941 the Richmond Chamber of Commerce began developing plans for the creation of a local housing authority. The importance of forming an authority to safeguard local interests in the imminent urban growth and the maintenance of traditional housing patterns became increasingly evident with the development of the shipyards. With the *Richmond Independent* championing their cause, the City Council, by resolution, formed the Housing Authority of the City of Richmond on January 24, 1941, "to represent the community in carrying out the Federal Public Housing Administration programs for low-income families."[10]

Continued.

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Contra Costa County, California

Narrative Statement of Significance (continued)

The Richmond Housing Authority (RHA) completed three federally funded housing projects in their first year. By the end of World War II, Richmond would maintain the largest federal housing program in the nation. Agencies had constructed 21,000 housing units by 1943, which housed over 60 percent of Richmond's total population.[11] The funding for these various projects came not only from the Lanham Act, but also from the United States Maritime Commission, the Federal Public Housing Administration, and the Farm Security Administration.

The first project constructed in Richmond, Atchison Village, was financed through the Lanham Act defense funds. The Federal Works Administration complimented the Richmond Housing Authority by designating them the "Agent of the Federal Works Administrator" for the construction of the $1,717,000 Atchison Village.[12] No other housing authority in the nation had yet been appointed to manage a defense project. The other two projects that year, Triangle Court and Nystrom Village, were constructed with United States Housing Authority funds.

The United States Housing Authority (USHA) hired Carl I. Warnecke to be the project architect and Andrew T. Hass to be the associate architect for the design of Atchison Village, or National Defense Project CAL 4171X. Both architects were well trained and highly respected in their field.[13] Warnecke, the more renowned of the two, studied at the Ecole des Beaux Arts in Paris, and apprenticed under Bernard Maybeck after returning to California. Shortly after he died in 1971, a retrospective exhibition of his work showed in New York City.[14]

With suggestions from the Richmond officials, the Federal Works Administrator selected the 30-acre site to be purchased from the Atchison, Topeka, and Santa Fe Railroad. Warnecke and Hass finished the design of the village in September 1941. The housing structures were typical of the period and complied with the strict USHA defense housing standards. The Lanham Act itself limited designs by requiring that no more than $3,500 be spent per unit. As discussed by Architectural Record, the most important aspect of defense housing design included economy: "economy of space planning; economy in the use of materials and units of equipment; [and] economy in time."[15]

The strength of this project lies in the development of the site itself and the relationships between the

Continued.

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Narrative Statement of Significance (continued)

structures. The architects of Atchison Village drew from the principles of Ebenezer Howard's Garden City movement and New Town ideals. Resigning from the established grid pattern of Richmond, Warnecke cut diagonal and curved streets through the site that provided for a relationship to the railroad and the placement of a large park within the village. The program included a central Community Building that served to unify the project. The residential buildings are oriented in relation to each other, forming small courtyards from the spaces between.

On October 30, 1941, building permit #15777 was issued to the RHA for the construction of the 450-unit Atchison Village.[16] Only 650 federally funded units were built for permanence in Richmond, including Atchison Village. The remaining public housing projects were constructed to be temporary and included "dormitories, demountables, and trailers."[17] The typical housing construction and design qualities were very poor. A Fortune magazine journalist described that "huge barrack-like public-housing projects cover the mud flats between the harbor and the town."[18] In general the projects were located on swampy flat-lands and provided unsanitary living conditions. Atchison Village provided a striking alternative to the typical housing situations found in Richmond. It soon came to be "Richmond's most coveted wartime housing project."[19] This community was privileged to be sited on firm, dry land and to have ample green space, trees, and solid construction.

Atchison Village provided much needed housing for shipyard workers and their families. Many of the residents were deemed Rosie the Riveters, a propaganda name given to women who worked on the Liberty ships. The tenants sent their children to the nearby day care centers developed for the shipyards, the Maritime Child Development Center and the Ruth C. Powers Child Development Center, while they worked. When the residents were at home their individual yards and the large playing field provided them with places where their children could safely play. The community center in the village offered a location for neighbors to gather and have functions, a feature no other housing project could boast.

Even after the war had ended, the need for housing had not. This need led the government to postpone the destruction of projects to far beyond the original two year post-war deadline. Not until November of 1950, five years after the end of the war, did the government begin the process of "conveyance or disposal" of Atchison Village.[20] The City Council decided not to convert the project

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Narrative Statement of Significance (continued)

into low-income public housing in November 1954. Therefore, the city turned to the three means of disposal that were identified under the provisions of the Lanham Act. The first offered each building, at a fixed price, to a preference buyer, such as a veteran. The second sale plan presented the entire property to a group of veterans organized as a cooperative. The final sale plan issued bidding to anyone, but only after the first two plans had failed.[21]

While other housing projects were being razed, a group of Atchison Village residents formed a Mutual Homes Corporation. After sale plans one and two had both failed, the community was available to public purchase. In a hurried effort, the Corporation raised $50,000 for the down payment and bought the Village from the government.

The fate of other Richmond housing projects was in peril, for it was deemed necessary that housing be removed as soon as the war was over.[22] By 1953 all of the seventeen projects near the harbor were torn down, in accordance with the Lanham Act. Nystrom Village, built the same year as Atchison but only a quater of the size, was converted into low-income public housing. Still extant, Nystrom Village illustrates a lower design quality, offerning little public open space, and does not maintain the integrity of Atchison Village, demonstrating a greater amount of alterations. Triangle Court also was converted into low-income public housing, but the original structures have since been destroyed and new housing built in its place.

Atchison Village demonstrates a cohesive example of a World War II Home Front defense housing project. It stands as an important intact model of both federal and local government intervention in the defense effort. Nationally, most of these housing sites were built as temporary installations and were either modernized, altered, or leveled and redeveloped for other uses.[23] With the Mutual Homes Corporation remaining as the owner and manager of the community, their strict covenants have protected the site and maintained its integrity. Atchison Village is an integral part of the Richmond Home Front, and in their feasibility study the National Park Service found that "Richmond is significant for its Home Front story in the San Francisco Bay Area, on the Pacific Coast and nationally."[24]

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9. Moore, 84.

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13. "Plan Standards for Defense Housing," *Architectural Record*, 90 (November 1941): 71.

14. *First Annual Housing Report*.

15. *Richmond, California: A City Wins the Purple Heart*, 6-7.

16. "Richmond Took a Beating," *Fortune Magazine*, (February 1945): 262.

17. Richard Reinhart, "Richmond's Boom That Didn't Bust: Where Can Displaced Tenants Find Homes?," *The San Francisco Chronicle*, (August 21, 1953).

18. Paul Wendt, "Report on Conveyance to Richmond Housing Authority of Atchison Village and Annex for Permanent Low-rent Use," (November 1, 1957, Copy in Richmond Collection, Richmond Public Library), 1.

19. Richmond, Office of the City Manager, *Atchison Village and Annex Housing Projects: Brief Historical Review and Alternate Methods of Future Operation*, (October 25, 1954), D6.

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Additional Documentation

A. Owner's letter of approval

B. USGS Map (Richmond Quadrangle, 7.5 Minute Series)

C. Site Plan

D. Diagrammatic Floor Plans of Residential Building Types 1-5

E. Existing Conditions Photographs (1-9)

F. Historic Photograph (10)

G. Index to Photographs:

Photographs #1-9 submitted with this nomination were taken by Kimberly Butt, on January 10, 2002, and the negatives reside at the office of Carey & Co, 460 Bush, San Francisco, CA.

1. View of the village entrance facing south.

2. View of the north facade of the Community Building facing south.

3. Photo of the Playing Field from Collins Street looking southwest.

4. Chanslor Avenue streetscape looking east.

5. Courtyard view on Bissell Avenue facing north.

6. Facade of "Building Type 1" on Collins Street looking northeast.

7. View of "Building Types 2 and 3" on Follette Street looking northeast.

Continued.

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Additional Documentation (continued)

8. Front view of "Building Type 4" on Chanslor Avenue facing northeast.

9. View of "Building Type 5" on Collins Street facing northwest.

10. Historic view of the north facade of the Community Building facing south. The photographer and date are unknown. The original photograph resides in the Richmond Room of the Richmond Public Library.

11. Historic photo of the Garrard Blvd streetscape just after project completion, c. 1941. The photographer is unknown. The original image resides in the First Annual Report of the Housing Authority of the City of Richmond located at the Richmond Museum of History.

**END.**

**ATCHISON VILLAGE MUTUAL HOMES CORPORATION**
**COLLINS AND CURRY STREETS**
**RICHMOND, CALIFORNIA 94801**
**(510) 234-9054**
**(510) 234-9072 fax**

**September 13, 2001**

**Rosie the Riveter Trust**
**C/O Mr. Thomas K. Butt**
**235 East Scenic Avenue**
**Richmond, California 94801**

**Dear Mr. Butt,**

**We wish to take this opportunity to thank you for all your efforts on our behalf in having Atchison Village listed as a historical site.**

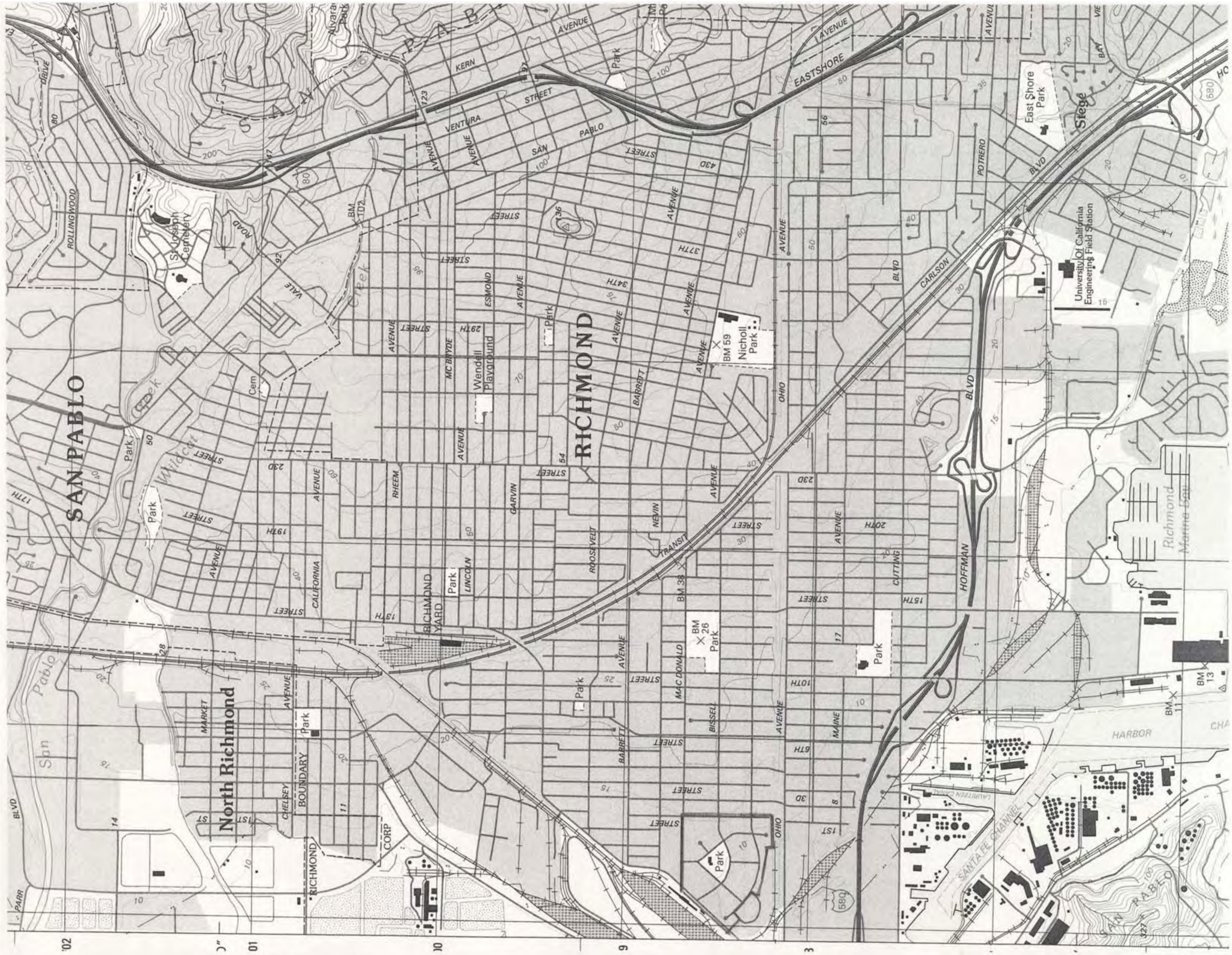
**The Board of Directors has approved that the application process for listing on the National Historical Register process should begin. We apologize in the delay in sending you this approval and once again thank you for all your efforts on our behalf.**

**Sincerely,**

**ATCHISON VILLAGE MUTUAL HOMES CORPORATION**

Rebecca

**Rebecca Cerda, President**


SAN PABLO
RICHMOND
North Richmond
EASTSHORE
SAN PABLO AVENUE
KERN
VENTURA AVENUE
ROLLINGWOOD DRIVE
VALE ROAD
St Joseph Cemetery
Wendell Playground
Nicholl Park
BM 59
East Shore Park
POTRERO AVENUE
CARLSON BLVD
University Of California Engineering Field Station
Richmond Marina Bay
HOFFMAN BLVD
RICHMOND YARD
LINCOLN
ROOSEVELT
GARVIN
RHEEM
MC BRYDE
ESMOND
BARRETT
NEVIN
MAC DONALD
BISSELL
MAINE
CUTTING
OHIO
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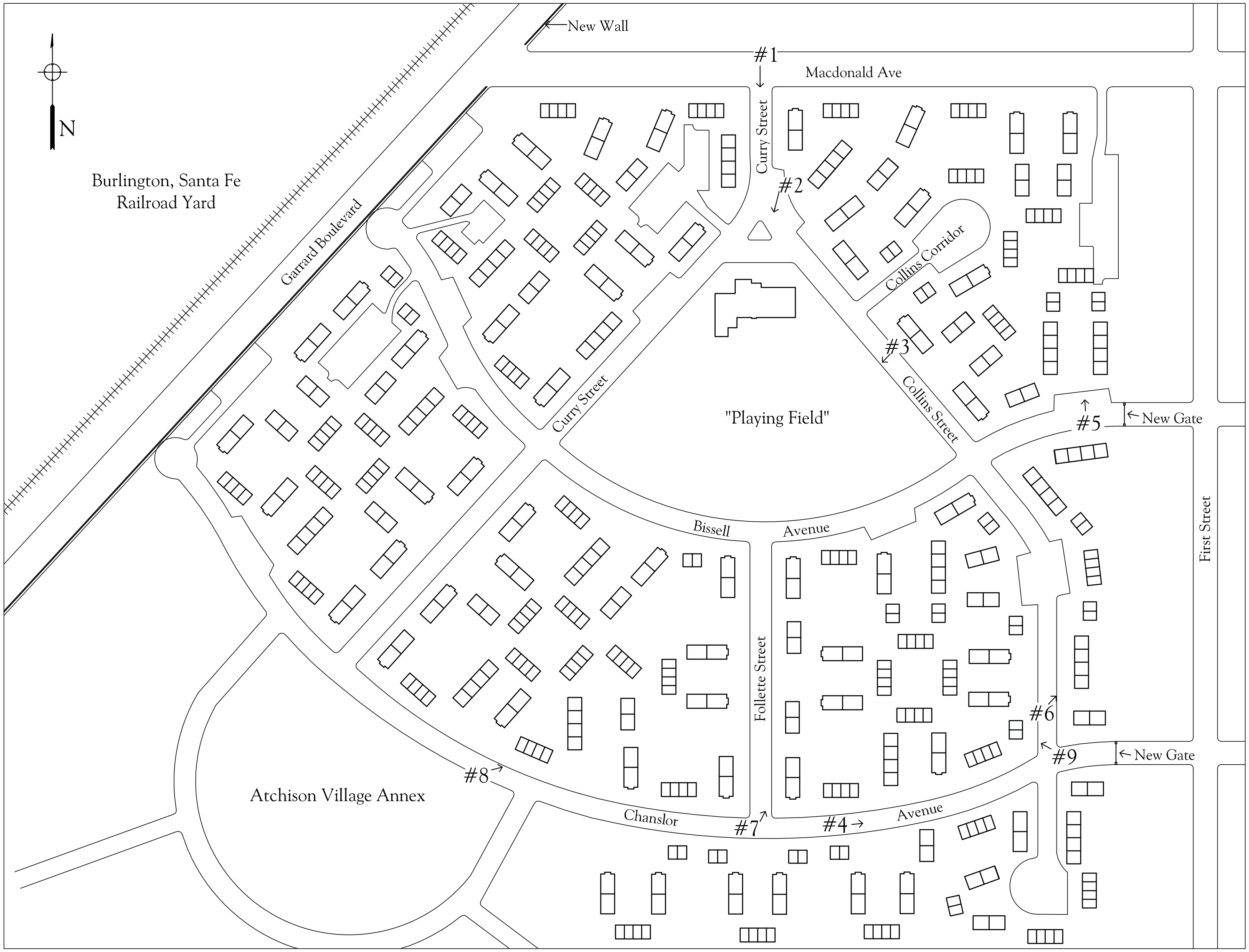
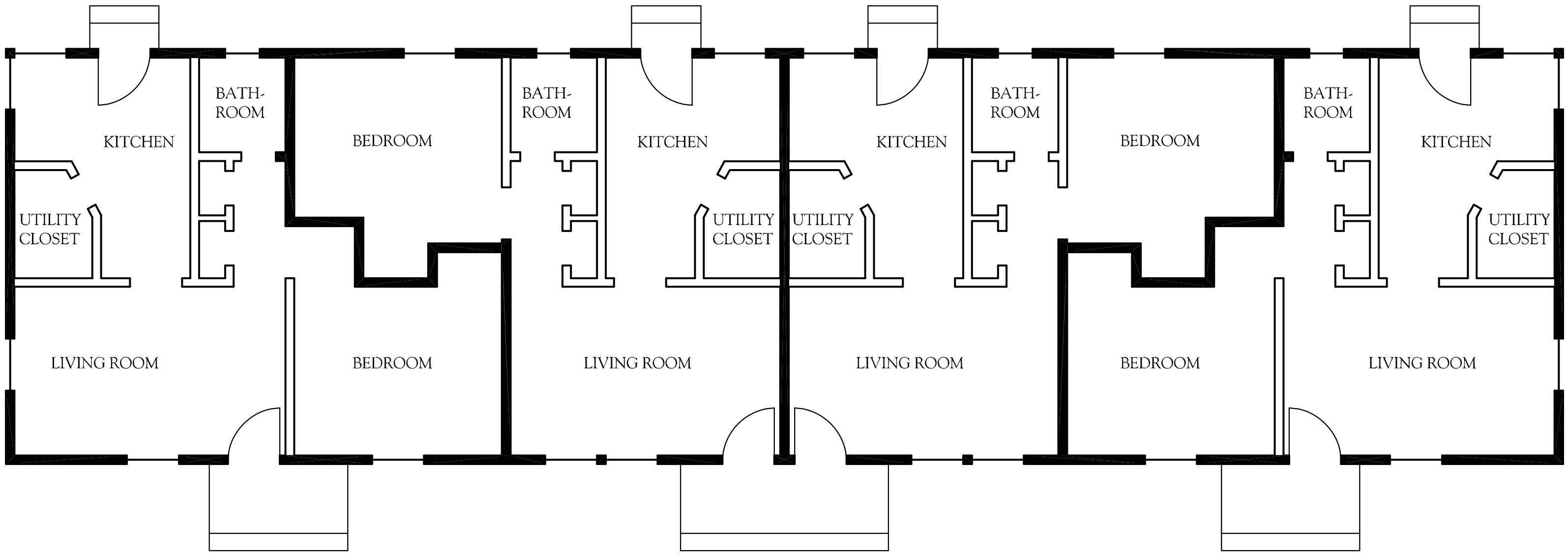
CALIFORNIA
MARKET
BOUNDARY
CHELSEY
CORP
HARBOR
SANTA FE CHANNEL
Wildcat Creek
Park




SITE PLAN　　ATCHISON VILLAGE DEFENSE HOUSING PROJECT　　SCALE: 1" = 300'

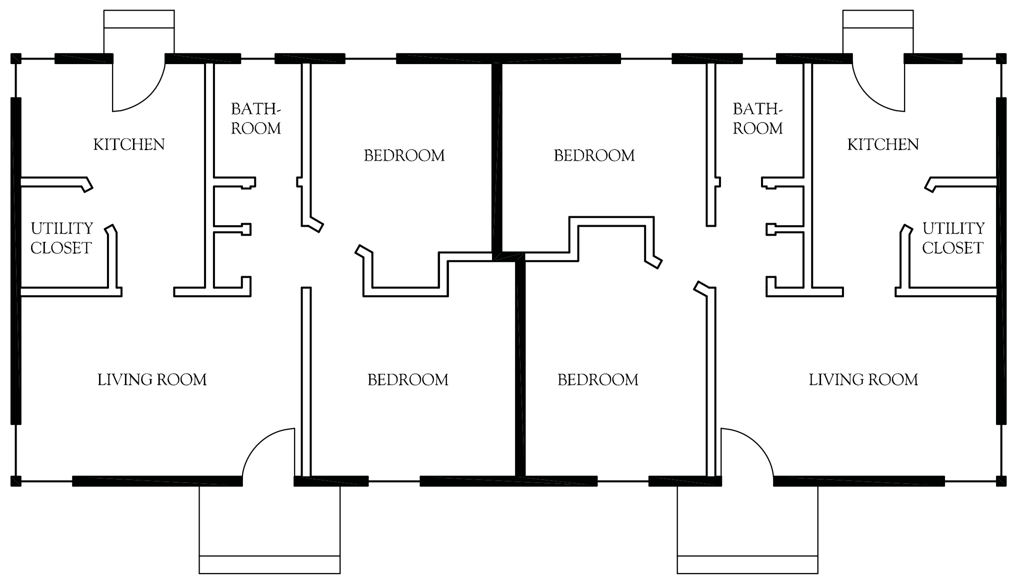
RICHMOND, CA



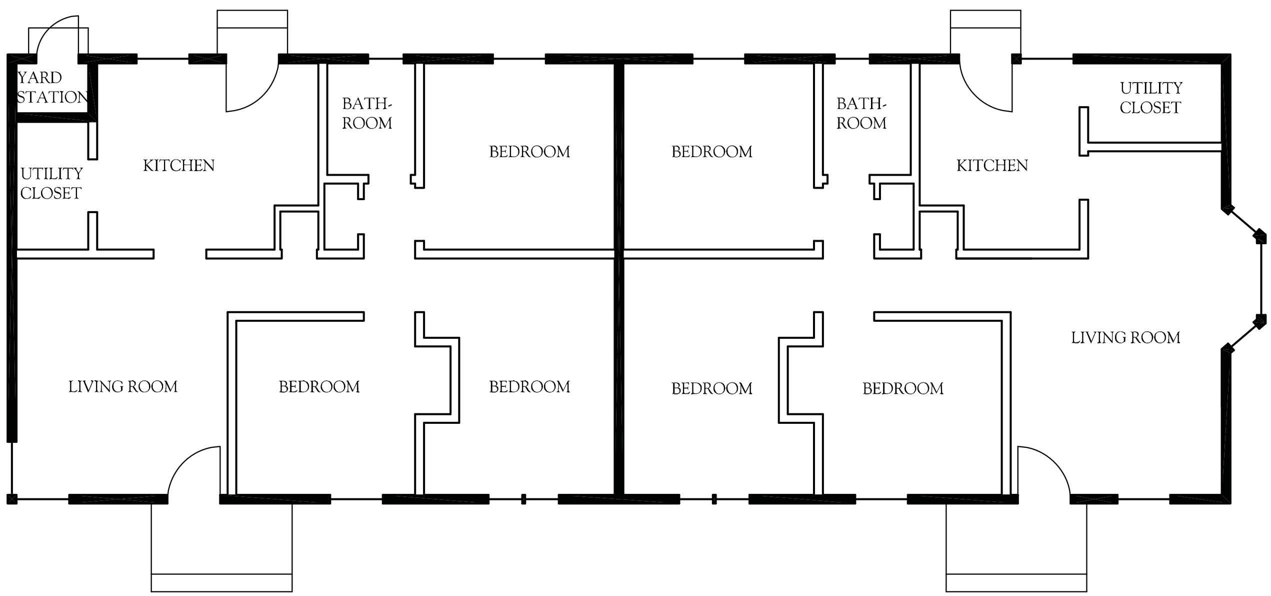

RESIDENTIAL BUILDING TYPE I
DIAGRAMMATIC FLOOR PLAN

ATCHISON VILLAGE DEFENSE HOUSING PROJECT
RICHMOND, CA

SCALE = NOT TO SCALE




RESIDENTIAL BUILDING TYPE 2 | ATCHISON VILLAGE DEFENSE HOUSING PROJECT | SCALE = NOT TO SCALE
DIAGRAMMATIC FLOOR PLAN | RICHMOND, CA




RESIDENTIAL BUILDING TYPE 3
DIAGRAMMATIC FLOOR PLAN

ATCHISON VILLAGE DEFENSE HOUSING PROJECT
RICHMOND, CA

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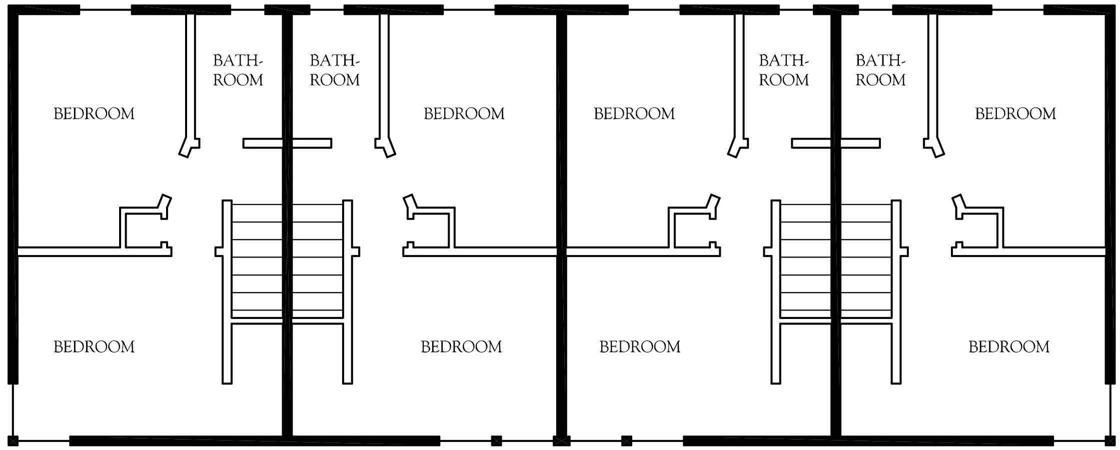


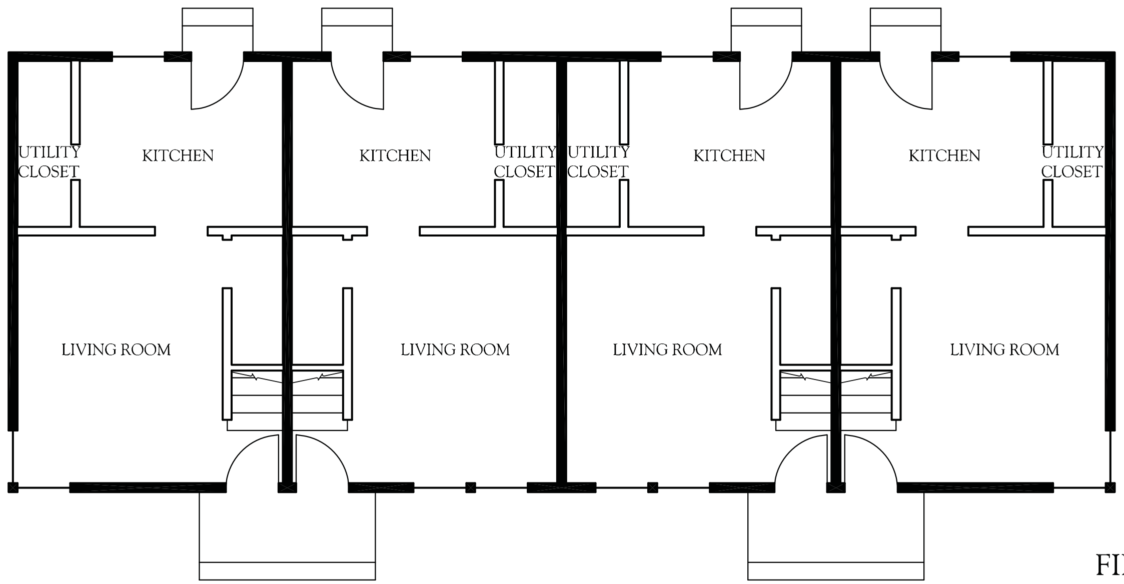


RESIDENTIAL BUILDING TYPE 4
DIAGRAMMATIC FLOOR PLANS

ATCHISON VILLAGE DEFENSE HOUSING PROJECT
RICHMOND, CA

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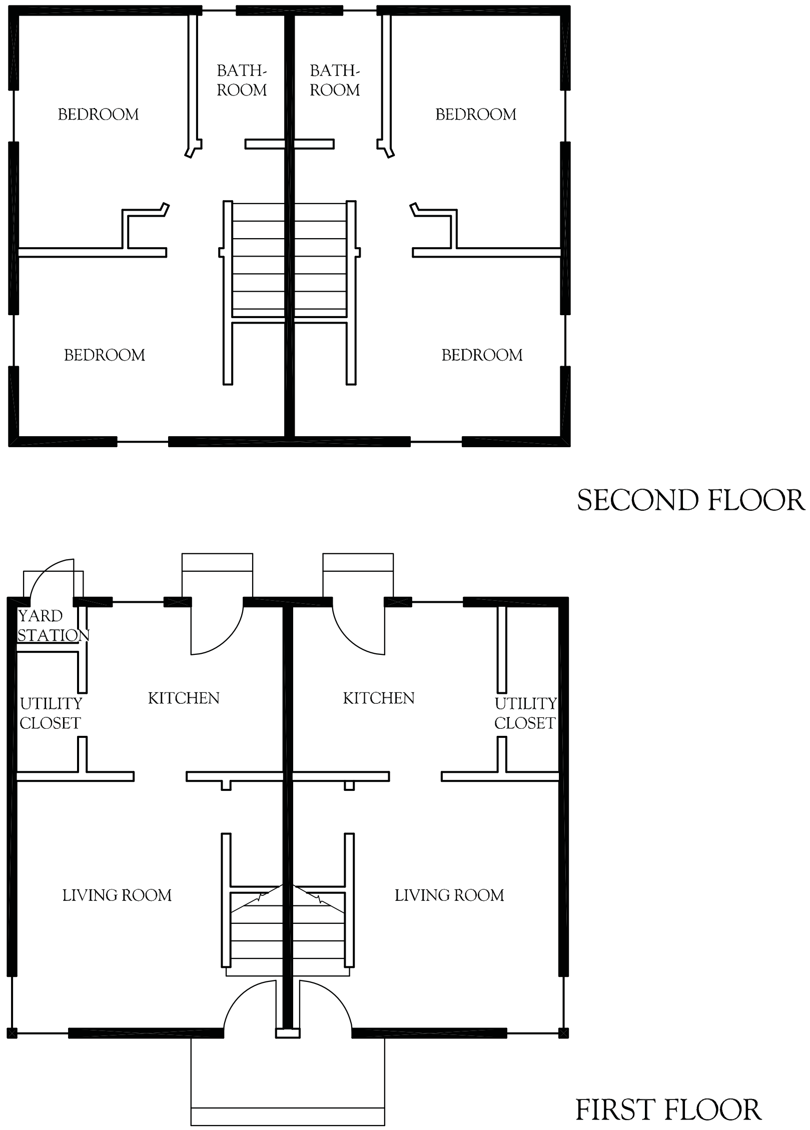


RESIDENTIAL BUILDING TYPE 5
DIAGRAMMATIC FLOOR PLANS

ATCHISON VILLAGE DEFENSE HOUSING PROJECT
RICHMOND, CA

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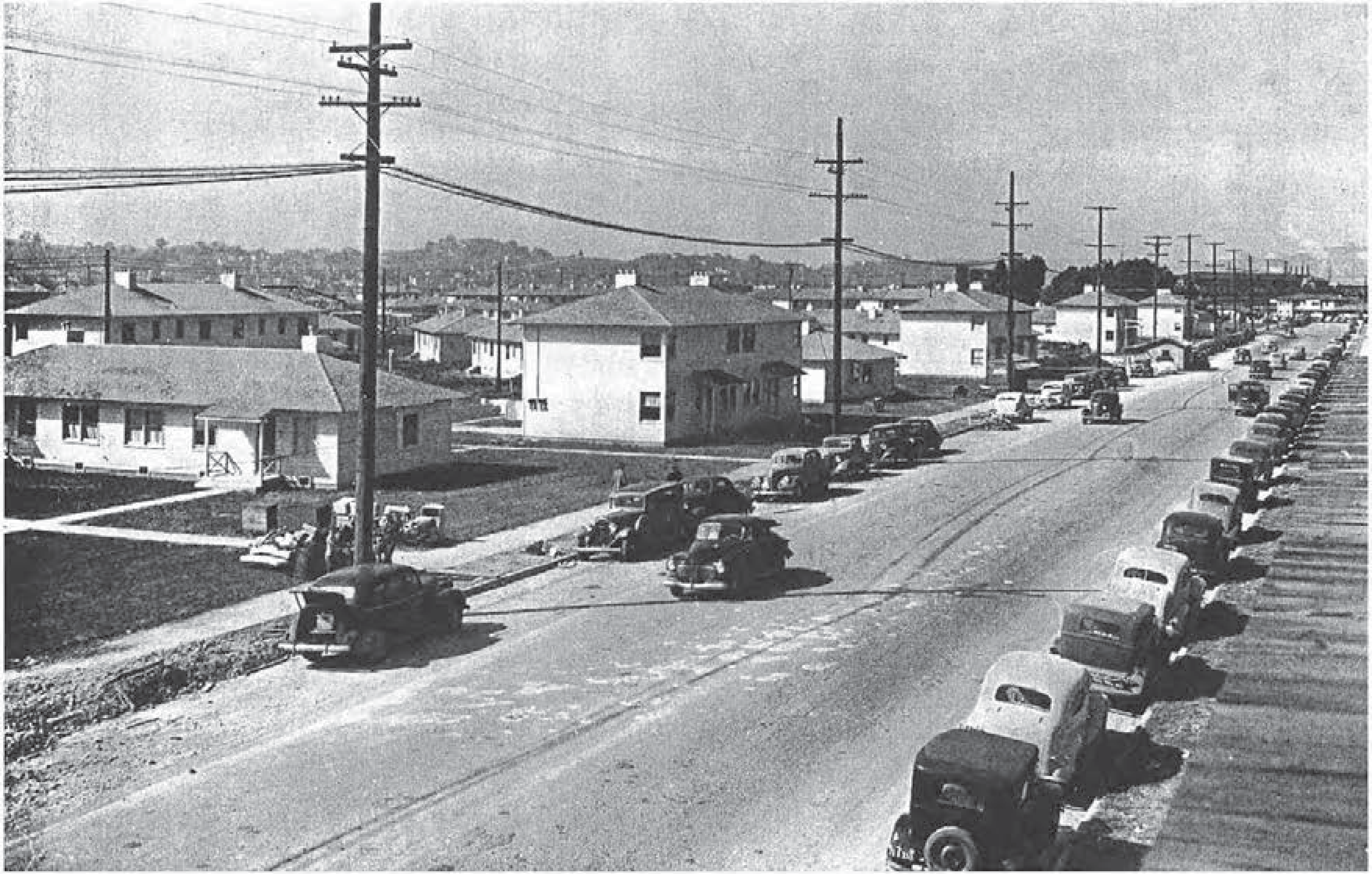

# APPENDIX E

# CRITERION C EVALUATION

**Atchison Village**

**National Register Evaluation (Criterion C)**

## I. INTRODUCTION

The Atchison Village Defense Housing Project (Cal. 4171-X) was constructed in Richmond, California, in 1941 as a permanent housing project for workers in World War II defense industries. The development, now called the Atchison Village Mutual Homes Corporation (Atchison Village), was listed in the National Register of Historic Places (National Register) in 2003. The development was determined to be a historic district of national significance under Criterion A (Event) for its association with federal and local governmental efforts to "provide low-cost family housing for workers involved in the defense shipbuilding industry during World War II."[1]

This report supplements the National Register Nomination Form by providing a context focused on the architecture and planning of Atchison Village and an evaluation of the property under Criterion C, Design/Construction. The context explores earlier developments in the design and planning of public housing projects that influenced the design of Atchison Village, beginning with the Garden City movement at the turn of the 20$^{th}$ century and continuing to World War II. A brief biography of project architect Carl I. Warnecke is included. Section VI provides an evaluation of Atchison Village's eligibility for the National Register under Criterion C, Design/Construction.

Research was conducted using the *Public Housing in the United States Context* prepared for the U.S. Department of Housing and Urban Development, the National Park Service, and the National Register of Historic Places. Additional research was drawn from *Historic Residential Suburbs in the United States, 1830—1960* by the NPS; the Atchison Village National Register Nomination; the Bancroft and Environmental Design libraries at the University of California, Berkeley; the Oakland and Berkeley public libraries; and online sources, including articles obtained through JSTOR and photographs from the Online Archive of California.

[1] "Atchison Village Defense Housing Project," National Register of Historic Places Registration Form, National Park Service; listed in the National Register May 30, 2003.

## II. Description

Atchison Village is located on a flat 30-acre site bounded by MacDonald Avenue, 1st Street, Chanslor Avenue, and Garrard Boulevard **(Figure 1)**. The development includes 162 one- to two-story residential buildings and a one-story Community Building designed in a simple utilitarian style. The residential buildings are built in five plan types. All buildings are capped by hip roofs and clad in vinyl siding designed to replicate the original redwood siding. Entrances include paneled wood doors set in small covered entry porches. Typical fenestration consists of double-hung wood windows. Architectural features include corner boards and exposed rafter tails. Atchison Village does not continue the rectilinear street grid of the rest of Richmond, but features curved and diagonal streets. Buildings are oriented to the street or grouped around small courtyards. The Community Building and an open playing field are located at the center of the development near the entrance. Atchison Village appears to be in good condition.

A complete physical description is included in the National Register Nomination Form.


**Figure 1. Aerial view of Atchison Village.**
**Source: Google Maps. Modified by Page & Turnbull, Inc.**

## III. National Context

World War II defense housing like Atchison Village were influenced by fresh ideas about urban planning, a movement to express social ideals in community design, and changing ideas about public housing. These combined with a dramatic national migration and large-scale housing shortages during the war to produce a housing landscape that incorporated design and social principles into mass-produced housing. Thus, the superblock site plan, curvilinear streets, and clustered residential buildings of Atchison Village evolved from the ideas of planners and housing advocates from the 1890s through the 1930s.…

This section explores relevant architecture and planning concepts, including Garden Cities, World War I government housing, New Deal public housing, and World War II defense housing, with a focus on aspects that contributed to the design of defense housing developments such as Atchison Village.

*The Garden City Concept*

The Garden City concept is one of the earliest examples of urban planning that shaped the design of Atchison Village. At the end of the nineteenth century, British urban planner Ebenezer Howard began advocating for what he considered an ideal city plan, which he called the "Garden City." Howard's ideal included a series of concentric circles, with a large park, public buildings, and businesses at the center and agricultural, industrial, and social institutions located at the periphery **(Figure 2)**.[2] Features included winding streets, well-defined open spaces, large blocks closed to automobile traffic, and hierarchical roads and secondary streets.[3] In 1898, Howard published *To-morrow: A Peaceful Path to Real Reform*, which publicized the Garden City model and sparked urban planning efforts in cities around the world.[4]



[2] "Historic Residential Suburbs in the United States, 1830—1960," National Register of Historic Places Multiple Property Documentation Form, National Park Service, E-18.
[3] Judith Robinson et al., "Public Housing in the United States, 1933-1949; A Historic Context: Volumes I-II," prepared for the U.S. Department of Housing and Urban Development; the U.S. Department of the Interior, National Park Service; and the National Register of Historic Places (1999), Vol. II, 13.
[4] Norman Lucey, "The Effect of Sir Ebenezer Howard and the Garden City Movement on Twentieth Century Town Planning" <http://www.rickmansworthherts.freeserve.co.uk/howard1.htm, accessed March 17, 2009>.

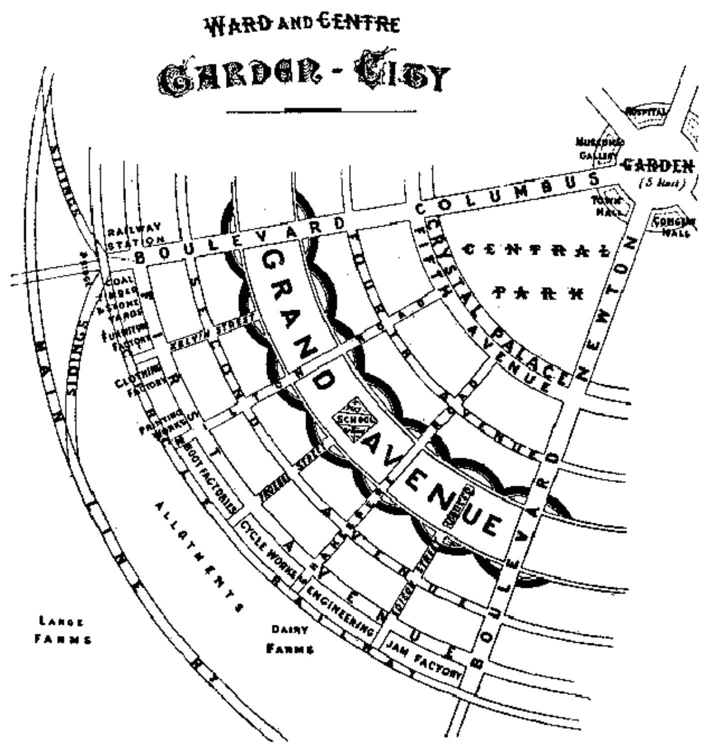


**Figure 2. Garden City Plan.**
**Source: *Garden Cities of To-Morrow*, Cornell University Library.**

*World War I Housing Programs*

In 1918, Congress created the U.S. Housing Corporation (USHC) and the U.S. Shipping Board Emergency Fleet Corporation to address the shortage of housing for moderate-income war workers facing severe housing shortages near shipbuilding and ammunition production centers.[5] The USHC and Emergency Fleet Corporation promoted Garden City models for emergency housing communities and encouraged town planners, architects, and landscape architects to collaborate on comprehensive community planning.[6] The USHC itself constructed 27 new communities.[7]

Both private and public housing developments drew on the Garden City model. Seaside Village, a public housing project for Connecticut defense workers built in 1918, featured naturalistic curvilinear streets, a small public park, and clustered houses.[8] Similar developments like Yorkship in New Jersey, Union Gardens in Delaware, Atlantic Heights in New Hampshire, and Hilton Village and Truxtun in Virginia set successful precedents for garden suburb wartime housing.

[5] Robinson et al., Vol. II, 9.
[6] "Historic Residential Suburbs," E-19.
[7] Robinson et al., 10.
[8] Witold Rybczynski, *City Life* (Simon and Schuster, 1996), 191.

*Further Development of Garden Cities*

In the 1920s, Howard's ideas influenced architect Clarence Stein and planner Henry Wright. In contrast to the prevalent city gridiron plan, partners Stein and Wright promoted the use of curvilinear, organic street plans in natural, healthful settings. This movement combined the principles of the Garden City with those of the Progressive Era, which sought to improve the lives of the urban working class through the provision of social facilities and programs. Stein and Wright's experimental, low-cost housing complex at Sunnyside Gardens (also known as Long Island City) in Queens, New York (1924-1928) was influential in advancing the Garden City Movement. Stein and Wright lined the peripheries of the city blocks with apartment buildings, reserving the blocks' interiors for common open space with light and fresh air.

In their design for the first modern planned suburb in Radburn, New Jersey (1928), Stein and Wright clustered houses back to back, abandoning the traditional street grid system **(Figure 3)**. They limited private outdoor space and designed large shared parks around the houses. The plan also revised the role of the automobile, as the houses were grouped on cul-de-sacs only accessible from perimeter roads. Sidewalks, not roads, were installed through the common open spaces between the houses. This reduced the number of roads required for the community and separated vehicular and pedestrian traffic for the safety and convenience of residents.

The organization and orientation of the houses and grounds at Radburn represented not only progressive community design, but also an economical method of building. Streamlined infrastructure and utilities were cost-efficient, making possible the construction of shared amenities such as parks, pools, and schools. Clustered housing allowed for more shared space and oriented community life to gardens, parks, and recreation areas. Thus, Stein and Wright built upon the Garden City concept to incorporate modern utilities and infrastructure and to reprogram the use of open spaces from agriculture to meet the needs of a post-agricultural society. These early alternatives to high density urban development influenced the theories behind the Federal Housing Campaign of the 1930s, and became the basis for most planning efforts in the United States in the late 1930s.

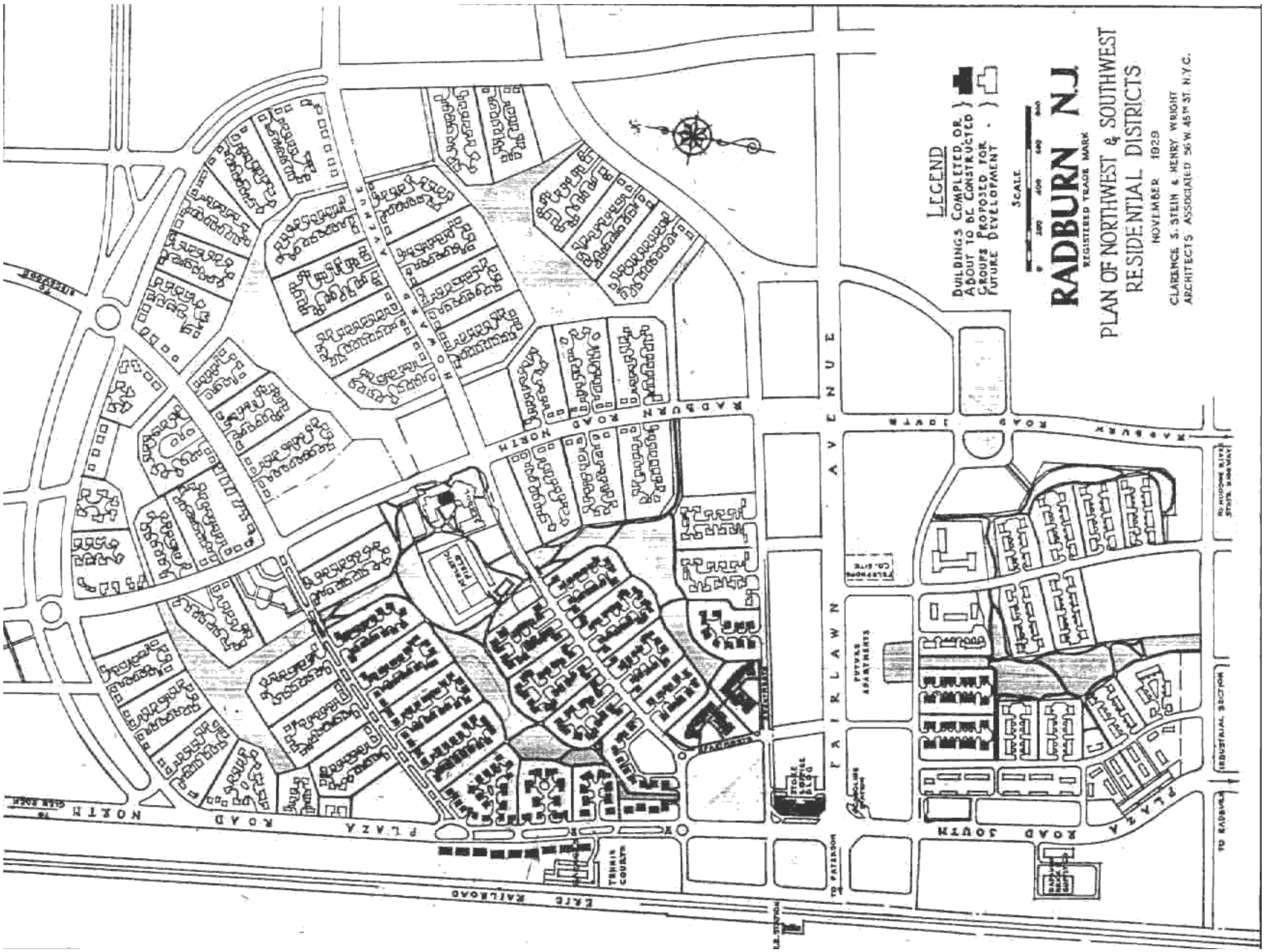


**Figure 3. Radburn site plan by Stein and Wright.**
**Source: Charlotte-Mecklenburg Historic Landmarks Commission <www.cmhpf.org>.**

Before and after World War I, American garden suburbs developed with curving tree-lined streets and cul-de-sacs, landscaped lawns and gardens, and homes designed in a variety of styles.[9] The National Register of Historic Places Multiple Property Documentation Form, "Historic Residential Suburbs in the United States, 1830—1960," describes the characteristics of a typical "garden apartment village":

> The overall aesthetic effect of garden apartment villages relied on the varied and irregular massing of units within a superblock, separation from automobile traffic, an interlocking arrangement of housing units to fit a site's topography which avoided the appearance of either rowhouses or large apartment blocks, and the provision of landscaped walkways, gardens, and recessed entry courts. Staggered roof lines and unifying cornices, fascia, and dentil friezes, and the repetition of modest and similar architectural embellishments—doorways, transoms, mouldings, window surrounds, roof designs—unified each complex's overall design.[10]

Developers tried to separate their subdivisions from the cities with distinguishing entrances that included plantings, signs, and portals, and planned new circulation networks within the developments.[11]

With the Banking Act of 1935, the federal government provided federal mortgage insurance to Garden City suburban developments. This support helped make Garden City ideals the norm in residential development.

*Public Housing, 1930-1940*

During the Great Depression, New Deal housing initiatives aimed to bring low-rent and high-quality housing and much-needed jobs to Americans, and to reform housing on a national scale by involving the government in the design and funding of a traditionally private enterprise. New Deal solutions allowed for innovative design aimed at affordable living and brought the modern revolution in planning to a national audience. Franklin Delano Roosevelt created the Federal Housing Administration in 1934, the Resettlement Administration in 1935, and the United States Housing Authority in 1937 to administer programs that would support the housing market and help alleviate the housing and work shortage.[12] In 1939, the Federal Works Agency (FWA) was created and the United States Housing Authority (USHA) was placed under it.

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9 "Historic Residential Suburbs," E-14.
10 *Ibid.*, E-32.
11 *Ibid.*, E-17.
12 "Historic Residential Suburbs," E-11; "A New FHA Low Cost Housing Plan," *Architectural Forum*, November 1935, 520-521; "Housing Act of 1937" <http://en.wikipedia.org/wiki/Housing_Act_of_1937, accessed March 10, 2009, updated

The federal housing effort took Stein and Wright's progressive planning and design ideas, which were outlined at a 1931 President's Conference on neighborhood and community planning, and applied them to building projects that would establish new communities for low-income families.[13] The Federal Housing Administration (FHA) established standards for neighborhood planning which were based on the Radburn community in New Jersey. The FHA standards encouraged the cost-saving construction of large-scale developments coupled with the design of Garden City style neighborhoods in an effort to ensure profitable and long-term occupancy. A 1939 USHA publication, *Design of Low-Rent Housing Projects*, focused on site planning that met residents' social needs and "cultivated self-reliance."[14]

At the time, public housing presented an opportunity to create a new, ordered environment that fostered community and connections to nature.[15] "Public housing is concerning itself deeply with the social needs of its residents," wrote the USHA in 1939.[16] To meet these perceived social needs, low-rise multi-family residential buildings with common design elements were grouped around large parks and shared recreational areas.[17] Community centers were often located near the project entrance. Private or semi-private gardens and courtyards allowed more intimate connections to nature, as well as a measure of family privacy. Circulation patterns diverted fast traffic, improved resident privacy, and protected people from "deteriorating outside influences."[18]

Design was important in achieving public housing's social mission, but it was heavily influenced by economics. One article targeting private builders of low-rent apartments quoted an FHA recommendation for "basic qualities which make the finished product livable, economical, and, hence, profitable to the owner."[19] Service alleys and stairs were eliminated to save on infrastructure costs, with the rationale that low-rent apartment dwellers could put up with some inconveniences. Besides providing residents with gathering spaces and exposure to nature, large open spaces were more economical to maintain than fragmented yards.[20] Building designs were simply shaped to reduce the cost and maintenance of site plantings, and plants were chosen for their hardiness and low



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February 19, 2009>; Catherine Bauer and Samuel Ratensky, "Planned Large-Scale Housing," *Architectural Record* 89, May 1941, 89-105; Peter Marcuse, "Housing Policy and the Myth of the Benevolent State," in *Critical Perspectives on Housing*, Rachel G. Bratt, Chester Hartman, and Ann Meyerson, eds. (Philadelphia: Temple University Press, 1986), 248.
[13] "Historic Residential Suburbs," E-21.
[14] *Design of Low-Rent Housing Projects: Planning the Site* (United States Housing Authority, 1939), 10, 14.
[15] Judith Robinson et al., Vol. I, 24.
[16] *Design of Low-Rent Housing Projects.*
[17] Robinson et al., Vol. I, 25.
[18] *Design of Low-Rent Housing Projects*, 9.
[19] "Project Planning Elements: Suggestions for Good Practice in Design Based on FHA Experience," *Architectural Record* 86, No. 3, September 1939, 93-100.
[20] *Design of Low-Rent Housing Projects*, 10.

maintenance.[21] Using a few identical plans for dwelling units was thought to foster a sense of unity while lowering design costs.

One of the first FHA projects, and one of the first garden apartment complexes built in the United States, was Colonial Village in Arlington, Virginia (1935). Colonial Village was a development of attached small-scale apartments arranged around shared interior gardens **(Figure 4)**. The FHA had a Large-Scale Rental Housing Division, which promoted the construction of "apartment villages" based on the designs of Sunnyside Gardens and Radburn.[22]

**Figure 4. Shared garden in Colonial Village.**
**Source: The Arlington Dirt <www.thearlingtondirt.com>.**

The garden apartment village concept influenced the site planning of Atchison Village, which included many of the above characteristics, including: varied and irregular massing of units within a superblock, separation of auto and pedestrian traffic, interlocking arrangement of housing units along site topography, landscape provisions, and unifying architectural elements such as covered porches and exposed rafter tails.

**Site planning**

Garden City principles and an awareness of financial constraints were both clearly manifested in site plans. The FHA and USHA favored superblocks like those designed by Stein and Wright: large parcels of land that could be redesigned with curving roads, clustered buildings, and concentrated open space to break with the traditional city grid **(Figure 5)**. Superblocks allowed for less expensive infrastructure development—an important consideration in low-cost housing—and followed Garden Cities' emphasis on generous, concentrated open space.[23]

21 "Project Planning Elements"; *Design of Low-Rent Housing Projects*, 10.
22 *Ibid.*, 32.
23 "Low-Rent Suburban Apartment Buildings," *Architectural Record* 86, No. 3, September 1939, 88-92; *Design of Low-Rent Housing Projects*, 9.

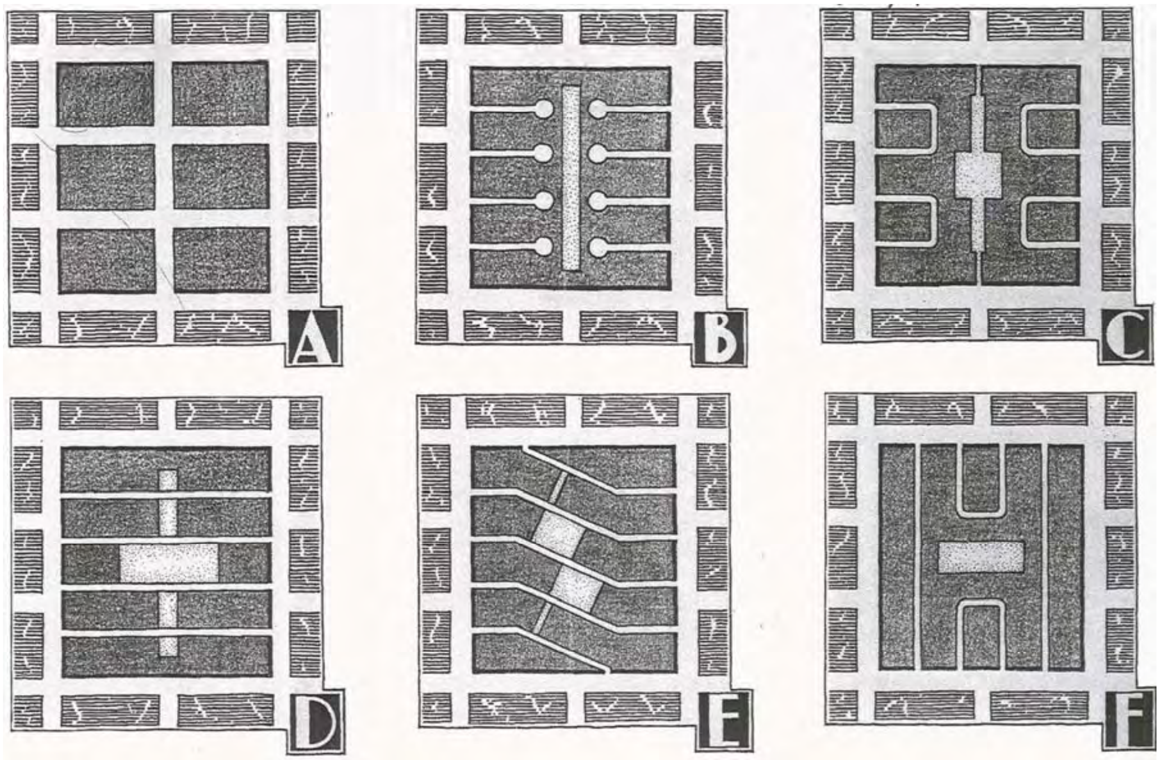


**Figure 5. Sample superblock site plans from the USHA, with *A* as the area to be replanned.**
**Source: *Design of Low Rent Housing Projects*, 1939.**

Superblock circulation plans often separated automobiles and pedestrians by building perimeter roads for cars and walkways between the residential buildings for pedestrians, with grouped parking spaces.[24] Fast car traffic was funneled to wide perimeter roads from narrow curving streets with low speed limits, and many buildings fronted on cul-de-sacs that barred through traffic **(Figure 6)**.[25]

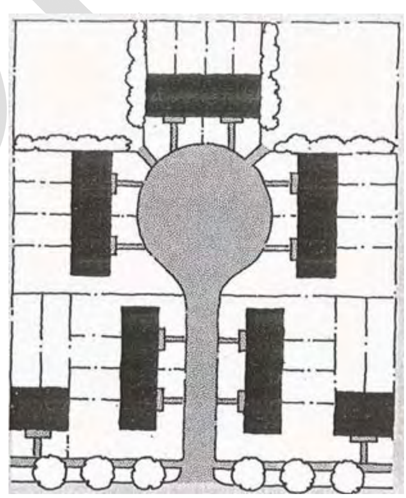

**Figure 6. Sample site plan for low-rent housing from the FHA.**
**Source: *Architectural Record*, September 1939.**

24 Robinson et al., Vol. I, 25.
25 *Design of Low-Rent Housing Projects*, 8.

Site plans were developed according to the topography. Level or gently sloping sites were preferred.[26] Landscaping was a key element, and open spaces were developed to serve a range of ages and needs. Plantings were used to demarcate areas as common or private space, or for different uses.[27] Some architectural critics discouraged gardens in multi-family developments, citing a potential lack of maintenance, but the USHA argued that tenant-maintained yards kept rents low and encouraged responsibility.[28] Thus, social improvements were considered part of the role of public housing.

Buildings were arranged to maximize views, light, ventilation, and privacy for each dwelling unit **(Figures 7-8)**.[29] One- to two-story buildings were judged best for suburban developments.[30] Low-rise multi-unit buildings with linear designs and arrangements, spaced some distance apart, allowed for all units to receive daylight and natural ventilation.[31]

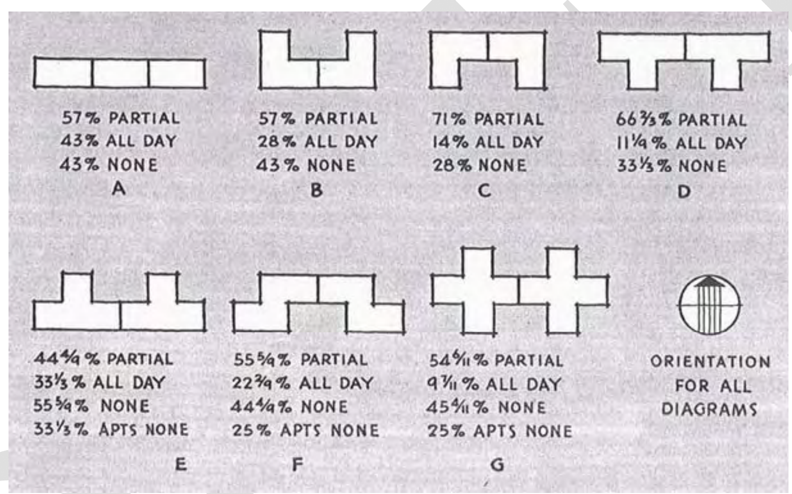


**Figure 7. From the FHA, building footprints showing proportions of building perimeters that receive sunlight on December 21.**
**Source: *Architectural Record*, September 1939.**

26 "Project Planning Elements."
27 *Ibid.*
28 "Low-Rent Suburban Apartment Buildings"; *Design of Low-Rent Housing Projects*, 10.
29 "Low-Rent Suburban Apartment Buildings."
30 *Ibid.*
31 "Project Planning Elements"; "Low-Rent Suburban Apartment Buildings."

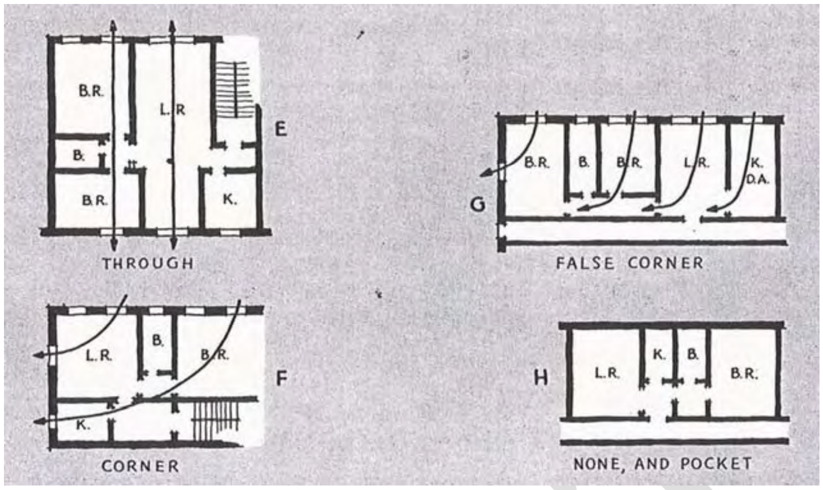


**Figure 8. From the FHA, unit floorplans showing natural ventilation.**
**Source: *Architectural Record*, September 1939.**

## Building design

Buildings were designed in a modern utilitarian style influenced by European public housing, with sparse or no ornamentation.[32] The USHA's 1939 *Design of Low-Rent Housing Projects* prioritized economy and rational organization, with aesthetics secondary in importance.[33] Residential units generally included one to four bedrooms, a kitchen, a living room, a full bathroom, and short or no hallways, as these were considered wasted space.[34] Rooms were regularly shaped, minimally sized, and designed for maximum sunlight and ventilation both within a room and through the entire apartment.[35] Architects were advised to pay attention to circulation and to have as few doors as possible, to maximize usable space for furniture and activity **(Figure 9)**.[36] Walls consisted of painted concrete blocks or plastered partitions, and floors were asphalt tile, linoleum, or wood parquet over concrete.[37] A typical kitchen included a gas stove, an electric refrigerator, and cupboards and closets without doors.



32 Robinson et al., Vol. I, 25.
33 *Design of Low-Rent Housing Projects*, 14.
34 Robinson et al., Vol. I, 25.
35 *Ibid.*; "Project Planning Elements."
36 *Ibid.*
37 Robinson et al., Vol. I, 25.

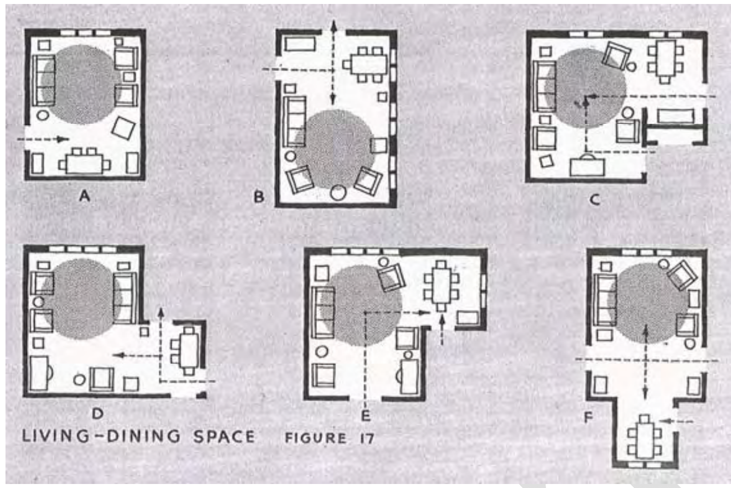


**Figure 9. From the FHA, unit floorplans showing circulation paths.**
**Source: *Architectural Record*, September 1939.**



The FHA provided advice to private developers of low-rent apartment communities that drew on its experience in residential development.[38] One- and two-bedroom units were most easily rented, wrote the agency. Galley, or "strip," kitchens were unpopular, and dining rooms could be replaced by dining alcoves off kitchens. Plans optimally allowed private access to all rooms and included closets, and foyers were "universally desirable except at [the] lowest rental levels." Laundry and storage space shared by multiple units were acceptable. This guidance, reinforced by FHA financing decisions, resulted in standardized economical designs that would be carried into the design of World War II defense housing projects like Atchison Village.

*Defense Housing Policy, 1940-1945*

A flurry of attention was paid to housing for enlisted personnel and defense workers on the eve of the United States' entrance into World War II, but efforts to construct emergency defense housing proceeded slowly, and a concerted approach was never developed.[39] Instead, the federal government allocated funding for various types of housing targeted at different constituents. The funding was controlled by a number of agencies, including the FWA, which included the Public Buildings Administration, the USHA, the Mutual Home Ownership Division, and the Division of Defense Housing; the Navy; the Defense Homes Corporation; and the Farm Security Administration (FSA).[40]

[38] "Low-Rent Suburban Apartment Buildings."
[39] Stephen G. Meyer, *As Long as They Don't Move Next Door: Segregation and Racial Conflict in American Neighborhoods* (Rowman & Littlefield, 2001), 66.
[40] Dorothy Rosenman, "Defense Housing," *Architectural Record*, November 1941, 110.

The FHA, the Defense Homes Corporation, the Federal Home Loan Bank Administration, and the Federal Public Housing Authority were consolidated under the National Housing Agency in 1942.[41]

Policies were quickly created in response to the U.S. preparation for war. The USHA was authorized to construct defense housing in June 1940. The next month, the National Defense Council created the Office of Defense Housing Coordinator (ODHC) to craft a policy for construction of defense housing and coordinate private industry and public resources.[42] In October 1940, the Lanham Act was passed.

The Lanham Act allocated $150 million to local authorities to construct defense housing in critical defense areas where private industry could not meet housing demand.[43] As a result of legislators' concerns about interfering with the postwar private housing market, the act restricted project costs to $4500 per unit and stipulated that projects be demolished after the war.[44] By January 1941, $285 million of federal money had been allocated to defense housing: $150 million to the Lanham Act for defense workers, $100 million for Army and Navy housing, and $35 million to the USHA.[45] Lanham Act funds provided the means for the FWA, working with local housing authorities, to build approximately 675,000 dwelling units.[46]

Local housing authorities played a large role in constructing defense housing through the Lanham Act and other means. By May 1941, 37 states contained 580 active city and county housing authorities, with USHA funds allocated to 233 of these local housing authorities. Thirty-three housing authorities were building 45 defense housing projects with Lanham Act funds.[47] Lanham Act contracts were written directly with the FWA, the local housing authority was a direct agent of the government, and the USHA served as adviser.[48] Even when projects were managed by the local housing authority, they were owned by the federal government.

Private builders also played a major role in constructing defense housing. As early as November 1940, trade journal *The Architectural Forum* urged the construction industry to meet the growing



41 Meyer, 67.
42 *Ibid.*, 66.
43 "Legislation," *The Architectural Forum*, November 1940, 441; "$240 Million Housing Program," *The Architectural Forum*, January 1941, 29.
44 Meyer, 66; Robinson et al., Vol. II, 63.
45 "$240 Million Housing Program," 29.
46 Samuel Trotter, "A Study of Public Housing in the United States" (Mississippi State College, 1958), 430.
47 Bauer and Ratensky.
48 "$240 Million Housing Program," 30.

demand for defense housing.[49] Lessons from World War I showed that "Housing must be considered in conjunction *with* military and industrial expansion, not *after* it." The article stated that 200,000 new dwelling units were needed. By then, the federal government had designated a Defense Housing Coordinator, hatched a defense housing program, and appropriated $250 million to finance construction of 80,000 dwelling units. Private industry was expected to finance and build the remaining 120,000 units.[50] In March 1941, Defense Housing Insurance—later War Housing Insurance—was created for rental housing in critical defense areas to encourage private builders to increase construction.[51] In 1942, Section 608 of Title VI of the National Housing Act was passed to provide mortgage insurance for new defense worker housing.[52]

Over the course of the war, the NHA worked with the War and Navy departments to coordinate construction of housing essential to the war effort. A total of $2 billion was made available for emergency war housing, and 945,000 temporary new dwellings were built.[53]

*Defense Housing Design, 1940-1945*

Federal incentives galvanized private builders and local housing authorities to construct housing for defense production workers and led to major changes in homebuilding practices. War industries' principles of mass production, standardization, and prefabrication were applied to house construction on a large scale for the first time.[54] At the same time, builders and housing authorities drew from the trends and innovations in public housing from the 1930s to increase efficiency, economy, and livability.

The task set before public and private builders was staggering. In November 1940, an estimated 200,000 units of defense housing were needed.[55] A year later, the number had risen to 525,000 units that were urgently required for defense housing.[56] Housing was needed in more than 275 areas around the country, each with a unique climate, topography, and availability of labor and materials. Among this variety of local conditions, builders were expected to finance and build single-family

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49 "Defense Housing," *The Architectural Forum*, November 1940, 437.
50 *Ibid*., 58-62.
51 Defense Housing Insurance was authorized by Title IV of the National Housing Act ("Historic Residential Suburbs," E-11); "Low Cost Housing," *The Architectural Forum*, October 1941, 212.
52 William C. Baldwin, Ph.D., "Army Family Housing in the 1950s," Office of History, U.S. Army Corps of Engineers <http://www.puaf.umd.edu/OEP/Military99/50SHSING.HTM; n.d.; accessed March 11, 2009>.
53 Meyer, 67.
54 "Historic Residential Suburbs," E-9, E-33.
55 "Defense Housing."
56 "Housing for Defense: A Building Types Study," *Architectural Record* 90, November 1941, 71.

homes, duplexes, row houses, garden apartments, multi-story apartments, dormitories, company housing, and entire planned communities.

While undertaking this massive construction effort, builders had to keep costs to a minimum. Lanham Act funds were only given to projects with an average total unit cost of $3,500 or lower—less than the amount permitted by the Housing Act of 1937.[57] With the war drawing heavily upon resources and the housing need growing dire, developers were forced to aim for economy in planning, labor costs, space, materials and equipment use, and time.[58]

Meanwhile, the goal of creating publicly-funded housing that would promote social good was not forgotten. Site plans incorporated Garden City ideals of common open space and play areas, aiming to meet residents' leisure needs. Some projects included community buildings. Dorothy Rosenman, who chaired the National Committee on Housing during the war,[59] wrote:

> If we are to profit at all by experiences of the past and if we are justified in thinking of future redevelopment within our cities, we have an obligation now to design our housing projects as well-planned, self-contained neighborhood units that fulfill the requirements of a modern urban community…low land coverage with generous open areas for recreation and gardens…living quarters that are built away from traffic ways, street crossings and play spaces that are safe, parking and service areas that are adequate and well located.[60]

Rosenman praised outstanding Lanham Act projects that were "planned for a continuing population and built in the way that people today wish to live…they will continue to be attractive, valuable neighborhoods long after this war is over."[61] She advocated for housing projects to be developed as planned communities, noting that self-contained neighborhoods could be more easily sold after the war and would not turn into slums. "Everything we do now will unquestionably have a bearing on the scope of things to come," she wrote. "We ought to try out every device and experiment with every method…to gain knowledge and experience in a field that is vital to the core of living."

57 *Ibid.*, 72; Hill-Hoover-Heckler-Kohankie, "Planning War Housing," *The Architectural Forum*, May 1942, 268.
58 "Housing for Defense," 71.
59 Joan Cook, "Obituary: Dorothy Rosenman, A Housing Specialist and an Author, 90," *New York Times*, January 17, 1991.
60 Dorothy Rosenman, "Housing," *Architectural Record*, April 1942, 46.
61 *Ibid.*

**Construction**

Most builders of large rental developments used new production and standardization techniques to make construction more efficient. The simple, standardized designs of 1930s public housing were easily adapted to "modern" construction techniques like on-site prefabrication of walls and roofs and pre-cutting materials such as pipes and electrical wires to specifications off-site **(Figure 10)**.[62]

"Rational organization of the job" was hailed by the architectural and construction industries, as well as government agencies.[63] The Mare Island development in Vallejo, California, designed by Modernist William Wilson Wurster, featured on-site prefabrication of construction components and double walls between units, so that each unit could be moved and reused individually after war needs had eased.[64]

In November 1941, the *Architectural Record* described how the war had altered the ongoing search for better, cheaper housing:

> Standardization is suddenly less objectionable. Speed of construction has become a dominating factor. Mass production techniques have been given new scope…The great galaxy of alphabetical agencies is devoting heated, almost competitive study to building types. And, while defining basic standards ever more rigidly, they are searching intensively for new ideas, and an increasing number of imaginative architects are working out solutions.[65]

The Lanham Act aimed to meet immediate needs without saturating the private housing market. This goal required that defense housing built with this funding be inexpensive to build, mostly temporary, and use minimal construction materials.[66]



[62] "Housing for Defense."
[63] Bauer and Ratensky.
[64] "Housing for Defense."
[65] *Ibid.*
[66] Meyer, 66.

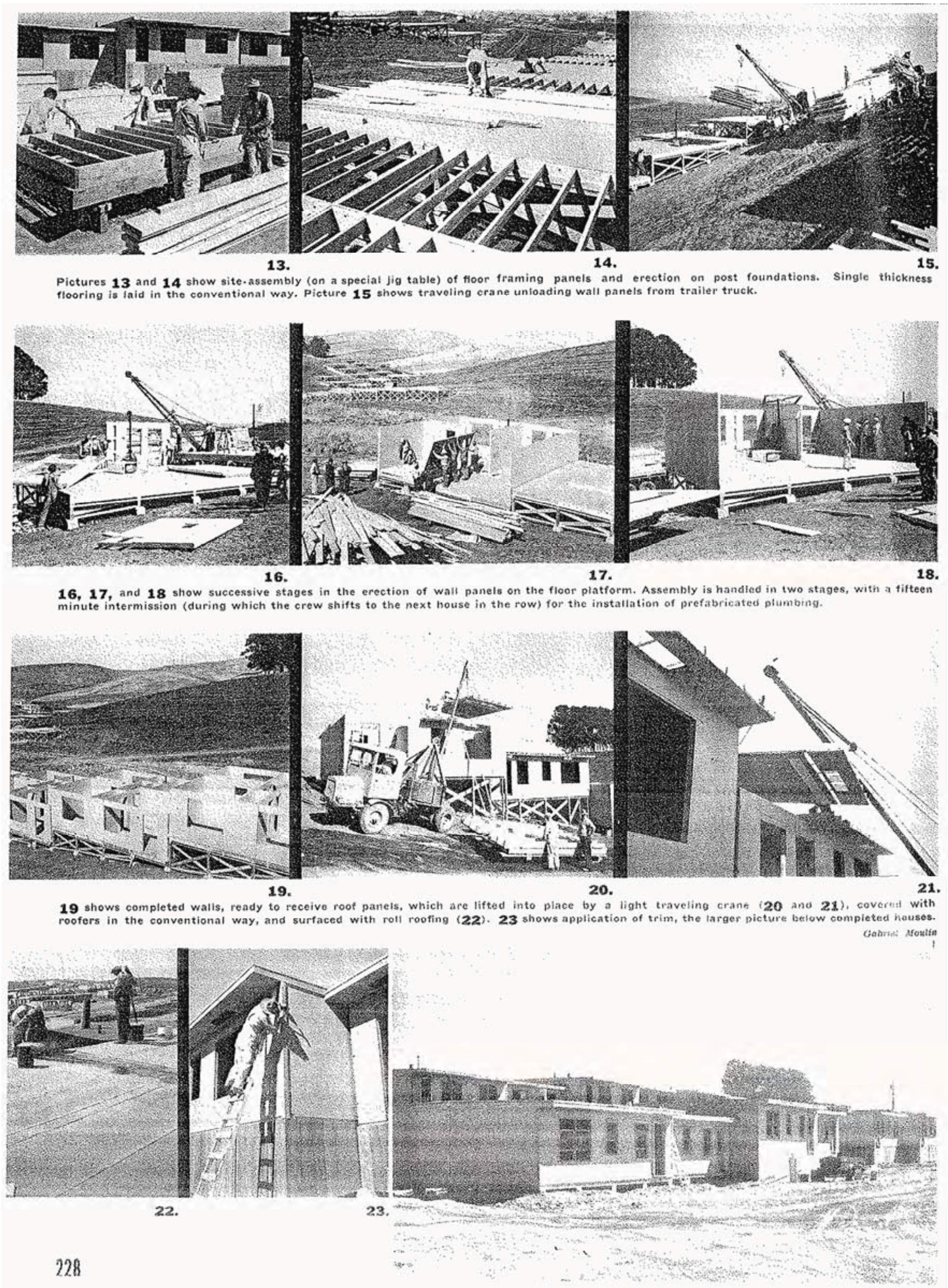


**Figure 10. Final steps of the manufacturing process for houses in the Mare Island housing development.**
**Source: *Architectural Forum*, October 1941.**

**Site planning**

The need to build wartime housing quickly and cheaply led to an emphasis on advance planning and site-specific design. Site selection and planning, preliminary studies, and specifications and estimates made construction faster and more efficient.[67]

Still, the general layout of defense housing was very similar to that of public housing in the 1930s, and further reinforced Garden City ideals **(Figures 11-12)**. Superblocks continued to be recognized as economical and community-oriented.[68] Common landscaped grounds and gardens buffered residential buildings from major streets. Streets through the development were curved, and cul-de-sacs were frequently used to discourage through-traffic and provide "garden space for outdoor living".[69] Automobile and pedestrian traffic were separated.


**Figure 11. Site plan for Pittsburgh defense housing project.**
**Source: *Architectural Forum*, May 1942.**



[67] Hill-Hoover-Heckler-Kohankie, 269.
[68] Bauer and Ratensky.
[69] "Low-Cost Housing," *The Architectural Forum*, October 1941.

**Figure 12. This development in Newport News, Virginia, "warranted special examination as an exemplification of FHA standards for defense housing." Source: *Architectural Record*, November 1941.**

With many war projects, however, carefully planned sites and varied building designs were supplanted by rows of undistinguished, nearly identical buildings that were cheaper to plan and build, such as those in San Francisco's Sunnydale project **(Figure 13)**.[70]


**Figure 13. Site plan of Sunnydale, in San Francisco. Source: *Architectural Forum*, June 1942.**

[70] Robinson et al., Vol. II, 61.

Building designs were also similar. Two- and three-story multi-family dwellings were built with a variety of standardized floor plans designed to allow privacy, sunlight, and ventilation in each unit. A variety of unit sizes and types were aimed at varying the appearance and feeling of the community, such as in the Eliel and Eero Saarinen-designed development in Center Line, Michigan **(Figure 14)**.[71] Many developments grouped residential buildings around courtyards to create a shared open space and feeling of community. Indeed, given more flexibility than with past public housing, architects were encouraged to design buildings that fit the local topography and displayed "interesting grouping."[72]

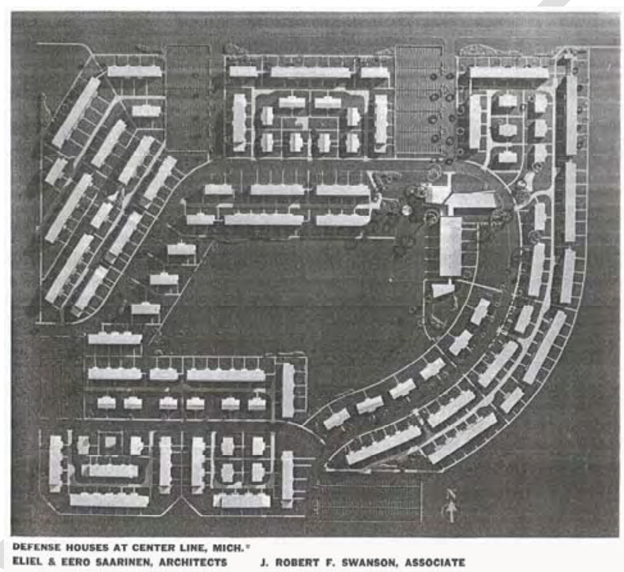


**Figure 14. Site plan of Center Line housing development.**
**Source: *Architectural Forum*, October 1941.**

Like the public housing of the previous decade, the benefits of open spaces were uncontested, but the forms of those open spaces were open to debate. Housing activist Catherine Bauer, the co-author of the Housing Act of 1937, and Samuel Ratensky concluded that community parks were good, but private gardens required less maintenance and were more useful for residents.[73] However, the majority of Garden City developments continued to concentrate common outdoor space in large areas.

**Building design**

Like site planning, defense housing architecture generally followed developments in pre-war public housing. Architects employed few stylistic flourishes, if any, and sought to add visual variety to virtually homogeneous buildings within a development. Residential buildings featured a variety of

[71] "Low-Cost Housing."
[72] Hill-Hoover-Heckler-Kohankie, 268.
[73] Bauer and Ratensky.

unit sizes and types. Individual dwelling units were minimally sized and designed to take advantage of natural light and ventilation.

Architectural styles remained utilitarian, primarily for reasons of cost. Though stylistic reference to vernacular architecture was applauded in a Texas project, defense housing developments generally adhered to a recognized minimal style "regarded as economical for defense housing."[74]

Typically, several dwelling units were arranged in one- to two-story buildings. Governmental agencies, housing reformers, and designers agreed that row house-type buildings were cheaper and more efficient to build than single-family houses, more private than skyscrapers, less expensive to rent than apartment buildings, and provided more green space by concentrating dwellings.[75] "Best apartments are shallow buildings, two rooms, deep, as straight and unbroken as possible, with two apartments per stair hall—hence with cross-ventilation," concluded a 1941 report on large-scale housing by Catherine Bauer and Samuel Ratensky. With this idea shared by funding agencies, designers and builders constructed low-rise buildings containing a variety of unit sizes.

The design of individual dwelling units was standardized. Flexibility in design was greater in defense housing than in public housing of the 1930s, but designers still had to work within stringent limitations on square footage **(Figure 15)**.[76] Thus, though floor plans and elevations varied slightly, the basic building blocks of rooms—and how they were configured—were very similar in projects across the country.

**Figure 15.** Acceptable square footage, per the Lanham Act.[77]

| *Room* | *Minimum s.f.* | *Maximum s.f.* |
|---|---|---|
| Living | 160 | 210 |
| Kitchen | 70 | 120 |
| Living + kitchen | 270 | 290 |
| 1st bedroom | 120 | 130 |
| 2nd bedroom—1 person | 65 | 80 |
| 2nd bedroom—2 people | 100 | 110 |
| Storage space | N/A | 30 |

74 "Housing for Defense."
75 Bauer and Ratensky.
76 "Housing for Defense."

Each defense housing unit included a kitchen, living room, a bathroom, one to four bedrooms, and closets **(Figure 16)**. Dining areas were placed within the kitchen, in an alcove off the kitchen, or in the living room. Kitchen appliances like refrigerators and stoves were typically provided, as well as a water heater and window blinds.[78]

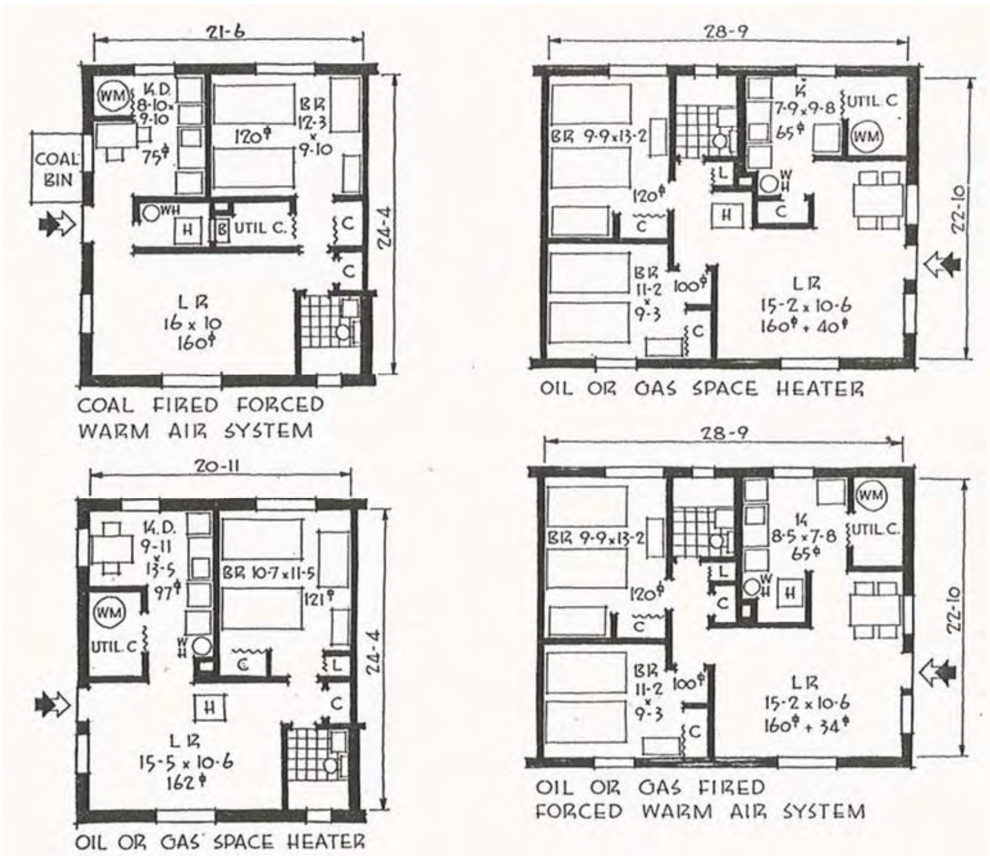


**Figure 16. Floor plans for a two-bedroom duplex that present basic requirements for low-cost defense housing, from the USHA. Source: *Architectural Record*, November 1941.**

In October 1941, *The Architectural Forum* showcased selected low-cost defense housing developments.[79] Designs that allowed for privacy, visual variety, and efficient interior designs were especially praised. Other notable qualities included usable storage and utility spaces, responsiveness to climate, provision of ventilation via strategically-placed windows, and soundproofed party walls. One design was recognized for its lack of partitions between the kitchen, living, and dining areas. A development in Bethlehem, Pennsylvania was showcased for new design elements that increased livability: corner screened porches, sliding doors and windows, and a second-floor balcony; and prefabricated movable closet units that enabled more flexible use of space.

[77] "Housing from the Tenant's Viewpoint," *Architectural Record* 91, April 1942, 71-83.
[78] *Ibid.*
[79] "Low-Cost Housing."

Though units were standardized for economy, the combination of different types of units and minor variations in materials and design was encouraged. Designers sought to vary building forms and facades to provide visual variety, though this aesthetic variety was trumped by financial concerns for later wartime developments.[80] In 1941, an otherwise "typical" New Jersey project was recognized by *Architectural Record* as a notable design because of its visual variety **(Figure 17)**.[81] The article stated, "…the designs are individual in the elimination of pitched roofs and the emphasis of lateral lines…" Another project in Newport News, Virginia was called "an exemplification of FHA standards for defense housing" due to its varying street frontage with different setbacks and cladding types **(Figure 12)**.

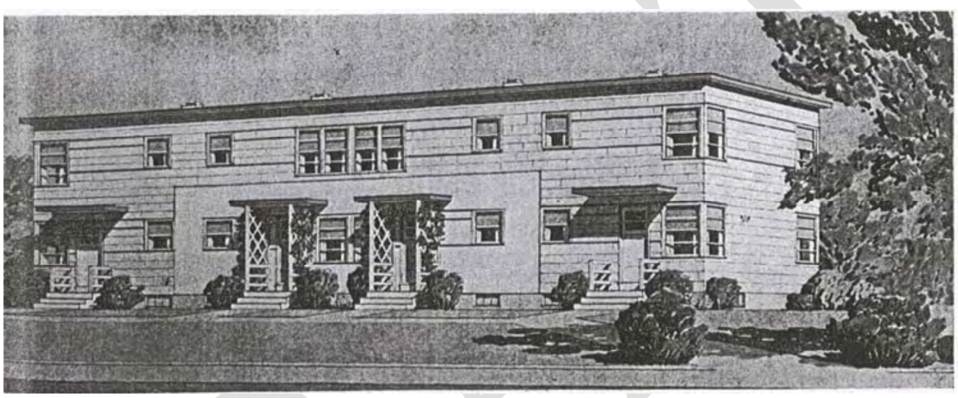

**Figure 17. Elevation from the Rahway River Park Project in Rahway, New Jersey. Source: *Architectural Record*, November 1941.**

**Community facilities**

Meanwhile, the concept of common resources in large developments continued to gain ground.[82] Housing reformers Catherine Bauer and Samuel Ratensky asserted, "A great many critics feel that the major purpose of the low-rent housing program will be lost if we do not raise standards of community facilities."[83] A medium-sized development might incorporate a community center, and a larger defense development might include stores, recreation centers, and medical offices.

In 1941, *The Architectural Forum* discussed the site plan as a social exercise, stating that the relationship between residential buildings and the community social center influenced how the community interacted. This was achieved through conscious placement of the social center, designing open courts between houses, and including children's play areas in the site plan.[84]

[80] "Housing for Defense."
[81] *Ibid.*
[82] Bauer and Ratensky.
[83] *Ibid.*

## IV. Local Context: Defense Housing in the Bay Area

Between 1940 and 1944, over 1.3 million people moved to California, drawn by enlistment in the armed forces or the burgeoning defense industry. The newcomers met a striking lack of housing and woefully inadequate infrastructure. Housing vacancy rates dropped from 8.6 percent to 1 percent.[85] To address the shortage, 290,000 permanent houses were constructed with public or private funds; 74,770 temporary units were built with public funds; 10,000 units were created in converted existing buildings; and 20,000 families lived in privately-owned trailers. Even with these measures, which housed 610,000 additional families, 40,000 families doubled up with other families in cramped living quarters.

With 30 shipyards, the San Francisco Bay Area was a major force in California's production line **(Figure 18)**. Local shipyards employed 244,000 people and ranged from tiny yards to the massive Kaiser shipyards in Richmond. As hubs of the defense industry, communities like Richmond, Oakland, Alameda, and San Francisco experienced substantial population growth. A 1940 call for construction estimated housing demand in Oakland at 2,500 dwelling units and Vallejo's Mare Island at 3,600 units.[86] Richmond was not on the list, as the Kaiser shipyards did not begin operation until January 1941.[87] Those shipyards would employ 100,000 workers at their peak and attract workers from across the country, fueling an enormous need for housing in Richmond.



84 "Low-Cost Housing."
85 "Postwar Housing in California," State Reconstruction and Reemployment Commission (Sacramento: June 1945), 6.
86 "Defense Housing Demand by Cities," *The Architectural Forum*, November 1940, 440.
87 "Nystrom Village Neighborhood Report: Richmond, California," Architectural Resources Group (prepared for the National Park Service, June 2004), 7.


**Figure 18. World War II historic places in the San Francisco Bay Area, including military forts and arsenals, airfields, shipyards and other wartime industry. Source: National Park Service <www.nps.gov>.**

*Nearby Bay Area Communities*

**Oakland**

In 1939, the Oakland Housing Authority began planning for new public housing projects.[88] The projects were still in the planning stage when the outbreak of World War II shifted the planned resident population to defense workers, most employees of the Moore Dry Dock shipyard. Three projects were constructed in 1941 and 1942: Campbell Village, Lockwood Gardens, and Peralta Villa. The projects involved $4.5 million in construction financed by public funds allocated before the war.

Campbell Village was constructed in fall 1941 for rental by defense workers **(Figure 19)**. The project included 29 buildings designed in a Modern style. Row house and flats buildings housed 154 families, and an administration/community building was intended to provide a community focus. Buildings occupied 23 percent of the site. The project was funded by the Housing Authority of the City of

[88] "Campbell Village," *The Architectural Forum*, May 1942, 314.

Oakland and designed by the Housing Authority's Board of Architects, with Carl I. Warnecke as Chairman.

**Figure 19. View of Campbell Village.**
**Source: *Architectural Forum*, May 1942.**

Lockwood Gardens was built in 1942.[89] The project included 53 buildings designed in a utilitarian style; these housed 372 families and included an administration/community building. Buildings occupied 20 percent of the 19-acre site. Designed by the Housing Authority's Board of Architects, Lockwood Gardens features curving streets, long and short buildings arranged around courts, and the majority of parking concentrated in lots at the end of cul-de-sacs **(Figure 20)**. Lockwood Gardens is still standing, and is notable for the similarity of its architectural design to Atchison Village. Its buildings are clad in smooth stucco, but they include exposed rafter tails and covered entry porches **(Figure 21)**. The administration/community building at Lockwood Gardens has an aesthetic horizontality like that of Atchison Village Community Building **(Figures 22, 35)**.

[89] Abt Associates Inc., Linda B. Fosburg, PhD., Susan J. Popkin, Ph.D., and Gretchen P. Locke, *An Historical and Baseline Assessment of HOPE VI: Volume I* (prepared for the U.S. Department of Housing and Urban Development, July 1996), 1-22; Fred Jones, "Oakland's Low Rent Housing Projects," *Architect and Engineer*, October 1942, 16.

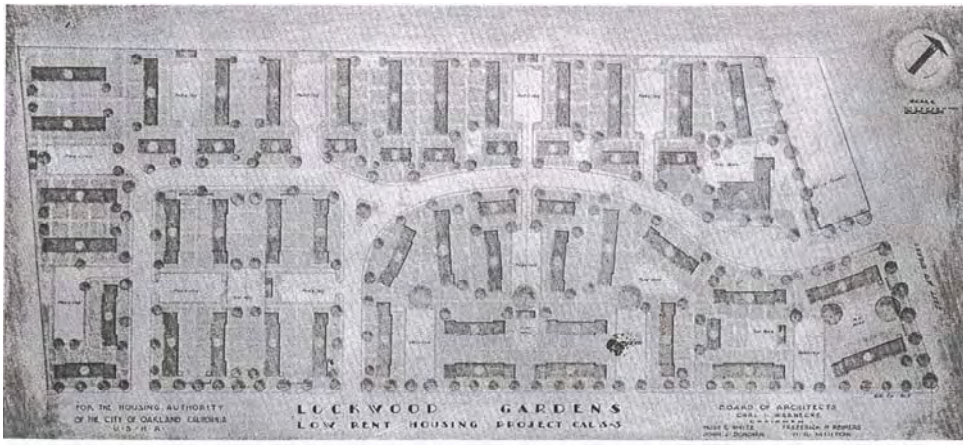


**Figure 20. Site plan of Lockwood Gardens.**
**Source: *Architect & Engineer*, October 1942.**

**Figure 21. View of Lockwood Gardens.**
**Source: *Architect & Engineer*, October 1942.**

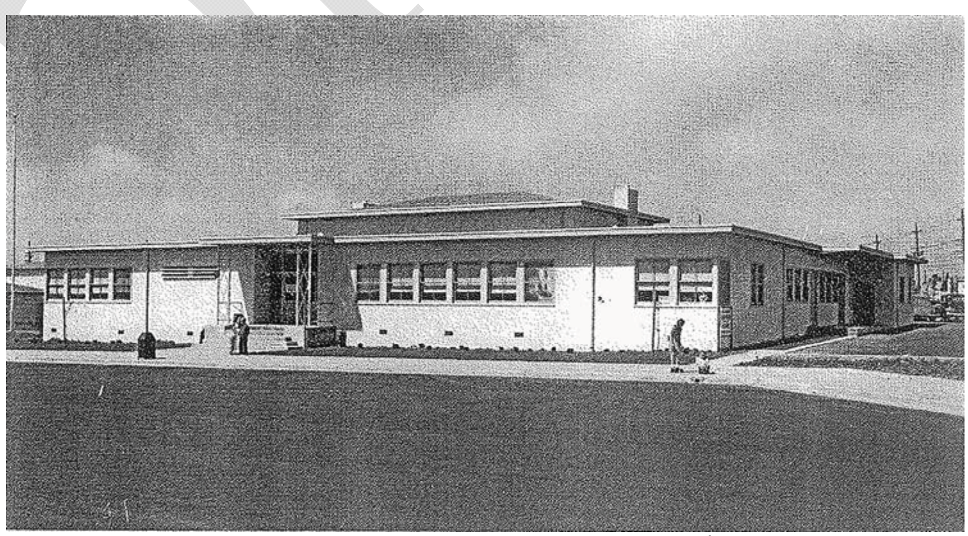

**Figure 22. View of Lockwood Gardens administration/community building. Source: *Architect & Engineer*, October 1942.**

Peralta Villa was constructed in 1942 for rental by defense workers. It housed 396 families in 19 row house buildings and 16 flats buildings, and included an administration building. Buildings designed in a Modern style occupied 21 percent of the 18-acre lot.

**Alameda**

During World War II, Alameda's population tripled from 35,000 to 90,000 people. People living and working at the Alameda Naval Air Station and Bethlehem Steel, United Engineering, General Engineering & Dry Dock, and Pacific Bridge created an enormous demand for housing.[90] In response, Alameda created a local housing authority in August 1940, which would go on to build over 4,800 housing units during the war.

The Woodstock Development defense housing project (CAL-4112) was built in 1941 by the Alameda Housing Authority, USHA, and the Federal Works Agency.[91] Designed by Andrew T. Hass and Carl I. Warnecke, the project included 200 dwelling units in 82 buildings designed in one of four utilitarian types. The development was located on a flat site in the middle of an established residential area. It features 1- to 2-story wood-frame buildings grouped around common courtyards and open areas, with curvilinear streets **(Figures 23-24)**.[92]

**Figure 23. View of Woodstock housing development.**
**Source: *Architect & Engineer*, April 1942.**

[90] "History of the Housing Authority," Housing Authority of the City of Alameda <http://www.alamedahsg.org/history.htm, accessed March 9, 2009, updated February 7, 2009>.
[91] "A Bay Region Defense Housing Project," *Architect and Engineer*, September 1941, 20; Dennis Evanosky, "Hiking through History: The Town of Woodstock," *Alameda Sun*, June 6, 2008 <http://www.alamedasun.com/index.php?option=com_content&task=view&id=3398&Itemid=14; accessed March 16, 2009>.
[92] "Alameda, California," *Architectural Record*, April 1942, 51.


**Figure 24. Aerial view of Woodstock housing development.**
**Source: *Architect & Engineer*, September 1941.**

**San Francisco**

Several wartime housing projects were built in San Francisco to house soldiers and defense workers. The Sunnydale project was completed in fall 1941 with USHA funds.[93] Though initially intended for non-defense housing, it was first used as housing for soldiers.[94] It was built by the San Francisco Housing Authority, with Albert F. Roller and Roland I. Stringham as architects and Thomas D. Church as the landscape architect.[95] *The Architectural Forum* praised the project for its organized site plan: "This project is the largest and among the best of its type on the West Coast. The site plan is orderly and efficient, with the units laid out to follow the contours…" **(Figures 13, 25)**. The 49-acre site included row houses designed in one of three types and a community building, health center, and nursery school.



93 "War Housing," *The Architectural Forum*, June 1942, 399.
94 Leslie Fulbright, "Life at the Bottom: S.F.'s Sunnydale Project," *San Francisco Chronicle*, February 3, 2008, A-1.
95 "War Housing."


**Figure 25. View of the Sunnydale housing project.**
**Source: San Francisco Chronicle, February 3, 2008.**

Other wartime public housing projects in San Francisco included Valencia Gardens, which was designed in the Modern style by William W. Wurster and Harry A. Thomsen; North Beach Housing, by Henry Gutterson and Ernest Born; and Potrero Terrace, by Frederick H. Meyer, Warren Perry, and John Bakewell.[96] Valencia Gardens **(Figure 26)** was demolished and replaced by new low-income housing in 2006. Both Sunnydale and Potrero Terrace are currently slated for demolition and replacement with new low-income housing units.[97]


**Figure 26. View of the Valencia Gardens housing project.**
**Source: San Francisco Chronicle, November 20, 2006.**

[96] "Parkmerced: NR and New International Selection Documentation Minimum Fiche," DOCOMOMO US Northern California Chapter <http://www.tclf.org/landslide/parkmerced/ParkmercedDOCOMOMO.pdf; accessed March 19, 2009>, 2.
[97] Heather Knight, "3 S.F. Public Housing Areas Getting Rebuilt," *San Francisco Chronicle*, March 12, 2008, C-3.

*Richmond*

Prior to World War II, Richmond was a small industrial city with a population of 20,000. Between 1940 and 1943, the population grew to 123,000 with newcomers seeking work in the city's four Maritime Commission shipyards.[98] These shipyards employed more than 60,000 workers and produced 747 ships, more than any other shipyard location in the U.S.[99]

Local and federal agencies held that the influx of defense workers would dissipate after the war ended. The federal government also sought to assure the worried construction industry that it was not aiming to become a major housing provider. Thus, the vast majority of the wartime housing in Richmond—and in other critical defense areas around the country—was built as temporary construction.

The Richmond Housing Authority was formed in 1941 and built over 23,000 public housing units during the war.[100] Private builders constructed another 6,000 homes.[101] Federal agencies like the United States Maritime Commission (USMC), the Federal Public Housing Authority, and the Farm Security Administration (FSA) constructed tens of thousands of temporary units.[102] Wartime housing developments included 650 permanent family units; 15,000 temporary family units; 1,000 demountable family units; 7,000 temporary dormitory units; and a camp for 350 trailers. Roughly 60 percent of Richmond's population lived in wartime housing projects **(Figures 27-31)**.[103]



98 "National Register Eligibility Evaluation, Richmond Shipyards Associated Resources," Carey & Co. (Prepared for the City of Richmond, May 30, 2001), 2.
99 "Historic Resources Evaluation Report," Nystrom Village," Carey & Co., Inc. (prepared for the Richmond Housing Authority, January 2008), 8.
100 Donna Graves, "Mapping Richmond's World War II Home Front" (prepared for the National Park Service, July 2004), 42.
101 McVittie, 9.
102 *Ibid.*, 30.
103 "Nystrom Village Neighborhood Report," 16.

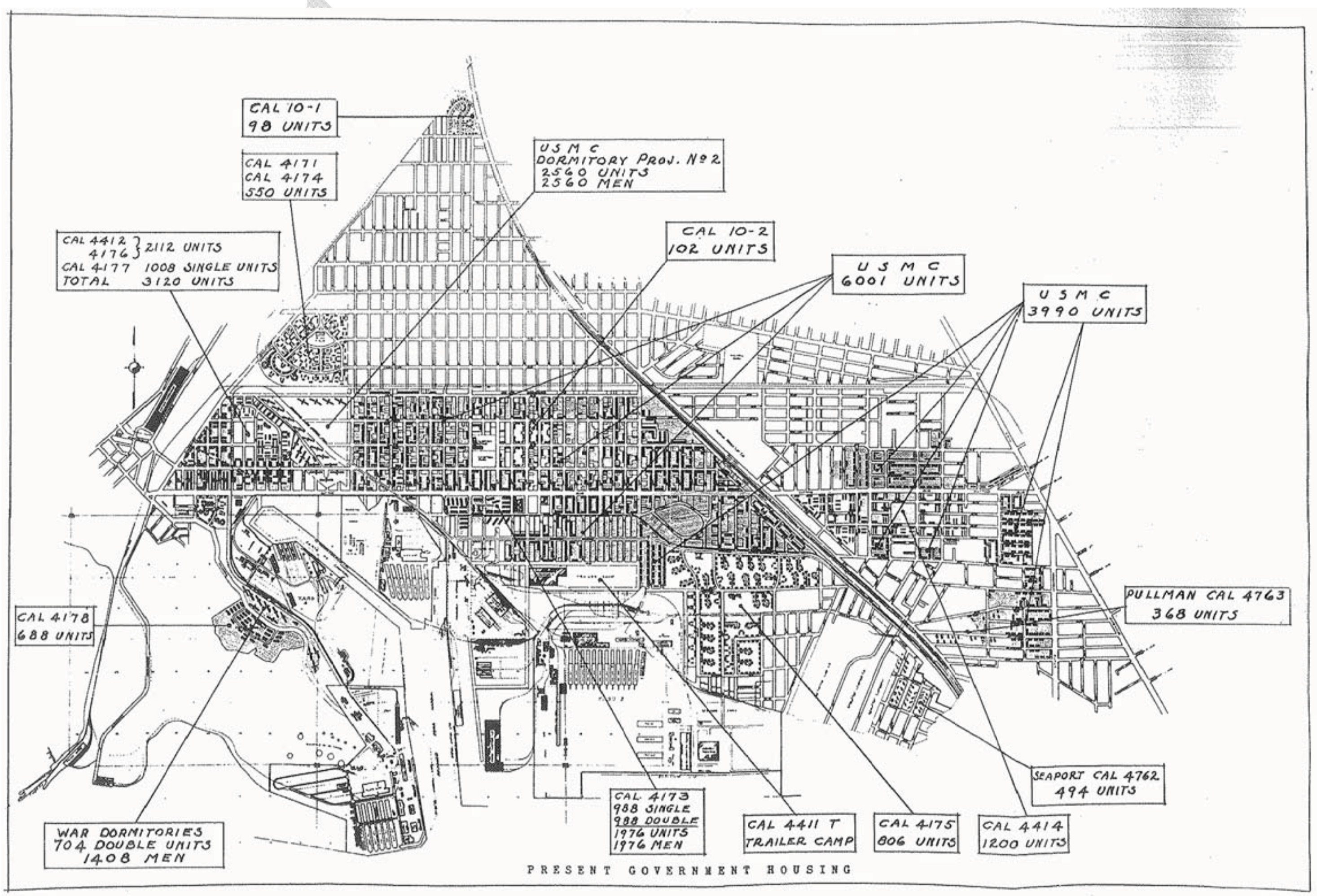


Figure 27. War housing in Richmond. Source: Kaiser Company, Inc., "Proposal for Conversion from Temporary FPHA Housing to Permanent Private Homes."

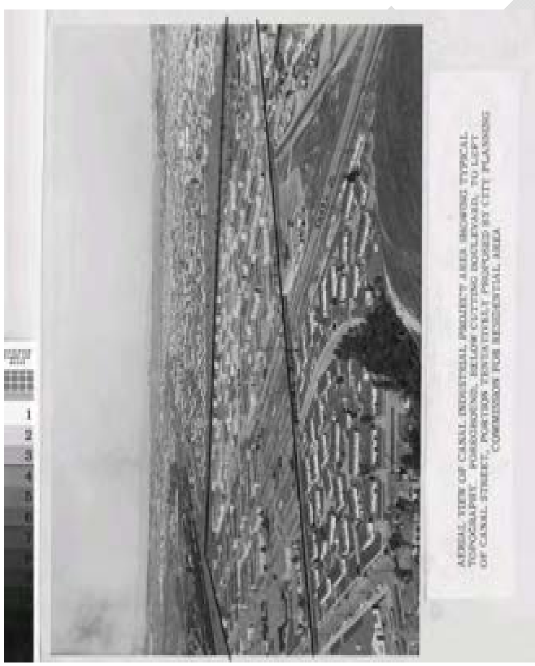

**Figure 28. View of Canal War Housing.**
**Source: Richmond Public Library/Online Archive of California.**

**Figure 29. View of Richmond Terrace.**
**Source: Bancroft Library/Online Archive of California.**

**Figure 30. View of Harbour Gate Housing.**
**Source: Richmond Public Library/Online Archive of California.**

**Figure 31. View of a USMC housing project in Richmond.**
**Source: Bancroft Library/Online Archive of California.**



The housing projects were located near shipyards because of wartime restrictions on tires that inhibited the use of automobiles.[104] Many housing units were built on the street grid of pre-existing neighborhoods, between existing houses. The USMC built 6,000 dwelling units on existing city blocks "at all available open areas."[105] The FSA constructed dormitories at Cutting Boulevard.[106] After World War II, the Kaiser Company proposed to demolish most of the USMC dormitories and family units and all the FSA dormitories.[107] Its stated objective was to convert the area south of Cutting Blvd. to industrial uses, in accordance with the City of Richmond's goal of fully utilizing potential industrial land.

Three permanent housing developments were constructed in Richmond during World War II: Atchison Village and Atchison Village Annex, Nystrom Village, and Triangle Court.

These projects shared a number of qualities:[108]

- Large, purposefully-planned sites
- Children's play areas
- Parking
- Open lawns and landscaping
- Natural light and ventilation in dwelling units
- Population densities comparable to single-family residences

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104 Kaiser Company, Inc., "Proposal for Conversion from Temporary FPHA Housing to Permanent Private Homes" (Richmond: n.d.—194-?), 2.
105 *Ibid.*, 17.
106 *Ibid.*, 18.
107 Kaiser Company, 17.
108 "Nystrom Village Neighborhood Report," 16.

*Atchison Village*

Built in 1941 to house defense workers in the local Kaiser shipyards, Atchison Village was the first defense housing development in the country to be built with Lanham Act funds, and Richmond's first public defense housing project **(Figure 32)**. It was built by the Housing Authority of Richmond and included 450 units in 162 residential buildings, plus a central Community Building. The project provided spacious, clean, highly desirable dwellings during the war and was called "Richmond's most coveted wartime housing project" by a 1954 city report.[109] The development was purchased by a resident-formed housing cooperative in 1956. It has not sustained any major physical changes.


**Figure 32. View of Atchison Village, 1940s.**
**Source: Bancroft Library/Online Archive of California.**

**Construction**

Because Atchison Village was intended to be permanent housing, it was constructed with relatively high-quality materials and construction techniques **(Figure 33)**. This was unusual among wartime housing developments and especially projects funded by the Lanham Act, which mandated that projects be temporary housing. Like other wartime housing, though, time and cost efficiency were critical in building Atchison Village.

[109] *Atchison Village and Annex Housing Projects: Brief Historical Review and Alternate Methods of Future Operation*, Richmond, Office of the City Manager, October 25, 1954, D6, qtd. in "Atchison Village Defense Housing Project," National Register of Historic Places Registration Form, 16.


**Figure 33. View of Atchison Village during construction, ca. 1941.**
**Source: Richmond Museum.**

Standardized elements kept costs lower and sped up construction—a necessary challenge due to the Lanham Act's cost ceiling of $3,500 per unit. Five plan types were repeated throughout the development, lowering design and construction costs. All buildings featured hip roofs and redwood cladding, and the residential buildings included matching paneled doors, double-hung wood-sash windows, and covered concrete porches. The dwelling units had identical interior finishes, with wood and linoleum flooring, gypsum lath and plaster wall coating, and stained wood trim.

It has not been determined whether any of the new prefabrication techniques recognized by the contemporary building industry were used during the construction of Atchison Village.

**Site Plan**

The layout of Atchison Village drew inspiration from the Garden City concept, the design ideals manifested in World War I housing, and the public housing site plans of the 1930s. A superblock layout incorporated curvilinear streets, landscaping, and shared outdoor spaces ranging from small courtyards to a large park in the center **(Figure 34)**.

The superblocks proposed by the Garden City movement and promoted by the FHA and USHA formed the basis of Atchison Village's site plan. The curved and diagonal streets of Atchison Village echoed garden suburbs and early public housing's emphasis on natural, park-like settings. As with 1930s housing projects, landscaping was an integral part of the site. Landscape plans developed concurrently with building plans arranged the extensive open spaces in a variety of sizes ranging from small courtyards to the large central playing field.

The social ideals of garden suburbs, which had been translated to public housing in the 1930s, were expressed in Atchison Village. Building cohesive communities was a goal of the Garden City and later public housing projects that translated into a Community Building located prominently near the project's entrance and houses clustered around shared courtyards **(Figure 35)**. Focuses on self-improvement and safety were manifested in the large central playing field and separated pedestrian and automobile routes. Buildings were sited and configured to ensure that each dwelling unit received a healthy amount of light and ventilation, recalling Catherine Bauer's question, "How can some of that deep driving desire of American families to improve their home environment be transformed into a dynamic push for more and better community housing?"[110]

**Figure 35. View of Atchison Village Community Building, 1940s.**
**Source: Richmond Public Library/Online Archive of California.**



[110] Bauer and Ratensky.


Figure 34. Site plan of Atchison Village, with residential unit types shown. Source: Original drawing by Carl I. Warnecke, September 1941, for the FWA and USHA. Modified by Page & Turnbull, Inc.

The Atchison Village design also acknowledged the need for economy. Public housing designs of the 1930s recognized that superblocks lowered infrastructure costs, and this—in addition to social ideals—probably played a part in the project's design.

**Building design**

Architects Carl I. Warnecke and Andrew T. Hass designed Atchison Village with five types of 1- to 2-story buildings **(Figures 36-40)**. As in other defense housing developments, the architectural style was utilitarian, featuring hip roofs, redwood siding, and small covered porches. Ornamentation consisted solely of exposed rafter tails and corner boards. However, despite their simplicity and economy, the buildings expressed convictions about community life and individual quality of life that developed from the Garden City movement and the World War I and 1930s housing projects that followed.

The idea of a housing project as a whole community rather than isolated dwelling units appeared in WWI-era defense housing projects and, more strongly, in 1930s housing policy. Atchison Village incorporated this concept with similar designs of 1- to 2-story buildings capped by hip roofs with identical pitched. Standardized materials like siding, doors, and windows, and even sparse architectural details like corner boards and exposed rafter tails, repeated in every building and visually unified the development.

The common aesthetic did not extend to homogeneity. In keeping with the "village" model of WWI defense housing developments and garden suburbs, Atchison Village's 1- to 2-story buildings comprised a landscape with small-scale buildings of varying heights **(Figure 41)**. The five building types were repeated throughout the project to avoid visual monotony. As in garden suburbs, residential buildings were clustered rather than aligned in rows, to avoid the appearance of rowhouses or large apartment buildings.

**Figure 41. Atchison Village, 1940s.**
**Source: Bancroft Library/Online Archive of California.**

Quality of life for residents was also considered. Earlier designers emphasized the importance of providing every dwelling unit with light and ventilation. In Atchison Village, dwelling units were arranged in a linear configuration that provided every habitable room with at least one window to the outdoors and allowed air to circulate through living areas. Direct access to the outdoors aimed to connect residents to nature.

As with previous public housing developments and contemporary defense housing projects, the design expressed its utilitarian purpose of housing people quickly and inexpensively. The utilitarian architectural style and minimal ornamentation affirmed the plain styles of public housing from the 1930s. Residential buildings built on the cost-saving advice of earlier public housing designers who advised against including full dining rooms, long hallways, and any interior area that might be wasted space.

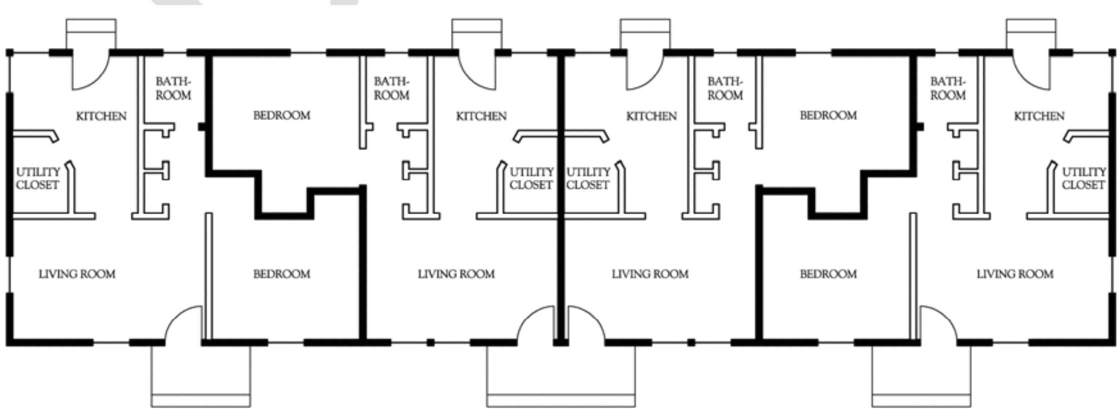


**Figure 36. Floor plan of Residential Unit Type 1 (not to scale).**
**Source: National Register Registration Form.**

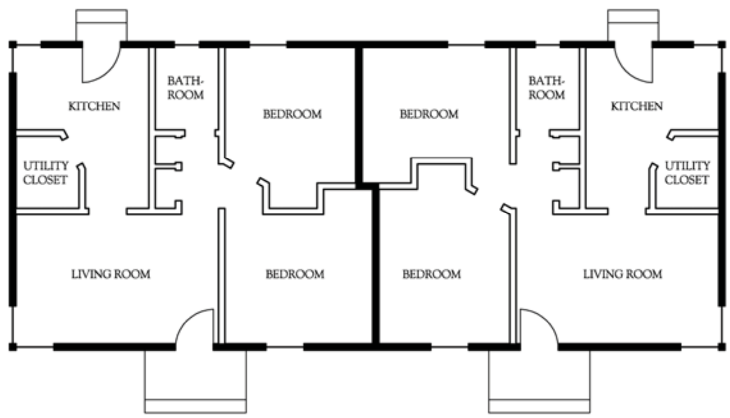


**Figure 37. Floor plan of Residential Unit Type 2 (not to scale).**
**Source: National Register Registration Form.**

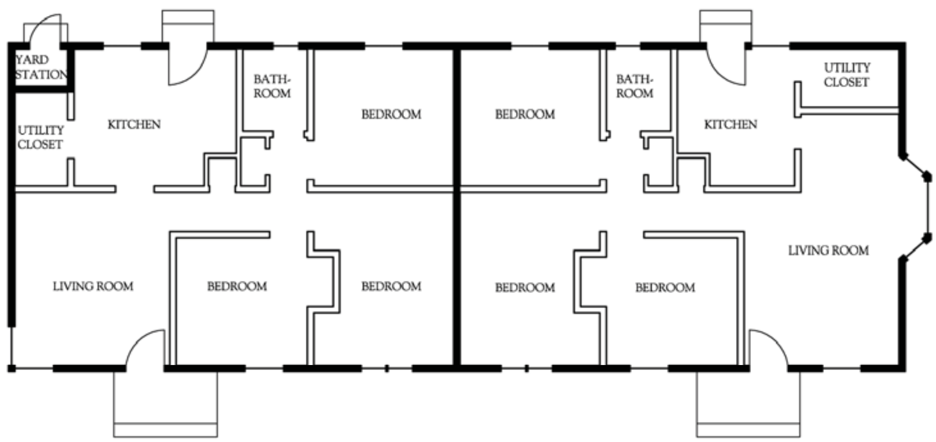


**Figure 38. Floor plan of Residential Unit Type 3 (not to scale).**
**Source: National Register Registration Form.**

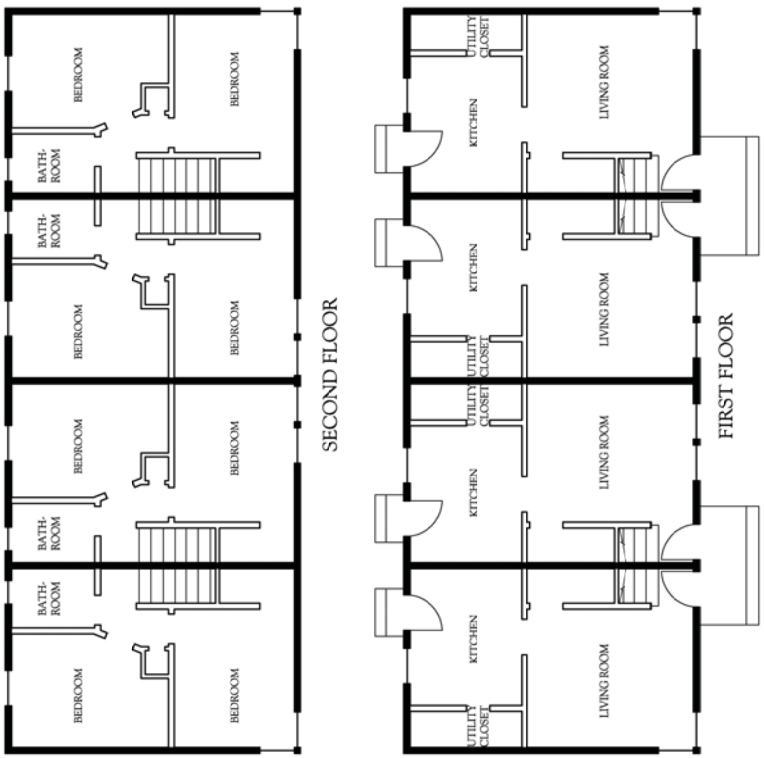


**Figure 39. Floor plan of Residential Unit Type 4 (not to scale).**
**Source: National Register Registration Form.**

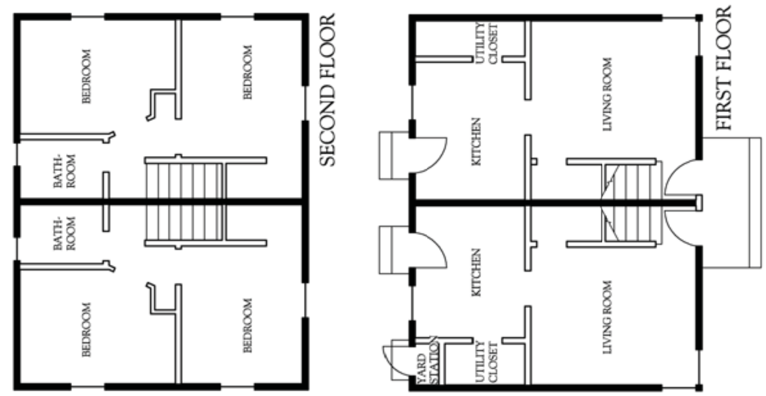


**Figure 40. Floor plan of Residential Unit Type 5 (not to scale).**
**Source: National Register Registration Form.**

*Atchison Village Annex*

Atchison Village Annex was constructed at the same time as Atchison Village. Located across Chanslor Avenue from Atchison Village, the Annex includes 50 duplex buildings designed by Frederick H. Reimers.[111] The buildings are of a lower standard of construction than Atchison Village, with partitions and walls of "demountable" plywood. The Annex is not included in the Atchison Village Defense Housing Project National Register Historic District.

*Nystrom Village*

Nystrom Village is one of Richmond's two remaining defense housing projects. It initially was designed as permanent low-income housing. By the time it was constructed in 1941, the USHA requested that it be converted to a permanent defense project.[112] Hailed as "a very well planned, highly desirable housing development" for defense workers, Nystrom Village covers 12.8 acres across four city blocks, with lot coverage of 14 percent, and includes 51 duplexes containing a variety of 1 to 3-bedroom units.[113] The duplexes are grouped around the perimeter of each block in a rough "3" shape, with a parking lot and two common open areas in the center **(Figure 42)**. A community building was not included in the original project.[114] Architects Narbett, Bangs and Hurd designed the buildings in a simple utilitarian style with hip or gable roofs, stucco cladding, small covered porches, and without ornamentation. Buildings were designed in one of four plan types. A 2004 report called Nystrom Village "significant for embodying innovative design ideals for public housing of the era."[115] Another report in 2008 deemed Nystrom Village eligible for the National Register because of its association with the World War II-era federal housing program and as an early example of public housing in Richmond.[116]



111 Thomas K. Butt, FAIA, "History of Atchison Village Richmond, California" <http://www.rosietheriveter.org/parkav.htm; accessed March 19, 2009>.
112 "Historic Resources Evaluation Report," 2.
113 Kaiser Company, 17; "Nystrom Village Neighborhood Report," 16.
114 "Nystrom Village Neighborhood Report," 17.
115 *Ibid.*, 16.
116 "Historic Resources Evaluation Report," 2.


**Figure 43. Aerial view of Nystrom Village.**
**Source: Microsoft Virtual Earth <maps.live.com>.**

*Triangle Court*

Triangle Court joined Atchison Village and Nystrom Village as Richmond's third permanent housing project. Located in at the northern apex of the Iron Triangle area, the project was funded by the USHA and intended as permanent low-rent housing.[117] It was designed in the Modern style by Narbett, Bangs and Hurd, with low flat-roofed buildings clad in stucco **(Figures 44-45)**.[118] Triangle Court was demolished and replaced by a new low-income housing development in the 1980s.[119]

117 "Atchison Village Defense Housing Project," 15.
118 "Nystrom Neighborhood Report," 17.
119 Graves.

**Figure 44. View of Triangle Court.**
**Source: Richmond Museum.**


**Figure 45. Aerial view of Triangle Court.**
**Source: Richmond Public Library/Online Archive of California.**

## V. CARL I. WARNECKE, ARCHITECT

Architect Carl I. Warnecke (1891-1971) was a Bay Area architect who designed many housing projects during World War II. Warnecke studied at the Ecole des Beaux Arts in Paris in 1914, but left when the school closed during World War I.[120] Upon his return to the United States, he worked for the firm of Bakewell and Brown for a year and apprenticed under Bernard Maybeck[121]

In the early 1940s, Warnecke lived in Oakland and served as Chairman of the Oakland Housing Authority's Board of Architects, which designed at least three public housing projects.[122] He was named by the Richmond Housing Authority to design 2,000 defense dwelling units with E. Geoffrey Bangs and Vincent G. Raney.[123] Resulting projects included the Canal War Apartments and Atchison Village.[124] The Alameda Housing Authority also appointed Andrew T. Hass and Warnecke to design 2,000 war apartments and defense dwelling units.[125]



[120] "Carl I. Warnecke," San Francisco Architectural Heritage file.
[121] *Ibid.*; "Atchison Village Defense Housing Project."
[122] Fred Jones, "Oakland's Low Rent Housing Projects," *Architect and Engineer*, October 1942, 16.
[123] Jones.
[124] Graves, 43.
[125] Jones.

## VI. National Register Evaluation – Criterion C

This section contains an evaluation of Atchison Village's eligibility for listing in the National Register of Historic Places as a potential historic district under Criterion C (Design/Construction).

*National Register of Historic Places*

The National Register of Historic Places is the official Federal list of districts, sites, buildings, structures and objects significant in American history, architecture, archeology, engineering, and culture. These resources contribute to an understanding of the historical and cultural foundations of the Nation at the national, state, or local level. Typically, resources over fifty years of age are eligible for listing in the National Register if they meet any one of the four significance criteria and if they retain sufficient historic integrity to convey that significance. However, resources under fifty years of age can be determined eligible if it can be demonstrated that they are of "exceptional importance." National Register criteria are defined in depth in *National Register Bulletin Number 15: How to Apply the National Register Criteria for Evaluation*. There are four basic criteria under which a structure, site, building, district, or object can be considered eligible for listing in the National Register. These criteria are:

> Criterion A (Event): Properties associated with events that have made a significant contribution to the broad patterns of our history;
>
> Criterion B (Person): Properties associated with the lives of persons significant in our past;
>
> Criterion C (Design/Construction): Properties that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant distinguishable entity whose components lack individual distinction; and
>
> Criterion D (Information Potential): Properties that have yielded, or may be likely to yield, information important in prehistory or history.

A resource can be considered significant on a national, state, or local level to American history, architecture, archaeology, engineering, and culture.

The context *Public Housing in the United States, 1933-1949* (1999) was developed to assist federal and local housing agencies in meeting their responsibilities under the National Historic Preservation Act. It "provides a framework for identifying historic housing projects…and establishes criteria for evaluating public housing projects for listing in the National Register of Historic Places."[126] Guidelines are given by this publication for each of the four National Register Criteria. As the purpose of this report is to evaluate Atchison Village under Criterion C (Design/Construction), only guidelines for Criterion C are provided here. The above publication states that Criterion C applies when one or more of the following guidelines are met:

> Guideline #1. "Embody the distinctive characteristics of a type, period, style, or method of construction."
>
> Guideline #2. "Represent the major work of a master architect, planner, or engineer."
>
> Guideline #3. "Possess high artistic value."

<u>Criterion C (Design/Construction)</u>

Atchison Village appears to be significant at the local level under Criterion C (Design/Construction) as a Public Housing Project property type and under the Architecture and Community Planning & Development themes. It is one of two remaining defense housing projects in Richmond, a city that held the largest World War II federal housing program in the U.S.[127] Furthermore, it provides a local example of how national trends in public housing were applied to wartime defense housing developments.

The recommended period of significance is 1941, the date of construction.

The *Public Housing in the United States* guidelines for Criterion C apply to Atchison Village as follows:

> **Guideline #1. "Embody the distinctive characteristics of a type, period, style, or method of construction."**

Atchison Village embodies the distinctive characteristics of a type and period of construction, representing a publicly-funded multi-family housing complex built during World War II. Constructed in 1941 under the Lanham Act, Atchison Village was Richmond's first defense housing project and is one of only two remaining defense housing developments in the city. The Lanham Act set a strict cost ceiling that required standardization and economy of design and construction. Accordingly, the

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[126] Robinson et al., Vol. I, 2.
[127] "Historic Resource Evaluation Report," 8.

buildings in Atchison Village were designed in a simple utilitarian style, unadorned except for exposed rafter tails and covered porches; have floor plans designed for efficiency; and display standardized plans in several building types. Therefore, Guideline #1 applies to Atchison Village under the theme of Architecture.

Furthermore, as a permanent housing development built relatively early in the war, Atchison Village balances its economical design with design concepts derived from public housing models of the 1930s and garden suburbs. The site plan employs a superblock layout, curving and diagonal streets, separate pedestrian and automobile circulation, landscaping, low ground coverage, and five low-rise building types to create a varied landscape. The project is unified visually by common architectural elements such as identical cladding and covered porches; and the central Community Building, clustered residential buildings, and common courtyards suggest the ideal of a cohesive social community. No other defense housing projects constructed in Richmond included a community center. Nystrom Village, the only other extant defense housing development and the most comparable to Atchison Village, was developed within the rectilinear city street grid.

Therefore, Guideline #1 also applies to Atchison Village under the theme of Community Planning and Development. The project serves as a physical symbol of how Garden City ideals and 1930s design theories regarding large-scale public housing reacted and adapted to wartime pressures on time and cost. The result was defense housing developments that blended social ideals, site planning and architectural design concepts, and economy.

**Guideline #2. "Represent the major work of a master architect, planner, or engineer."**

Carl I. Warnecke does not appear to be a master architect. He designed or contributed to the design of thousands of housing units in the East Bay during World War II, but none of these developments appear to be of outstanding architectural merit. Little is known about his other work. Therefore, Guideline #2 does not apply to the evaluation of Atchison Village under Criterion C.

**Guideline #3. "Possess high artistic value."**

Atchison Village does not appear to possess high artistic value. It was built according to the Lanham Act, which set a strict cost ceiling that required standardization and economy of design and construction. Therefore, Guideline #3 does not apply to the evaluation of Atchison Village under Criterion C.

*Character-Defining Features*

For historic resources, the character-defining features are those prominent or distinctive aspects, qualities, or characteristics that contribute significantly to a resource's character. The character-defining features best convey a resource's historical significance. Atchison Village's character-defining features are summarized below.

**Site Plan**

- Superblock configuration
- Low ground (or lot) coverage
- Clustered residential buildings
- Buildings oriented towards the street or grouped around shared courtyards
- Centrally-located Community Building
- Centrally-located playing field
- Courtyards
- Side yards
- Landscaping, including original Monterey pines, Australian black acacias, and weeping willows

**Circulation**

- Curvilinear and diagonal streets
- Separate pedestrian and automobile routes
- On-street parking niches

**Buildings and Structures**

- Building exteriors
  - Five building types
  - Simple architectural style
  - Common architectural elements such as cladding, doors, window types and materials, height and pitch of rooflines, covered entry porches, and exposed rafter tails
  - Lack of architectural ornamentation

- Building interiors
  - Five residential plan types
  - Efficient space planning demonstrated by lack of dining rooms, short hallways, etc.

*Integrity*

In addition to qualifying for listing under at least one of the National Register/California Register criteria, a property must be shown to have sufficient historic integrity in order to be considered eligible for listing in the National Register of Historic Places. The concept of integrity is essential to identifying the important physical characteristics of historical resources and hence, in evaluating adverse changes to them. Integrity is defined as "the authenticity of an historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance."

The process of determining integrity is similar for both the California Register of Historic Resources and the National Register of Historic Places. The same seven variables or aspects that define integrity—location, design, setting, materials, workmanship, feeling and association—are used to evaluate a resource's eligibility for listing in the California Register and the National Register. According to the *National Register Bulletin: How to Apply the National Register Criteria for Evaluation*, these seven characteristics are generally defined as follows:

> Location is the place where the historic property was constructed.
>
> Design is the combination of elements that create the form, plans, space, structure and style of the property.
>
> Setting addresses the physical environment of the historic property inclusive of the landscape and spatial relationships of the building/s.
>
> Materials refer to the physical elements that were combined or deposited during a particular period of time and in a particular pattern of configuration to form the historic property.
>
> Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history.
>
> Feeling is the property's expression of the aesthetic or historic sense of a particular period of time.
>
> Association is the direct link between an important historic event or person and a historic property.

The National Register Nomination for Atchison Village determined that the property retains integrity. The property was listed in the National Register in 2003.

## VII. CONCLUSION

Atchison Village, constructed in 1941 as a defense housing development under the Lanham Act, appears eligible for the National Register under Criterion C (Design/Construction) at the local level. Atchison Village appears significant under the themes of Architecture and Community Planning & Development. As a publicly-funded multi-family housing complex built during World War II, Atchison Village embodies the distinctive characteristics of a type and period of construction. Atchison Village's utilitarian style, standardized building designs, and efficient floor plans embody the distinctive characteristics of the World War II-era defense housing type. Additionally, the superblock site plan, curvilinear streets, building clusters, and Community Building reflect the national ideals in 1930s public housing and Garden City models. Atchison Village is one of two remaining defense housing developments in Richmond.

The project serves as a physical symbol of how Garden City ideals and 1930s design theories regarding large-scale public housing were adapted at the local level in reaction to wartime pressures on time and cost. The result was defense housing developments that blended social ideals, site planning and architectural design concepts, and economy. The period of significance is 1941, the date of construction.

The property retains integrity.

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# APPENDIX F

## CIVIL: DRAINAGE CALCULATIONS


SHERWOOD Design Engineers

# ATCHISON VILLAGE

RICHMOND, CALIFORNIA

DATE: July 17, 2009

SHERWOOD Design Engineers

**Table C-1: Weighted Runoff Coefficient (C) for Whole Site**

| Impervious (ac) | Pervious (ac) | Total (ac) | Weighted C Value |
|---|---|---|---|
| 30.14 | 29.46 | 59.60 | 0.603 |

**Table C-2: Time of Concentration for Whole Site**

| Length of Flow (ft) | Slope (ft/ft) | C Value | FAA Time of Concentration (min) |
|---|---|---|---|
| 2717 | 0.0025 | 0.603 | 73.7 |

**Table C-3: Design Storm Rainfall Intensities**

| | 2 yr | 5 yr | 10 yr | 25 yr | 50 yr | 100 yr |
|---|---|---|---|---|---|---|
| I (Rainfall intensity, in/hr) | 0.495 | 0.695 | 0.829 | 0.998 | 1.120 | 1.242 |

**Table C-4: Peak Stormwater Runoff Flow Rates for Different Frequency Storms**

| Q-2yr (cfs) | Q-5yr (cfs) | Q-10yr (cfs) | Q-25yr (cfs) | Q-50yr (cfs) | Q-100yr (cfs) |
|---|---|---|---|---|---|
| 17.79 | 24.00 | 29.80 | 35.87 | 40.26 | 44.62 |

SHERWOOD Design Engineers

## Table C-5: Individual Capacity Analysis of Storm Drain Piping

2-yr Storm Event

| Structure ID | Drainage Area (ac) | Weighted C Value | Rainfall Intensity (in/hr) | Peak Runoff (ft3/s) | Pipe Length (ft) | Pipe Slope (ft/ft) | Manning's n | Pipe Size (in) | Velocity (ft/s) | Full Flow (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|
| SB-1 to SB-3 | 10.887 | 0.56 | 0.50 | 3.02 | 72 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-2 to SB-3 | 31.260 | 0.56 | 0.50 | 8.69 | 62 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-4 to Out 4 | 1.350 | 0.47 | 0.50 | 0.32 | 150 | 0.00 | 0.024 | 18 | 1.29 | **2.28** |
| SB 1+3 to Out | 19.612 | 0.65 | 0.50 | 6.30 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |
| SB-2+3 to Out | 39.985 | 0.61 | 0.50 | 12.12 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |

10-yr Storm Event

| Structure ID | Drainage Area (ac) | Weighted C Value | Rainfall Intensity (in/hr) | Peak Runoff (ft3/s) | Pipe Length (ft) | Pipe Slope (ft/ft) | Manning's n | Pipe Size (in) | Velocity (ft/s) | Full Flow (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|
| SB-1 to SB-3 | 10.887 | 0.56 | 0.83 | 5.06 | 72 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-2 to SB-3 | 31.260 | 0.56 | 0.83 | 14.55 | 62 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-4 to Out 4 | 1.350 | 0.47 | 0.83 | 0.53 | 150 | 0.00 | 0.024 | 18 | 1.29 | **2.28** |
| SB 1+3 to Out | 19.612 | 0.65 | 0.83 | 10.55 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |
| SB-2+3 to Out | 39.985 | 0.61 | 0.83 | 20.31 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |

25-yr Storm Event

| Structure ID | Drainage Area (ac) | Weighted C Value | Rainfall Intensity (in/hr) | Peak Runoff (ft3/s) | Pipe Length (ft) | Pipe Slope (ft/ft) | Manning's n | Pipe Size (in) | Velocity (ft/s) | Full Flow (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|
| SB-1 to SB-3 | 10.887 | 0.56 | 1.00 | 6.09 | 72 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-2 to SB-3 | 31.260 | 0.56 | 1.00 | 17.52 | 62 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-4 to Out 4 | 1.350 | 0.47 | 1.00 | 0.64 | 150 | 0.00 | 0.024 | 18 | 1.29 | **2.28** |
| SB 1+3 to Out | 19.612 | 0.65 | 1.00 | 12.70 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |
| SB-2+3 to Out | 39.985 | 0.61 | 1.00 | 24.45 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |

50-yr Storm Event

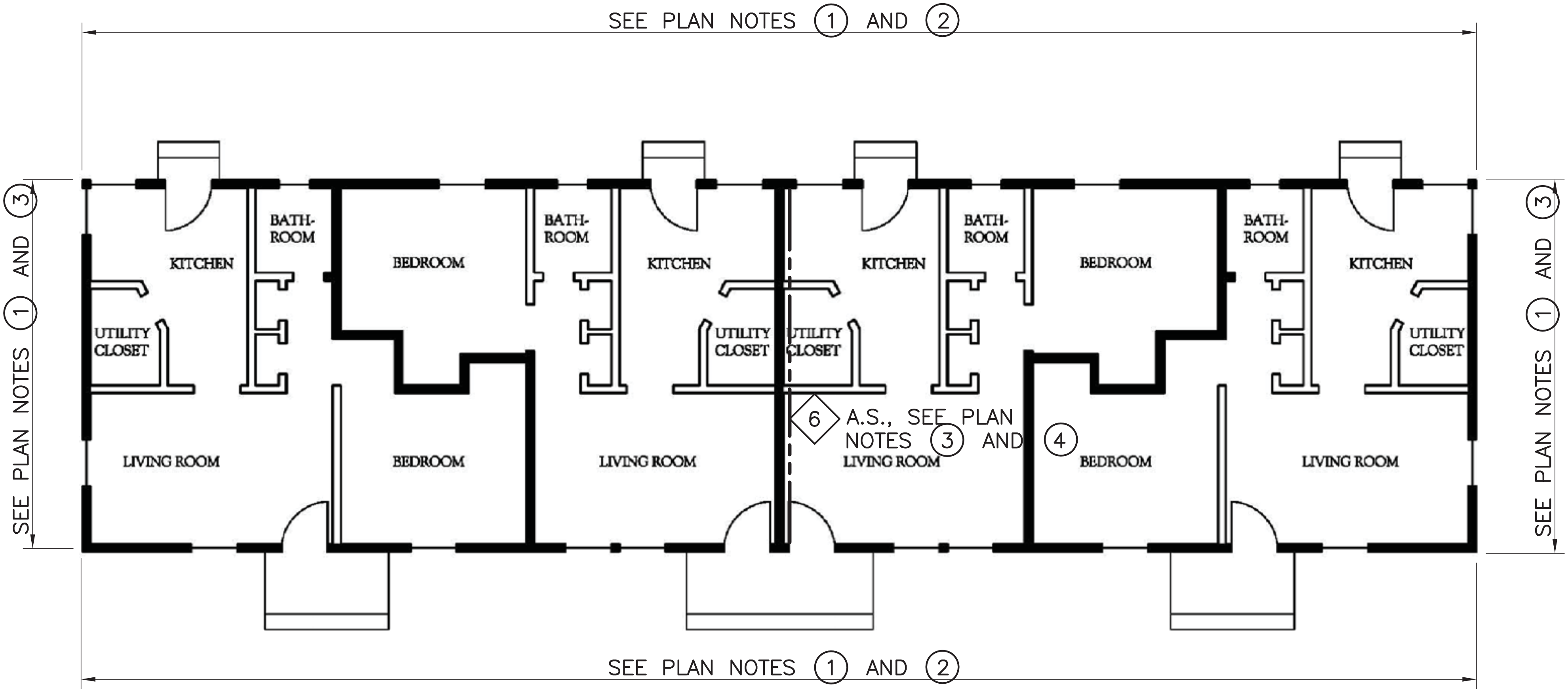
| Structure ID | Drainage Area (ac) | Weighted C Value | Rainfall Intensity (in/hr) | Peak Runoff (ft3/s) | Pipe Length (ft) | Pipe Slope (ft/ft) | Manning's n | Pipe Size (in) | Velocity (ft/s) | Full Flow (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|
| SB-1 to SB-3 | 10.887 | 0.56 | 1.12 | 6.84 | 72 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-2 to SB-3 | 31.260 | 0.56 | 1.12 | 19.66 | 62 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-4 to Out 4 | 1.350 | 0.47 | 1.12 | 0.71 | 150 | 0.00 | 0.024 | 18 | 1.29 | **2.28** |
| SB 1+3 to Out | 19.612 | 0.65 | 1.12 | 14.25 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |
| SB-2+3 to Out | 39.985 | 0.61 | 1.12 | 27.43 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |

100-yr Storm Event

| Structure ID | Drainage Area (ac) | Weighted C Value | Rainfall Intensity (in/hr) | Peak Runoff (ft3/s) | Pipe Length (ft) | Pipe Slope (ft/ft) | Manning's n | Pipe Size (in) | Velocity (ft/s) | Full Flow (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|
| SB-1 to SB-3 | 10.887 | 0.56 | 1.24 | 7.58 | 72 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-2 to SB-3 | 31.260 | 0.56 | 1.24 | 21.80 | 62 | 0.00 | 0.024 | 18 | 1.44 | **2.55** |
| SB-4 to Out 4 | 1.350 | 0.47 | 1.24 | 0.79 | 150 | 0.00 | 0.024 | 18 | 1.29 | **2.28** |
| SB 1+3 to Out | 19.612 | 0.65 | 1.24 | 15.81 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |
| SB-2+3 to Out | 39.985 | 0.61 | 1.24 | 30.42 | 300 | 0.00 | 0.015 | 27 | 3.03 | **12.03** |

# APPENDIX G

## STRUCTURAL: DRAWINGS AND DETAILS



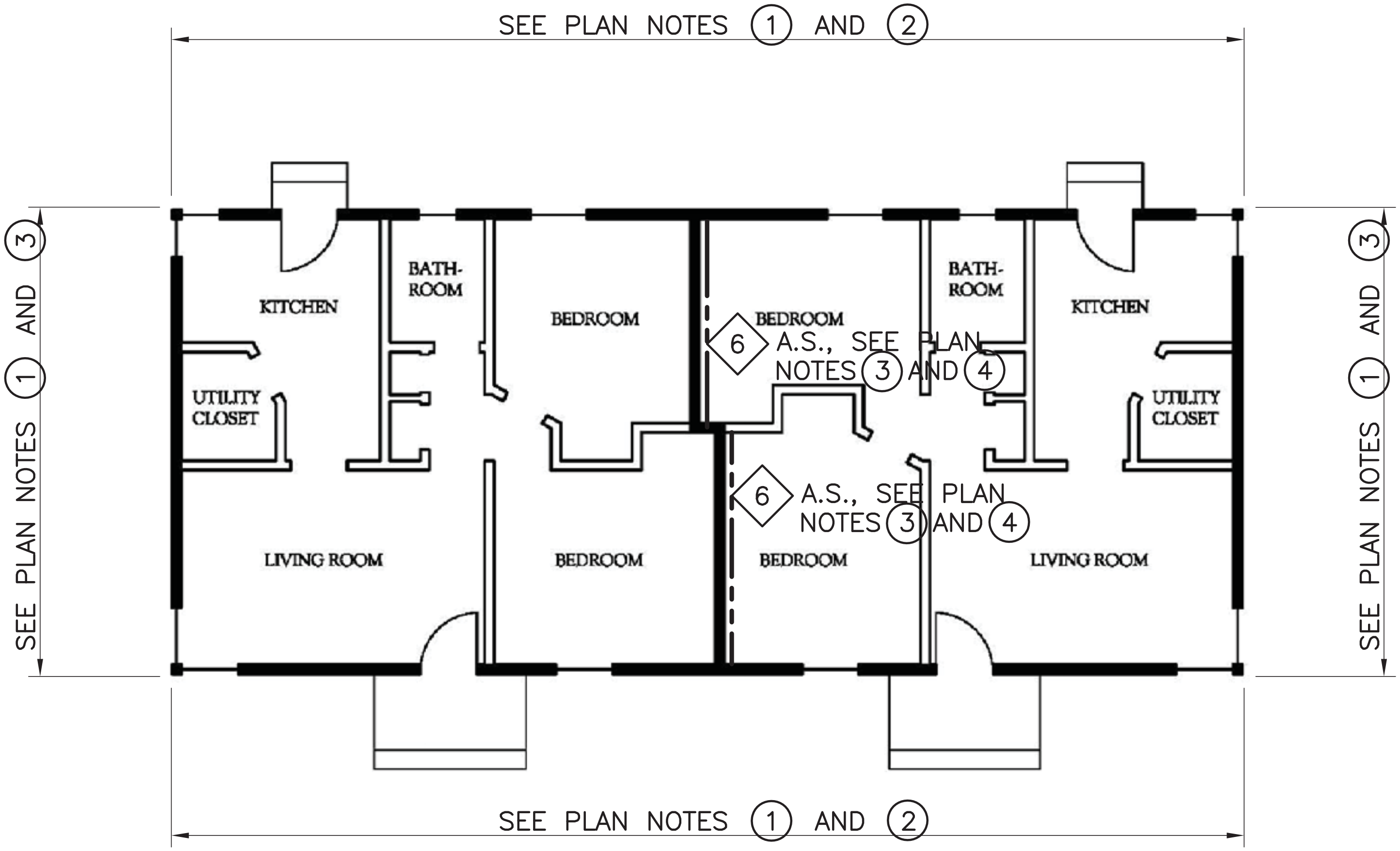

NOTES: SEE SKETCH SK6 IN APPENDIX 'A' FOR TYPICAL PLAN NOTES AND REFERENCES.

SK1

RESIDENTIAL BUILDING TYPE I
DIAGRAMMATIC FLOOR PLAN

ATCHISON VILLAGE DEFENSE HOUSING PROJECT
RICHMOND, CA

SCALE = NOT TO SCALE

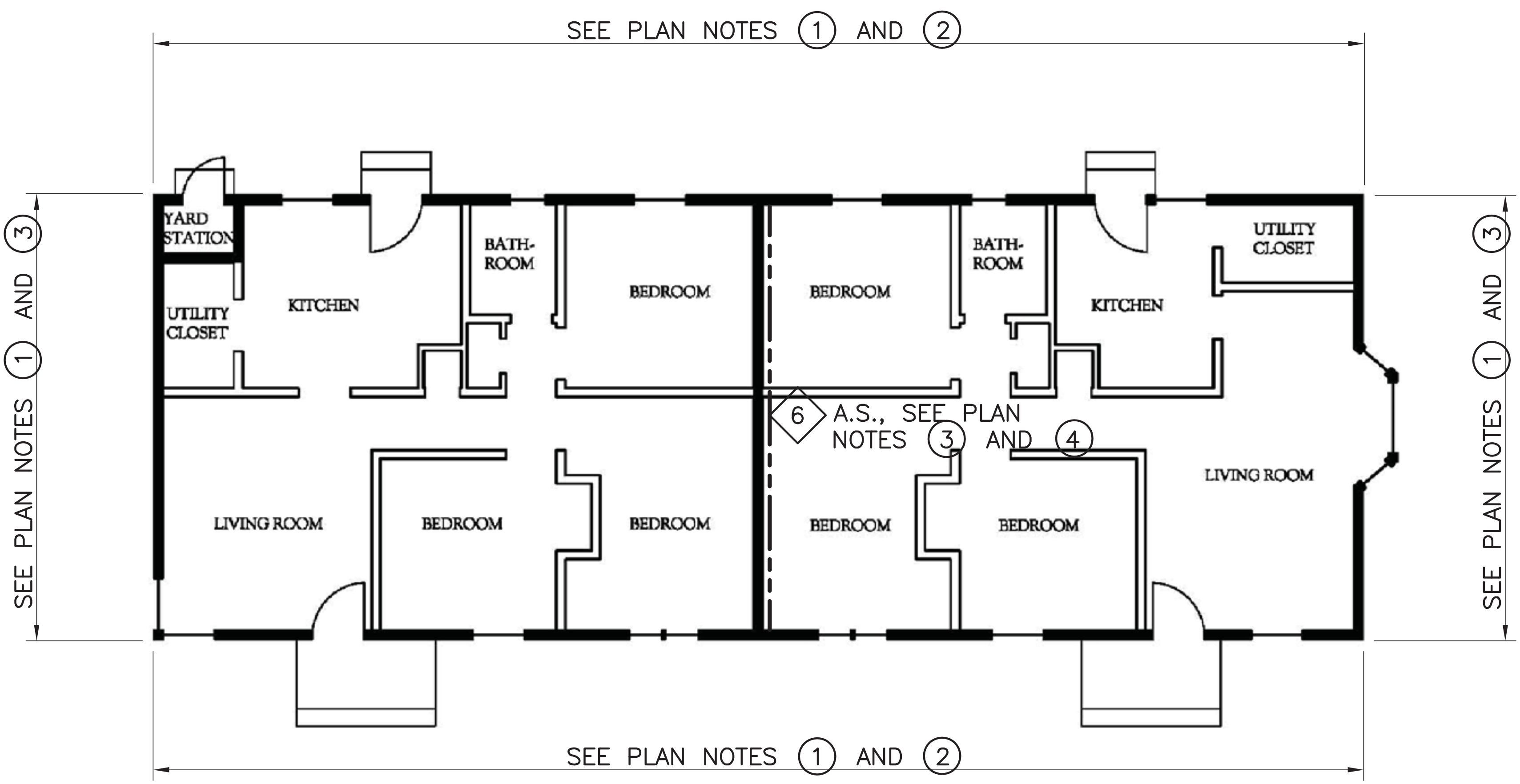



NOTES: SEE SKETCH SK6 IN APPENDIX 'A' FOR TYPICAL PLAN NOTES AND REFERENCES.

# SK2

RESIDENTIAL BUILDING TYPE 2 | ATCHISON VILLAGE DEFENSE HOUSING PROJECT | SCALE = NOT TO SCALE

DIAGRAMMATIC FLOOR PLAN | RICHMOND, CA

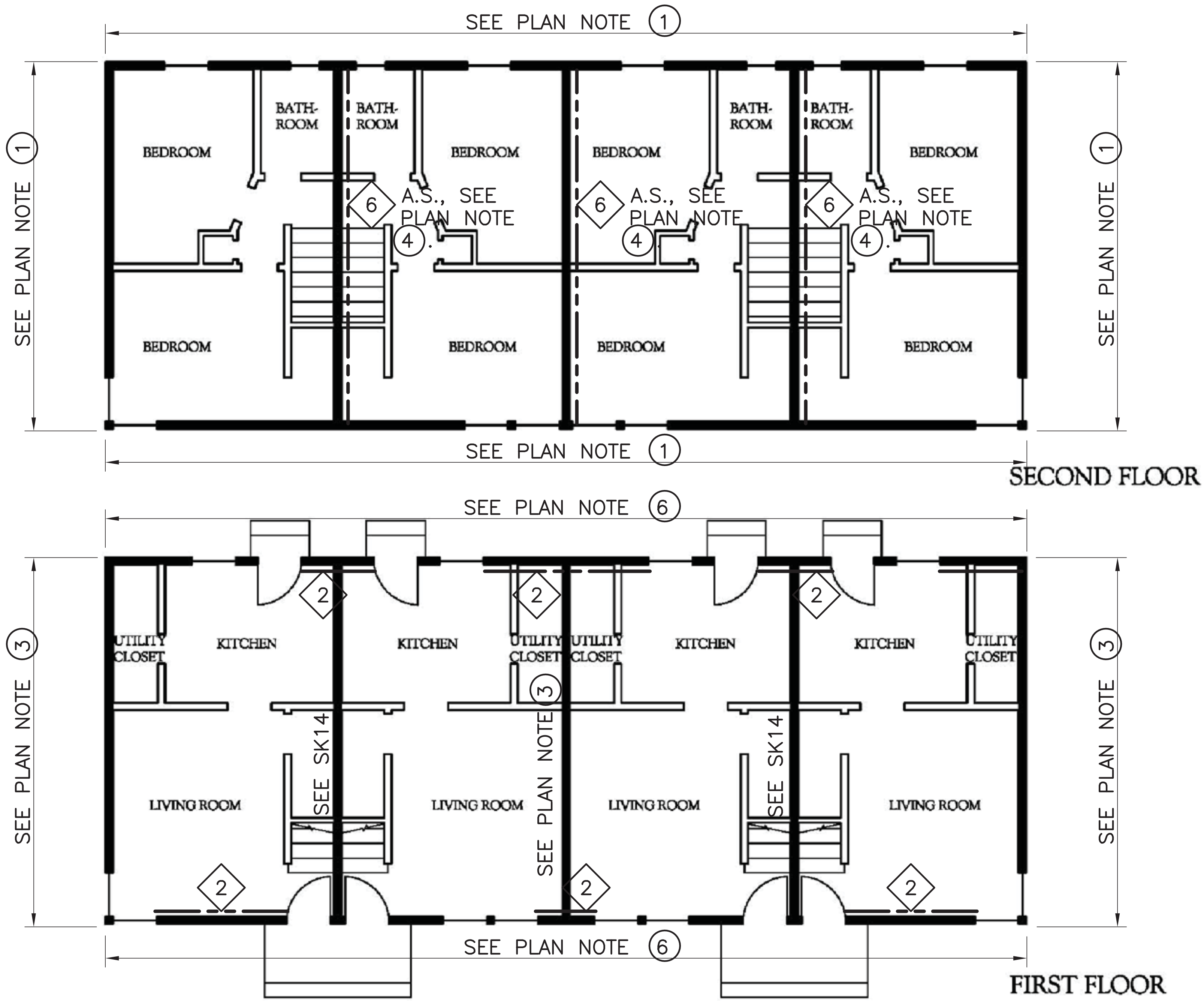



NOTES: SEE SKETCH SK6 IN APPENDIX 'A' FOR TYPICAL PLAN NOTES AND REFERENCES.

# SK3

RESIDENTIAL BUILDING TYPE 3 — ATCHISON VILLAGE DEFENSE HOUSING PROJECT — SCALE = NOT TO SCALE

DIAGRAMMATIC FLOOR PLAN — RICHMOND, CA



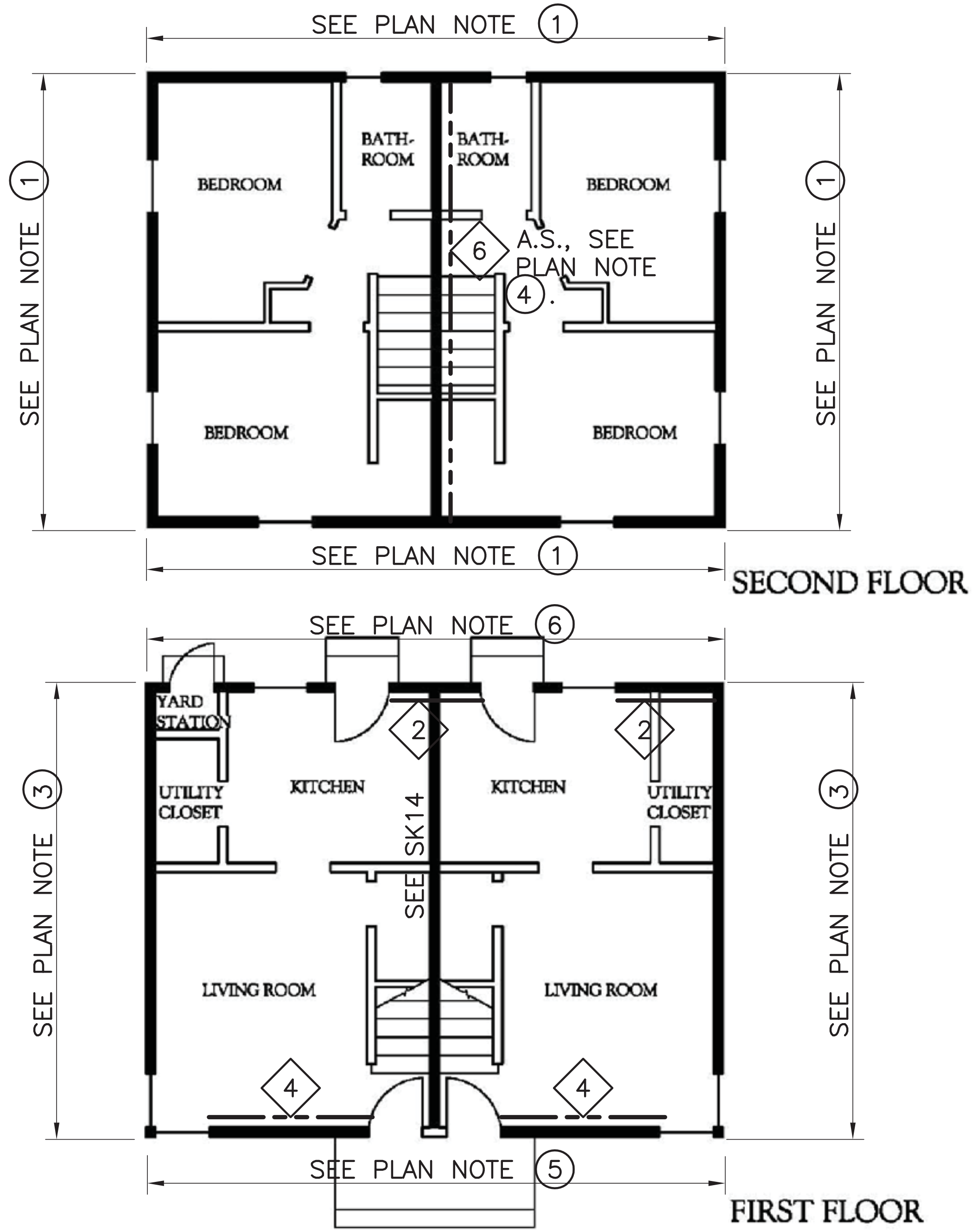

NOTES: SEE SKETCH SK6 IN APPENDIX 'A' FOR TYPICAL PLAN NOTES AND REFERENCES.

# SK4

SCALE = NOT TO SCALE

RESIDENTIAL BUILDING TYPE 4
DIAGRAMMATIC FLOOR PLANS

ATCHISON VILLAGE DEFENSE HOUSING PROJECT
RICHMOND, CA




NOTES: SEE SKETCH SK6 IN APPENDIX 'A' FOR TYPICAL PLAN NOTES AND REFERENCES.

# SK5

SCALE = NOT TO SCALE

RESIDENTIAL BUILDING TYPE 5
DIAGRAMMATIC FLOOR PLANS

ATCHISON VILLAGE DEFENSE HOUSING PROJECT
RICHMOND, CA

## PLAN NOTES – RESIDENTIAL BUILDING TYPE 1 TO 5



(1) PROVIDE (N) 2x SHAPED EDGE BLOCKING BETWEEN ROOF RAFTERS IN ATTIC SPACE AND (N) SIMPSON A35 CLIPS @ 16"o.c. AT (N) BLOCKS. SEE SK11.

(2) PROVIDE (N) SIMPSON A35 CLIPS TO (E) 2x BLOCKS BELOW FLOOR @ 32"o.c. AND (N) SIMPSON UFP10–SDS3 ANCHOR PLATES @ 48"o.c. SEE SK15, SK16.

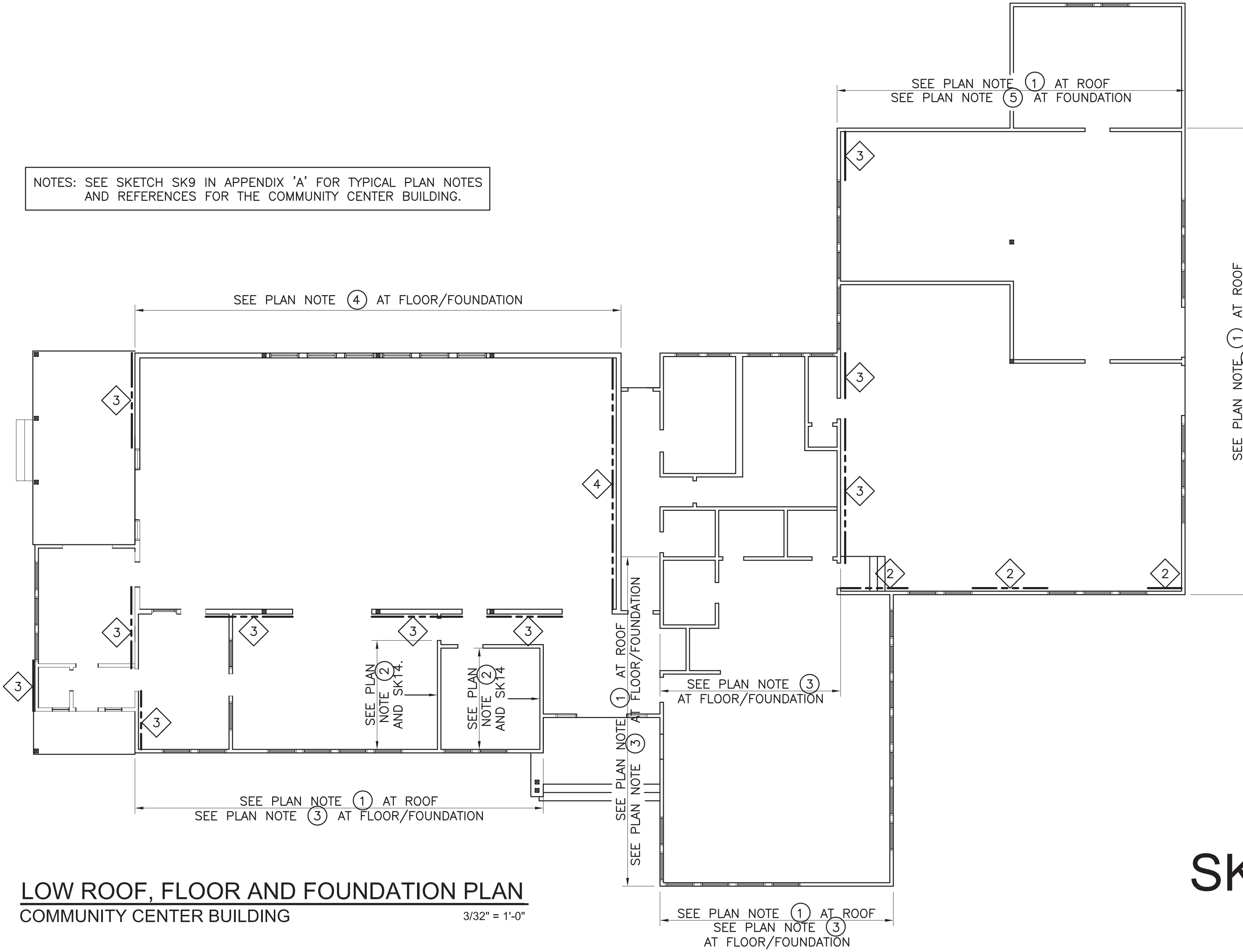
(3) PROVIDE (N) SIMPSON A35 CLIPS TO (E) 2x BLOCKS BELOW FLOOR @ 16"o.c. AND (N) SIMPSON UFP10–SDS3 ANCHOR PLATES @ 24"o.c. SEE SK15, SK16.

(4) ◇6 A.S. – INDICATES (N) TYPE 6 (10d @ 6"o.c. EDGE NAILING) PLYWOOD SHEARWALL IN ATTIC SPACE TO EXTEND (E) INTERIOR DEMISING/PARTITION WALL TO ROOF DIAPHRAGM. SEE SK11 AND SK13.

(5) ◇4 – INDICATES (N) TYPE 4 (10d @ 4"o.c. EDGE NAILING) PLYWOOD SHEARWALL ABOVE THE FIRST FLOOR. REMOVE AND REPLACE EXISTING PLASTER. SEE ALSO SCHEDULE ON SK10. SEE NOTE (2) ABOVE FOR REMAINDER OF FOUNDATION WHERE NO SHEARWALL ABOVE.

(6) ◇2 – INDICATES (N) TYPE 2 (10d @ 2"o.c. EDGE NAILING) PLYWOOD SHEARWALL ABOVE THE FIRST FLOOR. REMOVE AND REPLACE EXISTING PLASTER. SEE ALSO SCHEDULE ON SK10. SEE NOTE (2) ABOVE FOR REMAINDER OF FOUNDATION WHERE NO SHEARWALL ABOVE.

NOTES: SEE SKETCH SK9 IN APPENDIX 'A' FOR TYPICAL PLAN NOTES AND REFERENCES FOR THE COMMUNITY CENTER BUILDING.



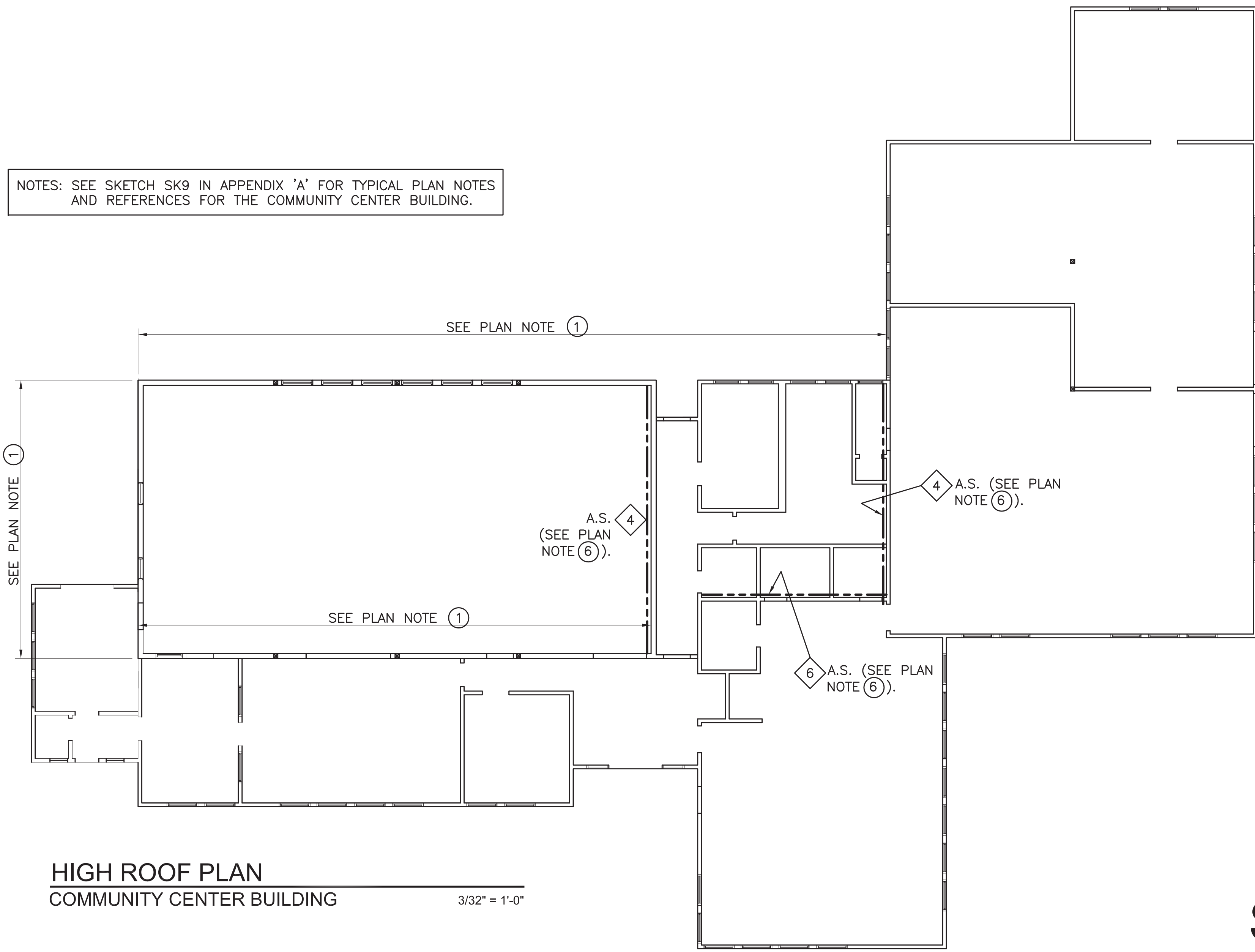

LOW ROOF, FLOOR AND FOUNDATION PLAN

COMMUNITY CENTER BUILDING

3/32" = 1'-0"

SK7

NOTES: SEE SKETCH SK9 IN APPENDIX 'A' FOR TYPICAL PLAN NOTES AND REFERENCES FOR THE COMMUNITY CENTER BUILDING.




## HIGH ROOF PLAN

COMMUNITY CENTER BUILDING 3/32" = 1'-0"

SK8

## PLAN NOTES – COMMUNITY CENTER BUILDING

(1) PROVIDE (N) 2x SHAPED EDGE BLOCKING BETWEEN ROOF RAFTERS IN ATTIC SPACE AND (N) SIMPSON A35 CLIPS @ 16"o.c. AT (N) BLOCKS. SEE SK11.

(2) PROVIDE (N) 2X SOLID, TAPERED BLOCKING OVER INTERIOR WALLS TO TIE TO ROOF DIAPHRAGM. CLIP (N) BLOCKING TO (E) WALL TOP PLATE WITH SIMPSON LTP4 CLIPS @ 32"o.c. AND TO ROOF SHEATHING WITH SIMPSON A35 CLIPS @ 32"o.c.

(3) PROVIDE (N) SIMPSON A35 CLIPS TO (E) 2x BLOCKS BELOW FLOOR @ 32"o.c. AND (N) SIMPSON UFP10–SDS3 ANCHOR PLATES @ 48"o.c. SEE SK15, SK16.

(4) PROVIDE (N) SIMPSON A35 CLIPS TO (E) 2x BLOCKS BELOW FLOOR @ 16"o.c. AND (N) SIMPSON UFP10–SDS3 ANCHOR PLATES @ 24"o.c. SEE SK15, SK16.

(5) PROVIDE (N) 5/8"ø x7" EMBED, A36 THREADED ROD BOLTS @ 48"o.c. FOR CONNECTION OF (E) STUD WALL SILL PLATES TO (E) FOUNDATIONS. DRILL AND EPOXY GROUT. PROVIDE (N) 3"x3"x1/4" PLATE WASHERS ON EACH (N) BOLT ON TOP OF (E) SILL PLATES. SEE SK17.

(6) ◇6 A.S.; ◇4 A.S. – INDICATES (N) TYPE 6 (10d @ 6'o.c.. EDGE NAILING) OR (N) TYPE 4 (10d @ 4"o.c. EDGE NAILING) PLYWOOD SHEARWALL IN ATTIC SPACE TO EXTEND (E) INTERIOR DEMISING/PARTITION WALL TO ROOF DIAPHRAGM. SEE SK11 AND SK13.

(7) ◇4 – INDICATES (N) TYPE 4 (10d @ 4"o.c. EDGE NAILING) PLYWOOD SHEARWALL ABOVE THE FIRST FLOOR. REMOVE AND REPLACE EXISTING PLASTER. SEE ALSO SCHEDULE ON SK10. SEE NOTE (3) ABOVE FOR REMAINDER OF FOUNDATION WHERE NO (N) SHEARWALL ABOVE.

(8) ◇3 – INDICATES (N) TYPE 3 (10d @ 3"o.c. EDGE NAILING) PLYWOOD SHEARAWALL ABOVE THE FIRST FLOOR. REMOVE AND REPLACE EXISTING PLASTER. SEE ALSO SCHEDULE ON SK10. SEE NOTE (3) ABOVE FOR REMAINDER OF FOUNDATION WHERE NO (N) SHEARWALL ABOVE.

(9) ◇2 – INDICATES (N) TYPE 2 (10d @ 2"o.c. EDGE NAILING) PLYWOOD SHEATHING ABOVE THE FIRST FLOOR. REMOVE AND REPLACE EXISTING PLASTER. SEE ALSO SCHEDULE ON SK10. SEE NOTE (3) ABOVE FOR REMAINDER OF FOUNDATION WHERE NO (N) SHEARWALL ABOVE.

# SK9

## SHEAR WALL SCHEDULE:

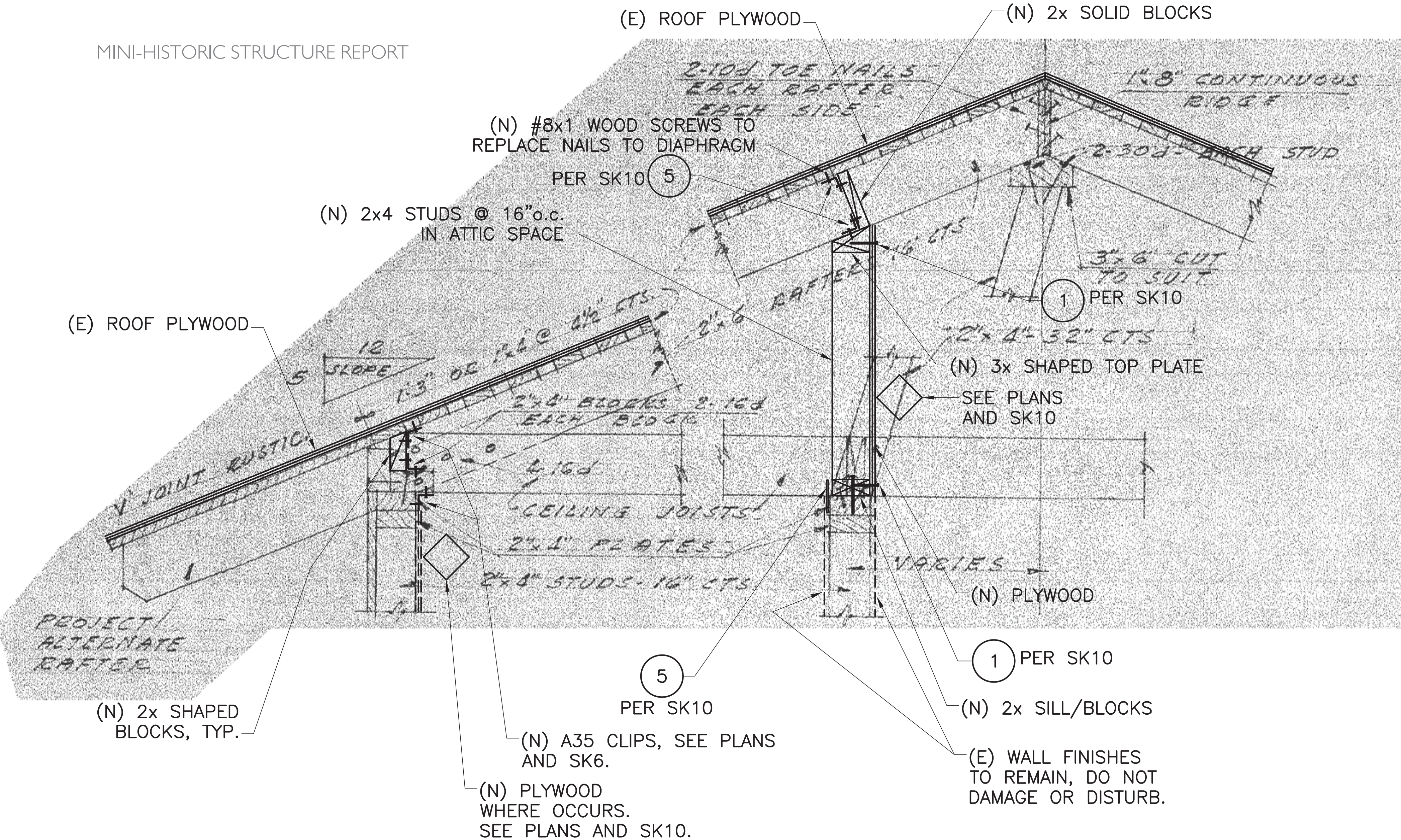
| SYMBOL | RATED SHEATHING THICKNESS | (1) PANEL EDGE NAILING | (2) STUD/BLOCK NAILING | (3) SILL NAILING | (4) (6) SILL CONNECTION | (5) CLIPS @ TOP OF WALL OR SILL | SPECIAL FRAMING |
|---|---|---|---|---|---|---|---|
| ◇6 | 1/2" | 10d@6" | 16d@4" | SEE (5) | – | A35@16"o.c. | – |
| ◇4 | 1/2" | 10d@4" | 16d@3" STAGGER | SEE (5) | UFP10–SDS3 @ 32"o.c. | A35@16"o.c. | PROVIDE 2x STUDS SISTERED TO (E) STUDS @ ADJOINING PANEL EDGES |
| ◇3 (6) | 1/2" | 10d@3" | 16d@2" STAGGER | SEE (5) | UFP10–SDS3 @ 32"o.c. | 2–A35@16"o.c. | PROVIDE 2x STUDS SISTERED TO (E) STUDS @ ADJOINING PANEL EDGES |
| ◇2 (6) | 1/2" | 10d@2" | 16d@2" STAGGER | SEE (5) | UFP10–SDS3 @ 16"o.c. | 2–A35@16"o.c. | PROVIDE 2x STUDS SISTERED TO (E) STUDS @ ADJOINING PANEL EDGES |

NOTES:

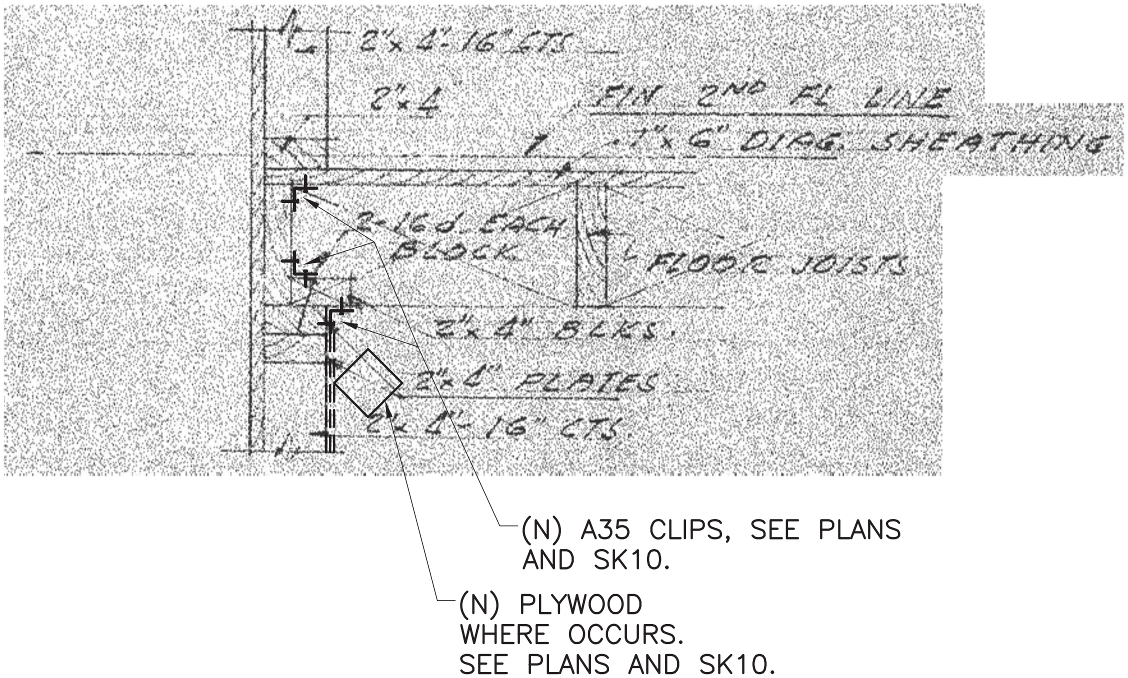
1. BLOCK ALL UNSUPPORTED EDGES OF SHEATHING.
2. WHERE FLAT CLIPS ARE DETAILED, USE SIMPSON LTP4 AT SAME SPACING AS CALLED IN SCHEDULE.
3. TYPICAL FIELD NAILING IS 10d @12" O.C. AT ALL INTERMEDIATE STUDS.
4. WHERE FASTENERS OR SPACING ARE NOTED ON DETAIL, THE DETAIL GOVERNS.
5. EMBED SILL BOLTS 7" MIN. (PLUS CURB HEIGHT, WHERE CURBS OCCUR), TYPICAL.
6. WHERE (N) SHEARWALLS OCCUR AT (E) SLAB–ON–GRADE IN COMMUNITY CENTER, IN LIEU OF SIMPSON UFP10–SDS3 PLATE ANCHORS, USE 5/8"ø x7" EMBED A36 THREADED ROD BOLTS, AT THE SAME SPACING, DRILLED AND EPOXIED INTO EXISTING FOUNDATIONS. USE MIN. 3'x3"x1/4" PLATE WASHERS ON (E) SILL PLATES.

# SHEARWALL SCHEDULE

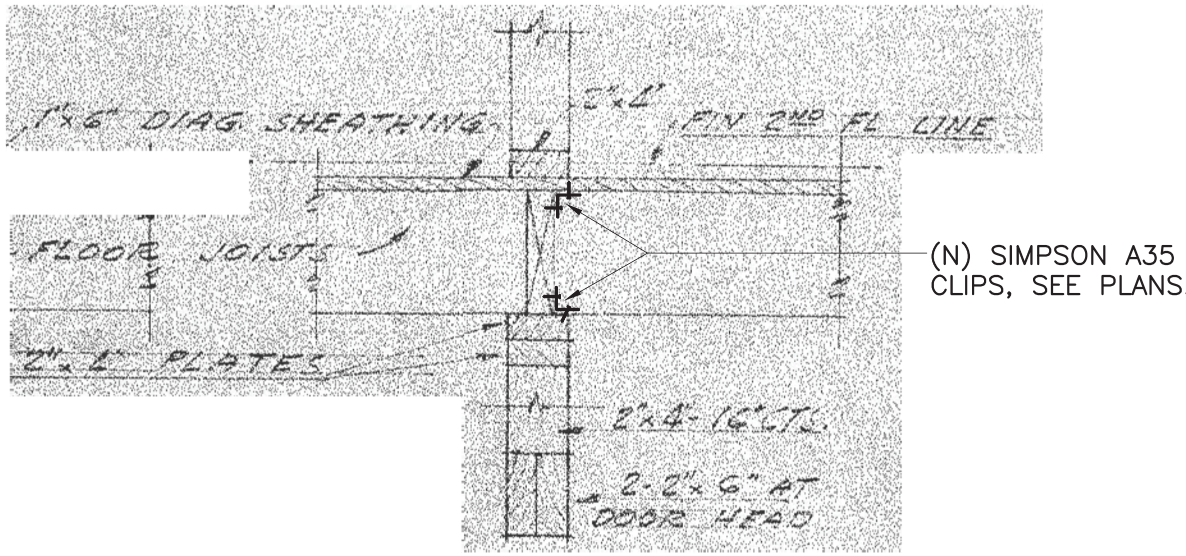
SK10



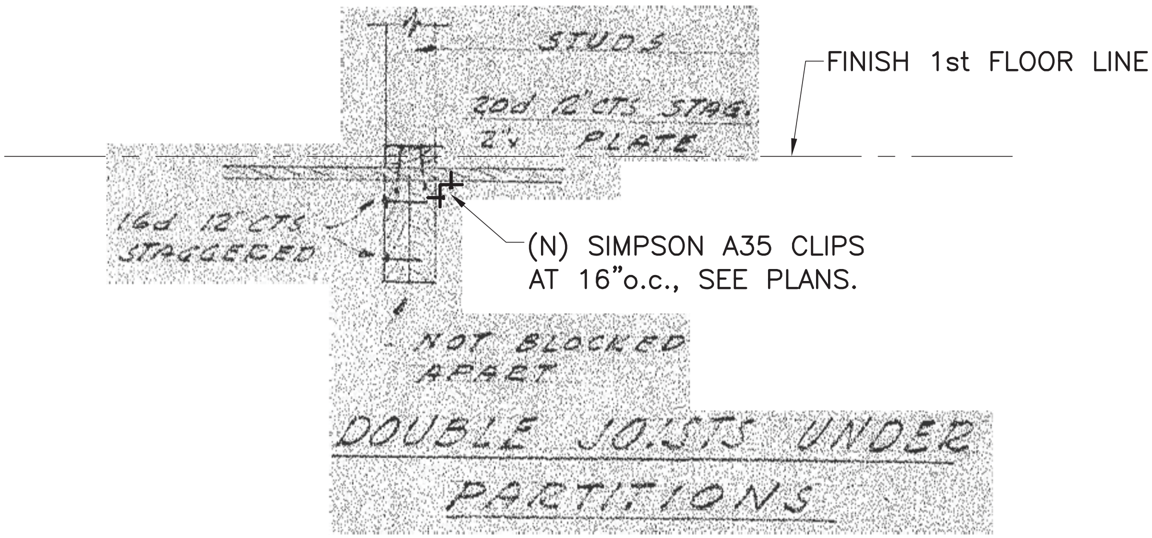

# SECTION AT ROOF/ATTIC


2"x 4"-16" CTS
2"x 4
FIN 2ND FL LINE
1"x 6" DIAG. SHEATHING
2-16d. EACH BLOCK
FLOOR JOISTS
2"x 4" BLKS.
2"x 4" PLATES
2"x 4"-16" CTS.
(N) A35 CLIPS, SEE PLANS AND SK10.
(N) PLYWOOD WHERE OCCURS. SEE PLANS AND SK10.

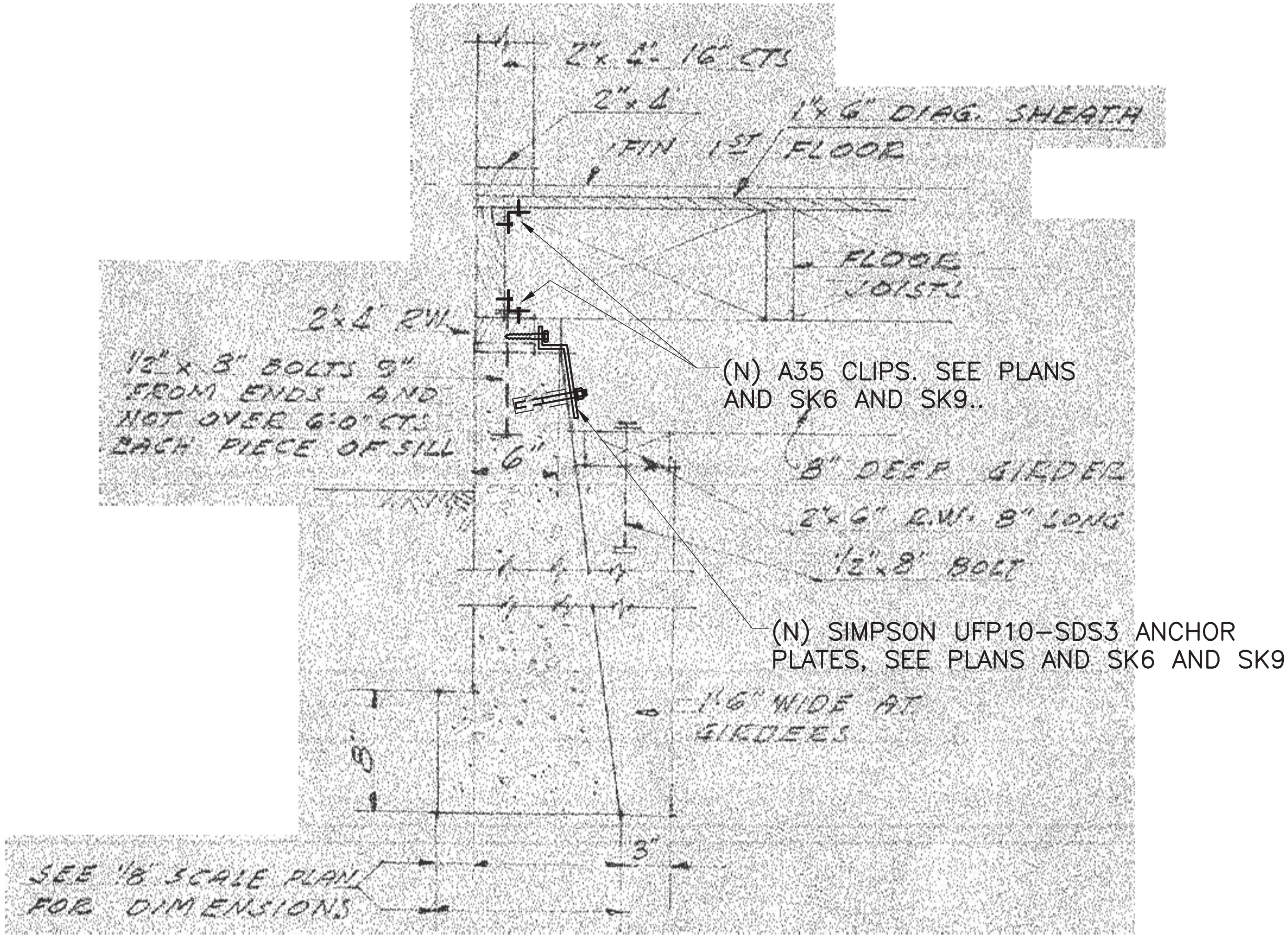
## SECTION


2"x4"
1"x6" DIAG SHEATHING
FIN 2ND FL LINE
FLOOR JOISTS
(N) SIMPSON A35
CLIPS, SEE PLANS.
2"x4" PLATES
2"x4"-16" CTS.
2-2"x6" AT
DOOR HEAD

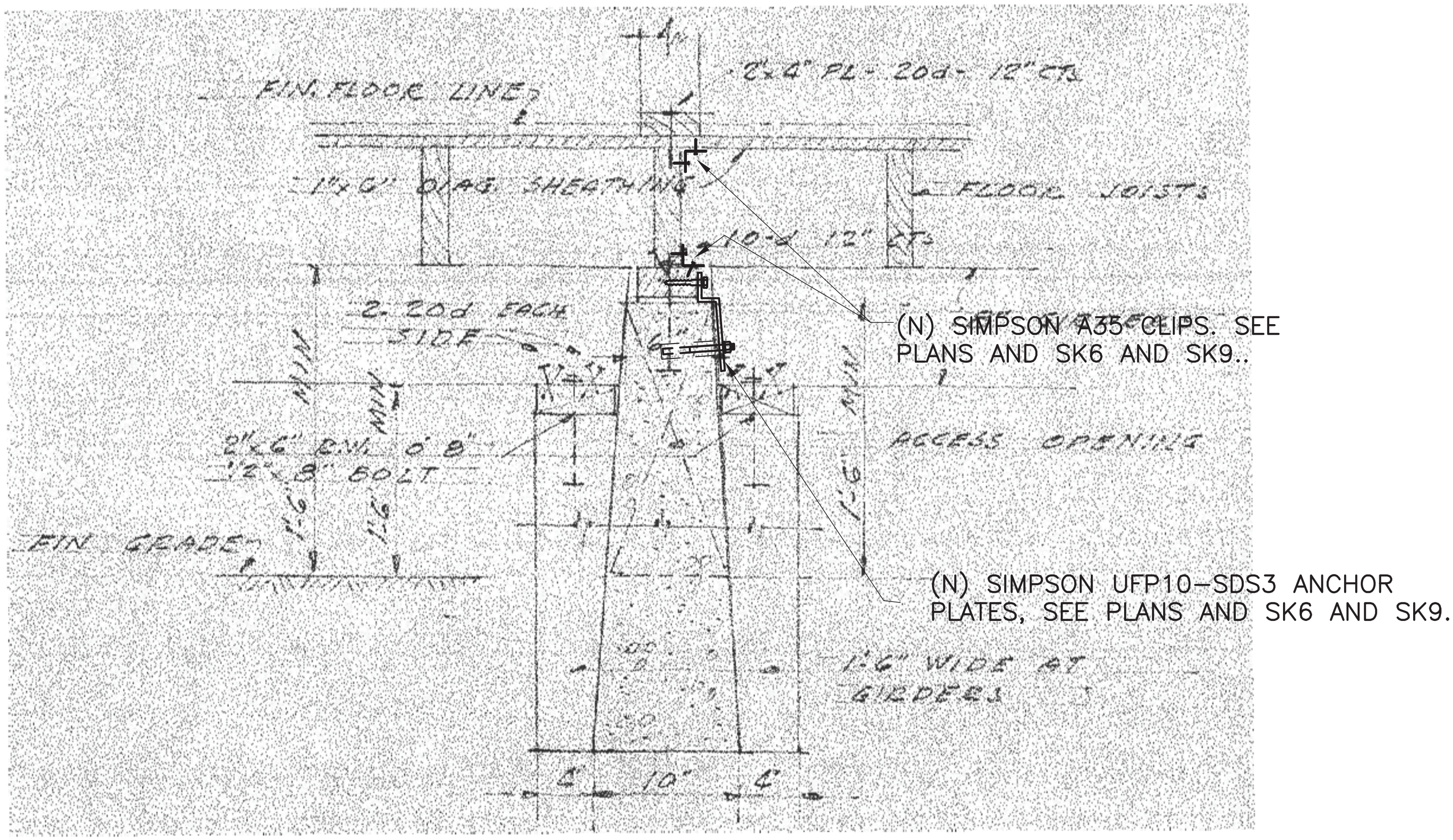
SECTION


STUDS
20d 12" CTS STAG.
2" PLATE
FINISH 1st FLOOR LINE
16d 12" CTS
STAGGERED
(N) SIMPSON A35 CLIPS
AT 16"o.c., SEE PLANS.
NOT BLOCKED
APART
DOUBLE JOISTS UNDER
PARTITIONS

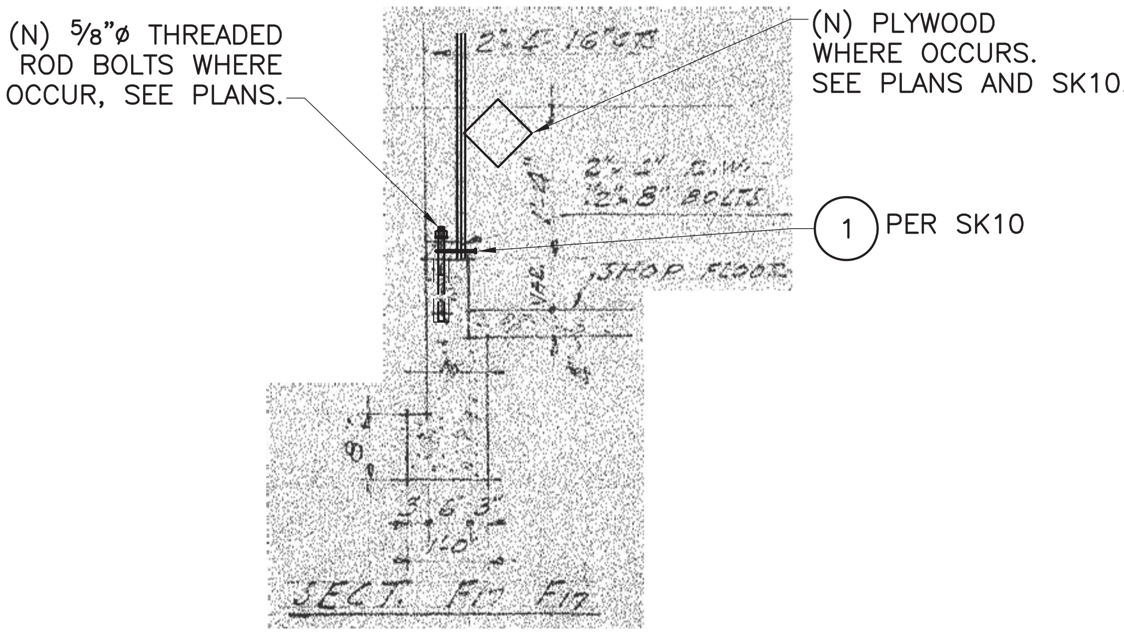
SECTION


(N) A35 CLIPS. SEE PLANS AND SK6 AND SK9..
(N) SIMPSON UFP10-SDS3 ANCHOR PLATES, SEE PLANS AND SK6 AND SK9.

SECTION


2"x4" PL - 20d - 12" CTS
FIN. FLOOR LINE
1"x6" DIAG. SHEATHING
FLOOR JOISTS
10-d 12" CTS
2-20d EACH SIDE
(N) SIMPSON A35 CLIPS. SEE PLANS AND SK6 AND SK9..
ACCESS OPENING
1/2"x8" BOLT
FIN. GRADE
(N) SIMPSON UFP10-SDS3 ANCHOR PLATES, SEE PLANS AND SK6 AND SK9.
1'-6" WIDE AT GIRDERS
4"
10"
4"

## SECTION


(N) 5/8"ø THREADED
ROD BOLTS WHERE
OCCUR, SEE PLANS.
(N) PLYWOOD
WHERE OCCURS.
SEE PLANS AND SK10.
1
PER SK10
SHOP FLOOR
SECT. F17 F17

## SECTION

# APPENDIX H

# LANDSCAPE: APPROPRIATE PLANTINGS LIST

## Plants for Afternoon Sun

| Genus | Species | Common Name |
|---|---|---|
| Acer | macrophyllum | Big Leaf Maple |
| Acer | negundo | California Box Elder |
| Achillea | millefolium | Mountain Yarrow |
| Aesculus | californica | Buckeye |
| Alnus | rhombifolia | White Alder |
| Amelanchier | alnifolia | Western Service Berry |
| Aquilegia | eximia | Serpentine Columbine |
| Aquilegia | formosa | Western Columbine |
| Aquilegia | shockleyi | Desert Columbine |
| Arctostaphylos | | might as well be a lawn manzanita |
| Arctostaphylos | | |
| Arctostaphylos | uva-ursi | sandberry |
| Aristolochia | californica | California Pipevine |
| Artemisia | douglasiana | Mugwort |
| Artemisia | dracunculus | Tarragon |
| Asarum | caudatum | Wild Ginger |
| Aster | chilensis | California Aster |
| Baccharis | pilularis | Dwarf Coyote Brush |
| Betula | occidentalis | |
| Boykinia | occidentalis | Coast Boykinia |
| Calycanthus | occidentalis | Spice Bush |
| Campanula | rotundifolia | California Harebell |
| Carex | fracta | Fragile Sheathed Sedge |
| Carex | globosa | Globe Sedge |
| Carex | sartwelliana | Yosemite Sedge |
| Carex | serratodens | Bifid Sedge |
| Carpenteria | californica | Bush Anemone |
| Clematis | lasiantha | Pipestem Clematis |
| Clematis | ligusticifolia | Western white clematis |
| Cornus | californica | California Dogwood |
| Cornus | occidentalis | Western Dogwood |
| Cornus | sessilis | Blackfruit Dogwood |

## Plants for Afternoon Sun

| Genus | Species | Common Name |
|---|---|---|
| Cornus | stolonifera | Red Stem Dogwood |
| Cyperus | eragrostis | Nutsedge, Umbrella Sedge |
| Dicentra | formosa | Pacific Bleeding Heart |
| Elymus | triticoides | Alkali Rye |
| Equisetum | kansanum | Dwarf Horsetail |
| Erigeron | philadelphicus | Philadelphia Daisy |
| Fragaria | californica | Wood Strawberry |
| Geranium | californicum | California Geranium |
| Geum | macrophyllum | Big Leaf Avens |
| Helenium | bigelovii | Bigelows Sneezeweed. |
| Helenium | puberulum | What happened to the Flower? |
| Heleocharis | montevidensis | |
| Heleocharis | parishii | Parishs Spike Rush |
| Heuchera | merriamii | Siskiyou Alum Root |
| Heuchera | micrantha | Alum Root |
| Heuchera | pilosissima | Hairy Alum Root |
| Heuchera | rubescens | Jack o the rocks |
| Holodiscus | discolor | Cream Bush |
| Iris | douglasiana | Douglas Iris |
| Iris | fernaldii | Fernalds Iris |
| Iris | hartwegii | Sierra Iris |
| Iris | hybrids | |
| Iris | macrosiphon | |
| Juncus | balticus | Baltic Rush |
| Juncus | effusus | Common Rush |
| Juncus | macrophyllus | Long leaf rush |
| Juncus | oxymeris | Pointed Rush |
| Juncus | phaeocephalus | Brown Headed Creeping Rush |
| Lilium | kelleyanum | Kelly's Lilly |
| Lilium | pardalinum | Sunset |
| Lobelia | cardinalis | Cardinal Flower |
| Lonicera | hispidula | California Honeysuckle |
| Lonicera | involucrata | Twinberry honeysuckle |

## Plants for Afternoon Sun

| *Genus* | *Species* | *Common Name* |
|---|---|---|
| Mahonia | aquifolium | Oregon Grape |
| Mahonia | aquifolium | Creeping Oregon Grape. |
| Mahonia | repens | Creeping Mahonia |
| Mimulus | cardinalis | Scarlet Monkey Flower |
| Mimulus | guttatus | Seep Monkey Flower |
| Oxalis | oregona | Redwood Sorrel |
| Physocarpus | capitatus | Ninebark |
| Polypodium | hesperium | Western Polypody |
| Polystichum | munitum | Western Sword Fern |
| Potentilla | glandulosa | Sticky Cinquefoil |
| Potentilla | gracilis | Cinquefoil |
| Potentilla | pectinisecta | Bodie Buttercup |
| Pteridium | aquilinum | Brake |
| Pycnanthemum | californicum | Mountain Mint |
| Rhamnus | californica | Coffeeberry |
| Ribes | divaricatum | |
| Ribes | sanguineum | Pink-Flowered Currant |
| Rosa | gymnocarpa | Wood Rose |
| Rosa | woodsii | |
| Rubus | leucodermis | Western Raspberry |
| Rubus | parviflorus | Thimbleberry |
| Rubus | ursinus | Pacific blackberry |
| Rudbeckia | occidentalis | Western Coneflower |
| Scirpus | californicus | California Bulrush |
| Scirpus | maritimus | |
| Scrophularia | atrata | Bumble Bee Plant |
| Scrophularia | californica | California Figwort |
| Sedum | oreganum | Green Stonecrop |
| Sedum | spathulifolium | Stonecrop |
| Sequoiadendron | giganteum | Giant Sequoia |
| Sidalcea | neomexicana | Checkers |
| Solidago | californica | California Goldenrod |
| Solidago | spathulata | Coast Golden Rod |

## Plants for Afternoon Sun

| *Genus* | *Species* | *Common Name* |
|---|---|---|
| Spiraea | douglasii | Western Spiraea |
| Stachys | ajugoides | Pink Hedge Nettle |
| Stachys | ajugoides | Bugle Hedgenettle |
| Stachys | albens | White hedge nettle |
| Stachys | bullata | Hedge Nettle |
| Stachys | chamissonis | Magenta Butterfly Flower |
| Symphoricarpos | albus | Common Snowberry |
| Symphoricarpos | mollis | Southern California Snowberry |
| Symphoricarpos | oreophilus | Roundleaf Snowberry |
| Symphoricarpos | rivularis | |
| Symphoricarpos | rotundifolius | Roundleaf Snowberry |
| Thalictrum | fendleri | Mountain Meadow Rue |
| Thalictrum | polycarpum | Meadow Rue |
| Thuja | plicata | Western Red Cedar |
| Tiarella | unifoliata | Sugar Scoop |
| Tolmiea | menziesii | Youth-On-Age |
| Umbellularia | californica | Bay Laurel |
| Urtica | holosericea | Hoary Nettle |
| Vaccinium | ovatum | Huckleberry |
| Venegasia | carpesioides | Canyon Sunflower |
| Verbena | lasiostachys | Western Vervain |
| Whipplea | modesta | Yerba de Selva |
| Zauschneria | californica | Island California Fuchsia |
| Zauschneria | californica | Red California Fuchsia |
| Zauschneria | californica | White California Fuchsia |
| Zauschneria | californica | Common California Fuchsia |
| Zauschneria | californica | San Jose California Fuchsia |
| Zauschneria | latifolia | Southern Mountain California Fuchsia |
| Zauschneria | septentrionalis | White Leaf Fuchsia |

Source: http://www.mynativeplants.com/site

## Plants for Part Shade

| *Genus* | *Species* | *Common Name* |
|---|---|---|
| Acer | macrophyllum | Big Leaf Maple |
| Adiantum | capillus-veneris | Maidenhair Fern |
| Aesculus | californica | Buckeye |
| Alnus | rhombifolia | White Alder |
| Aquilegia | eximia | Serpentine Columbine |
| Aquilegia | formosa | Western Columbine |
| Aralia | californica | California Spikenard |
| Aristolochia | californica | California Pipevine |
| Asarum | caudatum | Wild Ginger |
| Cornus | californica | California Dogwood |
| Cornus | occidentalis | Western Dogwood |
| Cornus | sessilis | Blackfruit Dogwood |
| Cornus | stolonifera | Red Stem Dogwood |
| Dicentra | formosa | Pacific Bleeding Heart |
| Equisetum | kansanum | Dwarf Horsetail |
| Fragaria | californica | Wood Strawberry |
| Oxalis | oregona | Redwood Sorrel |
| Physocarpus | capitatus | Ninebark |
| Polystichum | munitum | Western Sword Fern |
| Ribes | sanguineum | Pink-Flowered Currant |
| Rosa | gymnocarpa | Wood Rose |
| Rubus | leucodermis | Western Raspberry |
| Rubus | parviflorus | Thimbleberry |
| Scrophularia | atrata | Bumble Bee Plant |
| Scrophularia | californica | California Figwort |
| Thuja | plicata | Western Red Cedar |
| Tiarella | trifoliata | Laceflower |
| Tiarella | unifoliata | Sugar Scoop |
| Tolmiea | menziesii | Youth-On-Age |
| Umbellularia | californica | Bay Laurel |
| Vaccinium | ovatum | Huckleberry |
| Whipplea | modesta | Yerba de Selva |

Source: http://www.mynativeplants.com/site

# APPENDIX J

## NATIONAL PARK SERVICE - TECHNICAL PRESERVATION BRIEFS

3 Preservation Briefs

Technical Preservation Services
National Park Service
U.S. Department of the Interior

# >Conserving Energy in Historic Buildings

**Baird M. Smith, AIA**



**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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**With the dwindling supply of energy resources and new efficiency demands** placed on the existing building stock, many owners of historic buildings and their architects are assessing the ability of these buildings to conserve energy with an eye to improving thermal performance. This brief has been developed to assist those persons attempting energy conservation measures and weatherization improvements such as adding insulation and storm windows or caulking of exterior building joints. In historic buildings, many measures can result in the inappropriate alteration of important architectural features, or, perhaps even worse, cause serious damage to the historic building materials through unwanted chemical reactions or moisture caused deterioration. This brief recommends measures that will achieve the greatest energy savings with the least alteration to the historic buildings, while using materials that do not cause damage and that represent sound economic investments.

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## Inherent Energy Saving Characteristics of Historic Buildings

Many historic buildings have energy saving physical features and devices that contribute to good thermal performance. Studies by the Energy Research and Development Administration (see bibliography) show that the buildings with the poorest energy efficiency are actually those built between 1940 and 1975.

Older buildings were found to use less energy for heating and cooling and hence probably require fewer weatherization improvements. They use less energy because they were built with a well-developed sense of physical comfort and because they maximized the natural sources of heating, lighting and ventilation. The historic building owner should understand these inherent energy-saving qualities.

Shutters can be used to minimize the problem of summer heat gain by shading the windows. Photo: NPS files.

The most obvious (and almost universal) inherent energy saving characteristic was the use of operable windows to provide natural ventilation and light. In addition, historic commercial and public buildings often include interior light/ventilation courts, rooftop ventilators, clerestories or skylights. These features provide energy efficient fresh air and light, assuring that energy consuming mechanical devices may be needed only to supplement the natural energy sources. Any time the mechanical heating and air conditioning equipment can be turned off and the windows opened, energy will be saved.

Early builders and architects dealt with the poor thermal properties of windows in two ways. First, the number of windows in a building was kept to only those necessary to provide adequate light and ventilation. This differs from the approach in many modern buildings where the percentage of windows in a wall can be nearly 100%. Historic buildings where the ratio of glass to wall is often less than 20%, are better energy conservers than most new buildings. Secondly, to minimize the heat gain or loss from windows, historic buildings often include interior or exterior shutters, interior venetian blinds, curtains and drapes, or exterior awnings. Thus, a historic window could remain an energy efficient component of a building.

This 19th c. building in Massachusetts employed several energy-conserving features in its historic design, including shade trees, roof overhangs, awnings and shutters. Photo: HABS collection, NPS.

There are other physical characteristics that enable historic buildings to be energy efficient. For instance, in the warmer climates of the United States, buildings were often built to minimize the heat gain from the summer sun. This was accomplished by introducing exterior balconies, porches, wide roof overhangs, awnings and shade trees. In addition, many of these buildings were designed with the living spaces on the second floor to catch breezes and to escape the radiant heat from the earth's surface. Also, exterior walls were often painted light colors to reflect the hot summer sun, resulting in cooler interior living spaces.

Winter heat loss from buildings in the northern climates was reduced by using heavy masonry walls, minimizing the number and size of windows, and often using dark paint colors for the exterior walls. The heavy masonry walls used so typically in the late 19th century and early 20th century, exhibit characteristics that improve their thermal performance beyond that formerly recognized. It has been determined that walls of large mass and weight (thick brick or stone) have the advantage of high thermal inertia, also known as the "M factor." This inertia modifies the thermal resistance (R factor) (1) of the wall by lengthening the time scale of heat transmission. For instance, a wall with high thermal inertia, subjected to solar radiation for an hour, will absorb the heat at its outside surface, but transfer it to the interior over a period as long as 6 hours. Conversely, a wall having the same R factor, but low thermal inertia, will transfer the heat in perhaps 2 hours.

High thermal inertia is the reason many older public and commercial buildings, without modern air conditioning, still feel cool on the inside throughout the summer. The heat from the midday sun does not penetrate the buildings until late afternoon and evening, when it is unoccupied.

Although these characteristics may not typify all historic buildings, the point is that historic buildings often have thermal properties that need little improvement. One must understand the inherent energy saving qualities of a building, and assure, by reopening the windows for instance, that the building functions as it was intended.

Heavy masonry walls and few windows serve to maximize warmth inside. Photo: HABS collection, NPS.

To reduce heating and cooling expenditures there are two broad courses of action that may be taken. First, begin passive measures to assure that a building and its existing components function as efficiently as possible without the necessity of making alterations or adding new materials. The second course of action is preservation retrofitting, which includes altering the building by making appropriate weatherization measures to improve thermal performance. Undertaking the passive measures and the preservation retrofitting recommended here could result in a 50% decrease in energy expenditures in historic buildings.

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## Passive Measures

The first passive measures to utilize are operational controls; that is, controlling how and when a building is used. These controls incorporate programmatic planning and scheduling efforts by the owner to minimize usage of energy-consuming equipment. A building should survey and quantify all aspects of energy usage, by evaluating the monies expended for electricity, gas, and fuel oil for a year and by surveying how and when each room is used. This will identify ways of conserving energy by initiating operational controls such as:

- lowering the thermostat in the winter, raising it in the summer
- controlling the temperature in those rooms actually used
- reducing the level of illumination and number of lights (maximize natural light)
- using operable windows, shutters, awnings and vents as originally intended to control interior environment (maximize fresh air)
- having mechanical equipment serviced regularly to ensure maximum efficiency
- cleaning radiators and forced air registers to ensure proper operation

The passive measures outlined above can save as much as 30% of the energy used in a building. They should be the first undertakings to save energy in any existing building and are particularly appropriate for historic buildings because they do not necessitate building alterations or the introduction of new materials that may cause damage. Passive measures make energy sense, common sense, and preservation sense!

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## Preservation Retrofitting

In addition to passive measures, building owners may undertake certain retrofitting measures that will not jeopardize the historic character of the building and can be accomplished at a reasonable cost. Preservation retrofitting improves the thermal performance of the building, resulting in another 20%30% reduction in energy.

When considering retrofitting measures, historic building owners should keep in mind that there are no permanent solutions. One can only meet the standards being applied today with today's materials and techniques. In the future, it is likely that the standards and the technologies will change and a whole new retrofitting plan may be necessary. Thus, owners of historic buildings should limit retrofitting measures to those that achieve reasonable energy savings, at reasonable costs, with the least intrusion or impact on the character of the building. Overzealous retrofitting, which introduces the risk of damage to historic building materials, should not be undertaken.

The preservation retrofitting measures presented here, were developed to address the three most common problems in historic structures caused by some retrofitting actions. The first problem concerns retrofitting actions that necessitated inappropriate building alterations, such as the wholesale removal of historic windows, or the addition of insulating aluminum siding, or installing dropped ceilings in significant interior spaces. To avoid such alterations, refer to the Secretary of the Interior's "Standards for Historic Preservation Projects" which provide the philosophical and practical basis for all preservation retrofitting measures (see last page).

The second problem area is to assure that retrofitting measures do not create moisturerelated deterioration problems. One must recognize that large quantities of moisture are present on the interior of buildings.

In northern climates, the moisture may be a problem during the winter when it condenses on cold surfaces such as windows. As the moisture passes through the walls and roof it may condense within these materials, creating the potential for deterioration. The problem is avoided if a vapor barrier is added facing in.

In southern climates, insulation and vapor barriers are handled quite differently because moisture problems occur in the summer when the moist outside air is migrating to the interior of the building. In these cases, the insulation is installed with the vapor barrier facing out (opposite the treatment of northern climates). Expert advice should be sought to avoid moisture-related problems to insulation and building materials in southern climates.

The third problem area involves the avoidance of those materials that are chemically or physically incompatible with existing materials, or that are improperly installed. A serious problem exists with certain cellulose insulations that use ammonium or aluminum sulfate as a fire retardant, rather than boric acid which causes no problems. The sulfates react with moisture in the air forming sulfuric acid which can cause damage to most metals (including plumbing and wiring), building stones, brick and wood. In one instance, a metal building insulated with cellulose of this type collapsed when the sulfuric acid weakened the structural connections! To avoid problems such as these, refer to the recommendations provided here, and consult with local officials, such as a building inspector, the better business bureau, or a consumer protection agency.

Before a building owner or architect can plan retrofitting measures, some of the existing physical conditions of the building should be investigated. The basic building components (attic, roof, walls and basement) should be checked to determine the methods of construction used and the presence of insulation. Check the insulation for full coverage and whether there is a vapor barrier. This inspection will aid in determining the need for additional insulation, what type of insulation to use (batt, blownin, or poured), and where to install it. In addition, sources of air infiltration should be checked at doors, windows, or where floor and ceiling systems meet the walls. Last, it is important to check the condition of the exterior wall materials, such as painted wooden siding or brick, and the condition of the roof, to determine the weather tightness of the building. A building owner must assure that rain and snow are kept out of the building before expending money for weatherization improvements.

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## Retrofitting Measures

The following listing includes the most common retrofitting measures; some measures are highly recommended for a preservation retrofitting plan, but, as will be explained, others are less beneficial or even harmful to the historic building:

- Air Infiltration
- Attic Insulation
- Storm Windows
- Basement and Crawl Space Insulation
- Duct and Pipe Insulation
- Awnings and Shading Devices
- Doors and Storm Doors
- Vestibules
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- Wall Insulation--Wood Frame
- Wall Insulation--Masonry Cavity Walls
- Wall Insulation--Installed on the Inside
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- Waterproof Coatings for Masonry

The recommended measures to preservation retrofitting begin with those at the top of the list. The first ones are the simplest, least expensive, and offer the highest potential for saving energy. The remaining measures are not recommended for general use either because of potential technical and preservation problems, or because of the costs outweighing the anticipated energy savings. Specific solutions must be determined based on the facts and circumstances of the particular problem; therefore, advice from professionals experienced in historic preservation, such as, architects, engineers and mechanical contractors should be solicited.

**Air Infiltration:** Substantial heat loss occurs because cold outside air infiltrates the building through loose windows, doors, and cracks in the outside shell of the building. Adding weatherstripping to doors and windows, and caulking of open cracks and joints will substantially reduce this infiltration. Care should be taken not to reduce infiltration to the point where the building is completely sealed and moisture migration is prevented. Without some infiltration, condensation problems could occur throughout the building. Avoid caulking and weatherstripping materials that, when applied, introduce inappropriate colors or otherwise visually impair the architectural character of the building. Reducing air infiltration should be the first priority of a preservation retrofitting plan. The cost is low, little skill is required, and the benefits are substantial.

**Attic Insulation:** Heat rising through the attic and roof is a major source of heat loss, and reducing this heat loss should be one of the highest priorities in preservation retrofitting. Adding insulation in accessible attic spaces is very effective in saving energy and is generally accomplished at a reasonable cost, requiring little skill to install. The most common attic insulations include blankets of fiberglass and mineral wool, blownin cellulose (treated with boric acid only), blowing wool, vermiculite, and blown fiberglass. If the attic is unheated (not used for habitation), then the insulation is placed between the floor joists with the vapor barrier facing down. If flooring is present, or if the attic is heated, the insulation is generally placed between the roof rafters with the vapor barrier facing in. All should be installed according to the manufacturer's recommendations. A weatherization manual entitled, "In the Bank . . . or Up the Chimney" (see the bibliography) provides detailed descriptions about a variety of installation methods used for attic insulation. The manual also recommends the amount of attic insulation used in various parts of the country. If the attic has some insulation, add more (but without a vapor barrier) to reach the total depth recommended.

Problems occur if the attic space is not properly ventilated. This lack of ventilation will cause the insulation to become saturated and lose its thermal effectiveness. The attic is adequately ventilated when the net area of ventilation (free area of a louver or vent) equals approximately 1/300 of the attic floor area. With adequate attic ventilation, the addition of attic insulation should be one of the highest priorities of a preservation retrofitting plan.

If the attic floor is inaccessible, or if it is impossible to add insulation along the roof rafters, consider attaching insulation to the ceilings of the rooms immediately below the attic. Some insulations are manufactured specifically for these cases and include a durable surface which becomes the new ceiling. This option should not be considered if it causes irreparable damage to historic or architectural spaces or features; however, in other cases, it could be a recommended measure of a preservation retrofitting plan.

**Storm Windows:** Windows are a primary source of heat loss because they are both a poor thermal barrier (R factor of only 0.89) and often a source of air infiltration. Adding storm windows greatly improves these poor characteristics. If a building has existing storm windows (either wood or metal framed), they should be retained. Assure they are tight fitting and in good working condition. If they are not in place, it is a recommended measure of a preservation retrofitting plan to

Storm doors have been added on the inside of this historic building as an energy-conserving device. Photo: NPS files.

add new metal framed windows on the exterior. This will result in a window assembly (historic window plus storm window) with an R factor of 1.79 which outperforms a double paned window assembly (with an air space up to 1/2") that only has an R factor of 1.72. When installing the storm windows, be careful not to damage the historic window frame. If the metal frames visually impair the appearance of the building, it may be necessary to paint them to match the color of the historic frame.

Triple-track metal storm windows are recommended because they are readily available, in numerous sizes, and at a reasonable cost. If a preassembled storm window is not available for a particular window size, and a custommade storm window is required, the cost can be very high. In this case, compare the cost of manufacture and installation with the expected cost savings resulting from the increased thermal efficiency. Generally, custom-made storm windows, of either wood or metal frames, are not cost effective, and would not be recommended in a preservation retrofitting plan.

Interior storm window installations can be as thermally effective as exterior storm windows; however, there is high potential for damage to the historic window and sill from condensation. With storm windows on the interior, the outer sash (in this case the historic sash) will be cold in the winter, and hence moisture may condense there. This condensation often collects on the flat surface of the sash or window sill causing paint to blister and the wood to begin to deteriorate. Rigid plastic sheets are used as interior storm windows by attaching them directly to the historic sash. They are not quite as effective as the storm windows described previously because of the possibility of air infiltration around the historic sash. If the rigid plastic sheets are used, assure that they are installed with minimum damage to the historic sash, removed periodically to allow the historic sash to dry, and that the historic frame and sash are completely caulked and weatherstripped.

In most cases, interior storm windows of either metal frames or of plastic sheets are not recommended for preservation retrofitting because of the potential for damage to the historic window. If interior storm windows are in place, the potential for moisture deterioration can be lessened by opening (or removing, depending on the type) the storm windows during the mild months allowing the historic window to dry thoroughly.

Tinted glazing has jeopardized the character of this historic office building and is, thus, not a recommended approach. Photo: Mike Jackson.

**Basement and Crawl Space Insulation:** Substantial heat is lost through cold basements and crawl spaces. Adding insulation in these locations is an effective preservation retrofitting measure and should be a high priority action. It is complicated, however, because of the excessive moisture that is often present. One must be aware of this and assure that insulation is properly installed for the specific location. For instance, in crawl spaces and certain unheated basements, the insulation is generally placed between the first floor joists (the ceiling of the basement) with the **vapor barrier facing up**. Do not staple the insulation in place, because the staples often rust away. Use special anchors developed for insulation in moist areas such as these.

In heated basements, or where the basement contains the heating plant (furnace), or where there are exposed water and sewer pipes, insulation should be installed against foundation walls. Begin the insulation within the first floor joists, and proceed down the wall to a point at least 3 feet below the exterior ground level if possible, with the **vapor barrier facing in.** Use either batt or rigid insulation.

Installing insulation in the basement or crawl space should be a high priority of a preservation retrofitting plan, as long as adequate provision is made to ventilate the unheated space, perhaps even by installing an exhaust fan.

**Duct and Pipe Insulation:** Wrapping insulation around heating and cooling ducts and hot water pipes, is a recommended preservation retrofitting measure. Use insulation which is intended for this use and install it according to manufacturer's recommendations. Note that air conditioning ducts will be cold in the summer, and hence moisture will condense there. Use insulation with the **vapor barrier facing out**, away from the duct. These measures are inexpensive and have little potential for damage to the historic building.

**Awnings and Shading Devices:** In the past, awnings and trees were used extensively to provide shade to keep buildings cooler in the summer. If awnings or trees are in place, keep them in good condition, and take advantage of their energy-saving contribution. Building owners may consider adding awnings or trees if the summer cooling load is substantial. If awnings are added, assure that they are installed without damaging the building or visually impairing its architectural character. If trees are added, select deciduous trees that provide shade in the summer but, after dropping their leaves, would allow the sun to warm the building in the winter. When planting trees, assure that they are no closer than 10 feet to the building to avoid damage to the foundations. Adding either awnings or shade trees may be expensive, but in hot climates, the benefits can justify the costs.

Awnings reduce heat gain in the summer and, when they are raised in the winter, radiant heat from the sun provides free supplementary heat. Photo: NPS files.

**Doors and Storm Doors:** Most historic wooden doors, if they are solid wood or paneled, have fairly good thermal properties and should not be replaced, especially if they are important architectural features. Assure that the frames and doors have proper maintenance, regular painting, and that caulking and weatherstripping is applied as necessary.

A storm door would improve the thermal performance of the historic door; however, recent studies indicate that installing a storm door is not normally cost effective in residential settings. The costs are high compared to the anticipated savings. Therefore, storm doors should only be added to buildings in cold climates, and added in such a way to minimize the visual impact on the building's appearance. The storm door design should be compatible with the architectural character of the building and may be painted to match the colors of the historic door.

**Vestibules:** Vestibules create a secondary air space at a doorway to reduce air infiltration occurring while the primary door is open. If a vestibule is in place, retain it. If not, adding a vestibule, either on the exterior or interior, should be carefully considered to determine the possible visual impact on the character of the building. The energy savings would be comparatively small compared to construction costs. Adding a vestibule should be considered in very cold climates, or where door use is very high, but in either case, the additional question of visual intrusion must be resolved before it is added. For most cases with historic buildings, adding a vestibule is not recommended.

**Replacement Windows:** Unfortunately, a common weatherization measure, especially in larger buildings, has been the replacement of historic windows with modern double paned windows. The intention was to improve the thermal performance of the existing windows and to reduce longterm maintenance costs. The evidence is clear that adding exterior storm windows is a viable alternative to replacing the historic windows and it is the recommended approach in preservation retrofitting. However, if the historic windows are severely deteriorated and their repair would be impractical, or economically infeasible, then replacement windows may be warranted. The new windows, of either wood or metal, should closely match the historic windows in size, number of panes, muntin shape, frame, color and reflective qualities of the glass.

**Wall Insulation--Wood Frame:** The addition of wall insulation in a wood frame building is generally not recommended as a preservation retrofitting measure because the costs are high, and the potential for damage to historic building materials is even higher. Also, wall insulation is not particularly effective for small frame buildings (one story) because the heat loss from the uninsulated walls is a relatively small percentage of the total, and part of that can be attributed to infiltration. If, however, the historic building is two or more stories, and is located in a cold climate, wall insulation may be considered if extreme care (as explained later) is exercised with its installation.

The installation of wall insulation in historic frame buildings can result in serious technical and preservation problems. As discussed before, insulation must be kept dry to function properly, and requires a vapor barrier and some provision for air movement. Introducing insulation in wall cavities, without a vapor barrier and some ventilation can be disastrous. The insulation would become saturated, losing its thermal properties, and in fact, actually increasing the heat loss through the wall. Additionally, the moisture (in vapor form) may condense into water droplets and begin serious deterioration of adjacent building materials such as sills, window frames, framing and bracing. The situation is greatly complicated, because correcting such problems could necessitate the complete (and costly) dismantling of the exterior or interior wall surfaces. It should be clear that adding wall insulation has the potential for causing serious damage to historic building materials.

If adding wall insulation to frame buildings is determined to be absolutely necessary, the first approach should be to consider the careful removal of the exterior siding so that it may later be reinstalled. Then introduce batt insulation with the **vapor barrier facing in** into the now accessible wall cavity. The first step in this approach is an investigation to determine if the siding can be removed without causing serious damage.

If it is feasible, introducing insulation in this fashion provides the best possible solution to insulating a wall, and provides an excellent opportunity to view most of the structural system for possible hidden structural problems or insect infestations. A building owner should not consider this approach if it would result in substantial damage to or loss of historic wooden siding. Most siding, however, would probably withstand this method if reasonable care is exercised.

The second possible approach for wall insulation involves injecting or blowing insulation into the wall cavity. The common insulations are the loose fill types that can be blown into the cavity, the poured types, or the injected types such as foam. Obviously a vapor barrier cannot be simultaneously blown into the space. However, an equivalent vapor barrier can be created by assuring that the interior wall surfaces are covered with an impermeable paint layer. Two layers of oil base paint or one layer of impermeable latex paint constitute an acceptable vapor barrier. Naturally, for this to work, the paint layer must cover all interior surfaces adjacent to the newly installed wall insulation. Special attention should be given to rooms that are major sources of interior moisture--the laundry room, the bathrooms and the kitchen.

In addition to providing a vapor barrier, make provisions for some air to circulate in the wall cavity to help ventilate the insulation and the wall materials. This can be accomplished in several ways. One method is to install small screened vents (about 2 inches in diameter) at the base of each stud cavity. If this option is taken, the vents should be as inconspicuous as possible. A second venting method can be used where the exterior siding is horizontally lapped. Assure that each piece of siding is separated from the other, allowing some air to pass between them. Successive exterior paint layers often seal the joint between each piece of siding. Break the paint seal (carefully insert a chisel and twist) between the sections of exterior siding to provide the necessary ventilation for the insulation and wall materials.

With provisions for a vapor barrier (interior paint layer) and wall ventilation (exterior vents) satisfied, the appropriate type of wall insulation may then be selected. There are three recommended types to consider: blown cellulose (with boric acid as the fire retardant), vermiculite, or perlite. Cellulose is the preferred wall insulation because of its higher R factor and its capability to flow well into the various spaces within a wall cavity.

There are two insulation types that are not recommended for wall insulation: ***ureaformaldehyde foams, and cellulose*** which uses aluminum or ammonium sulfate instead of boric acid as a fire retardant. The cellulose treated with the sulfates reacts with moisture in the air and forms sulfuric acid which corrodes many metals and causes building stones to slowly disintegrate. This insulation is not appropriate for use in historic buildings.

Although ureaformaldehyde foams appear to have potential as retrofit materials (they flow into any wall cavity space and have a high R factor) their use is not recommended for preservation retrofitting until some serious problems are corrected. The major problem is that the injected material carries large quantities of moisture into the wall system. As the foam cures, this moisture must be absorbed into the adjacent materials. This process has caused interior and exterior paint to blister, and caused water to actually puddle at the base of a wall, creating the likelihood of serious deterioration to the historic building materials. There are other problems that affect both historic buildings and other existing buildings. Foams are a twopart chemical installed by franchised contractors. To obtain the exact proportion of the two parts, the foam must be mixed and installed under controlled conditions of temperature and humidity. There are cases where the controls were not followed and the foam either cured improperly, not attaining the desired R factor, or the foam continued to emit a formaldehyde smell. In addition, the advertised maximum shrinkage after curing (3%) has been tested and found to be twice as high. Until this material is further developed and the risks eliminated, it is clearly not an appropriate material for preservation retrofitting.

**Wall Insulation--Masonry Cavity Walls:** Some owners of historic buildings with masonry cavity wall construction have attempted to introduce insulation into the cavity. This is not good practice because it ignores the fact that masonry cavity walls normally have acceptable thermal performance, needing no improvement. Additionally, introducing insulation into the cavity will most likely result in condensation problems and alter the intended function of the cavity. The air cavity acts as a vapor barrier in that moist air passing through the inner wythe of masonry meets the cold face of the outer wythe and condenses. Water droplets form and fall to the bottom of the wall cavity where they are channeled to the outside through weep holes. The air cavity also improves the thermal performance of the wall because it slows the transfer of heat or cold between the two wythes, causing the two wall masses to function independently with a thermal cushion between them.

Adding insulation to this cavity alters the vapor barrier and thermal cushion functions of the air space and will likely clog the weep holes, causing the moisture to puddle at the base of the wall. Also, the addition of insulation creates a situation where the moisture dew point (where moisture condenses) moves from the inner face of the outer wythe, into the outer wythe itself. Thus, during a freeze, this condensation will freeze, causing spalling and severe deterioration. The evidence is clear that introducing insulation, of any type, into a masonry cavity wall is not recommended in a preservation retrofitting plan.

**Wall Insulation--Installed on the Inside:** Insulation could be added to a wall whether it be wooden or masonry, by attaching the insulation to furring strips mounted on the interior wall faces. Both rigid insulation, usually 1 or 2 inches thick, and batt insulation, generally 3-1/2 inches thick, can be added in this fashion, with the vapor barrier facing in. Extra caution must be exercised if rigid plastic foam insulation is used because it can give off dense smoke and rapidly spreading flame when burned. Therefore, it must be installed with a fireproof covering, usually 1/2-inch gypsum wallboard. Insulation should not be installed on the inside if it necessitates relocation or destruction of important architectural decoration, such as cornices, chair rails, or window trims, or causes the destruction of historic plaster or other wall finishes. Insulation installed in this fashion would be expensive and could only be a recommended preservation retrofitting measure if it is a large building, located in a cold climate, and if the interior spaces and features have little or no architectural significance.

**Wall Insulation--Installed on the Outside:** There is a growing use of aluminum or vinyl siding installed directly over historic wooden sidings, supposedly to reduce longterm maintenance and to improve the thermal performance of the wall. From a preservation viewpoint, this is a poor practice for several reasons. New siding covers from view existing or potential deterioration problems or insect infestations. Additionally, installation often results in damage or alteration to existing decorative features such as beaded weatherboarding, window and door trim, corner boards, cornices, or roof trim. The cost of installing the artificial sidings compared with the modest increase, if any, in the thermal performance of the wall does not add up to an effective energy-saving measure. The use of artificial siding is not recommended in a preservation retrofitting plan.

Good preservation practice would assure regular maintenance of the existing siding through periodic painting and caulking. Where deterioration is present, individual pieces of siding should be removed and replaced with matching new ones. Refer to the earlier sections of this brief for recommended retrofitting measures to improve the thermal performance of wood frame walls.

**Waterproof Coatings for Masonry:** Some owners of historic buildings use waterproof coatings on masonry believing it would improve the thermal performance of the wall by keeping it dry (dry masonry would have a better R factor than when wet). Application of waterproof coatings is not recommended because the coatings actually trap moisture within the masonry, and can cause spalling and severe deterioration during a freezing cycle.

In cases where exterior brick is painted, consider continued periodic painting and maintenance, since paints are an excellent preservation treatment for brick. When repainting, a building owner might consider choosing a light paint color in warm climates, or a dark color in co!d climates, to gain some advantage over the summer heat gain or winter heat loss, whichever the case may be. These colors should match those used historically on the building or should match colors available historically.

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## Mechanical Equipment

A detailed treatise of recommended or not recommended heating or air conditioning equipment, or of alternative energy sources such as solar energy or wind power, is beyond the scope of this brief. The best advice concerning mechanical equipment in historic buildings is to assure that the existing equipment works as efficiently as possible. If the best professional advice recommends replacement of existing equipment, a building owner should keep the following considerations in mind. First, as technology advances in the coming years, the equipment installed now will be outdated rapidly relative to the life of the historic building. Therefore, it may be best to wait and watch, until new technologies (such as solar energy) become more feasible, efficient, and inexpensive. Secondly, do not install new equipment and ductwork in such a way that its installation, or possible later removal, will cause irreversible damage to significant historic building materials. The concept of complete invisibility, which necessitates hiding piping and ductwork within wall and floor systems, may not always be appropriate for historic buildings because of the damage that often results. Every effort should be made to select a mechanical system that will require the least intrusion into the historic fabric of the building and that can be updated or altered without major intervention into the wall and floor systems. These points should be considered when weighing the decision to replace a less than efficient exiting system with a costly new system, which may cause substantial damage to the historic building materials and in turn may prove inefficient in the future.

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## Summary

The primary focus of this brief has been to describe ways to achieve the maximum energy savings in historic buildings without jeopardizing the architectural, cultural and historical qualities for which the properties have been recognized. This can be accomplished through undertaking the passive measures and the "recommended" preservation retrofitting. Secondly, this brief has emphasized the benefits of undertaking the retrofitting measures in phases so that the actual energy savings anticipated from each retrofitting measure can be realized. Thus, the "not recommended" retrofitting measures, with potential for damage or alteration of historic building materials, would not have to be undertaken, because the maximum feasible savings would have already been accomplished.

Lastly, and perhaps most important, we must recognize that the technologies of retrofitting and weatherization are relatively new. Unfortunately, most current research and product development is directed toward new construction. It is hoped that reports such as this, and the realization that fully 30% of all construction in the United States now involves work on existing buildings, will stimulate the development of new products that can be used with little hesitation in historic buildings. Until that time, owners of historic buildings can undertake the preservation retrofitting measures recommended here and greatly reduce the energy used for heating and cooling, without destroying those historic and architectural qualities that make the building worthy of preservation.

**NOTE**

(1) R factor is the measure of the ability of insulation to decrease heat flow. The higher the factor, the better the thermal performance of the material.

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**Washington, D.C. April, 1978**

**Home page logo: *Copper Grasshopper Weather Vane* by Shem Drowne, 1742, Faneuil Hall, Dock Square, Boston, Massachusetts. Photo: Courtesy, Index of American Design, Mass-Me-230, National Gallery of Art.**

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*This publication has been prepared pursuant to the National Historic Preservation Act of*

*1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.*

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# Aluminum and Vinyl Siding on Historic Buildings The Appropriateness of Substitute Materials for Resurfacing Historic Wood Frame Buildings

**John H. Myers, revised by Gary L. Hume**



**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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**A historic building is a product of the cultural heritage of its region,** the technology of its period, the skill of its builders, and the materials used for its construction. To assist owners, developers and managers of historic property in planning and completing rehabilitation project work that will meet the Secretary's "Standards for Rehabilitation"(36 CFR 67), the following planning process has been developed by the National Park Service and is applicable to all historic buildings. This planning process is a sequential approach to the preservation of historic wood frame buildings.

*It begins with the premise that historic materials should be retained wherever possible. When retention, including retention with some repair, is not*

Historic wood siding exhibits rich and varied surface textures. They range from hand-split clapboards of short lengths with feather-edged ends (shown here), to pit or mill sawn boards which can be beveled, rabbeted, or beaded. Photo: NPS files.

*possible,then replacement of the irreparable historic material can be considered.* The purpose of this approach is to determine the appropriate level of treatment for the preservation of historic wood frame buildings.

**Standard 6** of the *Secretary of the Interior's Standards for Rehabilitation* states that "deteriorated architectural features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials..." The *Guidelines* further caution against "removing or radically changing wood features which are important in defining the overall historic character of the building so that, as a result, the character is diminished."

The planning process has the following four steps:

**1. Identify and preserve those materials and features that are important in defining the building's historic character.** This may include features such as wood siding, brackets, cornices, window architraves, doorway pediments, and their finishes and colors.

**2. Undertake routine maintenance on historic materials and features.** Routine maintenance generally involves the least amount of work needed to preserve the materials and features of the building. For example, maintenance of a frame building would include caulking and painting; or, where paint is extensively cracking and peeling, its removal and the re-application of a protective paint coating.

**3. Repair historic materials and features.** For a historic material such as wood siding, repair would generally involve patching and piecing-in with new material according to recognized preservation methods.

**4. Replace severely damaged or deteriorated historic materials and features in kind.** Replacing sound or repairable historic material is never recommended; however, if the historic material cannot be repaired because of the extent of deterioration or damage, then it will be necessary to replace an entire character-defining feature such as the building's siding. The preferred treatment is always replacement in kind, that is, with the same material. Because this approach is not always feasible, provision is made under the recommended treatment options in the Guidelines that accompany the Secretary of the Interior's Standards to consider the use of a compatible substitute material. A substitute material should only be considered, however, if the form, detailing, and overall appearance of the substitute material conveys the visual appearance of the historic material, and the application of the substitute material does not damage, destroy or obscure historic features.

In many cases, the replacement of wood siding on a historic building is proposed because little attention has been given to the retention of historic materials. Instead, the decision to use a substitute material is made because: (1) it is assumed that aluminum or vinyl siding will be a maintenance-free material; and (2) there is the desire to give a building a "remodeled" or "renovated" appearance. A decision to replace historic material must, however, be carefully considered for its impact on the historic resource--even when the model planning process has been followed and the appropriate treatment is replacement.

Therefore, this brief focuses on the visual and physical consequences of using a substitute material such as aluminum or vinyl siding for new siding installations on a wood frame historic building. These concerns include the potential of ***damaging or destroying*** historic material and features; the potential of ***obscuring*** historic material and features; and, most important, the potential of ***diminishing the historic character*** of the building.

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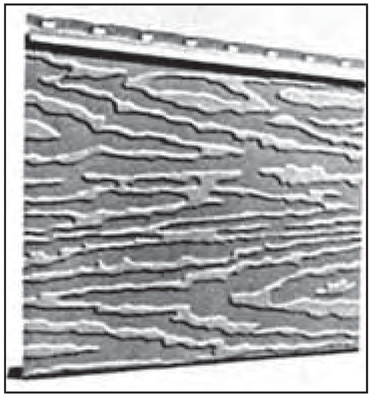
## The Historic Character of Buildings and Districts

The character or "identity" of a historic building is established by its form, size, scale and decorative features. It is also influenced by the choice of materials for the walls--by the dimension, detailing, color, and other surface characteristics. This is particularly true for wood frame buildings which are the typical objects of aluminum or vinyl siding applications. Since wood has always been present in abundance in America, it has been a dominant building material in most parts of the country. Early craftsmen used wood for almost every aspect of building construction: for structural members such as posts, beams and rafters, and for cladding materials and decorative details, such as trim, shakes, and siding.

The variety of tools used, coupled with regional differences



Aluminum and vinyl siding are available in a variety of widths and colors, but the optional wood graining is not characteristic of real wood siding. Photo: NPS files.

in design and craftsmanship, has resulted in a richness and diversity of wood sidings in America. For example, narrow boards with beveled, lapped joints called "clapboards" were used on New England frame dwellings. The size and shape of the "clapboards" were determined by the process of hand splitting or "riving" bolts of wood. The width, the short lengths, the beveled lapping, the "feathered" horizontal joints, and the surface nailing of the clapboards created a distinctive surface pattern that is recognizable as an important part of the historic character of these structures.

The sawn and hand-planed clapboards used throughout the Mid-Atlantic and Southern states in the eighteenth and early nineteenth centuries, by contrast, have a wide exposure--generally between six and eight inches. The exposure of the siding, frequently coupled with a beaded edge, created a very different play of light and shadow on the wall surface, thus resulting in a different character. The "German" or "Novelty siding"--a milled siding that is thin above and thicker below with a concave bevel--was used throughout many parts of the United States in the late nineteenth and early twentieth century but with regional variations in material, profile, and dimensions. One variation of this type of milled siding was called "California siding" and was milled with a rabbetted or shiplap edge to insure a tight installation of the weather boards. Shingles were also commonly used as an exterior cladding material, and in buildings such as the Bungalow style houses, were often an important character-defining feature of the exterior. Shingles were often applied in decorative patterns by varying the lap, thus creating alternating rows of narrow exposures and wide exposures. Shingles were also cut in geometric patterns such as diamond shapes and applied in patterns. This treatment was commonly used in the gable end of shingled houses. Siding and wood shingles were often used in combination with materials such as cobblestone and brick in Bungalow style buildings to create a distinctive interplay of surfaces and materials.

The primary concern, therefore, in considering replacement siding on a historic building, is the potential loss of those features such as the beaded edge, "drop" profile, and the patterns of application. Replacing historic wood siding with new wood, or aluminum or vinyl siding could severely diminish the unique aspects of

When aluminum was installed on the house on the right, the barge boards, scrollwork, columns, and railings were removed. The distinctive shingled gable and attic vent were covered, further compromising the building's architectural integrity. Photo: NPS files.

historic materials and craftsmanship. The inappropriate use of substitute siding is especially dramatic where sufficient care is not taken by the owner or applicator and the width of the clapboards is altered, shadow reveals are reduced, and molding or trim is changed or removed at the corners, at cornices or around windows and doors. Because substitute siding is usually added on top of existing siding, details around windows and doors may appear set back from the siding rather than slightly projecting; and if the relationship of molding or trim to the wall is changed, it can result in the covering or removal of these historic features. New substitute siding with embossed wood graining--intended to simulate the texture of wood--is also visually inappropriate. Exaggerated graining would have been undesirable on real wood siding and is generally found only after sandblasting, a destructive and totally unacceptable treatment for wood.

While this discussion focuses primarily on the historic character of individual wood frame buildings, of equal importance is the context of buildings that comprise a historic district or neighborhood. Changes to the character-defining features of a building, such as distinctive clapboarding and other wall surfaces and decorative trim, always have an impact on more than just that building; they also alter the historic visual relationship between the buildings in the district. If character-defining weatherboards, clapboards or shingles are replaced on a number of buildings in a historic district, the historic character of the entire district may be seriously damaged. Because of the potential impact some substitute materials have on the character of a neighborhood or district, many communities regulate their use through zoning ordinances and design review boards. These ordinances and review boards usually require review and approval of proposed alterations to a historic building that could potentially impact the historic character of the building or the district, including the application of substitute materials, such as aluminum or vinyl siding.

Preservation of a building or district and its historic character is based on the assumption that the retention of historic materials and features and their craftsmanship are of primary importance. Therefore, the underlying issue in any discussion of replacement materials is whether or not the integrity of historic materials and craftsmanship has been lost. Structures are historic because the materials and craftsmanship reflected in their construction are tangible and irreplaceable evidence of our cultural heritage. To the degree that substitute materials destroy and/or conceal the historic fabric, they will always subtract from the basic integrity of historically and architecturally significant buildings.

## The Products and Their Installation

The use of aluminum and vinyl siding really involves two separate industries. The siding materials themselves, including a variety of inside and outside corner pieces, trim and molding pieces and panning for window and door frames, are produced by a comparatively small number of manufacturers. The product information, advertising, and any manufacturer's warranties on the product itself are handled by this part of the industry. The installation of aluminum or vinyl siding is generally carried out by independent contractors or applicators, who are frequently called "home improvement" contractors, and they are not affiliated with the manufacturers. The manufacturer's warranties normally do not cover the installation, or any damage or defect resulting from the installation process.

Since the manufacturer has little control over the quality of the installation, both the quality of the work and the sensitivity of the application are variable. This variation in quality has traditionally been a problem in the industry and one which the industry and its professional associations have attempted to correct through publishing and disseminating information on the proper application of vinyl and aluminum siding.

When a building is in need of maintenance, such as the house on the right which needs painting, some owners consider installing aluminum or

Although it is sometimes argued that an artificial siding application is reversible since it can be removed, there is frequently irreversible damage to historic building materials if decorative features or trim are permitted to be cut down or destroyed, or removed by applicators and discarded. The installation process requires that the existing surface be flat and free of "obstructions" so that the new siding will be smooth and even in appearance. To achieve the requisite flat surface, furring strips are usually placed over the wall surface (vertical furring strips for horizontal aluminum or vinyl siding and vice-versa for vertical siding). The potential danger in this type of surface preparation is that the furring strips may change the relationship between the plane of the wall and the projecting elements such as windows, door trim, the cornice, or any other projecting trim or molding. Projecting details may also cause a vinyl siding. The result (see left) can be a complete loss of architectural character due to the covering of details and change of scale due to inappropriate siding dimensions. Photo: NPS files.

problem. To retain them, additional cutting and fitting will usually be required. Further, additional or special molding pieces, or "accessories" as they are called by the industry, such as channels, inserts and drip caps, will be needed to fit the siding around the architectural features. This custom fitting of the siding will be more labor-intensive, adding to the cost of the siding installation.

The existing wall fabric is further damaged by the nailing necessary to apply siding. Either by nailing directly to the building fabric or by nailing the furring strips to the old siding, the installation of aluminum or vinyl siding will leave numerous holes in wood siding, molding, trim, window and door frames. When applied to brick or other masonry units, the nail penetrations attaching the furring strips and siding can cause irreversible cracking or spalling of the masonry. Although this reference to damaging masonry is included as a point of fact, the application of aluminum or vinyl siding is highly inappropriate to historic masonry buildings.

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## The Use of Aluminum or Vinyl Siding on Historic Buildings

The maintenance and periodic painting of wood frame structures is a time-consuming effort and often a substantial expense for the homeowner. It is therefore understandable that a product which promises relief from periodic painting and gives the building a new exterior cladding would have considerable appeal. For these reasons, aluminum and vinyl siding have been used extensively in upgrading and rehabilitating the nation's stock of wood frame residential buildings. For historic residential buildings, aluminum or vinyl siding may be an acceptable alternative only if (1) the existing siding is so deteriorated or damaged that it cannot be repaired; (2) the substitute material can be installed without irreversibly damaging or obscuring the architectural features and trim of the building; and (3) the substitute material can match the historic material in size, profile and finish so that there is no change in the character of the historic building. In cases where a non-historic artificial siding has been applied to a building, the removal of such a siding, and the application of aluminum or vinyl siding would, in most cases, be an acceptable alternative, as long as the abovementioned first two conditions are met.

There are, however, also certain disadvantages in the use of a substitute material such as aluminum or vinyl siding, and these factors should be carefully considered before a decision is made to use such a material rather than the preferred replacement with new wood siding duplicating the old.

## Applying Siding without Dealing with Existing Problems

Since aluminum and vinyl sidings are typically marketed as home improvement items, they are frequently applied to buildings in need of maintenance and repair. This can result in concealing problems which are the early warning signs of deterioration. Minor uncorrected problems can progress to the point where expensive, major repairs to the structure become necessary.

If there is a hidden source of water entry within the wall or leakage from the roof, the installation of any new siding will not solve problems of deterioration and rotting that are occurring within the wall. If deferred maintenance has allowed water to enter the wall through deteriorated gutters and downspouts, for example, the cosmetic surface application of siding will not arrest these problems. In fact, if the gutters and downspouts are not repaired, such problems may become exaggerated because water may be channeled behind the siding. In addition to drastically reducing the efficiency of most types of wall insulation, such excessive moisture levels within the wall can contribute to problems with interior finishes such as paints or wallpaper, causing peeling, blistering or staining of the finishes.

It cannot be overemphasized that a cosmetic treatment to hide difficulties such as peeling paint, stains or other indications of deterioration is not a sound preservation practice; it is no substitute for proper care and maintenance. Aluminum and vinyl siding are not directly at fault in these situations since property owners should determine the nature and source of their problems, then make appropriate repairs. The difficulty arises when owners perceive the siding as the total solution to their required maintenance and forgo other remedial action.

## Durability and Cost

The questions of durability and relative costs of aluminum or vinyl siding compared to the maintenance cost of historic materials are complex. It is important to consider these questions carefully because both types of siding are marketed as long lasting, low maintenance materials. Assuming that the substitute sidings are not damaged, and that they will weather and age normally, there will be inevitable changes in color and gloss as time passes. A normal application of aluminum or vinyl siding is likely to cost from two to three times as much as a good paint job on wood siding. A sensitive application, retaining existing trim, will cost more. Therefore, to break even on expense, the new siding should last as long as two or three paintings before requiring maintenance. On wood two coats of good quality paint on a properly prepared surface can last from 8 to

10 years, according to the U.S. Department of Agriculture. If a conservative life of seven years is assumed for paint on wood, then aluminum and vinyl siding should last 15 to 21 years before requiring additional maintenance, to break even with the maintenance cost for painting wood siding. Once painted, the aluminum and vinyl siding will require repainting with the same frequency as wood.

While aluminum siding can dent upon impact and the impact resistance of vinyl siding decreases in low temperatures and, therefore, is susceptible to cracking from sharp impact, these materials are generally not more vulnerable than wood siding and shingles. All siding materials are subject to damage from storm, fire, and vandalism; however, there is a major difference in the repairability of wood siding versus substitute materials such as aluminum and vinyl. Although they can all be repaired, it is much easier to repair wood siding and the repair, after painting, is generally imperceptible. In addition, a major problem in the repairability of aluminum and vinyl siding, as mentioned above, is matching color since the factory finishes change with time. Matching the paint for wood siding has a greater likelihood of success.

## Energy

Because of high fuel costs, there is a concern for energy conservation in historic materials as well as in substitute materials. Because aluminum and vinyl siding can be produced with an insulating backing, these products are sometimes marketed as improving the thermal envelope of a historic building. The aluminum and vinyl material themselves are not good insulators, and the thickness of any insulating backing would, of necessity, be too small to add to the energy efficiency of a historic building. What energy savings did accrue as a result of a siding application would probably be as much the result of the creation of an air space between the old and new siding as the addition of insulating material. If the historic wood siding were removed in the course of installing the aluminum or vinyl siding (even with an insulating backing), the net result would likely be a loss in overall thermal efficiency for the exterior sheathing.

Preservation Briefs Number 3, "Conserving Energy in Historic Buildings," notes that the primary sources of energy loss in small frame buildings are the doors, windows and roof. It is, therefore, more cost-effective to apply storm windows, weatherstripping and attic insulation than to treat the sidewalls of these structures. There are numerous publications on energy retrofitting which explain techniques of determining cost-effectiveness based on utility costs, R-factors or materials and initial cost of the treatment. Persons interested in this approach may wish to read "Retrofitting Existing Houses for Energy Conservation: An Economic Analysis" published by the National Bureau of Standards, or the U.S. Department of Housing and Urban Development booklet "In the Bank or Up the Chimney." One such study in Providence, Rhode Island, determined that for a two-story house, twenty-five feet square, the payback period for twenty-three storm windows, two storm doors and six inches of attic insulation (R-20) was 4.4 years while the payback period of aluminum siding with an R-factor of 2.5 was 29.96 years. Most of the information which is available supports the position that aluminum or vinyl siding will not have a reasonable payback on an energy-saving basis alone.

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## Summary

The intent of this brief has been to delineate issues that should be considered when contemplating the use of aluminum or vinyl sidings on historic buildings and assessing under what circumstances substitute materials such as artificial siding may be used without damaging the integrity of the historic building or adversely changing its historic character. Many property owners are faced with decisions weighing the historic value of their building and its maintenance cost against the possible benefit of aluminum and vinyl siding materials. To assist in making these decisions, "The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings" have been published and are available from National Park Service Regional Offices and State Historic Preservation Offices. Further, since rehabilitation projects for income-producing historic buildings often seek tax benefits under the 1981 Economic Recovery Tax Act, as amended, it is essential that all work, such as the replacement of exterior siding, be carried out in conformance with the Standards and be consistent with the building's historic character to insure that the tax benefits are not denied.

As stated earlier, the application of aluminum and vinyl siding is frequently considered as an alternative to the maintenance of the original historic material. The implication is that the new material is an economical and long-lasting alternative and therefore somehow superior to the historic material. In reality, historic building materials such as wood, brick and stone, when properly maintained, are generally durable and serviceable materials. Their widespread existence on tens of thousands of old buildings after many decades in serviceable condition is proof that they are the original economic and long-lasting alternatives. All materials, including aluminum and vinyl siding can fall into disrepair if abused or neglected; however, the maintenance, repair and retention of historic materials are always the most architecturally appropriate and usually the most economically sound measures when the objective is to preserve the unique qualities of historic buildings.

The inappropriate siding applied to the house on the right has altered the character of the urban setting. Photo: NPS files.

The appropriate preservation decision on the use of a substitute material in the rehabilitation of a historic building must always center on two principal concerns: the possible damage or destruction of historic building materials; and, the possible negative impact on the historic character of the building and the historic district or setting in which the building is located. Because applications of substitute materials such as aluminum and vinyl siding can either destroy or conceal historic building material and features and, in consequence, result in the loss of a building's historic character, they are not recommended by the National Park Service. Such destruction or concealment of historic materials and features confuses the public perception of that which is truly historic and that which is imitative.

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9 Preservation Briefs

Technical Preservation Services
National Park Service
U.S. Department of the Interior

# The Repair of Historic Wooden Windows

**John H. Myers**



**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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**The windows on many historic buildings are an important aspect of the architectural character of those buildings.** Their design, craftsmanship, or other qualities may make them worthy of preservation. This is self-evident for ornamental windows, but it can be equally true for warehouses or factories where the windows may be the most dominant visual element of an otherwise plain building. Evaluating the significance of these windows and planning for their repair or replacement can be a complex process involving both objective and subjective considerations. *The Secretary of the Interior's Standards for Rehabilitation* and the accompanying guidelines, call for respecting the significance of original materials and features, repairing and retaining them wherever possible, and when necessary, replacing them in kind. This Brief is based on the issues of significance and repair which are implicit in the standards, but the primary emphasis is on the technical issues of planning for the repair of windows including evaluation of their physical condition, techniques of repair, and design considerations when replacement is necessary.

Much of the technical section presents repair techniques as an instructional guide for the do-it-yourselfer. The information will be useful, however, for the architect, contractor, or developer on large-scale projects. It presents a methodology for approaching the evaluation and repair of existing windows, and considerations for replacement, from which the professional can develop alternatives and specify appropriate materials and procedures.

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## Architectural or Historical Significance

Evaluating the architectural or historical significance of windows is the first step in planning for window treatments, and a general understanding of the function and history of windows is vital to making a proper evaluation. As a part of this evaluation, one must consider four basic window functions: admitting light to the interior spaces, providing fresh air and ventilation to the interior, providing a visual link to the outside world, and enhancing the appearance of a building. No single factor can be disregarded when planning window treatments; for example, attempting to conserve energy by closing up or reducing the size of window openings may result in the use of *more* energy by increasing electric lighting loads and decreasing passive solar heat gains.

Historically, the first windows in early American houses were casement windows; that is, they were hinged at the side and opened outward. In the beginning of the eighteenth century single- and double-hung windows were introduced. Subsequently many styles of these vertical sliding sash windows have come to be associated with specific building periods or architectural styles, and this is an important consideration in determining the significance of windows, especially on a local or regional basis. Site-specific, regionally oriented architectural comparisons should be made to determine the significance of windows in question. Although such comparisons may focus on specific window

Windows are frequently important visual focal points, especially on simple facades such as this mill building. Replacement of the multi-pane windows with larger panes could dramatically alter the appearance of the building. Photo: NPS files.

types and their details, the ultimate determination of significance should be made within the context of the whole building, wherein the windows are one architectural element.

After all of the factors have been evaluated, **windows should be considered significant to a building if they: 1)** are original, **2)** reflect the original design intent for the building, **3)** reflect period or regional styles or building practices, **4)** reflect changes to the building resulting from major periods or events, or **5)** are examples of exceptional craftsmanship or design. Once this evaluation of significance has been completed, it is possible to proceed with planning appropriate treatments, beginning with an investigation of the physical condition of the windows.

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## Physical Evaluation

The key to successful planning for window treatments is a careful evaluation of existing physical conditions on a unit-by-unit basis. A graphic or photographic system may be devised to record existing conditions and illustrate the scope of any necessary repairs. Another effective tool is a window schedule which lists all of the parts of each window unit. Spaces by each part allow notes on existing conditions and repair instructions. When such a schedule is completed, it indicates the precise tasks to be performed in the repair of each unit and becomes a part of the specifications. In any evaluation, one should note at a minimum:

- **1)** window location
- **2)** condition of the paint
- **3)** condition of the frame and sill
- **4)** condition of the sash (rails, stiles and muntins)
- **5)** glazing problems
- **6)** hardware, and
- **7)** the overall condition of the window (excellent, fair, poor, and so forth)

Many factors such as poor design, moisture, vandalism, insect attack, and lack of maintenance can contribute to window deterioration, but moisture is the primary contributing factor in wooden window decay. All window units should be inspected to see if water is entering around the edges of the frame and, if so, the joints or seams should be caulked to eliminate this danger. The glazing putty should be checked for cracked, loose, or missing sections which allow water to saturate the wood, especially at the joints. The back putty on the interior side of the pane should also be inspected, because it creates a seal which prevents condensation from running down into the joinery. The sill should be examined to insure that it slopes downward away from the building and allows water to drain off. In addition, it may be advisable to cut a dripline along the underside of the sill. This almost invisible treatment will insure proper water runoff, particularly if the bottom of the sill is flat. Any conditions, including poor original design, which permit water to come in contact with the wood or to puddle on the sill must be corrected as they contribute to deterioration of the window.


**Deterioration of poorly maintained windows usually begins on horizontal surfaces and at joints, where water can collect and saturate the wood. Photo: NPS files.**

One clue to the location of areas of excessive moisture is the condition of the paint; therefore, each window should be examined for areas of paint failure. Since excessive moisture is detrimental to the paint bond, areas of paint blistering, cracking, flaking, and peeling usually identify points of water penetration, moisture saturation, and potential deterioration. Failure of the paint should not, however, be mistakenly interpreted as a sign that the wood is in poor condition and hence, irreparable. Wood is frequently in sound physical condition beneath unsightly paint. After noting areas of paint failure, the next step is to inspect the condition of the wood, particularly at the points identified during the paint examination.

Each window should be examined for operational soundness beginning with the lower portions of the frame and sash. Exterior rainwater and interior condensation can flow downward along the window, entering and collecting at points where the flow is blocked. The sill, joints between the sill and jamb, corners of the bottom rails and muntin joints are typical points where water collects and deterioration begins. The operation of the window (continuous opening and closing over the years and seasonal temperature changes) weakens the joints, causing movement and slight separation. This process makes the joints more vulnerable to water which is readily absorbed into the endgrain of the wood. If severe deterioration exists in these areas, it will usually be apparent on visual inspection, but other less severely deteriorated areas of the wood may be tested by two traditional methods using a small ice pick.

An ice pick or an awl may be used to test wood for soundness. The technique is simply to jab the pick into a wetted wood surface at an angle and pry up a small section of the wood. Sound wood will separate in long fibrous splinters, but decayed wood will lift up in short irregular pieces due to the breakdown of fiber strength.

Another method of testing for soundness consists of pushing a sharp object into the wood, perpendicular to the surface. If deterioration has begun from the hidden side of a member and the core is badly decayed, the visible surface may appear to be sound wood. Pressure on the probe can force it through an apparently sound skin to penetrate deeply into decayed wood. This technique is especially useful for checking sills where visual access to the underside is restricted.

Following the inspection and analysis of the results, the scope of the necessary repairs will be evident and a plan for the rehabilitation can be formulated. Generally the actions necessary to return a window to "like new" condition will fall into three broad categories: ***1) routine maintenance procedures***, ***2) structural stabilization***, and ***3) parts replacement***. These categories will be discussed in the following sections and will be referred to respectively as **Repair Class I**, **Repair Class II**, and **Repair Class III.** Each successive repair class represents an increasing level of difficulty, expense, and work time. Note that most of the points mentioned in Repair Class I are routine maintenance items and should be provided in a regular maintenance program for any building. The neglect of these routine items can contribute to many common window problems.

Before undertaking any of the repairs mentioned in the following sections all sources of moisture penetration should be identified and eliminated, and all existing decay fungi destroyed in order to arrest the deterioration process. Many commercially available fungicides and wood preservatives are toxic, so it is extremely important to follow the manufacturer's recommendations for application, and store all chemical materials away from children and animals. After fungicidal and preservative treatment the windows may be stabilized, retained, and restored with every expectation for a long service life.

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## Repair Class I: Routine Maintenance

Repairs to wooden windows are usually labor intensive and relatively uncomplicated. On small scale projects this allows the do-it-yourselfer to save money by repairing all or part of the windows. On larger projects it presents the opportunity for time and money which might otherwise be spent on the removal and replacement of existing windows, to be spent on repairs, subsequently saving all or part of the material cost of new window units. Regardless of the actual costs, or who performs the work, the evaluation process described earlier will provide the knowledge from which to specify an appropriate work program, establish the work element priorities, and identify the level of skill needed by the labor force.

This historic double-hung window has many layers of paint, some cracked and missing putty, slight separation at the joints, broken sash cords, and one cracked pane. Photo: NPS files.

After removing paint from the seam between the interior stop and the jamb, the stop can be pried out and gradually worked loose using a pair of putty knives as shown. Photo: NPS files.

The routine maintenance required to upgrade a window to "like new" condition normally includes the following steps: 1) some degree of interior and exterior paint removal, 2) removal and repair of sash (including reglazing where necessary), 3) repairs to the frame, 4) weatherstripping and reinstallation of the sash, and 5) repainting. These operations are illustrated for a typical double-hung wooden window, but they may be adapted to other window types and styles as applicable.

Historic windows have usually acquired many layers of paint over time. Removal of excess layers or peeling and flaking paint will facilitate operation of the window and restore the clarity of the original detailing. Some degree of paint removal is also necessary as a first step in the proper surface preparation for subsequent refinishing (if paint color analysis is desired, it should be conducted prior to the onset of the paint removal). There are several safe and effective techniques for removing paint from wood, depending on the amount of paint to be removed.

Paint removal should begin on the interior frames, being careful to remove the paint from the interior stop and the parting bead, particularly along the seam where these stops meet the jamb. This can be accomplished by running a utility knife along the length of the seam, breaking the paint bond. It will then be much easier to remove the stop, the parting bead and the sash. The interior stop may be initially loosened from the sash side to avoid visible scarring of the wood and then gradually pried loose using a pair of putty knives, working up and down the stop in small increments. With the stop removed, the lower or interior sash may be withdrawn. The sash cords should be detached from the sides of the sash and their ends may be pinned with a nail or tied in a knot to prevent them from falling into the weight pocket.

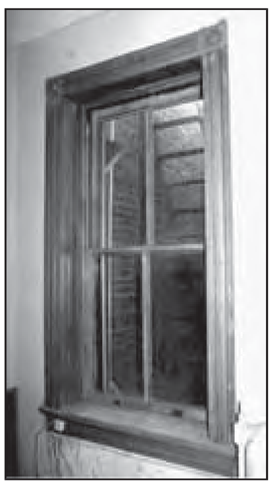
Sash can be removed and repaired in a convenient work area. Paint is being removed from this sash with a hot air gun. Photo: NPS files.

Removal of the upper sash on double-hung units is similar but the parting bead which holds it in place is set into a groove in the center of the stile and is thinner and more delicate than the interior stop. After removing any paint along the seam, the parting bead should be carefully pried out and worked free in the same manner as the interior stop. The upper sash can be removed in the same manner as the lower one and both sash taken to a convenient work area (in order to remove the sash the interior stop and parting bead need only be removed from one side of the window). Window openings can be covered with polyethylene sheets or plywood sheathing while the sash are out for repair.

The sash can be stripped of paint using appropriate techniques, but if any heat treatment is used, the glass should be removed or protected from the sudden temperature change which can cause breakage. An overlay of aluminum foil on gypsum board or asbestos can protect the glass from such rapid temperature change. It is important to protect the glass because it may be historic and often adds character to the window. Deteriorated putty should be removed manually, taking care not to damage the wood along the rabbet. If the glass is to be removed, the glazing points which hold the glass in place can be extracted and the panes numbered and removed for cleaning and reuse in the same openings. With the glass panes out, the remaining putty can be removed and the sash can be sanded, patched, and primed with a preservative primer. Hardened putty in the rabbets may be softened by heating with a soldering iron at the point of removal. Putty remaining on the glass may be softened by soaking the panes in linseed oil, and then removed with less risk of breaking the glass. Before reinstalling the glass, a bead of glazing compound or linseed oil putty should be laid around the rabbet to cushion and seal the glass. Glazing compound should only be used on wood which has been brushed with linseed oil and primed with an oil based primer or paint. The pane is then pressed into place and the glazing points are pushed into the wood around the perimeter of the pane.

The final glazing compound or putty is applied and beveled to complete the seal. The sash can be refinished as desired on the inside and painted on the outside as soon as a "skin" has formed on the putty, usually in 2 or 3 days. Exterior paint should cover the beveled glazing compound or putty and lap over onto the glass slightly to complete a weather-tight seal. After the proper curing times have elapsed for paint and putty, the sash will be ready for reinstallation.

While the sash are out of the frame, the condition of the wood in the jamb and sill can be evaluated. Repair and refinishing of the frame may proceed concurrently with repairs to the sash, taking advantage of the curing times for the paints and putty used on the sash. One of the most common work items is the replacement of the sash cords with new rope cords or with chains. The weight pocket is frequently accessible through a door on the face of the frame near the sill, but if no door exists, the trim on the interior face may be removed for access. Sash weights may be increased for easier window operation by elderly or handicapped persons. Additional repairs to the frame and sash may include consolidation or replacement of deteriorated wood. Techniques for these repairs are discussed in the following sections.



Following the relatively simple repairs, the window is weathertight, like new in appearance, and

The operations just discussed summarize the efforts necessary to restore a window with minor deterioration to "like new" condition. The techniques can be applied by an unskilled person with minimal training and experience. To demonstrate the practicality of this approach, and photograph it, a Technical Preservation Services staff member repaired a wooden double-hung, two over two window which had been in service over ninety years. The wood was structurally sound but the window had one broken pane, many layers of paint, broken sash cords and inadequate, worn-out weatherstripping. The staff member found that the frame could be stripped of paint and the sash removed quite easily. Paint, putty and glass removal required about one hour for each sash, and the reglazing of both sash was accomplished in about one hour. Weatherstripping of the sash and frame, replacement of the sash cords and reinstallation of the sash, parting bead, and stop required an hour and a half. These times refer only to individual operations; the entire process took several days due to the drying and curing times for putty, primer, and serviceable for many years to come.Photo: NPS files.

paint, however, work on other window units could have been in progress during these lag times.

## Repair Class II: Stabilization

The preceding description of a window repair job focused on a unit which was operationally sound. Many windows will show some additional degree of physical deterioration, especially in the vulnerable areas mentioned earlier, but even badly damaged windows can be repaired using simple processes. Partially decayed wood can be waterproofed, patched, built-up, or consolidated and then painted to achieve a sound condition, good appearance, and greatly extended life. Three techniques for repairing partially decayed or weathered wood are discussed in this section, and all three can be accomplished using products available at most hardware stores.

One established technique for repairing wood which is split, checked or shows signs of rot, is to: **1)** dry the wood, **2)** treat decayed areas with a fungicide, **3)** waterproof with two or three applications of boiled linseed oil (applications every 24 hours), **4)** fill cracks and holes with putty, and **5)** after a "skin" forms on the putty, paint the surface. Care should be taken with the use of fungicide which is toxic. Follow the manufacturers' directions and use only on areas which will be painted. When using any technique of building up or patching a flat surface, the finished surface should be sloped slightly to carry water away from the window and not allow it to puddle. Caulking of the joints between the sill and the jamb will help reduce further water penetration.

This illustrates a two-part expoxy patching compound used to fill the

When sills or other members exhibit surface weathering they may also be built-up using wood putties or homemade mixtures such as sawdust and resorcinol glue, or whiting and varnish. These mixtures can be built up in successive layers, then sanded, primed, and painted. The same caution about proper slope for flat surfaces applies to this technique.

Wood may also be strengthened and stabilized by consolidation, using semirigid epoxies which saturate the porous decayed wood and then harden. The surface of the consolidated wood can surface of a weathered sill and rebuild the missing edge. When the epoxy cures, it can be sanded smooth and painted to achieve a durable and waterproof repair. Photo: NPS files.

then be filled with a semirigid epoxy patching compound, sanded and painted. Epoxy patching compounds can be used to build up missing sections or decayed ends of members. Profiles can be duplicated using hand molds, which are created by pressing a ball of patching compound over a sound section of the profile which has been rubbed with butcher's wax. This can be a very efficient technique where there are many typical repairs to be done. The process has been widely used and proven in marine applications; and proprietary products are available at hardware and marine supply stores. Although epoxy materials may be comparatively expensive, they hold the promise of being among the most durable and long lasting materials available for wood repair. More information on epoxies can be found in the publication "Epoxies for Wood Repairs in Historic Buildings," cited in the bibliography.

Any of the three techniques discussed can stabilize and restore the appearance of the window unit. There are times, however, when the degree of deterioration is so advanced that stabilization is impractical, and the only way to retain some of the original fabric is to replace damaged parts.

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## Repair Class III: Splices and Parts Replacement

When parts of the frame or sash are so badly deteriorated that they cannot be stabilized there are methods which permit the retention of some of the existing or original fabric. These methods involve replacing the deteriorated parts with new matching pieces, or splicing new wood into existing members. The techniques require more skill and are more expensive than any of the previously discussed alternatives. It is necessary to remove the sash and/or the affected parts of the frame and have a carpenter or woodworking mill reproduce the damaged or missing parts. Most millwork firms can duplicate parts, such as muntins, bottom rails, or sills, which can then be incorporated into the existing window, but it may be necessary to shop around because there are several factors controlling the practicality of this approach. Some woodworking mills do not like to repair old sash because nails or other foreign objects in the sash can damage expensive knives (which cost far more than their profits on small repair jobs); others do not have cutting knives to duplicate muntin profiles. Some firms prefer to concentrate on larger jobs with more profit potential, and some may not have a craftsman who can duplicate the parts. A little searching should locate a firm which will do the job, and at a reasonable price. If such a firm does not exist locally, there are firms which undertake this kind of repair and ship nationwide. It is possible, however, for the advanced do-it-yourselfer or craftsman with a table saw to duplicate moulding profiles using techniques discussed by Gordie Whittington in "Simplified Methods for Reproducing Wood Mouldings," *Bulletin* of the Association for Preservation Technology, Vol. III, No. 4, 1971, or illustrated more recently in *The Old House*, Time-Life Books, Alexandria, Virginia, 1979.

The repairs discussed in this section involve window frames which may be in very deteriorated condition, possibly requiring removal; therefore, caution is in order. The actual construction of wooden window frames and sash is not complicated. Pegged mortise and tenon units can be disassembled easily, if the units are out of the building. The installation or connection of some frames to the surrounding structure, especially masonry walls, can complicate the work immeasurably, and may even require dismantling of the wall. It may be useful, therefore, to take the following approach to frame repair: **1)** conduct regular maintenance of sound frames to achieve the longest life possible, **2)** make necessary repairs in place, wherever possible, using stabilization and splicing techniques, and **3)** if removal is necessary, thoroughly investigate the structural detailing and seek appropriate professional consultation.

Another alternative may be considered if parts replacement is required, and that is sash replacement. If extensive replacement of parts is necessary and the job becomes prohibitively expensive it may be more practical to purchase new sash which can be installed into the existing frames. Such sash are available as exact custom reproductions, reasonable facsimiles (custom windows with similar profiles), and contemporary wooden sash which are similar in appearance. There are companies which still manufacture high quality wooden sash which would duplicate most historic sash. A few calls to local building suppliers may provide a source of appropriate replacement sash, but if not, check with local historical associations, the state historic preservation office, or preservation related magazines and supply catalogs for information.

If a rehabilitation project has a large number of windows such as a commercial building or an industrial complex, there may be less of a problem arriving at a solution. Once the evaluation of the windows is completed and the scope of the work is known, there may be a potential economy of scale. Woodworking mills may be interested in the work from a large project; new sash in volume may be considerably less expensive per unit; crews can be assembled and trained on site to perform all of the window repairs; and a few extensive repairs can be absorbed (without undue burden) into the total budget for a large number of sound windows. While it may be expensive for the average historic home owner to pay seventy dollars or more for a mill to grind a custom knife to duplicate four or five bad muntins, that cost becomes negligible on large commercial projects which may have several hundred windows.

Most windows should not require the extensive repairs discussed in this section. The ones which do are usually in buildings which have been abandoned for long periods or have totally lacked maintenance for years. It is necessary to thoroughly investigate the alternatives for windows which do require extensive repairs to arrive at a solution which retains historic significance and is also economically feasible. Even for projects requiring repairs identified in this section, if the percentage of parts replacement per window is low, or the number of windows requiring repair is small, repair can still be a cost effective solution.

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## Weatherization

A window which is repaired should be made as energy efficient as possible by the use of appropriate weatherstripping to reduce air infiltration. A wide variety of products are available to assist in this task. Felt may be fastened to the top, bottom, and meeting rails, but may have the disadvantage of absorbing and holding moisture, particularly at the bottom rail. Rolled vinyl strips may also be tacked into place in appropriate locations to reduce infiltration. Metal strips or new plastic spring strips may be used on the rails and, if space permits, in the channels between the sash and jamb. Weatherstripping is a historic treatment, but old weatherstripping (felt) is not likely to perform very satisfactorily. Appropriate contemporary weatherstripping should be considered an integral part of the repair process for windows. The use of sash locks installed on the meeting rail will insure that the sash are kept tightly closed so that the weatherstripping will function more effectively to reduce infiltration. Although such locks will not always be historically accurate, they will usually be viewed as an acceptable contemporary modification in the interest of improved thermal performance.

Many styles of storm windows are available to improve the thermal performance of existing windows. The use of exterior storm windows should be investigated whenever feasible because they are thermally efficient, cost-effective, reversible, and allow the retention of original windows (see "Preservation Briefs: 3"). Storm window frames may be made of wood, aluminum, vinyl, or plastic; however, the use of unfinished aluminum storms should be avoided. The visual impact of storms may be minimized by selecting colors which match existing trim color. Arched top storms are available for windows with special shapes. Although interior storm windows appear to offer an attractive option for achieving double glazing with minimal visual impact, the potential for damaging condensation problems must be addressed. Moisture which becomes trapped between the layers of glazing can condense on the colder, outer prime window, potentially leading to deterioration. The correct approach to using interior storms is to create a seal on the interior storm while allowing some ventilation around the prime window. In actual practice, the creation of such a durable, airtight seal is difficult.

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## Window Replacement

Although the retention of original or existing windows is always desirable and this Brief is intended to encourage that goal, there is a point when the condition of a window may clearly indicate replacement. The decision process for selecting replacement windows should not begin with a survey of contemporary window products which are available as replacements, but should begin with a look at the windows which are being replaced. Attempt to understand the contribution of the window(s) to the appearance of the facade including: **1)** the pattern of the openings and their size; **2)** proportions of the frame and sash; **3)** configuration of window panes; **4)** muntin profiles; **5)** type of wood; **6)** paint color; **7)** characteristics of the glass; and **8)** associated details such as arched tops, hoods, or other decorative elements. Develop an understanding of how the window reflects the period, style, or regional characteristics of the building, or represents technological development.

Armed with an awareness of the significance of the existing window, begin to search for a replacement which retains as much of the character of the historic window as possible. There are many sources of suitable new windows. Continue looking until an acceptable replacement can be found. Check building supply firms, local woodworking mills, carpenters, preservation oriented magazines, or catalogs or suppliers of old building materials, for product information. Local historical associations and state historic preservation offices may be good sources of information on products which have been used successfully in preservation projects.

Consider energy efficiency as one of the factors for replacements, but do not let it dominate the issue. Energy conservation is no excuse for the wholesale destruction of historic windows which can be made thermally efficient by historically and aesthetically acceptable means. In fact, a historic wooden window with a high quality storm window added should thermally outperform a new double-glazed metal window which does not have thermal breaks (insulation between the inner and outer frames intended to break the path of heat flow). This occurs because the wood has far better insulating value than the metal, and in addition many historic windows have high ratios of wood to glass, thus reducing the area of highest heat transfer. One measure of heat transfer is the U-value, the number of Btu's per hour transferred through a square foot of material. When comparing thermal performance, the lower the U-value the better the performance.

According to ASHRAE 1977 Fundamentals, the U-values for single glazed wooden windows range from 0.88 to 0.99. The addition of a storm window should reduce these figures to a range of 0.44 to 0.49. A non-thermal break, double-glazed metal window has a U-value of about 0.6.

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## Conclusion

Technical Preservation Services recommends the retention and repair of original windows whenever possible. We believe that the repair and weatherization of existing wooden windows is more practical than most people realize, and that many windows are unfortunately replaced because of a lack of awareness of techniques for evaluation, repair, and weatherization. Wooden windows which are repaired and properly maintained will have greatly extended service lives while contributing to the historic character of the building. Thus, an important element of a building's significance will have been preserved for the future.

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## Additional Reading

*ASHRAE Handbook 1977 Fundamentals.* New York: American Society of Heating, Refrigerating and Air-conditioning Engineers, 1978 (chapter 26).

Ferro, Maximillian. *Preservation: Present Pathway to Fall River's Future.* Fall River, Massachusetts: City of Fall River, 1979 (chapter 7).

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Morrison, Hugh. *Early American Architecture*. New York: Oxford University Press, 1952.

Phillips, Morgan, and Selwyn, Judith. *Epoxies for Wood Repairs in Historic Buildings.* Washington, DC: Technical Preservation Services, U.S. Department of the Interior (Government Printing Office, Stock No. 024016000951), 1978.

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"Sealing Leaky Windows." *Old House Journal* (no. 1, 1973): 5.

Smith, Baird M. "Preservation Briefs: 3 Conserving Energy in Historic Buildings." Washington, DC: Technical Preservation Services, U.S. Department of the Interior, 1978.

Weeks, Kay D. and David W. Look, "Preservation Briefs: 10 Exterior Paint Problems on Historic Woodwork." Washington, DC: Technical Preservation Services, U.S. Department of the Interior, 1982.

**Washington, D.C. 1981**

**Home page logo: Historic six-over-six windows--preserved. Photo: NPS files.**

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*This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.*

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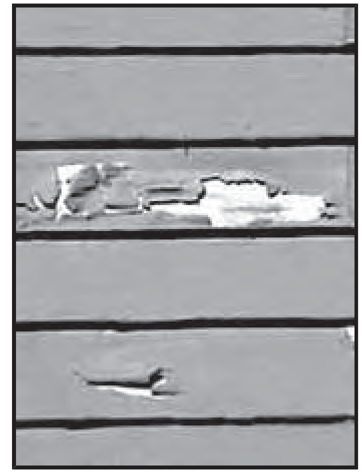
10 Preservation Briefs

Technical Preservation Services
National Park Service
U.S. Department of the Interior

# Exterior Paint Problems on Historic Woodwork

Kay D. Weeks and David W. Look, AIA





**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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**A cautionary approach to paint removal is included in the guidelines to the *Secretary of the Interior Standards for Rehabilitation.*** Removing paints down to bare wood surfaces using harsh methods can permanently damage those surfaces; therefore such methods are not recommended. Also, total removal obliterates evidence of the historical paints and their sequence and architectural context.

This Brief expands on that advice for the architect, building manager, contractor, or homeowner by identifying and describing common types of paint surface conditions and failures, then recommending appropriate treatments for preparing exterior wood surfaces for repainting to assure the best adhesion and greatest durability of the new paint.

Although the Brief focuses on responsible methods of "paint removal," several paint surface conditions will be described which do not require any paint removal, and still others which can be successfully handled by limited paint removal. In all cases, the information is intended to address the concerns related to exterior wood. It will also be generally assumed that, because houses built before 1950 involve one or more layers of lead-based paint, the majority of conditions warranting paint removal will mean dealing with this toxic substance along with the dangers of the paint removal tools and chemical strippers themselves.

## Purposes of Exterior Paint

The paint on this exterior decorative feature is sound. Photo: NPS files.

Paint applied to exterior wood must withstand yearly extremes of both temperature and humidity. While never expected to be more than a temporary physical shield--requiring reapplication every 5 to 8 years--its importance should not be minimized. Because one of the main causes of wood deterioration is moisture penetration, a primary purpose for painting wood is to exclude such moisture, thereby slowing deterioration not only of a building's exterior siding and decorative features but, ultimately, its underlying structural members. Another important purpose for painting wood is, of course, to define and accent architectural features and to improve appearance.

## Treating Paint Problems in Historic Buildings

Exterior paint is constantly deteriorating through the processes of weathering, but in a program of regular maintenance--assuming all other building systems are functioning properly--surfaces can be cleaned, lightly scraped, and hand sanded in preparation for a new finish coat. Unfortunately, these are ideal conditions. More often, complex maintenance problems are inherited by owners of historic buildings, including areas of paint that have failed beyond the point of mere cleaning, scraping, and hand sanding (although much so-called "paint failure" is attributable to interior or exterior moisture problems or surface preparation and application mistakes with previous coats).

Although paint problems are by no means unique to historic buildings, treating multiple layers of hardened, brittle paint on complex, ornamental--and possibly fragile--exterior wood surfaces necessarily requires an extremely cautious approach. In the case of recent construction, this level of concern is not needed because the wood is generally less detailed and, in addition, retention of the sequence of paint layers as a partial record of the building's history is not an issue.

When the protective and decorative paint finish was removed and an inappropriate clear finish applied, the exterior character of the building was altered. Photo: NPS files.

When historic buildings are involved, however, a special set of problems arises--varying in complexity depending upon their age, architectural style, historical importance, and physical soundness of the wood--which must be carefully evaluated so that decisions can be made that are sensitive to the longevity of the resource.

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## Justification for Paint Removal

At the outset of this Brief, it must be emphasized that removing paint from historic buildings--with the exception of cleaning, light scraping, and hand sanding as part of routine maintenance--should be avoided unless absolutely essential. ***Once conditions warranting removal have been identified the general approach should be to remove paint to the next sound layer using the gentlest means possible, then to repaint.*** Practically speaking as well, paint can adhere just as effectively to existing paint as to bare wood, providing the previous coats of paint are also adhering uniformly and tightly to the wood and the surface is properly prepared for repainting-- cleaned of dirt and chalk and dulled by sanding.

But, if painted exterior wood surfaces display continuous patterns of deep cracks or if they are extensively blistering and peeling so that bare wood is visible, then the old paint should be completely removed before repainting. The only other justification for removing all previous layers of paint is if doors, shutters, or windows have literally been "painted shut," or if new wood is being pieced-in adjacent to old painted wood and a smooth transition is desired.

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## Paint Removal Precautions

Because paint removal is a difficult and painstaking process, a number of costly, regrettable experiences have occurred--and continue to occur--for both the historic building and the building owner. Historic buildings have been set on fire with blow torches; wood irreversibly scarred by sandblasting or by harsh mechanical devices such as rotary sanders and rotary wire strippers; and layers of historic paint inadvertently and unnecessarily removed. In addition, property owners, using techniques that substitute speed for safety, have been injured by toxic lead vapors or dust from the paint they were trying to remove or by misuse of the paint removers themselves.

Owners of historic properties considering paint removal should also be aware of the amount of time and labor involved. While removing damaged layers of paint from a door or porch railing might be readily accomplished within a reasonable period of time by one or two people, removing paint from larger areas of a building can, without professional assistance, easily become unmanageable and produce less than satisfactory results. The amount of work involved in any paint removal project must therefore be analyzed on a case-by-case basis. Hiring qualified professionals will often be a cost-effective decision due to the expense of materials, the special equipment required, and the amount of time involved. Further, paint removal companies experienced in dealing with the inherent health and safety dangers of paint removal should have purchased such protective devices as are needed to mitigate any dangers and should also be aware of State or local environmental and/or health regulations for hazardous waste disposal.

All in all, paint removal is a messy, expensive, and potentially dangerous aspect of rehabilitating or restoring historic buildings and should not be undertaken without careful thought concerning first, its necessity, and second, which of the available recommended methods is the safest and most appropriate for the job at hand.

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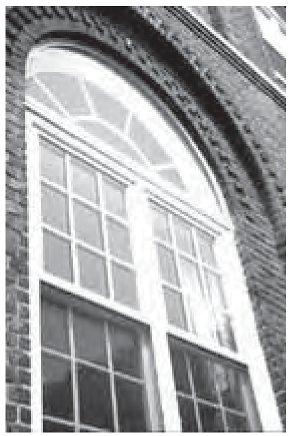
## Re-painting Historic Buildings for Cosmetic Reasons

If existing exterior paint on wood siding, eaves, window sills, sash, and shutters, doors, and decorative features shows no evidence of paint deterioration such as chalking, blistering, peeling, or cracking, then there is no physical reason to repaint, much less remove paint! Nor is color fading, of itself, sufficient justification to repaint a historic building.

The decision to repaint may not be based altogether on paint failure. Where there is a new owner, or even where ownership has remained constant through the years, taste in colors often changes. Therefore, if repainting is primarily to alter a building's primary and accent colors, a technical factor of paint accumulation should be taken into consideration.



When the paint on the wood windows became too thick, it was removed and the window repainted. Photo: NPS files.

When paint builds up to a thickness of approximately 1/16" (approximately 16 to 30 layers), one or more extra coats of paint may be enough to trigger cracking and peeling in limited or even widespread areas of the building's surface. This results because excessively thick paint is less able to withstand the shrinkage or pull of an additional coat as it dries and is also less able to tolerate thermal stresses. Thick paint invariably fails at the weakest point of adhesion--the oldest layers next to the wood. Cracking and peeling follow. Therefore, if there are no signs of paint failure, it may be somewhat risky to add still another layer of unneeded paint simply for color's sake (extreme changes in color may also require more than one coat to provide proper hiding power and full color). When paint appears to be nearing the critical thickness, a change of accent colors (that is, just to limited portions of the trim) might be an acceptable compromise without chancing cracking and peeling of paint on wooden siding.

If the decision to repaint is nonetheless made, the "new" color or colors should, at a minimum, be appropriate to the style and setting of the building. On the other hand, where the intent is to restore or accurately reproduce the colors originally used or those from a significant period in the building's evolution, they should be based on the results of a paint analysis.

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## Identification of Exterior Paint Surface Conditions/Recommended Treatments

It is assumed that a preliminary check will already have been made to determine, first, that the painted exterior surfaces are indeed wood--and not stucco, metal, or other wood substitutes--and second, that the wood has not decayed so that repainting would be superfluous. For example, if any area of bare wood such as window sills has been exposed for a long period of time to standing water, wood rot is a strong possibility. Repair or replacement of deteriorated wood should take place before repainting. After these two basic issues have been resolved, the surface condition identification process may commence.


The problem evidenced here by mossy growth and deteriorated wood must be resolved and the wood allowed to dry out before the wood is repainted. Photo: NPS files.

The historic building will undoubtedly exhibit a variety of exterior paint surface conditions. For example, paint on the wooden siding and doors may be adhering firmly; paint on the eaves peeling; and paint on the porch balusters and window sills cracking and alligatoring. The accurate identification of each paint problem is therefore the first step in planning an appropriate overall solution.

Paint surface conditions can be grouped according to their relative severity: CLASS I conditions include minor blemishes or dirt collection and generally require no paint removal; CLASS II conditions include failure of the top layer or layers of paint and generally require limited paint removal; and CLASS III conditions include substantial or multiple-layer failure and generally require total paint removal. It is precisely because conditions will vary at different points on the building that a careful inspection is critical. Each item of painted exterior woodwork (i.e., siding, doors, windows, eaves, shutters, and decorative elements) should be examined early in the planning phase and surface conditions noted.

## CLASS I Exterior Surface Conditions Generally Requiring No Paint Removal

### Dirt, Soot, Pollution, Cobwebs, Insect Cocoons, etc.

***Cause of Condition***

Environmental "grime" or organic matter that tends to cling to painted exterior surfaces and, in particular, protected surfaces such as eaves, do not constitute a paint problem unless painted over rather than removed prior to repainting. If not removed, the surface deposits can be a barrier to proper adhesion and cause peeling.

***Recommended Treatment***

Most surface matter can be loosened by a strong, direct stream of water from the nozzle of a garden hose. Stubborn dirt and soot will need to be scrubbed off using l/2 cup of household detergent in a gallon of water with a medium soft bristle brush. The cleaned surface should then be rinsed thoroughly, and permitted to dry before further inspection to determine if repainting is necessary. Quite often, cleaning provides a satisfactory enough result to postpone repainting.

## Mildew

***Cause of Condition***

Mildew is caused by fungi feeding on nutrients contained in the paint film or on dirt adhering to any surface. Because moisture is the single most important factor in its growth, mildew tends to thrive in areas where dampness and lack of sunshine are problems such as window sills, under eaves, around gutters and downspouts, on the north side of buildings, or in shaded areas near shrubbery. It may sometimes be difficult to distinguish mildew from dirt, but there is a simple test to differentiate: if a drop of household bleach is placed on the suspected surface, mildew will immediately turn white whereas dirt will continue to look like dirt.

***Recommended Treatment***

Because mildew can only exist in shady, warm, moist areas, attention should be given to altering the environment that is conducive to fungal growth. The area in question may be shaded by trees which need to be pruned back to allow sunlight to strike the building; or may lack rain gutters or proper drainage at the base of the building. If the shady or moist conditions can be altered, the mildew is less likely to reappear. A recommend solution for removing mildew consists of one cup non-ammoniated detergent, one quart household bleach, and one gallon water. When the surface is scrubbed with this solution using a medium soft brush, the mildew should disappear; however, for particularly stubborn spots, an additional quart of bleach may be added. After the area is mildew-free, it should then be rinsed with a direct stream of water from the nozzle of a garden hose, and permitted to dry thoroughly. When repainting, specially formulated "mildew-resistant" primer and finish coats should be used.

## Excessive Chalking

### *Cause of Condition*

Chalking--or powdering of the paint surface--is caused by the gradual disintegration of the resin in the paint film. (The amount of chalking is determined both by the formulation of the paint and the amount of ultraviolet light to which the paint is exposed.) In moderation, chalking is the ideal way for a paint to "age," because the chalk, when rinsed by rainwater, carries discoloration and dirt away with it and thus provides an ideal surface for repainting. In excess, however, it is not desirable because the chalk can wash down onto a surface of a different color beneath the painted area and cause streaking as well as rapid disintegration of the paint film itself. Also, if a paint contains too much pigment for the amount of binder (as the old white lead carbonate/oil paints often did), excessive chalking can result.

### *Recommended Treatment*

The chalk should be cleaned off with a solution of l/2 cup household detergent to one gallon water, using a medium soft bristle brush. After scrubbing to remove the chalk, the surface should be rinsed with a direct stream of water from the nozzle of a garden hose, allowed to dry thoroughly, (but not long enough for the chalking process to recur) and repainted, using a non-chalking paint.

## Staining

### *Cause of Condition*

Staining of paint coatings usually results from excess moisture reacting with materials within the wood substrate. There are two common types of staining, neither of which requires paint removal. The most prevalent type of stain is due to the oxidation or rusting of iron nails or metal (iron, steel, or copper) anchorage devices. A second type of stain is caused by a chemical reaction between moisture and natural extractives in certain woods (red cedar or redwood) which results in a surface deposit of colored matter. This is most apt to occur in new replacement wood within the first 10-15 years.

### *Recommended Treatment*

In both cases, the source of the stain should first be located and the moisture problem corrected.

When stains are caused by rusting of the heads of nails used to attach shingles or siding to an exterior wall or by rusting or oxidizing iron, steel, or copper anchorage devices adjacent to a painted surface, the metal objects themselves should be hand sanded and coated with a rust-inhibitive primer followed by two finish coats. (Exposed nail heads should ideally be countersunk, spot primed, and the holes filled with a high quality wood filler except where exposure of the nail head was part of the original construction system or the wood is too fragile to withstand the countersinking procedure.)

Discoloration due to color extractives in replacement wood can usually be cleaned with a solution of equal parts denatured alcohol and water. After the affected area has been rinsed and permitted to dry, a "stainblocking primer" especially developed for preventing this type of stain should be applied (two primer coats are recommended for severe cases of bleeding prior to the finish coat). Each primer coat should be allowed to dry at least 48 hours.

## CLASS II Exterior Surface Conditions Generally Requiring Limited Paint Removal

### Crazing

***Cause of Condition***

Crazing--or surface cracking--is an exterior surface condition which can be successfully treated by sanding and painting. Photo: Courtesy, National Decorating Products Assocation.

Crazing--fine, jagged interconnected breaks in the top layer of paint--results when paint that is several layers thick becomes excessively hard and brittle with age and is consequently no longer able to expand and contract with the wood in response to changes in temperature and humidity. As the wood swells, the bond between paint layers is broken and hairline cracks appear. Although somewhat more difficult to detect as opposed to other more obvious paint problems, it is well worth the time to scrutinize all surfaces for crazing. If not corrected, exterior moisture will enter the crazed surface, resulting in further swelling of the wood and, eventually, deep cracking and alligatoring, a Class III condition which requires total paint removal.

***Recommended Treatment***

Crazing can be treated by hand or mechanically sanding the surface, then repainting. Although the hairline cracks may tend to show through the new paint, the surface will be protected against exterior moisture penetration.

## Intercoat Peeling

### *Cause of Condition*

Here, a latex top coat was applied directly over old oil paint, resulting in intercoat peeling. The latex was unable to adhere. If latex is used over oil, an oil-base primer should be applied first. Photo: Mary L. Oehrlein, AIA.

Intercoat peeling can be the result of improper surface preparation prior to the last repainting. This most often occurs in protected areas such as eaves and covered porches because these surfaces do not receive a regular rinsing from rainfall, and salts from airborne pollutants thus accumulate on the surface. If not cleaned off, the new paint coat will not adhere properly and that layer will peel.

Another common cause of intercoat peeling is incompatibility between paint types. For example, if oil paint is applied over latex paint, peeling of the top coat can sometimes result since, upon aging, the oil paint becomes harder and less elastic than the latex paint. If latex paint is applied over old, chalking oil paint, peeling can also occur because the latex paint is unable to penetrate the chalky surface and adhere.

### *Recommended Treatment*

First, where salts or impurities have caused the peeling, the affected area should be washed down thoroughly after scraping, then wiped dry. Finally, the surface should be hand or mechanically sanded, then repainted.

Where peeling was the result of using incompatible paints, the peeling top coat should be scraped and hand or mechanically sanded. Application of a high quality oil type exterior primer will provide a surface over which either an oil or a latex topcoat can be successfully used.

## Solvent Blistering

### *Cause of Condition*

Solvent blistering, the result of a less common application error, is not caused by moisture, but by the action of ambient heat on paint solvent or thinners in the paint film. If solventrich paint is applied in direct sunlight, the top surface can dry too quickly and, as a result, solvents become trapped beneath the dried paint film. When the solvent vaporizes, it forces its way through the paint film, resulting in surface blisters. This problem occurs more often with dark colored paints because darker colors absorb more heat than lighter ones. To distinguish between solvent blistering and blistering caused by moisture, a blister should be cut open. If another layer of paint is visible, then solvent blistering is likely the problem whereas if bare wood is revealed, moisture is probably to blame. Solvent blisters are generally small.

***Recommended Treatment***

Solvent-blistered areas can be scraped, hand or mechanically sanded to the next sound layer, then repainted. In order to prevent blistering of painted surfaces, paint should not be applied in direct sunlight.

## Wrinkling

***Cause of Condition***


Wrinkled layers can generally be removed by scraping and sanding as opposed to total paint removal. Photo: Courtesy, National Decorating Products Association.

Another error in application that can easily be avoided is wrinkling. This occurs when the top layer of paint dries before the layer underneath. The top layer of paint actually moves as the paint underneath (a primer, for example) is drying. Specific causes of wrinkling include: (1) applying paint too thick; (2) applying a second coat before the first one dries; (3) inadequate brushing out; and (4) painting in temperatures higher than recommended by the manufacturer.

***Recommended Treatment***

The wrinkled layer can be removed by scraping followed by hand or mechanical sanding to provide as even a surface as possible, then repainted following manufacturer's application instructions.

## CLASS III Exterior Surface Conditions Generally Requiring Total Paint Removal

If surface conditions are such that the majority of paint will have to be removed prior to repainting, it is suggested that a small sample of intact paint be left in an inconspicuous area either by covering the area with a metal plate, or by marking the area and identifying it in some way. (When repainting does take place, the sample should not be painted over). This will enable future investigators to have a record of the building's paint history.

## Peeling

### *Cause of Condition*

Extensively deteriorated paint needs to be removed to bare wood, then primed and re-painted. Photo: NPS files.

Peeling to bare wood is most often caused by excess interior or exterior moisture that collects behind the paint film, thus impairing adhesion. Generally beginning as blisters, cracking and peeling occur as moisture causes the wood to swell, breaking the adhesion of the bottom layer.

### *Recommended Treatment*

There is no sense in repainting before dealing with the moisture problems because new paint will simply fail. Therefore, the first step in treating peeling is to locate and remove the source or sources of the moisture, not only because moisture will jeopardize the protective coating of paint but because, if left unattended, it can ultimately cause permanent damage to the wood. Excess interior moisture should be removed from the building through installation of exhaust fans and vents. Exterior moisture should be eliminated by correcting the following conditions prior to repainting: faulty flashing; leaking gutters; defective roof shingles; cracks and holes in siding and trim; deteriorated caulking in joints and seams; and shrubbery growing too close to painted wood. After the moisture problems have been solved, the wood must be permitted to dry out thoroughly. The damaged paint can then be scraped off with a putty knife, hand or mechanically sanded, primed, and repainted.

## Cracking / Alligatoring

### *Cause of Condition*

Cracking and alligatoring are advanced stages of crazing. Once the bond between layers has been broken due to intercoat paint failure, exterior moisture is able to penetrate the surface cracks, causing the wood to swell and deeper cracking to take place.

This process continues until cracking, which forms parallel to grain, extends to bare wood. Ultimately, the cracking becomes an overall pattern of horizontal and vertical breaks in the paint layers that looks like reptile skin; hence, "alligatoring." In advanced stages of cracking and alligatoring, the surfaces will also flake badly.

***Recommended Treatment***

If cracking and alligatoring are present only in the top layers they can probably be scraped, hand or mechanically sanded to the next sound layer, then repainted. However, if cracking and/or alligatoring have progressed to bare wood and the paint has begun to flake, it will need to be totally removed. Methods include scraping or paint removal with the electric heat plate, electric heat gun, or chemical strippers, depending on the particular area involved. Bare wood should be primed within 48 hours then repainted.

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## Selecting the Appropriate / Safest Method to Remove Paint

After having presented the "hierarchy" of exterior paint surface conditions--from a mild condition such as mildewing which simply requires cleaning prior to repainting to serious conditions such as peeling and alligatoring which require total paint removal--one important thought bears repeating: if a paint problem has been identified that warrants either limited or total paint removal, the gentlest method possible for the particular wooden element of the historic building should be selected from the many available methods.

The treatments recommended--based upon field testing as well as onsite monitoring of Department of Interior grant-in-aid and certification of rehabilitation projects--are therefore those which take three overriding issues into consideration (1) the continued protection and preservation of the historic exterior woodwork; (2) the retention of the sequence of historic paint layers; and (3) the health and safety of those individuals performing the paint removal. By applying these criteria, it will be seen that no paint removal method is without its drawbacks and all recommendations are qualified in varying degrees.

### Methods for Removing Paint

After a particular exterior paint surface condition has been identified, the next step in planning for repainting--if paint removal is required--is selecting an appropriate method for such removal.

The method or methods selected should be suitable for the specific paint problem as well as the particular wooden element of the building. Methods for paint removal can be divided into three categories (frequently, however, a combination of the three methods is used). Each method is defined below, then discussed further and specific recommendations made:

**Abrasive**--"Abrading" the painted surface by manual and/or mechanical means such as scraping and sanding. Generally used for surface preparation and limited paint removal.

**Thermal**--Softening and raising the paint layers by applying heat followed by scraping and sanding. Generally used for total paint removal.

**Chemical**--Softening of the paint layers with chemical strippers followed by scraping and sanding. Generally used for total paint removal.

## Abrasive Methods (Manual)

If conditions have been identified that require limited paint removal such as crazing, intercoat peeling, solvent blistering, and wrinkling, scraping and hand sanding should be the first methods employed before using mechanical means. Even in the case of more serious conditions such as peeling--where the damaged paint is weak and already sufficiently loosened from the wood surface --scraping and hand sanding may be all that is needed prior to repainting.

*Recommended Abrasive Methods (Manual)*

**Putty Knife / Paint Scraper:** Scraping is usually accomplished with either a putty knife or a paint scraper, or both. Putty knives range in width from one to six inches and have a beveled edge. A putty knife is used in a pushing motion going under the paint and working from an area of loose paint toward the edge where the paint is still firmly adhered and, in effect,"beveling" the remaining layers so that as smooth a transition as possible is made between damaged and undamaged areas.

Paint scrapers are commonly available in 1-5/16, 2-1/2, and 3-1/2 inch widths and have replaceable blades. In addition, profiled scrapers can be made specifically for use on moldings. As opposed to the putty knife, the paint scraper is used in a pulling motion and works by raking the damaged areas of paint away.

The obvious goal in using the putty knife or the paint scraper is to selectively remove the affected layer or layers of paint; however, both of these tools, particularly the paint scraper with its hooked edge, must be used with care to properly prepare the surface and to avoid gouging the wood.

**Sandpaper / Sanding Block / Sanding sponge:** After manually removing the damaged layer or layers by scraping, the uneven surface (due to the almost inevitable removal of varying numbers of paint layers in a given area) will need to be smoothed or "feathered out" prior to repainting. As stated before, hand sanding, as opposed to harsher mechanical sanding, is recommended if the area is relatively limited. A coarse grit, open-coat flint sandpaper--the least expensive kind--is useful for this purpose because, as the sandpaper clogs with paint it must be discarded and this process repeated until all layers adhere uniformly.

Blocks made of wood or hard rubber and covered with sandpaper are useful for handsanding flat surfaces. Sanding sponges--rectangular sponges with an abrasive aggregate on their surfaces--are also available for detail work that requires reaching into grooves because the sponge easily conforms to curves and irregular surfaces. All sanding should be done with the grain.

***Summary of Abrasive Methods (Manual)***

Recommended: Putty knife, paint scraper, sandpaper, sanding block, sanding sponge.

Applicable areas of building: All areas. For use on: Class I, Class II, and Class III conditions.

Health/Safety factors: Take precautions against lead dust, eye damage; dispose of lead paint residue properly.

## Abrasive Methods (Mechanical)

If hand sanding for purposes of surface preparation has not been productive or if the affected area is too large to consider hand sanding by itself, mechanical abrasive methods, i.e., power-operated tools may need to be employed; however, it should be noted that the majority of tools available for paint removal can cause damage to fragile wood and must be used with great care.

*Recommended Abrasive Methods (Mechanical)*

**Orbital sander**: Designed as a finishing or smoothing tool--not for the removal of multiple layers of paint--the orbital sander is thus recommended when limited paint removal is required prior to repainting. Because it sands in a small diameter circular motion (some models can also be switched to a back-and-forth vibrating action), this tool is particularly effective for "feathering" areas where paint has first been scraped. The abrasive surface varies from about 3x7 inches to 4x9 inches and sandpaper is attached either by clamps or sliding clips. A medium grit, open-coat aluminum oxide sandpaper should be used; fine sandpaper clogs up so quickly that it is ineffective for smoothing paint.

**Belt sander**: A second type of power tool--the belt sander--can also be used for removing limited layers of paint but, in this case, the abrasive surface is a continuous belt of sandpaper that travels at high speeds and consequently offers much less control than the orbital sander. Because of the potential for more damage to the paint or the wood, use of the belt sander (also with a medium grit sandpaper) should be limited to flat surfaces and only skilled operators should be permitted to operate it within a historic preservation project.

*Not Recommended*

**Rotary Drill Attachments**: Rotary drill attachments such as the rotary sanding disc and the rotary wire stripper should be avoided. The disc sander--usually a disc of sandpaper about 5 inches in diameter secured to a rubber based attachment which is in turn connected to an electric drill or other motorized housing--can easily leave visible circular depressions in the wood which are difficult to hide, even with repainting. The rotary wire stripper--clusters of metals wires similarly attached to an electric drill-type unit--can actually shred a wooden surface and is thus to be used exclusively for removing corrosion and paint from metals.

**Waterblasting**: Waterblasting above 600 p.s.i. to remove paint is not recommended because it can force water into the woodwork rather than cleaning loose paint and grime from the surface; at worst, high pressure waterblasting causes the water to penetrate exterior sheathing and damages interior finishes. A detergent solution, a medium soft bristle brush, and a garden hose for purposes of rinsing, is the gentlest method involving water and is recommended when cleaning exterior surfaces prior to repainting.

**Sandblasting**: Finally--and undoubtedly most vehemently "not recommended"--sandblasting painted exterior woodwork will indeed remove paint, but at the same time can scar wooden elements beyond recognition. As with rotary wire strippers, sandblasting erodes the soft porous fibers (spring wood) faster than the hard, dense fibers (summer wood), leaving a pitted surface with ridges and valleys. Sandblasting will also erode projecting areas of carvings and moldings before it removes paint from concave areas. Hence, this abrasive method is potentially the most damaging of all possibilities, even if a contractor promises that blast pressure can be controlled so that the paint is removed without harming the historic exterior woodwork. (For Additional Information, See Preservation Briefs 6, "Dangers of Abrasive Cleaning to Historic Buildings".)

***Summary of Abrasive Methods (Mechanical)***

*Recommended*: Orbital sander, belt sander (skilled operator only).

Applicable areas of building: Flat surfaces, i.e., siding, eaves, doors, window sills.

For use on: Class II and Class III conditions.

Health/Safety factors: Take precautions against lead dust and eye damage; dispose of lead paint residue properly.

*Not Recommended*: Rotary drill attachments, high pressure waterblasting, sandblasting.

## Thermal Methods

Where exterior surface conditions have been identified that warrant total paint removal such as peeling, cracking, or alligatoring, two thermal devices--the electric heat plate and the electric heat gun--have proven to be quite successful for use on different wooden elements of the historic building. One thermal method--the blow torch--is not recommended because it can scorch the wood or even burn the building down!

*Recommended Thermal Methods*

**Electric heat plate**: The electric heat plate operates between 500 and 800 degrees Fahrenheit (not hot enough to vaporize lead paint), using about 15 amps of power. The plate is held close to the painted exterior surface until the


A heat plate was used on the cornice to remove paint. Photo: NPS files.

layers of paint begin to soften and blister, then moved to an adjacent location on the wood while the softened paint is scraped off with a putty knife (it should be noted that the heat plate is most successful when the paint is very thick!). With practice, the operator can successfully move the heat plate evenly across a flat surface such as wooden siding or a window sill or door in a continuous motion, thus lessening the risk of scorching the wood in an attempt to reheat the edge of the paint sufficiently for effective removal. Since the electric heat plate's coil is "red hot," extreme caution should be taken to avoid igniting clothing or burning the skin. If an extension cord is used, it should be a heavy-duty cord (with 3-prong grounded plugs). A heat plate could overload a circuit or, even worse, cause an electrical fire; therefore, it is recommended that this implement be used with a single circuit and that a fire extinguisher always be kept close at hand.

**Electric heat gun**: The electric heat gun (electric hot-air gun) looks like a hand-held hairdryer with a heavy-duty metal case. It has an electrical resistance coil that typically heats between 500 and 750 degrees Fahrenheit and, again, uses about 15 amps of power which requires a heavy-duty extension cord. There are some heat guns that operate at higher temperatures but they should not be purchased for removing old paint because of the danger of lead paint vapors. The temperature is controlled by a vent on the side of the heat gun. When the vent is closed, the heat increases. A fan forces a stream of hot air against the painted woodwork, causing a blister to form. At that point, the softened paint can be peeled back with a putty knife. It can be used to best advantage when a paneled door was originally varnished, then painted a number of times. In this case, the paint will come off quite easily, often leaving an almost pristine varnished surface behind. Like the heat plate, the heat gun works best on a heavy paint buildup. (It is, however, not very successful on only one or two layers of paint or on surfaces that have only been varnished. The varnish simply becomes sticky and the wood scorches.)


The nozzle on the electric heat gun permits hot air to be aimed into cavities on solid decorative

surfaces, such as this carriage house door. After the paint has been sufficiently softened, it can be carefully removed with a scraper. Photo: NPS files.

Although the heat gun is heavier and more tiring to use than the heat plate, it is particularly effective for removing paint from detail work because the nozzle can be directed at curved and intricate surfaces. Its use is thus more limited than the heat plate, and most successfully used in conjunction with the heat plate. For example, it takes about two to three hours to strip a paneled door with a heat gun, but if used in combination with a heat plate for the large, flat area, the time can usually be cut in half. Although a heat gun seldom scorches wood, it can cause fires (like the blow torch) if aimed at the dusty cavity between the exterior sheathing and siding and interior lath and plaster. A fire may smolder for hours before flames break through to the surface. Therefore, this thermal device is best suited for use on solid decorative elements, such as molding, balusters, fretwork, or "gingerbread."

*Not Recommended*

**Blow Torch**: Blow torches, such as hand-held propane or butane torches, were widely used in the past for paint removal because other thermal devices were not available. With this technique, the flame is directed toward the paint until it begins to bubble and loosen from the surface. Then the paint is scraped off with a putty knife. Although this is a relatively fast process, at temperatures between 3200 and 3800 degrees Fahrenheit the open flame is not only capable of burning a careless operator and causing severe damage to eyes or skin, it can easily scorch or ignite the wood. The other fire hazard is more insidious. Most frame buildings have an air space between the exterior sheathing and siding and interior lath and plaster. This cavity usually has an accumulation of dust which is also easily ignited by the open flame of a blow torch. Finally, leadbase paints will vaporize at high temperatures, releasing toxic fumes that can be unknowingly inhaled. Therefore, because both the heat plate and the heat gun are generally safer to use--that is, the risks are much more controllable--the blow torch should definitely be avoided!

***Summary of Thermal Methods***

Recommended: Electric heat plate, electric heat gun.

Applicable areas of building: Electric heat plate--flat surfaces such as siding, eaves, sash, sills, doors. Electric heat gun--solid decorative molding, balusters, fretwork, or "gingerbread."

For use on: Class III conditions.

Health/Safety factors: Take precautions against eye damage and fire. Dispose of lead paint residue properly.

Not Recommended: Blow torch.

## Chemical Methods

With the availability of effective thermal methods for total paint removal, the need for chemical methods--in the context of preparing historic exterior woodwork for repainting--becomes quite limited. Solvent-base or caustic strippers may, however, play a supplemental role in a number of situations, including:

- Removing paint residue from intricate decorative features, or in cracks or hard to reach areas if a heat gun has not been completely effective;
- Removing paint on window muntins because heat devices can easily break the glass;
- Removing varnish on exterior doors after all layers of paint have been removed by a heat plate/heat gun if the original varnish finish is being restored;
- Removing paint from detachable wooden elements such as exterior shutters, balusters, columns, and doors by dip stripping when other methods are too laborious.

*Recommended Chemical Methods*

(Use With Extreme Caution)

Because all chemical paint removers can involve potential health and safety hazards, no wholehearted recommendations can be made from that standpoint. Commonly known as "paint removers" or "strippers," both solvent-base or caustic products are commercially available that, when poured, brushed, or sprayed on painted exterior woodwork are capable of softening several layers of paint at a time so that the resulting "sludge"--which should be remembered is nothing less than the sequence of historic paint layers--can be removed with a putty knife. Detachable wood elements such as exterior shutters can also be "dip-stripped."

**Solvent-base Strippers**: The formulas tend to vary, but generally consist of combinations of organic solvents such as methylene chloride, isopropanol, toluol, xylol, and methanol; thickeners such as methyl cellulose; and various additives such as paraffin wax used to prevent the volatile solvents from evaporating before they have time to soak through multiple layers of paint. Thus, while some solvent-base strippers are quite thin and therefore unsuitable for use on vertical surfaces, others, called "semi-paste" strippers, are formulated for use on vertical surfaces or the underside of horizontal surfaces.

However, whether liquid or semi-paste, there are two important points to stress when using any solvent-base stripper: First, the vapors from the organic chemicals can be highly toxic if inhaled; skin contact is equally dangerous because the solvents can be absorbed; second, many solvent-base strippers are flammable. Even though application out-of-doors may somewhat mitigate health and safety hazards, a respirator with special filters for organic solvents is recommended and, of course, solvent-base strippers should never be used around open flames, lighted cigarettes, or with steel wool around electrical outlets.

Although appearing to be the simplest for exterior use, a particular type of solvent-base stripper needs to be mentioned here because it can actually cause the most problems. Known as "water-rinsable," such products have a high proportion of methylene chloride together with emulsifiers. Although the dissolved paint can be rinsed off with water with a minimum of scraping, this ultimately creates more of a problem in cleaning up and properly disposing of the sludge. In addition, these strippers can leave a gummy residue on the wood that requires removal with solvents. Finally, water-rinsable strippers tend to raise the grain of the wood more than regular strippers.

On balance, then, the regular strippers would seem to work just as well for exterior purposes and are perhaps even better from the standpoint of proper lead sludge disposal because they must be hand 'scraped as opposed to rinsed off (a coffee-can with a wire stretched across the top is one effective way to collect the sludge; when the putty knife is run across the wire, the sludge simply falls into the can. Then, when the can is filled, the wire is removed, the can capped, and the lead paint sludge disposed of according to local health regulations).

**Caustic strippers**: Until the advent of solvent-base strippers, caustic strippers were used exclusively when a chemical method was deemed appropriate for total paint removal prior to repainting or refinishing. Now, it is more difficult to find commercially prepared caustic solutions in hardware and paint stores for homeowner use with the exception of lye (caustic soda) because solvent-base strippers packaged in small quantities tend to dominate the market.

Most commercial dip stripping companies, however, continue to use variations of the caustic bath process because it is still the cheapest method available for removing paint. Generally, dip stripping should be left to professional companies because caustic solutions can dissolve skin and permanently damage eyes as well as present serious disposal problems in large quantities.

If exterior shutters or other detachable elements are being sent out for stripping in a caustic solution, it is wise to see samples of the company's finished work. While some companies do a first-rate job, others can leave a residue of paint in carvings and grooves. Wooden elements may also be soaked too long so that the wood grain is raised and roughened, requiring extensive hand sanding later. In addition, assurances should be given by these companies that caustic paint removers will be neutralized with a mild acid solution or at least thoroughly rinsed with water after dipping (a caustic residue makes the wood feel slippery). If this is not done, the lye residue will cause new paint to fail.

***Summary of Chemical Methods***

Recommended, with extreme caution: Solvent-base strippers, caustic strippers.

Applicable areas of buildings: decorative features, window muntins, doors, exterior shutters, columns, balusters, and railings.

For use on: Class III Conditions.

Health/Safety factors: Take precautions against inhaling toxic vapors; fire; eye damage; and chemical poisoning from skin contact. Dispose of lead residue properly

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## General Paint Type Recommendations

Based on the assumption that the exterior wood has been painted with oil paint many times in the past and the existing top coat is therefore also an oil paint, it is recommended that for CLASS I and CLASS II paint surface conditions, a top coat of high

Decorative features were painted with a traditional oil-based paint as a part of the rehabilitation. Photo: NPS files.

quality oil paint be applied when repainting. The reason for recommending oil rather than latex paints is that a coat of latex paint applied directly over old oil paint is more apt to fail. The considerations are twofold. First, because oil paints continue to harden with age, the old surface is sensitive to the added stress of shrinkage which occurs as a new coat of paint dries. Oil paints shrink less upon drying than latex paints and thus do not have as great a tendency to pull the old paint loose. Second, when exterior oil paints age, the binder releases pigment particles, causing a chalky surface. Although for best results, the chalk (or dirt, etc.) should always be cleaned off prior to repainting, a coat of new oil paint is more able to penetrate a chalky residue and adhere than is latex paint. Therefore, unless it is possible to thoroughly clean a heavily chalked surface, oil paints--on balance--give better adhesion.

If however, a latex top coat is going to be applied over several layers of old oil paint, an oil primer should be applied first (the oil primer creates a flat, porous surface to which the latex can adhere). After the primer has thoroughly dried, a latex top coat may be applied. In the long run, changing paint types is more time consuming and expensive. An application of a new oil-type top coat on the old oil paint is, thus, the preferred course of action.

If CLASS III conditions have necessitated total paint removal, there are two options, both of which assure protection of the exterior wood: (1) an oil primer may be applied followed by an oil-type top coat, preferably by the same manufacturer; or (2) an oil primer may be applied followed by a latex top coat, again using the same brand of paint. It should also be noted that primers were never intended to withstand the effects of weathering; therefore, the top coat should be applied as soon as possible after the primer has dried.

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## CONCLUSION

The recommendations outlined in this Brief are cautious because at present there is no completely safe and effective method of removing old paint from exterior woodwork.

This has necessarily eliminated descriptions of several methods still in a developmental or experimental stage, which can therefore neither be recommended nor precluded from future recommendation. With the ever-increasing number of buildings being rehabilitated, however, paint removal technology should be stimulated and, in consequence, existing methods refined and new methods developed which will respect both the historic wood and the health and safety of the operator.

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**Home page logo: Peeling paint on historic wood siding. Photo: ©John Leeke, 2002.**

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KDW

14 Preservation Briefs

Technical Preservation Services
National Park Service
U.S. Department of the Interior

# New Exterior Additions to Historic Buildings Preservation Concerns

**Kay D. Weeks**



**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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*Because a new exterior addition to a historic building can damage or destroy significant materials and can change the building's character, an addition should be considered only after it has been determined that the new use cannot be met by altering nonsignificant, or secondary, interior spaces. If the new use cannot be met in this way, then an attached addition may be an acceptable alternative if carefully planned. A new addition should be constructed in a manner that preserves significant materials and features and preserves the historic character. Finally, an addition should be differentiated from the historic building so that the new work is not confused with what is genuinely part of the past.*

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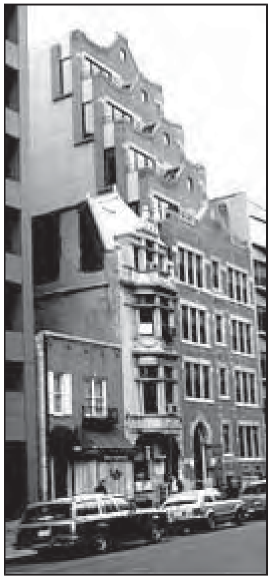
## Change is as inevitable in buildings and neighborhoods as it is in individuals

**and families.** Never static, buildings and neighborhoods grow, diminish, and continue to evolve as each era's technological advances bring conveniences such as heating, street paving, electricity, and air conditioning; as the effects of violent weather, uncontrolled fire, or slow unchecked deterioration destroy vulnerable material, as businesses expand, change hands, become obsolete, as building codes are established to enhance life safety and health; or as additional family living space is alternately needed and abandoned.

Preservationists generally agree that the history of a building, together with its site and setting, includes not only the period of original construction but frequently later alterations and additions. While each change to a building or neighborhood is undeniably part of its history--much like events in human life--not every change is equally important. For example, when a later, clearly nonsignificant addition is removed to reveal the original form, materials, and craftsmanship, there is little complaint about a loss to history.



The historic character of this commercial building has been radically changed by a replicative four-story addition. This approach does not meet the Standards for Rehabilitation. Photo: NPS files.

When the subject of new exterior additions is introduced, however, areas of agreement usually tend to diminish. This is understandable because the subject raises some serious questions. Can a historic building be enlarged for a new use without destroying what is historically significant? And just what is significant about each particular historic building that should be preserved? Finally, what new construction is appropriate to the old building?

The vast amount of literature on the subject of change to America's built environment reflects widespread interest as well as divergence of opinion. New additions have been discussed by historians within a social and political, framework; by architectural historians in terms of construction technology and style; and by urban planners as successful or unsuccessful contextual design. Within the historic preservation programs of the National Park Service, however, the focus has been and will continue to be the protection of those resources identified as worthy of listing in the National Register of Historic Places.

## National Register Listing--
## Acknowledging Change While Protecting Historical Significance

Entire districts or neighborhoods may be listed in the National Register of Historic Places for their significance to a certain period of American history (e.g., activities in a commercial district between 1870 and 1910). This "framing" of historic districts has led to a concern that listing in the National Register may discourage any physical change beyond a certain historical period--particularly in the form of attached exterior additions. This is not the case. National Register listing does not mean that an entire building or district is frozen in time and that no change can be made without compromising the historical significance. It also does not mean that each portion of a historic building is equally significant and must be retained intact and without change. Admittedly, whether an attached new addition is small or large, there will always be some loss of material and some change in the form of the historic building. There will also generally be some change in the relationship between the buildings and its site, neighborhood or district. Some change is thus anticipated within each rehabilitation of a building for a contemporary use.

## Scope of National Park Service Interest in New Exterior Additions

The National Park Service interest in new additions is simply this--a new addition to a historic building has the potential to damage and destroy significant historic material and features and to change its historic character. A new addition also has the potential to change how one perceives what is genuinely historic and thus to diminish those qualities that make the building eligible for listing in the National Register of Historic Places. Once these basic preservation issues have been addressed, all other aspects of designing and constructing a new addition to extend the useful life of the historic building rest with the creative skills of the architect.

The intent of this Brief, then, is to provide guidance to owners and developers planning additions to their historic buildings. A project involving a new addition to a historic building is considered acceptable within the framework of the National Park Service's standards if it:

**1. Preserves significant historic materials and features; and**

**2. Preserves the historic character; and**

**3. Protects the historical significance by making a visual distinction between old and new.**

Paralleling these key points, the Brief is organized into three sections. Case study examples are provided to point out acceptable and unacceptable preservation approaches where new use requirements were met through construction of an exterior addition. These examples are included to suggest ways that change to historic buildings can be sensitively accomplished, not to provide in-depth project analyses, endorse or critique particular architectural design, or offer cost and construction data.

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## 1. Preserving Significant Historic Materials and Features

Connecting a new exterior addition always involves some degree of material loss to an external wall of a historic building and, although this is to be expected, it can be minimized. On the other hand, damage or destruction of significant materials and craftsmanship such as pressed brick, decorative marble, cast stone, terra-cotta, or architectural metal should be avoided, when possible.

Generally speaking, preservation of historic buildings is enhanced by avoiding all but minor changes to primary or "public" elevations. Historically, features that distinguish one building or a row of buildings and can be seen from the streets or sidewalks are most likely to be the significant ones. This can include window patterns, window hoods, or shutters; porticoes, entrances, and doorways; roof shapes, cornices, and decorative moldings; or commercial storefronts with their special detailing, signs, and glazing. Beyond a single building, entire blocks of urban or residential structures are often closely related architecturally by their materials, detailing, form, and alignment. Because significant materials and features should be preserved, not damaged or hidden, the first place to consider constructing a new addition is where such material loss will be minimized. This will frequently be on a secondary side or rear elevation. For both economic and social reasons, secondary elevations were often constructed of "common" material and were less architecturally ornate or detailed.

In constructing the new addition, one way to minimize overall material loss is simply to reduce the size of the new addition in relationship to the historic building. If a new addition will abut the historic building along one elevation or wrap around a side and rear elevation, the integration of historic and new interiors may result in a high degree of loss--exterior walls as well as significant interior spaces and features. Another way to minimize

Two historic commercial buildings were successfully joined as part of a larger rehabilitation project. The glass connector detail is shown below. Photo: Martha L. Werenfels, AIA.

loss is to limit the size and number of openings between old and new.

This small glass connector between two historic buildings is appropriately set back. This approach meets the Standards for Rehabilitation. Photo: Martha L. Werenfels, AIA.

A particularly successful method to reduce damage is to link the new addition to the historic block by means of a hyphen or connector. In this way, only the connecting passageway penetrates a historic side wall; the new addition can be visually and functionally related while historic materials remain essentially intact and historic exteriors remain uncovered.

Although a general recommendation is to construct a new addition on a secondary elevation, there are several exceptions. First, there may simply be no secondary elevation--some important freestanding buildings have significant materials and features on all sides, making any above-ground addition too destructive to be considered. Second, a structure or group of structures together with their setting (for example, in a National Historic Park) may be of such significance in American history that any new addition would not only damage materials and alter the buildings' relationship to each other and the setting, but seriously diminish the public's ability to appreciate a historic event or place. Finally, there are other cases where an existing side or rear elevation was historically intended to be highly visible, is of special cultural importance to the neighborhood, or possesses associative historical value. Then, too, a secondary elevation should be treated as if it were a primary elevation and a new addition should be avoided.

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## 2. Preserving the Historic Character

This new stair tower addition on the rear elevation of a historic townhouse is compatible in size, scale, and materials. This approach meets the Standards for Rehabilitation. Photo: NPS files.

The second, equally important, consideration is whether or not the new addition will preserve the resource's historic character. The historic character of each building may differ, but a methodology of establishing it remains the same. Knowing the uses and functions a building has served over time will assist in making what is essentially a physical evaluation. But while written and pictorial documentation can provide a framework for establishing the building's history, the historic character, to a large extent, is embodied in the physical aspects of the historic building itself--its shape, its materials, its features, its craftsmanship, its window arrangements, its colors, its setting, and its interiors. It is only after the historic character has been correctly identified that reasonable decisions about the extent--or limitations--of change can be made.

To meet National Park Service preservation standards, a new addition must be "compatible with the size, scale, color, material, and character" of the building to which it is attached or its particular neighborhood or district. A new addition will always change the size or actual bulk of the historic building. But an addition that bears no relationship to the proportions and massing of the historic building--in other words, one that overpowers the historic form and changes the scale will usually compromise the historic character as well.

The appropriate size for a new addition varies from building to building; it could never be stated in a tidy square or cubic footage ratio, but the historic building's existing proportions, site, and setting can help set some general parameters for enlargement. To some extent, there is a predictable relationship between the size of the historic resource and the degree of change a new addition will impose.

For example, in the case of relatively low buildings (small-scale residential or commercial structures) it is difficult, if not impossible, to minimize the impact

This new stairtower addition on a historic university building has been constructed on a highly visible side elevation. Together with its contrasting color and size, it obscures the historic form and roofline. This approach does not meet the Standards for Rehabilitation. Photo: Martha L. Werenfels, AIA.

of adding an entire new floor even if the new addition is set back from the plane of the facade. Alteration of the historic proportions and profile will likely change the building's character. On the other hand, a rooftop addition to an eight story building in a historic district of other tall buildings might not affect the historic character simply because the new work would not be visible from major streets. A number of methods have been used to help predict the effect of a proposed rooftop addition on the historic building and district, including pedestrian sight lines, three-dimensional schematics and computer-assisted design (CAD). Sometimes a rough full-size mock up of a section or bay of the proposed addition can be constructed using temporary material; the mockup can then be photographed and evaluated from critical vantage points.

A sizeable addition was placed on a non-significant rear elevation of a late-19th century Greek Revival house that was rehabilitated for use as a bank with a drive-up component. The old building and new addition were sensitively joined by a small connecting hyphen. This approach meets the Standards for Rehabilitation. Photo: NPS files.

In the case of freestan residential structures, the preservation considerations are generally twofold. First, a large addition built out on a highly visible elevation can radically alter the historic form or obscure features such as a decorative cornice or window ornamentation. Second, an addition that fills in a planned void on a highly visible elevation (such as a "U" shaped plan or feature such as a porch) may also alter the historic form and, as a result, change the historic character.

Some historic structures such as government buildings, metropolitan museums, or libraries may be so massive in size that a large-scale addition may not compromise the historic character. Yet similar expansion of smaller buildings would be dramatically out of scale. In summary, where any new addition is proposed, correctly assessing the relationship between actual size and relative scale will be a key to preserving the character of the historic building.

A contemporary new addition (above left) was designed to fit into a nonsignificant U-shaped area on a rear elevation of a historic library building. Note the new addition is lower than the historic building and clearly differentiated in appearance. This approach meets the Standards for Rehabilitation. Photo: NPS files.

Constructing the new addition on a secondary side or rear elevation--in addition to material preservation--will also address preservation of the historic character. Primarily, such placement will help to preserve the building's historic form and relationship to its site and setting. Historic landscape features, including distinctive grade variations, need to be respected; and any new landscape features such as plants and trees kept at a scale and density that would not interfere with appreciation of the historic resource itself.

In highly developed urban areas, locating a new addition on a less visible side or rear elevation may be impossible simply because there is no available space. In this instance, there may be alternative ways to help preserve the historic character. If a new addition is being connected to the adjacent historic building on a primary elevation, the addition may be set back from the front wall plane so the outer edges defining the historic form are still apparent. In still other cases, some variation in material, detailing, and color may provide the degree of differentiation necessary to avoid changing the essential proportions and character of the historic building.

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## 3. Protecting the Historical Significance

### Making a Visual Distinction Between Old and New

The following statement of approach could be applied equally to the preservation of districts, sites, buildings, structures, and objects of National Register significance: "A conservator works within a conservation ethic so that the integrity of the object as an historic entity is maintained. The concern is not just with the original state of the object, but the way in which it has been changed and used over the centuries. Where a new intervention must be made to save the object, either to stabilize it or to consolidate it, it is generally accepted that those interventions must be clear, obvious, and reversible. It is this same attitude to change that is relevant to conservation policies and attitudes to historic towns..." (1)

This highly visible new rooftop addition appears to be part of the historic building because of its replicative design and historicized detailing, such as the arched windows. This approach does not meet the Standards for Rehabilitation. Photo: NPS files.

Rather than establishing a clear and obvious difference between old and new, it might seem more in keeping with the historic character simply to repeat the historic form, material, features, and detailing in a new addition. But when the new work is indistinguishable from the old in appearance, then the "real" National Register property may no longer be perceived and appreciated by the public.

Thus, the third consideration in planning a new addition is to be sure that it will protect those visual qualities that made the building eligible for listing in the National Register of Historic Places.

A question often asked is what if the historic character is not compromised by an addition that appears to have been built in the same period? A small porch or a wing that copied the historic materials and detailing placed on a rear elevation might not alter the public perception of the historic form and massing. Therefore, it is conceivable that a modest addition could be replicative without changing the resource's historic character; generally, however, this approach is not recommended because using the same wall plane, roof line, cornice height, materials, siding lap, and window type in an addition can easily make the new work appear to be part of the historic building. If this happens on a visible elevation, it becomes unclear as to which features are historic and which are new, thus confusing the authenticity of the historic resource itself.

The National Park Service policy on new additions, adopted in 1967, is an outgrowth and continuation of a general philosophical approach to change first expressed by John Ruskin in England in the 1850s, formalized by William Morris in the founding of the Society for the Protection of Ancient Buildings in 1877, expanded by the Society in 1924 and, finally, reiterated in the 1964 Venice Charter--a document that continues to be followed by 64 national committees of the International Council on Monuments and Sites (ICOMOS). The 1967 Administrative Policies for Historical Areas of the National Park System thus states, "...a modern addition should be readily distinguishable from the older work; however, the new work should be harmonious with the old in scale, proportion, materials, and color. Such additions should be as inconspicuous as possible from the public view." Similarly, the Secretary of the Interior's 1977 "Standards for Rehabilitation" call for the new work to be "compatible with the size, scale, color, material, and character of the property, neighborhood, or environment."

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## Conclusion

A major goal of our technical assistance program is a heightened awareness of significant materials and the historic character prior to construction of a new exterior addition so that essential change may be effected within a responsible preservation context. In summary, then, these are the three important preservation questions to ask when planning a new exterior addition to a historic resource:

**1. Does the proposed addition preserve significant historic materials and features?**

**2. Does the proposed addition preserve the historic character?**

**3. Does the proposed addition protect the historical significance by making a visual distinction between old and new?**

If the answer is **YES** to all three questions, then the new addition will protect significant historic materials and the historic character and, in doing so, will have satisfactorily addressed those concerns generally held to be fundamental to historic preservation.

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## New Exterior Additions to Historic Buildings

### Preserve Significant Historic Materials and Features.

Avoid constructing an addition on a primary or other character- defining elevation to ensure preservation of significant materials and features.

Minimize loss of historic material comprising external walls and internal partitions and floor plans.

### Preserve the Historic Character

Make the size, scale, massing, and proportions of the new addition compatible with the historic building to ensure that the historic form is not expanded or changed to an unacceptable degree.

Place the new addition on an inconspicuous side or rear elevation so that the new work does not result in a radical change to the form and character of the historic building.

Consider setting an infill addition or connector back from the historic buildings wall plane so that the form of the historic building--or buildings--can be distinguished from the new work.

Set an additional story well back from the roof edge to ensure that the historic building's proportions and profile are not radically changed.

### Protect the Historical Significance--Make a Visual Distinction Between Old and New

Plan the new addition in a manner that provides some differentiation in material, color, and detailing so that the new work does not appear to be part of the historic building. The character of the historic resource should be identifiable after the addition is constructed.

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(1) **Note:** Roy Worskett, RIBA, MRTIP, "Improvement of Urban Design in Europe and the United States: New Buildings in Old Settings." Background Report (prepared July, 1984) for Seminar at Strasbourg, France, October, 1984.

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**Washington, D.C. September, 1986.**

**Home page logo: Approriate new stair tower addition. Photo: NPS files.**

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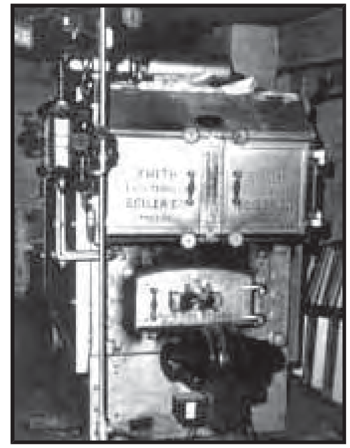
# Heating, Ventilating, and Cooling Historic Buildings
## Problems and Recommended Approaches



**Sharon C. Park, AIA**



**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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**The need for modern mechanical systems is one of the most common reasons to undertake work on historic buildings.** Such work includes upgrading older mechanical systems, improving the energy efficiency of existing buildings, installing new heating, ventilation or air conditioning (HVAC) systems, or--particularly for museums--installing a climate control system with humidification and dehumidification capabilities. Decisions to install new HVAC or climate control systems often result from concern for occupant health and comfort, the desire to make older buildings marketable, or the need to provide specialized environments for operating computers, storing artifacts, or displaying museum collections. Unfortunately, occupant comfort and concerns for the objects within the building are sometimes given greater consideration than the building itself. In too many cases, applying modern standards of interior climate comfort to historic buildings has proven detrimental to historic materials and decorative finishes.

This Preservation Brief underscores the importance of careful planning in order to balance the preservation objectives with interior climate needs of the building. It is not intended as a technical guide to calculate tonnage or to size piping or ductwork. Rather, this Brief identifies some of the problems associated with installing mechanical systems in historic buildings and recommends approaches to minimizing the physical and visual damage associated with installing and maintaining these new or upgraded systems.

Historic buildings are not easily adapted to house modern precision mechanical systems. Careful planning must be provided early on to ensure that decisions made during the design and installation phases of a new system are appropriate. Since new mechanical and other related systems, such as electrical and fire suppression, can use up to 10% of a building's square footage and 30%-40% of an overall rehabilitation budget, decisions must be made in a systematic and coordinated manner. The installation of inappropriate mechanical systems may result in any or all of the following:

- large sections of historic materials are removed to install or house new systems.
- historic structural systems are weakened by carrying the weight of, and sustaining vibrations from, large equipment.
- moisture introduced into the building as part of a new system migrates into historic materials and causes damage, including biodegradation, freeze/thaw action, and surface staining.
- exterior cladding or interior finishes are stripped to install new vapor barriers and insulation.
- historic finishes, features, and spaces are altered by dropped ceilings and boxed chases or by poorly located grilles, registers, and equipment.
- systems that are too large or too small are installed before there is a clearly planned use or a new tenant.

For historic properties it is critical to understand what spaces, features, and finishes are historic in the building, what should be retained, and what the realistic heating, ventilating, and cooling needs are for the building, its occupants, and its contents. A systematic

The dropped ceilings covering an air conditioning system also cover the historic windows, altering their proportion and resulting in loss of the historic character. Photo: NPS files.

approach, involving preservation planning, preservation design, and a follow-up program of monitoring and maintenance, can ensure that new systems are successfully added--or existing systems are suitably upgraded--while preserving the historic integrity of the building.

No set formula exists for determining what type of mechanical system is best for a specific building. Each building and its needs must be evaluated separately. Some buildings will be so significant that every effort must be made to protect the historic materials and systems in place with minimal intrusion from new systems. Some buildings will have museum collections that need special climate control. In such cases, curatorial needs must be considered--but not to the ultimate detriment of the historic building resource. Other buildings will be rehabilitated for commercial use. For them, a variety of systems might be acceptable, as long as significant spaces, features, and finishes are retained.

Most mechanical systems require upgrading or replacement within 15-30 years due to wear and tear or the availability of improved technology. Therefore, historic buildings should not be greatly altered or otherwise sacrificed in an effort to meet short-term systems objectives.

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## History of Mechanical Systems

The history of mechanical systems in buildings involves a study of inventions and ingenuity as building owners, architects, and engineers devised ways to improve the interior climate of their buildings. Following are highlights in the evolution of heating, ventilating, and cooling systems in historic buildings.

**Eighteenth Century.** Early heating and ventilation in America relied upon common sense methods of managing the environment. Builders purposely sited houses to capture winter sun and prevailing summer cross breezes; they chose materials that could help protect the inhabitants from the elements, and took precautions against precipitation and damaging drainage patterns. The location and sizes of windows, doors, porches, and the floor plan itself often evolved to maximize ventilation. Heating was primarily from fireplaces or stoves and, therefore, was at the source of delivery. In 1744, Benjamin Franklin designed his "Pennsylvania stove" with a fresh air intake in order to maximize the heat radiated into the room and to minimize annoying smoke.

Thermal insulation was rudimentary--often wattle and daub, brick and wood nogging. The comfort level for occupants was low, but the relatively small difference between internal and external temperatures and relative humidity allowed building materials to expand and contract with the seasons.

Regional styles and architectural features reflected regional climates. In warm, dry and sunny climates, thick adobe walls offered shelter from the sun and kept the inside temperatures cool. Verandas, courtyards, porches, and high ceilings also reduced the impact of the sun. Hot and humid climates called for elevated living floors, louvered grilles and shutters, balconies, and interior courtyards to help circulate air.

19th century buildings used porches, cupolas, and awnings to make them more comfortable in the summer. Photo: NPS files.

**Nineteenth Century.** The industrial revolution provided the technological means for controlling the environment for the first time. The dual developments of steam energy from coal and industrial mass production made possible early central heating systems with distribution of heated air or steam using metal ducts or pipes. Improvements were made to early wrought iron boilers and by late century, steam and low pressure hot water radiator systems were in common use, both in offices and residences. Some large institutional buildings heated air in furnaces and distributed it throughout the building in brick flues with a network of metal pipes delivering heated air to individual rooms. Residential designs of the period often used gravity hot air systems utilizing decorative floor and ceiling grilles.

Ventilation became more scientific and the introduction of fresh air into buildings became an important component of heating and cooling. Improved forced air ventilation became possible in mid-century with the introduction of power-driven fans. Architectural features such as porches, awnings, window and door transoms, large openwork iron roof trusses, roof monitors, cupolas, skylights and clerestory windows helped to dissipate heat and provide healthy ventilation.

Cavity wall construction, popular in masonry structures, improved the insulating qualities of a building and also provided a natural cavity for the dissipation of moisture produced on the interior of the building. In some buildings, cinder chips and broken masonry filler between structural iron beams and jack arch floor vaults provided thermal insulation as well as fireproofing. Mineral wool and cork were new sources of lightweight insulation and were forerunners of contemporary batt and blanket insulation.

The technology of the age, however, was not sufficient to produce "tight" buildings. There was still only a moderate difference between internal and external temperatures. This was due, in part, to the limitations of early insulation, the almost exclusive use of single glazed windows, and the absence of airtight construction. The presence of ventilating fans and the reliance on architectural features, such as operable windows, cupolas and transoms, allowed sufficient air movement to keep buildings well ventilated. Building materials could behave in a fairly traditional way, expanding and contracting with the seasons.

**Twentieth Century.** The twentieth century saw intensive development of new technologies and the notion of fully integrating mechanical systems. Oil and gas furnaces developed in the nineteenth century were improved and made more efficient, with electricity becoming the critical source of power for building systems in the latter half of the century. Forced air heating systems with ducts and registers became popular for all types of buildings and allowed architects to experiment with architectural forms free from mechanical encumbrances. In the 1920s large-scale theaters and auditoriums introduced central air conditioning, and by mid-century forced air systems which combined heating and air conditioning in the same ductwork set a new standard for comfort and convenience. The combination and coordination of a variety of systems came together in the post-World War II high-rise buildings; complex heating and air conditioning plants, electric elevators, mechanical towers, ventilation fans, and full service electric lighting were integrated into the building's design.

A return air grille is successfully

The insulating qualities of building materials improved. Synthetic materials, such as spun fiberglass batt insulation, were fully developed by mid-century. Prototypes of insulated thermal glazing and integral storm window systems were promoted in construction screened behind the arch. Photo: NPS files.

journals. Caulking to seal out perimeter air around window and door openings became a standard construction detail.

The last quarter of the twentieth century has seen making HVAC systems more energy efficient and better integrated. The use of vapor barriers to control moisture migration, thermally efficient windows, caulking and gaskets, compressed thin wall insulation, has become standard practice. New integrated systems now combine interior climate control with fire suppression, lighting, air filtration, temperature and humidity control, and security detection. Computers regulate the performance of these integrated systems based on the time of day, day of the week, occupancy, and outside ambient temperature.

## Climate Control and Preservation

Although twentieth century mechanical systems technology has had a tremendous impact on making historic buildings comfortable, the introduction of these new systems in older buildings is not without problems. The attempt to meet and maintain modern climate control standards may in fact be damaging to historic resources. Modern systems are often over-designed to compensate for inherent inefficiencies of some historic buildings materials and plan layouts. Energy retrofit measures, such as installing exterior wall insulation and vapor barriers or the sealing of operable window and vents, ultimately affect the performance and can reduce the life of aging historic materials.

In general, the greater the differential between the interior and exterior temperature and humidity levels, the greater the potential for damage. As natural vapor pressure moves moisture from a warm area to a colder, dryer area, condensation will occur on or in building materials in the colder area. Too little humidity in winter, for example, can dry and crack historic wooden or painted surfaces. Too much humidity in winter causes moisture to collect on cold surfaces, such as windows, or to migrate into walls. As a result, this condensation deteriorates wooden or metal windows and causes rotting of walls and wooden structural elements,

Complex mechanical systems for

dampening insulation and holding moisture against exterior surfaces. Moisture migration through walls can cause the corrosion of metal anchors, angles, nails or wire lath, can blister and peel exterior paint, or can leave efflorescence and salt deposits on exterior masonry. In cold climates, freeze-thaw damage can result from excessive moisture in external walls.

institutional buildings may require a central control room. Photo: NPS files.

To avoid these types of damage to a historic building, is important to understand how building components work together as a system. Methods for controlling interior temperature and humidity and improving venation must be considered in any new or upgraded HVAC or climate control system. While certain energy retrofit measures will have a positive effect on the overall building, installing effective vapor barriers in historic walls is difficult and often results in destruction of significant historic materials.

## Planning the New System

Climate control systems are generally classified according to the medium used to condition the temperature: air, water, or a combination of both. The complexity of choices facing a building owner or manager means that a systematic approach is critical in determining the most suitable system for a building, its contents, and its occupants. No matter which system is installed, a change in the interior climate will result. This physical change will in turn affect how the building materials perform. New registers, grilles, cabinets, or other accessories associated with the new mechanical system will also visually change the interior (and sometimes the exterior) appearance of the building. Regardless of the type or extent of a mechanical system, the owner of a historic building should know before a system is installed what it will look like and what problems can be anticipated during the life of that system. The potential harm to a building and costs to an owner of selecting the wrong mechanical system are very great.

The use of a building and its contents will largely determine the best type of mechanical system. The historic building materials and construction technology as well as the size and availability of secondary spaces within the historic structure will affect the choice of a system. It may be necessary to investigate a combination of systems. In each case, the needs of the user, the needs of the building, and the needs of a collection or equipment must be considered. It may not be necessary to have a comprehensive climate control system if climate-sensitive objects can be accommodated in special areas or climate-controlled display cases. It may not be necessary to have central air conditioning in a mild climate if natural ventilation systems can be improved through the use of operable windows, awnings, exhaust fans, and other "lowtech" means. Modern standards for climate control developed for new construction may not be achievable or desirable for historic buildings. In each case, the lowest level of intervention needed to successfully accomplish the job should be selected.

Before a system is chosen, the following planning steps are recommended:

**1. Determine the use of the building.** The proposed use of the building (museum, commercial, residential, retail) will influence the type of system that should be installed. The number of people and functions to be housed in a building will establish the level of comfort and service that must be provided. Avoid uses that require major modifications to significant architectural spaces. What is the intensity of use of the building: intermittent or constant use, special events or seasonal events? Will the use of the building require major new services such as restaurants, laundries, kitchens, locker rooms, or other areas that generate moisture that may exacerbate climate control within the historic space? In the context of historic preservation, uses that require radical reconfigurations of historic spaces are inappropriate for the building.

**2. Assemble a qualified team.** This team ideally should consist of a preservation architect, mechanical engineer, electrical engineer, structural engineer, and preservation consultants, each knowledgeable in codes and local requirements. If a special use (church, museum, art studio) or a collection is involved, a specialist familiar with the mechanical requirements of that building type or collection should also be hired.

Team members should be familiar with the needs of historic buildings and be able to balance complex factors: the preservation of the historic architecture (aesthetics and conservation), requirements imposed by mechanical systems (quantified heating and cooling loads), building codes (health and safety), tenant requirements (quality of comfort, ease of operation), access (maintenance and future replacement), and the overall cost to the owner.

**3. Undertake a condition assessment of the existing building and its systems.** What are the existing construction materials and mechanical systems? What condition are they in and are they reusable? Where are existing chillers, boilers, air handlers, or cooling towers located? Look at the condition of all other services that may benefit from being integrated into a new system, such as electrical and fire suppression systems. Where can energy efficiency be improved to help downsize any new equipment added, and which of the historic features, e.g. shutters, awnings, skylights, can be reused? Evaluate air infiltration through the exterior envelope; monitor the interior for temperature and humidity levels with hygrothermographs for at least a year. Identify building, site, or equipment deficiencies or the presence of asbestos that must be corrected prior to the installation or upgrading of mechanical systems.

**4. Prioritize architecturally significant spaces, finishes, and features to be preserved.** Significant architectural spaces, finishes and features should be identified and evaluated at the outset to ensure their preservation. This includes significant existing mechanical systems or elements such as hot water radiators decorative grilles, elaborate switch-plates, and nonmechanical architectural features such as cupolas, transoms, or porches. Identify nonsignificant spaces where mechanical equipment can be placed and secondary spaces where equipment and distribution runs on both a horizontal and vertical basis can be located. Appropriate secondary spaces for housing equipment might include attics, basements, penthouses, mezzanines, false ceiling or floor cavities, vertical chases, stair towers, closets, or exterior below-grade vaults.

The flexible duct work, seen here, can be used to advantage in tight attic spaces. Photo: NPS files.

**5. Become familiar with local building and fire codes.** Owners or their representatives should meet early and often with local officials. Legal requirements should be checked; for example, can existing ductwork be reused or modified with dampers? Is asbestos abatement required? What are the energy, fire, and safety codes and standards in place, and how can they be met while maintaining the historic character of the building? How are fire separation walls and rated mechanical systems to be handled between multiple tenants? Is there a requirement for fresh air intake for stair towers that will affect the exterior appearance of the building? Many of the health, energy, and safety code requirements will influence decisions made for mechanical equipment for climate control. It is importance to know what they are before the design phase begins.

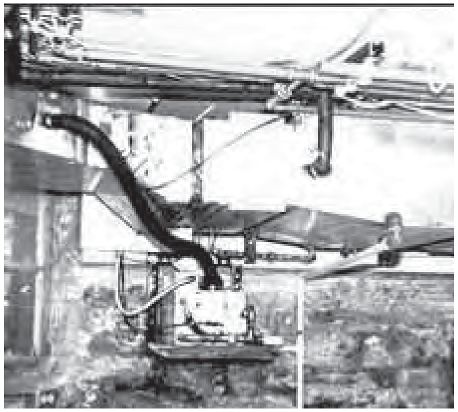
**6. Evaluate options for the type and size of systems.** A matrix or feasibility studies should be developed to balance the benefits and drawbacks of various systems. Factors to consider include heating and/or cooling, fuel type, distribution system, control devices, generating equipment and accessories such as filtration, and humidification. What are the initial installation costs, projected fuel costs, long-term maintenance, and life-cycle costs of these components and systems? Are parts of an existing system being reused and upgraded? The benefits of added ventilation should not be overlooked. What are the tradeoffs between one large central system and multiple smaller systems? Should there be a forced air ducted system, a two-pipe fan coil system, or a combined water and air system? What space is available for the equipment and distribution system? Assess the fire risk levels of various fuels. Understand the advantages and disadvantages of the various types of mechanical systems available. Then evaluate each of these systems in light of the preservation objectives established during the design phase of planning.

## Overview of HVAC Systems

### WATER SYSTEMS: Hydronic radiators, Fan coil, or radiant pipes

Water systems are generally called hydronic and use a network of pipes to deliver water to hot water radiators, radiant pipes set in floors or fan coil cabinets which can give both heating and cooling. Boilers produce hot water or steam; chillers produce chilled water for use with fan coil units. Thermostats control the temperature by zone for radiators and radiant floors.

Fan coil units have individual controls. Radiant floors provide quiet, even heat, but are not common.



A fan coil unit in the basement is feeding controlled air to a primary space upstairs. Photo: Courtesy, Karen Sweeney, Frank Lloyd Wright Home & Studio.

Advantages: Piped systems are generally easier to install in historic buildings because the pipes are smaller than ductwork.

Disadvantages: There is the risk, however, of hidden leaks in the wall or burst pipes in winter if boilers fail. Fan coil condensate pans can overflow if not properly maintained. Fan coils may be noisy.

***Hydronic Radiators:*** Radiators or baseboard radiators are looped together and are usually set under windows or along perimeter walls. New boilers and circulating pumps can upgrade older systems. Most piping was cast iron although copper systems can be used if separately zoned. Modern cast iron baseboards and copper fin-tubes are available. Historic radiators can be reconditioned.

***Fan Coil Units:*** Fan coil systems use terminal cabinets in each room serviced by 2, 3, or 4 pipes approximately 11/2" each in diameter. A fan blows air over the coils which are serviced by hot or chilled water. Each fan coil cabinet can be individually controlled. Four-pipe fan coils can provide both heating and cooling all year long. Most piping is steel. Non-cabinet units may be concealed in closets or custom cabinetry, such as benches, can be built.

## CENTRAL AIR SYSTEMS

The basic heating, ventilation and air conditioning (HVAC) system is all-air, single zone fan driven designed for low, medium or high pressure distribution. The system is composed of compressor drives, chillers, condensers, and furnace depending on whether the air is heated, chilled or both. Condensers, generally air cooled, are located outside. The ducts are sheet metal or flexible plastic and can be insulated. Fresh air can be circulated. Registers can be designed for ceilings, floors and walls. The system is controlled by thermostats; one per zone.

Advantages: Ducted systems offer a high level of control of interior temperature, humidity, and filtration. Zoned units can be relatively small and well concealed.

Disadvantages: The damage from installing a ducted system without adequate space can be serious for a historic building. Systems need constant balancing and can be noisy.

***Basic HVAC***: Most residential or small commercial systems will consist of a basic furnace with a cooling coil set in the unit and a refrigerant compressor or condenser located outside the building. Heating and cooling ductwork is usually shared. If sophisticated humidification and dehumidification is added to the basic HVAC system, a full climate control system results. This can often double the size of the equipment.

***Basic Heat Pump/Air System:*** The heat pump is a basic HVAC system as described above except for the method of generating hot and cold air. The system operates on the basic

refrigeration cycle where latent heat is extracted from the ambient air and is used to evaporate refrigerant vapor under pressure. Functions of the condenser and evaporator switch when heating is needed. Heat pumps, somewhat less efficient in cold climates, can be fitted with electric resistance coil.

## COMBINED AIR AND WATER SYSTEMS

These systems are popular for restoration work because they combine the ease of installation for the piped system with the performance and control of the ducted system. Smaller air handling units, not unlike fan coils, may be located throughout a building with service from a central boiler and chiller. In many cases the water is delivered from a central plant which services a complex of buildings.

This system overcomes the disadvantages of a central ducted system where there is not adequate horizontal or vertical runs for the ductwork. The equipment, being smaller, may also be quieter and cause less vibration. If only one air handler is being utilized for the building, it is possible to house all the equipment in a vault outside the building and send only conditioned air into the structure.

Advantages: flexibility for installation using greater piping runs with shorter ducted runs; Air handlers can fit into small spaces.

Disadvantages: piping areas may have undetected leaks; air handlers may be noisy.

## OTHER SYSTEM COMPONENTS

Non-systems components should not be overlooked if they can make a building more comfortable without causing damage to the historic resource or its collection.

Advantages: components may provide acceptable levels of comfort without the need for an entire system.

Disadvantages: Spot heating, cooling and fluxuations in humidity may harm sensitive collections or furnishings. If an integrated system is desirable, components may provide only a temporary solution.

***Portable Air Conditioning:***

Most individual air conditioners are set in windows or through exterior walls which can be visually as well as physically damaging to historic buildings. Newer portable air conditioners are available which sit in a room and exhaust directly to the exterior through a small slot created by a raised window sash.

Installing a fan (successfully concealed here) for increased ventilation can be a successful low-tech substitute for air conditioning. Photo: Courtesy, Shelburne Village.

***Fans:*** Fans should be considered in most properties to improve ventilation. Fans can be located in attics, at the top of stairs, or in individual rooms. In moderate climates, fans may eliminate the need to install central air systems.

***Dehumidifiers:*** For houses without central air handling systems, a dehumidifier can resolve problems in humid climates. Seasonal use of dehumidifiers can remove moisture from damp basements and reduce fungal growth.

***Heaters:*** Portable radiant heaters, such as those with water and glycol, may provide temporary heat in buildings used infrequently or during systems breakdowns. Care should be taken not to create a fire hazard with improperly wired units.

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## Designing the new system

In designing a system, it is important to anticipate how it will be installed, how damage to historic materials can be minimized, and how visible the new mechanical system will be within the restored or rehabilitated spaces. Mechanical equipment space needs are often overwhelming; in some cases, it may be advantageous to look for locations outside of the building, including ground vaults, to house some of the equipment but only if it there is no adverse impact to the historic landscape or adjacent archeological resources. Various means for reducing the heating and cooling loads (and thereby the size of the equipment) should be investigated. This might mean reducing slightly the comfort levels of the interior, increasing the number of climate control zones, or improving the energy efficiency of the building.

The following activities are suggested during the design phase of the new system:

**1. Establish specific criteria for the new or upgraded mechanical system.** New systems should be installed with a minimum of damage to the resource and should be visually compatible with the architecture of the building. They should be installed in a way that is easy to service, maintain, and upgrade in the future. There should be safety and backup monitors in place if buildings have collections, computer rooms, storage vaults or special conditions that need monitoring. The new systems should work within the structural limits of the historic building. They should produce no undue vibration, no undue noise, no dust or mold, and no excess moisture that could damage the historic building materials. If any equipment is to be located outside of the building, there should be no impact to the historic appearance of building or site, and there should be no impact on archeological resources.

**2. Prioritize the requirements for the new climate control system.** The use of the building will determine the level of interior comfort and climate control. Sometimes, various temperature zones may safely be created within a historic building. This zoned approach may be appropriate for buildings with specialized collections storage, for buildings with mixed uses, or for large buildings with different external exposures, occupancy patterns, and delivery schedules for controlled air. Special archives, storage vaults or computer rooms may need a completely different climate control from the rest of the building. Determine temperature and humidity levels for occupants and collections and ventilation requirements between differing zones. Establish if the system is to run 24 hours a day or only during operating or business hours. Determine what controls are optimum (manual, computer, preset automatic, or other). The size and location of the equipment to handle these different situations will ultimately affect the design of the overall system as well.

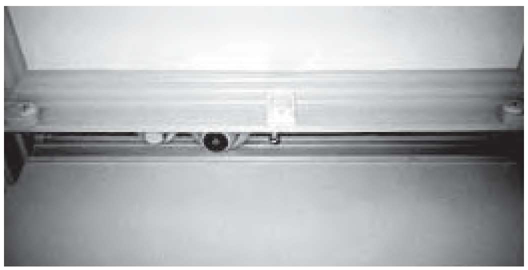
**3. Minimize the impact of the new HVAC on the existing architecture.** Design criteria for the new system should be based on the type of architecture of the historic resource. Consideration should be given as to whether or not the delivery system is visible or hidden. Utilitarian and industrial spaces may be capable of accepting a more visible and functional system. More formal, ornate spaces which may be part of an interpretive program may require a less visible or disguised system. A ducted system should be installed without ripping into or boxing out large sections of floors, walls, or ceilings. A wet pipe system should be installed so that hidden leaks will not damage important decorative finishes. In each case, not only the type of system (air, water, combination), but its distribution (duct, pipe) and delivery appearance (grilles, cabinets, or registers) must be evaluated. It may be necessary to use a combination of different systems in order to preserve the historic building. Existing chases should be reused whenever possible.

This radiator would be identified as a significant element of the interior. In any work to upgrade the mechanical system, it would be retained and preserved, even if non-functioning. Photo: NPS files.

**4. Balance quantitative requirements and preservation objectives.** The ideal system may not be achievable for each historic resource due to cost, space limitations, code requirements, or other factors beyond the owner's control. However, significant historic spaces, finishes, and features can be preserved in almost every case, even given these limitations. For example, if some ceiling areas must be slightly lowered to accommodate ductwork or piping, these should be in secondary areas away from decorative ceilings or tall windows. If modern fan coil terminal units are to be visible in historic spaces, consideration should be given to custom designing the cabinets or to using smaller units in more locations to diminish their impact. If grilles and registers are to be located in significant spaces, they should be designed to work within the geometry or placement of decorative elements. All new elements, such as ducts, registers, pipe-runs, and mechanical equipment should be installed in a reversible manner to be removed in the future without further damage to the building.

## Systems Performance and Maintenance

Once the system is installed, it will require routine maintenance and balancing to ensure that the proper performance levels are achieved. In some cases, extremely sophisticated, computerized systems have been developed to control interior climates, but these still need monitoring by trained staff. If collection exhibits and archival storage are important to the resource, the climate control system will require constant monitoring and tuning. Backup systems are also needed to prevent damage when the main system is not working. The owner, manager, or chief of maintenance should be aware of all aspects of the new climate control system and have a plan of action before it is installed.


A sprinkler system is unobtrusively placed behind a false cornice at the end of a corridor. Photo: NPS files.

Regular training sessions on operating, monitoring, and maintaining the new system should be held for both curatorial and building maintenance staff. If there are curatorial reasons to maintain constant temperature or humidity levels, only individuals thoroughly trained in how the HVAC systems operates should be able to adjust thermostats. Ill-informed and haphazard attempts to adjust comfort levels, or to save energy over weekends and holidays, can cause great damage.

## HVAC Do's and Don'ts

### DO's:

- Use shutters, operable windows, porches, curtains, awnings, shade trees and other historically appropriate nonmechanical features of historic buildings to reduce the heating and cooling loads. Consider adding sensitively designed storm windows to existing historic windows.

- Retain or upgrade existing mechanical systems whenever possible: for example, reuse radiator systems with new boilers, upgrade ventilation within the building, install proper thermostats or humidistats.

- Improve energy efficiency of existing buildings by installing insulation in attics and basements. Add insulation and vapor barriers to exterior walls only when it can be done without further damage to the resource.

- In major spaces, retain decorative elements of the historic system whenever possible. This includes switch-plates, grilles and radiators. Be creative in adapting these features to work within the new or upgraded system.

- Use space in existing chases, closets or shafts for new distribution systems.

- Design climate control systems that are compatible with the architecture of the building: hidden system for formal spaces, more exposed systems possible in industrial or secondary spaces. In formal areas, avoid standard commercial registers and use custom slot registers or other less intrusive grilles.

- Size the system to work within the physical constraints of the building. Use multi-zoned smaller units in conjunction with existing vertical shafts, such as stacked closets, or consider locating equipment in vaults underground, if possible.

- Provide adequate ventilation to the mechanical rooms as well as to the entire building. Selectively install air intake grilles in less visible basement, attic, or rear areas.

- Maintain appropriate temperature and humidity levels to meet requirements without accelerating the deterioration of the historic building materials. Set up regular monitoring schedules.

- Design the system for maintenance access and for future systems replacement.
- For highly significant buildings, install safety monitors and backup features, such as double pans, moisture detectors, lined chases, and battery packs to avoid or detect leaks and other damage from system failures.
- Have a regular maintenance program to extend equipment life and to ensure proper performance.
- Train staff to monitor the operation of equipment and to act knowledgeably in emergencies or breakdowns.
- Have an emergency plan for both the building and any curatorial collections in case of serious malfunctions or breakdowns.

**DON'TS:**

- Don't install a new system if you don't need it.
- Don't switch to a new type of system (e.g. forced air) unless there is sufficient space for the new system or an appropriate place to put it.
- Don't over-design a new system. Don't add air conditioning or climate control if they are not absolutely necessary.
- Don't cut exterior historic building walls to add through-wall heating and air conditioning units. These are visually disfiguring, they destroy historic fabric, and condensation runoff from such units can further damage historic materials.
- Don't damage historic finishes, mask historic features, or alter historic spaces when installing new systems.
- Don't drop ceilings or bulkheads across window openings.
- Don't remove repairable historic windows or replace them with inappropriately

designed thermal windows.

- Don't seal operable windows, unless part of a museum where air pollutants and dust are being controlled.
- Don't place condensers, solar panels, chimney stacks, vents or other equipment on visible portions of roofs or at significant locations on the site.
- Don't overload the building structure with the weight of new equipment, particularly in the attic.
- Don't place stress on historic building materials through the vibrations of the new equipment.
- Don't allow condensation on windows or within walls to rot or spall adjacent historic building materials.

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Maintenance staff should learn how to operate, monitor, and maintain the mechanical equipment. They must know where the maintenance manuals are kept. Routine maintenance schedules must be developed for changing and cleaning filters, vents, and condensate pans to control fungus, mold, and other organisms that are dangerous to health. Such growths can harm both inhabitants and equipment. (In piped systems, for example, molds in condensate pans can block drainage lines and cause an overflow to leak onto finished surfaces). Maintenance staff should also be able to monitor the appropriate gauges, dials, and thermographs. Staff must be trained to intervene in emergencies, to know where the master controls are, and whom to call in an emergency. As new personnel are hired, they will also require maintenance training.

In addition to regular cyclical maintenance, thorough inspections should be undertaken from time to time to evaluate the continued performance of the climate control system. As the system ages, parts are likely to fail, and signs of trouble may appear. Inadequately ventilated areas may smell musty. Wall surfaces may show staining, wet patches, bubbling or other signs of moisture damage. Routine tests for air quality, humidity, and temperature should indicate if the system is performing properly. If there is damage as a result of the new system, it should be repaired immediately and then closely monitored to ensure complete repair.

Equipment must be accessible for maintenance and should be visible for easy inspection. Moreover, since mechanical systems last only 15-30 years, the system itself must be "reversible." That is, the system must be installed in such a way that later removal will not damage the building. In addition to servicing, the backup monitors that signal malfunctioning equipment must be routinely checked, adjusted, and maintained. Checklists should be developed to ensure that all aspects of routine maintenance are completed and that data is reported to the building manager.

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## Conclusion

The successful integration of new systems in historic buildings can be challenging. Meeting modern HVAC requirements for human comfort or installing controlled climates for museum collections or for the operation of complex computer equipment can result in both visual and physical damage to historic resources. Owners of historic buildings must be aware that the final result will involve balancing multiple needs; no perfect heating, ventilating, and air conditioning system exists. In undertaking changes to historic buildings, it is best to have the advice and input of trained professionals who can:

- assess the condition of the historic building,
- evaluate the significant elements that should be preserved or reused,
- prioritize the preservation objectives,
- understand the impact of new interior climate conditions on historic materials
- integrate preservation with mechanical and code requirements,
- maximize the advantages of various new or upgraded mechanical systems,
- understand the visual and physical impact of various installations,
- identify maintenance and monitoring requirements for new or upgraded systems, and
- plan for the future removal or replacement of the system.

Too often the presumed climate needs of the occupants or collections can be detrimental to the long-term preservation of the building. With a careful balance between the preservation needs of the building and the interior temperature and humidity needs of the occupants, a successful project can result.

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**Washington, D.C. October, 1991**

**Home page logo: Historic boiler in functioning condition. Photo: NPS files.**

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# Making Historic Properties Accessible

**Thomas C. Jester and Sharon C. Park, AIA**



**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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**Historically, most buildings and landscapes were not designed to be readily accessible for people with disabilities.** In recent years, however, emphasis has been placed on preserving historically significant properties, and on making these properties-and the activities within them-more accessible to people with disabilities. With the passage of the Americans with Disabilities Act in 1990, access to properties open to the public is now a civil right.

This Preservation Brief introduces the complex issue of providing accessibility at historic properties, and


A significant entrance may be difficult to modify. Although a special challenge, sensitive changes can almost always be made to provide access while preserving the unique historic character. Photo: NPS files.

underscores the need to balance accessibility and historic preservation. It provides guidance on making historic properties accessible while preserving their historic character; the Brief also provides examples to show that independent physical accessibility at historic properties can be achieved with careful planning, consultation, and sensitive design. While the Brief focuses primarily on making buildings and their sites accessible, it also includes a section on historic landscapes. The Brief will assist historic property owners, design professionals, and administrators in evaluating their historic properties so that the highest level of accessibility can be provided while minimizing changes to historic materials and features. Because many projects encompassing accessibility work are complex, it is advisable to consult with experts in the fields of historic preservation and accessibility before proceeding with permanent physical changes to historic properties.

Modifications to historic properties to increase accessibility may be as simple as a small, inexpensive ramp to overcome one entrance step, or may involve changes to exterior and interior features. The Brief does not provide a detailed explanation of local or State accessibility laws as they vary from jurisdiction to jurisdiction. A concise explanation of several federal accessibility laws is included below.

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## Planning Accessibility Modifications

Historic properties are distinguished by features, materials, spaces, and spatial relationships that contribute to their historic character. Often these elements, such as steep terrain, monumental steps, narrow or heavy doors, decorative ornamental hardware, and narrow pathways and corridors, pose barriers to persons with disabilities, particularly to wheelchair users.

A three-step approach is recommended to identify and implement accessibility modifications that will protect the integrity and historic character of historic properties:

1) Review the historical significance of the property and identify character-defining features; 2) Assess the property's existing and required level of accessibility; and 3) Evaluate accessibility options within a preservation context.

## 1) Review the Historical Significance of the Property

This accessibility ramp is compatible with the historic building in scale and materials. Photo: William Smith.

If the property has been designated as historic (properties that are listed in, or eligible for listing in the National Register of Historic Places, or designated under State or local law), the property's nomination file should be reviewed to learn about its significance. Local preservation commissions and State Historic Preservation Offices can usually provide copies of the nomination file and are also resources for additional information and assistance. Review of the written documentation should always be supplemented with a physical investigation to identify which character defining features and spaces must be protected whenever any changes are anticipated. If the level of documentation for a property's significance is limited, it may be necessary to have a preservation professional identify specific historic features, materials, and spaces that should be protected.

For most historic properties, the construction materials, the form and style of the property, the principal elevations, the major architectural or landscape features, and the principal public spaces constitute some of the elements that should be preserved. Every effort should be made to minimize damage to the materials and features that convey a property's historical significance when making modifications for accessibility. Very small or highly significant properties that have never been altered may be extremely difficult to modify.

Secondary spaces and finishes and features that may be less important to the historic character should also be identified; these may generally be altered without jeopardizing the historical significance of a property. Nonsignificant spaces, secondary pathways, later additions, previously altered areas, utilitarian spaces, and service areas can usually be modified without threatening or destroying a property's historical significance.

## 2) Assess the Property's Existing and Required Level of Accessibility

A building survey or assessment will provide a thorough evaluation of a property's accessibility. Most surveys identify accessibility barriers in the following areas: building and site entrances; surface textures, widths and slopes of walkways; parking; grade changes; size, weight and configuration of doorways; interior corridors and path of travel restrictions; elevators; and public toilets and amenities. Simple audits can be completed by property owners using readily available checklists (See Further Reading). Accessibility specialists can be hired to assess barriers in more complex properties, especially those with multiple buildings, steep terrain, or interpretive programs. Persons with disabilities can be particularly helpful in assessing specific barriers.

All applicable accessibility requirements--local codes, State codes and federal laws--should be reviewed carefully before undertaking any accessibility modification. Since many States and localities have their own accessibility regulations and codes (each with their own requirements for dimensions and technical requirements), owners should use the most stringent accessibility requirements when implementing modifications. The Americans with Disability Act Accessibility Guidelines (ADAAG) is the document that should be consulted when complying with the Americans with Disabilities Act (ADA) requirements.

### 3) Identify and Evaluate Accessibility Options within a Preservation Context

Once a property's significant materials and features have been identified, and existing and required levels of accessibility have been established, solutions can be developed. Solutions should provide the greatest amount of accessibility without threatening or destroying those materials and features that make a property significant. Modifications may usually be phased over time as funds are available, and interim solutions can be considered until more permanent solutions are implemented. A team comprised of persons with disabilities, accessibility and historic preservation professionals, and building inspectors should be consulted as accessibility solutions are developed.

Modifications to improve accessibility should generally be based on the following priorities:

> 1) Making the main or a prominent public entrance and primary public spaces accessible, including a path to the entrance; 2) Providing access to goods, services, and programs; 3) Providing accessible restroom facilities; and, 4) Creating access to amenities and secondary spaces.

All proposed changes should be evaluated for conformance with the Secretary of the Interior's

The ramp's scale and materials are inconsistent with the historic character of the building. Photo: NPS files.

"Standards for the Treatment of Historic Properties," which were created for property owners to guide preservation work. These Standards stress the importance of retaining and protecting the materials and features that convey a property's historical significance. Thus, when new features are incorporated for accessibility, historic materials and features should be retained whenever possible. Accessibility modifications should be in scale with the historic property, visually compatible, and, whenever possible, reversible. Reversible means that if the new feature were removed at a later date, the essential form and integrity of the property would be unimpaired. The design of new features should also be differentiated from the design of the historic property so that the evolution of the property is evident.

In general, when historic properties are altered, they should be made as accessible as possible. However, if an owner or a project team believes that certain modifications would threaten or destroy the significance of the property, the State Historic Preservation Officer should be consulted to determine whether or not any special accessibility provisions may be used. Special accessibility provisions for historic properties will vary depending on the applicable accessibility requirements.

In some cases, programmatic access may be the only option for extremely small or unaltered historic properties, such as a two-story house museum with no internal elevator. Programmatic access for historic properties refers to alternative methods of providing services, information, and experiences when physical access cannot be provided. It may mean offering an audio-visual program showing an inaccessible upper floor of a historic house museum, providing interpretive panels from a vista at an inaccessible terraced garden, or creating a tactile model of a historic monument for people with visual impairments.

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## Accessibility Solutions

The goal in selecting appropriate solutions for specific historic properties is to provide a high level of accessibility without compromising significant features **or** the overall character of the property. The following sections describe accessibility solutions and offer guidance on specific historic property components, namely the building site, entrances, interiors, landscapes, amenities, and new additions. Several solutions are discussed in each section, referencing dimensions and technical requirements from the ADA's accessibility guidelines, ADAAG. State and local requirements, however, may differ from the ADA requirements. Before making any modification owners should be aware of all applicable accessibility requirements.

**The Building Site**

An accessible route from a parking lot, sidewalk, and public street to the entrance of a historic building or facility is essential. An accessible route, to the maximum extent possible, should be the circulation route used by the general public. Critical elements of accessible routes are their widths, slopes, cross slopes, and surface texture. Each of these route elements must be appropriately designed so that the route can be used by everyone, including people with disabilities. The distance between the arrival and destination points should also be as short as possible. Sites containing designed landscapes should be carefully evaluated before making accessibility modifications. Historic landscapes are described in greater detail below.


The significant building site is now accessible to people with disabilities (note steps in front of ramp). Photo: NPS files.

**Providing Convenient Parking.** If parking is provided, it should be as convenient as possible for people with disabilities. Specially designated parking can often be created to improve accessibility. Modifications to parking configurations and pathways should not alter significant landscape features.

**Creating an Accessible Route.** The route or path through a site to a historic building's entrance should be wide enough, generally at least 3 feet (91 cm), to accommodate visitors with disabilities and must be appropriately graded with a stable, firm, and slip-resistant surface. Existing paths should be modified to meet these requirements whenever possible as long as doing so would not threaten or destroy significant materials and features.

Existing surfaces can often be stabilized by providing a new base and resetting the paving materials, or by modifying the path surface. In some situations it may be appropriate to create a new path through an inaccessible area. At large properties, it may be possible to regrade a slope to less than 1:20 (5%), or to introduce one or more carefully planned ramps. Clear directional signs should mark the path from arrival to destination.

**Entrances**

Whenever possible, access to historic buildings should be through a primary public entrance. In historic buildings, if this cannot be achieved without permanent damage to character-defining features, at least one entrance used by the public should be made accessible. If the accessible entrance is not the primary public entrance, directional signs should direct visitors to the accessible entrance. A rear or service entrance should be avoided as the only mean of entering a building.

The historic threshold was made accessible with a 1/2" wood bevel. Photo: NPS files.

Creating an accessible entrance usually involves overcoming a change in elevation. Steps, landings, doors, and thresholds, all part of the entrance, often pose barriers for persons with disabilities. To preserve the integrity of these features, a number of solutions are available to increase accessibility. Typical solutions include regrading, incorporating ramps, installing wheelchair lifts, creating new entrances, and modifying doors, hardware, and thresholds.

**Regrading an Entrance.** In some cases, when the entrance steps and landscape features are not highly significant, it may be possible to regrade to provide a smooth entrance into a building. If the existing steps are historic masonry, they should be buried, whenever possible, and not removed.

**Incorporating Ramps.** Permanent ramps are perhaps the most common means to make an entrance accessible. As a new feature, ramps should be carefully designed and appropriately located to preserve a property's historic character.

Ramps should be located at public entrances used by everyone whenever possible, preferably where there is minimal change in grade. Ramps should also be located to minimize the loss of historic features at the connection points-porch railings, steps, and windows-and should preserve the overall historic setting and character of the property. Larger buildings may have below grade areas that can accommodate a ramp down to an entrance. Below grade entrances can be considered if the ramp leads to a publicly used interior, such as an auditorium, or if the building is serviced by a public elevator. Ramps can often be incorporated behind historic features, such as cheek-walls or railings, to minimize the visual effect.

A new elevator entrance was provided next to the stairs to provide universal access to the services inside. Photo: Courtesy, GSA.

The steepest allowable slope for a ramp is usually 1:12 (8%), but gentler slopes should be used whenever possible to accommodate people with limited strength. Greater changes in elevation require larger and longer ramps to meet accessibility scoping provisions and may require an intermediate landing. Most codes allow a slightly steeper ramp for historic buildings to overcome one step.

Ramps can be faced with a variety of materials, including wood, brick, and stone. Often the type and quality of the materials determines how compatible a ramp design will be with a historic property. Unpainted pressure-treated wood should not be used to construct ramps because it usually appears temporary and is not visually compatible with most historic properties.

Railings should be simple in design, distinguishable from other historic features, and should extend one foot beyond the sloped area.

Ramp landings must be large enough for wheelchair users, usually at least 5 feet by 5 feet (152.5 cm by 152.5 cm), and the top landing must be at the level of the door threshold. It may be possible to reset steps by creating a ramp to accommodate minor level changes and to meet the threshold without significantly altering a property's historic character. If a building's existing landing is not wide or deep enough to accommodate a ramp, it may be necessary to modify the entry to create a wider landing. Long ramps, such as switchbacks, require intermediate landings, and all ramps should be detailed with an appropriate edge and railing for wheelchair users and visually impaired individuals.

Temporary or portable ramps are usually constructed of light-weight materials and, thus, are rarely safe or visually compatible with historic properties. Moreover, portable ramps are often stored until needed and, therefore, do not meet accessibility requirements for independent access. Temporary and portable ramps, however, may be an acceptable interim solution to improve accessibility until a permanent solution can be implemented.

**Installing Wheelchair Lifts.** Platform lifts and inclined stair lifts, both of which accommodate only one person, can be used to overcome changes of elevation ranging from three to 10 feet (.9 m-3 m) in height. However, many States have restrictions on the use of wheelchair lifts, so all applicable codes should be reviewed carefully before installing one. Inclined stair lifts, which carry a wheelchair on a platform up a flight of stairs, may be employed selectively. They tend to be visually intrusive, although they are relatively reversible. Platform lifts can be used when there is inadequate space for a ramp. However, such lifts should be installed in unobtrusive locations and under cover to minimize maintenance if at all possible. A similar, but more expensive platform lift has a retracting railing that lowers into the ground, minimizing the visual effect to historic properties. Mechanical lifts have drawbacks at historic properties with high public visitation because their capacity is limited, they sometimes cannot be operated independently, and they require frequent maintenance.

**Considering a New Entrance.** When it is not possible to modify an existing entrance, it may be possible to develop a new entrance by creating an entirely new opening in an appropriate location, or by using a secondary window for an opening. This solution should only be considered after exhausting all possibilities for modifying existing entrances.

**Retrofitting Doors.** Historic doors generally should not be replaced, nor should door frames on the primary elevation be widened, as this may alter an important feature of a historic design. However, if a building's historic doors have been removed, there may be greater latitude in designing a compatible new entrance. Most accessibility standards require at least a 32" (82 cm) clear opening with manageable door opening pressures. The most desirable preservation solution to improve accessibility is retaining historic doors and upgrading the door pressure with one of several devices. Automatic door openers (operated by push buttons, mats, or electronic eyes) and power-assisted door openers can eliminate or reduce door pressures that are accessibility barriers, and make single or double-leaf doors fully operational.

**Adapting Door Hardware.** If a door opening is within an inch or two of meeting the 32" (81 cm) clear opening requirement, it may be possible to replace the standard hinges with off-set hinges to increase the size of the door opening as much as 1 ½" (3.8 cm). Historic hardware can be retained in place, or adapted with the addition of an automatic opener, of which there are several types. Door hardware can also be retrofitted to reduce door pressures. For example, friction hinges can be retrofitted with ball-bearing inserts, and door closers can be rethreaded to reduce the door pressure.

This door handle has been retrofitted to meet ADA requirements. Photo: NPS files.

**Altering Door Thresholds.** A door threshold that exceeds the allowable height, generally ½" (1.3 cm), can be altered or removed with one that meets applicable accessibility requirements. If the threshold is deemed to be significant, a bevel can be added on each side to reduce its height. Another solution is to replace the threshold with one that meets applicable accessibility requirements and is visually compatible with the historic entrance.

### Readily Acheivable Accesibility Options

Many accessibility solutions can be implemented easily and inexpensively without destroying the significance of historic properties. While it may not be possible to undertake all of the modifications listed below, each change will improve accessibility.

#### Sites and Entrances

- Creating a designated parking space.
- Installing ramps.
- Making curb cuts.

#### Interiors

- Repositioning shelves.
- Rearranging tables, displays, and furniture.
- Repositioning telephones.
- Adding raised markings on elevator control buttons.
- Installing flashing alarm lights.
- Installing offset hinges to widen doorways.
- Installing or adding accessible door hardware.

- Adding an accessible water fountain, or providing a paper cup dispenser at an inaccessible water fountain.

**Restrooms**

- Installing grab bars in toilet stalls.
- Rearranging toilet partitions to increase maneuvering space.
- Insulating lavatory pipes under sinks to prevent burns.
- Installing a higher toilet seat.
- Installing a full-length bathroom mirror.
- Repositioning the paper towel dispenser.

**Moving Through Historic Interiors**

A retractable lift for this historic building foyer was created using "like" materials. Photo: NPS files.

Persons with disabilities should have independent access to all public areas and facilities inside historic buildings. The extent to which a historic interior can be modified depends on the significance of its materials, plan, spaces, features, and finishes. Primary spaces are often more difficult to modify without changing their character. Secondary spaces may generally be changed without compromising a building's historic character. Signs should clearly mark the route to accessible restrooms, telephones, and other accessible areas.

**Installing Ramps and Wheelchair Lifts.** If space permits, ramps and wheelchair lifts can also be used to increase accessibility inside buildings. However, some States and localities restrict interior uses of wheelchair lifts for life-safety reasons. Care should be taken to install these new features where they can be readily accessed. Ramps and wheelchair lifts are described below.

**Upgrading Elevators.** Elevators are an efficient means of providing accessibility between floors. Some buildings have existing historic elevators that are not adequately accessible for persons with disabilities because of their size, location, or detailing, but they may also contribute to the historical significance of a building. Significant historic elevators can usually be upgraded to improve accessibility. Control panels can be modified with a "wand" on a cord to make the control panel accessible, and timing devices can usually be adjusted.

**Retrofitting Door Knobs.** Historic door knobs and other hardware may be difficult to grip and turn. In recent years, lever-handles have been developed to replace door knobs. Other lever-handle devices can be added to existing hardware. If it is not possible or appropriate to retrofit existing door knobs, doors can be left open during operating hours (unless doing so would violate life safety codes), and power-assisted door openers can be installed. It may only be necessary to retrofit specific doorknobs to create an accessible path of travel and accessible restrooms.

**Modifying Interior Stairs.** Stairs are the primary barriers for many people with disabilities. However, there are some ways to modify stairs to assist people who are able to navigate them. It may be appropriate to add hand railings if none exist. Railings should be 1 ¼" (3.8 cm) in diameter and return to the wall so straps and bags do not catch. Color-contrasting, slip-resistant strips will help people with visual impairments. Finally, beveled or closed risers are recommended unless the stairs are highly significant, because open risers catch feet.

**Building Amenities**

Some amenities in historic buildings, such as restrooms, seating, telephones, drinking fountains, counters, may contribute to a building's historic character. They will often require modification to improve their use by persons with disabilities. In many cases, supplementing existing amenities, rather than changing or removing them, will increase access and minimize changes to historic features and materials.

**Upgrading Restrooms.** Restrooms may have historic fixtures such as sinks, urinals, or marble partitions that can be retained in the process of making modifications. For example, larger restrooms can sometimes be reconfigured by relocating or combining partitions to create an accessible toilet stall. Other changes to consider are adding grab bars around toilets, covering hot water pipes under sinks with insulation to prevent burns, and providing a sink, mirror, and paper dispenser at a height suitable for wheelchair users. A unisex restroom may be created if it is technically infeasible to create two fully accessible restrooms, or if doing so would threaten or destroy the significance of the building. It is important to remember that restroom fixtures, such as sinks, urinals, and partitions, may be historic, and therefore, should be preserved whenever possible.

**Modifying Other Amenities.** Other amenities inside historic buildings may require modification. Seating in a theater, for example, can be made accessible by removing some seats in several areas. New seating that is accessible can also be added at the end of existing rows, either with or without a level floor surface. Readily removable seats may be installed in wheelchair spaces when the spaces are not required to accommodate wheelchair users. Historic water fountains can be retained and new, two-tiered fountains installed if space permits. If public telephones are provided, it may be necessary to install at least a Text Telephone (TT), also known as a Telecommunication Device for the Deaf (TDD. Historic service counters commonly found in banks, theaters, and hotels generally should not be altered. It is preferable to add an accessible counter on the end of a historic counter if feasible. Modified or new counters should not exceed 36" (91.5 cm) in height.

**Making Historic Landscapes Accessible**

To successfully incorporate access into historic landscapes, the planning process is similar to that of other historic properties. Careful research and inventory should be undertaken to determine which materials and features convey the landscape's historical significance. As part of this evaluation, those features that are character-defining (topographical variation, vegetation, circulation, structures, furnishings, objects) should be identified. Historic finishes, details, and materials that also contribute to a landscape's significance should also be documented and evaluated prior to determining an approach to landscape accessibility. For example, aspects of the pedestrian circulation system that need to be understood include walk width, aggregate size, pavement pattern, texture, relief, and joint details. The context of the walk should be understood including its edges and surrounding area. Modifications to surface textures or widths of pathways can often be made with minimal effect on significant landscape features.

Additionally, areas of secondary importance such as altered paths should be identified-especially those where the accessibility modifications will not destroy a landscape's significance. By identifying those features that are contributing or non-contributing, a sympathetic circulation experience can then be developed.

After assessing a landscape's integrity, accessibility solutions can be considered. Full access throughout a historic landscape may not always be possible. Generally, it is easier to provide accessibility to larger, more open sites where there is a greater variety of public experiences. However, when a landscape is uniformly steep, it may only be possible to make discrete portions of a historic landscape accessible, and viewers may only be able to experience the landscape from selected vantage points along a prescribed pedestrian or vehicular access route. When defining such a route, the interpretive value of the user experience should be considered; in other words, does the route provide physical or visual access to those areas that are critical to understand the meaning of the landscape?

**Considering a New Addition as an Accessibility Solution**

Many new additions are constructed specifically to incorporate modern amenities such as elevators, restrooms, fire stairs, and new mechanical equipment. These new additions often create opportunities to incorporate access for people with disabilities. It may be possible, for example, to create an accessible entrance, path to public levels via a ramp, lift, or elevator. However, a new addition has the potential to change a historic property's appearance and destroy significant building and landscape features. Thus, all new additions should be compatible with the size, scale, and proportions of historic features and materials that characterize a property.

New additions should be carefully located to minimize connection points with the historic building, such that if the addition were to be removed in the future, the essential form and integrity of the building would remain intact. On the other hand, new additions should also be conveniently located near parking that is connected to an accessible route for people with disabilities. As new additions are incorporated, care should be taken to protect significant landscape features and archeological resources. Finally, the design for any new addition should be differentiated from the historic design so that the property's evolution over time is clear. New additions frequently make it possible to increase accessibility, while simultaneously reducing the level of change to historic features, materials, and spaces.

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## Federal Accessibility Laws

Today, few building owners are exempt from providing accessibility for people with disabilities. Before making any accessibility modification, it is imperative to determine which laws and codes are applicable. In addition to local and State accessibility codes, the following federal accessibility laws are currently in effect:

**Architectural Barriers Act (1968)**

The Architectural Barriers Act stipulates that all buildings designed, constructed, and altered by the Federal Government, or with federal assistance, must be accessible. Changes made to federal buildings must meet

The automatic door to this museum building is a practical solution for universal entry. Photo: NPS files.

the Uniform Federal Accessibility Standards (UFAS). Special provisions are included in UFAS for historic buildings that would be threatened or destroyed by meeting full accessibility requirements.

**Rehabilitation Act (1973)**

The Rehabilitation Act requires recipients of federal financial assistance to make their programs and activities accessible to everyone. Recipients are allowed to make their properties accessible by altering their building, by moving programs and activities to accessible spaces, or by making other accommodations.

**Americans with Disabilities Act (1990)**

Historic properties are not exempt from the Americans with Disabilities Act (ADA) requirements. To the greatest extent possible, historic buildings must be as accessible as non-historic buildings. However, it may not be possible for some historic properties to meet the general accessibility requirements.

Under Title II of the ADA, State and local governments must remove accessibility barriers either by shifting services and programs to accessible buildings, or by making alterations to existing buildings. For instance, a licensing office may be moved from a second floor to an accessible first floor space, or if this is not feasible, a mail service might be provided. However, State and local government facilities that have historic preservation as their main purpose-State-owned historic museums, historic State capitols that offer tours-must give priority to physical accessibility.

Under Title III of the ADA, owners of "public accommodations" (theaters, restaurants, retail shops, private museums) must make "readily achievable" changes; that is, changes that can be easily accomplished without much expense. This might mean installing a ramp, creating accessible parking, adding grab bars in bathrooms, or modifying door hardware. The requirement to remove barriers when it is "readily achievable" is an ongoing responsibility. When alterations, including restoration and rehabilitation work, are made, specific accessibility requirements are triggered.

Recognizing the national interest in preserving historic properties, Congress established alternative requirements for properties that cannot be made accessible without "threatening or destroying" their significance. A consultation process is outlined in the ADA's Accessibility Guidelines for owners of historic properties who believe that making specific accessibility modifications would "threaten or destroy" the significance of their property. In these situations, after consulting with persons with disabilities and disability organizations, building owners should contact the State Historic Preservation Officer (SHPO) to determine if the special accessibility provisions for historic properties may be used. Further, if it is determined in consultation with the SHPO that compliance with the minimum requirements would also 'threaten or destroy" the significance of the property, alternative methods of access, such as home delivery and audio-visual programs, may be used.

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## Conclusion

Historic properties are irreplaceable and require special care to ensure their preservation for future generations. With the passage of the Americans with Disabilities Act, access to historic properties open to the public is a now civil right, and owners of historic properties must evaluate existing

buildings and determine how they can be made more accessible. It is a challenge to evaluate properties thoroughly, to identify the applicable accessibility requirements, to explore alternatives and to implement solutions that provide independent access and are consistent with accepted historic preservation standards. Solutions for accessibility should not destroy a property's

significant materials, features and spaces, but should increase accessibility as much as possible. Most historic buildings are not exempt from providing accessibility, and with careful planning, historic properties can be made more accessible, so that all citizens can enjoy our Nation's diverse heritage.

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**Home page logo: Accessible historic building. Photo: NPS files.**

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39 Preservation Briefs

Technical Preservation Services
National Park Service
U.S. Department of the Interior

# Holding the Line
# Controlling Unwanted Moisture in Historic Buildings

**Sharon C. Park, AIA**



**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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**Uncontrolled moisture is the most prevalent cause of deterioration in older and historic buildings.** It leads to erosion, corrosion, rot, and ultimately the destruction of materials, finishes, and eventually structural components. Ever-present in our environment, moisture can be *controlled* to provide the differing *levels* of moisture necessary for human comfort as well as the longevity of historic building materials, furnishings, and museum collections. The challenge to building owners and preservation professionals alike is to understand the patterns of moisture movement in order to better manage it-not to try to eliminate it. There is never a single answer to a moisture problem. Diagnosis and treatment will always differ depending on where the building is located, climatic and soil conditions, ground water effects, and local traditions in building construction.

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## Remedial Actions within an Historic Preservation Context

In this Brief, advice about controlling the sources of unwanted moisture is provided within a preservation context based on philosophical principles contained in the *Secretary of the Interior's Standards for the Treatment of Historic Properties.* Following the Standards means significant materials and features that contribute to the historic character of the building should be preserved, not damaged during remedial treatment.

Applying a waterproof coating to an above-ground masonry wall can trap moisture underneath, causing further damage to the historic material. Photo: NPS files.

It also means that physical treatments should be reversible, whenever possible. The majority of treatments for moisture management in this Brief stress preservation maintenance for materials, effective drainage of troublesome ground moisture, and improved interior ventilation.

The Brief encourages a systematic approach for evaluating moisture problems which, in some cases, can be undertaken by a building owner. Because the source of moisture can be elusive, it may be necessary to consult with historic preservation professionals prior to starting work that would affect historic materials. Architects, engineers, conservators, preservation contractors, and staff of State Historic Preservation Offices (SHPOs) can provide such advice. Regardless of who does the work, however, these are the principles that should guide treatment decisions:

- Avoid remedial treatments without prior careful diagnosis.
- Undertake treatments that protect the historical significance of the resource.
- Address issues of ground-related moisture and rain run-off thoroughly.
- Manage existing moisture conditions before introducing humidified/dehumidified mechanical systems.

- Implement a program of ongoing monitoring and maintenance once moisture is controlled or managed.
- Be aware of significant landscape and archeological resources in areas to be excavated.

Finally, mitigating the effects of catastrophic moisture, such as floods, requires a different approach and will not be addressed in this Brief.

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## How and Where to Look for Damaging Moisture

Finding, treating, and managing the sources of damaging moisture requires a systematic approach that takes time, patience, and a thorough examination of all aspects of the problem-including a series of variable conditions.Moisture problems may be a direct result of one of these factors or may be attributable to a combination of interdependent variables.

### Factors Contributing to Moisture Problems

A variety of simultaneously existing conditions contribute to moisture problems in old buildings. For recurring moisture problems, it may be necessary for the owner or preservation professional to address many, if not all, of the following variables:

- Types of building materials and construction systems
- Type and condition of roof and site drainage systems and their rates of discharge
- Type of soil, moisture content, and surface /subsurface water flow adjacent to building
- Building usage and moisture generated by occupancy
- Condition and absorption rates of materials
- Type, operation, and condition of heating, ventilating, cooling, humidification/ dehumidification, and plumbing systems
- Daily and seasonal changes in sun, prevailing winds, rain, temperature, and relative humidity (inside and outside), as well as seasonal or tidal variations in groundwater levels
- Unusual site conditions or irregularities of construction

- Conditions in affected wall cavities, temperature and relative humidity, and dewpoints
- Amount of air infiltration present in a building
- Adjacent landscape and planting materials


Debris will impede the normal flow of water from the roof's gutter and downspout system to the ground and result in moisture problems. Photo: NPS files.

Diagnosing and treating the cause of moisture problems requires looking at both the localized decay, as well as understanding the performance of the entire building and site. Moisture is notorious for traveling far from the source, and moisture movement within concealed areas of the building construction make accurate diagnosis of the source and path difficult. Obvious deficiencies, such as broken pipes, clogged gutters, or cracked walls that contribute to moisture damage, should always be corrected promptly. For more complicated problems, it may take several months or up to four seasons of monitoring and evaluation to complete a full diagnosis. Rushing to a solution without adequate documentation can often result in the unnecessary removal of historic materials-and worse-the creation of long-term problems associated with an increase, rather than a decrease, in the unwanted moisture.

## Looking for Signs

Identifying the type of moisture damage and discovering its source or sources usually involves the human senses of sight, smell, hearing, touch, and taste combined with intuition. Some of the more common signs of visible as well as hidden moisture damage, include:

- Presence of standing water, mold, fungus, or mildew
- Wet stains, eroding surfaces, or efflorescence (salt deposits) on interior and exterior surfaces
- Flaking paint and plaster, peeling wallpaper, or moisture blisters on finished surfaces
- Dank, musty smells in areas of high humidity or poorly ventilated spaces
- Rust and corrosion stains on metal elements, such as anchorage systems and protruding roof nails in the attic
- Cupped, warped, cracked, or rotted wood

- Spalled, cracked masonry or eroded mortar joints
- Faulty roofs and gutters including missing roofing slates, tiles, or shingles and poor condition of flashing or gutters
- Condensation on window and wall surfaces
- Ice dams in gutters, on roofs, or moisture in attics

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## Uncovering and Analyzing Moisture Problems

Moisture comes from a variety of external sources. Most problems begin as a result of the weather in the form of rain or snow, from high ambient relative humidity, or from high water tables. But some of the most troublesome moisture damage in older buildings may be from internal sources, such as leaking plumbing pipes, components of heating, cooling, and climate control systems, as well as sources related to use or occupancy of the building. In some cases, moisture damage may be the result of poorly designed original details, such as projecting outriggers in rustic structures that are vulnerable to rotting, and may require special treatment. The five most common sources of unwanted moisture include:

- Above grade exterior moisture entering the building
- Below grade ground moisture entering the building
- Leaking plumbing pipes and mechanical equipment
- Interior moisture from household use and climate control systems
- Water used in maintenance and construction materials.

**Above grade exterior moisture** generally results from weather related moisture entering through deteriorating materials as a result of deferred maintenance, structural settlement cracks, or damage from high winds or storms. Such sources as faulty roofs, cracks in walls, and open joints around window and door openings can be corrected through either repair or limited replacement. Due to their age, historic buildings are notoriously "drafty," allowing rain, wind, and damp air to enter through missing mortar joints; around cracks in windows, doors, and wood siding; and into uninsulated attics. In some cases, excessively absorbent materials, such as soft sandstone, become saturated from rain or gutter overflows, and can allow moisture to dampen interior surfaces. Vines or other vegetative materials allowed to grow directly on building materials without trellis or other framework can cause damage from roots eroding mortar joints and foundations as well as dampness being held against surfaces. In most cases, keeping vegetation off buildings, repairing damaged materials, replacing flashings, rehanging gutters, repairing downspouts, repointing mortar, caulking perimeter joints around windows and doors, and repainting surfaces can alleviate most sources of unwanted exterior moisture from entering a building above grade.

**Damp interior plaster around windows generally indicates moisture has entered from the outside. Photo: NPS files.**

**Below grade ground moisture** is a major source of unwanted moisture for historic and older buildings. *Proper handling of surface rain run-off is one of the most important measures of controlling unwanted ground moisture.* Rain water is often referred to as "bulk moisture" in areas that receive significant annual rainfalls or infrequent, but heavy, precipitation. For example, a heavy rain of 2" per hour can produce 200 gallons of water from downspout discharge alone for a house during a one hour period. When soil is saturated at the base of the building, the moisture will wet footings and crawl spaces or find its way through cracks in foundation walls and enter into basements. Moisture in saturated basement or foundation walls-also exacerbated by high water tables-will generally rise up within a wall and eventually cause deterioration of the masonry and adjacent wooden structural elements.

Builders traditionally left a working area, known as a builder's trench, around the exterior of a foundation wall. These trenches have been known to increase moisture problems if the infill soil is less than fully compacted or includes rubble backfill, which, in some cases, may act as a reservoir holding damp materials against masonry walls. Broken subsurface pipes or downspout drainage can leak into the builder's trench and dampen walls some distance from the source. Any subsurface penetration of the foundation wall for sewer, water, or other piping also can act as a direct conduit of ground moisture unless these holes are well sealed. A frequently unsuspected, but serious, modern source of ground moisture is a landscape irrigation system set too close to the building. Incorrect placement of

A clogged or broken downspout causes the water to pour directly into the ground. NPS files. Photo: NPS files.

sprinkler heads can add a tremendous amount of moisture at the foundation level and on wall surfaces.

The ground, and subsequently the building, will stay much drier by 1) re-directing rain water away from the foundation through sloping grades, 2) capturing and disposing downspout water well away from the building, 3) developing a controlled ground gutter or effective drainage for buildings historically without gutters and downspouts, and 4) reducing splash-back of moisture onto foundation walls. The excavation of foundations and the use of dampproof coatings and footing drains should only be used after the measures of reducing ground moisture listed above have been implemented.

**Leaking plumbing pipes and mechanical equipment** can cause immediate or long-term damage to historic building interiors. Routine maintenance, repair, or, if necessary, replacement of older plumbing and mechanical equipment are common solutions. Older water and sewer pipes are subject to corrosion over time. Slow leaks at plumbing joints hidden within walls and ceilings can ultimately rot floor boards, stain ceiling plaster, and lead to decay of structural members. Frozen pipes that crack can damage interior finishes. In addition to leaking plumbing pipes, old radiators in some historic buildings have been replaced with water-supplied fan coil units which tend to leak. These heating and cooling units, as well as central air equipment, have overflow and condensation pans that require cyclical maintenance to avoid mold and mildew growth and corrosion blockage of drainage channels. Uninsulated forced-air sheet metal ductwork and cold water pipes in walls and ceilings often allow condensation to form on the cold metal, which then drips and causes bubbling plaster and peeling paint. Careful design and vigilant maintenance, as well as repair and insulating pipes or ductwork, will generally rid the building of these common sources of moisture.

**Interior moisture** from building use and modern humidified heating and cooling systems can create serious problems. In northern U.S. climates, heated buildings will have winter-time relative humidity levels ranging from 10%-35% Relative Humidity (RH). A house with four occupants generates between 10 and 16 pounds of water a day (approximately 1 ½- 2 gallons) from human residents. Moisture from food preparation, showering, or laundry use will produce condensation on windows in winter climates.

When one area or floor of a building is air-conditioned and another area is not, there is the chance for condensation to occur between the two areas. Most periodic condensation does not create a long-term problem.

If adequate ventilation is installed, damage to interior walls such as this can be prevented. NPS files.Photo: NPS files.

Humidified climate control systems are generally a major problem in museums housed within historic buildings. They produce between 35%-55% RH on average which, as a vapor, will seek to dissipate and equalize with adjacent spaces. Moisture can form on single-glazed windows in winter with exterior temperatures below 30° F and interior temperatures at 70°F with as little as 35% RH. Frequent condensation on interior window surfaces is an indication that moisture is migrating into exterior walls, which can cause long-term damage to historic materials. Materials and wall systems around climate controlled areas may need to be made of moisture resistant finishes in order to handle the additional moisture in the air. Moist interior conditions in hot and humid climates will generate mold and fungal growth. Unvented mechanical equipment, such as gas stoves, driers, and kerosene heaters, generate large quantities of moisture. It is important to provide adequate ventilation and find a balance between interior temperature, relative humidity, and airflow to avoid interior moisture that can damage historic buildings.

**Moisture from maintenance and construction materials** can cause damage to adjacent historic materials. Careless use of liquids to wash floors can lead to water seepage through cracks and dislodge adhesives or cup and curl materials. High-pressure power washing of exterior walls and roofing materials can force water into construction joints where it can dislodge mortar, lift roofing tiles, and saturate frame walls and masonry. Replastered or newly plastered interior walls or the construction of new additions attached to historic buildings may hold moisture for months; new plaster, mortar, or concrete should be fully cured before they are painted or finished. The use of materials in projects that have been damaged by moisture *prior* to installation or have too high a moisture content may cause concealed damage.

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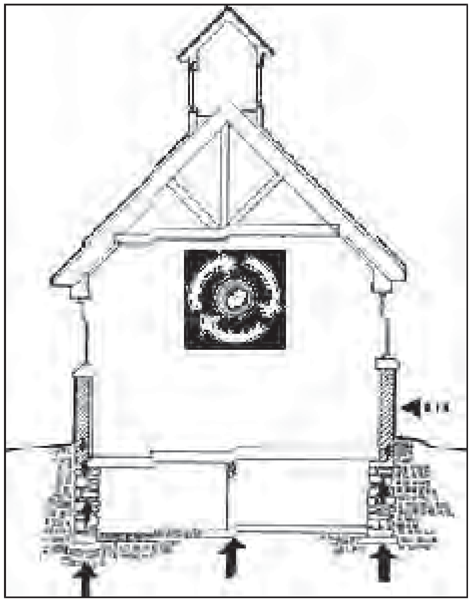
## Transport or Movement of Moisture

Knowing the five most common sources of moisture that cause damage to building materials is the first step in diagnosing moisture problems. But it is also important to understand the basic mechanisms that affect moisture movement in buildings. Moisture transport, or movement, occurs in two states: liquid and vapor. It is directly related to pressure differentials. For example, water in a gaseous or vapor state, as warm moist air, will move from its high pressure area to a lower pressure area where the air is cooler and drier. Liquid water will move as a result of differences in hydrostatic pressure or wind pressure. *It is the pressure differentials that drive the rate of moisture migration in either state.* Because the building materials themselves resist this moisture movement, the rate of movement will depend on two factors: the permeability of the materials when affected by vapor and the absorption rates of materials in contact with liquid.



The dynamic forces that move air and moistue through a building are important to understand, particularly when selecting a treatment to correct a moisture problem. This drawing shows how moisture can invade "inward" from the exterior; "upward" from the ground; and be generated from "within" the interior. All have damaging effects. Drawing: NPS files.

The mechanics, or physics, of moisture movement is complex, but if the driving force is difference in pressure, then an approach to reducing moisture movement and its damage is to reduce the difference in pressure, not to increase it. That is why the treatments discussed in this Brief will look at *managing moisture by draining bulk moisture and ventilating vapor moisture* before setting up new barriers with impermeable coatings or over-pressurized new climate control systems that threaten aging building materials and archaic construction systems.

Three forms of moisture transport are particularly important to understand in regards to historic buildings-*infiltration, capillary action, and vapor diffusion*--remembering, at the same time, that the subject is infinitely complex and, thus, one of continuing scientific study. Buildings were traditionally designed to deal with the movement of air. For example, cupolas and roof lanterns allowed hot air to rise and provided a natural draft to pull air through buildings. Cavity walls in both frame and masonry buildings were constructed to allow moisture to dissipate in the air space between external and internal walls. Radiators were placed in front of windows to keep cold surfaces warm, thereby reducing condensation on these surfaces. Many of these features, however, have been altered over time in an effort to modernize appearances, improve energy efficiency, or accommodate changes in use. The change in use will also affect moisture movement, particularly in commercial and industrial buildings with modern mechanical systems. Therefore, the way a building handles air and moisture today may be different from that intended by the original builder or architect, and poorly conceived changes may be partially responsible for chronic moisture conditions.

Moisture moves into and through materials as both a visible liquid (capillary action) and as a gaseous vapor (infiltration and vapor diffusion). Moisture from leaks, saturation, rising damp, and condensation can lead to the deterioration of materials and cause an unhealthy environment. Moisture in its solid form, ice, can also cause damage from frozen, cracked water pipes, or split gutter seams or spalled masonry from freeze-thaw action. Moisture from melting ice dams, leaks, and condensation often can travel great distances down walls and along construction surfaces, pipes, or conduits. The amount of moisture and how it deteriorates materials is dependent upon complex forces and variables that must be considered for each situation.

Determining the way moisture is handled by the building is further complicated because each building and site is unique. Water damage from blocked gutters and downspouts can saturate materials on the outside, and high levels of interior moisture can saturate interior materials. Difficult cases may call for technical evaluation by consultants specializing in moisture monitoring and diagnostic evaluation. In other words, it may take a team to effectively evaluate a situation and determine a proper approach to controlling moisture damage in old buildings.

**Infiltration** is created by wind, temperature gradients (hot air rising), ventilation fan action, and the stack or chimney effect that draws air up into tall vertical spaces. Infiltration as a dynamic force does not actually move liquid water, but is the vehicle by which dampness, as a component of air, finds its way into building materials. Older buildings have a natural air exchange, generally from 1 to 4 changes per hour, which, in turn, may help control moisture by diluting moisture within a building. The tighter the building construction, however, the lower will be the infiltration rate and the natural circulation of air. In the process of infiltration, however, moisture that has entered the building and saturated materials can be drawn in and out of materials, thereby adding to the dampness in the air. Inadequate air circulation where there is excessive moisture (i.e., in a damp basement), accelerates the deterioration of historic materials. To reduce the unwanted moisture that accompanies infiltration, it is best to incorporate maintenance and repair treatments to close joints and weatherstrip windows, while providing controlled air exchanges elsewhere. The worst approach is to seal the building so completely, while limiting fresh air intake, that the building cannot breathe.

**Capillary action** occurs when moisture in saturated porous building materials, such as masonry, wicks up or travels vertically as it evaporates to the surface. In capillary attraction, liquid in the material is attracted to the solid surface of the pore structure causing it to rise vertically; thus, it is often called "rising damp," particularly when found in conjunction with ground moisture. It should not, however, be confused with moisture that laterally penetrates a foundation wall through cracks and settles in the basement. Not easily controlled, most rising damp comes from high water tables or a constant source under the footing. In cases of damp masonry walls with capillary action, there is usually a whitish stain or horizontal tide mark of efflorescence that seasonally fluctuates about 1- 3 feet above grade where the excess moisture evaporates from the wall. This tide mark is full of salt crystals, that have been drawn from the ground and building materials along with the water, making the masonry even more sensitive to additional moisture absorption from the surrounding air. Capillary migration of moisture may occur in any material with a pore structure where there is a constant or recurring source of moisture. The best approach for dealing with capillary rise in building materials is to reduce the amount of water in contact with historic materials. If that is not possible due to chronically high water tables, it may be necessary to introduce a horizontal damp-proof barrier, such as slate course or a lead or plastic sheet, to stop the vertical rise of moisture. Moisture should not be sealed into the wall with a waterproof coating, such as cement parging or vinyl wall coverings, applied to the inside of damp walls. This will only increase the pressure differential as a vertical barrier and force the capillary action, and its destruction of materials, higher up the wall.

**Vapor diffusion** is the natural movement of pressurized moisture vapor through porous materials. It is most readily apparent as humidified interior air moves out through walls to a cooler exterior. In a hot and humid climate, the reverse will happen as moist hot air moves into cooler, dryer, air-conditioned, interiors. The movement of the moisture vapor is not a serious problem until the dewpoint temperature is reached and the vapor changes into liquid moisture known as *condensation*. This can occur within a wall or on interior surfaces. Vapor diffusion will be more of a problem for a frame structure with several layers of infill materials within the frame cavity than a dense masonry structure. Condensation as a result of vapor migration usually takes place on a surface or film, such as paint, where there is a change in permeability.

The installation of climate control systems in historic buildings (mostly museums) that have *not* been properly designed or regulated and that force pressurized damp air to diffuse into perimeter walls is an ongoing concern. These newer systems take constant monitoring and back-up warning systems to avoid moisture damage.

Long-term and undetected condensation or high moisture content can cause serious structural damage as well as an unhealthy environment, heavy with mold and mildew spores. Reducing the interior/exterior pressure differential and the difference between interior and exterior temperature and relative humidity helps control unwanted vapor diffusion. This can sometimes be achieved by reducing interior relative humidity. In some instances, using vapor barriers, such as heavy plastic sheeting laid over damp crawl spaces, can have remarkable success in stopping vapor diffusion from damp ground into buildings. Yet, knowledgeable experts in the field differ regarding the appropriateness of vapor barriers and when and where to use them, as well as the best way to handle natural diffusion in insulated walls.

Adding insulation to historic buildings, particularly in walls of wooden frame structures, has been a standard modern weatherization treatment, but it can have a disastrous effect on historic buildings. The process of installing the insulation destroys historic siding or plaster, and it is very difficult to establish a tight vapor barrier. While insulation has the benefit of increasing the efficiency of heating and cooling by containing temperature controlled air, it does not eliminate surfaces on which damaging moisture can condense. For insulated residential frame structures, the most obvious sign of a moisture diffusion problem is peeling paint on wooden siding, even after careful surface preparation and repainting. Vapor impermeable barriers such as plastic sheeting, or more accurately, *vapor retarders*, in cold and moderate climates generally help slow vapor diffusion where it is not wanted.

In regions where *humidified* climate control systems are installed into insulated frame buildings, it is important to stop *interstitial,* or in-wall, dewpoint condensation. This is very difficult because humidified air can penetrate breaches in the vapor barrier, particularly around electrical outlets. Improperly or incompletely installed retrofit vapor barriers will cause extensive damage to the building, just in the installation process, and will allow trapped condensation to wet the insulation and sheathing boards, corrode metal elements such as wiring cables and metal anchors, and blister paint finishes. Providing a tight wall vapor barrier, as well as a ventilated cavity behind wooden clapboards or siding appears to help insulated frame walls, if the interior relative humidity can be adjusted or monitored to avoid condensation. Correct placement of vapor retarders within building construction will vary by region, building construction, and type of climate control system.

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## Surveying and Diagnosing Moisture Damage: Key Questions to Ask

It is important for the building to be surveyed first and the evidence and location of suspected moisture damage systematically recorded before undertaking any major work to correct the problem. This will give a baseline from which relative changes in condition can be noted.

When materials become wet, there are specific physical changes that can be detected and noted in a record book or on survey sheets. Every time there is a heavy rain, snow storm, water in the basement, or mechanical systems failure, the owner or consultant should note and record the way moisture is moving, its appearance, and what variables might contribute to the cause. *Standing outside to observe a building in the rain may answer many questions and help trace the movement of water into the building.* Evidence of deteriorating materials that cover more serious moisture damage should also be noted, even if it is not immediately clear what is causing the damage. ( For example, water stains on the ceiling may be from leaking pipes, blocked fan coil drainage pans above, or from moisture which has penetrated around a poorly sloped window sill above.) Don't jump to conclusions, but use a systematic approach to help establish an educated theory-or hypothesis-of what is causing the moisture problem or what areas need further investigation.

*Surveying moisture damage must be systematic so that relative changes can be noted*. Tools for investigating can be as simple as a notebook, sketch plans, binoculars, camera, aluminum foil, smoke pencil, and flashlight. The systematic approach involves looking at buildings from the top down and from the outside to the inside. Photographs, floor plans, site plan, and exterior elevations-even roughly sketched-should be used to indicate all evidence of damp or damaged materials, with notations for musty or poorly ventilated areas. Information might be needed on the absorption and permeability characteristics of the building materials and soils. Exterior drainage patterns should be noted and these base plans referred to on a regular basis in different seasons and in differing types of weather. It is best to start with one method of periodic documentation and to use this same method each time. Because moisture is affected by gravity, many surveys start with the roof and guttering systems and work down through the exterior walls. Any obvious areas of water penetration, damaged surfaces, or staining should be noted. Any recurring damp or stain patterns, both exterior and interior, should also be noted with a commentary on the temperature, weather, and any other facts that may be relevant (driving rains, saturated soil, high interior humidity, recent washing of the building, presence of a lawn watering system, etc.).

The interior should be recorded as well, beginning with the attic and working down to the basement and crawl space. It may be necessary to remove damaged materials selectively in order to trace the path of moisture or to pinpoint a source, such as a leaking pipe in the ceiling. The use of a basic resistance moisture meter, available in many hardware stores, can identify moisture contents of materials and show, over time, if wall surfaces are drying or becoming damper. A smoke pencil can chart air infiltration around windows or draft patterns in interior spaces. For a quick test to determine if a damp basement is caused by saturated walls or is a result of condensation, tape a piece of foil onto a masonry surface and check it after a day or two; if moisture has developed behind the foil, then it is coming from the masonry. If condensation is on the surface of the foil, then moisture is from the air.

Comparing current conditions with previous conditions, historic drawings, photographs, or known alterations may also assist in the final diagnosis. A chronological record, showing improvement or deterioration, should be backed up with photographs or notations as to the changing size, condition, or features of the deterioration and how these changes have been affected by variables of temperature and rainfall. If a condition can be related in time to a particular event, such as efflorescence developing on a chimney after the building is no longer heated, it may be possible to isolate a cause, develop a hypothesis, and then test the hypothesis (by adding some temporary heat), before applying a remedial treatment. If the owner or consultant has access to moisture survey and monitoring equipment such as resistance moisture meters, dewpoint indicators, salt detectors, infrared thermography systems, psychrometer, fiber-optic boroscopes, and miniaturized video cameras, additional quantified data can be incorporated into the survey. If it is necessary to track the wetting and drying of walls over a period of time, deep probes set into walls and in the soil with connector cables to computerized data loggers or the use of long-term recording of hygrothermographs may require a trained specialist. Miniaturized fiber-optic video cameras can record the condition of subsurface drain lines without excavation. It should be noted, however, that *instrumentation, while extremely useful, cannot take the place of careful personal observation and analysis.* Relying on instrumentation alone rarely will give the owner the information needed to fully diagnose a moisture problem. To avoid jumping to a quick-potentially erroneous-conclusion, a series of questions should be asked first. This will help establish a theory or hypothesis that can be tested to increase the chances that a remedial treatment will control or manage existing moisture.

***How is water draining around building and site?*** What is the effectiveness of gutters and downspouts? Are the slopes or grading around foundations adequate? What are the locations of subsurface features such as wells, cisterns, or drainage fields? Are there subsurface drainage pipes (or drainage boots) attached to the downspouts and are they in good working condition? Does the soil retain moisture or allow it to drain freely? Where is the water table? Are there window wells holding rain water? What is the flow rate of area drains around the site (can be tested with a hose for several minutes)? Is the storm piping out to the street sufficient for heavy rains, or does water chronically back up on the site? Has adjacent new construction affected site drainage or water table levels?

***How does water/moisture appear to be entering the building?*** Have all five primary sources of moisture been evaluated? What is the condition of construction materials and are there any obvious areas of deterioration? Did this building have a builder's trench around the foundation that could be holding water against the exterior walls? Are the interior bearing walls as well as the exterior walls showing evidence of rising damp? Is there evidence of hydrostatic pressure under the basement floor such as water percolating up through cracks? Has there been moisture damage from an ice dam in the last several months? Is damage localized, on one side of the building only, or over a large area?

***What are the principal moisture dynamics?*** Is the moisture condition from liquid or vapor sources? Is the attic moisture a result of vapor diffusion as damp air comes up through the cavity walls from the crawl space or is it from a leaking roof? Is the exterior wall moisture from rising damp with a tide mark or are there uneven spots of dampness from foundation splash back, or other ground moisture conditions? Is there adequate air exchange in the building, particularly in damp areas, such as the basement? Has the height of the water table been established by inserting a long pipe into the ground in order to record the water levels?

***How is the interior climate handling moisture?*** Are there areas in the building that do not appear to be ventilating well and where mold is growing? Are there historic features that once helped the building control air and moisture that can be reactivated, such as operable skylights or windows? Could dewpoint condensation be occurring behind surfaces, since there is often condensation on the windows? Does the building feel unusually damp or smell in an unusual way that suggest the need for further study? Is there evidence of termites, carpenter ants, or other pests attracted to moist conditions? Is a dehumidifier keeping the air dry or is it, in fact, creating a cycle where it is actually drawing moisture through the foundation wall?

***Does the moisture problem appear to be intermittent, chronic, or tied to specific events?*** Are damp conditions occurring within two hours of a heavy rain or is there a delayed reaction? Does rust on most nail heads in the attic indicate a condensation problem? What are the wet patterns that appear on a building wall during and after a rain storm? Is it localized or in large areas? Can these rain patterns be tied to gutter overflows, faulty flashing, or saturation of absorbent materials? Is a repaired area holding up well over time or is there evidence that moisture is returning? Do moisture meter readings of wall cavities indicate they are wet, suggesting leaks or condensation in the wall?

The owner used long black extender pipes to test a theory that it was faulty roof drainage causing the problem. Photo: NPS files.

Once a hypothesis of the source or sources of the moisture has been developed from observation and recording of data, it is often useful to prove or disprove this hypothesis with interim treatments, and, if necessary, the additional use of instrumentation to verify conditions. For damp basements, test solutions can help determine the cause. For example, surface moisture in low spots should be redirected away from the foundation wall with regrading to determine if basement dampness improves. If there is still a problem, determine if subsurface downspout collection pipes or cast iron boots are not functioning properly. The above grade downspouts can be disconnected and attached to long, flexible extender pipes and redirected away from the foundation. If, after a heavy rain or a simulation using a hose, there is no improvement, look for additional ground moisture sources such as high water tables, hidden cisterns, or leaking water service lines as a cause of moisture in the basement. New data will lead to a new hypothesis that should be tested and verified. *The process of elimination can be frustrating, but is required if a systematic method of diagnosis is to be successful.*

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## Selecting an Appropriate Level of Treatment

The treatments that follow this section in chart format are divided into levels based on the degree of moisture problems. Level I covers preservation maintenance; Level II focuses on repair using historically compatible materials and essentially mitigating damaging moisture conditions; and Level III discusses replacement and alteration of materials that permit continued use in a chronically moist environment. It is important to begin with Level I and work through to a manageable treatment as part of the control of moisture problems. Buildings in serious decay will require treatments in Level II, and difficult or unusual site conditions may require more aggressive treatments in Level III. Caution should always be exercised when selecting a treatment. The treatments listed are a guide and not intended to be recommendations for specific projects as the key is always proper diagnosis.

Start with the repair of any obvious deficiencies using sound preservation maintenance. If moisture cannot be managed by maintenance alone, it is important to reduce it by mitigating problems *before* deteriorated historic materials are replaced. Treatments should not remove materials that can be preserved; should not involve extensive excavation unless there is a documented need; and should not include coating buildings with waterproof sealers that can exacerbate an existing problem. Some alteration to historic materials, structural systems, mechanical systems, windows, or finishes may be needed when excessive site moisture cannot be controlled by drainage systems, or in areas prone to floods. These changes, however, should, be sensitive to preserving those materials, features, and finishes that convey the historic character of the building and site.

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## Level I Preservation Maintenance

***Exterior: Apply cyclical maintenance procedures to eliminate rain and moisture infiltration.***

Installing ventilating fans can improve damp conditions or reduce cooling loads. Photo: NPS files.

**Roofing/ guttering**: Make weather-tight and operational; inspect and clean gutters as necessary depending on number of nearby trees, but at least twice a year; inspect roofing at least once a year, preferably spring; replace missing or damaged roofing shingles, slates, or tiles; repair flashing; repair or replace cracked downspouts.

**Walls:** Repair damaged surface materials; repoint masonry with appropriately formulated mortar; prime and repaint wooden, metal, or masonry elements or surfaces; remove efflorescence from masonry with non-metallic bristle brushes.

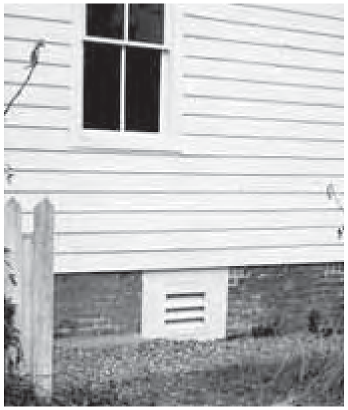
**Window and door openings:** Eliminate cracks or open joints; caulk or repoint around openings or steps; repair or reset weatherstripping; check flashing; repaint, as necessary.

***Ground: Apply regular maintenance procedures to eliminate standing water and vegetative threats to building/site.***

**Grade**: Eliminate low spots around building foundations; clean out existing downspout boots twice a year or add extension to leaders to carry moisture away from foundation; do a hose test to verify that surface drains are functioning; reduce moisture used to clean steps and walks; eliminate the use of chlorides to melt ice which can increase freeze/thaw spalling of masonry; check operation of irrigation systems, hose bib leaks, and clearance of air conditioning condensate drain outlets.

**Crawl space**: Check crawl space for animal infestation, termites, ponding moisture, or high moisture content; check foundation grilles for adequate ventilation; seasonally close grilles when appropriate-in winter, if not needed, or in summer if hot humid air is diffusing into air conditioned space.

**Foliage**: Keep foliage and vines off buildings; trim overhanging trees to keep debris from gutters and limbs from rubbing against building; remove moisture retaining elements, such as firewood, from foundations.



A vent may be added if there is none. Close grilles in the summer, if hot humid air is getting into air conditioned spaces. Photo: NPS files.

***Basements and foundations: Increase ventilation and maintain surfaces to avoid moisture.***

**Equipment**: Check dehumidifiers, sump pump, vent fans, and water detection or alarm systems for proper maintenance as required; check battery back-up twice a year.

**Piping/ductwork**: Check for condensation on pipes and insulate/seal joints, if necessary.

***Interior: Maintain equipment to reduce leaks and interior moisture.***

**Plumbing pipes**: Add insulation to plumbing or radiator pipes located in areas subject to freezing, such as along outside walls, in attics, or in unheated basements.

**Mechanical equipment**: Check condensation pans and drain lines to keep clear; insulate and seal joints in exposed metal ductwork to avoid drawing in moist air.

**Cleaning**: Routinely dust and clean surfaces to reduce the amount of water or moist chemicals used to clean building; caulk around tile floor and wall connections; and maintain floor grouts in good condition.

**Ventilation:** Reduce household-produced moisture, if a problem, by increasing ventilation; vent clothes driers to the outside; install and always use exhaust fans in restrooms, bathrooms, showers, and kitchens, when in use.

## Level II Repair and Corrective Action

***Exterior: Repair features that have been damaged. Replace an extensively deteriorated feature with a new feature that matches in design, color, texture, and where possible, materials.***

**Roofing**: Repair roofing, parapets and overhangs that have allowed moisture to enter; add ice and water shield membrane to lower 3-4 feet or roofing in cold climates to limit damage from ice dams; increase attic ventilation, if heat and humidity build-up is a problem. Make gutters slope @ 1/8" to the foot. Use professional handbooks to size gutters and reposition, if necessary and appropriate to historic architecture. Add ventilated chimney caps to unused chimneys that collect rain water.

New drainage systems for roof run-off may be installed in order to remove moisture from the base of the building. Photo: NPS files.

**Walls:** Repair spalled masonry, terra cotta, etc. by selectively installing new masonry units to match; replace rotted clapboards too close to grade and adjust grade or clapboards to achieve adequate clearance; protect or cover open window wells.

***Ground: Correct serious ground water problems; capture and dispose of downspout water away from foundation; and control vapor diffusion of crawlspace moisture.***

**Grade**: Re-establish positive sloping of grade; try to obtain 6" of fall in the first 10' surrounding building foundation; for buildings without gutter systems, regrade and install a positive subsurface collection system with gravel, or waterproof sheeting and perimeter drains; adjust pitch or slope of eave line grade drains or French drains to reduce splash back onto foundation walls; add subsurface drainage boots or extension pipes to take existing downspout water away from building foundation to the greatest extent feasible.

**Crawl space**: Add polyethylene vapor barrier (heavy construction grade or Mylar ) to exposed dirt in crawlspace if monitoring indicates it is needed and there is no rising damp; add ventilation grilles for additional cross ventilation, if determined advisable.

***Foundations and Basements: Correct existing high moisture levels, if other means of controlling ground moisture are inadequate.***

**Mechanical devices:** Add interior perimeter drains and sump pump; add dehumidifiers for seasonal control of humidity in confined, unventilated space ( but don't create a problem with pulling dampness out of walls); add ventilator fans to improve air flow, but don't use both the dehumidifier and ventilator fan at the same time.

**Walls**: Remove commentates coatings, if holding rising damp in walls; coat walls with vapor permeable lime based rendering plaster, if damp walls need a sacrificial coating to protect mortar from erosion; add termite shields, if evidence of termites and dampness cannot be controlled.

***Framing:*** *Reinforce existing floor framing weakened by moisture by adding lolly column support and reinforcing joist ends with sistered or parallel supports. Add a vapor impermeable shield, preferably non-ferrous metal, under wood joists coming into contact with moist masonry.*

***Interior: Eliminate areas where moisture is leaking or causing a problem***

***Plumbing****: Replace older pipes and fixtures subject to leaking or overflowing; insulate water pipes subject to condensation.*

***Ventilation****: Add exhaust fans and whole house fans to increase air flow through buildings, if areas are damp or need more ventilation to control mold and mildew.*

***Climate****: Adjust temperature and relative humidity to manage interior humidity; Correct areas of improperly balanced pressure for HVAC systems that may be causing a moisture problem.*

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## Level III Replacement / Alterations For Chronically Damp Conditions

***Exterior: Undertake exterior rehabilitation work that follows professional repair practices-i.e., replace a deteriorated feature with a new feature to match the existing in design, color, texture, and when possible, materials. In some limited situations, non-historic materials may be necessary in unusually wet areas***

**Roofs:** Add ventilator fans to exhaust roofs but avoid large projecting features whose designs might negatively affect the appearance of the historic roof. When replacing roofs, correct conditions that have caused moisture problems, but keep the overall appearance of the roof; for example, ventilate under wooden shingles, or detail standing seams to avoid buckling and cracking. Be attentive to provide extra protection for internal or built-in gutters by using the best quality materials, flashing, and vapor impermeable connection details.

**Walls:** If insulation and vapor barriers are added to frame walls, consider maintaining a ventilation channel behind the exterior cladding to avoid peeling and blistering paint occurrences.

**Windows:** Consider removable exterior storm windows, but allow operation of windows for periodic ventilation of cavity between exterior storm and historic sash. For stained glass windows using protective glazing, use only ventilated storms to avoid condensation as well as heat build-up.

***Ground: Control excessive ground moisture. This may require extensive excavations, new drainage systems, and the use of substitute materials. These may include concrete or new sustainable recycled materials for wood in damp areas when they do not impact the historic appearance of the building.***

**Grade:** Excavate and install water collection systems to assist with positive run-off of low lying or difficult areas of moisture drainage; use drainage mats and under finished grade to improve run-off control; consider the use of column plinth blocks or bases that are ventilated or constructed of non-absorbent substitute materials in chronically damp areas. Replace improperly sloped walks; repair non-functioning catch basins and site drains; repair settled areas around steps and other features at grade.

***Foundations: Improve performance of foundation walls with damp-proof treatments to stop infiltration or damp course layers to stop rising damp. Some***

***substitute materials may need to be selectively integrated into new features.***

**Walls**: excavate, repoint masonry walls, add footing drains, and waterproof exterior subsurface walls; replace wood sill plates and deteriorated structural foundations with new materials, such as pressure treated wood, to withstand chronic moisture conditions; materials may change, but overall appearance should remain similar. Add dampcourse layer to stop rising damp; avoid chemical injections as these are rarely totally effective, are not reversible, and are often visually intrusive.

***Interior: Control the amount of moisture and condensation on the interiors of historic buildings. Most designs for new HVAC systems will be undertaken by mechanical engineers, but systems should be selected that are appropriate to the resource and intended use.***

**Windows, skylights:** Add double and triple glazing, where necessary to control condensation. Avoid new metal sashes or use thermal breaks where prone to heavy condensation.

**Mechanical systems:** Design new systems to reduce stress on building exterior. This might require insulating and tightening up the building exterior, but provisions must be made for adequate air flow. A new zoned system, with appropriate transition insulation, may be effective in areas with differing climatic needs.

**Control devices/Interior spaces:** If new climate control systems are added, design back-up controls and monitoring systems to protect from interior moisture damage.

**Walls:** If partition walls sit on floors that periodically flood, consider spacers or isolation membranes behind baseboards to stop moisture from wicking up through absorbent materials.

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## Ongoing Care

Once the building has been repaired and the larger moisture issues addressed, it is important to keep a record of additional evidence of moisture problems and *to protect the historic or old building through proper cyclical maintenance*. In some cases, particularly in museum environments, it is critical to monitor areas vulnerable to moisture damage. In a number of historic buildings, in-wall moisture monitors are used to ensure that the moisture purposely generated to keep relative humidity at ranges appropriate to a museum collection does not migrate into walls and cause deterioration. The potential problem with all systems is the failure of controls, valves, and panels over time. Back-up systems, warning devices, properly trained staff and an emergency plan will help control damage if there is a system failure.

Ongoing maintenance and vigilance to situations that could potentially cause moisture damage must become a routine part of the everyday life of a building. The owner or staff responsible for the upkeep of the building should inspect the property weekly and note any leaks, mustiness, or blocked drains. Again, observing the building during a rain will test whether ground and gutter drainage are working well.

For some buildings a back-up power system may be necessary to keep sump pumps working during storms when electrical power may be lost. For mechanical equipment rooms, condensation pans, basement floors, and laundry areas where early detection of water is important, there are alarms that sound when their sensors come into contact with moisture.

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## Conclusion

Moisture in old and historic buildings, though difficult to evaluate, can be systematically studied and the appropriate protective measures taken. Much of the documentation and evaluation is based on common sense combined with an understanding of historic building materials, construction technology, and the basics of moisture and air movement. Variables can be evaluated step by step and situations creating direct or secondary moisture damage can generally be corrected. The majority of moisture problems can be mitigated with maintenance, repair, control of ground and roof moisture, and improved ventilation. For more complex situations, however, a thorough diagnosis and an understanding of how the building handles moisture *at present*, can lead to a treatment that solves the problem without damaging the historic resource.

It is usually advantageous to eliminate one potential source of moisture at a time. Simultaneous treatments may set up a new dynamic in the building with its own set of moisture problems. Implementing changes sequentially will allow the owner or preservation professional to track the success of each treatment.

Moisture problems can be intimidating to a building owner who has diligently tried to control them. Keeping a record of evidence of moisture damage, results of diagnostic tests, and remedial treatments, is beneficial to a building's long-term care. The more complete a survey and evaluation, the greater the success in controlling unwanted moisture now and in the future.

Holding the line on unwanted moisture in buildings will be successful if 1) there is constant concern for signs of problems and 2) there is ongoing physical care provided by those who understand the building, site, mechanical systems, and the previous efforts to deal with moisture. For properties with major or difficult-to-diagnose problems, a team approach is often most effective. The owner working with properly trained contractors and consultants can monitor, select, and implement treatments within a preservation context in order to manage moisture and to protect the historic resource.

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## Glossary

*Air flow/ infiltration:* The movement that carries moist air into and through materials. Air flow depends on the difference between indoor and outdoor pressures, wind speed and direction as well as the permeability of materials.

*Bulk water:* The large quantity of moisture from roof and ground run-off that can enter into a building either above grade or below grade.

*Capillary action:* The force that moves moisture through the pore structure of materials. Generally referred to as rising damp, moisture at or below the foundation level will rise vertically in a wall to a height at which the rate of evaporation balances the rate at which it can be drawn up by capillary forces.

*Condensation:* The physical process by which water vapor is transformed into a liquid when the relative humidity of the air reaches 100% and the excess water vapor forms, generally as droplets, on the colder adjacent surface.

*Convection:* Heat transfer through the atmosphere by a difference in force or air pressure is one type of air transport. Sometimes referred to as the "stack effect," hotter less dense air will rise, colder dense air will fall creating movement of air within a building.

*Dewpoint:* The temperature at which water vapor condenses when the air is cooled at a constant pressure and constant moisture content.

*Diffusion:* The movement of water vapor through a material. Diffusion depends on vapor pressure, temperature, relative humidity, and the permeability of a material.

*Evaporation:* The transformation of liquid into a vapor, generally as a result of rise of temperature, is the opposite of condensation. Moisture in damp soil, such as in a crawl space, can evaporate into the air, raise the relative humidity in that space, and enter the building as a vapor.

*Ground moisture:* The saturated moisture in the ground as a result of surface run-off and naturally occuring water tables. Ground moisture can penetrate through cracks and holes in foundation walls or can migrate up from moisture under the foundation base.

*Monitoring instrumentation:* These devices are generally used for long term diagnostic analysis of a problem, or to measure the performance of a treatment, or to measure changes of conditions or environment. In-wall probes or sensors are often attached to data-loggers which can be down-loaded into computers.

*Permeability:* A characteristic of porosity of a material generally listed as the rate of diffusion of a pressurized gas through a material. The pore structure of some materials allows them to absorb or adsorb more moisture than other materials. Limestones are generally more permeable than granites.

*Relative humidity (RH):* Dampness in the air is measured as the percent of water vapor in the air at a specific temperature relative to the amount of water vapor that can be held in a vapor form at that specific temperature.

*Survey instrumentation:* technical instrumentation that is used on-site to provide quick readings of specific physical conditions. Generally these are hand-held survey instruments, such as moisture, temperature and relative humidity readers, dewpoint sensors, and fiber optic boroscopes.

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**Home page logo: Invasive vegetation on a brick wall. Photo: Richard Wagner, AIA.**

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