GREENING HISTORIC DISTRICTS WITH SOLAR ROOFS: AN EXPLORATION OF WESTERN HEIGHTS IN LOS ANGELES

By

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Dedication

To my parents, Xiaojie Cai and Jihong Liang, thank you for your supports and sacrifices for my dreams.

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Abstract

One of the most significant methods for improving an historic building's energy performance is to implement an on-site renewable energy system like solar energy. Although solar panels are commonly used successfully in dwellings, their use on historic properties and the potential impact to historic character remains controversial. Recently, a new improvement has been invented based on solar panel technology. Solar roofing systems can be produced with small tiles matching both the conventional roofing color and form. With this technology, it will be possible to integrate a solar energy system and a historic property without compromising its distinctive character. This thesis explores the possibility of adopting solar roofs in an historic district and analyzing the potential outcomes. The Western Heights Historic Preservation Overlay Zone in Los Angeles was selected as an appropriate neighborhood for installing solar roofs. The evaluation includes candidate identification and energy efficiency calculation, as well as a comparison between solar panels and solar roofs. Ultimately, this thesis explores the possibility of using solar roofs on historic properties to focus attention on this promising blend of sustainable design and heritage conservation.

Introduction

For too long, we have been building our world with the assumption that natural resources are inexhaustible. Especially since the debut of the International Style of architecture, our building methods changed drastically with the new formulations of comfort standards and new materials.[1] New technology enabled us to build the same house anywhere and the same interior conditions could be achieved regardless of the location. Heating and air conditioning enabled the buildings to overcome the weather through high consumption of energy. The Oil Embargo in 1973 not only awakened public awareness of energy limits, but also encouraged the development of the sustainability movement, including the adoption of solar energy in buildings.[2] Today, the world is experiencing ever more extreme weather-related disasters each year. Climate change indicates that human activity is having great impact on nature, destroying the planet's ecosystems and resources. "Climate change" is no longer an exaggeration to scare people, it is real and requires all human beings' efforts to handle for a sustainable future.

In response to climate change, heritage conservation is finding ways to mitigate climate change by upgrading building systems, technology, and rehabilitation methods. The advocates of heritage conservation think about the long-term survivability of existing buildings regarding maintenance, improvement, and innovation for future generations.[3] The concept of embodied energy, first raised by Richard G. Stein in 1970s and later adopted by the Advisory Council on Historic Preservation (ACHP), implies that an energy crisis and an architectural crisis are interwoven with each other since buildings are responsible for over forty percent of the energy used in the United States.[4] This concept further reinforces the importance of heritage conservation in sustainable development. Vernacular houses that function in harmony with the environment are early energy efficient models by making simple, yet efficient use of natural resources like solar and wind. Although many other older homes are not performing efficiently

[1] Richard G. Stein, *Architecture and Energy* (New York: Anchor Press/Doubleday, Garden City, 1977), 2.
[2] Amalia Leifeste, Barry L. Stiefel, *Sustainable heritage: Merging Environmental Conservation and Historic Preservation* (New York and London: Routledge, 2018), 89.
[3] The terms of heritage conservation, historic conservation, and conservation will be mainly used in this thesis. The term of historic preservation will only be used when it comes to official documents such as historic preservation ordinance, historic preservation boards, etc. Heritage conservation/historic conservation deals with both tangible and intangible heritage. It is about managing change of a place. Also, the term of sustainable conservation in this thesis means conserving heritage in a sustainable way such as making improvement, renovation, rehabilitation of existing buildings for saving energy in a long term.
[4] Richard G. Stein, *Architecture and Energy*, 1.

today, they contain embodied energy that deserves to be recognized. Meanwhile, technological advancement provides more possibility for sustainable heritage and building conservation, such as improving the building envelope and adopting renewable energy in historic properties.

Today, sustainable conservation is supported by various preservation boards throughout the United States. Many design guidelines for historic properties encourage owners to adopt renewable energy in their house. Compared to other renewable resources like wind or geothermal energy, solar energy is the most common type of energy using in dwellings due to its accessibility in the most regions. According to a study published in *Environmental Science and Technology* in 2008, eighty-nine percent of air emissions associated with electricity generation could be prevented if we used solar photovoltaic (PV) energy to displace conventional fossil-fuel-based electricity.[5] Since 2010, the National Park Service has published a series of guidelines for installing solar panels and meeting the *Secretary of the Interior's Standards for Rehabilitation*. The *Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings* also includes a section on installing solar technology. Yet, there are still questions about the adoption of solar energy in historic properties. Mostly, concerns remain in the aesthetic issues that brought by solar panels towards historic roofs. The discord between solar panels and historic roofing materials supposes that solar installations will lead to degradation of the visual integrity. Moreover, in states like California, the state Solar Rights Acts discourages discretionary review of solar installations, exempting solar panel installations from historic preservation design reviews. These exemptions further strengthen the threats of solar panel installation leading to visual disharmony in historic properties.

While the advocates of heritage conservation are seeking alternative methods like Community Solar, the evolving technology at the same time provides more possibilities for sustainable conservation.[6] Recently, solar roofs systems have been introduced to the market. Unlike solar panels, the solar roofs are also called "building-integrated photovoltaic." The smaller tiles both produce electricity and provide a weather barrier / functional roof. The colors of solar roofs can also be compatible with historic roof colors and thus reduce the loss of visual

[5] Jean Carroon, *Sustainable Preservation: Greening Existing Buildings*, (New Jersey: John Wiley & Sons, Inc., 2010), 180.

[6] "Community Solar" is to install solar panels either on rural sites or on some of the many commercial roofs hat exists in a community.

character. To date, there is limited research on the adoption of solar roofs, let alone experiments on historic properties.

While the energy production of an individual solar roof tile could never compare to a solar panel's, the result might turn out differently with a total energy calculation in a whole historic district. Even though solar panels are more efficient, they should not be used in a place on a historic building that can be viewed from the street. Less intrusive solar roofs might be able to be installed on a larger roof area in a historic district, increasing the amount of energy it provides. The aim of this thesis is to explore the possibility of adopting solar roofs in a historic district. To conduct research on adopting solar roofs in a historic district, there are four aspects to consider: the identification of potential candidates, a calculation of the energy efficiency of solar roofs, a comparison between the energy production of solar roofs and solar panels, and the potential visual outcome after installation. The Western Heights Historic Preservation Overlay Zone (HPOZ) in Los Angeles was selected to conduct this experiment for its ideal conditions to install solar roofs. Fifty-nine of 127 contributing properties have been identified as candidates for their suitable solar orientation and roof styles, as well as roof colors. With this neighborhood, this thesis is able to provide practical information of adopting solar roofs in a historic district.

The thesis consists of five chapters. Chapter 1 introduces the broad context of sustainable conservation and its relationship towards solar energy around the United States. Although many preservation design guidelines encourage the adoption of solar energy, the use of solar energy is still restricted in many aspects for conserving historic character. Chapter 2 introduces the working principles of solar energy systems on dwellings and the development of solar roofs. These products may provide new methods for both conserving historic integrity and adopting renewable energy at the same time. Yet, there are limited cases of using solar roofs on a historic property. Chapter 3 summarizes the overall framework of adopting solar energy in a historic district of the City of Los Angeles, since the thesis has chosen a historic district in Los Angeles as the study plot for adopting solar roofs. A brief development of solar energy in Los Angeles is illustrated with the framework of policies, incentives, and design guidelines of using solar energy in a historic district. The chapter also introduces an analysis tool for using solar resources in the county, the L.A. County Solar Map. Chapter 4 presents an overview of the Western Heights Historic Preservation Overlay Zone (HPOZ) in Los Angeles: the location, history, architectural features, and the reasons for choosing this historic district to conduct the study. After

demonstrating the context of the Western Heights HPOZ, an analysis and calculation of adapting solar roofs in this district are given in Chapter 5. A field survey was conducted for candidates' data collection and spreadsheets were used for comparison with data from the L.A. County Solar Map, showing the potential outcomes of adopting solar roofs in a historic district.

Generally, the thesis provides a reference for adopting solar roofs in a historic district. Although it is narrow in scale, it will inspire further research on using other new technology to make historic buildings greener. There are more ways to make our building green. While heritage conservation is already inherently sustainable, all people in this field should keep on working on practical methods with evolving technology. Methods should ensure the improvement of building performance without compromising or damaging historic character.

As Jean Carroon mentions in her book *Sustainable Preservation: Greening Existing Buildings*, we must reshape our culture to become one of reuse, repair, and renewal that is respectful of existing resources, including buildings.[7] Evolving energy technology like solar roofs provides a better way for heritage conservation to rehabilitate our existing built environment.

[7] Jean Carroon, *Sustainable Preservation: Greening Existing Buildings*, 18.

Chapter 1: Sustainable Conservation and Solar Energy

"In order to reasonably hope for the survival of our species, with some continuity with the meaningful traditions of our past and retention of the biodiversity of the Earth, we must see heritage preservation and sustainable design integrated together."

-- Amalia Leifeste and Barry L. Stiefel, Sustainable Heritage: Merging Environmental Conservation and Historic Preservation

Sustainable Conservation and Energy Efficiency

In the 1960s, heritage conservation in the United States was rarely connected to environmental issues. Historic preservation was once defined as the movement to only take care of existing buildings, landscapes, and other artifacts due to their architectural significance.[8] Yet, the limited natural resources and consistent climate change challenge us to conserve more even in our built environment.

In the 1970s, Richard G. Stein had already started to explore the energy consumption of buildings:

> Energy is consumed in the complete process of making and assembling buildings' components, to operate the various systems during the useful life of buildings, in the transportation systems predetermined by decisions on how buildings are grouped together, and to demolish buildings or to dismantle the shells of buildings that have been destroyed in other ways.[9]

The concept of embodied energy was further emphasized by the 1976 report entitled *Energy Use for Building Construction* by the Advisory Council on Historic Preservation (ACHP).[10] Embodied energy is the description of energy used directly and indirectly in raw material acquisition, production of materials, transportation, and the assemblage of those materials into a building.[11] According to U.S. Energy Information Administration and the U.S. Department of Energy, buildings account for up to forty-one percent of the nation's energy consumption, seventy-two percent of its electricity consumption, thirty-eight percent of its

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[8] Amalia Leifeste, Barry L. Stiefel, *Sustainable heritage: Merging Environmental Conservation and Historic Preservation* (New York and London: Routledge, 2018), 1.
[9] Richard G. Stein, *Architecture and Energy* (New York: Anchor Press/Doubleday, Garden City, 1977), 5.
[10] Mike Jackson, "Embodied Energy and Historic Preservation: A Needed Reassessment," APT Bulletin, Vol. 36, Not. 4 (2005): 47-49.
[11] Jean Carroon, *Sustainable Preservation: Greening Existing Buildings*, (New Jersey: John Wiley & Sons, Inc., 2010), 7.

carbon dioxide emissions, and approximately fifty percent of all raw materials transformed from nature.[12] Energy from nature is embodied in our construction and thus demolition of buildings generates a of waste of energy.

In 2007, Carl Elefante's essay "*The Greenest Buildings is…One That is Already Built*" in the *Forum Journal* of the National Trust for Historic Preservation, mentioned that

> Taking into account the massive investment of materials and energy in existing buildings, it is both obvious and profound that extending the useful service of life of the building stock is common sense, good business, and sound resource management… the Greenest Building is the one that's already built.[13]

Although there is growing process to use sustainable design in new buildings like vegetative roofs or renewable energy sources, sustainability is still far from fully realized.[14] It is certainly impossible to rebuild all existing buildings into green structures with even more energy consumption. The effective way to achieve sustainability is not only about building new green buildings but also about converting our great number of existing buildings into sustainable buildings. To achieve this goal, an intersection between sustainable design and conservation should be studied.

According to Carl Elefante, conservation should accept the need to improve the energy performance of the existing building stock, to improve building envelope performance, to upgrade the effectiveness of all energy consuming systems, and to convert to renewable energy sources both on and off site.[15] New standards for sustainable construction, such as the Leadership in Energy and Environmental Design (LEED) certification program and analytical tools like energy audits and life cycle assessments (LCAs) enable builders to conduct an assessment of energy saving options in both new and existing construction.[16]

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[12] Stephanie Meeks and Kevin C. Murphy, *the Past and Future City: How Historic Preservation is Reviving America's Communities* (Washington, Covelo, London: Island Press, 2016), 238; Erica Avrami, "Sustainability and the Built Environment: Forging a Role for Heritage Conservation," *Sustainability & Heritage* (Spring 2011), The Getty Conservation Institute: http://www.getty.edu/conservation/publications_resources/newsletters/26_1/feature.html.

[13] Carl Elefante, "The Greenest Building Is…One That is Already Built," *Forum Journal*, Volume 21, No.4, (Summer 2007), The Journal of the National Trust for Historic Preservation: 32.

[14] Elefante, "The Greenest Building," 26.

[15] Elefante, "The Greenest Building," 35.

[16] LEED, or Leadership in Energy and Environmental Design, is the most widely used green rating system in the world. It provides a framework to create healthy, highly efficient and cost-saving green buildings. The certification of LEED is a globally recognized symbol of sustainability achievement; "LEED is green building," https://new.usgbc.org/leed; Avrami, "Sustainability and the Built Environment," 2.

To date, besides preserving significance, heritage conservation is already practicing sustainability. The term – "sustainable conservation" merges green building design and heritage conservation together. It adopts methods like rehabilitation, improvement for existing building systems, and reusing building fabric to extend the service life period of buildings. Sustainable conservation is, in part, making use of historic properties' significance to gather people together to save buildings and save energy. While many modern buildings have been designed to use renewable energy like wind or sun, historic sites are also increasingly adopting this technology too.

Implementing Solar Energy in Historic Properties

Solar energy is one of the most sufficient resources on earth. The development of solar energy in the United States followed the 1973 oil crisis. In 1974 the first of several solar energy bills went into law and the Congress responded by enacting the Solar Energy Research, Development and Demonstration Act of 1974. In 1976, Michael Holtz wrote solar design guides -- *Solar Dwelling Design Concepts*.[17] Although solar technologies have already been around for several centuries, this legislation and guidance encouraged the development of solar energy usage on dwellings.[18]

To use the solar collectors in historic buildings successfully without damaging historic resources, the *Secretary of the Interior's Standards for Rehabilitation* provide a framework for alteration of historic resources while retaining the historic character of the building site, and district. Specifically, two standards are pertinent to solar energy projects:[19]

> Standard 2: The historic character of a property will be retained and preserved.
>
> Standard 9: New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be

[17] Phillip James Tabb, "1970s: Solar Architecture" in *The Greening of Architecture: A Critical History and Survey of Contemporary Sustainable Architecture and Urban Design*, edited by Phillip James Tabb and A. Senem Deviren, (Ashgate Publishing, 2016), 49.
[18] Tabb, "1970s: Solar Architecture," 52: in the 18th century Horace de Saussure successfully constructed a rectangular box out of half-inch pine and generated heat.
[19] U.S. Department of Energy, North Carolina Solar Center, National Trust for Historic Preservation, *Installing Solar Panels on Historic Buildings: A Survey of the Regulatory Environment*, prepared in August 2012: 10, https://www.solsmart.org/media/installing-solar-panels-on-historic-buildings_0812.pdf.

compatible with the historic materials, features, size and proportion, and massing to protect the integrity of the property and its environment.[20]

The Guidelines on Sustainability further supplement the existing Standards for Rehabilitation with recommendations for installing sustainable technology systems in a historic building while still conserving the historic character. (Figure 1.1)

SOLAR TECHNOLOGY

RECOMMENDED	NOT RECOMMENDED
Considering on-site, solar technology only after implementing all appropriate treatments to improve energy efficiency of the building, which often have greater life-cycle cost benefit than on-site renewable energy.	Installing on-site, solar technology without first implementing all appropriate treatments to the building to improve its energy efficiency.
Analyzing whether solar technology can be used successfully and will benefit a historic building without compromising its character or the character of the site or the surrounding historic district.	Installing a solar device without first analyzing its potential benefit or whether it will negatively impact the character of the historic building or site or the surrounding historic district.
Installing a solar device in a compatible location on the site or on a non-historic building or addition where it will have minimal impact on the historic building and its site.	Placing a solar device in a highly-visible location where it will negatively impact the historic building and its site.
Installing a solar device on the historic building only after other locations have been investigated and determined infeasible.	Installing a solar device on the historic building without first considering other locations.

72

73

74

75

Recommended: [72-73] Solar panels were installed appropriately on the rear portion of the roof on this historic row house that are not visible from the primary elevation.

Recommended: [74] Free-standing solar panels have been installed here that are visible but appropriately located at the rear of the property and compatible with the character of this industrial site.

Not Recommended: [75] Solar roof panels have been installed at the rear, but because the house is situated on a corner, they are highly visible and negatively impact the character of the historic property.

Fig 1.1: The sustainability guideline for solar panels. Source: *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings*, U.S. Department of the Interior, National Park Service, Technical Preservation Services, (http://www.ohp.parks.ca.gov/pages/1054/files/NPS%20sustainability-guidelines.pdf).

In 2009, The National Park Service also created another guideline: *Incorporating Solar Panels in a Rehabilitation Project*. This provides guidance for the installation of solar panels in historic properties while meeting the Secretary of the Interior's Standards for Rehabilitation. The goal is to minimize visibility to avoid diminishing the historic character of the building:[21]

[20] "Secretary of the Interior's Standards for Rehabilitation," Technical Preservation Service, National Park Service, https://www.nps.gov/tps/standards/rehabilitation.htm.

[21] Jenny Parker, "ITS Number 52 Interpreting the Secretary of the Interior's Standards for Rehabilitation: Incorporating Solar Panels in a Rehabilitation Project," *ITS Number 52* (August 2009), Technical Preservation Services, National Park Service.

> Therefore, the installation of solar panels should conform to guidance regarding rooftop additions, i.e. that they be minimally visible, to avoid altering the historic character of the building. Historic buildings with a flat roof or parapet can usually accommodate solar panels because the panels will be hidden, while properties with a hipped or gabled roof are generally not good candidates for a rooftop solar installation. Solar panels on historic buildings should not be visible from the public right of way such as nearby streets, sidewalks or other public spaces.
>
> In circumstances where solar collectors are not placed on rooftops, they should only be positioned in limited or no-visibility locations in secondary areas of the property...For some historic buildings, it may not be possible to incorporate solar panels and meet the Secretary of the Interior's Standards for Rehabilitation.[22]

There are three listed circumstances of the installation of solar panels on historic buildings: installation on a flat roof, installation on the rear slope roof, and installation on the rear yard of the property. In the meanwhile, more examples are listed on the Technical Preservation Service website such as installation on the pole-mounted array, on a low-slope roof, on a cross gable, etc. (Appendix A)

In 2011, the National Renewable Energy Laboratory (NREL) published "*Implementing Solar PV Projects on Historic Buildings and in Historic Districts*" which provides guidance regarding the usage of solar technologies within historic properties. In addition to introducing historic preservation regulations as well as incentives, and an overview of solar photovoltaic (PV) technology, the document provides a five-step process for implementation. It also demonstrates the intersection of heritage conservation and solar disciplines in order to meet the various criteria such as the Secretary's Standards for Rehabilitation and local design guidelines. According to the NREL, Rehabilitation is the most appropriate treatment approach for integrating solar projects. [23] Local solar panel guidelines and incentives throughout the United States are provided in the NREL guideline to help people to produce solar projects on historic properties successfully.

Also, the NREL presents a process for implementing a solar energy project. To conduct a solar PV project, the first step is to identify potential project and stakeholders for different levels. For example, owners need to find out the public agencies responsible for administering the

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[22] Ibid.

[23] According to "*the Secretary of the Interior's Standards for Treatment of Historic Properties with Guidelines,*" there are four treatments: Preserving, Rehabilitating, Restoring and Reconstructing. A treatment for a historic building requires careful decision-making about a building's historical significance as well as other considerations like relative importance in history, physical condition, proposed use, and mandated code requirements. A treatment is decided before any evaluation of alterations and additions; A. Kandt et al., *Implementing Solar PV Projects on Historic Buildings and in Historic Districts*, National Renewable Energy Laboratory (September 2011): 18.

historic properties and the regulations to meet. In the early stage, projects will need to be defined available locations with clear motivations like energy reduction or practicing renewable energy use, etc. The goals of the project will dictate the type of people to be involved in later stages, such as technical assistance or State Historic Preservation Officers, local historic districts boards and so on. Second, the owners engage with different stakeholders and professionals for assessment of historic properties: identifying the character-defining features and the potential location for a PV system.[24] This is a significant step to integrate solar energy and to avoid any negative impact on historic properties. After the implementation along with appropriate review requirements, the NREL encourages people to evaluate the effects of a project by reviewing what was successful in the project implementation and what could be improved upon, which could increase the rate of success of such projects in the future. [25] In this stage, review criteria include energy savings and system performance, the impact of historic integrity, and financial impact. Successful cases and evaluations should be shared with all stakeholders in order to enlighten other projects.

In general, those guidelines of implementing solar technology, mostly solar panels, will help to increase sustainability in heritage conservation to some degree.

Considerations and Challenges

Although early guidelines and examples help to encourage the usage of solar energy in historic sites, barriers still remain. As Elefante also writes in his essay, "Far too many preservationists bristle at the mention of using renewable energy at historic sites."[26] Conflicts happen when properties' owners consider financial aspects more than heritage conservation since solar energy could create energy savings to some degree. Early examples allow solar energy improvement in very limited cases with criteria to meet. A large number of properties will fail to satisfy those criteria, especially when their face to the sun is on primary façades.

As preservationists try to balance historic integrity and sustainable energy improvement, they face the challenge of the lack of comprehensive guidelines for sustainable energy at the local level. Currently, the situation is uneven all around the country.

[24] A. Kandt et al., "Implementing Solar PV Projects" 19.
[25] A. Kandt et al., "Implementing Solar PV Projects" 28.
[26] Elefante, "The Greenest Building," 35.

Some local historic preservation commissions have adopted indicators for sustainable improvement like solar collectors in their design guidelines, bridging aesthetics and sustainability. The City of New Orleans encourages solar collectors for space heating, hot water, and electricity in historic districts in the guidelines for roofing for the Historic District Landmarks Commission. This guideline demonstrates that solar collectors shall be minimally visible or hidden from public view – as far back from the front of the building wall as possible, and a minimum of 10'-0" from the front building wall, or to be blended with their surroundings if they could be visible.[27] Oklahoma City's planning department also rewrote the city's existing historic preservation guidelines and standards with sustainability principles.[28] The new guideline with "Green" revisions was published in July 2012 and contains a section of features for improving energy efficiency with new construction on historic buildings. The installation of solar panels and solar shingles are defined as "Actions that require review and may be administratively approved" with four guidelines of installation positions: back facing roof slopes and lay flat on roof slope, not on the front roof slope of south-facing buildings, free-standing solar panels in backyards of south-facing buildings and solar panels with limited height in backyards.[29] (Figure 1.2) The preservation ordinance of Breckenridge, Colorado, requires that panels not be placed on a character-defining roofline or on a primary elevation, so as to not be visible from the street.[30] Salt Lake City, Utah has compiled a set of design standards to measure the visual impact of solar and skylights in their preservation handbook for historic properties.[31]

In some cases, design standards for energy improvement like solar panels might not go through the historic preservation ordinance. For example, in the city of Portland, Oregon, solar panels are automatically permitted if they are on the rear facing part of the pitched roof.[32] In a

[27] City of New Orleans HDLC, "Guidelines for Roofing" (April 2016): 05-10.
[28] Catherine Montgomery, AIA and Phil Thomason, "Oklahoma City's Green Guidelines: Combining Historic Preservation Design Review and Sustainability Policy," *Forum Journal & Forum Focus*, December 09, 2015, National Trust for Historic Preservation, https://forum.savingplaces.org/viewdocument/greening-design-guidelines-two-cas.
[29] Thomason and Associates et al., *Oklahoma City Historic Preservation Design & Sustainability Standards and Guidelines*, Oklahoma City, Oklahoma (July 2012): 121.
[30] Kimberly Kooles, "Adapting Historic District Guidelines for Solar and Other Green Technologies," *Forum Journal & Forum Focus*, Volume 24, December 09, 2015, National Trust for Historic Preservation, https://forum.savingplaces.org/viewdocument/adapting-historic-district-guidelin.
[31] Salt Lake City, *A Preservation Handbook for Historic Residential Properties & Districts* (December 11, 2012): 7:7.
[32] "Solar Energy in A Historic District," *Historic Laurelhurst*, January 24, 2017, https://www.historiclaurelhurst.com/single-post/2017/01/24/Solar-Energy-In-A-Historic-District.

proposed ordinance in Durango, Colorado, solar panels would be allowed in historic districts without any regard for aesthetic considerations.[33] In other cases, the solar panels might be reviewed by other departments rather than historic preservation commission. Maryland's Washington County zoning ordinance was recently amended to allow for solar panels and small wind turbines in zoning districts without any indication for reviewing solar panels in historic districts.[34]

Fig 1.2: Solar roofs installations examples; left figure shows solar panels on a rear roof, the right figure shows a wrong installation - the solar panels are visible from the public right-of-way. Source: Oklahoma City Historic Preservation Design & Sustainability Standards and Guideline.

It should be kept in mind that the priority of heritage conservation is to conserve the integrity of a historic property by keeping its significant features. Particularly, two of the seven aspects of integrity should be considered**:**

> Setting: Setting is the physical environment of a historic property that illustrates the character of the place. Integrity of setting remains when the surroundings of an aid to navigation have not been subjected to radical change. Integrity of setting of an isolated lighthouse would be compromised, for example, if it were now completely surrounded by modern development.
>
> Feeling: Feeling is a property's expression of the aesthetic or historic sense of a particular period of time. It results from the presence of physical features that, taken together, convey the property's historic character.[35]

The alteration of historic properties, such as the installation of modern energy improvement can cause discord with original setting and feeling. Although renewable energy

[33] Kimberly Kooles, "Adapting Historic District Guidelines."
[34] Kimberly Kooles, "Adapting Historic District Guidelines."
[35] U.S. Department of Interior, National Park Service, *National Register Bulletin: How to Apply the National Register Criteria for Evaluation*, 1997: 45.

should be encouraged in historic sites, conducting projects without any concern for integrity is not compatible with good practice. It is crucial to identify a better way of saving energy while respecting the historical and cultural value.

Chapter 2: Understanding the Technology

The Solar Energy System

Current solar energy technology makes use of two types of solar resources: photovoltaic (PV) and thermal. A PV system converts sunlight directly into electricity while a thermal system uses the sun's energy to heat liquid or gas to high temperatures.[36] Solar thermal systems are better used in large energy plants while a solar PV system is usually an option for a home or business.

In a PV system, the conversion of the sun's energy into electricity is accomplished by the use of PV cells composed of crystalline silicon and connected together into panels.[37] Many solar panels combine together to create one system that is called a solar array.[38] Electricity generated from the PV cells of the panels is passed through an inverter which converts the direct current (DC) electricity into alternating current (AC) electricity that can be used by household appliances.[39] PV systems located on or near a building are used to meet the electricity needs on site. If the full electricity demands are not satisfied, additional energy is still provided by conventional electrical systems.[40] If a solar energy system produces more electricity than the users need, the surplus energy will enter the grid and be used to offset future electricity demand, often showed by a customer's meter spinning backwards.[41] Figure 2.1 illustrates a general working principle of a solar panel system.

The adoption of solar panel systems in a historic site depend on variables like local climate, installation costs, user demand, and the characteristics of the buildings, structure, and site. Solar panels should be installed orienting south - any facing east or west will need to be tilted to achieve optimum performance.[42]

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[36] "What is Photovoltaics?" RGS Rethink Your Roof, September 17, 2015, https://rgsenergy.com/how-solar-panels-work/what-is-photovoltaics/.
[37] *Installing Solar Panels on Historic Buildings*: 6.
[38] *National Register Bulletin: How to Apply the National Register Criteria for Evaluation*: 11.
[39] *Installing Solar Panels on Historic Buildings*: 6.
[40] Ibid.
[41] Ibid.
[42] Ibid.

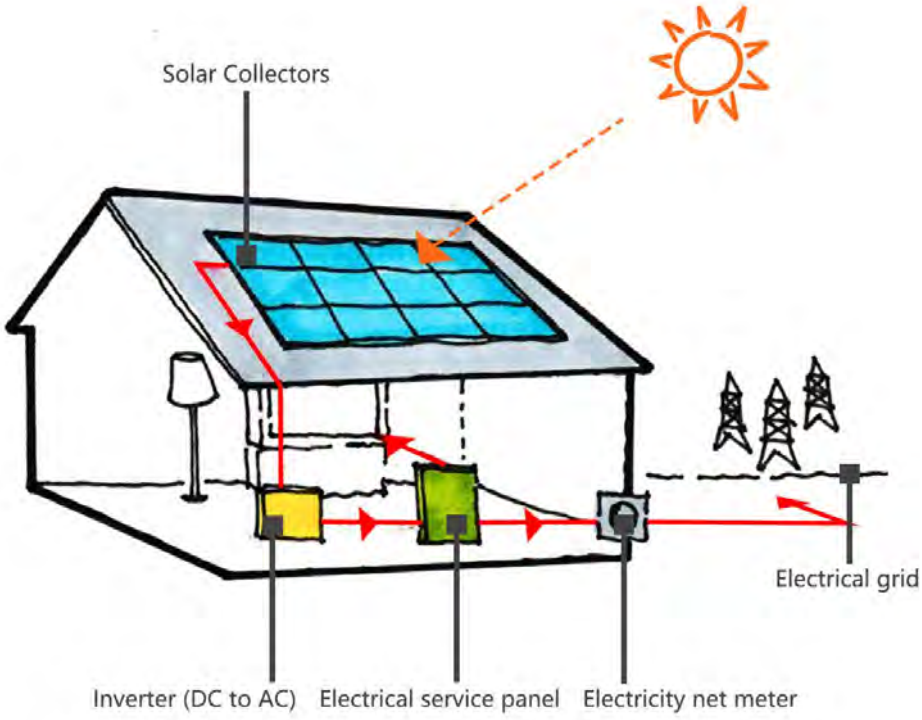

Fig 2.1: Solar panel system. Source: Diagram is produced by author.

Evolving Technology – Solar Roof

With new technology, solar panels are invented in different shapes, and some can retain the appearance and function of traditional building materials like roof shingles and tiles. This new improvement for solar panels is called the solar roof.[43] It is usually referred to as "building-integrated photovoltaic system," which, unlike solar panels, can replace original roof shingles and match the color while acting as a functional, protective, and weatherproof roof at the same time. With this technology, it might be possible to reduce the loss of visual character in historic districts compared to the addition of solar panels.

A solar roof consists of thin PV sheets that, like a solar panel, capture energy from sunlight. They can be installed in any climate or environment and each sheet usually about twelve inches wide.[44] A single solar roof tile is typically less than an inch thick. It has thin-film solar cells made from either copper indium gallium selenide, which is said to have one of the

[43]Solar roof, solar roof tiles and solar shingles all indicate a same product, which is a roof made of a number of PV sheets. In this thesis, solar roof indicates the whole system while solar roof tiles indicate components of the PV sheets.

highest conversion efficiency rates or monocrystalline silicon, a natural semiconductor used in computer chips.[45] An individual roof tile only can produce between fifty to 200 watts, but linked with others, 350 solar roof tiles could reduce forty to seventy percent of electrical power demand from the public utility, and can potentially generate power equal to regular solar panels.[46] (Figure 2.2) The appearance of solar roof tiles vary by manufacturer, including textures that are similar to asphalt shingles, red clay tile, slate, and smooth glass tiles, making them suitable for a wide range of architectural styles.[47] There are products like Apollo Tile by CertainTeed Solar, Sunslate6 by Aesthetic Green Power, Sun Roof by Tesla, etc. The full working principle as well as detailed introduction of these solar roofs are listed in Appendix B and C.

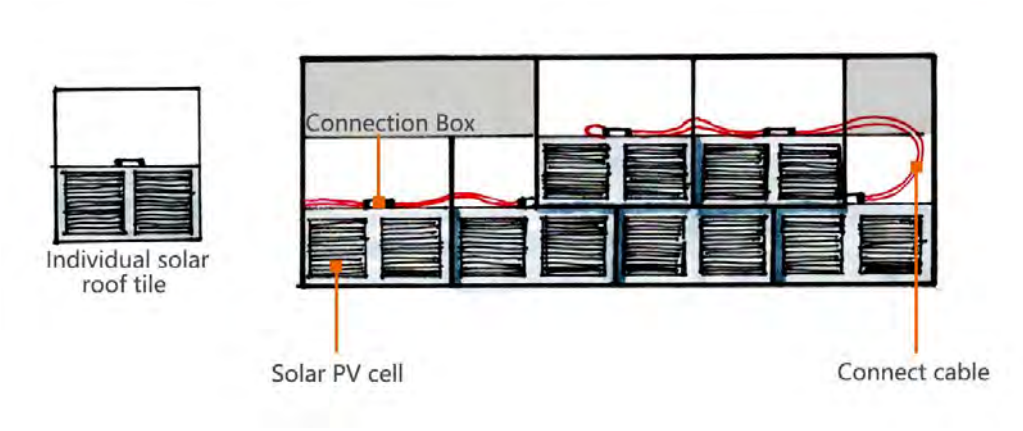

Fig 2.2: A diagram of the connection of solar roof tiles. A full illustration of the solar roof tiles system is in Appendix C. Source: Diagram is produced by author.

The solar roof tiles are also potentially less expensive to purchase than conventional roofing tiles, especially in a new home which could be built with solar energy.[48] In the case of existing property, homeowners could do the installation themselves or ask for help from an electrician. The PV system is either connected to utility power or has batteries. The electricity generated from the solar roof is connected directly to the power grid, saving cost to the owner. In

[44] Size are various from different manufacturers, from 8.65 inches to 14 inches, 12 inches by 47 inches, to 12 inches by 86 inches, and so on.
[45] Alyssa Baker, "A Guide to Solar Roof Tiles: Shingles are The Next Big Thing," *Solar Power Authority*, https://www.solarpowerauthority.com/guide-to-solar-shingles/.
[46] Keith Pandolfi, "Solar Shingles: A seamless appearance – and generous tax breaks – make rooftop power plants more attractive than ever," *This Old House Insider*, https://www.thisoldhouse.com/ideas/solar-shingles; Alyssa Baker, "A Guide to Solar Roof Tiles."
[47] "Solar Panels vs. Solar Shingles – Pro, Cons, Comparisons and Costs," *Fixr*, https://www.fixr.com/comparisons/solar-panels-vs-solar-shingles.

a battery backup system, the PV tiles charge a battery to provide power for up to eight hours.[49] Also, company like Tesla is confident in the strength of the solar roofs. According to Tesla, it is assumed that the material is warranted for the lifetime of a house since the glass used to make the solar roofs is three times stronger than slate, clay, or terracotta.[50]

There are some disadvantages of solar roof compared to solar panels. The biggest problem of a solar roof is the high price of production and installation compared to traditional solar panels. Even though some companies claim that users could see over a 200 percent return of money in thirty years with the state and federal tax credits, there is no real conclusion yet.[51] Solar roofs may be less efficient than solar panels. Solar panels can be adjusted to the best angle for sunlight exposure and solar roof tiles are fixed with the existing roof angle. As a result, solar roofs will be more functional in a region with stable exposure to the sun.

As of August 2018, only twelve solar roofs had been reported to be installed in California.[52] There are also some cases with solar roofs on residential properties in Massachusetts. (Figure 2.3) Moreover, the solar roofs have been adopted on one certifiable LEED building, the Thomas E. Curtis Wildlife Hospital and Education Center in Massachusetts. The building uses solar roofs as the building integrated system to produce approximately five percent of the whole building energy.[53] (Figure 2.4) Regarding to the aesthetic merit, there is an expectation of replacement of solar panels with solar roofs. As the issues of climate change and energy crisis grows, the costs of solar energy are expected to come down with a series of tax credits.

Although there are few experimenting on historic landmarks currently, the implements of solar roofs may lead to great progress on sustainable conservation. A solar roof with its ability to

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[48] Kyle Pennell, "The History and Future of Solar Shingles," *Altenergy Stocks*, January 17, 2018, http://www.altenergystocks.com/archives/2018/01/history-future-solar-shingles/.
[49] Jenny Millward, "History and evolution of Solar Shingles," *Prezi*, updated on February 26, 2014, https://prezi.com/kvvsjb2dbsh4/history-and-evolution-of-solar-shingles/.
[50] Hadley Keller, "What you should know before buying Tesla's Solar Roof Tiles?" *Beautiful House,* April 23, 2019, https://www.housebeautiful.com/home-remodeling/a27241892/tesla-solar-roof-tiles-facts-cost/.
[51] Kyle Pennell, "History of Solar Shingles," *Solar Village*, January 18, 2018, http://www.thesolarvillage.com/content/news-post.cfm?news=628. Also, for instance, company like Solexel Inc. in California produces a low-cost, high-efficiency solar shingle funded by $31 million in equity financing and a $13 million Department of Energy grant. From "The History and Future of Solar Shingles"
[52] Luck Richardson, "Tesla Soar Roof: Elon Musk's solar roof tiles complete review," *Energysage,* January 3, 2019, https://news.energysage.com/tesla-solar-panel-roof-the-next-solar-shingles/.
[53] "Our Green Building," New England Wildlife Center, https://www.newildlife.org/about-2/green-building/.

conserve the conventional roofline could be an effective way to bring sustainable energy production to historic properties. Although the cost will likely be higher, under today's conditions, than the usage of solar panels, the incentives of preservation will also help homeowners to access. There is a possibility that solar roof could produce more energy on a historical roof than solar panels depending on the available locations of installation. The following chapters will explore the possibility of adopting solar roof in historic districts with evaluation of benefits and barriers.

Fig 2.3: Solar roofs installations on some residential houses; left figure is a red house in Bolton, Massachusetts, right figure is a house with solar slates in Falmouth, Massachusetts. Source: provided by Aesthetic Green Power from email.

Fig 2.4: The New England Wildlife Center's green building in Massachusetts. Solar roofs have produced five percent of total building energy. Source: "Our Green Building," New England Wildlife Center, https://www.newildlife.org/about-2/green-building/, photo rights authorized by e-mail.

Other Solar Technologies

Besides new invention like solar roofs, there are other alternative technologies that could be used in historic properties and should be explored. "Community Solar" is a strategy to install solar panels either on rural sites or on some of the many commercial roofs that exist in a community. Owners will be able to buy or subscribe to a solar project elsewhere and receive the benefits just as if the electricity were being generated on their own roof.[54] There is a type of solar roof tile, which produces energy by absorbing thermal resources other than photovoltaic of the sun. This type of solar tile could be designed along with traditional materials but will not be as efficient as solar PV roof tiles.[55] This type may be best along with the historic properties with red tile roof. Another technology like solar paving, which installs solar panels on a road rather than on a building, will not cause visual issue like solar panels and could also be used in a historic site.[56]

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[54] "Solar Energy in A Historic District."
[55] Istvan Fekete, Istvan Farkas, "Numerical and experimental study of building integrated solar tile collectors," *Renewable Energy* (2018).
[56] Dylan Ryan, "Solar panels replaced tarmac on a road – here are the results," *the Conversation*, September 21, 2018, http://theconversation.com/solar-panels-replaced-tarmac-on-a-road-here-are-the-results-103568.

Chapter 3: Framework of Implementing Solar Energy in Historic Districts, Los Angeles

The History of Solar Energy in California

Located at the southwest of the United States, California is a state with high exposure to the sunlight due to the dry climate and clear sky. According to National Renewable Energy Laboratory (NREL), California is one of the states that have good photovoltaic solar resources in the country. Some regions of California, like Daggett, can even reach 6.6 hours of exposure per day. (Figure 3.1)

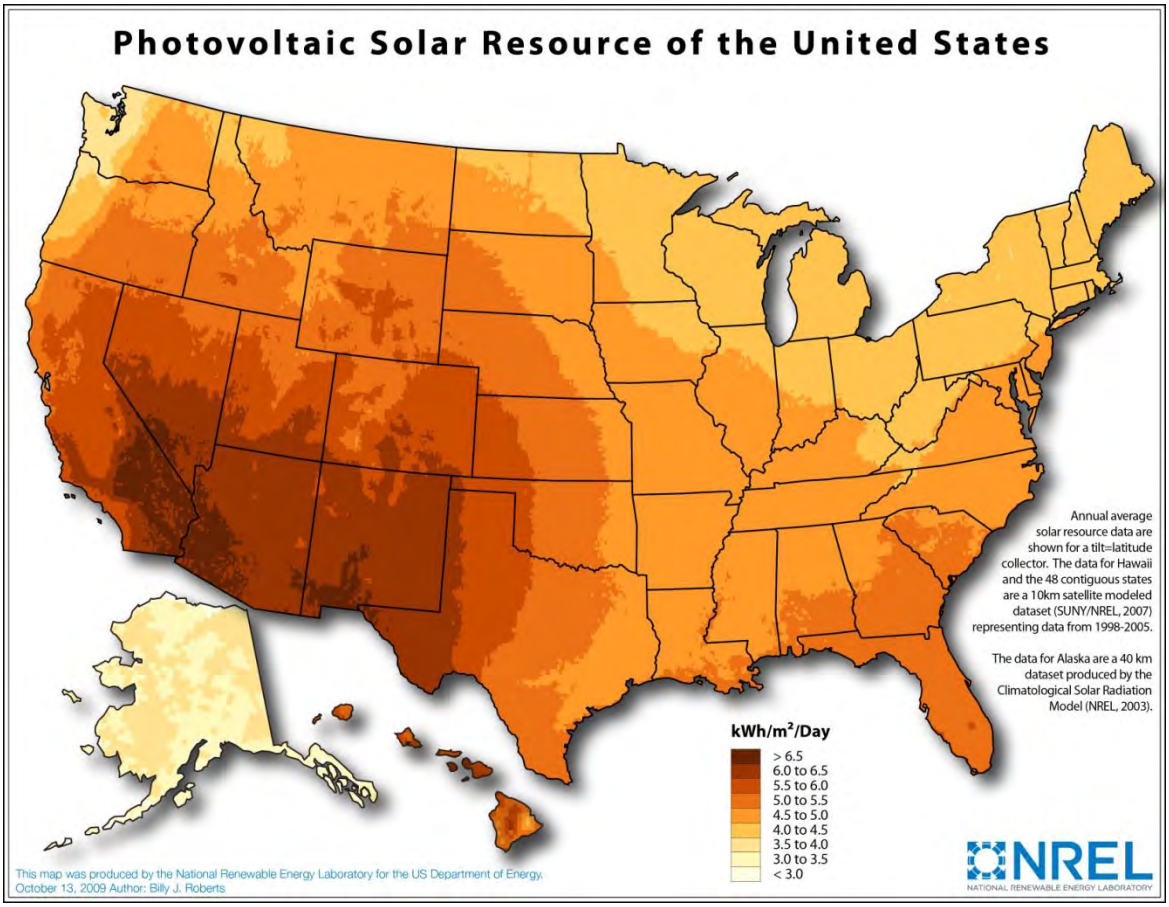

Fig 3.1: Billy J. Roberts, GIS map of U.S. solar resources, October 13, 2009. Source: National Renewable Energy Laboratory for the US Department of Energy, (https://www.nrel.gov/gis/images/solar/national_photovoltaic_2009-01.jpg).

California has a rich history of employing solar energy along with the development of solar technology in the country. As mentioned in Chapter 1, the federal solar energy bill was created in 1974 following the Oil Embargo. In 1978, the Congress passed the Public Utility Regulatory Policy Act and the Energy Tax Act. These acts established the right for using solar

photovoltaic (PV) and encouraged tax credits for users. In 1979, ARCO Solar began to construct the world's largest PV manufacturing facility at that time, located in Camarillo California.[57] Then the Solar One project in 1981, the first test of a large-scale thermal solar tower and power plant, was built in Daggett, California.[58] It continued to generate power until 1988, but shut down due to low efficiency in storing energy. A redesign -- the Solar Two project served from 1995 to 1999 with a better storage system, producing energy that could be used by 7500 homes.[59] These two experimental projects pioneered solar technology and later led to more solar energy projects on a large scale in the California desert.

From the 1990s to 2006, California developed a series of bills to encourage the usage of solar energy. For example, the Electric Utility Industry Restructuring Act in 1996 (Bill 1890) was established to deregulate the state's investor-owned electric utilities and to create incentives for grid-tied PV systems under the California Energy Commission's Renewable Energy Program.[60] Senate Bill 1345 in 2000 directed the state Energy Commission to develop and administer grants to encourage the purchase and installation of solar energy systems.[61] By 2005, renewable resources, including solar energy, were providing approximately eleven percent of the state's electricity mix.[62]

In 2006, Governor Arnold Schwarzenegger announced "Go Solar California" at the Solar Power 2006 Conference and Expo in San Jose. Go Solar California is a statewide effort based on the "Million Solar Roofs" vision of California.[63] It includes two new solar incentive programs. The Energy Commission provides incentives to energy efficient new home construction in the New Solar Homes Partnership, and the California Public Utilities Commission gives rebates to all other facilities in investor-owned utility territories.[64] Go Solar California has collected general

[57] This was the first project to produce more than 1 megawatt (MW) of PV modules in one year, and for years later, ARCO Solar dedicated a 6-megawatt PV facility in central California in the Carrissa Plain. "History of Solar Energy in California," Go Solar California, https://www.gosolarcalifornia.ca.gov/about/gosolar/california.php.
[58] Ibid.
[59] "Solar One and Solar Two: Decommissioned experimental solar facilitates that pioneered solar energy technology," Atlas Obscura, https://www.atlasobscura.com/places/solar-one-and-solar-two.
[60] Ibid.
[61] Ibid.
[62] George Simons, Joe McCabe, *California Solar Resources: In support of the 2005 integrated energy policy report*, Research and Development, Energy Research and Development Division, California Energy Commission, April 2005: 2.
[63] "History of Go Solar, California!" Go Solar California, https://www.gosolarcalifornia.ca.gov/about/gosolar/history.php.
[64] Ibid.

information about incentives, solar rights, the development of solar energy in California, and installation instructions on its website, providing helpful guidance for users to access solar energy.

One of the most significant steps for California to ensure the popularization of solar resources is the 1978 Solar Rights Act. It is a legal framework for protection to allow users to access to sunlight and to limit the ability of homeowner associations and local governments from preventing installation of solar energy systems.[65] For more than thirty years, it protected and facilitated access to solar energy in California. The solar access rights also balance the needs of solar system owners with other property owners. Along with the Solar Rights Act, the 1978 Solar Shade Act further secure owners' right by protecting the solar energy system from shading caused by trees and shrubs on adjacent properties.[66] According to Go Solar California, planned communities may sometimes try to limit the growth in the use of solar energy for various reasons, but the enactment of California Solar Rights Act and the Solar Shade Act ensures the homeowner's ability to go solar.

By October 2018, the average electricity rate in California is about $0.1573 per kilowatt, and the energy savings produced by solar panels could reach to $29,424 for a typical household over twenty years with the good access to solar resources. (Note that this does not include the average installation price for a 6kW solar system of $18,180)[67] The California Energy Commission announced new standards in 2018 – to cut energy use in new homes by more than fifty percent.[68] This goal is expected to reduce residents' utility expenses in the long term and save energy. To achieve this goal, the state requires all new homes and low-rise apartment buildings to be constructed with solar panels starting in 2020. Although the mandatory standards focus more on new construction, the goal for saving energy in California will no doubt increase.

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[65] "Solar Rights: Access to the Sun for Solar Systems", Go Solar California, https://www.gosolarcalifornia.ca.gov/about/gosolar/legislation.php.
[66] Ibid.
[67] Luke Richardson, "How Much Do Solar Panels Save?" *Energysage*, January 1, 2019, https://news.energysage.com/much-solar-panels-save/.
[68] Amber Pasricha Beck, "Energy Commission Adopts Standards Requiring Solar Systems for New Homes, First in Nation," California Energy Commission, released May 8, 2018, https://www.energy.ca.gov/releases/2018_releases/2018-05-09_building_standards_adopted_nr.html.

Since existing buildings account for twenty-five percent of the state's greenhouse gas emissions, another crucial aspect is to retrofit these buildings with sustainable energy.[69]

Solar Rights Act and Historic Resources

The 1978 California Solar Rights encourages the use of solar energy and reduce the barriers like design review for aesthetic purposes throughout the state.[70] Local governments are discouraged from adopting ordinances that would unreasonably restrict the use of solar energy systems.[71] The state law also requires local governments to use a ministerial or administrative application review instead of a discretionary review.[72] Along with the Solar Rights Act, the Office of Historic Preservation (OHP), California, encourages the owners of historic properties to install solar energy system followed the Guidelines on Sustainability from National Park Service, which has been mentioned in Chapter 1, to minimize the impact to historic resources. OHP also suggests that owners work with permit officials and preservation commissions to provide guidance and installation details for conserving significant roofing materials and character-defining features.[73]

> Although the Solar Rights Act discourages discretionary review, preservation ordinances for adopting solar energy vary across California. Each city interprets the state policy differently. For example, in the Duboce Park Landmark District in San Francisco, the designation ordinance requires a Certificate of Appropriateness for installations of solar structures:
>
> A Certificate of Appropriateness for the installation of structures that support solar panels, regardless of visibility, provided that the installation would not require alterations to the building greater than normally required to install a solar energy system, such as: (a) Set with a low profile, and (b) Mounted parallel with the slope of the roof (if the roof is sloped greater than 1/12, and (c) Not visible from adjacent street sightlines if on a flat roof, and (d) Set in from the perimeter walls of the building, including the building's primary façade.[74]

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[69] Times Editorial Board, "Of Course California Should Require Solar Panels on New Homes," *Los Angeles Times*, May 11, 2018, https://www.latimes.com/opinion/editorials/la-ed-solar-new-homes-20180511-story.html.
[70] "The 1978 California Solar Rights Act and Historic Resources," California Office of Historic Preservation, http://ohp.parks.ca.gov/?page_id=25664.
[71] "California Government Code Section 65850.5." California Legislative Information, https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=65850.5.&lawCode=GOV.
[72] Ibid.
[73] "The 1978 California Solar Rights Act and Historic Resources," California Office of Historic Preservation.
[74] "Update: April 2013, Proposed Duboce Park Historic District," San Francisco Planning, April 2013, http://default.sfplanning.org/Preservation/landmark_districts/proposed/duboce_park/Duboce_Park_Update_2013.pdf.

In Santa Monica, the local zoning ordinance requires all solar energy systems proposed on designated landmarks and historic district contributor properties to achieve a certificate of appropriateness from the Landmarks Commission Liaison.[75] Installations would be evaluated based on the Secretary of Interior's Standards for Rehabilitation. Although likely rare, by authorizing the liaison to act for the Landmarks Commission on these applications, the hearing process is not required, and the review process can be expedited. The city of Orange has classified the design review for alteration in historic districts into two types: Minor Design Review (MDR) and the Design Review Committee (DRC). The MDR is for streamlining review of repairs and minor rehabilitation like the installations of solar panels.[76] Also, there are some cities like Los Angeles that do not require discretionary design review for solar systems installations on a historic property per the state law.

The variety of preservation ordinances throughout the state will require preservationists to be familiar with local regulations. Improper advice will otherwise generate unnecessary delay or even damage on a historic property's character, even causing the loss of designation. Also, complicated issues might happen, such as installing a solar system for a non-contributing property in a historic district. A circumstance like this will require preservationists to produce a comprehensive plan for local residents. Preservationists will be more familiar with alternative methods, such as using other technology like efficient windows and walls or encouraging owners to buy credit in a solar farm. Recent evolving technology, such as the development of the solar roof, will reduce visual degradation compared to solar panels. Thus, in a state with a rich history of solar energy, the exploration of new technology on a historic property is important.

Solar Rights and Historic Districts in Los Angeles

Besides the context of solar technology in the state, Los Angeles itself is a region with a long connection to solar energy. After the Oil Embargo, the first Solar Energy Society meeting was held in Los Angeles in 1975 with an exhibition of solar components.[77] The Los Angeles Department of Water and Power (LADWP) was one of the early designers of the first large-scale

[75] Eileen Fogarty, "Ordinance Pertaining to Solar Energy Development and Design Standards (continued from December 2, 2008)," City Council Meeting, Santa Monica, May 12, 2009, https://www.smgov.net/departments/council/agendas/2009/20090512/s2009051207-A.htm.
[76] Orange City Council, *Historic Preservation Design Standards*, the city of Orange, adopted on December 12, 2018.
[77] Phillip James Tabb, "1970s: Solar Architecture," 50.

thermal solar tower - Solar One, which was completed in 1981 and produced power from 1982 to 1988.[78]

In 2018, Los Angeles was announced as the city in the United States with the most installation of solar power systems. The city's sustainable plan includes a clean and resilient energy supply through the expansion of local solar resources. The growing installation of solar power reflects that the city is streamlining produces for solar programs, making solar energy more accessible to people.[79] In addition to the federal Solar Investment Tax Credit since 2006, LADWP offers its own incentives like LADWP Solar Incentive Program for residents in Los Angeles to offset the cost. These incentives make it more attractive for local residents to access solar energy.

Also, solar technology is encouraged to be used in the large number of historic districts in Los Angeles. The city adopted the Historic Preservation Overlay Zones (HPOZ) ordinance in 1979, for providing review of proposed exterior alterations and additions to historic properties within those designated neighborhoods.[80] HPOZs include neighborhoods which are the most intact historic communities with distinct architectural and cultural significance throughout the city. There are currently thirty-five designated HPOZs in size ranging from approximately fifty parcels to more than 4000 properties.[81] Many of the HPOZs have their own preservation plans. Alterations as well as additions within HPOZ in Los Angeles will need to go through review by HPOZ boards. Yet, the installation of solar systems is exempt from review under the California Solar Rights Act to ensure solar access.[82] In the "Advisory Notice for Installing Solar Equipment on Historic Buildings," LADWP states:

> In accordance with State Law (Assembly Bill 2188), permits for solar energy installations affecting properties within Historic Preservation Overlay Zones (HPOZs) or other designated historic resources, including City Historic-Cultural

[78] "History of Go Solar, California!" Go Solar California, https://www.gosolarcalifornia.ca.gov/about/gosolar/history.php.
[79] "Los Angeles Named #1 Solar City in America," Mayor Eric Garcetti, City of Los Angeles, April 4, 2018, https://www.lamayor.org/los-angeles-named-1-solar-city-america.
[80] "What is an HPOZ?" Office of Historic Resources, Los Angeles, https://preservation.lacity.org/hpoz/homepage/about. Also, there are other historic districts in Los Angeles, which are identified and formally determined eligible listed on the California Register or National Register that are not designated HPOZs.
[81] Ibid.
[82] Office of Historic Resources, "Frequently Asked Questions (FAQs) on Proposed Historic Preservation Overlay Zones (HPOZs)." Department of City Planning, Los Angeles.

> Monuments, will not require clearances from the Department of City Planning. To help maintain the character of historic districts, property owners are encouraged to place rooftop solar panels on flat roofs, rear-facing rooftops, and other locations that will minimize the visual impact of new solar equipment on individual historic buildings and the historic district as a whole.[83]

According to Lambert Giessinger, the historic preservation architect in the Office of Historic Resources, a solar installation that is attached directly to the historic structure is exempt from discretionary review in Los Angeles. The ideal way to install is the panels are not visible from the public right-of-way.[84]

As a result, HPOZs in Los Angeles could also play an important role in building a sustainable city by adopting solar energy easily. It may still require local HPOZ boards to provide guidance for users, in order to conserve historic neighborhoods' character. Currently, most installations of solar systems in HPOZs are solar panels. There is no case of installing a solar roof on a historic property.

Summary of Solar Energy Legislation and Milestones

Years	1974	1975	1978	1996	2000	2006	2018
Federal	First solar energy bill		Utility Regulatory Policy Act Energy Tax Act			Solar Investment Tax Credit (30% tax credit)	
State			Solar Rights Act Solar Shade Act	The Electric Utility Industry Restructuring Act (Bill 1890)	State Energy Resources Conservation and Development (Senate Bill 1345)	"Go Solar California"	New standards, starting in 2020
Los Angeles		Solar Energy Society meeting					The city with most installed solar power systems

Table 3.1: Summary of the legal frameworks mentioned in Chapters 2 and 3. Source: Table is produced by author.

[83] Los Angeles Department of City Planning, "Advisory Notice for Installing Solar Equipment on Historic Buildings," https://www.ladbs.org/docs/default-source/publications/misc-publications/solar-historic.pdf?sfvrsn=11.
[84] Lambert Giessinger, email to author, February 11, 2019.

Evaluation Tool: L.A. County Solar Map

To evaluate the potential energy and money can be saved with a solar system, Los Angeles County and Energy Upgrade California announced a new tool, the L.A. County Solar Map in October 2012. The L.A. County Solar Map uses Geographic Information Systems (GIS) to visualize and analyze energy savings per property within Los Angeles County. According to Howard Choy, manager of the L.A. County Office of Sustainability, the map is a single source for information about solar electricity, hot water, and energy efficiency projects, and personalized information about their property like the potential installation locations of solar panels.[85]

On the website's interface, users can easily access information by clicking a property. The map directly shows the property's rooftop area and shade place as well as detailed costs, savings, and potential payback for installing a solar system. The potential area for solar installation is visualized in a set of colors: red is the best access to solar, orange means good access to solar, green is poor access to solar, and blue represents not available to solar resource. (Figure 3.2) An even more detailed rooftop report presents additional information like the range of energy savings possible and the estimation process. (Appendix D) Chapter 4 will use the LA County Solar Map to evaluate potential energy saving with solar roofs in a historic district in Los Angeles.

[85] Nick Franchino, "Los Angeles County Solar Map," Los Angeles County, Department of Regional Planning, last updated October 6, 2015, http://planning.lacounty.gov/solar/.

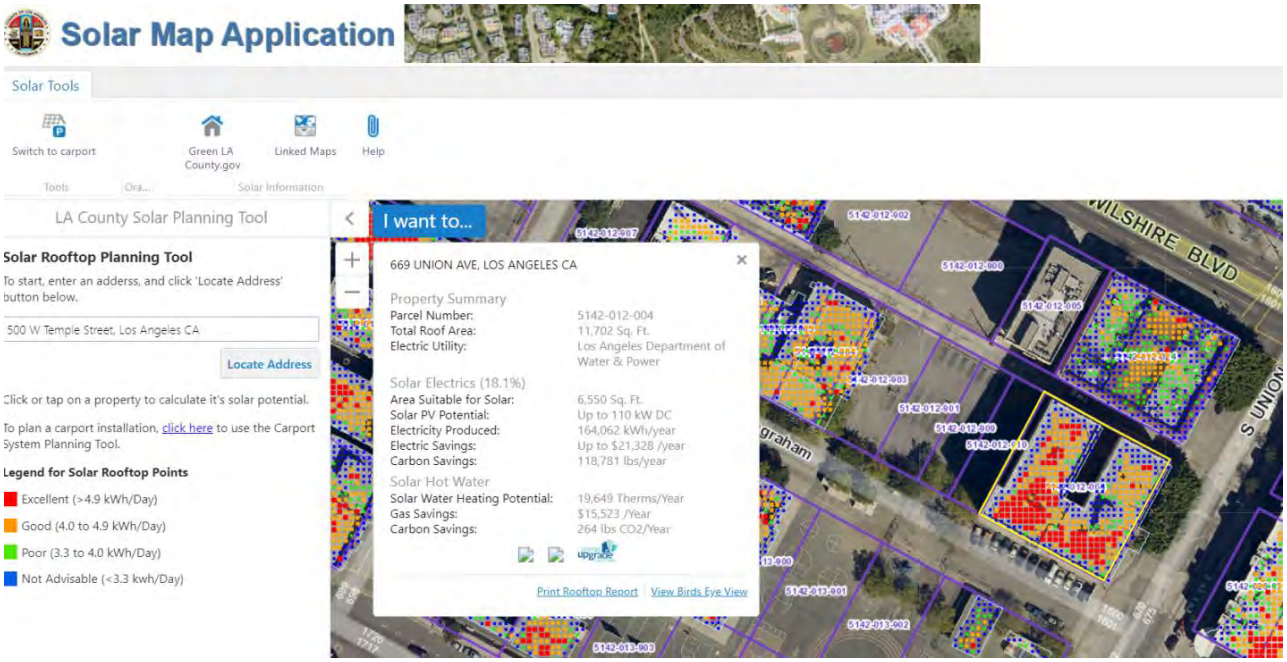


Fig 3.2: The interface of LA County Solar Map. Source: LA County Solar Map website, (http://egisgcx.isd.lacounty.gov/solar/m/?viewer=solarmap).

Chapter 4: A Good Candidate – Western Heights HPOZ, Los Angeles

In order to explore the possibility of adopting solar roofs in a historic district, the Western Heights Historic Preservation Overlay Zone (HPOZ) in Los Angeles has been selected as a candidate.

A Brief History of Western Heights HPOZ

Western Heights is west of the original land grant given to Spanish settlers in 1781 and was used exclusively for grazing and agriculture until the later part of the nineteenth century. (Figure 4.1) In 1896, it was included in the third annexation of the City of Los Angeles. Due to the introduction of horse-drawn streetcars, it was later developed as a suburban neighborhood for those families who worked downtown Los Angeles. In the 1920s, the population in south Los Angeles's neighborhoods grew rapidly. The growth encouraged the development of more residential structures, including multi-family properties like apartments. After the 1930s, the routes of streetcars and electric railways had further encouraged the residential development of south Los Angeles. The "suburbanization" movement extended to outlying farm communities. (Figure 4.1) The nearby the resources of water distribution, including artesian wells and larger water distribution stations erected by the Los Angeles Department of Water and Power also enabled Western Heights to be developed as a concentrated residential area.

Fig 4.1 Left: An orchard at the intersection of Washington Boulevard and Western Avenue in 1899, Los Angeles, CA, 1899. Source: USC Libraries/California Historical Society Collection, 1899; filename CHS-6414 (http://digitallibrary.usc.edu/cdm/singleitem/collection/p15799coll65/id/3965/rec/5); Right: The streetcar lines on the intersection of Washington Boulevard and Western Avenue in 1935, Los Angeles, CA, 1935. Source: USC Libraries/ "Dick" Whittington Photography Collection,1924-1987; filename DW-1935-03-05-27 (http://digitallibrary.usc.edu/cdm/compoundobject/collection/p15799coll170/id/58992/rec/17).

Today, the Western Heights neighborhood is located north of the Santa Monica Freeway in the West Adams neighborhood. It is approximately bounded by Arlington Avenue on the west, Western Avenue on the east, Washington Boulevard on the north, and the Santa Monica Freeway on the south. Although Western Heights later developed commercial storefronts on the Washington Boulevard, the neighborhood has remained mostly unaltered in the last eighty years with over seventy percent of buildings retaining their historic character. It was designated as a HPOZ on March 2, 2001, with 127 of 175 properties identified as contributing resources.[86] (Figure 4.2) Compared to the historic map of the neighborhood in Figure 4.3, many of the contributing properties remain the same. (Figure 4.2, 4.3)

It retains significance in the contexts of the development of the streetcar network, the annexation of Los Angeles, and residential development with single family structures and multi-

[86] Contributing resources are any building, structure, landscaping, natural feature identified on the Historic Resources Survey as contributing to the historic significance of the Historic Preservation Overlay Zone including a building or structure which has been altered, where the nature and extent of the alterations are determined reversible by the Historic Resources Survey. Generally, contributing structures would have been built within the historic period of significance of the HPOZ, and will retain elements that identify it as belonging to that period; Citywide HPOZ Ordinance NO. 184903, Los Angeles Municipal Code, http://clkrep.lacity.org/onlinedocs/2016/16-1157_ord_184903_5-5-17.pdf.; all information about Western Heights HPOZ in this chapter, unless additional noted, is from the Western Heights HPOZ Preservation Plan, adopted by the City of Los Angeles on December 9, 2010.

family structures. It also contains resources associated with the minority heritage of Los Angeles. The period of significance of the Western Heights HPOZ extends from the 1860s to the 1950s.

Fig 4.2: The HPOZ map of Western Heights with all contributing properties. Source: Diagram is produced by author based on the Western Heights HPOZ survey map and ZIMAS, Office of Historic Resources, City of Los Angeles Department of City Planning, (https://preservation.lacity.org/files/Western%20Heights%20Survey%20Map.pdf).

Fig 4.3: Historic Sanborn Map 1921 with contributing properties in the HPOZ today. Source: Compiled by author based on the Los Angeles Sanborn maps vol.8, 1921, Digital Sanborn Maps 1867-1970, (http://sanborn.umi.com.libproxy1.usc.edu/ca/656/dateid-000007.htm?CCSI=20518n).

It is a quiet neighborhood in a trapezoidal shape, bounded by greenbelt at the south and storefronts at the north. A plaque with "Western Heights" is sitting at the intersection of Gramercy Place and West 21st Street. Streets are paved with asphalt, concrete sidewalks line the streets, and the parkway has mature trees. (Figure 4.4) The houses are in various architectural

styles and still remain harmonious. Most of them have small front yards without fences, merging into the streetscape. Some of the houses display small flags with signs “Historic West Adams” in front of the door, celebrating their historic properties. (Figure 4.5, 4.6)

In general, this is a streetcar neighborhood in a low scale. The roofline is visible from the pedestrian perspective and thus it is one of the significant features of the historic district that should be maintained appropriately. Many of the historic roofs have already been altered in this neighborhood and some are not in a very good condition. (Figure 4.7) Yet, this condition that requires further maintenance might also provide an opportunity for new rehabilitation project, such as adopting sustainable technology systems.

Fig 4.4: The Western Heights HPOZ. Source: Photos by author.

Fig 4.5: Buildings are in various architectural styles and still remain harmonious. Source: Photos by author.

Fig 4.6: Some properties have small flags to celebrate their historic resources. Source: Photos by author.

Fig 4.7: Some contributing properties are not in good condition and will need maintenance. Source: Photos by author.

Architectural Styles and Roof Features of the Western Heights HPOZ

From the 1920s to the 1950s, the rapid population growth and streetcar development let south Los Angeles continue to have powerful residential construction. Many residential neighborhoods were developed in a very short time with a single developer, and thus were consistent to one architectural style. In later decades, residential development continued to change as older structures were replaced by newer ones. These neighborhoods have a variety of architectural features regarding the changes in population, income level, and generations. Thus, with a long period of significance from the 1860s to the 1950s, the Western Heights HPOZ

contains buildings in various architectural styles, ranging from American Four Square, Queen Anne, Craftsman, and Spanish Colonial Revival, etc.

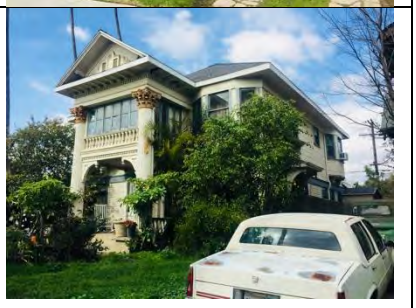
The residential streets of Western Heights are characterized by two and two-and-one-half story single family residences.[87] The single-family home was the predominant resource type of Western Heights in a variety of sizes, scales, site characteristics, and architectural styles. Some of these houses were designed by some of the most prominent architects of Los Angeles, such as Myron Hunt and Paul R. Williams. The Western Heights HPOZ Preservation Plan describes the single-family homes in western Heights as:

> Craftsman bungalows included the stone foundations, porch supports, and chimneys that typified the style. Wood sheathing or shingles, protruding rafters, the low, horizontal emphasis, and other hallmarks combined to create a regional aesthetic loosely derived from the Arts and Crafts Movement in England and America. Colonial Revival examples typically included a symmetrical facade with columns flanking the doorway. Clapboard sheathing and clipped gable roof forms were also typical. The Spanish Revival and Mission styles had stucco walls, red tile roofs or overhangs, and frequently incorporated arched windows and details as well as other elements derived from the California missions. Tudor style homes included steeply pitched roofs and stucco and half-timber wall designs.

Multi-family residential structures in Western Heights include duplexes, bungalow courts, and apartments. Many of them included outdoor open space like courtyards or gardens, creating a relationship between living space and the landscape.

For implementing solar roofs in the Western Heights HPOZ, a specific summary of architectural styles with roof features is listed in table 4.1. (Table 4.1) A complete illustration of the architectural styles of the Western Heights HPOZ is included in Appendix E.

[87] "Western Heights," Office of Historic Resources, City of Los Angeles, https://preservation.lacity.org/hpoz/la/western-heights.

Styles	General Characteristics	Roofing systems	Examples
American Foursquare	Simple floor plan Boxy, cubic shape Two to two-and-a-half stories Large central dormer Simple and restrained two-color and three-color paint schemes highlighting body, trim and accents	Pyramidal, hipped roof, often with wide eaves Shingle roof	
Classical Revival	Massive symmetrical and rectilinear form Triangular pediments supported by classic columns Large rectangular windows usually arranged singularly Masonry walls Color schemes indicative of stone and masonry construction	Low pitched roof Shingle roof	
Queen Anne	Highly ornamented with spindle work, finials, roof cresting, corner brackets on porches and cutouts Fanciful shingle and clapboard Covered porches often wrap from the front and around side and are decorated with spindle work and friezes Complex and contrasting color schemes highlight ornate wood-work	Complex and steeply pitched roof forms with cross gables and front-facing gables, roof cresting Shingle roof	
Shingle	Asymmetrical facades Clad with naturally stained shingle Rough-hewn stone foundations and porch supports Rectangular, grouped, double-hung windows Stained shingles in natural tones with one or trim trim/accent colors	Asymmetrical roof forms Complex cross-gables and front-facing gables Occasional use of gambrel roof Shingle roof	
Colonial Revival	Symmetrical facades, and occasional use of side-porch Basic rectangular shape Central entrance usually adorned with pediments and decorative crown Diminutive or no front porch Two or three-color paint schemes with house body often in light or white tones	Hipped or side-facing gable roof Shingle roof	

Styles	General Characteristics	Roofing systems	Examples
Craftsman	Pronounced front porch, symmetrical or offset with massive battered or elephantine columns Grouped rectangular multi-pane windows Massive stone or masonry chimneys Use of earth tone color palette and natural finishes Three-color schemes for body, trim and accents	Broad gabled roofs with deeply overhanging eaves Shingle roof	
Mission Revival	Simple, smooth stucco or plaster siding Large square pillars or twisted columns Arched entry and windows with deep openings Covered walkways or arcades Round or quatrefoil window Restrained decorative elements usually consisting of tile, iron, and wood	Either hipped or gabled tile roof Roof parapets Clay tile roof	
Dutch Colonial Revival	One-and-half to two stories Clapboard, shingle, stone or stucco siding Typically, symmetrical facades, but also found with side entries Gable-end chimneys Porch under overhanging eaves with simple classical columns Shed, hipped, or gable dormers	Gambrel roof, side gables widely used Shingle roof	
English Tudor Revival	One-and-one-half to two stories with asymmetrical and irregular plan Use of half-timbering, patterned masonry, stone and stucco Over scaled chimneys with decorative brick work and chimney pots Rectangular or arched doorways, often recessed or found within tower features	Cross-gabled, medium to steeply pitched roof, sometimes with clipped gables Shingle roof	
Italian Renaissance Revival	Moderate to wide eaves with decorative bracket supports Recessed porches with arched openings Most often symmetrical Balanced wings Use of three-color palette with subdued and formal tones	Low pitched, hipped tile roof Tiles in reds, greens and blues	

Styles	General Characteristics	Roofing systems	Examples
Mediterranean Revival	Rectangular or irregular plans Arched and rectangular windows and doors Balconies, patios and courtyards integrated into plan Vibrant two and three-color schemes with walls in shades reminiscent of adobe	Varied, irregular roofs with simple eaves Clay tile roof	

Table 4.1: Architectural styles and roof features of the Western Heights HPOZ. Table is produced by author based on the Western Heights HPOZ Preservation Plan, all photos by author.

In general, although the Western Heights HPOZ includes many architectural styles, the most common roof forms are in hipped and gabled. According to the Western Heights HPOZ Preservation Plan, the colors of roof shingles are in earth tones such as rusty reds, greens, and browns rather than light colors, and thus could be compatible with solar roof tiles' color.

Rehabilitation Guideline

The Western Heights HPOZ Preservation Plan, adopted in December 2010, ensures the vitality of the Western Heights HPOZ as a livable and sustainable neighborhood through the restoration, preservation, and enhancement of structures, landscaping, and natural features. (Appendix E) The plan presents design guidelines for rehabilitation and restoration projects within the Western Heights HPOZ. The Western Heights HPOZ Board conducts a review process, in conjunction with the staff of the Planning Department, based on this Preservation Plan.[88] This plan also serves as an educational tool for both existing residents and potential property owners, residents, and investors in the future to learn more about this HPOZ. Since most of properties in the Western Heights HPOZ are single family residential structures, a Residential Rehabilitation Guideline is a crucial part of the preservation plan, which is mostly adopted and used in planning, reviewing and executing. This guideline ensures that historic properties in the HPOZ can still retain elements to be identified within the historic period of significance.

[88] HPOZ has different review processes for different types of project, such as Certificate of Appropriateness, Certificate of Compatibility, Conforming Work on a contributing element, Conforming Work on non-contributing Elements, more information goes in Appendix E, Chapter 3.4.

In order to install solar energy system on historic properties properly without loss of visual character, the users should refer to the sections of roofs and mechanical equipment of this Rehabilitation Guideline. For rehabilitation of roofs, the guideline states that:

> 5. Historic specialty roofing materials, such as tile, slate, gravel or built-up shingles, should be preserved in place or replaced in kind. Wood roof shingles are no longer permissible in Los Angeles, and where possible, special care should be taken to make minimal repairs to wood shingle roofs rather than replace the roof outright.
>
> 6. Replacement roof materials, where in-kind replacement is not possible, should convey a scale, texture, and color similar to those used originally.
>
> 8. Skylights or solar panels should be designed and placed in such a way as to minimize their impact. Locations on the side and rear facades are preferred for skylights. Where skylights are found appropriate, they should be flat and relatively flush to the roof surface.

In the meanwhile, the guideline encourages historic properties to adopt new mechanical systems like modern heating and cooling systems, electrical systems, and solar panels, meeting criteria like "the location of one of these elements may not seem to make a significant negative impact on a structure or neighborhood." For installation of solar panels specifically, the guideline states that:

> 8. Solar panels should not be placed upon rooftops that are visible to the general public. Location upon detached garages in many instances will be appropriate, or upon rear-facing roofs that are minimally visible from a public street. Solar panels should be low in profile and should not overhang or alter existing rooflines.

While the Rehabilitation Guideline of Western Heights HPOZ provides detailed criteria for solar system installation, the review of installation is delegated to the Director of Planning if the installations are not visible from the street. As mentioned in Chapter 2, the installations of solar systems are exempt from review under the California Solar Rights Act. As a result, most of installations of solar systems are not reviewed by HPOZ Boards in public hearings. The guideline hasn't included any criteria for installation of solar roofs yet, which needs to replace parts of original roof materials, but unlikely causes visual degradation compared to solar panels.

The use of solar roofs will maintain the historic roofline by replacing the historic roof materials with elements of the same scale. According to Preservation Brief on Substitute Materials, it is possible to replace historical materials with newer products that match the historic

character of the original, if there is long term benefit such as cost-effectiveness.[89] The Preservation Brief suggests four circumstances to consider before using substitute materials: 1) the unavailability of historic materials; 2) the unavailability of skilled craftsmen; 3) inherent flaws in the original materials; and 4) code-required changes.[90] For roofing rehabilitation project specifically, the Preservation Brief states that roof materials could be replaced with valid reasons, but the decision to use an alternative material should be weighed carefully.[91] If the roof is readily visible, the alternative material should match as closely as possible the scale, texture, and coloration of the historic roofing material.[92] The case of using solar roofs is not one of these four circumstances yet will lead to the improvement of the whole historic building while matching historic character at the same time. Further guidelines should be set to address the application of replacing historic materials with solar roof tiles' materials. New preservation guideline should also discuss the possibility of installing solar roofs on a street-view elevation.

Being a Good Candidate of Implementing Solar Roofs

There are several reasons for choosing the Western Heights HPOZ in Los Angeles as a location to exploration of implementing solar roofs.

First of all, the scale of the Western Heights HPOZ is practical for conducting a field survey because there are only about 127 contributing resources to document. Second, the orientation of buildings in the Western Heights HPOZ makes them good candidates for the installation of solar systems. The latitude of Los Angeles is 34.0522° N, meaning that the city is located north of the Tropic of Cancer and can only accept sunlight from the south.[93] As figure 4.8 shows, most of the buildings in this HPOZ are north or south-facing, and thus will have a large roof area to accept the sunlight. (Figure 4.8)

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[89] Sharon C. Park, "Preservation Briefs 16: the Use of Substitute Materials on Historic Building Exteriors," Technical Preservation Services, National Park Service, U.S. Department of the Interior, accessed September 1988, https://www.nps.gov/tps/how-to-preserve/briefs/16-substitute-materials.htm.
[90] Ibid.
[91] Sarah M. Sweetser, "Preservation Briefs 4: Roofing for Historic Buildings," Technical Preservation Services, National Park Service, U.S. Department of the Interior, accessed February 1978, https://www.nps.gov/tps/how-to-preserve/briefs/4-roofing.htm#materials.
[92] Ibid.
[93] "Los Angeles, United States latitude, longitude," Latitude, Longitude.org, https://latitudelongitude.org/us/los-angeles/; "Latitude," Enviropedia, http://www.enviropedia.org.uk/Climate/Latitude.php.

Fig 4.8: Satellite view of the Western Heights HPOZ. Source: Map is produced by author based on Google Maps.

In addition, the roof forms of the Western Heights HPOZ will be suitable to implement solar roofs. Figure 4.9 shows an analysis of roof forms suitable for installation of solar roofs. In general, side-gabled/gambrel roofs facing south/north, front-gabled/gambrel roofs facing east/west, and hipped roofs with appropriate area to use solar systems, make good candidates for solar roofs.[94] Although there are numerous architectural styles in the Western Heights HPOZ, most of the roof forms are gabled-roofs and hipped roofs with houses facing south or north, and therefore can be compatible with solar roofs. Figure 4.10 shows a solar map of parts of historic properties that will have good access to solar resources.

[94] The building orientation / facing is based on the elevation facing the street with main entrance way.

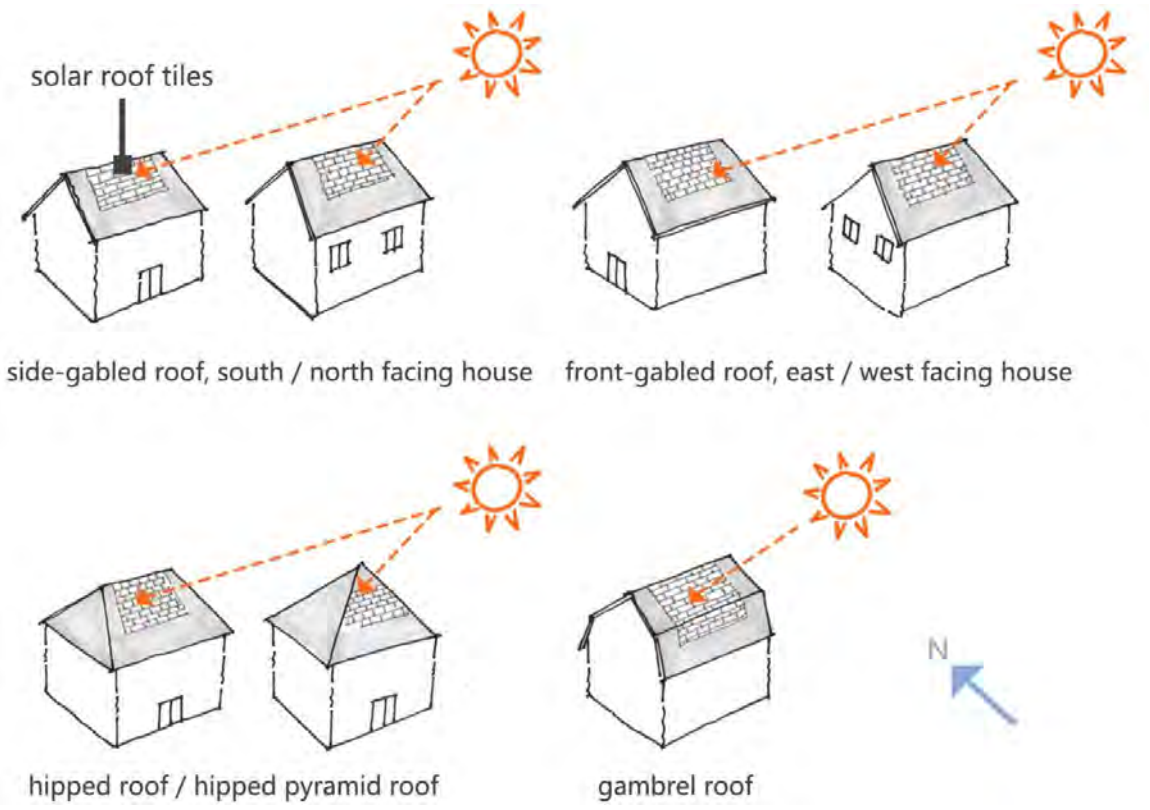

Fig 4.9: A diagram of the roof forms suitable for solar roofs. Source: Diagram is produced by author.

Fig 4.10: The solar map of a portion of the Western Heights HPOZ; the red color shows the best access to solar resources while the orange color shows good access. Source: L.A. County Solar Map (http://egisgcx.isd.lacounty.gov/solar/m/?viewer=solarmap).

As mentioned in Chapter 1, the current technology of solar roof tiles is more compatible with slate roofs, dark color shingle roofs, and possibly red clay tile roofs.[95] In order to achieve the goal of installing solar roofs without loss of historic character, the appropriate roofs for installation are in these three types of roofs. (Figure 4.11) In the Western Heights HPOZ, many of historic properties use shingle roofs in dark colors, and thus will be workable to explore the possibility of adopting solar roofs.

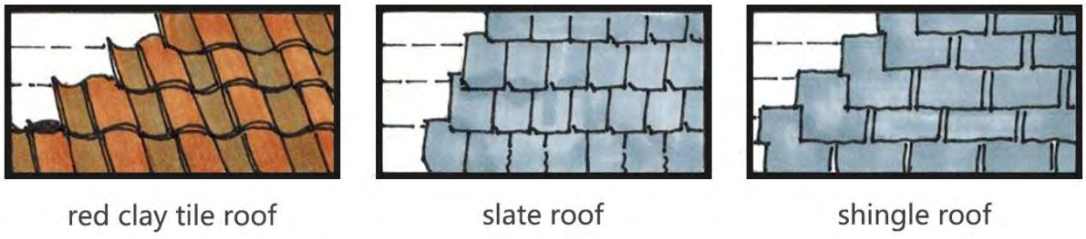

Fig 4.11: The roof materials that can be compatible with solar roof tiles. Source: Figure is produced by author.

In conclusion, the Western Heights HPOZ is a good candidate to explore the possibility of adopting solar roofs due to its scale, building orientation, roof forms, and roof materials. Furthermore, the variety of architectural styles in the Western Heights HPOZ provides a valuable chance to explore the impact of solar roofs on different architecture forms.

[95] The solar roof tiles that are compatible to red clay tile are only proposed by Tesla Company currently and they have not been produced yet.

Chapter 5: Adopting Solar Roofs in the Western Heights HPOZ

Research Methods

Although the implementation of solar roofs is likely to maintain the historic character of a property, the energy efficiency of solar roofs is another thing to consider. In this chapter, research was conducted for analyzing and calculating the potential energy production of solar roofs in the Western Heights Historic Preservation Overlay Zone (HPOZ). The research focuses on how efficient solar roofs can be compared to solar panels.

The research project design has five steps. (Figure 5.1) In Step 1, a field survey was taken in order to identify appropriate properties which might install solar roofs. Solar roof products are more compatible with grey, dark grey, blue, or dark blue roofs, while the roofing materials can be in shingle, slate, or red clay tile. A map with all candidates was drawn after the field research of the Western Heights HPOZ. In Step 2, a new solar map for these candidates was produced by combining the map from Step 1 and the L.A. County Solar Map. In Step 3, a spreadsheet was created to collect information on each candidate home, including address, roof plane types, orientation, roof materials, color, roof total area, suitable total area for solar photovoltaic (PV) based on the L.A. County Solar Map, and suitable area for using solar panels meeting the preservation guideline.

In Step 4, the solar panels potentials of the area meeting the preservation guideline will be set as the reference group. The calculation and comparison are given in two ways: using solar roofs on the same area as the solar panels and using solar roofs on all area that is available to solar PV as the L.A. County Solar Map suggests.

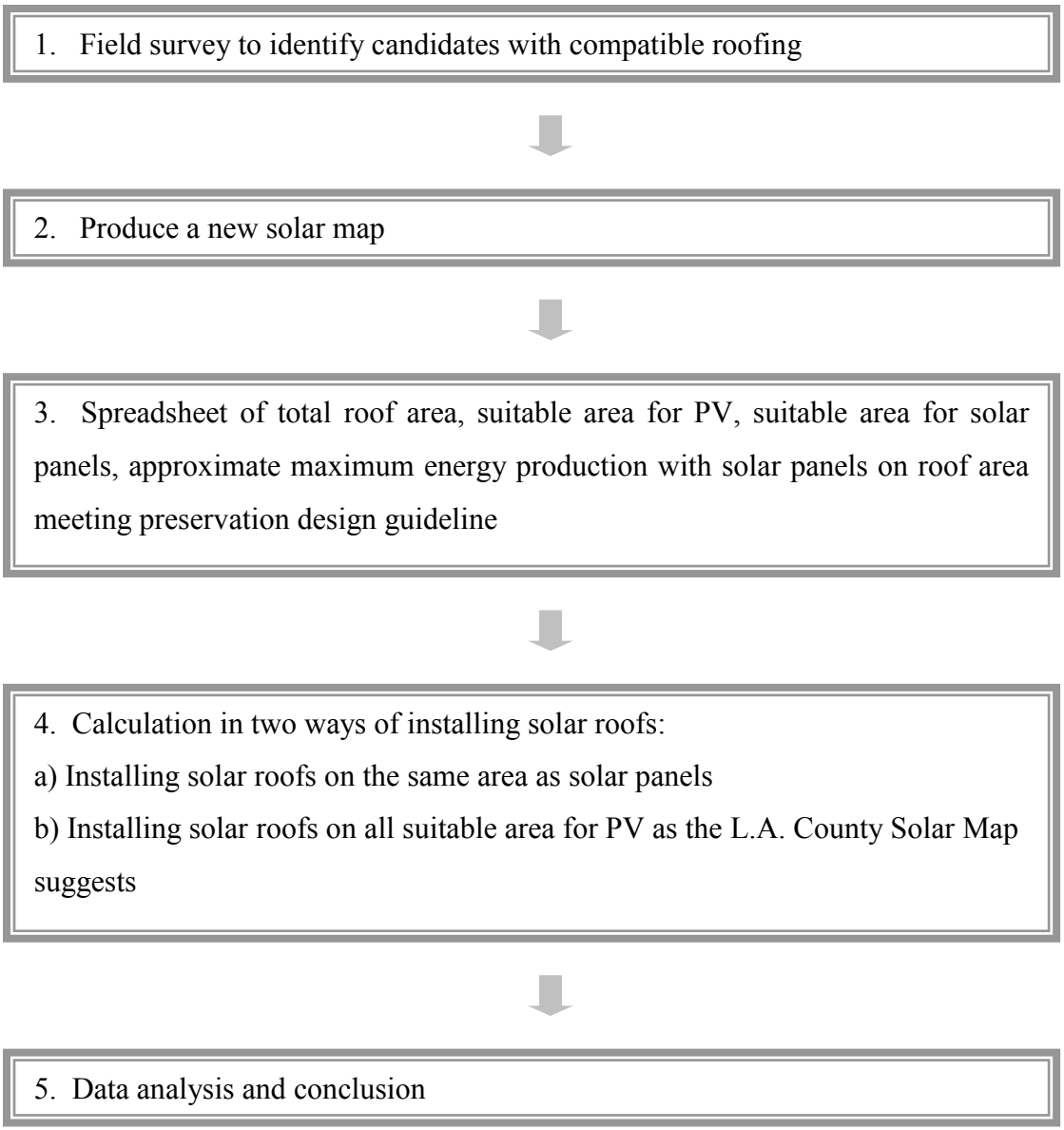

Fig 5.1: Flowchart of research methods. Source: Produced by author.

Field Survey

The analysis and calculation of adopting solar roofs will be given regarding only Contributing properties of the Western Heights HPOZ. In order to identify candidates that could use solar roofs, a field survey was conducted to document each contributor's roof plane types, house orientation, roof plane materials, and color. Table 5.1 shows an example of the spreadsheet that has been designed for documenting details of each property and the full documentation is compiled in Table 5.2. (Table 5.1)

Number	Site Address	Roof Plane Types	Orientation	Roof Plane Materials	Color	Possibility
2371	W 20TH ST	Hip roof	South	Shingle	Dark grey	√
2361	W 20TH ST	Front Gable	South	Shingle	Dark grey	√
2355	W 20TH ST	Side Gable	South	Shingle	Dark grey	√

Table 5.1: An example of the spreadsheet that used to document the contributors of the Western Heights HPOZ. Source: Table is produced by author.

The survey documents the current condition of the installation of solar technology within the HPOZ. It is notable that there are three contributing properties with solar panels on top of their side roofs. Although the installations are with setbacks, the panels can still be viewed from the street level. (Figure 5.2, 5.3) In the meanwhile, there is one non-contributing property, located at a crossroad and next to a contributing property, with solar panels in all directions on the roof. The panels can be seen even across the street, causing discord in the historic neighborhood. (Figure 5.4)

Fig 5.2: Contributing properties with solar panels. Source: Photos by author.

Fig 5.3: A Contributing property with solar panels on both sides of the gable front roof and not visible from directly in front with no impact to the roofline. Source: Photos by author.

Fig 5.4: A non-contributing property with solar panels in all directions next to a contributing property. Source: Photos by author.

Most of the historic properties in the Western Heights HPOZ have roofs in earth-tone colors like grey, dark grey, dark green, and brown. The survey identifies those who in grey, dark grey, dark green, and red clay tile roofs as candidates that might be compatible with solar roofs. Given the current solar roofs products available, shingle / slate roofs in brown color and red color would not be appropriate. (Figure 5.5) Figure 5.6 is a map documenting all candidates with their roof colors.

Fig 5.5: Roof colors that will not be compatible with solar roofs. Source: Photos by author.

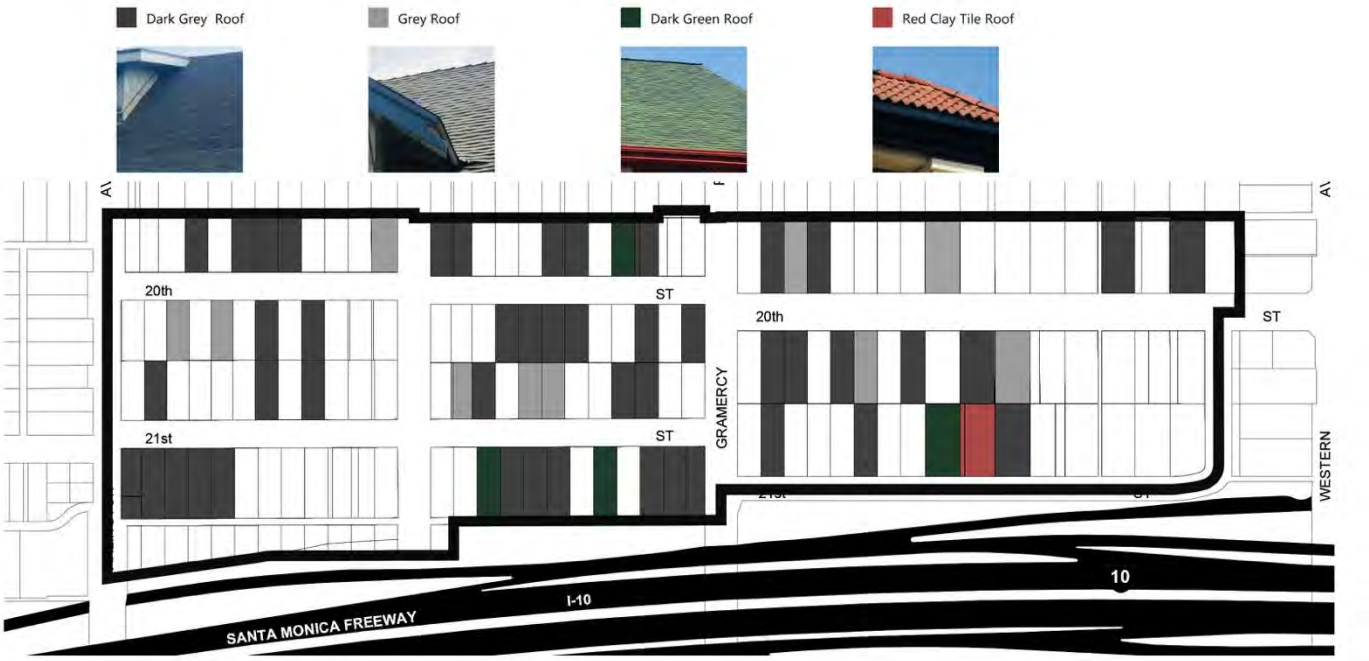

Fig 5.6: Map of all candidates with their roof colors. Source: Figure is produced by author.

Analysis and Comparison

The field survey identified fifty-nine properties out of 127 total contributing properties as candidates for adopting solar roofs. Based on the survey, a new solar map was drawn to document each property's access to solar resources. (Figure 5.7) Information from the L.A. County Solar Map including the rooftop area, area suitable for solar resources, and solar photovoltaic (PV) potential is collected in Table 5.2, in preparation for later calculation.

Fig 5.7 Solar map of all candidates in the Western Heights HPOZ. Source: Figure is produced by author based on L.A. County Solar Map.

Table 5.2 shows the calculation and comparison of adopting solar roofs in the Western Heights HPOZ. There are several points that need to be explained:

- "Suitable Area for PV (Sq. Ft)" means the total roof area that is available to solar PV resource, provided by the L.A. County Solar Map. "Suitable Area for Solar Panels (Sq. Ft)" is calculated by the author based on the area that could install solar panels in keeping with preservation design guideline. For example, areas like rear roofs and side roofs that are rarely visible from street level. As a result, "Solar Panels Potential (kWh/day)" in the table is not the same as the solar PV potential exactly provided by L.A. County Solar Map, which is the maximum energy production of using solar panels on all suitable area. Also, some properties in the historic district that could not install solar panels due to visual impacts will have a zero score in the table.
- The data of energy efficiency of solar roofs is based on three companies' products in different exposed area, as well as maximum power: 1) the Apollo Tile, produced by CertainTeed Solar, has size of 46" × 13.25" with maximum power 63 Watts per tile / 14.89 Watts per square foot; 2) the Sunslate6, produced by Aesthetic Green Power, has size of 14.5" × 19.688" with maximum power 23 Watts per tile / 11.6 Watts per square foot; 3) the Sun Roof, produced by Tesla, has size of 8.65" × 14" with

maximum power 12 Watts per tile / 14.3 Watts per square foot.[96] Full information of Apollo Tile and Sunslate6 is displayed in Appendix B and C. (Appendix B, C) Although they are in various sizes, the unit conversion indicates that they all have similar energy efficiency per square foot, which is about 14 Watts. The calculation in Table 5.2 uses 14 Watts per square foot as the solar roofs' energy production.

- The potential output of solar panels is measured in kWh per day. This is calculated by multiplying solar PV potential system size in kW by 5.3 hours of generation per day, based on the calculation method from the solar rooftop potential report by L.A. County Solar Map. (Appendix D)
- The potential output for the solar roof multiplies the calculated area by 14 Watts per square foot by 5.3 hours of generation per day times 1 kW. The calculation includes two ways with different calculated area: 1) to use the same roof area that solar panels use for solar roofs ("Solar Roofs as Panels, kWh/day"); 2) to use the solar roofs on all area that are suitable for PV, provided by L.A. County Solar Map ("Solar Roofs on All Suitable Area, kWh/day"). For example, the #8 property has 225 square feet suitable area for PV, but only 50 square feet could be installed with solar panels due to visual issues. In the "Solar Roofs as Panels, kWh/day" column, the calculation adopts 50 square feet, while for the "Solar Roofs on All Suitable Area, kWh/day" column, the calculation adopts 225 square feet.

[96] 46" × 13.25" with maximum power 63 Watts is Apollo Tile by CertainTeed Solar, https://www.certainteed.com/resources/ApolloTileIITDS.pdf;
14.5" × 19.688" with maximum power 23 Watts is Sunslate6 by Aesthetic Green Power, http://aestheticgreenpower.com/wp-content/uploads/2018/04/Sunslates6-Specs-Rev2.0.pdf; 8.65" × 14" with maximum power 12 Watts is Sun Roof by Tesla, https://electrek.co/2017/06/20/tesla-solar-roof-more-details-certification/.

#	No.	Site Address	Roof Plane Types	Orientation	Roof Plane Materials	Color	Rooftop Area (Sq. Ft)	Suitable Area for PV (Sq. Ft)	Suitable Area for Solar Panels (Sq. Ft)	Solar Panels Potentials (kWh/day)	Solar Roofs as Panels (kWh/day)	Solar Roofs on All Suitable Area (kWh/day)
1	2371	W 20TH ST	Hip	South	Shingle	Dark grey	2066	50	50	5.3	3.7	3.7
2	2361	W 20TH ST	Front gable	South	Shingle	Dark grey	3046	225	225	21.2	16.7	16.7
3	2355	W 20TH ST	Side gable	South	Shingle	Dark grey	2820	400	×	×	×	29.7
4	2351	W 20TH ST	Front gable	South	Shingle	Dark grey	3263	150	100	10.6	11.1	11.1
5	2325 2327	W 20TH ST	Cross gable	South	Shingle	Grey	2258	425	×	×	×	31.5
6	2315 2317	W 20TH ST	Hip	South	Shingle	Dark grey	2147	50	×	×	×	3.7
7	2307	W 20TH ST	Front gable	South	Shingle	Grey	2117	150	×	×	×	11.1
8	2287	W 20TH ST	Front gable	South	Shingle	Dark grey	2836	225	50	5.3	3.7	16.7
9	2279	W 20TH ST	Cross gable	South	Shingle	Dark grey	2516	150	150	15.9	11.1	11.1
10	2265 2267	W 20TH ST	Cross gable	South	Shingle	Dark green	1697	100	×	×	×	7.4
11	2255 2257	W 20TH ST	Cross gable	South	Shingle	Dark grey	2709	25	×	×	×	1.9
12	2237	W 20TH ST	Hip	South	Shingle	Dark grey	1794	50	×	×	×	3.7
13	2231	W 20TH ST	Cross gable	South	Shingle	Grey	2091	225	225	21.2	16.7	16.7
14	2225	W 20TH ST	Cross gable	South	Shingle	Dark grey	1944	125	125	10.6	9.3	9.3
15	2179	W 20TH ST	Hip and gable	South	Shingle	Grey	3010	150	150	15.9	11.1	11.1
16	2143	W 20TH ST	Cross gable	South	Shingle	Dark grey	4459	300	300	26.5	22.3	22.3
17	2129	W 20TH ST	Cross gable	South	Shingle	Dark grey	2578	100	100	10.6	7.4	7.4
18	2376	W 20TH ST	Cross gable	North	Shingle	Grey	1699	0	0	0	0.0	0.0
19	2364 2366	W 20TH ST	Cross gable	North	Shingle	Grey	1438	50	50	5.3	3.7	3.7
20	2354 2356	W 20TH ST	Hip	North	Shingle	Dark grey	2595	125	125	10.6	9.3	9.3
21	2342 2344	W 20TH ST	Hip	North	Shingle	Dark grey	2191	50	50	5.3	3.7	3.7
22	2298	W 20TH ST	Hip and front gable	North	Shingle	Dark grey	2328	100	100	10.6	7.4	7.4
23	2294	W 20TH ST	Gambrel	North	Shingle	Dark grey	1806	0	0	0	0.0	0.0
24	2288	W 20TH ST	Cross gable	North	Shingle	Dark grey	2372	150	150	15.9	11.1	11.1
25	2280	W 20TH ST	Cross gable	North	Shingle	Dark grey	2361	275	275	26.5	20.4	20.4
26	2260 2262	W 20TH ST	Cross gable	North	Shingle	Dark grey	2636	75	50	5.3	5.6	5.6
27	2250	W 20TH ST	Cross gable	North	Shingle	Dark grey	2910	200	200	15.9	14.8	14.8
28	2236	W 20TH ST	Side gable	North	Shingle	Dark grey	3254	375	375	31.8	27.8	27.8

#	No.	Site Address	Roof Plane Types	Orientation	Roof Plane Materials	Color	Rooftop Area (Sq. Ft)	Suitable Area for PV (Sq. Ft)	Suitable Area for Solar Panels (Sq. Ft)	Solar Panels Potentials (kWh/day)	Solar Roofs as Panels (kWh/day)	Solar Roofs on All Suitable Area (kWh/day)
29	2230	W 20TH ST	Cross gable	North	Shingle	Dark grey	2288	175	175	15.9	13.0	13.0
30	2218	W 20TH ST	Cross gable	North	Shingle	Dark grey	2864	375	375	31.8	27.8	27.8
31	2214	W 20TH ST	Cross gable	North	Shingle	Grey	2798	275	275	26.5	20.4	20.4
32	2202	W 20TH ST	Hip	North	Slate	Dark grey	2906	0	0	0	0	0
33	2170	W 20TH ST	Side gable	North	Shingle	Dark grey	2441	0	0	0	0	0
34	2164	W 20TH ST	Side gable	North	Shingle	Grey	3433	0	0	0	0	0
35	2383	W 21ST ST	Cross gable	South	Shingle	Dark grey	2542	275	275	26.5	20.4	20.4
36	2357	W 21ST ST	Cross gable	South	Shingle	Dark grey	2606	475	475	42.4	35.2	35.2
37	2345 2347	W 21ST ST	Side gable	South	Shingle	Dark grey	2237	275	150	15.9	11.1	20.4
38	2307	W 21ST ST	Side gable	South	Shingle	Grey	2053	150	150	15.9	11.1	11.1
39	2301	W 21ST ST	Cross gable	South	Shingle	Dark grey	2107	250	250	21.2	18.6	18.6
40	2291	W 21ST ST	Cross gable	South	Shingle	Grey	2046	275	275	26.5	20.4	20.4
41	2283	W 21ST ST	Cross gable	South	Shingle	Grey	1733	350	350	31.8	26.0	26.0
42	2267	W 21ST ST	Cross gable	South	Shingle	Dark grey	2372	275	275	26.5	20.4	20.4
43	2261	W 21ST ST	Cross gable	South	Shingle	Dark grey	2498	325	325	26.5	24.1	24.1
44	2233	W 21ST ST	Hip and gable	South	Shingle	Dark grey	2924	225	225	21.2	16.7	16.7
45	2211	W 21ST ST	Cross gable	South	Shingle	Dark grey	2568	175	175	15.9	13.0	13.0
46	2179	W 21ST ST	Side gable	South	Shingle	Green	4070	100	100	10.6	7.4	7.4
47	2173	W 21ST ST	N/A	South	Red clay tile	Red	2151	0	0	0	0	0
48	2167	W 21ST ST	Side gable	South	Shingle	Dark grey	3624	375	×	×	×	27.8
49	2388	W 21ST ST	Cross gable	North	Shingle	Dark grey	1943	200	200	15.9	14.8	14.8
50	2384	W 21ST ST	Hip and gable	North	Shingle	Dark grey	3331	275	275	26.5	20.4	20.4
51	2378	W 21ST ST	Cross gable	North	Shingle	Dark grey	3287	50	50	5.3	3.7	3.7
52	2372	W 21ST ST	Side gable	North	Shingle	Dark grey	3650	0	0	0	0	0
53	2366 2368 2370	W 21ST ST	Gambrel	North	Shingle	Dark grey	1952	400	400	37.1	29.7	29.7
54	2302	W 21ST ST	Cross gable	North	Shingle	Green	2932	225	225	21.2	16.7	16.7
55	2298	W 21ST ST	Hip and gable	North	Shingle	Dark grey	3364	150	150	15.9	11.1	11.1

#	No.	Site Address	Roof Plane Types	Orientation	Roof Plane Materials	Color	Rooftop Area (Sq. Ft)	Suitable Area for PV (Sq. Ft)	Suitable Area for Solar Panels (Sq. Ft)	Solar Panels Potentials (kWh/day)	Solar Roofs as Panels (kWh/day)	Solar Roofs on All Suitable Area (kWh/day)
56	2294	W 21ST ST	Front gable	North	Shingle	Dark grey	2733	250	250	21.2	18.6	18.6
57	2288	W 21ST ST	Front gable	North	Shingle	Dark grey	3280	150	150	15.9	11.1	11.1
58	2274	W 21ST ST	Cross gable	North	Shingle	Green	3465	175	175	15.9	13.0	13.0
59	2260 2256 2250	W 21ST ST	Cross gable	North	Slate	Dark grey	5483	300	300	26.5	22.3	22.3
Total (kWh/day)										826.8	673.7	803.2

Table 5.2: Analysis and calculation of solar roofs energy efficiency. Source: Table is produced by author.

Impacts Study

Within the calculation of fifty-nine of 127, forty-seven percent contributing candidates, there are five circumstances to be noticed:

1) Seven properties have no access to solar resources according to the L.A. County Solar Map, such as #18, #23, #32, etc. These properties are counted as "0" in the table. As a result, there are only fifty-two properties that could use solar roofs;

2) Eight properties are not available to install solar panels due to visual impacts, such as #3, #5, #6, #10, #11, counted as "x" in the table; (Figure 5.8)

3) There are some properties facing south where only a partial installation is possible due to visual impacts, such as #14, #16, #39, etc. (Figure 5.9) For these properties, the comparison still shows that the adoption of solar roofs can produce almost the same energy as solar panels, even though the energy efficiency of solar roofs is approximate seventy percent of solar panels.

4) In case of those properties that could install solar panels in all suitable areas, the total energy production of solar roofs is less than the solar panels', such as #1, #2, #8, etc.

5) Properties that have suitable area for PV less than a hundred square feet are actually not recommended to install solar energy system. Since the energy production is so small the cost of installation cannot be justified, such as #1, #6, #12, etc.

Fig 5.8: Photos shows #10 and #11 properties with their solar maps. The solar maps indicate solar access on front roofs. Yet, according to preservation plan that "solar panels should not be placed upon rooftops that are visible to the general public", it will be inappropriate to install solar panels on the front roofs of these two properties. Sources: Photos by author, the solar maps are based on L.A. County Solar Map.

Fig 5.9: Photos show #14 property with its solar map on right. It will be inappropriate to install solar panels on the front roof that could be viewed from the streets, but it may be possible to install solar panels on top of the front gable. Sources: Photos by author, the solar maps are based on L.A. County Solar Map.

It should be noted that using the national average energy demand per household of 28.5 kWh per day (10,400 kWh per year divided by 365 days per year), only four of the properties can completely cover their energy demand with solar (#28, #30, #36, and #41).[97] At 42.4 kWh per day for panels / 35.2 kWh per day for solar roofs, Property #36 appears to have the highest solar potential. Using the system installation cost and annual energy savings from the L.A. County Solar Map report, the payback period (the time period where energy savings pays for installation cost) is approximately sixteen years.

For all candidate properties in the Western Heights HPOZ, the total energy production of solar roofs is approximate 803.2 kWh versus 826.8 kWh of solar panels per day. The energy production turns out to be similar since solar panels are only installed at places that are minimally viewed by the public, while solar roofs can be adopted in a larger area since it will cause less visual impacts in a historic district. Even though the solar panels are more efficient, it cannot be installed in most place that could be seen from the public view. Also, it should be notice that the difference of energy production of solar panels and solar roofs will be narrower with a smaller suitable area for PV. Neither solar panels nor solar roofs would be applicable for those properties with incompatible roof colors.

The installation of solar roofs could be conducted by replacing only portions of historic roofing materials, such as the rendering of a contributing property in the Western Heights HPOZ with solar roofs in Figure 5.10. (Figure 5.10) Some companies like Tesla will encourage the owner to replace the whole roof with parts of solar roofs and others of regular roof materials that produced by the same company without solar cells inside for matching. The company recommends using only thirty-five percent of solar roofs and fulfilling in the rest with non-solar tiles.[98] It is another method to consider for conserving the feeling of a historic property while improving the building envelope at the same time.

The exploration in the Western Heights HPOZ shows the possibility of adopting solar roofs with fifty-two of 127, approximately forty-one percent contributing properties that could use solar roofs. The outcome indicates that the energy production of solar roofs could be very similar to solar panels for all suitable properties in the historic district. Still, the research is

[97] Luke Richardson, "How Much Do Solar Panels Save?" *Energysage*, January 1, 2019, https://news.energysage.com/much-solar-panels-save/.

conducted under the ideal situation with maximum energy production of both solar panels and solar roofs. There is very limited data of solar roofs in a long term currently, and the outcome may be different regarding regional conditions like solar angle as well as weather issues. Moreover, the price of solar roofs could be twice to four times as expensive as solar panels depending on different products.[99] It is still too high for the solar roofs to be popular in normal residential properties right now.

Fig 5.10: The rendering of a contributing property with solar roofs in the Western Heights HPOZ. Source: Figure is produced by author.

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[98] Hadley Keller, "What you should know before buying Tesla's Solar Roof Tiles?"

[99] "Solar Panel vs Solar Shingles," *Fixr*, last modified on July 5, 2018, https://www.fixr.com/comparisons/solar-panels-vs-solar-shingles.

Conclusion

In the era of sustainable conservation, the exploration of new technology enables heritage conservation to have more methods for saving our buildings.[100] Although many preservation design guidelines do encourage the adoption of renewable energy like solar systems on historic properties, the gap still remains in conserving historic characters and adopting new building systems like solar panels. While the new technology like solar roofs is gradually used in architecture design currently, limited experiments are on historic property. The thesis tries to explore the possibility of adopting solar roofs in a historic district. The Western Heights Historic Preservation Overlay Zone (HPOZ) in Los Angeles is selected as a study plot. Besides the appropriate physical conditions of the Western Heights HPOZ, the policies and rich context of using solar energy in Los Angeles also encourage this HPOZ to be a good candidate for installing solar roofs. The research has identified fifty-nine of 127, approximately forty-seven percent of contributing properties that are compatible with solar roofs. Fifty-two of 127, approximately forty-one percent, of contributing properties could actually produce enough electricity to make solar roofs theoretically worthwhile. The result turns out solar roofs can produce similar total energy as solar panels in all appropriate properties of a historic district.

A successful example of exploring solar roofs will no doubt inspire other HPOZs with similar conditions such as Harvard Heights, which have 573 contributing properties and many of them are in Craftsman styles with shingle roofs. Also, this will make a great impact on sustainable development if it can bring other historic districts around the country in the conversation.

Still, additional research is required. This thesis is narrow in scope with a hypothesis that is based on an ideal maximum production of solar roofs. There is possibility that when it is applied in a larger scale, the result will vary. Also, there is not sufficient data over a long term of the solar roofs and all the performance information is provided by manufacturers. Especially for red tile roofs, a compatible product is still hypothetical. Concern also remains in the high expense of implementing solar roofs. Is a payback period of fifteen years or higher affordable for

[100] The term of "advocates for heritage conservation" is giving credit to all people in this field rather than just preservationists, including students, future professionals, academic and professionals, planners, architects, engineers, scientists, etc.

homeowners in historic districts? Yet, it is likely that as production increases, it will reduce the cost similarly to solar panels in 1980s.

The research is conducted under no preservation design guideline since there is a lack of reference guideline for solar roofs. The preservation design guidelines of the City of Los Angeles only mention the adoption of solar panels in a historic property, and there has no case of using solar roofs in the city yet. Moreover, Los Angeles will not require historic property to go through any preservation design review under the California Solar Act. It is suggested that preservation design guideline to be evolved along with burgeoning technology like solar roofs. Questions like whether it is available to install solar roofs on a visible front roof, whether it is appropriate to replace historic roofing materials with solar roof tiles, and whether it is possible to install solar roofs on a vertical shingled wall should be addressed. Ideally, a comprehensive strategy needs to be charted out with clear goals for sustainability in a design guideline. Design reviews are required in order to conserve historic integrity. This will organize the extent of detail which should be provided with specific topics, such as solar systems installation, windows replacement, etc.[101]

To adopt solar roofs practically, besides preservation guidelines, there are more to consider such as the preparation of installation with professionals, and installation technique with the local energy companies. For cities like Los Angeles which has sufficient solar resources and supportive policies, it will be better for encouraging sustainable conservation by proposing new incentive programs for adopting solar roofs in historic properties.

It is expected that the advocates for heritage conservation are familiar with not only preservation policies but also upgrading technology that can improve the performance of a historic building. Besides solar roofs, there are other new technologies that could be adopted within a historic property and needed to be explored. Bringing properties' owners as well as experts from other disciplines into the conversation will be another challenge for popularizing new technology.

In 2018, the United States has experienced several extreme weather events. California had its hottest summer with several massive fires, while parts of New England and New York

[101] Nore Winter, "Developing 'Green' -Friendly Guidelines: Advice for Preservation Commissions," Forum News, Volume 17, Issue 4, December 1, 2010, https://forum.savingplaces.org/viewdocument/developing-green-friendly-guidel.

have a historically snowy November.[102] In the circumstance of climate change, human beings must do everything to preserve the limited resources for future generations. While heritage conservation is already playing its role in sustainable development, in keeping with evolving technology day by day like solar roofs will achieve more opportunities to make a building greener. The exploration for adopting solar roofs within the Western Heights HPOZ in Los Angeles tries to provide a reference of greening historic properties with new technology. The goal of heritage conservation is never to stop the changing of our heritage but to manage change. Historic buildings should be allowed to evolve for satisfying the ever-changing needs of our environment. The greenest building is the one that has already been built.[103]

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[102] Ian Livingston, "The Five Most Extreme Weather Events of 2018 in the United States," *the Washington Post*, December 31, 2018, https://www.washingtonpost.com/weather/2018/12/31/five-most-extreme-weather-events-united-states/?noredirect=on&utm_term=.dc8a0bb9ae49.
[103] Elefante, "The Greenest Building," 26.

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Appendix A: Incorporating Solar Panels in a Rehabilitation Project

National Park Service
U.S. Department of the Interior
Technical Preservation Services

ITS
NUMBER 52

Interpreting
The Secretary of the Interior's Standards for Rehabilitation

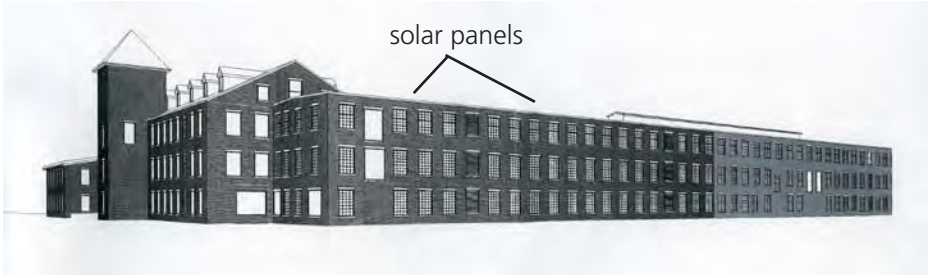
Subject: Incorporating Solar Panels in a Rehabilitation Project

Applicable Standards:
2. Retention of Historic Character
9. Compatible Additions/Exterior Alterations

Issue: Enhancing the energy efficiency of a historic building is important. To that end, it is often possible to install features such as solar panels and photovoltaic cells provided they are installed in a sensitive manner. Because these elements must be positioned to take advantage of unobstructed sunlight, the roof of a historic structure is an obvious location. The roofline of a historic building is often a distinctive feature. Therefore, the installation of solar panels should conform to guidance regarding rooftop additions, i.e. that they be minimally visible, to avoid altering the historic character of the building. Historic buildings with a flat roof or parapet can usually accommodate solar panels because the panels will be hidden, while properties with a hipped or gabled roof are generally not good candidates for a rooftop solar installation. Solar panels on historic buildings should not be visible from the public right of way such as nearby streets, sidewalks or other public spaces.

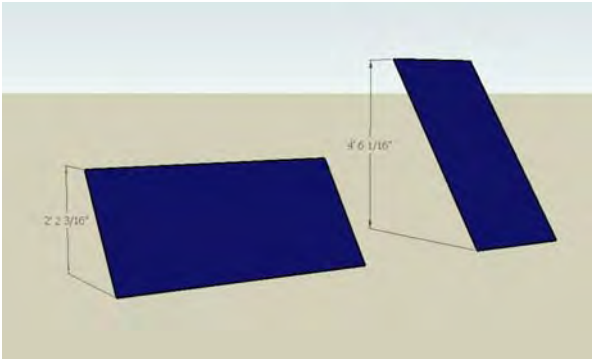
In circumstances where solar collectors are not placed on rooftops, they should only be positioned in limited or no-visibility locations in secondary areas of the property. Vegetation or a compatible screen may also be an option to further reduce the impact of these features on a historic property. For some historic buildings, it may not be possible to incorporate solar panels and meet the Secretary of the Interior's Standards for Rehabilitation.

Application 1 (*Compatible treatment*): The rehabilitation of this mid-nineteenth century mill incorporated a large, roof-mounted photovoltaic installation. Although the historic building does not have a parapet wall at the roofline, the height of the building and the arrangement of the panels render the entire installation invisible from the ground. It is important to note that the panels are placed horizontally. Had the panels been installed with a vertical tilt, the angle required to maximize efficiency would have caused the panels to extend significantly higher above the roof. Simply changing the direction in which the panels are tilted can affect their visibility and reduce their impact on the character of the historic property.



Because of the size of this historic mill, a large array of solar panels could be installed on the flat roof without being seen from the ground.

Solar panels installed on the flat roof.



By placing the panels horizontally, the overall height of the installation and its visibility is reduced.

Application 2 (*Incompatible treatment*): During the rehabilitation of this late-nineteenth century commercial building, a conspicuous rooftop monitor with prominent solar panels and skylights was constructed on the one-story structure. The size and finish of this rooftop addition are incompatible with the historic character of the building. However, the building could have accommodated both skylights and solar panels if they had been installed differently. An alternative design that could have met the Standards would have included low-profile skylights and solar panels concealed behind the parapet wall.

The addition of a large rooftop monitor featuring skylights on the front slope and solar panels on the rear slope is not compatible with the historic character of this small, one-story commercial building.

Application 3 (*Compatible treatment*): The rehabilitation of this historic post office incorporated solar panels as dual-function features: generation of electricity and shading for south-facing windows. In this instance, the southern elevation of the building is also a secondary elevation with limited visibility from the public right of way. Additionally, because this area of the building is immediately next to the post office's loading dock, it has a more utilitarian character than the primary facades and, therefore, can better accommodate solar panels. Because the panels are in a suitable location at the rear of the property and are appropriately sized to serve as awnings, they do not affect the overall historic character of the property. Additionally, a screen of tall plantings shields the solar panels from view from the front of the building, further limiting their visibility.

Above: *Shown from the rear of the property, these solar panels serve a secondary function as awnings to shade south-facing windows. Because of their location at the back of the building immediately adjacent to a loading dock, the installation of these panels does not affect the historic character of the property.*

Left: *The solar panels are not visible from the front of the building. Additionally, even if the vegetation were removed, the installation would only be minimally visible along an alley at the rear of a secondary side elevation.*

Jenny Parker, Technical Preservation Services, National Park Service

Appendix B: Apollo Tile II Solar Roofing System – CertainTeed Solar

CertainTeed Solar

APOLLO® TILE II
SOLAR ROOFING SYSTEM

See reverse for product specifications

A high-efficiency solar tile designed for integration with most tile roofs.

Features and Benefits

- ***Functional:*** The Apollo Tile II system functions as both a roof and a solar array
- ***Beautiful:*** An earth-toned custom frame combined with a profile that matches flat concrete tiles provides a clean, integrated aesthetic
- ***Efficient:*** Modules use 14 high-efficiency monocrystalline solar cells
- ***Strong:*** Mechanical load rating of 250 lbs per square foot
- ***Lightweight:*** Weighs significantly less than a tile roof eliminating the need for structural review or reinforcement
- ***Wind Resistant:*** Tested to the highest wind standards and backed by a 110mph wind warranty
- ***Water Shedding:*** Built-in water management features
- ***Easy to Install:*** Open space under the modules and built-in wire clips allow for easy wire management and installation
- ***Aesthetic:*** Brown (frame); black (cells) on black (backsheet) provides a greater aesthetic and visually blends with most concrete tile colors

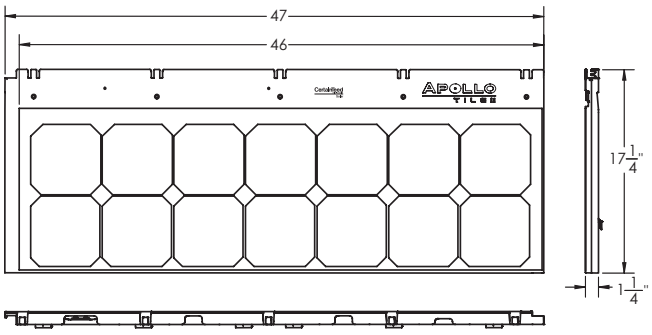
Each System Includes

- 63 watt, high-efficiency monocrystalline modules
- Waterproof and fire-resistant underlayment membranes
- Flashing accessories
- Starter strip and wind clips
- String inverter
- Home run wiring
- Monitoring system (optional)

MADE IN USA
using foreign and domestic components

CertainTeed
SAINT-GOBAIN

Dimensions



Electrical Characteristics

Standard Test Conditions: 25 C, 1kW/m², AM 1.5

Maximum Power (Pmax)	63W
Maximum Power Voltage (Vmp)	7.27 V
Maximum Power Current (Imp)	8.67 A
Open Circuit Voltage (Voc)	9.28 V
Short Circuit Current (Isc)	9.25 A
Maximum System Voltage	600 V
Series Fuse Rating	15 A
Performance Tolerance	+/- 3%
Conversion Efficiency	16%
Power Temp. Coefficient (Ptmp)	-0.45%/˚C
Voltage Temp. Coefficient (Vtoc)	-0.30%/˚C
Normal Operating Cell Temp. (NOCT)	53.5˚C
PTC Rating	54.1W

Absolute Maximum Ratings

Parameters	Rating	Unit
Operating Temperature	-40 to +90	˚C
Storage Temperature	-40 to +90	˚C
Dielectric Voltage Withstood	600 Max	V-DC

Mechanical Characteristics

Exposed Area	46” x 13.25”
Weight	13 lbs (3.1 lbs per sq ft)
Cell	Monocrystalline
No. of cells and connections	14 in series
Bypass Diode	1 per panel
Load Rating	250 lbs/sq ft
Wiring	14 AWG PV wire
Connectors	MC4-EVO 3

Warranty and Certifications

Warranty	25 year limited power warranty 10 year limited product warranty
Certifications	Certified to UL 1703 by CSA UL 790 Class A Fire Rating ASTM D3161 Class F IEC 61215 California CEC Listed

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Appendix C: Sunslate6 Installation Manual – Aesthetic Green Power

Table of Contents

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1. About this Installation Manual

Aesthetic Green Power provides these guidelines for the installation of Sunslates6™ PV roofing slates to assist the applicator in creating an efficient and workman-like application. Although this manual provides details for typical conditions encountered on slate applications, all application details are beyond the scope of this text. When encountering any conditions not illustrated in this manual, please contact Aesthetic Green Power for assistance.

All materials utilized in the construction, including fasteners, flashing, felts and penetrations, should be selected to provide the same life as the Sunslates6™ installation (50 year life-time expected). The installer must use all of the electrical materials (cables, junction boxes, inverters etc.) specified in this manual. Artificially concentrated sunlight shall not be directed on the module. Failure to conform to these installation guidelines will void the Aesthetic Green Power and/or Eternit warranty.

2. Sunslates6™ Specifications

2.1 Sunslates6™ Physical Specifications

Sunslates6™ are a roofing material that use solar energy to produce electrical energy. Sunslates6™ are composed of:

1. Solar Module
2. Connection Box
3. Eternit Fiber Cement Roofing Slate
4. Wire Clips

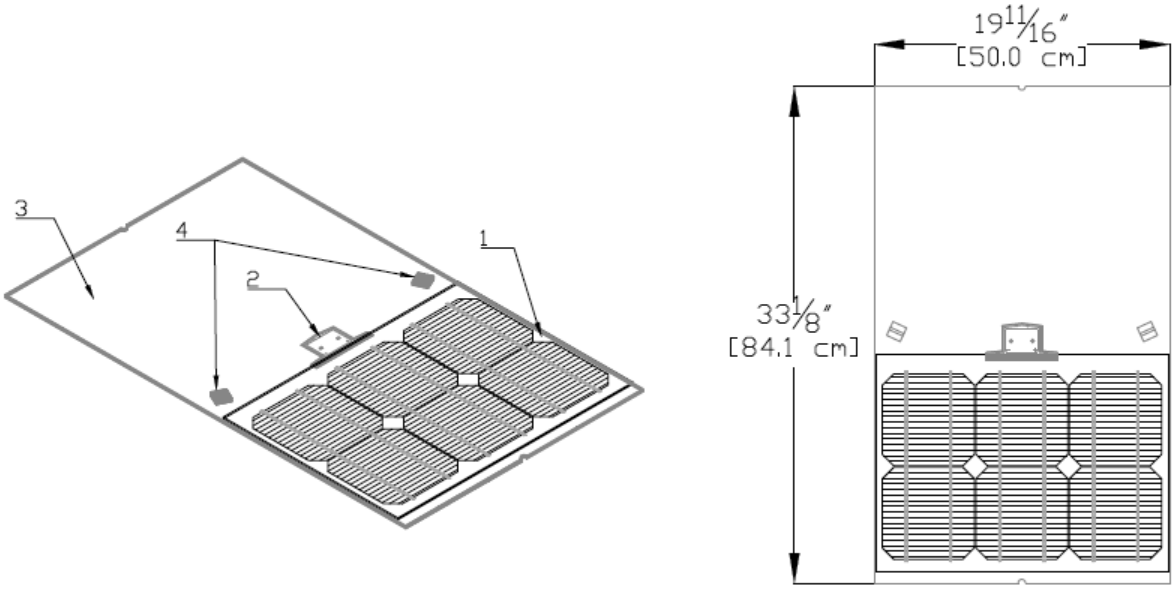


Figure 1 – Sunslates6™ Components and Dimensions

Exposed Surface	19-11/16" x 14-1/2" (50.0 cm x 36.8 cm)
Total Sunslates/ 100 ft^2	50 Sunslates/ 100 ft^2
Powered Sunslates/ 100 ft^2	45 Powered Sunslates/ 100 ft^2
Weight/ Sunslate	14.3 lbs. (6.49 kg)
Sunslate Weight/100 ft^2	715 lbs (324 kg)/ 100 ft^2

2.2 Sunslates6™ Electrical Specifications

The electrical characteristics are within ±5% of the indicated values of I_{sc}, V_{oc} and P_{max} under Standard Test Conditions (STC)[1]. Depending on ambient conditions, time of day, time of year, and shading, Sunslates6™ may produce more current and/or voltage than reported at STC. Accordingly, the rated values of I_{sc} and V_{oc} should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, fuse size and the size of controls connected to the PV output.

The Sunslates6™ module consists of six 6" (156mm) mono-crystalline PV cells connected in series.

Note: All characteristics are at Standard Test Conditions (STC)

Model	SS156GM
Power	23 Watts
I_{SC}	8.55 ADC
V_{oc}	3.76 VDC
I_{MPP}	8.07 ADC
V_{MPP}	2.85 VDC

This product adheres to UL Standard 1703 and is CEC listed. All module components rated for 600 VDC. Please see Section 7.1 for limitations on series string voltage.

Roofing Material Fire Rating - **Class A**

3. Sunslates6™ Storage and Handling

Store Sunslates6™ and Eternit slates in a clean, dry, well ventilated area, protected from the weather. As soon as the slates have been delivered and stored under cover, split the plastic wrap to allow for ventilation to prevent excessive water condensation. If the slates should get wet in storage, efflorescence is likely to occur. Mild efflorescence of the slates will usually disappear over a period of time. Severe efflorescence may require special treatment. Contact the Technical Department at Eternit Inc. or Aesthetic Green Power for details.

Do not handle Sunslates6™ in rainy or wet weather conditions (water must not enter the connection box).

[1] Standard Test Conditions (STC): 1000 W/m^2 irradiance, 25°C temperature, and AM 1.5 spectrum

4. Tools and Materials Used for Installing the Sunslates6™ Roof

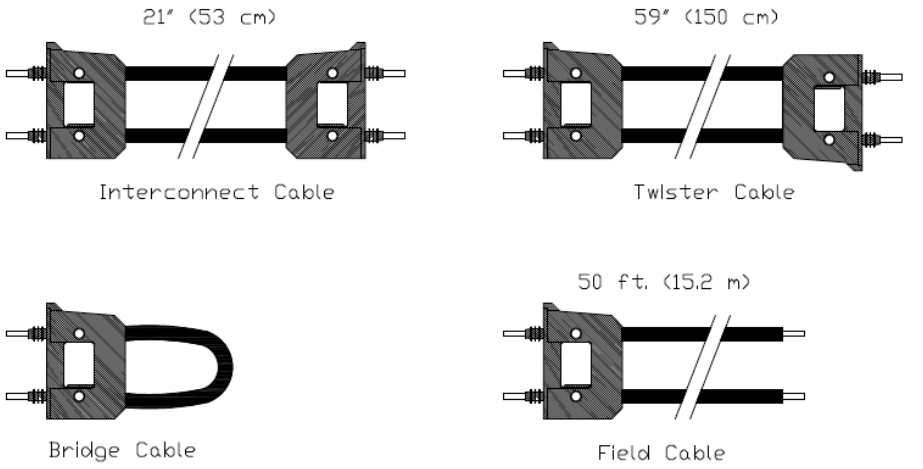
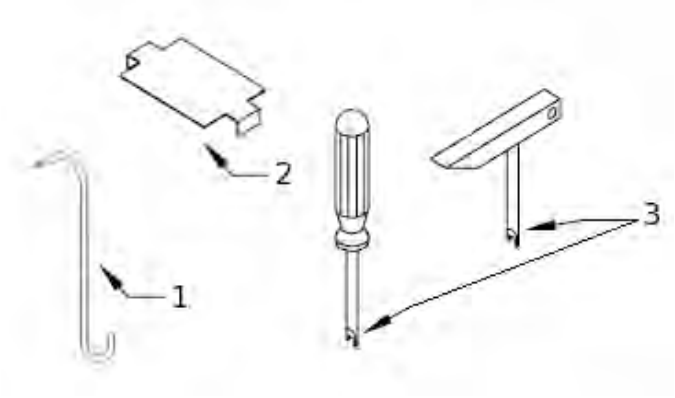
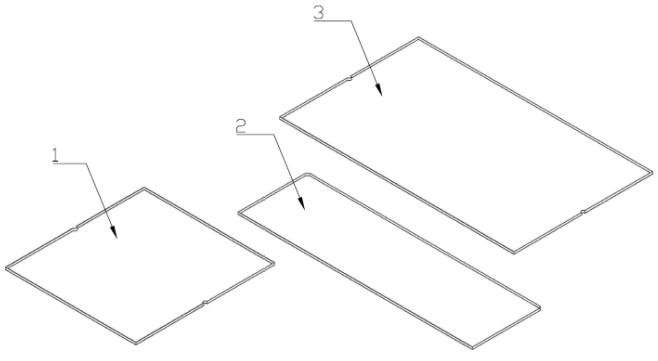


Figure 2 – Sunslates6™ Cables



1	Sunslates6™ Hook
2	Protection Shield
3	Connection Opener

Figure 3 – Hardware and Tools

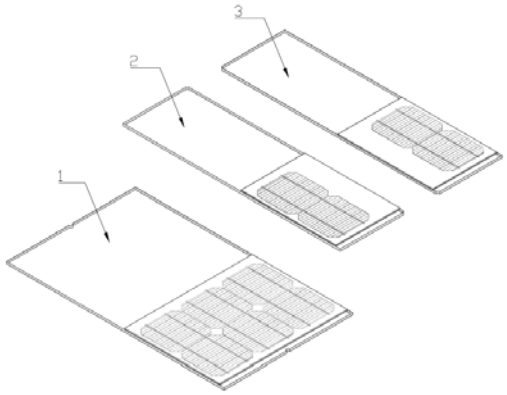


1	Starter Slate	18-1/2” x 19-11/16” (47.0 cm x 50.0 cm)
2	Half Slate	33-1/8" x 9-13/16" (84.1 cm x 24.9 cm)
3	Main Slate	33-1/8” x 19-11/16” (84.1 cm x 50.0 cm)

Figure 4 –Eternit Slates

Starter Slates are installed under the first row of Sunslates6™.

Main slates and half slates are optional for finishing the edges and/or eaves of roof.



1	NP Sunslates6™	33-1/8” x 19-11/16” (84.1 cm x 50.0 cm)
2	Left NP Sunslates6™	33-1/8" x 9-13/16" (84.1 cm x 24.9 cm)
3	Right NP Sunslates6™	33-1/8" x 9-13/16" (84.1 cm x 24.9 cm)

No-Power (NP) Sunslates6™ are used for aesthetic purposes only. There is no electrical performance from the NP Sunslates6™.

Figure 5 – NP Sunslates6™ (optional)

Other Materials (not provided by Aesthetic Green Power):

1. Ice and water shield (optional)
2. 30 lb. roofing felt
3. Metal flashing and drip edges
4. Wooden battens
    a. 2x2 vertical battens
    b. 1x4 horizontal battens
    c. 1x8 horizontal starter batten
    d. ½ x1 cant strip
5. 0.1205" x 2-1/2" galvanized steel nails or #10 2-1/2” galvanized steel wood screws
6. 0.1205” x 1-1/2” galvanized steel nails or #10 1-1/2” galvanized steel wood screws
7. Silicon adhesive (Recommended Shinetsu KE-45)

5. Cutting Eternit Slates

Eternit fiber cement slates can be cut and punched with a slater's hammer. For rapid and efficient cutting, punching and notching, a portable slate cutting machine may be utilized. Interior cuts in the slate can be accomplished with a pin punch and hammer. Individual slates can be faced, scored and snapped over a straight edge.

6. Preparing the Roof for Installation

Sunslates6™ are installed using the double overlap system provided by the Eternit, Inc. The double overlap system is a method of cladding thin panels to fixed battens. This method of cladding is characterized by the fact that at every point on the surface, there are at least two layers of slate. To get a good water and airtight seal, an underlayment of roofing-felt, vertical battens and horizontal battens is necessary.

6.1 Waterproofing the Roof

Use one layer of 30 lb. felt. In some areas an underlayment of ice and water shield may be required or desired as an upgrade. Use appropriate metal flashing, including drip edges where necessary.

6.2 Vertical Battens

Fix 2x2 battens to rafters, securing at not more than 24” on center using 0.1205" x 2-1/2" galvanized steel nails or #10 2-1/2” galvanized steel wood screws.

6.3 Horizontal Battens

A 1x8 horizontal starter batten and a ½x1 cant strip are required for the first row. 1x4 battens are used for the remainder of the horizontal battens. The bottom edge of the first 1x4 batten should measure 16-1/2" (41.9cm) from the bottom edge of the starter batten. Fix the remaining 1x4 battens to conform to chalk lines securing at 14-1/2" (36.8cm) on center. Use 0.1205" x 1-1/2" galvanized steel nails or #10 1-1/2" galvanized steel wood screws (two offset nails/screws per intersection). Please refer to the diagram below (Figure 6).

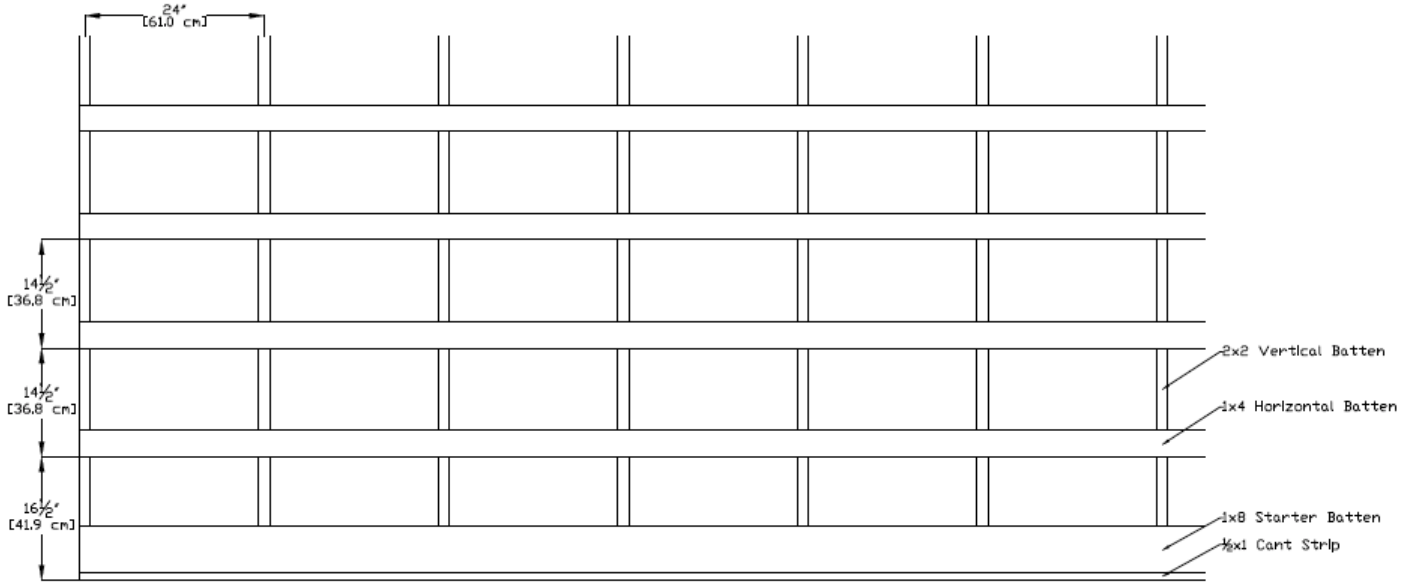


Figure 6 – Batten Layout

6.4 Installing the First Row of Hooks

Sunslates6™ are mounted on the roof using hooks. DO NOT nail or screw Sunslates6™ into the roof. Only starter slates, main slates, half slates, and NP Sunslates6™ may be nailed or screwed to the battens.

Place the first hook in the bottom row at 9-7/8" (25.1cm) from the edge of the first vertical batten and 4-1/2" (11.4cm) from the bottom edge of the starter batten (see Figure 7). To attach the hook, nail it directly into the starter batten. Use a chalk cord and water level to attach the remainder of the hooks in the first row at 20-1/16" (51cm) apart.[2] **It is extremely important that the first row hooks are aligned and spaced evenly.**

6.5 Marking Hook Locations

After it is insured that the first row hooks are in place, a series of chalk lines are used to mark the locations of the remainder of the hooks on the roof. Follow these steps carefully (refer to Figure 7):

1. Measuring from the starter hook line, create horizontal chalk lines spaced at 14-1/2" (36.8cm) up the roof slope.
2. Starting from each hook in the first row, create vertical chalk lines, marking the horizontal battens at every second intersection with the horizontal chalk lines (i.e. every 29" up the roof).
3. Create diagonal chalk lines that connect the hooks in the 1st, 3rd, 5th rows etc. Mark the locations on the 2nd, 4th, 6th etc. row battens where the diagonal chalk lines intersect the horizontal chalk lines.

[2] The hook-to-hook distance may be decreased slightly to 20" (50.8cm). **The spacing that is chosen for the first row must be used consistently for the remainder of the roof. The first row of hooks and starter slates are the most important to ensure an aligned roof.**

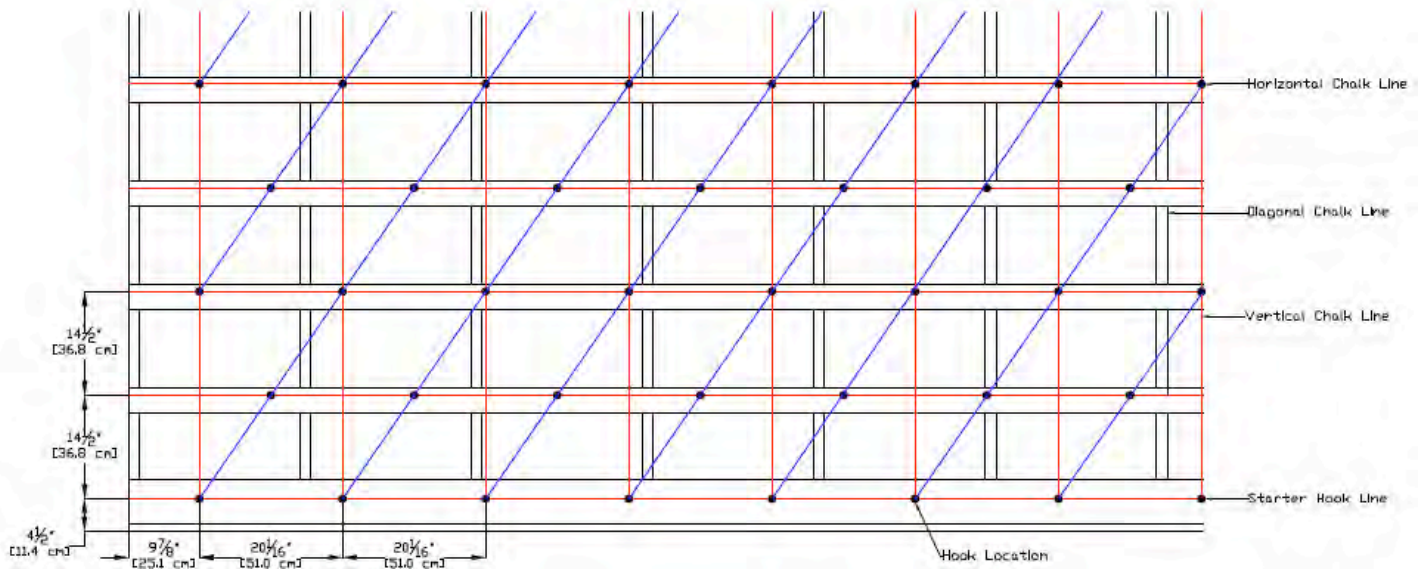


Figure 7 – Hook Locations using Chalk Lines

6.6 Fixing the Starter Slates

The starter slates are installed under the first row of Sunslates6™ and are fastened to the starter batten. One starter slate must be cut in half (Section 5) for use as the first and last starter slates in the row. Allow each starter slate to overhang the bottom edge of the starter batten by ½" (1.3cm) and center between the first row hooks. Secure with two nails into the starter batten (Figure 8).

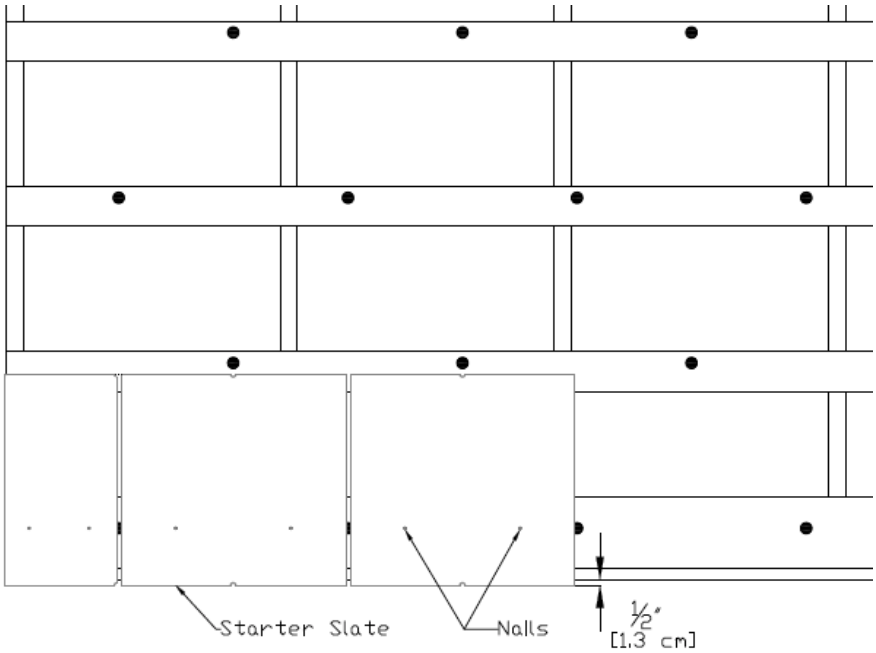


Figure 8 –Starter Slates

7. Sunslates6™ Installation Procedure

7.1 Sunslates6™ Field (String) Electrical Characteristics

The Sunslates6™ array is divided into sections called “fields” (aka. “strings”). All fields in the array contain an equal number of Sunslates6™ connected in series.

Although Sunslates6™ are rated for 600VDC, **DO NOT** connect more than 36 Sunslates6™ in series on the roof. If higher voltage is desired, a code compliant combiner box may be used to connect fields, up to a maximum of 60 Sunslates6™ in series. All connections under the roof are to be performed by a trained and licensed electrical contractor.

When calculating the operating voltage please refer to the inverter/charge controller input voltage specifications. Aesthetic Green Power is not responsible for design inconsistencies.

Maximum Series String Electrical Characteristics
(36 Sunslates6™ in Series)

Note: All characteristics are at Standard Test Conditions (STC)

Power	828 Watts
I_{SC}	8.55 ADC
V_{oc}	135.4 VDC
I_{MPP}	8.07 ADC
V_{MPP}	102.6 VDC

Series fuse rating: 15 Amps

For battery charging applications we recommend the following configuration:

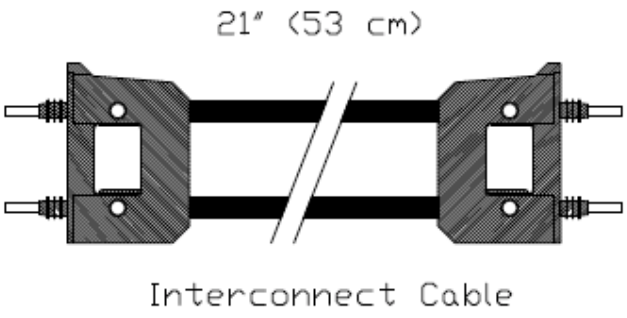
12 Volt Systems	24 Volt Systems	48 Volt Systems
6 Sunslates6™ in series	12 Sunslates6™ in series	24 Sunslates6™ in series

Aesthetic Green Power recommends that all system components, including batteries and electronic devices, are listed by a nationally recognized laboratory.

7.2 Sunslates6™ Cable Types

All cables for the installation (Interconnect cable, Twister Cable, Bridge Cable, and Field Cable) supplied by Aesthetic Green Power are 13 AWG, type UF (UL), sunlight resistant, 90°C, 600 Volts.

7.2.1 Sunslates6™ Interconnect Cable (Slate-to-Slate Cable)



The Interconnect Cable connects Sunslates6™ in the same row in series.

Figure 9 – Interconnect Cable

7.2.2 Sunslates6™ Twister Cable (Row-to-Row Cable)

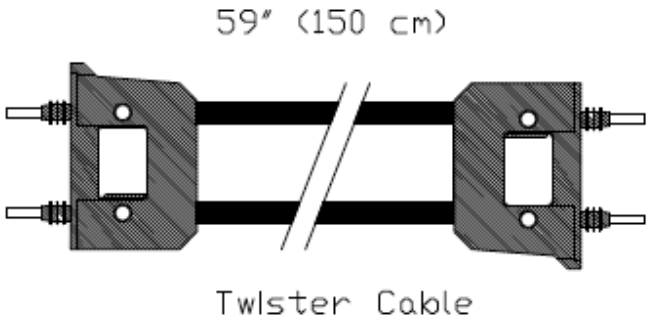


Figure 10 – Twister Cable

The Twister Cable is used to connect Sunslates6™ in different rows in series. The Twister Cable is used when the field spans more than one row.

7.2.3 Sunslates6™ Bridge Cable

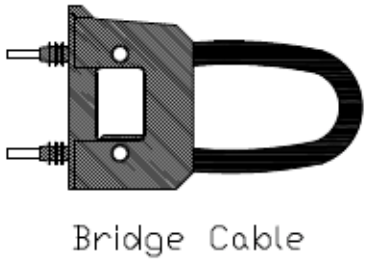


Figure 11 – Bridge Cable

The purpose of the bridge cable is to route one terminal of the field to the opposite end of the field. In this manner, both the positive (+) and negative (-) terminals of the field are located at the same end of the field.

7.2.4 Sunslates6™ Field Cable

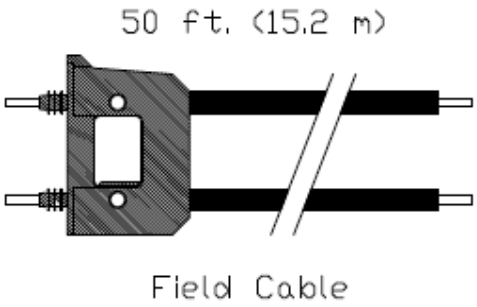


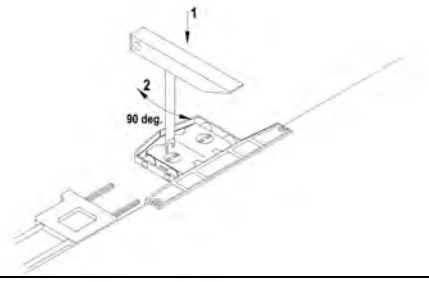
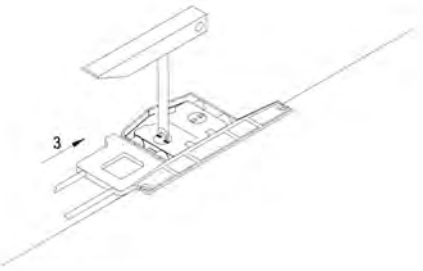
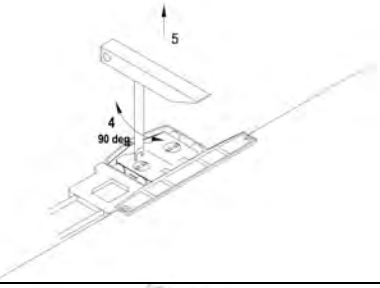
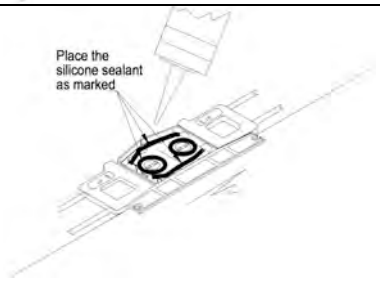
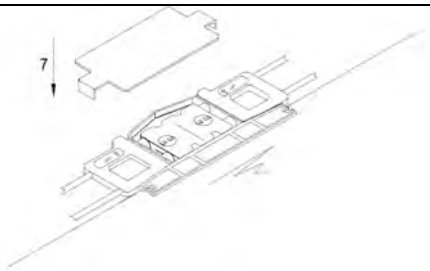
Figure 12 – Field Cable

The Field Cable is placed at the beginning of the field. The field cable has two wires: a positive (+) terminal and a negative (-) terminal for the field.

Custom length field cables may be purchased if required.

7.3 Sunslates6™ Connections

In order to connect the Sunslates6™ cables to the connection box, follow these instructions:

Open connection box: Place the tool in the connection box (1). Turn the tool 90 degrees (2).	
Insert cable: Place the cable in the connection box (3). Be sure to fully seat connector. Gasket at base of pins must snap in.	
Close connection box: Turn the tool 90 degrees (4). Remove the tool (5).	
Apply adhesive*: Clean the box surface (acetone or alcohol may be used). Apply silicone sealant on the locations shown. Use safety and installation instructions of the silicone sealant.	
Attach protection shield*: Place the protection shield over the connection box and apply pressure (7). The two side clips of the shield must snap under the connection plugs.	

* Performed AFTER row-checking (Section 7.6)

7.4 Making Field Connections

Each field begins with a Field Cable and ends with a Bridge Cable (Figure 13). When installing the field, **ALWAYS** start at the end with the Field Cable (which goes through the roof into the building) and work your way to the end of the string. The Bridge Cable should be the last cable in the field to be installed. Use Interconnect Cables to connect modules in the same row. If the field spans more than 1 row, use a Twister Cable to connect one row to the next (Figure 14).

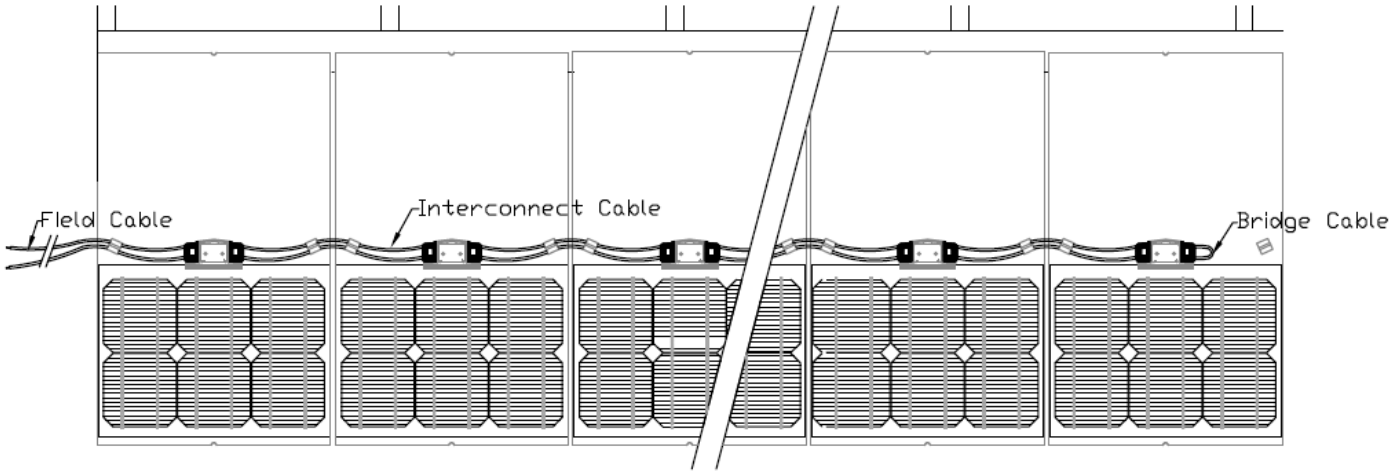


Figure 13 – Sunslates6™ Field

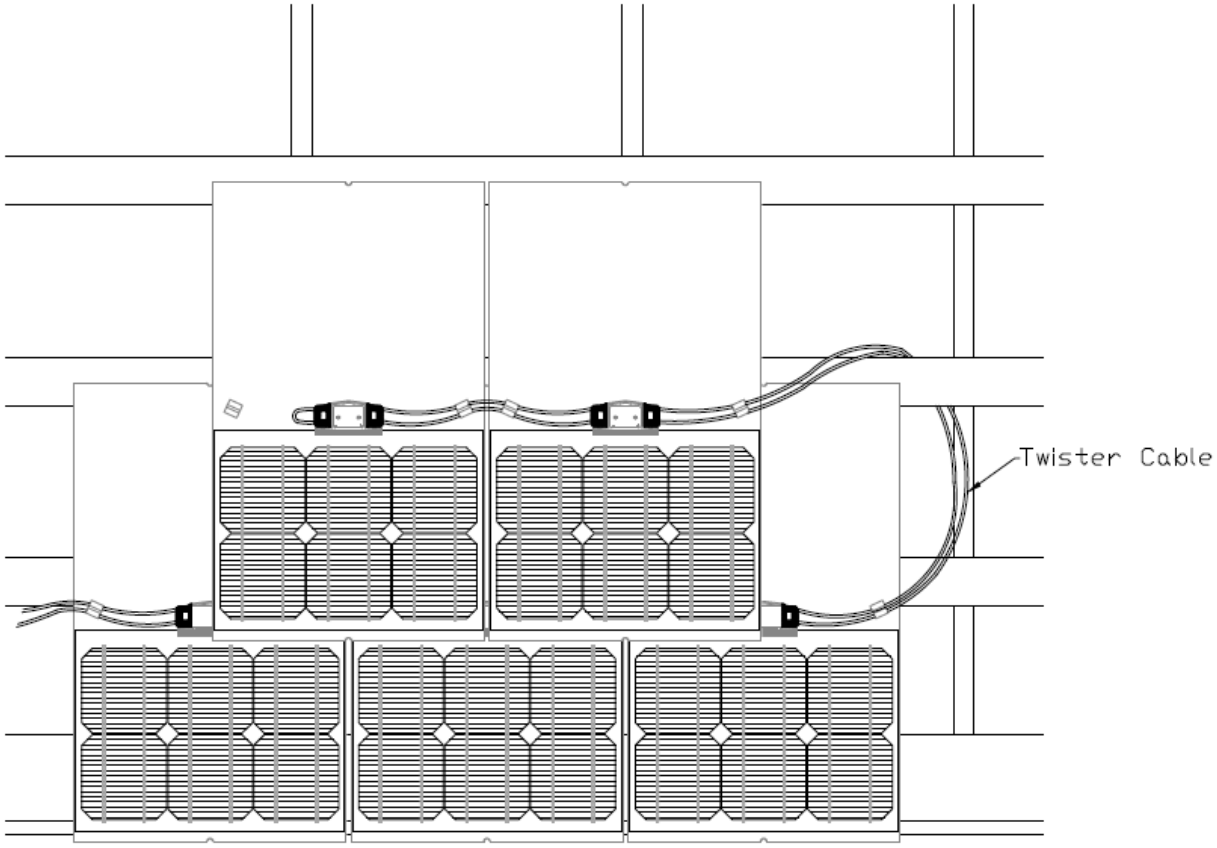


Figure 14 - Sunslates6™ Field Using Twister Cable

7.5 Installing the Sunslates6™ Modules

To install the first row of Sunslates6™, simply slide the notch at the bottom edge of the Sunslates6™ onto the hook. Ensure that each hook is straight and that the marked location for the hook in the next row is visible between the slates. As each Sunslates6™ is installed, make the connections as outlined in Sections 7.3 and 7.4.

Once the first row has been installed and row-checking has been performed (Section 7.6), the next row can be installed. As subsequent rows of Sunslates6™ are installed, nail the hooks into the pre-marked locations (Section 6.5) and follow the same procedure used for the first row of Sunslates6™.

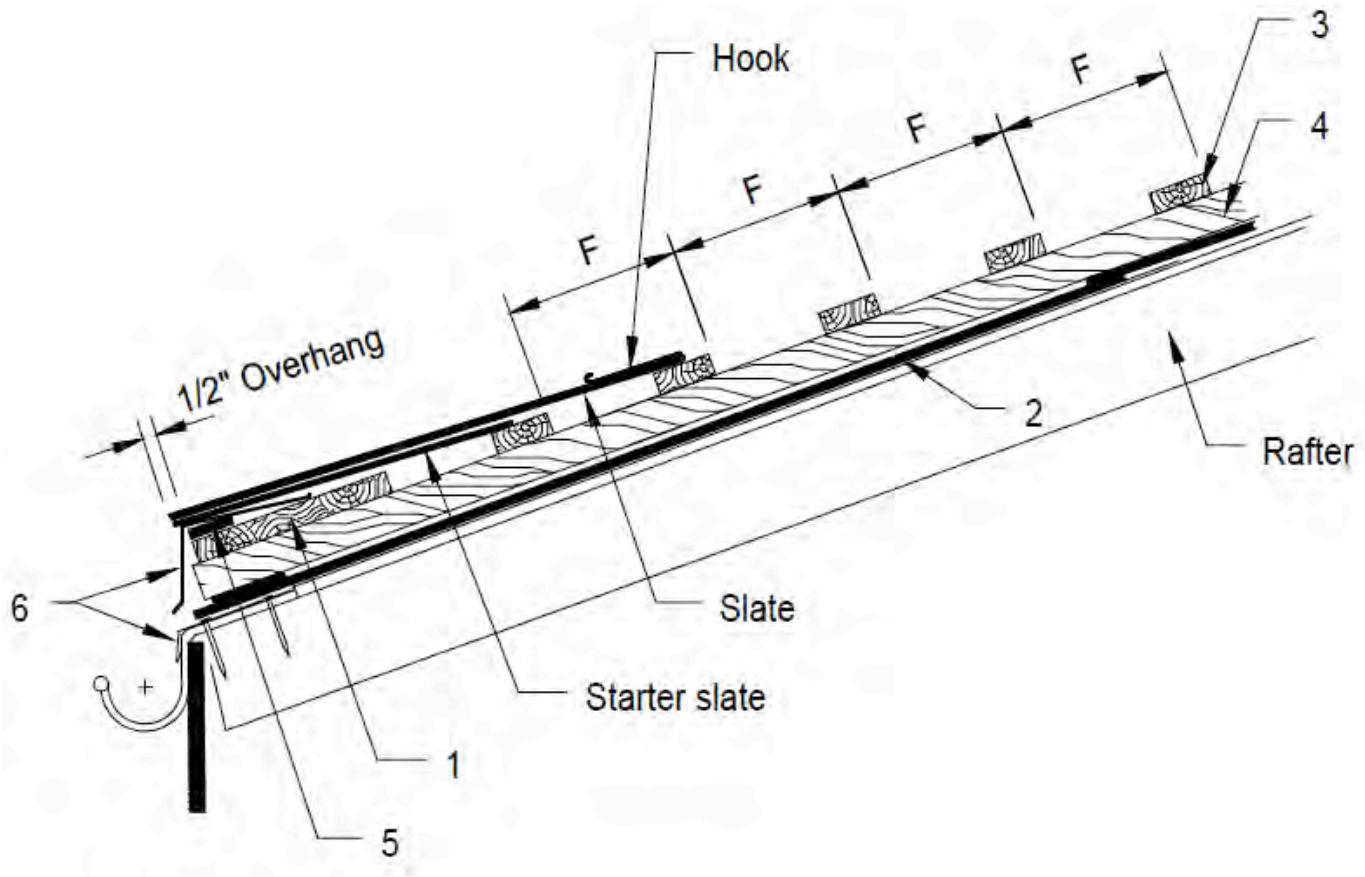


Figure 15 – First Row Profile

1.Starter batten (1x8)
2. Plywood (5/8” or 1/2” CDX)
3. Horizontal Batten (1x4)
4. Vertical Batten (2x2)
5. Cant Strip (1/2x1)
6. Drip Edges

F = 14-1/2” (36.8cm)

7.6 Row-Checking

7.6.1 Row-Checking Overview

When installing Sunslates6™, the most common error made is that the Sunslates6™ connection box is not in a closed position. The installer must perform row-checking for each row to insure that the Sunslates6™ connection boxes are closed and making electrical contact.

Row-checking is performed by measuring the open circuit voltage of each field. Make sure that row-checking is performed **BEFORE** the row is covered by the next row of Sunslates6™. This will prevent any difficulties with having to un-install portions of the roof to fix a connection box that was not properly closed.

If a field spans more than one row, it will be necessary to temporarily install a Bridge Cable at the end of the uncompleted field to perform the voltage measurement. **Once these connections have been verified, the protection shields can be attached and the next row of Sunslates6™ may be installed.**

7.6.2 Row-Checking Instructions

1. First, the expected open circuit voltage (V_{oc}) of one Sunslates6™ module at current ambient conditions must be determined. Use a simple DC voltmeter to measure the V_{oc} of a single Sunslates6™ module. To make the measurement, open the connection box terminals (Section 7.3), insert the voltmeter probes, and then close the connection box terminals (Figure 16). Measure the V_{oc} of a few additional Sunslates6™ modules and average the results. The average V_{oc} should be approximately 3.8 V, but may vary depending on ambient conditions.

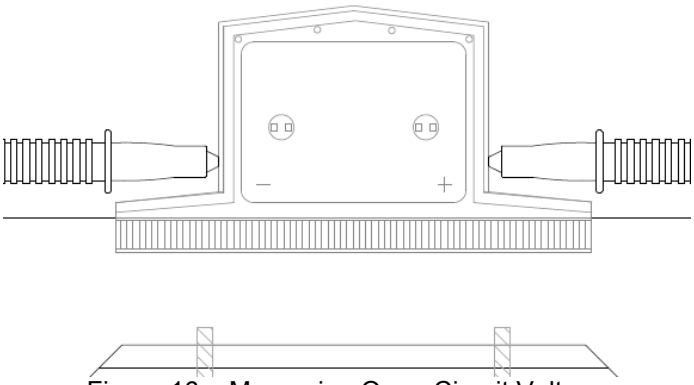


Figure 16 – Measuring Open Circuit Voltage

2. Determine the expected V_{oc} of the field by multiplying the expected V_{oc} of one Sunslates6™ module by the number of Sunslates6™ in the field.
3. Measure the V_{oc} of the field using the DC voltmeter. Ensure that the field measures a V_{oc} that varies from the expected V_{oc} by no greater than 3 VDC.

Shadows from instruments or cables over the Sunslates6™ will cause the voltage to drop; be sure that there are no shadows when testing the field.

7.6.3 Row-Checking Example

If the field is composed of 20 Sunslates6™ in series and the expected V_{oc} of one Sunslates6™ module is 3.8 VDC:

V_{oc} (field) = (3.8 VDC) x (20 Sunslates6™) = 76 VDC

If the field measures lower than 73 VDC or does not measure any V_{oc}, it is likely one or more Sunslates6™ modules are poorly connected and the installer must go back and check the field for:

1) A connection box which is not fully closed or
2) A faulty Sunslates6™ module.

7.6.4 Finding the Location of a Fault

To find the location of the fault, the easiest way is to divide the faulty field into sections. For a field of 20 Sunslates6™, divide the field into 2 sections of 10 Sunslates6™. Check each section separately using a Bridge Cable to temporarily close the circuit. Once it has been determined which of the two sections is faulty, that section can again be divided into 2 more sections (i.e. into 2 sections of 5 Sunslates6™). Continuing in this way, keep dividing the section until it is determined which individual Sunslates6™ is at fault. The expected V_{oc} must be recalculated each time the number of Sunslates6™ changes. For example, if the expected V_{oc} of one Sunslates6™ module is 3.8 VDC:

20 Sunslates6™ V_{oc} = 76 VDC 10 Sunslates6™ V_{oc} = 38 VDC

5 Sunslates6™ V_{oc} = 19 VDC 3 Sunslates6™ V_{oc} = 11.4 VDC

2 Sunslates6™ V_{oc} = 7.6 VDC 1 Sunslates6™ V_{oc} = 3.8 VDC

7.7 Making Connections Under the Roof

The information below is provided as a guideline. Please refer to NEC 690 for the most up-to-date electrical wiring requirements

After row-checking has been completed, the field cable is then inserted through a hole (min ⌀ 0.5”) in the roof. The field cable must be secured with a cable clamp, for strain relief, onto the nearest 2x2 vertical batten. From here, the electrician will make the connections under the roof (in the building). The field cable must be connected to a junction box (via terminal strips, 10A) through standard MC (metal-clad) cable or EMT (electrical metallic tubing).

The junction box is connected to the inverter using home run cables through standard MC (metal-clad) cable or EMT (electrical metallic tubing) (refer to NEC 690 for cable requirements). Make sure that the DC positive goes to the positive terminal of the inverter and the DC negative goes to the negative terminal of the inverter. Test the field polarity prior to making any connection.

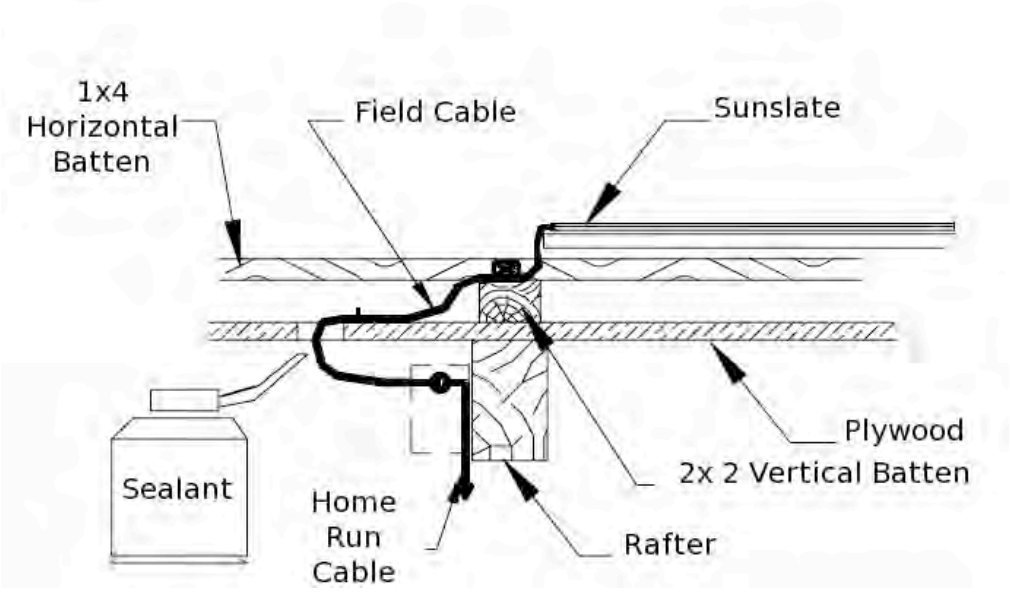


Figure 17 – Routing the Field Cable

Seal the hole in the roof from the inside with fire stop expanding foam or silicon seal. The fire stop sealant shall be a one-part, neutral curing silicone sealant. The sealant shall be completely water resistant and shall contain no solvents or inorganic fibers of any kind. The through-penetration fire stop sealant shall allow movement of ±25% and shall be UL Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479). The recommended silicon sealant is Pensil® 300 (PEN300).

7.8 Uninstalling and Replacing Sunslates6™

Before disconnecting the Sunslates6™, the DC disconnect switch at the inverter must be in OFF position

Bend the hook that holds the slate at the bottom with a roofer's hammer, and then slide the slate down until you see the Sunslates6™ connection box. Open the connectors and pull out the Interconnect Cables; the Sunslates6™ will then slide down and can be removed. Replace with a new Sunslates6™ by sliding it up between the slates and then connecting the Interconnect Cables. The hook must then be bent back into place to secure the slate.

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Appendix D: An Example of the Solar Roof Report

PROPERTY ADDRESS:
2388 21ST ST, LOS ANGELES CA

SOLAR ROOFTOP POTENTIAL REPORT

LA COUNTY SOLAR MAP (http://egisgcx.isd.lacounty.gov/cos/m/?viewer=solarmap)

Local Property Map with Solar Potential

Property Information

Property Address	2388 21ST ST, LOS ANGELES CA	(LA County Assessor)
Parcel Number	5073-026-013 (Assessor map)	(LA County Assessor)
Utility Name	Los Angeles Department of Water & Power https://www.ladwp.com/ladwp/faces/ladwp/commercial/c-gogreen/c-gg-installsolar	
Total Roof Area (squre feet)	1,943 Sq. Ft.	(2008 LA County Building outline data)
Area Suitable for Solar (square feet)	200 Sq. Ft.	(2006 LA County Solar Model - see back for details)

Solar PV Potential Information Click for Solar Map

Typical panel efficiency:	18.1%	13.1%
Solar PV System size (kW DC)	Up to 3 kW DC	Up to 2 kW DC
1kw system = 1,490 kWh/year	Figures represent the use of all suitable area. 1 kWh = 3 hours of TV, 10 hours of 100w lightbulb	
Electricity output (kWh/year)	5,010 kWh/year	3,626 kWh/year
Electricity savings ($/year) (See back for details)	Up to $651 /year	Up to $471 /year
Carbon Savings (lbs/year)	3,627 lbs/year	2,625 lbs/year

Solar PV Costs and Incentives

These figures are best estimates which vary by roof type, system size, and installer.

Initial system cost ($/watt)		$4.50 /watt	*More Info:*
Federal Tax Credit	(30% tax credit)	-$1.35 /watt	http://www.gosolarcalifornia.ca.gov/consumers/taxcredits.php
Final cost ($/watt)		$3.15 /watt	

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Solar Water Heating	Figures represent the use of all suitable area.
Solar water heating potential (therms)	600 Therms/Year
Gas savings ($/year)	$474 /Year
Carbon savings (lbs/year)	8 lbs CO2/Year
Other Information	A typical LA County household uses 200 therms/year to heat water

How Los Angeles County estimated this property's solar potential:

The LA County Solar Rooftop Planning Tool is based on solar radiation calculated every 5 feet for over 3,000 square miles. This model includes the effects of roof pitch, orientation, and shading from surrounding structures and trees. It was created through a Geographic Information Systems (GIS) analysis of Light Detection and Ranging (LiDAR) elevation information

Total Roof Area	From the 2008 LA County building dataset.
Area Suitable for Solar	Roof area in square feet where average daily raw insolation > 4.04 kWh.
Solar PV Potential (kW DC)	Area in square feet is converted to area in square meters (divide area 10.76391), and multiplied by 0.181 (for 18.1% efficiency) to determine system size in kW (DC) or by .131 (for 13.1% efficiency). Note that these panels are representative, not recommendations.
Potential Annual Output (kwH/year)	1,490 kWh per year per solar PV Potential kW (DC). This is calculated by multiplying solar PV potential in kW by 5.3 hours of generation per day and a 77% de-rate factor which take into consideration electrical losses and other environmental factors like soiling. (Solar PV Potential x 365 days x 5.3 hours/day x 0.77 efficiency).
Potential Cost Savings ($/kWh)	Los Angeles Department of Water & Power $0.130
Potential Annual CO2 Savings	The carbon dioxide emission reductions for Southern California are 724 lbs of carbon dioxide reduced for every MWh of solar electricity (CA Climate Action Registry General Reporting Protocol, Version 3.1, Table C.2 - CO2 Emission) and CO2 emissions for natural gas (11.7 lbs/CO2/therm).
Gas Savings	Therms per year multiplied by the SoCal Gas baseline gas rate per therm. A typical LA County household uses 200 therms/year to heat water.
More Details	http://solarmap.lacounty.gov/content/map/estimate.htm

Disclaimer: The tools in the Solar Map application are for estimating purposes only and subject to changes due to latest technologies, efficiencies, and current data tool was developed or updated.

Appendix E: Western Heights HPOZ Preservation Plan

Western Heights HPOZ

Preservation Plan

City of Los Angeles
Adopted December 9, 2010

Table of Contents

Chapter 1 Mission Statement

Facilitate the vitality of the district as a livable and sustainable neighborhood through the restoration, preservation and enhancement of structures, landscaping and natural features.

Chapter 2 Goals & Objectives

Goal 1 **Preserve The Historic Character Of The Community**

Objective 1.1 Safeguard the character of historic buildings and sites
Objective 1.2 Recognize and protect the historic streetscape and development patterns
Objective 1.3 Ensure rehabilitation and new construction within the district complements the historic fabric
Objective 1.4 Recognize that the preservation of the character of the district as a whole takes precedence over the treatment of individual structures or sites.

Goal 2 **Preserve The Historic Streetscape**

Objective 2.1 Encourage and maintain traditional front yards.
Objective 2.2 Promote retention of historic landscape features

Goal 3 **Preserve The Historic Appearance Of Residential Structures**

Objective 3.1 Encourage retention of significant architectural features

Goal 4 **Achieve Widespread Public Awareness And Involvement In Historic Preservation Throughout The HPOZ**

Objective 4.1 Keep local residents, the preservation community, the general public and decision makers informed about historic preservation issues and initiatives, and facilitate public access to this information

Objective 4.2 Promote public participation in the HPOZ review process

Objective 4.3 Inform the public and preservation community about effective preservation techniques and resources

Goal 5 **Assist In The Effective Implementation Of The HPOZ Ordinance**

Objective 5.1 Facilitate fair and impartial decisions regarding proposed projects with this Plan

Objective 5.2 Educate and inform the HPOZ community about the community benefits of historic preservation

Objective 5.3 Create a resource of information on architectural styles found within the neighborhood

Objective 5.4 Encourage citizen involvement and participation in the review process

Chapter 3 Function of the Plan

3.1 Role of the Preservation Plan

This Preservation Plan is a City Planning Commission approved document which governs the Western Heights Historic Preservation Overlay Zone (HPOZ). The plan, through its design guidelines, as well as its goals and objectives, aims to create a clear and predictable set of expectations as to the design and review of proposed projects within the district. This plan has been prepared specifically for this HPOZ to clarify and elaborate upon the review criteria established under the HPOZ Ordinance.

The Western Heights HPOZ Preservation Plan serves as an implementation tool of the South Los Angeles and West Adams-Baldwin Hills-Leimert Park Community Plans (both parts of the land use element of the City's General Plan). HPOZs are one of many types of overlay districts, policies, and programs that serve to advance the goals and objectives of the Community Plan.

The Western Heights Preservation Plan outlines design guidelines for the rehabilitation and restoration of structures, natural features, landscape and the public realm including streets, parks, street trees, and other types of development within the HPOZ. The Preservation Plan also serves as an educational tool for both existing and potential property owners, residents, and investors and will be used by the general public to learn more about the HPOZ. The Preservation Plan is to be made available to property owners and residents within the HPOZ, and should be reviewed by the Board every two years.

The Western Heights HPOZ Board will make recommendations and decisions based on this document. Similarly, the Department of City Planning will use this document as the basis for its determinations. The Preservation Plan articulates the community's vision and goals regarding the HPOZ by setting clear guidelines for the development of properties within the district. The Preservation Plan will serve as a resource for property owners planning repairs or alterations as an educational tool for both existing and potential property owners, residents, and investors, and will also be used by the general public to learn more about the City of Los Angeles and its unique neighborhoods.

3.2 Role of the HPOZ Board

All HPOZs in the City are administered by a local board comprised of five members appointed by the Mayor, the Councilmember, the Cultural Heritage Commission and the Board at-large. These members are appointed because they have expertise in historic preservation, architecture, real estate and construction. The HPOZ Ordinance requires that the HPOZ Board make all decisions related to maintenance, repair, restoration and minor alterations to a property (work defined as "Conforming Work") and that the HPOZ Board serve as an advisory body to the Department of City Planning related to new construction, large additions and major alterations or rehabilitation projects. In

addition to their role as a decision making body, the HPOZ Board is an educational resource with unique experience and expertise both in historic preservation practices and in the rich history of this culturally and architecturally significant neighborhood.

In an effort to encourage property owners to comply with the Preservation Plan guidelines and facilitate a streamlined review of simple maintenance, repair and restoration projects, review of many types of Conforming Work projects have been delegated by the HPOZ Board to the Director of Planning. For many types of work applicants can contact Planning staff and have their projects reviewed once the appropriate application materials have been received instead of being agendized for an HPOZ Board meeting. However, most types of work on a property that involve a discernable change to the structure or site will require HPOZ Board review. The list of projects that are delegated to the Director of Planning for decision is provided in Section 3.5 below.

3.3 **Organization of the Preservation Plan**

Each Preservation Plan is required to contain seven elements: The Mission Statement, Goals and Objectives, Function of the Plan, the Context Statement, the Historic Resources Survey, Design Guidelines, and the Preservation Incentives/Adaptive reuse policies located in the Appendix.

Chapter 1 - Mission Statement: Establishes the community's vision for the Preservation Plan.

Chapter 2 - Goals and Objectives: States the goals for this plan and offers specific programs or actions as the means to accomplish these goals.

Chapter 3 - Function of the Plan: Reviews the role, organization, and process of the Preservation Plan.

Chapter 4 - Context Statement: Outlines the history and significance of the community's development.

Chapter 5 - Historic Resources Survey: Identifies all Contributing and Non-Contributing structures and includes Contributing landscaping, natural features and sites, and vacant lots.

Chapter 6 - Architectural Styles: Provides an explanation of architectural styles and building types that are relevant to the neighborhood.

Chapter 7 - Residential Rehabilitation: Provides guidelines related to the maintenance, repair and minor rehabilitation of existing sites and structures.

Chapter 8: Residential Additions: Provides guidelines related to additions and secondary structures.

Chapter 9: Residential In-fill: Provides guidelines for building new residential structures in an HPOZ.

Chapter 10: Public Realm: Provides guidelines related to public spaces, parks and streets.

Chapter 11: Definitions: Provides definitions for the various technical and architectural terms used throughout this document.

An appendix of other useful information is found at the back of this Plan. This appendix includes a compilation of preservation incentives and adaptive reuse policies, process charts, and the HPOZ Ordinance.

3.4 HPOZ Process Overview

The Historic Preservation Overlay Zone has different review processes for different types of project review within the HPOZ. For more information on which review type is appropriate for a certain project, contact staff at the Department of City Planning.

Certificate of Appropriateness: A Certificate of Appropriateness (COA) is required when significant work is proposed for a Contributing element in the HPOZ. A COA requires that a formal application be filed with the Department of City Planning. The HPOZ Board will conduct a public hearing and submit a recommendation to the Director of Planning, who will also consider input from the Cultural Heritage Commission regarding the project.

Certificate of Compatibility: A Certificate of Compatibility (CCMP) is required for the review of new construction on vacant lots or on lots where a Non-contributor is proposed for demolition. A CCMP also requires that a formal application be filed with the Department of City Planning. The HPOZ Board will conduct a public hearing and submit a recommendation to the Director of Planning.

Conforming Work on Contributing Elements: Conforming Work on a Contributing Element (CWC) is a more expedient review process limited to restoration, demolition in response to a natural disaster, maintenance and repair, and minor alterations that do not result in a discernable change to the character-defining features on a structure. Some CWC projects may be simply reviewed by Planning staff while others will require review by the HPOZ Board; see Section 3.5 for more information.

Conforming Work on Non-Contributing Elements: Conforming Work on a Non-contributing Element (CWNC) is a review process for work on Non-contributing properties that does not involve demolition of a structure or construction of a new building on a vacant lot.

3.5 **Exemptions**

As instructed by the City Planning Commission, and City Council (notwithstanding LAMC 12.20.3 to the contrary), the following types of work are exempt from HPOZ review in the Western Heights HPOZ (unless the work is located in the public right-of-way).

1. Interior alterations that do not result in a change to an exterior feature;

2. The correction of Emergency or Hazardous conditions where a City enforcement agency has determined that such conditions currently exist and they must be corrected in the interest of public health, safety and welfare. When feasible, the City agencies should consult with the Planning Department on how to correct the hazardous conditions consistent with the Preservation Plan;

3. Department of Public Works improvements where the Director finds that a) The certified Historic Resources Survey for the Preservation Zone does not identify any Contributing Elements located within the Right-of-Way and/or where the Right-of-Way is not specifically addressed in the Preservation Plan; and b) Where the Department of Public Works has completed a CEQA review of the proposed improvement and the review has determined that the work is exempt from CEQA, or will have no potentially significant environmental impacts (the HPOZ Board shall be notified of such Projects, given a Project description and an opportunity to comment);

4. Alterations to City Historic-Cultural Monuments and properties under an approved Historical Property (Mills Act) Contract;

5. Work specifically authorized by a Historical Property Contract approved by the City Council;

6. Rear yard (non-corner lots only) landscape/hardscape work that is not visible from the street and that does not involve the removal of a mature tree or a feature identified in the historic resources survey;

7. Landscape work in front and side yards, not including: hardscape work; installation of artificial turf; installation of fences or hedges; planting of new trees; removal/pruning of any mature tree or work on any feature identified in the historic resources survey. Additionally, landscapes where more than 40% of the front yard area is bereft of planting are not exempt;

8. Installation or repair of in-ground swimming pools located in the rear yard on non-corner lots;

9. Rear yard grading and earth work on Non-Hillside lots as determined by the LAMC;

10. Installation and expansion of rear patios or decks that are no higher than 5 feet above finish grade (including railings), not including balconies, roof structures, trellises, gazebos or other similar structures;

11. Installation, replacement or repair of mechanical equipment that is located within the rear yard area;

12. Installation of lighting devices on facades that are not visible from the street;

13. Exterior painting with no change from existing paint colors;

14. Maintenance and repair of existing foundations with no physical change to the exterior;

15. Removal of security grilles and/or gates that were installed outside of the Period of Significance;

16. Removal of fences that were installed outside of the Period of Significance.

3.6 **Delegated to the Director of Planning**

In the Western Heights HPOZ, the review of the following types of work is delegated to the Director of Planning and therefore shall not require review by the HPOZ Board, but the HPOZ Board shall receive a notice of the Director of Planning's action or decision. The Director of Planning shall utilize the Design Guidelines contained within this Preservation Plan to determine whether the proposed project may be found to be Conforming Work. Projects that do not comply with the Design Guidelines, or that involve an existing enforcement case with the Department of Building and Safety or the Housing Department, or otherwise involve a request for approval of work that was performed without appropriate approval, shall be brought before the HPOZ Board for review and consideration, either as Conforming Work or as requiring a Certificate of Appropriateness or Certificate of Compatibility.

1. Pruning of mature trees and the installation of new trees.

2. In-kind hardscape replacement within the front yard (driveway, walkways, etc) that does not expand the hardscape footprint;

3. Exterior painting involving new paint colors and not including paint applied to previously unpainted surfaces such as stone, masonry or stained wood;

4. Ordinary maintenance and repair (including in-kind replacement) to correct deterioration or decay, that does not involve a change in the existing design, materials or exterior paint color;

5. In-kind replacement of asphalt roof shingles, or repairs to tile, slate or other similar roofs where existing roof materials are re-used

and repairs are made to underlying roof structure, and where roof details such as fascia, eaves and brackets will not be affected.

6. Removal of non-historic stucco, asbestos shingles, vinyl siding or other similar materials, when underlying historic materials can be repaired or replaced in-kind. Where evidence of original materials is unclear, work shall be deferred to the HPOZ Board for review;

7. Installation of screen doors or windows that do not obscure the actual door or window;

8. Replacement of non-original windows with windows that match the originals, when examples of original windows still exist on the structure;

9. Construction or installation of ramps, railings, lifts, etc., on any non-visible elevation of a building intended to allow for accessibility;

10. Any alterations to a structure that is identified as Non-Contributing in the Historic Resources Survey, not including additions, new construction, relocation or demolition;

11. Additions of less than 250 square feet to any Contributing building or structure, where the addition does not break the side-planes or roofline of the existing structure, is contained completely within the rear yard and is not visible from the street;

12. Additions to Non-Contributing structures that increase the square footage by less than 30% of the existing square footage (as determined by LADBS) when the addition does not affect the front façade of the structure or break the side and top planes of the structure;

13. Alterations to façade openings, such as new doors or windows, to portions of a structure that are not visible from the street;

14. Installation or repair of fences, walls, and hedges in the rear and side yards that are not visible from the street (non corner-lots only) and that do not require a Zoning Administrator's approval for height or location;

15. Installation or repair of solar collectors, skylights, antennas, satellite dishes and broadband internet systems on rear-facing facades/roof surfaces or garage roofs that are not visible from the street;

16. Installation of window security bars or grills, located on secondary facades;

17. Repair or replacement of gutters and downspouts.

All questions of visibility are to be determined by Department of City Planning staff. For the purposes of this Plan, visibility includes all portions of the front and side elevations that are visible from the adjacent street or sidewalk or that would be visible but are currently

obscured by landscaping. It also includes undeveloped portions of a lot where new construction or additions would be visible from the adjacent street or sidewalk, such as the street-side side yard on a corner lot and the front yard. Finally, construction or additions to areas that are not currently visible but that will become visible following the construction or addition will be considered visible and reviewed accordingly.

A street visible façade excludes those portions of the side elevations that are not visible from the adjacent street or sidewalk and all rear elevations. A street visible façade may also include side and rear facades that are generally visible from a non-adjacent street due to steep topography, or second stories that are visible over adjacent one story structures, etc.

Projects requiring a Certificate of Appropriateness or Compatibility shall not have any part of their applications be exempt or delegated.

The Department of City Planning retains the authority to refer any delegated project to the Historic Preservation Overlay Zone (HPOZ) Board for a recommendation when compliance with the adopted design guidelines is unclear.

3.7 **Accessory Structures**

Any alteration of, addition of less than 250 square feet to, or demolition of an existing detached accessory structure, on a parcel that has been designated as a Contributor in the HPOZ, shall be reviewed as a Conforming Work by the HPOZ Board if it can be demonstrated that the accessory structure was built outside of the Period of Significance for the HPOZ. If it cannot be demonstrated that the accessory structure was built outside of the Period of Significance, the proposed work shall be addressed through a request for a Certificate of Appropriateness pursuant to 12.20.3 K.4, provided that the Director of Planning, having weighed recommendations from the HPOZ Board and the Cultural Heritage Commission, can find the following:

1. That the alteration, addition to, or demolition of the accessory structure will not degrade the primary structure's status as a Contributor in the HPOZ because the accessory structure is not visible to the general public; or is minimally visible to the general public; and

2. That the alteration, addition to, or demolition of the accessory structure will not degrade the primary structure's status as a Contributor in the HPOZ because the accessory structure does not possess physical or architectural qualities that are otherwise found on the primary structure or that constitute cultural or architectural significance in their own right; and

3. That the accessory structure's primary historical use has been for the storage of automobiles (i.e. a garage), or household items (i.e. a tool shed, garden shed, etc.).

All properties must comply with parking standards set forth in the Los Angeles Municipal Code.

4.1 History of Western Heights

The historic neighborhood of Western Heights contains 175 parcels, 127 identified as Contributing, and 48 as Non-Contributing resources, with structures that date back to the late 1800s. Used for agriculture starting with the Spanish land grant that established the City of Los Angeles, streetcar extensions facilitated the neighborhood's development into a suburban enclave for families who worked downtown. Later it was home to migrating minorities who were redlined out of other neighborhoods in Los Angeles. Despite the change that has come to the commercial storefronts of Washington Blvd which border the area, the neighborhood has remained mostly unaltered in the last 80 years, with over 70% of the buildings still retaining the character that makes them historic.

Pico Boulevard looking east from Western Avenue in the 1890s. Bicyclists are riding on the unimproved road.

The Western Heights area is immediately west of the original land grant given to Spanish settlers in 1781. Lands outside of the land grant were supplemental to the pueblo lands and were controlled first by the Spanish and then by the Mexican Governors of Alta California, and then by the United States after 1847. Until the later part of the nineteenth century, the area including Western Heights was used exclusively for grazing and agriculture. Later it was developed as a series of suburban neighborhoods, except for the independent city of Watts and small pre-1890 farm communities such as Rosedale (located near the Rosedale Cemetery). Portions of the area were subdivided for residential and commercial use beginning in the late 1880's.

A man with an ostrich drawn cart receives a traffic ticket from a motorcycle policeman at 2922 W. Pico Blvd., near Harvard. The cart shows a sign reading: Los Angeles Ostrich Farm.

Suburban neighborhoods were developed in response to the extension of local horse-drawn streetcar routes coming out of downtown Los Angeles. Significant suburban communities were created in the late 1800s including the eastern section of the West Adams District and the University District. The horse-drawn streetcar lines were quickly subsumed by the Los Angeles Transit Lines and Pacific Electric Railway system and upgraded to electric routes, further spurring development southward in the first decade of the twentieth century. By 1910 only small sections of the area west of the original pueblo were still used agriculturally; most of the land had been subdivided into residential tracts.

Agricultural Development

Agriculture was the primary industry of South Los Angeles from the first days of the pueblo until residential development consumed the last large areas of farmland shortly after 1910. The area was first used for grazing cattle and sheep and later for farming. The farms grew alfalfa, sugar beets, and vegetables, raised hogs and poultry, and produced dairy products.

The transfer of one hundred and sixty acres to the Southern District Agricultural Society in 1872 and the subsequent development of Agricultural Park on that land was an indication of the significance of

General view of Exposition Park looking north toward Mudd Hall at the University of Southern California

Passengers aboard the Pacific Electric Venice Line circa 1920.

the agricultural industry to early Los Angeles. Agricultural Park was initially intended and later re- dedicated to displaying the agricultural products of the state's Southern Agricultural District. By 1908, Exposition Park, as it became known, had become an inner-city park surrounded by residential neighborhoods.

Wood barns and stables were the predominant built forms associated with the agricultural industry in South Los Angeles. Utilitarian in design, they displayed simple gable roof forms and clapboard or board-and-batten sheathing. Warehouses for packing and shipping agricultural products were another type of structure associated with the industry, and were often very large one story buildings. It is unlikely that any examples of these resource types survive. If identified, however, even in deteriorated condition, they would be significant reminders of the region's agricultural past.

As the dominance of the agricultural industry waned in South Los Angeles, other industries developed including lumber yards, sash and door manufacturing companies, a carpet factory, candy company and a bottled water plant. It is logical that the industries associated with construction and residential development would be located in the area as the neighborhoods were being built. Many were located on alleys or near railroad spurs near Western Heights in order to facilitate loading activities. Buildings associated with these industries include warehouses, workshops, and administrative structures.

Streetcar Development & Annexation

The first local streetcars reached the area around Rosedale Cemetery and the University District in the early 1890's, prompting the migration of wealthy businessmen from downtown Los Angeles. The first east-west streets to become major thoroughfares included Pico, Washington and Jefferson Boulevards. .

While the railroads and Pacific Electric system spurred the growth of outlying communities, local streetcars, begun as independent franchises using horse-drawn cars, also spurred development within the residential subdivisions close to downtown Los Angeles. All of the local streetcars were later electrified and eventually absorbed into the Los Angeles Transit Lines (the "Yellow Cars"). Usually there was a direct relationship between the streetcar routes and the development of residential tracts. Another significant streetcar routes included the Washington Street line to Rosedale Cemetery (1895). Development of each line was motivated by the desire to sell real estate in the area. The resources associated with rail transportation include depots, platforms, substations, and track right-of-ways.

As residential communities developed, citizens increasingly perceived a need for services beyond those provided by the initial subdividers and real estate entrepreneurs. Primary among these services were water distribution and law enforcement, which often implied a regulation

and curtailment of liquor consumption. As a result of these needs, areas west of the Pueblo were annexed to the City of Los Angeles. The Southern and Western Addition of 1896 was the third annexation from when the city was first founded, and included over ten square miles in two roughly rectangular sections adjacent to the original city boundaries; Western Heights was included in this annexation.

Washington Boulevard near Western Avenue

The availability and distribution of water for agricultural and residential use was of primary importance in every area of Los Angeles. Concern about water was one of the most common motivations for annexation to the City of Los Angeles and, as a result, water was an important catalyst in the political development of the region as well as in the determination of agricultural and residential land use. In other parts of South Los Angeles, artesian wells were the primary source of water. Although none of these structures exist in Western Heights, nearby the resources associated with water distribution include artesian wells as well as the larger distributing stations erected by the Department of Water and Power in residential areas during the 1930's

Residential Development

The residential development of South Los Angeles from its first settlement until 1950 was a powerful and persistent factor in the organization of the community's built environment. The routes of streetcars and electric railways in most cases determined the first areas of concentrated residential development and hastened the "suburbanization" of outlying farm communities. Many residential neighborhoods were developed in very short periods of time by single developers. As a result they demonstrate a consistency of architectural style, size, and scale. In other areas, residential development occurred over two or three decades and continued to change as older structures were replaced by newer ones. These neighborhoods evolved a variety of characteristics that today document changes in population, income level, and in the architectural conventions preferred by successive generations.

Washington Boulevard, near Arlington Avenue, festively decorated with flags in the mid-1920s. A sign on a brick building says "United." Cars are seen on the street.

The original subdivisions that composed the survey area were:

- Orange Crest Tract between Washington Boulevard on the north and 20th Street on the south, and the line of the Cribb & Sinclair's West Garfield Heights Tract on the east and Arlington Avenue on the west;
- Cribb & Sinclair's Garfield Heights Tract between Washington on the north and 21st Street on the south, and Gramercy Place on the east and Cimarron on the west;
- Cribb & Sinclair's West Garfield Heights Tract between Washington Boulevard on the north and 21st Street on the south, and Cimarron on the east and on the west the boundary lines of the Orange Crest

Stone marker placed by West Adams Heights tract realtors at Washington Boulevard. The top portion of the marker has an intricate street lamp with its base made up of steel scrolls.


Intersection at Washington Boulevard, west from Western Avenue. Numerous shops line both sides of the street.

Tract north of 20th Street and the Robert Marsh & Co.'s Florence Heights Track south of 20th Street;

- Robert Marsh & Co.'s Florence Heights Tract between 20th Street on the north and 21st on the south, and the boundary line of the Cribb & Sinclair's West Garfield Heights Tract on the west and Arlington on the west;
- Kinney Heights Tract between 21st Street on the north and 23rd Street on the south (the lower portion of this tract is now south of the I-10 Freeway, and Gramercy Place on the east and Arlington on the west;
- Belvedere Heights Tract between Washington on the north and 21st Street on the south, and the boundary line of the Robert Marsh & Co.'s Western Heights Tract on the east and Gramercy Place on the west;
- Robert Marsh & Co.'s Western Heights Tract between Washington on the north and 21st Street on the south, and Western on the east and the boundary line of the Belevdere Heights Tract on the west.

Patterns of residential development contributed not only to the physical characteristics of the built environment, but also to the social environment of South Los Angeles; it became associated with various ethnic and immigrant populations. Restrictive covenants instituted in other sections of Los Angeles led to settlements of several neighborhoods in this area by Blacks. By 1920, most of Los Angeles's Black population lived in a few district scattered throughout South Los Angeles. At the same time there were additional pockets of residential neighborhoods associated with other ethnic groups throughout the area.

Single Family Homes

Home ownership was a cultural value embraced by almost every generation and ethnic group of settlers that came to California when residential subdivision began in the 1880's. Many local real estate entrepreneurs capitalized on the universal desire to own property. Prior to that time, few dwellings were built in South Los Angeles. Structures from the early Spanish and Mexican periods were constructed of adobe. Associated with agricultural land uses, the adobe ranch house was later joined by the first wood frame farm houses constructed by American immigrants from the East and Midwest. The farmers from Maine built two story frame houses much like the ones they remembered in New England. As residential subdivision gained momentum, the adobe homestead and the Maine farmhouse were joined by a proliferation of one story Craftsman and period revival style bungalows.

Subdivisions in the north part of the South Los Angeles were directed at wealthy middle class families rather than the working class that populated other sections of the area. As a result, the homes were large

and lavish. The first wave of concentrated residential development in eastern West Adams and the University District consisted largely of Los Angeles businessmen and their families who wished to move out of the central city but needed to remain within easy commuting distance of downtown. The streetcar systems that traversed Pico, Washington, and Jefferson initially made this kind of suburban settlement possible. Men of means who had achieved a certain wealth and stature in Los Angeles constructed large residences in the area from 1890 into the 1920's.

Mission Revival residence at Arlington Ave & 21st Street, displaced by Santa Monica Freeway.

As a result of the overwhelming desire for home ownership and the subdivision patterns, the single family home was the predominant resource type of residential development in Western Heights. House type, size, site characteristics, and architectural style varied greatly from community to community, but the subdivision of tracts into lots for single family homes proceeded at a relentless pace throughout the region in the early decades of the 20th century.

Single family homes in Western Heights include a broad range of styles and scale. Craftsman bungalows included the stone foundations, porch supports, and chimneys that typified the style. Wood sheathing or shingles, protruding rafters, the low, horizontal emphasis, and other hallmarks combined to create a regional aesthetic loosely derived from the Arts and Crafts Movement in England and America. Colonial Revival examples typically included a symmetrical facade with columns flanking the doorway. Clapboard sheathing and clipped gable roof forms were also typical. The Spanish Revival and Mission styles had stucco walls, red tile roofs or overhangs, and frequently incorporated arched windows and details as well as other elements derived from the California missions. Tudor style homes included steeply pitched roofs and stucco and half-timber wall designs.

The works of many distinguished local architects are found in South Los Angeles including Sumner Hunt, Theodore A. Eisen, Carroll H. Brown, John Parkinson, Hudson and Munsell, Frank M. Tyler, and many. Designed for specific clients or speculative builders, the works of these architects graced subdivisions owned and promoted by entrepreneurs such as Frederick Rindge and George Ira Cochran of West Adams Heights, Abbot Kinney, who later founded the resort community of Venice, and. A concentration of these structures in neighborhoods and districts collectively tell the story of residential development in Los Angeles.

Multi Family Residential Structures

Residential development in Western Heights was not limited to single family homes, but included multi-family resource types such as duplexes, "railroad courts" and bungalow courts, and apartment buildings. Executed in the same styles and materials as single family homes, these structures in most cases served the working class

population of each community for whom home ownership was not economically feasible or whose work was of a more transient nature. Builders developed strategies both to efficiently house workers and to bolster the attractiveness of apartment living, often incorporating features of single family residences into multi-family dwellings.

"Railroad courts" or "tenements," which were developed in Watts and initially housed Black and Mexican-American laborers, were whole complexes of independent or adjoining one room structures of wood clapboard with gable roofs. Small and inexpensive to build, these linear courts often lacked the central exterior courtyard of bungalow courts but both arrangements provided the security of an individual structure within a community of similar residences. The number of minorities immigrating to Los Angeles increased in the 1920s and the number of neighborhoods open to Blacks decreased as a result of new subdivisions, which included restricted covenants on ownership and occupancy. These opposing trends of growth and containment caused the population of South Central Avenue and Watts neighborhoods to increase dramatically. When this occurred, single family homes gave way to larger structures including these first "tenements" and apartment buildings. Other apartment arrangements included courtyard or garden apartments each with access to an outdoor open space which, together with bungalow courts, defined a regional relationship between housing and the landscape.

Later multi-family residential structures included masonry apartment buildings. These apartment buildings were larger than their "tenement" precursors, and often ornamented in a variety of styles. A direct result of Los Angeles's exponential population growth in the 1920's, many of these apartment buildings still stand and are essential to understanding Los Angeles' housing patterns.

Resources Associated with Minority Heritage

Many different ethnic groups made substantial contributions to the historic and cultural heritage of South Los Angeles. Some examples of resource types associated with these residents of these neighborhoods have been mentioned in preceding paragraphs.

Housing stock used by Blacks and by other minority groups such as the Mexican-Americans who labored on the railroad lines, may survive and can be traced through early maps and directories. Examples that survive may not only be of significance to each individual ethnic group, but may demonstrate a sequential residential pattern significant to all those who shared the neighborhoods and communities of South Los Angeles.

4.2 **Western Heights Period of Significance**

19th Century Styles (1860s – 1900s)

American Foursquare

Classical Revival *(Also, Neo-classical Revival, Beaux Arts, Greek Revival*)

Folk Victorian

Queen Anne

Shingle

Arts & Crafts Turn of the Century Styles (1890s – 1920s)

Colonial Revival

Craftsman *(Also, Transitional Arts & Crafts, Tudor Craftsman, Japanese Craftsman, etc.)*

Mission Revival

Prairie

Eclectic Revival Styles (1915 – 1940)

Dutch Colonial Revival

English Tudor Revival *(Also, English Revival, English Cottage, etc.)*

French Eclectic Revival *(Also French Normandie, French Revival, etc.)*

Italian Renaissance Revival

Mediterranean Revival

Spanish Colonial Revival

Early Modern Styles (1900 – 1950s)

Minimal Traditional

Moderne *(Also Streamline Moderne)*

Chapter 5 The Historic Resources Survey

5.1 Introduction

The historic resources survey is a document which identifies all Contributing and Non-contributing structures and all Contributing landscaping, natural features and sites, individually or collectively, including street features, furniture or fixtures, and which is certified as to its accuracy and completeness by the cultural heritage commission.

5.2 Contributing or Non-contributing?

To find out if a particular structure, landscape feature, natural features, or site is Contributing, consult the Historic Resource Survey. Depending on the Contributing/Non-contributing status of a structure, feature, or site, different elements of the design guidelines will be used in the planning and review of projects.

Contributing Structures

Contributing structures are those structures, landscape features, natural features, or sites identified as Contributing in the Historic Resources survey for the HPOZ. Generally, "Contributing" structures will have been built within the historic Period of Significance of the HPOZ, and will retain elements that identify it as belonging to that period. The historic period of significance of the HPOZ is usually the time period in which the majority of construction in the area occurred. In some instances, structures that are compatible with the architecture of that period or that are historic in their own right, but were built outside of the Period of Significance of the district, will also be "Contributing".

Contributing Altered

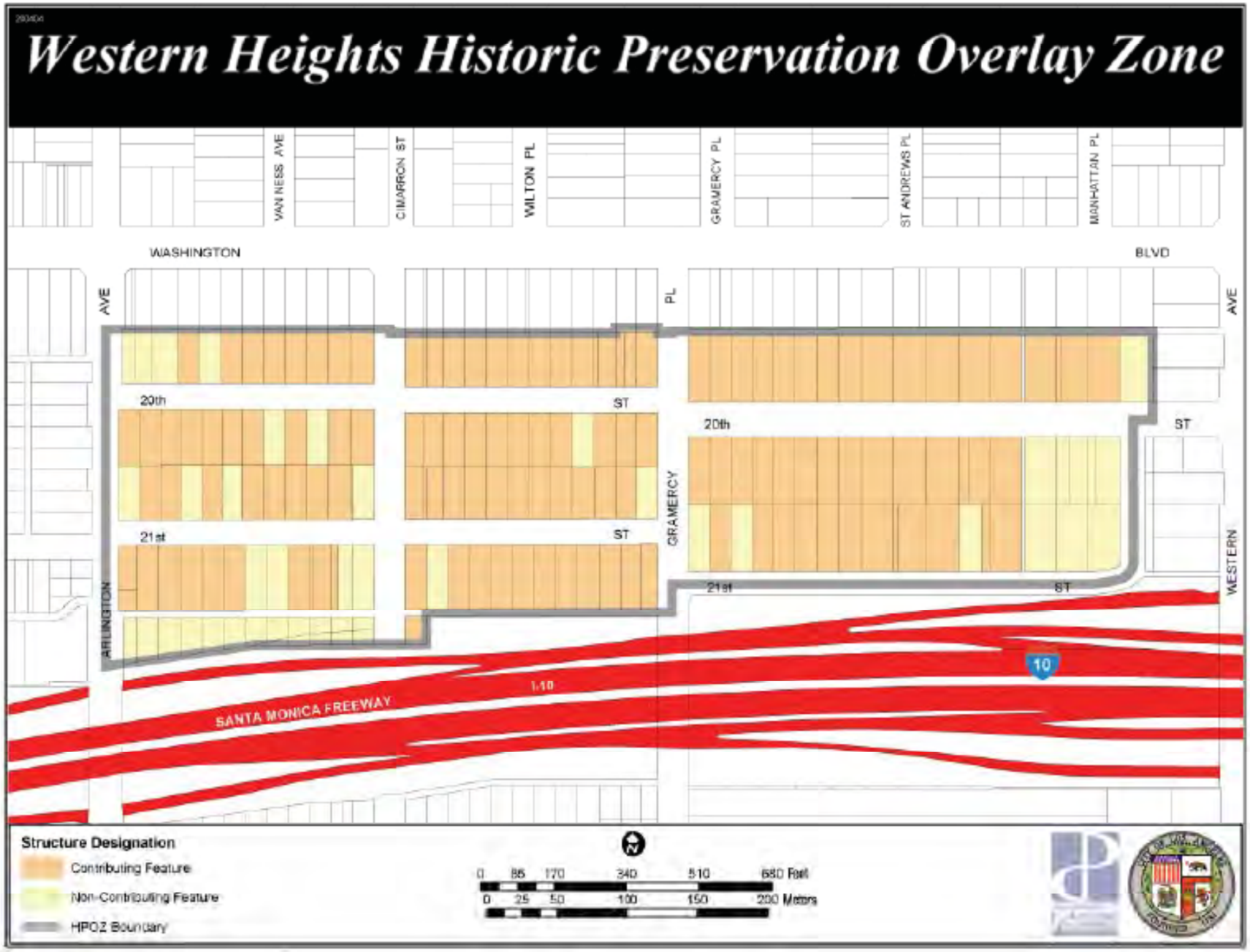
Contributing Altered structures are structures that date from the period of significance, built in the same time period as Contributing structures that have retained their historic character in spite of subsequent alterations or additions and are deemed reversible.

Non-contributing Structures

Non-contributing structures are those structures, landscapes, natural features, or sites identified as not retaining their historic character as a result of un-reversable alterations, or as having been built outside of the HPOZ Period of Significance or because they are vacant lots.

The Western Heights Historic Resources Survey can be reviewed at:

City Hall
City Planning Department, Office of Historic Resources
200 N Spring Street, Room 620
Los Angeles, CA 90021


Western Heights Historic Preservation Overlay Zone
WAN NESS AVE
CIMARRON ST
WILTON PL
GRAMERCY PL
ST ANDREWS PL
MANHATTAN PL
WASHINGTON
BLVD
AVE
PL
AVE
20th
ST
20th
ST
21st
ST
21st
ST
GRAMERCY
ARLINGTON
WESTERN
10
I-10
SANTA MONICA FREEWAY
Structure Designation
Contributing Feature
Non-Contributing Feature
HPOZ Boundary
0 85 170 340 510 680 Feet
0 25 50 100 150 200 Meters

6.1 Overview of Architectural Styles in Los Angeles

The following is a history of architectural styles found throughout the City of Los Angeles. The narrative of architectural styles is helpful in understanding how the architecture of the HPOZ relates to the larger region-wide context. The summary of styles and periods is intentionally broad and is intended to give the reader an understanding of major architectural themes in the City. However, it should be understood that individual structures may adhere rigorously to the themes and descriptions described below, or may defy them altogether based upon the preferences and tastes of individual architects, home-builders and developers.

Nineteenth Century Styles (1880s–1900s)

The 19th Century architectural styles popular in Los Angeles included the Italianate, Queen Anne, Folk Victorian, and Eastlake/Stick styles; styles that many lay-people might refer to simply as "Victorian." Most of these styles were transmitted to Los Angeles by means of pattern books or the experience of builders from the eastern United States. Later in the period builders began to embrace more simplified home plans and the Foursquare, Shingle and Victorian Vernacular styles began to emerge (Victorian Vernacular styles generally include the Hipped-roof Cottage and the Gabled-roof Cottage). Neo-classical styles were also popular during this period. While there are residential examples of Neo-classical architecture, the styles is most often attributed to commercial and institutional structures.

These 19th Century styles were built most prolifically in the boom years of the 1880s, with consistent building continuing through the turn of the last century. These styles were concentrated in areas near today's downtown Los Angeles. Many examples of 19th century architectural styles have been lost through redevelopment or urban renewal projects. Surviving examples of 19th Century architectural styles within the City of Los Angeles are most commonly found in neighborhoods surrounding the Downtown area such as Angelino Heights, University Park, Boyle Heights, Lincoln Heights, and South Los Angeles. Surviving examples of the pure Italianate styles are rare in Los Angeles, although Italianate detail is often found mixed with the Eastlake or Queen Anne styles.

The prominent architects in Los Angeles in this period included Ezra Kysar, Morgan & Walls, Bradbeer & Ferris, Frederick Roehrig and Carroll Brown.

A Japanese-American family sits for a photograph in front of their Queen Anne cottage in Garvanza.

The E.C. Hurd residence, which stood at 6954 Hollywood Blvd is shown with ornate Queen Anne detailing.

This Mission Revival home once stood where the present-day Hollywood/Highland development is currently located.

A collection of early Craftsman and Foursquare homes is shown in the Harvard Heights neighborhood (Western Ave. north of Venice Blvd.)

Spanish Colonial Revival emerged as a popular style for many neighborhoods in the Mid-Wilshire area.

Arts & Crafts/Turn of the Century Styles (1890s–1910s)

The late 1800s and early 1900s saw a substantial change in design philosophy nation-wide. The Arts and Crafts Movement, born in Western Europe rejected the rigidity and formality of Victorian era design motifs and embraced styles that were more organic and that emphasized craftsmanship and function. During this time in Los Angeles, architectural styles that emerged in popularity include the Craftsman Style in its various iterations (Japanese, Swiss, Tudor, etc.); the Mission Revival Style, unique to the southwestern portion of the United States; and the Prairie Style, initially popularized in the Mid-west and Prairie states. Colonial Revival styles, including American Colonial Revival (inspired by architecture of the early American Colonies) and Spanish Colonial Revival (inspired by architecture of the early Spanish colonies) also emerged in popularity during this period, though there is a stronger preponderance of these styles later during the Eclectic Revival period of early to mid-century.

These styles were concentrated in areas spreading from downtown Los Angeles into some of the area's first streetcar suburbs. Although many examples of these styles have been lost through redevelopment, fire, and deterioration, many fine examples of these styles still exist in Los Angeles. These styles can be commonly found in the greater West Adams area, portions of South Los Angeles, Hollywood and throughout the Northeast Los Angeles environments.

In this period, Los Angeles was beginning to develop a broad base of prominent architects. Prominent architects in Los Angeles during this period included Henry and Charles Greene, the Heineman Brothers, Frank Tyler, Sumner Hunt, Frederick Roehrig, Milwaukee Building Co., Morgan & Walls, J. Martyn Haenke, Hunt & Burns, Charles Plummer, Theodore Eisen, Elmer Grey, Hudson & Munsell, Dennis & Farwell, Charles Whittlesby, and Thornton Fitzhugh. Only one surviving example of the work of architects Charles and Henry Greene survives in Los Angeles, in the Harvard Heights HPOZ.

The Eclectic Revival Styles (1915–1940s)

The period between the World Wars was one of intense building activity in Los Angeles, and a wide range of revival styles emerged in popularity. The Eclectic Revival styles, which draw upon romanticized notions of European, Mediterranean and other ethnic architectural styles, include Colonial Revival; Dutch Colonial Revival; English and English Tudor Revival styles; French Eclectic styles; Italian Renaissance Revival; Mediterranean Revival; Monterey Revival; Spanish Colonial Revival; and to a lesser extent, highly stylized ethnic revival styles such as Egyptian Revival, and Hispano-Moorish styles. Use of the Craftsman Style continued through this period as well. Many of these styles were widely adapted to residential, commercial and institutional use. Styles such as Egyptian Revival, Chateauesque

(a French Eclectic style) Mediterranean Revival and Spanish Colonial Revival being particularly popular for use in small and large scale apartment buildings.

All of these styles were based on an exuberantly free adaptation of previous historic or "foreign" architectural styles. The Los Angeles area is home to the largest and most fully developed collection of these styles in the country, probably due to the combination of the building boom that occurred in this region in the 1920s and the influence of the creative spirit of the film industry.

Prominent architects working in these styles included Paul Revere Williams, Walker & Eisen, Curlett & Beelman, Reginald Johnson, Gordon Kauffman, Roland Coates, Arthur R. Kelley, Carleton M. Winslow, and Wallace Neff. Many surviving examples of these styles exist in Los Angeles, particularly in the Mid-Wilshire, Mid City and Hollywood environments.

The Eclectic Revival (or Period Revival) movement presents a number of romantic building styles to this single streetscape.

The Early Modern Styles (1900s–1950s)

The period between the World Wars was also a fertile one for the development of architectural styles that were based on an aggressively modern aesthetic, with clean lines and new styles of geometric decoration, or none at all. The Modern styles: Art Deco, Art Moderne, and Streamline Moderne and the International Style, all took root and flourished in the Los Angeles area during this period. The influence of the clean lines of these styles also gave birth to another style, the Minimal Traditional style, that combined the sparseness and clean lines of the Moderne styles with a thin veneer of the historic revival styles. Early Modern styles were most readily adapted to commercial, institutional and in some cases, multi-family residential structures citywide, though there is certainly a preponderance of early modern single family residential structures in the Silver Lake and Echo Park areas, Hollywood, the Santa Monica Mountains, Mid-Wilshire and West Los Angeles areas.

Richard J. Neutra's Strathmore Apartments in Westwood, built in 1937, are an example of the cutting-edge early International Style.

Prominent architects in the Los Angeles region working in these styles included Richard Neutra, Paul Revere Williams, R.M. Schindler, Stiles O. Clements, Robert Derrah, Milton Black, Lloyd Wright, and Irving Gill.

Post-World War II/Response to Early Modern (1945–1965)

The period dating from 1945-1965 saw an enormous explosion in the development of single-family housing in the Los Angeles area. Much of this development took the architectural vocabulary of the pre-war years and combined it into simplified styles suitable for mass developments and small-scale apartments. Residential architectural styles popular in Los Angeles in this period included the Minimal Traditional, the various Ranch styles, Mid-Century Modern styles such as Post and Beam and

Los Angeles' love of the auto is often reflected in Art Deco and Streamline styles.

The Dingbat, a product of 1950s Los Angeles, combines a basic utilitarian form with fanciful design motifs.

The Post-War building boom brought inexpensive and plentiful housing to the San Fernando Valley.

Contemporary, and the Stucco Box (most popularly expressed in the Dingbat type). Though these styles may be found as in-fill development throughout the City, areas where complete districts of these styles may be found in Los Angeles include Westchester, West Los Angeles, the Santa Monica Mountains and the San Fernando Valley.

Prominent architects working in these styles in Los Angeles included Gregory Ain, A. Quincy Jones, J. R. Davidson, Cliff May, John Lautner, William Pereira, Rapahael Soriano, and H. Hamilton Harris, although many of these styles were builder-developed.

6.2 **Building Types**

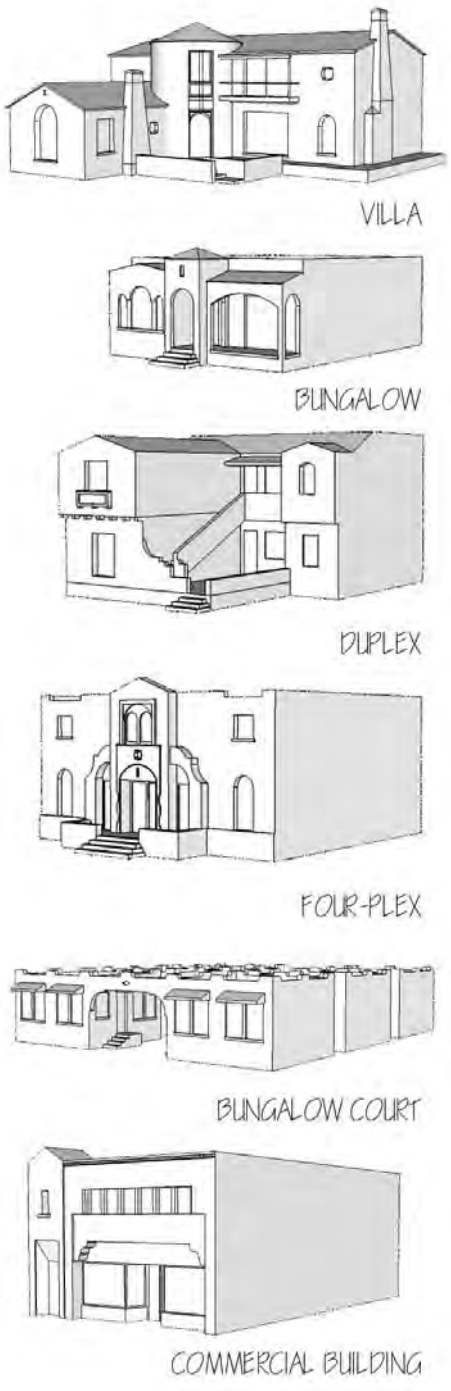
The diversity of building periods and architectural styles in Los Angeles is matched only by the diversity of building types. The cityscape is marked by single family homes, big and small; multi-family structures of varying sizes and densities and a breadth of commercial and institutional buildings varying in scale and function. An understanding of building types can be especially helpful in planning and evaluating an in-fill project in a historical context. Some architectural styles in Los Angeles, such as the Spanish Colonial Revival style have been gracefully adapted to a wide range of residential, commercial and institutional building types. Other styles tend to only have been applied to particular building types; for example, the Art Deco style tends to be found most often on commercial and institutional building types, and the Craftsman style, a predominant residential style was rarely applied to commercial building types. While it is important to address issues of architectural style, it is equally important to ensure that new projects fit in their context with respect to function, layout and type.

Single Family Homes

Though most single family homes may be similar by virtue of their use, there is a significant range of single family building types within Los Angeles. Some neighborhoods may be characterized by standard two-to-three story single family homes, and others may be characterized by cottages or bungalows—simple one-story to one-and-a-half-story homes. Idiosyncratic building types may also exist in particular neighborhoods. For example, the Villa, a two-story home oriented lengthwise along the street may be popularly found in affluent pre-war suburbs throughout the Mid-City and Mid-Wilshire areas. While there are always exceptions, attention should be paid to which architectural styles are applied to which single family home types. For example, the English Tudor Revival style has usually been applied to large single family homes, while the simpler English Revival style has usually been applied to bungalows and cottages. The various design guidelines in this document are intended to ensure that additions to single family homes, as well as in-fill projects do not defy established building types as well as architectural styles.

Multi-Family Homes

A wide range of multi-family building types were adapted in historic Los Angeles. Some, such as simple duplexes or garden style apartments were designed to blend with the surrounding single family context, and others, such as traditional four-plexes, one-over-one duplexes or large scale apartment buildings define neighborhoods in their own right. When planning a multi-family project, special attention should be paid to predominant building types, and to what styles are most often applied to those types, to ensure that the project is compatible



with the surrounding neighborhood. For example, there tend not to be Craftsman style large-scale apartment buildings, though the style is readily applied to duplexes and fourplexes. The Multi-Family In-Fill design guidelines in Chapter 9 provide a clear understanding of the specific multi-family building types.

Commercial and Institutional Uses

While the majority of parcels within Los Angeles HPOZs tend to be residential, there is a significant number of commercial buildings and commercial uses within HPOZ purview. Most commercial buildings in HPOZs tend to be simple one-story and two-story buildings built along the street frontage with traditional store-fronts and offices or apartments above. Institutional building types tend to be defined by their use: churches, schools, libraries, etc. Successful in-fill projects will adhere both to prevailing architectural styles and building types. The Commercial Rehabilitation and In-Fill chapters (Chapters 10 and 11) provide assistance in this area.

6.3 **Introduction to Western Heights Architectural Styles**

The Architectural Styles Chapter of this Plan is intended to give an overview of the predominant styles that may exist in the Western Heights HPOZ. Each architectural style explanation has been divided into two sections, a textual overview of the style and its development, and a listing of some typical significant architectural features of that style. These descriptions are intended to assist property owners and the HPOZ board in determining the predominant architectural style of a structure, and in understanding the elements of that style. These descriptions are not intended as comprehensive lists of significant features of any style, and are not to be taken as an exhaustive list of what features should be preserved. Rather, they are intended as a starting point for discussion about what rehabilitation or restoration projects might be appropriate to a particular property.

The reader may note that each architectural style description contains a note on what architectural styles can commonly be found mixed together. This note is included because architectural styles are not always found in a pure state. Individual owners and builders quite often customized or mixed the elements of different architectural styles together in designing a structure. This may be because cultural tastes were transitioning between two styles, with some styles falling out of favor and new styles being introduced, or simply due to the personal taste of the designer. It is important to realize that these mixed style structures are no less architecturally significant than the "purer" forms of a particular style, and that mixed style structures are not "improved" through remodeling with the goal of achieving a "pure" style. Los Angeles is particularly rich in inventive, "fantasy" structures that show a great deal of creativity on the part of the architect, owner, and builder, and this richness should be preserved.

The architectural style descriptions may contain some unfamiliar terms. Many of these terms are defined in the Definitions chapter located at the end of this Preservation Plan, or are illustrated within the Design Guidelines chapters.

19th Century Styles: **American Foursquare**

Background

The American Foursquare style is a residential style frequently used in Los Angeles from the turn of the last century through the 1910s. Popular in American suburban development, the style lent itself to low-cost design that maximized square footage on small lots while presenting a dignified appearance. A precursor to the Craftsman and Prairie styles, Foursquare houses tended to avoid the ornate detail associated with styles such as Queen Anne and Eastlake.

Common Components of the Foursquare Style

A Foursquare house is generally two stories, with a simple square or rectangular footprint, a low-pitched, usually hipped, roof, a front hipped-dormer, and a substantial, though often asymmetrical front porch. Columns suggestive of the classical orders, dentils, and traditional moldings are also commonly found on Foursquare houses, though the popularity of the Craftsman style in the West Adams area brings Arts and Crafts details to many Foursquare houses and the Foursquare house in many ways has served as a canvas by which other architectural styles have emerged. Windows are always rectangular and may be arranged singularly or in groups—often the first floor will have grouped windows and the upper-floor will have singular windows. Doorways are also rectangular and tend to be wide, often with large panes of glass in the door or as side lights. Cladding may be masonry, clapboard or to a lesser extent stucco.

General Characteristics:

- Simple floor plan
- Boxy, cubic shape
- Full width or off-set front porch with columnar supports and wide stairs
- Offset front entry in an otherwise symmetrical facade
- Two to two-and-a-half stories
- Pyramidal, hipped roof, often with wide eaves
- Large central dormer
- Large single light windows in front, otherwise double hung
- Incorporated design elements from other contemporaneous styles, but usually in simple applications
- Simple and restrained two-color and three-color paint schemes highlighting body, trim and accents

19th Century Styles: **Classical Revival**

(Includes Neo-Classical Revival, Beaux Arts, Greek Revival)

Background

The various Classical Revival styles, including Neo-classical Revival, were popularly used in Los Angeles from the mid 1800s through the 1930s, though the style remained en vogue with institutional and commercial structures through the Second World War. Many attribute the popularity of the Classical Revival styles to the City Beautiful Movement, born out of the World Columbian Exposition held in Chicago in 1893, though the style was in use prior to that event.

Common Components of the Neo-classical Revival Styles

The Neoclassical Revival style is closely related to both the Greek Revival and Colonial Revival styles. The style's earlier iterations are generally adapted to large houses. A double height front portico with Ionic or Corinthian columns tends to be a hallmark of the style. Windows are generally arranged singularly and may be adorned with lentils. Roofs are often hipped or with side-facing gables. Neo-classical design features such as columns, pediments may be found on smaller homes and are often mixed with Greek Revival, Colonial Revival and Italian Renaissance Revival homes as each of these styles draws from antient classical building forms.

General Characteristics

- Massive symmetrical and rectilinear form
- Low pitched roof
- Decorative dentils along eaves
- Triangular pediments supported by classic columns
- Large rectangular windows, usually arranged singularly
- Decorative plaster elements
- Masonry walls
- Color schemes indicative of stone and masonry construction

19th Century Styles: **Queen Anne**

Background

The Queen Anne, popularized in England in the mid 1800s and later in the US, was modeled loosely on Medieval Elizabethan and Jacobean architecture and in many ways is a statement of the excesses of the Victorian era. Many of the largest and most impressive homes of this period where built in the Queen Anne style. Innovations in balloon frame construction allowed builders of Queen Anne homes to create complex floor plans, which resulted in equally complex elevations and the style was thus a reaction to the classical symmetry of earlier styles. Industrial innovations such as mass production facilitated the use of complex house components like doors, windows, roofing, and decorative details. In the United States, craftsman added their own touches with intricate spindles and other stylized wooden details.

Common Characteristics of the Queen Anne Style

The Queen Anne Revival style is exemplified by an asymmetrical floor plan, gabled roofs with exposed decorative trusses, towers, patterned wooden wall cladding, wrap-around porches, bay windows and patterned masonry. Queen Anne Revival buildings are typically one to two stories, with wide eaves and decorative brackets, and rectangular windows. Fish scale shingle siding and decorative clapboard is often employed in various patterns and cuts, as well as spindle work, bay windows and bump outs. Towers are often used with imaginatively shaped roofs ranging from cones and bell shapes to octagons and domes with decorative finials. Interestingly, towers placed at the corner of the front facade are most often a characteristic of the Queen Anne style, whereas placement is often elsewhere on other styles like the Victorian Stick style. Wrap around porches are very common.

General Characteristics

- Complex and steeply pitched roof forms with cross gables and front-facing gables. Towers and turrets are common.
- Long, narrow double hung windows, ornate stained glass
- Highly ornamented with spindle work, finials, roof cresting, corner brackets on porches and cutouts.
- Fanciful shingle and clapboard
- Parapets and brickwork are often variably colored and patterned and highly decorative.
- Covered porches often wrap from the front and around a side and are decorated with spindle work and friezes.
- Chimneys may be patterned masonry and are sometimes seen with chimney pots.
- Complex and contrasting color schemes highlight ornate wood-work

19th Century Styles: **Shingle**

Background

The Shingle style was popular in Los Angeles during the 1880s through the 1900s and appealed to homebuilders who desired homes less decorative and opulent than the Queen Anne and Eastlake styles. The Shingle style is often thought of as an eclectic American adaptation of the Queen Anne, Colonial Revival and Richardsonian Romanesque styles and the style has been successfully adapted to homes large and small. By covering most or all of a building with shingles stained a single color, architects created a uniform, unembellished surface and a clean, pure aesthetic.

Common Components of the Shingle Style

The Shingle style features walls and roofs clad in shingles, with asymmetrical facades. Structures are typically two stories, with steeply pitched roofs, gables, narrow eaves, and large wrapping porches. The extensive use of shingles de-emphasizes other elements of the façade, such as cornices and windows. The Shingle style features are found mixed in with Queen Anne, Classical Revival, Stick, and Arts and Crafts styles. Given the popularity of the Craftsman style in the West Adams area, most Shingle style homes incorporate Craftsman design themes such as exposed rafters and complex cross-gables.

General Characteristics

- Asymmetrical facades and roof forms
- Complex cross-gables and front-facing gables
- Occasional use of gambrel roof
- Clad with naturally stained shingle
- Simple eaves
- Rough-hewn stone foundations and porch supports
- Rectangular, grouped, double-hung windows
- Stained shingles in natural tones with one or two trim/accent colors

Arts & Crafts/Turn of the Century Styles: **Colonial Revival**

Background

Early use of the Colonial Revival style dates from 1890 and it remained popular through the 1950s (consequently, it may also be considered part of 19th Century Styles Period or the Eclectic Revival Period). Popularity of the style resulted from a rejection of the ornate European inspired styles such as Queen Anne, and a desire to return to a more "traditional" American building type. This popularity was reinforced by the City Beautiful movement which gave attention to Neo-classical building forms. Colonial Revival took on added popularity with the restoration of Colonial Williamsburg in the 1920s. This style draws from the simple building forms typical of early American colonial structures, and elements of classical or Georgian architecture. It is closely related to the Neoclassical Revival and Georgian Revival styles.

Common Characteristics of the Colonial Revival Style

Colonial Revival residential structures are typically one or two stories, with hipped or gabled roofs (gables nearly always oriented to the sides of the structure) and symmetrical facades. Porches tend to be diminutive if present at all, and entryways are often adorned with decorative crowns or pediments and square or round columns. Doorways are generally single and are rectangular. Windows on older Arts and Crafts period structures, may be arranged in pairs or threes, though later Eclectic Revival Colonial houses often have windows arranged singularly with shutters. More decorative versions of Colonial Revival, such as Adam Revival, Federal Revival or Georgian Revival may integrate Neo-classical design motifs such as quoins and dental brackets. The entryway or porch is the primary focus, often highlighted with a decorative crown or pediment. Commercial structures are usually low in scale.Elements of the Colonial Revival style are often found mixed with the Queen Anne and Craftsman architectural styles.

General Characteristics

- Symmetrical Facades, and occasional use of side-porch
- Basic rectangular shape
- Hipped or side-facing gable roof
- Multi-pane double-hung windows, often adorned with shutters
- Central entrance usually adorned with pediments and decorative crown
- Diminutive or no front porch
- High-style variants may use dormers, quoins, dentils and full-height classical columns
- Two or three-color paint schemes with house body often in light or white tones

Arts & Crafts/Turn of theCentury Styles: **Craftsman**

(Also Japanese Craftsman, Swiss Craftsman, Tudor Craftsman)

Background

Quintessential to the Arts and Crafts design movement, Craftsman architecture stressed the importance of craftsmanship, simplicity, adapting form to function, and relating the building to the surrounding landscape through its ground-hugging massing and orientation. Many early Craftsman homes utilized design elements also found on English Tudor Revival homes such as exposed half-timbers, a steeply pitched roof and plaster façade surfaces. (These structures may be identify as "Transitional Arts and Crafts.") Later, the Craftsman style was simplified and often reduced to signature design elements such as an offset front gable roof, tapered porch piers, and extended lintels over door and window openings. In many cases, the Craftsman style incorporated distinctive elements from other architectural styles resulting in numerous variations (namely Asian and Swiss influences).

The Craftsman style is found in single family homes, duplexes, four-plexes and apartment houses are not uncommon. Though larger Craftsman homes are common in West Adams, the style is perhaps best known in the Bungalow type: single-story smaller homes built from kits or pre-drawn catalogue plans. The Airplane Bungalow is a building type that is wholly unique to the Craftsman style and generally consists of a Bungalow with a small pop-up second story (resembling, to some extent, an airplane cockpit

Common Characteristics of the Craftsman Style

Craftsman architecture is usually characterized by a rustic aesthetic of shallowly pitched overhanging gable roofs; earth-colored wood siding; spacious, often L-shaped porches; windows, both casement and double-hung sash, grouped in threes and fours; natural wood for the front doors and through-out the interior; and exposed structural elements such as beams, rafters, braces and joints. Cobblestone or brick was favored for chimneys, porch supports and foundations. Craftsman structures may also exhibit characteristics of Prairie and Mission Revival styles.

General Characteristics

- Broad gabled roofs with deeply overhanging eaves
- Pronounced front porch, symmetrical or offset with massive battered or elephantine columns
- Exposed and decorative beams, rafters, vents
- Decorative brackets and braces
- Grouped rectangular multi-pane windows
- Massive stone or masonry chimneys
- Use of earth tone color palette and natural finishes
- Three-color schemes for body, trim and accents

Arts & Crafts/Turn of the Century Styles: **Mission Revival**

Background

The Mission Revival style was born in California in the 1890s. It has been an enduring architectural style, and examples continue to be constructed into the present day, although in much smaller numbers than in its heyday in the 1910s and 1920s and with less of an emphasis on Arts and Crafts detail. The Mission Revival style owes its popularity in large part to the publication of "Ramona" in the late 19th Century, the release of the Mary Pickford film of the same title in 1910, and the consequent romanticization of the Mission era in California and resurgence of interest in the Spanish heritage of the southwestern United States.

Common Characteristics of the Mission Revival Style

Mission Revival structures are generally clad with stucco and employ sculpted parapets (espandanas), and arched openings reflected the simplicity of Southern California's Mexican and Spanish heritage. Mission Revival style residential structures are typically two or three stories (commercial structures typically are no more than four), have low pitched roofs with gables and wide eaves, arched arcades enclosing large, front porches, a mixture of small square windows, and long, rectangular windows, quatrefoils, Moorish detailing and often towers.

The features of the Mission Revival style are often mixed with the Spanish Colonial Revival, Craftsman, Prairie and Hispano-Moorish styles. While the Mission Revival style may easily be confused with other Mediterranean and Spanish styles a true Mission Revival structure will exhibit the intricacy of detail associated with the Arts and Crafts movement and will embody the rustic nature of the early California Missions over the ornate formality of other Spanish Colonial settlements.

General Characteristics

- Simple, smooth stucco or plaster siding
- Broad, overhanging eaves with exposed rafters
- Either hipped or gabled tile roof
- Roof parapets
- Large square pillars or twisted columns
- Arched entry and windows with deep openings
- Covered walkways or arcades
- Round or quatrefoil window
- Restrained decorative elements usually consisting of tile, iron, and wood

Eclectic Revival Styles: **Dutch Colonial Revival**

Background

Dutch Colonial Revival emerged as an architectural style in the United States in the early 1900s and structures in this style in Los Angeles generally date from the 1910s to the 1930s. The Dutch Colonial Revival style is imitative of early Dutch Colonial buildings in the Northeastern United States during the American Colonial period. One of the tenants of the style is a gambrel roof that houses a full second story (this originally emerged as a building type where second-story restrictions prevented a full second floor). The Dutch Colonial Revival style is part of the Revival or Romantic architectural movements that were popular in the United States during the early 20th Century.

Common Characteristics of the Dutch Colonial Style

Dutch Colonial Revival structures are typically two-story, with a gambrel roof, shallow eaves, and sometimes sport Dutch doors or half-timbering. Windows are quite often arranged singularly, as are doors. Porches tend to be diminutive in size and use simple square or round columns. Some variants will incorporate Georgian entry features such as pilasters and crowns surrounding the front door. Roofs are nearly always gambrel, and side gables tend to be most widely used. Dutch Colonial Revival features are often mixed with Colonial Revival or Shingle styles.

General Characteristics

- 1½ to 2 stories
- Clapboard, shingle, stone or stucco siding
- Typically symmetrical façades, but also found with side entries
- Gable-end chimneys
- Round windows in gable end
- Porch under overhanging eaves with simple classical columns
- Multi-pane, double-hung windows
- Shed, hipped, or gable dormers

Eclectic Revival Styles: **English Tudor Revival**

(Also English Cottage, English Revival, Storybook Revival, etc.)

Background

A romanticized recreation of medieval English architecture, the English Tudor Revival style found popularity in the United States in the 1890s through the 1930s. In Los Angeles, the first Tudor style buildings were built in the early 1900s during the Arts and Crafts Period, though the style continued on in popularity through the 1930s. A higher concentration of English Tudor Revival structures were built during the Eclectic Revival Period, though the style could also be considered an Arts and Crafts Period style. Variations of this style include the English Cottage, which typically includes an asymmetrical floor plan but without the half timbering and heavy ornamentation and the playful Storybook Style, which usually over-emphasizes features such as faux-thatched roofs, roof pitch and whimsical ornamentation.

Common Characteristics of the English Tudor Revival Styles

English Tudor Revival structures are typically two or three stories, with steeply pitched roofs, cross gables, and often have shingle or slate roofs that attempt to replicate the look of medieval thatching. English cottage structures will replicate this pattern, though they are often found in single-story versions. English Tudor Revival structures nearly always use half-timbering, stucco and masonry (often arranged in a herring bone pattern, or using clinker bricks) while English Cottage structures may simply be stucco. Windows tend to be arranged singularly, may be casement or use hung sashes, and often utilize artful leaded glass patterns. Chimneys are massive and integral to the overall look of the house. Porches are minimal, and include simple archways and recesses. Doors are usually singular and may be rectangular or arched.

The Tudor and English Revival styles features can be found mixed Victorian era styles such as Queen Anne, Arts and Crafts Period structures such as Craftsman, and with other Eclectic Revival period styles such as French Eclectic.

General Characteristics

- One-and-one-half to two stories with asymmetrical and irregular plan
- Cross-gabled, medium to steeply pitched roof, sometimes with clipped gables
- Use of half-timbering, patterned masonry, stone and stucco
- Arrangements of tall, narrow windows in bands; small window panes either double-hung or casement
- Over scaled chimneys with decorative brickwork and chimney pots
- Rectangular or arched doorways, often recessed or found within tower features

Eclectic Revival Styles: **Italian Renaissance Revival**

Background

Italian Renaissance Revival buildings were popular in the United States from the early 1900's and surged in popularity in Los Angeles in the 1910's. Along with the rest of the Period Revival movement, Italian Renaissance Revival draws upon romanticized notions of historic architectural motifs. The Italian Renaissance Revival style is loosely based on Italian palazzos of the sixteenth century. The style was usually used in particularly grand homes and public buildings where an imposing presence was desired. The style gained particular popularity in Los Angeles because it could easily be integrated with other popular styles both within the Arts and Crafts movement and the Eclectic Revival Movement. There are Italian Renaissance Revival homes in LA that exhibit characteristics of the Mission Revival and Craftsman styles as well as Mediterranean Revival and Spanish Colonial Revival styles.

Common Characteristics of the Italian Renaissance Revival Style

Italian Renaissance Revival homes usually have a low-pitched hipped roof adorned with clay pantile and decorative edge features, elaborate windows on the first floor with a more simplified window pattern on the second, wide roof overhangs with decorative brackets, an emphasis on arches, especially on the first floor and are most often symmetrical.

Italian Renaissance Revival structures bear a close resemblance to their Mediterranean Revival counterparts but can usually be distinguished by a higher level of decorative detail, a stronger adherence to order and symmetry and a full second floor. One must understand that while Italian Renaissance Revival homes are inspired by Italian palazzos, Mediterranean Revival homes are inspired by more rustic seaside villas found throughout Mediterranean region.

General Characteristics

- Low pitched, hipped tile roof
- Pantiles in reds, greens and blues
- Moderate to wide eaves with decorative bracket supports
- Recessed porches with arched openings
- Classical detailing in use of columns, quoins, pediments, arches, and pilasters
- Most often symmetrical
- Balanced wings
- Use of three-color palette with subdued and formal tones

Eclectic Revival Styles: **Mediterranean Revival**

Background

The Mediterranean Revival style is loosely based on Italian seaside villas from the sixteenth century. The style was particularly prevalent in Southern California, because of a popular association of the California coast with Mediterranean resorts and because the original Mediterranean structures were adapted to a climate not unlike California's. Though often used in massive and imposing structures, style is somewhat free-flowing, bereft of many of the classical elements that adorn Italian Renaissance Revival counterparts. The first Mediterranean/Italian Renaissance Revival buildings were built in the United States starting in the early 1900s. These styles became popular in Los Angeles in the nineteen-teens.

Common Characteristics of the Mediterranean Revival Style

Structures may be either symmetrical or asymmetrical, often incorporate courtyards and garden walls, archways, arcades and mosaic tile work. Roofs may be gabled or hipped, but are nearly always adorned with clay tile or pantile. Windows are often deeply recessed and may be grouped or singular and often use casements. Elements of the Mediterranean Revival style can often be found mixed with Italian Renaissance Revival, Beaux Arts and Spanish Colonial Revival styles.

General Characteristics

- Rectangular or irregular plans
- Varied, irregular roofs with simple eaves
- Arched and rectangular windows and doors
- Windows may be grouped or singular
- Balconies, patios and courtyards integrated into plan
- Entry often accentuated with decorative columns
- Clay tile roofs
- Vibrant two and three-color schemes with walls in shades reminiscent of adobe

Eclectic Revival Styles: **Monterey Revival**

Background

The Monterey Revival style re-creation of the rustic American-influenced Spanish Colonial houses of the Central Coast region of California during the California colonial period of the 1840s. Monterey buildings are a blend of Spanish Adobe construction fused with American Colonial massing. The style emerged in popularity along with various other Spanish and Mediterranean inspired styles in the 1920s.

Common Characteristics of the Monterey Revival Style

Monterey Revival style structures are two stories with different cladding material for each floor, an 'L'-shaped plan, a low-pitched gabled roof and a cantilevered second floor balcony. Earlier versions exhibit more Spanish Colonial detailing, while later versions contain more colonial references such as shuttered windows and wood siding on the upper or both floors. The Monterey Revival style is often combined with Spanish Colonial Revival, Mediterranean Revival and Minimal Traditional styles.

General Characteristics

- Cantilevered second-floor balcony at front elevation with simple posts and railings
- Always two-stories with disparate building materials between first and second floor
- Low pitched side-gabled roof with clay tile or wood shingle
- Entrance adorned with pediments or crown, no porch
- Windows often adorned with shutters
- Rustic natural colors used on body with vibrant accent colors

Eclectic Revival Styles: **Spanish Colonial Revival**

Background

The Spanish Colonial Revival style grew out of a renewed interest in the architecture the early Spanish colonies of North and South America. The architectural features of this style are intended to reflect the rustic traditional Spanish architecture with local building materials such as stucco, adobe, clay and tile. While the style can be closely tied to the Mission Revival style, Spanish Colonial Revival is generally inspired by the more formal buildings that were constructed during the colonial area, whereas Mission Revival tends to be more rustic and holds more closely to the design principles of the Arts and Crafts Movement. While the differences may be minor when the subject is a small single family house, larger Spanish Colonial Revival structures, such as churches, institutional buildings or grandiose mansions tend to reflect a higher level of ornamentation and order. Structures that hold less closely to the aesthetic of Spanish Colonial architecture may also be called Spanish Eclectic.

Common Characteristics of the Spanish Colonial Revival Style

Spanish Colonial structures are typically one or two stories and rectangular in floor plan. The buildings have low-pitched tile roofs, parapet roofs with tile coping, or some combination of the two; recessed openings, decorative ironwork and decorative plaster reliefs. In its simplest form, Spanish Colonial Revival structures are characterized by white stucco or plaster exteriors, red tile roofs and arched window or doorway openings. More elaborate examples incorporate jehas and grilles of wood, wrought iron or plaster. It is not uncommon to find extensive use of terra cotta and glazed tile; balconies and patios. Spanish Colonial buildings are often mixed with Mission Revival, Mediterranean Revival, Moorish Revival, Monterey Revival and Moderne styles.

General Characteristics

- Asymmetrical
- Low-pitched flat, gable, or hip roof, typically with no overhang
- Clay tile roof
- Half round arches, doors, and windows
- Stucco over adobe brick, or adobe brick exterior walls
- Ornate tile, wrought iron, and wood work
- Formal plan with decorative plaster work
- Later variants using more whimsical plans with diminished ornamentation

Chapter 7 Residential Rehabilitation

7.1 Introduction

Rehabilitation is the process of working on a historic structure or site in a way that adapts it to modern life while respecting and preserving the historic, character-defining elements that make the structure, site or district important.

These Residential Rehabilitation Guidelines are intended for the use of residential property owners and care-takers planning work on Contributing structures or sites within the HPOZ. Contributing structures are those structures, landscapes, natural features, or sites identified as contributing to the overall integrity of the HPOZ by the Historic Resources Survey for the Western Heights HPOZ. Generally, "Contributing" structures would have been built within the historic period of significance of the HPOZ, and will retain elements that identify it as belonging to that period. The historic period of significance of the HPOZ is usually the time period in which the majority of construction in the area occurred. In some instances, structures that are compatible with the architecture of that period or that are historic in their own right, but were built outside of the period of significance of the district, will also be "Contributing".

The Residential Rehabilitation of the guidelines should be used in planning, reviewing and executing projects for single-family structures and most multi-family structures in residential areas. They are also intended for use in the planning and review of projects or structures that were originally built as residential structures but have since been converted to commercial use. For instance, the Residential Rehabilitation Guidelines would be used to plan work on a historic structure built as a residence that is now used as a day-care facility.

The Residential Rehabilitation Guidelines are divided into ten (10) sections, each of which discusses an element of the design of historic structures and sites. If you are thinking about planning a project that involves the area around your house, such as repaving your driveway or building a fence, the "Setting" would be a good place to start. If you are planning work on your roof, you might want to look back at Chapter 6, Architectural Styles to determine the style of the building and what type of roof and roof materials are appropriate, and then at the "Roofs" section here in Chapter 7 of these guidelines. The Table of Contents details other sections that might pertain to your project.

While the Design Guidelines throughout this Preservation Plan are a helpful tool for most projects, some types of work may not specifically be discussed here. With this in mind, it is always appropriate to remember that the Design Guidelines of this Preservation Plan have been developed in concert with the Secretary of Interior's Standards for Rehabilitation, a set of standards used nationally for the review of projects at historic sites and districts. All projects should comply with the Secretary of Interior's Standards, and where more specific

guidelines have been set for by this Preservation Plan, the guidelines herein. The following principles are from the portions of the Secretary of the Interior's Standards that are applicable to HPOZ review, and are the basic principles on which these guidelines are based:

Rehabilitation, maintenance, and modification of design elements not visible from the public right-of-way will generally not be required to be held to strict guideline standards. However they will be evaluated to ensure that materials are compatible, and that rhythm, scale, and style are harmonious and appropriate to the original structure.

Principle 1:

The historic appearance of the HPOZ should be preserved. This appearance includes both the structures and their setting.

Principle 2:

The historic appearance of contributing structures within the HPOZ should be preserved. (The historic appearance of publicly visible facades of contributing structures within the HPOZ should be preserved.)

Principle 3:

The historic fabric of contributing structures should be preserved. Repair should be attempted before replacement.

Principle 4:

Replacement elements should match the original in materials, design, and finish as closely as possible.

Principle 5:

If historic design elements have been lost, conjectural elements should not be used. Every effort should be made to ascertain the original appearance of the structure, and to replicate that appearance.

Principle 6:

New additions should be designed to be compatible with the massing, size, scale, and architectural features of a historic structure or site, while clearly reflecting the modern origin of the addition. Additions should be designed to preserve the significant historic fabric of contributing structures or sites.

7.2 **Setting - Landscaping, Fences, Walls, Walks, and Open Space**

The site design of an historic structure is an essential part of its character. This design includes the streetscape in which the site is set, the planting strip along the street, setbacks, drives, walks, retaining walls, the way a structure sits on its lot in relation to other structures and the street, and other landscaping elements. While many of the historic structures in the HPOZ may have lost some of these characteristics over time, certain common characteristics remain which help to define the character of these historic areas and the structures within them.

Traditionally, residential structures were sited on their lots in a way that emphasized a progression of public to private spaces. Streetscapes led to planting strips, planting strips to sidewalks, sidewalks to yards and front walkways, which led to porches and the private spaces within a house. Residential structures were configured in such a way that living space was oriented toward the front of the house and utility spaces such as kitchens, service porches garages were most often oriented toward the rear yard. Rear yards were most commonly used as a utility space, keeping car parking, gardening, and household chores to the privacy of an enclosed and private space. Common setbacks in the front and side yards helped ensure these orderly progressions. Preservation of these progressions is essential to the preservation of the historic residential character of structures and neighborhoods. Preservation of these progressions is often essential to the maintenance of historic neighborhood streets as a functioning resource around which a neighborhood interacts.

Guidelines

1. Mature trees and hedges, particularly street trees in the public planting strip, should be retained whenever possible, or alternately replaced with in-kind materials. Special attention should be paid to historic tree planting patterns and species and efforts should be made to re-introduce similar landscape elements on new plantings.

2. If historic plantings do exist, they should be preserved in their original locations. If these features cannot be preserved, they should be replaced in kind.

3. Historic topographic features should be preserved whenever possible. Leveling or terracing a lot that was traditionally characterized by a steep hillside or a terrace is not appropriate.

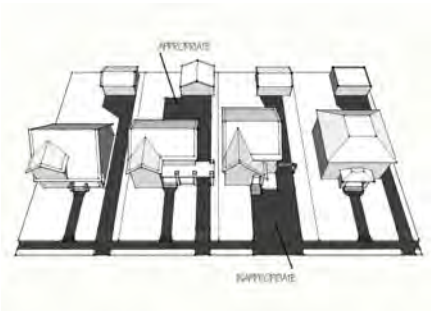
4. Historic sidewalks, walkways and other hardscape features should be preserved. If these elements are replaced, they should be replaced with materials similar to those historically present in the area. Special attention should be paid to replicating score patterns, pavement texture, swirl patterns and coloration.

Historic and mature trees provide shade and establish an indelible part of the neighborhood's character.

Historic retaining walls, often comprised of stone, are an important part of the neighborhood setting.

Poured concrete steps and walkways are a common feature in the neighborhood.

The fence arrangements in the middle two properties fortify the entire yard, obscure views of the building's features and are considered inappropriate.



Parking pads should always be located to the rear. Excessive front yard pavement is inappropriate.

5. If historic retaining walls, pathways, stairs or fences exist, they should be rehabilitated or preserved in place. If they must be removed, they should be replaced in kind. If reinforcement is necessary, finish materials should match the original in materials and design.

6. Painting unfinished concrete, stone or masonry historic retaining walls or garden walls is inappropriate.

7. When original site features have been lost and must be replaced, designs should be based on historic photographic evidence. If no such evidence exists, the design of replacement details should be based on a combination of physical evidence and evidence of similar elements found at similar properties in the HPOZ.

8. The traditional character of residential front and side yards should be preserved. These areas should be reserved for planting materials and lawn, and non-porous ground coverings should be minimized. Excessive pavement within the front yard area is inappropriate.

9. The traditional character of multi-family residential front yards, courtyards and other open areas should be preserved. These areas should be reserved for planting materials and lawn, and non-porous ground coverings should be minimized. Excessive pavement within the front yard or courtyard areas is inappropriate.

10. The use of front yard areas or courtyards for car parking, storage or other utility uses is generally inappropriate. Designated parking areas and driveways should be located within the rear yard area and should be screened from view of the general public by appropriate fencing or planting strips.

11. Fencing and walls, where appropriate, should be comprised of simple materials that are consistent with the Period of Significance. In most cases, front yard fencing is inappropriate, but low garden walls that do not obstruct views of the home or the streetscape may be appropriate in some locations. Rear yard fencing should be visually unobtrusive to the general public. Materials such as unfinished concrete block or overly ornate wrought iron are inappropriate.

12. Landscaping should not be so lush or massive that public views of the house or streetscape are significantly obstructed.

13. Gates and fences that enclose a rear yard should not completely block views of building architectural details nor should they completely enclose a porte-cochere or similar driveway feature.

14. Swimming pools should be confined to an enclosed rear yard. Above-ground pools are generally inappropriate, as are excessively massive pool accoutrements that would be visible to the general public such as fountains, slides and waterfalls.

15. New physical features within a front yard, such as ponds, fountains, gazebos, recreational equipment, sculptural elements, etc. are generally discouraged. When appropriate, such features should be diminutive in scale and style and visually deferential both to the residential structure onsite and to similar physical features that were constructed during the Period of Significance.

16. Drought tolerant alternatives to traditional front yard lawns may be found appropriate at some locations so long as such alternatives are consistent with the prevailing character and appearance of front yards in the neighborhood. In most cases front yards in historic neighborhoods are green and open. A thoughtfully prepared landscape plan using alternative low-water plant species may replicate the desired greenness and openness. High-quality artificial turf that allows for surface permeability and closely resembles the look and texture of grass might also be found appropriate for some locations.

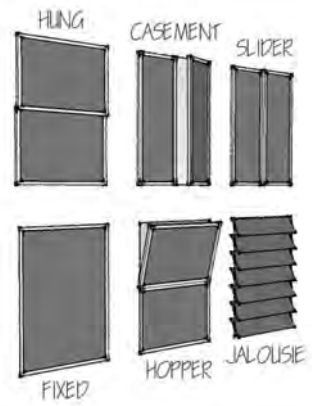
17. In addition to compliance with the City's sign regulations (LAMC 12.21 A 7), any signs used for a home-based business or church structure in a residential area should be designed with sensitivity for the historic context. Such signs should be minimal in size, should not conceal any significant architectural or landscape features, and should be constructed of materials and colors that are appropriate to the style of the house and the Period of Significance. Illuminated signs and digital signs are not permitted by the City in residential areas and would be inappropriate in an HPOZ

Low-water and native landscapes can be lush and attractive and are well suited to the Arts and Crafts period.

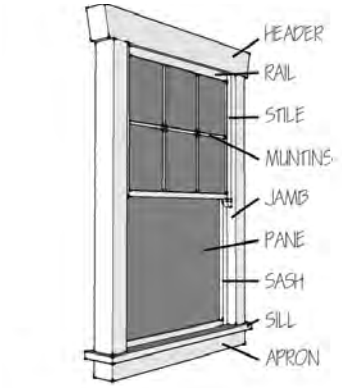
7.3 **Windows**

Windows are an integral part of a historic structure's design. The placement of window openings on a façade, also known as fenestration, the size of openings, and how openings are grouped, are all of great importance. Of equal importance are the construction, material and profile of individual windows. Important defining features of a window include the sill profile, the height of the rails, the pattern of the panes and muntins, the arrangement of the sashes, the depth of the jamb, and the width and design of casing and the head. In some cases, the color and texture of the glazing are also important.

Most windows found in Los Angeles' Pre-WWII Historic Districts are wood-frame true divided light windows. True divided light windows have multiple panes of glass. These windows are usually double-hung, fixed, or casement style windows. Double-hung windows have operable sashes that slide vertically. Casement windows open either outwards or inwards away from the wall. In some areas, metal frame casement or fixed divided light windows are common. These windows range from simple one-over-one windows to windows with panes in specialty shapes or leaded and stained glass. In many Post-WWII Historic Districts



Window types typical to historic homes are shown.



The basic anatomy of a double-hung window is shown.

The modern windows that have been added to this home are poorly scaled and dramatically alter the home's original appearance.

windows may use simpler materials such as metal frames, however the placement of unique window features, such as floor-to-ceiling windows, or unique glazing surfaces can require substantial consideration.

Inappropriate replacement of windows can compromise the integrity of a building and have a serious negative effect on the character of a structure. Generally, historic windows should not be replaced unless they cannot be repaired or rebuilt. If windows must be replaced, the replacement windows should match the originals in dimension, material, configuration and detail. Because it is often difficult to find off-the-shelf windows that will match historic windows in these details, replacing historic windows appropriately often requires having windows custom built.

Maintaining historic windows makes good economic sense, as they will typically last much longer than modern replacement windows. Problems with peeling paint, draftiness, sticking sashes, and loose putty are all problems that are easy to repair. Changing a sash cord, re-puttying a window, or waxing a window track are repairs that most homeowners can accomplish on their own to extend the life of their windows.

Guidelines

1. Repair windows and window hardware whenever possible instead of replacing them. Special attention should be paid to materials, hardware, method of construction and profile.

2. When the replacement of windows is necessary, replacement windows should match the historic windows in size, shape, arrangement of panes, materials, hardware, method of construction and profile.

3. The historic pattern of windows on a façade, and the placement of individual windows should be maintained. Fenestration patterns on historic houses are generally most evident on front-facing facades, secondary and non-visible facades may have less defined fenestration patterns.

4. Adding new windows, filling-in historic windows, or altering the size of historic windows on a street-visible facade is inappropriate.

5. Conjectural elements such as new decorative windows or window ornamentation should be avoided if such features were not originally part of the structure.

6. When altering window sizes or placement on non-street-visible facades is of a minimal scope and can be found appropriate, care should be taken so that new windows on historic facades should match the rhythm and scale of the existing windows on the facade.

7. If a window is missing entirely, replace it with a new window in the same design as the original if the original design is known. If the design is not known, the design of the new window should be compatible with the size of the opening, and the style of the building.

8. Replacement windows on a non-street-visible facade may vary in materials and method of construction from the historic windows, although the arrangement of panes, size, and shape should be similar.

9. The installation of 'greenhouse' type kitchen windows extending beyond the plane of the facade is generally inappropriate.

10. Window screens should match the existing window trim in finish color.

11. Awnings and shutters should be similar in materials, design, and operation to those used historically, and should not be used on architectural styles that do not normally use such features. When they can be appropriately used, awnings should always conform to the shape of the window on which they are installed.

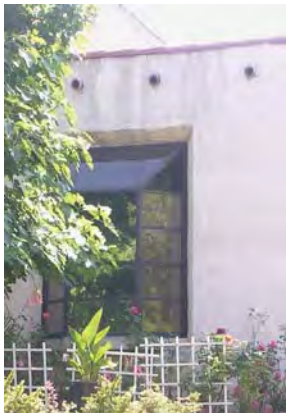
12. Burglar or safety bars that are not original to the structure are discouraged. In cases where bars may be found appropriate, such as installation on a non-street-visible façade, bars should use minimal ornamentation.

13. Bars or grillwork that is original to the structure should be retained.

14. In the interest of energy savings, alternative methods of weather-proofing should be considered prior to consideration of the removal of original windows. Methods such as wall, attic and roof insulation or weather-stripping existing windows or the restoration of existing windows may provide desired energy savings without the removal of important historic features.

A curved bay of double-hung windows is shown.

An inappropriately sized aluminum window diminishes the historic value of a house.

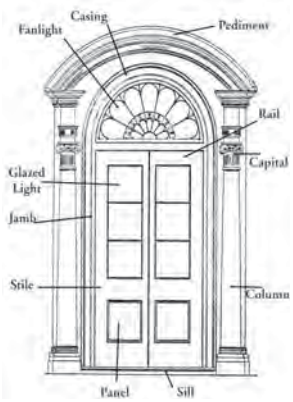


Despite their utility, garden-box windows such as this did not exist during this home's Period of Significance.

7.4 **Doors**

The pattern and design of doors are major defining features of a structure. Changing these elements in an inappropriate manner has a strong negative impact on the historic character of the structure and the neighborhood. Doors define character through their shape, size, construction, glazing, embellishments, arrangement on the façade, hardware, detail and materials, and profile. In many cases doors were further distinguished by the placement of surrounding sidelights, fanlights, or other architectural detailing. Preservation of these features is also important to the preservation of a house's architectural character.

Replacing or obscuring doors can have a serious negative effect on the character of a structure. Generally, historic doors and their surrounds



The anatomy of a Colonial Revival style door is shown.


This Craftsman style door shows off a rustic wood finish, original hardware and a rectilinear design.


This doorway has been altered with a metal gate and plate glass sidelights.

should not be replaced unless they cannot be repaired or rebuilt. If doors must be replaced, the replacement doors and their surrounds should match the originals in dimension, material, configuration and detail. Because it is often difficult to find standard doors that will match historic doors in these details, replacing historic doors appropriately often requires having doors custom built or requires searching for appropriate doors at architectural salvage specialty stores.

Maintaining historic doors makes good economic sense, as they will typically last much longer than modern replacement doors. Problems with peeling paint, draftiness, sticking, and loose glazing, are all problems that are often quite easy to repair. Applying weather stripping, re-puttying a window, or sanding down the bottom of a door are repairs that most homeowners can accomplish on their own.

Screened doors were often historically present on many houses, and appropriately designed screened doors can still be obtained. However, installing a metal security door which blocks your door from view is inappropriate, and should be avoided.

Guidelines

1. Existing doors should be repaired when possible, rather than replaced. Special attention should be paid to the materials and design of historic doors and their surrounds.
2. The size, scale, and proportions of historic doors on a façade should be maintained.
3. Filling in or altering the size of historic doors, especially on street-visible facades, is inappropriate.
4. Adding doors to street-visible historic facades is inappropriate.
5. When replacement of doors is necessary, replacement doors should match the historic doors in size, shape, scale, glazing, materials, method of construction, and profile.
6. When original doors have been lost and must be replaced, designs should be based on historic photographic evidence. If no such evidence exists, the design of replacement doors should be based on a combination of physical evidence (indications in the structure of the house itself) and evidence of similar doors on houses of the same architectural style in the neighborhood.
7. Painting historic doors that were originally varnished or stained and are not currently painted is not appropriate.
8. Original hardware, including visible hinges, doorknockers, and latches or locks should not be removed. Repairing original hardware is preferable; if replacing hardware is necessary, hardware that is similar in design, materials, and scale should be used.

9. Screen doors that are consistent with the architectural style and compatible with the door size may be appropriate. Metal security doors, especially on front doors are inappropriate.

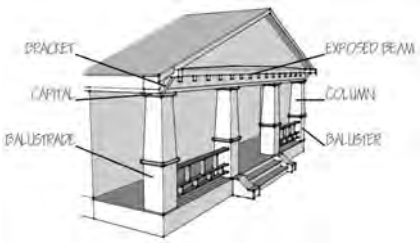
10. In the interest of energy savings, alternative methods of weather-proofing should be considered prior to consideration of the removal of an original door. Methods such as wall, attic and roof insulation or weather-stripping existing doors or lights within doors may provide desired energy savings without the removal of important historic features

7.5 **Porches**

Historically, residential porches in their many forms—stoops, porticos, terraces, entrance courtyards, porte-cocheres, patios, or verandas—served a variety of functions. They provided a sheltered outdoor living space in the days before reliable climate controls, they defined a semi-public area to help mediate between the public street areas and the private area within the home, and they provided an architectural focus to help define entryways and allow for the development of architectural detail.

Porch design, scale, and detail vary widely between architectural styles. To help determine what elements are particularly important on your porch, consult the architectural styles of these guidelines, or contact your HPOZ board for a consultation

In addition to preservation benefits, retaining porches makes economic sense, because the shade provided by a porch may greatly reduce energy bills. Porch elements which have deteriorated due to moisture or insect damage should be carefully examined to determine if the entire element is unsalvageable. If only a part of the element is damaged, then piecing in or patching may be a better solution than removal and replacement. If replacement is necessary, the element to be removed should be carefully documented through photos and careful measurements before the element is discarded. Having these photos and measurements will assist you in finding or making a replica of the element you are replacing. When porch foundations fail, the underlying cause is often ground subsidence or a build-up of moisture around the foundation. In these cases, a careful analysis should be made to locate the causes of the failure, and eliminate them as a part of the project.



The components of a Craftsman style porch are shown

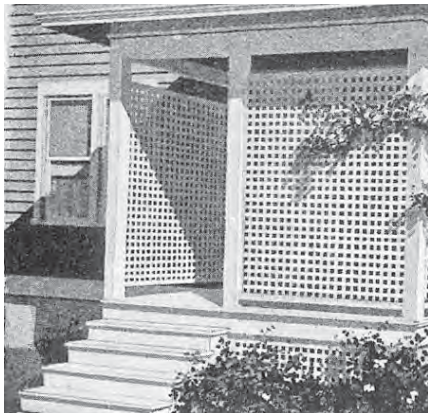
Non-perminant devices such as this bamboo screen may effectively screen a porch without altering the home and disrupting the streetscape.

Guidelines

1. Preserve historic porches in place and maintain their use as an outdoor living space.

2. Preserve decorative details that help to define an historic porch. These may include balusters, balustrades, columns, and brackets.

Enclosing a front porch disrupts the porch's intended purpose as an outdoor room.



Back porches and services porches may beenclosed in sensitive and appropriate ways.

The porch, porte-cochere and balcony are a prominant feature on this Tudor-Craftsman house.

3. If porch elements are damaged, they should be repaired in place wherever possible, instead of being removed and replaced.

4. If elements of the porch, such as decorative brackets or columns, must be replaced, replacement materials should exactly match the originals in design and materials.

5. When original details have been lost and must be replaced, designs should be based on historic photographic evidence. If no such evidence exists, the design of replacement details should be based on a combination of physical evidence (indications in the structure of the house itself) and evidence of similar elements on houses of the same architectural style in the neighborhood.

6. Additional porch elements should not be added if they did not exist historically. For instance, the addition of decorative "gingerbread" brackets to a Craftsman-style porch is inappropriate.

7. In many instances, historic porches did not include balustrades, and these should not be added unless there is evidence that a balustrade existed on a porch historically.

8. The addition of a porch that would not have existed on a house historically, such as an elaborate, highly detailed porch to the rear of an historic structure, is strongly discouraged.

9. Enclosure of part or all of an historic porch is inappropriate.

10. Enclosure of a porch at the side or rear of the house, for instance a sleeping porch, may be appropriate if the porch form is preserved and the porch openings are fitted with windows using reversible construction techniques.

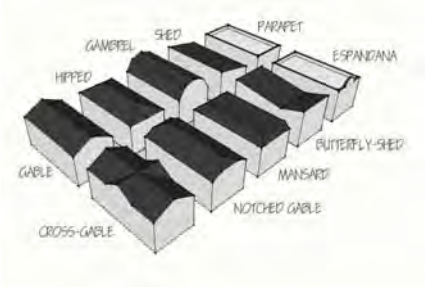
11. Alterations for handicapped access should be done at a side or rear entrance whenever feasible, and should be designed and built in the least intrusive manner possible using reversible construction techniques.

12. Addition of a handrail on the front steps of a house for safety or handicapped access reasons may be appropriate, if the handrail is very simple in design.

7.6 **Roofs**

The roof is a major character-defining feature for most historic structures. Similar roof forms repeated on a street help create a sense of visual continuity for the neighborhood. Roof pitch, materials, size, orientation, eave depth and configuration, and roof decoration are all distinct features that contribute to the overall integrity of an historic roof. The location and design of chimneys as well as decorative features such as dormers, vents and finials are also often character defining roof features.

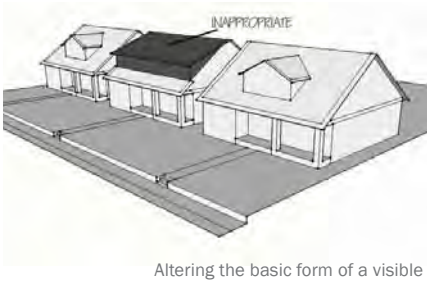
Certain roof forms and materials are strongly associated with particular architectural styles; for instance, built-up faux thatch roofs are often found on English Tudor Revival cottages. Consult the architectural styles guide of these guidelines for more specific information about the roof of your house.



Basic roof forms are shown.

Guidelines

1. Preserve the historic roof form. For instance, a complex roof plan with many gables should not be simplified.
2. Preserve the historic eave depth and configuration.
3. Roof and eave details, such as rafter tails, vents, corbels, built in gutters and other architectural features should be preserved. If these elements have deteriorated, they should be repaired in place if possible. If these elements cannot be repaired in place, match the originals in design, materials, and details.
4. When original details have been lost and must be replaced, designs should be based on historic photographic evidence. If no such evidence exists, the design of replacement details should be based on a combination of physical evidence (indications in the structure of the house itself) and evidence of similar elements on houses of the same architectural style in the neighborhood.
5. Historic specialty roofing materials, such as tile, slate, gravel or built-up shingles, should be preserved in place or replaced in kind. Wood roof shingles are no longer permissible in Los Angeles, and where possible, special care should be taken to make minimal repairs to wood shingle roofs rather than replace the roof outright.
6. Replacement roof materials, where in-kind replacement is not possible, should convey a scale, texture, and color similar to those used originally.
7. Light colored asphalt shingle is generally inappropriate. Earth tones, such as rusty reds, greens, and browns, are generally appropriate for asphalt shingle roofs.



Altering the basic form of a visible roof is inappropriate.

Roof details may vary greatly depending upon the architectural style.

Clay tile is an inappropraite material for this Craftsman style home.

Ionic column details are shown on this Classical Revival building.

8. Skylights or solar panels should be designed and placed in such as way as to minimize their impact. Locations on the side and rear facades are preferred for skylights. Where skylights are found appropriate, the should be flat and relatively flush to the roof surface.

9. Existing chimney massing, details, and finishes should be retained. Modern spark-arrestors or other similar devices should be hidden within the chimney to the best extent feasible.

10. Existing roof dormers should not be removed on visible facades. New roof dormers should not be added to visible facades.

7.7 **Architectural Details**

Architectural details showcase superior craftsmanship and architectural design, add visual interest, and distinguish certain building styles and types. Features such as lintels, brackets, and columns were constructed with materials and finishes that are associated with particular styles, and are character-defining features as well. Determining the architectural style of your house can help you to understand the importance of the related architectural details of your house. The architectural styles of these guidelines, or your HPOZ board, can help you determine what architectural details existed historically on your house.

Decorative details should be maintained and repaired in a manner that enhances their inherent qualities and maintains as much as possible of their original character. A regular inspection and maintenance program involving cleaning, and painting will help to keep problems to a minimum. Repair of deteriorated architectural detail may involve selective replacement of portions in kind, or it may involve the application of an epoxy consolidant to stabilize the deteriorated portion in place. These options should be carefully considered before architectural detail is replaced, since matching architectural details often requires paying a finish carpenter or metalworker to replicate a particular element, which can be a major expense.

Guidelines

1. Preserve original architectural features. Deteriorated materials or features should be repaired in place, if possible. For instance, deteriorated wood details can be repaired with wood filler or epoxy in many cases.

2. When it is necessary to replace materials or features due to deterioration, replacement should be in kind, matching materials, texture and design.

3. When original details have been lost and must be replaced, designs should be based on historic photographic evidence. If no such evidence exists, the design of replacement details should be based on a combination of physical evidence (indications in the structure of the house itself) and evidence of similar elements on houses of the same architectural style in the neighborhood.

4. Materials, such as masonry, which were not originally painted or sealed, should remain unpainted.

5. Original building materials and details should not be covered with inappropriate materials such as stucco, vinyl siding, or other materials.

6. Architectural detail that did not originally appear on a structure should not be added to a structure. For example, decorative spindle work should not be added to a Craftsman-style balcony.

7. Decorative detail that is expressed through the pattern of materials used in the construction of the house, such as decorative shingles or masonry patterns, should be preserved or replaced in kind. Covering or painting these details in a manner that obscures these patterns is inappropriate.

7.8 **Building Materials and Finishes**

The characteristics of primary building materials, including the scale of units that the materials are used and the texture and finish of the material, contribute to the historic character of a building. For example, the scale of wood shingle siding is so distinctive from the early Craftsman period, it plays an important role in establishing the scale and character of these historic buildings. In a similar way, the color and finish of historic stucco is an important feature of Mission Revival homes.

Before you replace exterior building materials, make sure that replacement is necessary. In many cases, patching in with repair materials is all that is needed. For instance, warped wooden clapboards or shingles can be removed, and new materials can be pieced in. Sometimes, epoxy or similar filler can be used to repair small areas of damage. Replacement of deteriorated building materials requires careful attention to the scale, texture, pattern, and detail of the original material. The three-dimensionality of wood moldings and trim, the distinctive texture of weatherboards, and the bonding pattern of masonry walls are all important to duplicate when replacement is necessary. When repairing or refreshing stucco finishes, it is important to understand the role the texture of the stucco finish plays in the design of the structure. Different architectural styles were characterized by different finishes, and care should be taken to replicate the original finish when stucco work is needed. Replacing or concealing exterior wall

Foam plant-ons and pre-cast concrete are materials that would not have been originally used on this historic house.

Stone and masonry should always be left to exhibit their natural finish qualities. Painting over the Arroyo stone on this house has muted the stone's texture.

This house has recently been emancipated from a layer of stucco exposing ornate and beautiful materials.

Wood siding comes in a variety of textures and types. One size does not fit all.

Smooth, hand-trowled stucco is an approprate finish for this Italian Renaissance Revival home.

The sandstone porch columns are left to display their natural finish quality.

materials with substitute materials is not appropriate. For example, placing synthetic siding or stucco over original materials results in a loss of original fabric, texture, and detail. In addition, such surfaces may conceal moisture or termite damage or other causes of structural deterioration from view.

Guidelines

1. Original building materials should be preserved whenever possible.
2. Repairs through consolidation or "patching in" are preferred to replacement.
3. If replacement is necessary, replacement materials should match the original in material, scale, finish, details, profile, and texture.
4. Building materials not originally painted should not be painted.
5. Original building materials should not be covered with vinyl, stucco, or other finishes.
6. If resurfacing of a stucco surface is necessary, the surface applied should match the original in texture and finish.
7. In choosing paint or stain colors, one should reference the Architectural Styles Chapter to learn more about appropriate paint colors and application. Stain or paint color choices should be selected appropriate to the architectural period or style and care should be take to address how various elements of the structure, for instance the body, trim and accents will be painted.
8. In most cases, exterior paint should have a matte finish, not glossy or semi-gloss.

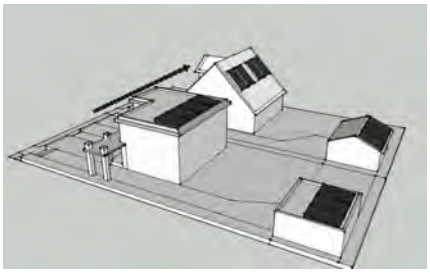
7.9 **Mechanicals**

The usefulness of historic structures in the modern world is often increased by updating these structures with modern heating and cooling systems, electrical systems, satellite television or broadband internet systems, solar panels, and other mechanical appurtenances that require the location of equipment outside of the historic structure itself. While the location of one of these elements may not seem to make a significant negative impact on a structure or neighborhood, the visible location of many of these elements along the streetscape can have a significant negative effect on the historic character of a neighborhood.

With careful planning, many mechanical appurtenances can be located where they cannot be seen from the public way. Air conditioning units can be placed in the rear yard or through rear windows. Attic vents can be placed on the rear elevations of a roof, or in a rear dormer.

Satellite television dishes can usually be placed in the rear yard or on a rear elevation of the roof. Junction boxes can be placed on rear facades. Wiring for cable or telephone equipment or electrical lines can be run through the interior walls of a structure instead of along visible facades.

Even when mechanical equipment must be placed in a visible location in the side or front yards, landscaping or paint treatments can help to conceal these incompatible elements.



Solar panels are best located outside of the line of sight.

Guidelines

1. Satellite television dishes and other mechanical appurtenances should be located in the rear yard, in a location not visible from the public way, whenever possible. Small dishes or other appurtenances (under 2' in diameter) may be located on lower rear roof surfaces, on rear yard accessory structures, on rear facades, or in the rear yard.

2. Mechanical appurtenances that are physically mounted on an historic structure must be attached using the least invasive method, without damaging significant architectural features.

3. Mechanical apparatus not mounted on the structure should be located in rear or side yard areas not visible from the public way whenever possible. In addition, consider placing such apparatus out of sight and sound of neighboring homes, if at all possible.

4. Mechanical apparatus not mounted on the structure may be installed in areas visible from the public way if there is no other technically and economically feasible location for installation and if appropriate landscape screening is proposed and installed as a part of the project.

5. Mechanical apparatus that must be placed in a location potentially visible from the public way should be obscured from view where possible, including the use of landscape screening and the use of paint colors to match the surrounding environment.

6. Utilities should be placed underground where feasible.

7. Electrical masts, headers, and fuse boxes should be located at the rear of a structure where possible.

8. Solar panels should not be placed upon rooftops that are visible to the general public. Location upon detached garages in many instances will be appropriate, or upon rear-facing roofs that are minimally visible from a public street. Solar panels should be low in profile, and should not overhang or alter existing rooflines.

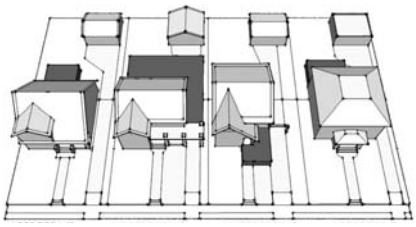
Chapter 8 Residential Additions

8.1 Introduction

Few things can alter the appearance of a historic structure more quickly than an ill-planned addition. Additions can not only radically change the appearance of a structure to passersby, but can also result in the destruction of much of the significant historic material in the original structure. New additions within an HPOZ are appropriate, as long as they do not destroy significant historic features, or materials, and are compatible with both the neighborhood and the building to which they are attached.

Careful planning of additions will allow for the adaptation of historic structures to the demands of the current owner, while preserving their historic character and materials.

The purpose of this is to ensure that the scale, height, bulk and massing of attached additions on main and secondary structures is compatible with the existing context of the historic structure and compatible with the other "contributing structures in the neighborhood", as viewed from the street.



Appropriate locations for additions will generally not disrupt the front visible facades, or the overall mass and character of the original structure.

This second-story addition is set-back and preserves the look and scale of the original bungalow.

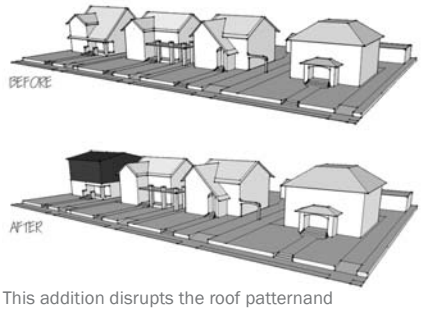
This second-story addition, with its noticable dormers, calls attention to itself, overwhelming the original cottage.

8.2 Additions to Primary Structures

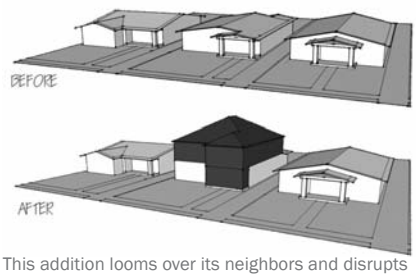
While additions to primary structures may be appropriate, special care should be taken to ensure that the addition does not disrupt the prevailing architectural character of the district or of the structure itself. Additions that are small in size, located to the rear of existing structures, and that replicate existing building patterns such as roof forms and fenestration, tend to be more successful than those that do not. Great care should be taken with additions so as not to communicate a false sense of history within the district with respect to the size and arrangement of structures. For example, a massive second-story addition that maximizes buildable floor area on a single story Craftsman bungalow in a district comprised of similarly sized single-story Craftsman bungalows would be inappropriate regardless of whether or not the addition is adorned with historic appearing architectural features.

Guidelines

1. Additions should be located at the rear of the structure, away from the street-facing architectural façade.
2. Additions that break the plane established by the existing roofline or side facades of the house are discouraged.
3. Additions that comprise a new floor (for instance a new second floor on a single-story house) are discouraged. Where additions that comprise a new floor can be found appropriate, such additions should be located to the rear of the structure.



This addition disrupts the roof patternand unique features of the home.



This addition looms over its neighbors and disrupts the charm of a single-story bungalow neighborhood.

Additions should avoid breaking the side-plane and roof-plane of the existing house.

4. Additions should use similar finish materials and fenestration patterns as the original structure. A stucco addition to a wood clapboard house, for example, would be inappropriate.

5. Additions should utilize roof forms that are consistent with the existing house to the greatest extent possible, but should be differentiated by virtue of scale and volume. Attention should be paid to eave depth and roof pitch replicating these to the greatest extent possible.

6. The original rooflines of the front facade of a structure should remain readable and not be obscured by an addition.

7. Additions should distinguish themselves from the original structure through the simplified use of architectural detail, or through building massing or subtle variations of exterior finishes to communicate that the addition is new construction.

8. The enclosure of rear porches, when found to be appropriate, should preserve the overall look of the porch to the greatest extent possible with respect to railings, balusters, openings and roofs.

9. Additions should utilize fenestration patterns that are consistent with the existing house to the greatest extent possible, though simplified window types may be an appropriate means to differentiate the addition from the original structure. For instance, if windows on the original structure are multi-pane 8-over-1 light windows, simple 1-over-1 light windows may be appropriate.

10. Additions should be subordinate in scale and volume to the existing house. Additions that involve more than a 50% increase in the ground floor plate are generally inappropriate.

11. Additions that extend the existing side facades rearward are discouraged. Additions should be stepped-in from the side facade.

12. Decorative architectural features established on the existing house should be repeated with less detail on the addition. Exact replicas of features such as corbels, pilasters, decorative windows etc. are inappropriate.

13. Additions that would necessitate the elimination of significant architectural features such as chimneys, decorative windows, architectural symmetry or other impacts to the existing house are not appropriate

14. Additions that would involve the removal or diminishment of open areas on Multi-family properties, such as the infill of a courtyard to be used for floor area, are in appropriate.

15. Additions that would require the location of designated parking areas within the front yard area are inappropriate.

8.3 New Accessory Structures and Additions to Existing Secondary Structures

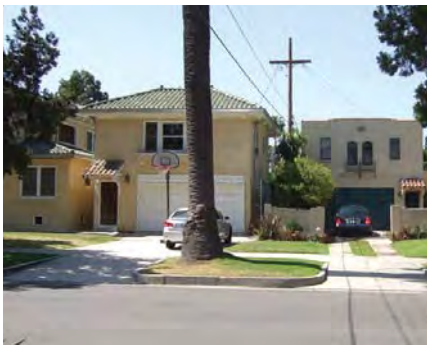
Garages and accessory structures can make an important contribution to the character of an historic neighborhood. Although high style "carriage houses" did exist historically, garages and other accessory structures were typically relatively simple structures architecturally, with little decorative detail. Quite often these structures reflected a simplified version of the architectural style of the house itself, and were finished in similar materials.

Unfortunately, many historic garages and accessory structures have not survived to the present day, perhaps because the structures were often built flush with the ground, without a raised foundation. Therefore, many homeowners in historic areas may need to confront the issue of designing a new secondary structure.

For the rehabilitation of existing garages and accessory structures, follow the same guidelines throughout this as you would for the rehabilitation of a residential structure. The guidelines in this section are specifically targeted towards the addition or reconstruction of accessory structures on historic properties. It will also be useful to consult the Setting guidelines of this Plan to determine the placement, dimensions, and massing of such structures on lots with existing historic buildings.

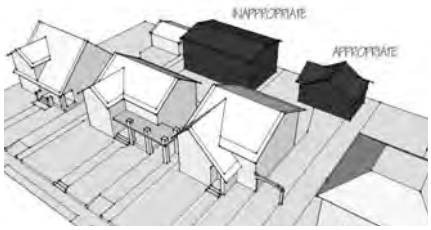
Guidelines

1. New accessory structures and garages should be similar in character to those which historically existed in the area.
2. Basic rectangular roof forms, such as hipped or gabled roofs, are appropriate for most garages.
3. New garages or accessory structures should be designed not to compete visually with the historic residence.
4. Detached garages are preferred. Attached garages, when found to be appropriate should be located to the rear of the house unless the HPOZ consists of homes that have a preponderance of street-facing garages.
5. New garages should be located behind the line of the rear wall of the house whenever possible.
6. New accessory structures, such as greenhouses, porches or gazebos should not take up more than 50% of the available back yard area.
7. Single-bay garage doors are more appropriate than double-bay garage doors on most historic properties.



Many historic neighborhoods were built with accessory living quarters over garages. Attention should be paid to the historic precedent on your street.

This in-fill accessory structure is diminutive to its primary structure.



In many cases second stories can more gracefully be accommodated as attics than full second stories.

8. Second floor additions to garages or carriage houses, when found to be appropriate, should not be larger than the length and width of a standard three-car garage.

9. Accessory structures should always be diminutive in height, width and area in comparison to the existing primary structure.

10. Accessory structures should replicate the architectural style of the existing house with respect to materials, fenestration, roof patterns etc., though architectural details such as corbels, pilasters or molding should be replicated with less detail on accessory structures.

11. Modifications to existing garages, carriage houses or accessory structures that would involve a loss of significant architectural details pursuant to the Rehabilitation Guidelines should be avoided. Special attention should be paid to preserving existing historic garage doors where they exist.

Chapter 9 Residential Infill

9.1 Introduction

"Infill" is the process of building a new structure on a vacant site within an existing neighborhood. These Infill guidelines are also applicable to the review of alterations to structures or sites within the HPOZ that are "Non-Contributing" as identified in the Historic Resource Survey.

These Residential Infill Guidelines are intended for the use of residential property owners planning new structures on vacant sites or alterations to Non-Contributing structures or sites within the HPOZ. These guidelines help ensure that such new construction and alterations recognize and are sensitive to their historic context.

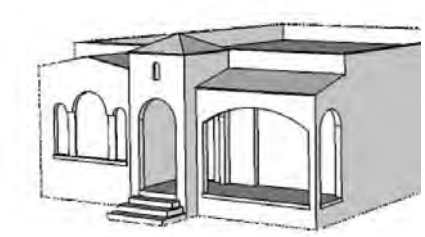
Non-Contributing structures are those structures, landscapes, natural features, or sites identified as Non-Contributing in the Historic Resources Survey for this HPOZ. Generally, Non-Contributing structures are those that have been built outside of the historic period of significance of the HPOZ, or are those that were built within that period but no longer retain the features (due to subsequent alterations) that identify them as belonging to that period. The historic period of significance of the HPOZ is usually the time period in which the majority of construction in the area occurred.

The Residential Infill Guidelines are divided into six (6) sections, each covering a building design element. Elements from all sections will be important when planning or evaluating proposed new construction or alterations to existing non-contributing structures or sites. The Residential Infill of the guidelines should be used in the planning and review of most projects involving new structures in residential areas. They are also intended for use in the planning and review of projects for structures in areas that were originally built as residential areas which have since been converted to commercial use.

9.2 The Design Approach

In addition to following these guidelines, successful new construction shall take cues from its context and surroundings. One of the first steps in designing a new building within an historic district is to look at other buildings on the block, and other similar buildings in the neighborhood. In general, new construction should not try to exactly replicate the style of the surrounding historic structures. However, it is important that the design of new construction in an historic district be consistent with the design of surrounding historic structures and sites. Design elements that are usually important in establishing this consistency include orientation on a site; massing and scale; roof form; materials and the patterns of doors and windows.

Most HPOZs have stood the test of time because they contain structures that are designed and constructed with a high level of design integrity and quality of workmanship. Consequently, new structures within



the HPOZ should strive to integrate the highest and best design and construction practices while integrating such elements into a program that is well suited for the historic context.

Single Family Housing

Different architectural styles or types generally exhibit common architectural design elements. Therefore, if you are considering a project that involves new construction on a vacant lot, the first step in designing a new building is to determine what style elements are present in other building on the block. If the existing buildings are all of the same or similar styles, common design themes should emerge. Do the majority of structures on your street have large front porches? Parapet roofs? Wood cladding? The Residential Infill Guidelines that follow point out various design elements that need special attention to insure that new construction is compatible with the historic streetscape.

Contemporary designs for new in-fill construction are not necessarily discouraged within the HPOZ. Most importantly, each project should respond to its surrounding context and help to create a seamless transition from architectural style to architectural style and from building type to building type.

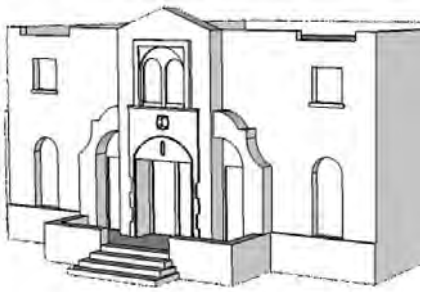
Multi-family Housing

Many HPOZs contain multi-family structures that were constructed during their Period of Significance. These may include a variety of building types, including large apartment buildings, garden-style apartment buildings, bungalow courts, or secondary dwelling units in a rear yard. In some instances, single family homes were divided into boarding houses or apartments during the Period of Significance, and those modifications may have historical significance. Other HPOZs would have originally consisted of single family homes, but beyond the Period of Significance, land use patterns and zoning regulations may have allowed for multi-family uses. Houses may have been converted to multi-family residences, or newer apartment or condo buildings may have been constructed. In any event, when a multi-family residential project is proposed in an HPOZ the project should follow the Residential Infill Guidelines contained in this section. The In-Fill Guidelines contain examples of several multi-family building types and architectural styles that may be compatible with the HPOZ. When possible, applicants should pay close attention to what types of multi-family structures existed in the HPOZ during the Period of Significance.

The Residential Duplex/Triplex/Fourplex

In the period when many of Los Angeles' HPOZs developed, low density multi-family structures in residential neighborhoods often

were developed in the same architectural styles and with similar massing as single-family residences in the same area. The Craftsman and Renaissance Revival styles, in particular, lent themselves to the development of 2-unit to 4-unit structures, often with simple rectangular massing. Usually, the only external indication that these structures were not single family dwellings was the multi-door entryway, often designed with the same porch form as single family neighbors.



These multi-family structures were usually developed with the same setbacks, height, and often the same roof-forms as their neighbors. In some cases, individual entryways were concealed in a foyer or lobby beyond a common entry door, rendering these structures indistinguishable from single-family residences in the same neighborhood. In historic residential neighborhoods composed primarily of two-story single-family structures, this architectural style may be a useful model for low-density multi-family development.

Guidelines for building in the Duplex/Triplex/Fourplex form:

1. The scale, roof form and architectural style of the structure should be consistent with these residential infill guidelines and with surrounding historic residential structures.
2. Entryways should be located on the street-facing facade of the structure, and should be designed to read as a single entryway. This may be achieved through the location of doorways around a central recessed entry, or through the use of a single exterior doorway leading to an interior entry hall.
3. Entryways should be defined by a single traditional-styled porch.
4. Parking areas should be located to the rear of the structure.
5. Front yard areas should be comprised of landscaping. paving front yard areas is inappropriate.
6. Setbacks should be consistent with surrounding historic single-family structures.

The Bungalow Court

A low-scale multi-family housing solution popular in the pre-World War II era, bungalow courts were classically composed as a cluster of small one story residential structures of a common architectural style organized, usually in two parallel lines, around a central courtyard arranged perpendicular to the street, and often anchored by a two story complex at the back of the courtyard.

Important elements of this design style that ensure its compatibility with historic residential development patterns include the small scale of the bungalows, the quality of their architectural detailing,

the choice of an architectural style compatible with surrounding residential development, and a treatment of the facades on the bungalows facing the primary street that includes details like porches, entryways, overhanging eaves and other details which emphasize reliance on traditional single-family residential design elements. This type of development may be appropriate in historic areas composed predominantly of small single story cottages or duplexes where multi-family development is permitted by the zoning code.

Guidelines for building in the Bungalow Court form:

1. All buildings within the court should be designed in a cohesive architectural style that reflects an architectural style common in the surrounding neighborhood.

2. Entryways within the court should be marked by porches that face onto a central courtyard.

3. The central courtyard should be arranged perpendicular to the street, with a central axial path leading through the development. The central courtyard should not be sectioned off into private open space.

4. The scale of the bungalows should reflect the scale of the surrounding historic residential structures.

The Courtyard Apartment Building

Courtyard apartments were a popular multi-family housing style in Los Angeles from the 1920s-1950s. Typically, these complexes were designed as two-story L or U shaped structures or clusters of structures that wrapped around a central entry courtyard. These complexes were typically built in a romantic style, often Spanish Colonial Revival or Mediterranean Revival. Later examples were often built in the Early Modern styles such as Streamline Moderne or Minimal Traditional.

The defining feature of these complexes is the central courtyard, which was typically the central entryway to individual apartments. Complexes with an L-shaped plan were typically designed in a smaller scale, with individual exterior entryways for each unit. Quite often, in these structures second-story entryways were designed as romantic balconies or loggias. Quite often, the street-facing end of the L was marked with large, elaborate windows.

In the U shaped variant of this style, the central courtyard typically led to a central entryway, and each unit was accessed from an interior hallway. These U shaped structures sometimes rose to three stories or higher.

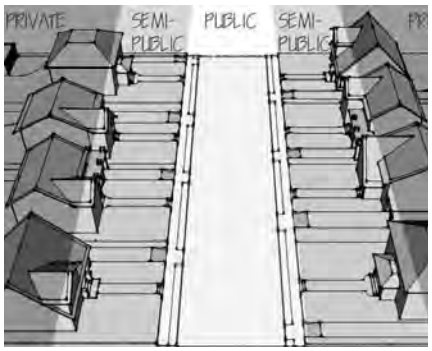
Guidelines for building in the Courtyard Apartment form:

1. New Courtyard Apartment structures should reflect the scale of surrounding historic residential structures.
2. Structures should be arranged on their lots in an L or U shape around a central courtyard which is open to the street.
3. Lower scale structures may have individual exterior entryways for each unit. These entryways should each be marked by its own porch. Common balconies or porches spanning more than two entryways are discouraged.
4. The central courtyard area should be extensively landscaped. Water features and fountains are encouraged.
5. The architectural style and materials of the new structure should reflect an architectural style appropriate to the surrounding historic area.
6. Parking areas should be located to the rear or beneath the structure.

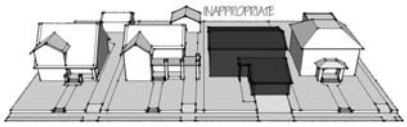
9.3 **Setting, Location and Site Design**

The site design of an historic structure is an essential part of its character. Further, the spacing and location of historic structures within an historic neighborhood usually establishes a rhythm that is essential to the character of the neighborhood. While each individual house within an HPOZ may not be architecturally significant in its own right, the grouping of houses, with uniform setbacks and street features, give the neighborhood a strong sense of place that is indeed significant. The early designers and builders of the HPOZ considered the streetscape, setbacks, drives, walks, retaining walls, and the way a structure itself sits on its lot in relation so others on the street. The purpose of this is to provide guidelines that ensure that new construction visible from the street respects and complements the existing historic streetscape.

Traditionally, residential structures were sited on their lots in a way that emphasized a progression of public to private spaces: public streets, planting strips (or parkways), sidewalks, front yard and front walks, porches and, finally, the private space of an individual home. Nearly all historic residential structures were designed to present their face to the street, and not to a side or rear yard. This paradigm dictated that spaces such as living rooms, dining rooms and parlors were generally found at the front of houses whereas spaces such as kitchens, service areas and detached garages were found at the rear. Common setbacks in the front and side yards and appropriate floor-planning helped ensure these orderly progressions. Preservation of these progressions is essential to the preservation of the historic residential character of structures and neighborhoods.



The setting is characterized by a transition from public to private space.



New houses should replicate the basic orientation and arrangement of uses on the lot. Garages located in the front are inappropriate.

Houses of varying styles and periods may co-exist harmoniously by virtue of their similar massing and orientation.

Guidelines

1. New residential structures should be placed on their lots to harmonize with the existing historic setbacks of the block on which they are located. The depth of the front and side yards should be preserved, consistent with other structures on the same block face.
2. A progression of public to private spaces from the street to the residence should be maintained. One method of achieving this goal is to maintain the use of a porch to create a transitional space from public to private.
3. Historic topography and continuity of grade between properties should be maintained.
4. Attached garages are generally inappropriate; detached garages are preferred. Garages should be located to the rear of the property.
5. Parking areas should be located to rear of a structure. Designation of parking spaces within a front yard area is generally inappropriate.
6. Front and side yard areas should be largely dedicated to planting areas. Large expanses of concrete and parking areas are inappropriate.
7. The lot coverage proposed for an in-fill project should be substantially consistent with the lot coverage of nearby Contributor properties.

9.4 **Massing and Orientation**

The height and massing of historic structures in an intact historic neighborhood is most often fairly uniform along a block face. Nearly all historic residential structures were designed to present their face to the street, and not to a side or rear yard. The purpose of this section is to ensure that the scale, height, bulk, and massing of new construction visible from the street is compatible with the existing context of historic structures and the neighborhood as a whole.

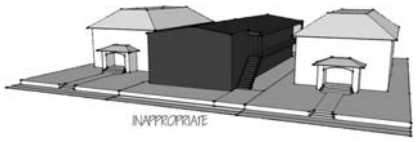
Guidelines

1. New residential structures should harmonize in scale and massing with the existing historic structures in surrounding blocks. For instance, a 2.5 story structure should not be built in a block largely occupied by single-story bungalows.
2. When found to be appropriate, new structures that will be larger than their neighbors should be designed in modules, with the greater part of the mass located away from the main facade to minimize the perceived bulk of the structure.

3. New residential structures should present their front door and major architectural facades to the primary street and not to the side or rear yard.

4. In some cases on corner lots, a corner entryway between two defining architectural facades may be appropriate.

5. A progression of public to private spaces in the front yard is encouraged. One method of achieving this goal is through the use of a porch to define the primary entryway.



The in-fill example shown ignores the setback and entrance orientation of its neighbors.

9.5 **Roof Forms**

It is often true that the structures on one block of an historic neighborhood share a common architectural style. This common style frequently is articulated by a common roof form, which helps establish a common character for the block. The purpose of this is to encourage traditional roof forms on infill houses in order to help maintain a common character for the area.

The in-fill example shown here ignores the complex gable patterns of its neighbors.

Guidelines

1. New residential structures should echo the roof forms of the surrounding historic structures. For instance, if the majority of structures along a particular street utilize front-facing gable-ends, the in-fill structure should likewise utilize a gable-end. Where a diversity of roof forms exist on a street, a predominant form should be used. It would be inappropriate to introduce a new roof form that is not present on the street.

2. Roofing materials should appear similar to those used traditionally in surrounding historic residential structures. If modern materials are to be used, such materials should be simple and innocuous.

3. Dormers, and other roof features on new construction should echo the size and placement of such features on historic structures within the HPOZ.

4. In HPOZs where roof edge details, such as corbels, rafter tails, or decorative vergeboards are common, new construction should incorporate roof edge details which echo these traditional details in a simplified form.

This street presents a consistent roof pattern that should be replicated on new construction.

Though different in style, this house's deep, and vertical openings help it to blend with its neighbors.

Flush, frameless, and oddly arranged windows may be inappropriate on a new house.

9.6 **Openings**

The pattern of windows, doors, and other openings on the facades of an historic structure strongly define the character of the structure's design. These openings define character through their shape, size, construction, façade arrangement, materials, and profile. Repetition of these patterns in the many historic structures of an historic district helps to define the distinctive historic character of the area. It is important, therefore, that new construction in these areas reflect these basic historic design patterns.

Guidelines

1. New construction should have a similar façade solid-to-void ratio to those found in surrounding historic structures.
2. New construction should use similar window groupings and alignments to those on surrounding historic structures.
3. Windows should be similar in shape and scale to those found in surrounding historic structures.
4. Windows should appear similar in materials and construction to those found in surrounding historic structures.
5. Dormers should be similar in scale to those found on existing historic structures in the area.
6. Main entryways should be configured and emphasized similarly to those on surrounding structures. Attention should be paid to design similarities such as symmetry, depth, and the use of architectural features such as pediments, crowns, porches, etc.
7. Entrance enclosures, such as porches, porte-cocheres and overhangs should be used when similar features are widely used within the neighborhood.

9.7 **Materials and Details**

Traditionally, the materials used to form the major facades of a residential structure were intended to work in harmony with the architectural detail of the building to present a unified architectural style. Often, this style is repeated with subtle variations on many structures within an historic district. It is essential that new construction within an historic area reflect the character of the area by reflecting the palette of materials and design details historically present in the neighborhood.

Guidelines

1. New construction should incorporate materials similar to those used traditionally in historic structures in the area. If most houses within a neighborhood are wood clapboard, an in-fill house that is entirely stucco is generally inappropriate.
2. Materials used in new construction should be in units similar in scale to those used historically. For instance, bricks or masonry units should be of the same size as those used historically.
3. Architectural details such a newel posts, porch columns, rafter tails, etc., should echo, but not exactly imitate, architectural details on surrounding historic structures. Special attention should be paid to scale and arrangement, and, to a lesser extent, detail.
4. Use of simplified versions of traditional architectural details is encouraged.
5. If the integration of modern building materials, not present during the Period of Significance, is found to be appropriate, such materials should be subtly used and appear visually innocuous in comparison to surrounding historic structures.

Gaudy and conjectural features can cause a house to stand out rather than find compatibilty with a historic neighborhood.

9.8 **Relocating Historic Structures**

In most cases, the proposed relocation of an historic structure to a location within an historic district should be evaluated in much the same way as a proposed new infill construction project. There are, however, several additional considerations that should be taken into account when evaluating this type of project to ensure that the historic importance of both the structure to be moved and the district in which it will be relocated are preserved.

Though innovative and interesting, the materials on this home do not relate to those used in its surroundings.

Guidelines

1. If feasible, relocation of a structure within its original neighborhood is strongly preferred.
2. Relocation of the structure to a lot similar in size and topography to the original is strongly preferred.
3. Generally, the structure to be relocated should be similar in age, style, massing, and size to existing historic structures on the block front on which it will be placed.
4. The structure to be relocated should be placed on its new lot in the same orientation and with the same setbacks to the street as its placement on its original lot.
5. A relocation plan should be prepared prior to relocation that ensures that the least destructive method of relocation will be used.

This home is being relocated to an HPOZ in Pico-Union.

6. Alterations to the historic structure proposed to further the relocation process should be evaluated in accordance with the Rehabilitation Guidelines.

7. The appearance, including materials and height of the new foundations for the relocated historic structure should match those original to the structure as closely as possible, taking into account applicable codes.

Chapter 10 Public Realm: Streetscapes, Alleyscapes, Parks, & Public Buildings

12.1 Introduction

Along with private residential and commercial buildings and spaces, public spaces and buildings also contribute to the unique historic character of a preservation zone. Public spaces include streetscapes, alleyscapes, and parks. Public buildings cover a broad variety of buildings such as police stations, libraries, post offices, and civic buildings.

Streetscapes add to the character of each HPOZ neighborhood through the maintenance and preservation of historic elements. Street trees in particular contribute to the experience of those driving or walking through an HPOZ area. Character defining elements of streetscapes may include historic street lights, signs, street furniture, curbs, sidewalks, walkways in the public right-of-way, public planting strips and street trees.

Alleys, the lowest category of streets, may not exist in all HPOZ areas, but if present they traditionally serve as the vehicular entry and exit to garages providing an important element of the neighborhood character.

Like alleys, parks are sometimes present in an HPOZ area and, as such, traditional elements should be preserved and maintained, and the addition of new elements should be compatible with the historic character of the neighborhood.

Additions to public buildings may require the installation of ramps, handrails and other entry elements that make a building entrance more accessible. These elements should be introduced carefully so that character-defining features are not obscured or harmed. Guidelines relating to public buildings covering Americans with Disabilities Act (ADA) requirements and location of parking lots are covered in this section. Guidelines for new and existing historic public buildings are the same as those in the commercial rehabilitation and infill sections excluding those on storefronts. Please refer to those sections when making changes, constructing additions or construction of new public buildings.

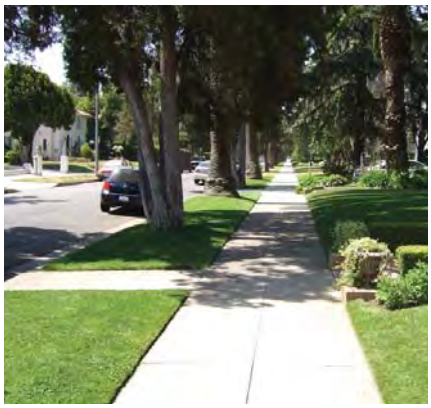
Guidelines

Consult with the Public Works Department regarding new and replacement work in the public right-of-way.

1. Protect and preserve street, sidewalk, alley and landscape elements, such as topography, patterns, features, and materials that contribute to the historic character of the preservation zone.

    a. Preserve and maintain mature street trees.
    b. Trim mature trees so that the existing canopies are preserved.
    c. Preserve and maintain historically significant landscaping in the public planting strips.

Existing street markers are a significant piece of the neighborhood's history.



Sidewalk widths, parkway landscaping and sidewalk score patterns should all be preserved.

Retaining walls are an important part of the neighborhood streetscape.

d. Use landscaping to screen public parking lots from view of public streets.
e. New plantings in the public planting strip should be compatible with the historic character of the Preservation Zone.

Paving and Curbs

2. Maintain and preserve historic curb configuration, material and paving.

3. For repair or construction work in the Preservation Zone right-of-way, replace in-kind historic features such as granite curbs, etc.

4. Avoid conflicts between pedestrian and vehicular traffic by minimizing curb cuts that cross sidewalks.

Signage

5. Preserve and maintain historic street signs.

6. New street signage shall be placed so that historic features are least obstructed.

Street Furniture

7. New street furniture, such as benches, bike racks, drinking fountains, and trash containers, should be compatible in design, color and material with the historic character of the Preservation Zone. Use of traditional designs constructed of wood or cast iron is encouraged.

Utilities

8. New utility poles, etc. shall be placed in the least obtrusive location. Consider introducing new utility lines underground to reduce impacts to historic character of preservation zone

Street Lights

9. Preserve and maintain existing historic street lights.

10. New street lighting should be consistent with existing historic street lights. If there are no existing historic street lights, new lights should be compatible in design, materials, and scale with the historic character of the Preservation Zone.

Sidewalks

11. Preserve historic sidewalks.

12. Replace only those portions of sidewalks that have deteriorated. When portions of a sidewalk are replaced special attention should be paid to replicating score lines, texture, coloration and swirl-patterns.

13. New sidewalks should be compatible with the historic character of the streetscape.

14. Maintain public walkway connections between streets and between buildings.

Alley scapes

15. Preserve existing alleys as public rights-of-way.

16. Preserve traditional relationships between alleys and garages.

17. Preserve traditional fencing along alley right-of-ways.

18. The introduction of new fencing should be compatible with existing historic fencing.

Public Buildings

19. New public buildings should comply with the appropriate In-fill Design Guidelines.

20. Introduce accessible ramps and entry features so that character defining elements of the building's entryways are impacted to the least extent possible.

21. Construct new access ramps and entry features so that they are reversible.

22. Locate new parking lots and parking structures to the rear of public buildings to reduce impacts on neighborhood character.

23. Construction of parking areas for public buildings should be screened from view of adjacent residential structures.

Parks

24. Preserve and maintain any existing historic elements such as walkway materials, mature trees, plantings, park benches and lighting.

25. Replace in-kind elements that cannot be repaired.

26. New elements such as public benches, walkways, drinking fountains, and fencing should be compatible with the existing historic character of the Preservation Zone.

Chapter 11: Definitions

Arch: A curved structure for spanning an opening.

Architectural façade: The façade distinguished by the primary architectural features or detail.

Asymmetrical: Having no balance or symmetry.

Awnings: A canopy made of canvas to shelter people or things from rain or sun.

Balcony: An elevated platform projecting from the wall of a building, usually enclosed by a parapet or railing.

Baluster: Any of a number of closely spaced supports for a railing.

Balustrade: A railing with supporting balusters.

Barge Boards (verge boards): A board, often carved, attached to the projecting end of a gable roof.

Battered: Sloping, as of the outer face of a wall, that recedes from bottom to top.

Bay: A part of a building marked off by vertical or transverse details.

Bay window: A window or series of windows projecting outward from the main wall of a building and forming a bay or alcove in a room within.

Belfry: A bell tower.

Blockface: The architectural setting formed by the conjunction of all the buildings in a block.

Board and Batten: Siding application where the vertical joints are covered with narrow strips of wood.

Boxed Cornice: A slightly projecting, hollow cornice of boards and moldings, nailed to rafters.

Bracket: A support projecting horizontally diagonally from a wall to bear the weight of a cantilever or for decorative purposes.

Box (built-in) gutter: A gutter built into the slope of the roof, above the cornice.

Cantilevered: Horizontal element of a structure supported by horizontal, not vertical, structural members.

Canopy: Projecting element, usually over a façade opening, as if to provide shelter.

Casement: A window sash opening on hinges generally attached to the upright side of the windows frame.

Clapboard: A long, thin board with one edge thicker than the other, laid horizontally as bevel siding.

Clerestory window: Ribbon windows on the portion of an interior rising above adjacent rooftops.

Clinker brick: A very hard burned brick whose shape is distorted, knobby or bloated.

Column: A rigid, relatively slender vertical structural member, freestanding or engaged.

Coping: The top layer or course of a masonry wall, usually having a slanting upper surface to shed water.

Corbels: A stepped projection from a wall, usually masonry.

Cornice: A continuous, molded projection that crowns a wall.

Crown: The highest portion of an arch, including the keystone.

Cupola: A domelike structure surmounting a roof or dome, often used as a lookout or to admit light and air.

Dentil: Simple, projecting, tooth-like molding.

Dormer: A projecting structure built out from a sloping roof, usually housing a vertical window or ventilating louver.

Double-hung window: A window with two sashes, both of which are operable, usually arranged one above the other.

Eave: The overhanging lower edge of a roof.

Entablature: The upper of a building, resting on the columns and constituting the architrave, frieze, and cornice.

Façade: The front or any side of a building.

Fascia: Any broad, flat horizontal surface, as the outer edge of a cornice or roof.

Fenestration: The design, proportioning, and location of windows and other exterior openings of a building.

Finial: A sculptured ornament, often in the shape of a leaf or flower, at the top of a gable, pinnacle, or similar structure

Frieze: A decorative horizontal band, as along the upper part of a wall.

Glazed: Filled with a pane of glass.

Gothic Arch: A pointed arch reminiscent of those found on Gothic Cathedrals

Grilles: A decorative screen, usually of wood, tile, or iron, covering or protecting an opening.

Half-timbering: Detail creating the appearance of exposed structural timbers on plaster.

Keystone: The wedge shaped detail at the top of an arch.

Louver: Fixed or movable horizontal slats for admitting air and light.

Marquee: A tall projection above a theatre entrance, often containing a sign.

Massing: The unified composition of a structure's volume, affecting the perception of density and bulk.

Molding: A slender strip of ornamental material with a uniform cross and a decorative profile.

Newel post: A post supporting one end of a handrail at the top or bottom of a flight of stairs.

Ogee arch: An arch formed by two S-shaped curves meeting at a point.

Oriel: A bay window supported from below by corbels or brackets.

Parapet: A low protective wall at the edge of a terrace, balcony, orabove the roof line.

Patterned Shingles: Shingles, usually used as a sheathing material, which are cut and arranged so as to form decorative patterns such as fishscales, diamonds, scallops, etc.

Pediment: A wide, low-pitched gable surmounting a colonnade, portico, or major bay on a façade.

Pergola: An arbor or a passageway of columns supporting a roof of trelliswork on which climbing plants are trained to grow

Pier: Vertical structural members.

Pilaster: A shallow rectangular projecting feature, architecturally treated as a column.

Pinnacle: A small turret or spire on a roof or buttress.

Porch: An exterior covered approach or vestibule to a doorway.

Porte cochere: A roofed structure covering a driveway to provide shelter while entering or leaving a vehicle.

Portico: A vertically proportioned porch having a roof supported by columns.

Quoin: An exterior angle of a masonry wall marked by stones or bricks differentiated in size and/or material from adjoining surfaces.

Rafter: Any of a series of small, parallel beams for supporting the sheathing and covering of a pitched roof.

Rafter tail: Portion of a rafter which projects under the eave.

Scale: Proportionate size judged in relation to an external point of reference.

Showcase windows: Large glazed openings designed to showcase merchandise.

Sidelights: Vertical windows along the outside of a door.

Sleeping porch:

Soffit: The underside of an architectural element, such as a beam or cornice.

Spandrel: The roughly triangular space between the left or right exterior curve of an arch and the rectangular framework surrounding it.

Spindles: Slender architectural ornaments made of wood turned on a lathe in simple or elaborate patterns.

Spire: Structure or formation, such as a steeple, that tapers to a point at the top.

Splay: An oblique angle or bevel given to the sides of an opening in a wall.

Stair tower: A tower articulating the location of the stairway, usually of a residence.

Stoop: A raised platform, approached by steps and sometimes having a roof, at the entrance to a house.

Streetscape: The pattern and impression created by the combination of visible elements from all lots on a blockface.

String courses: A horizontal course of brick or stone flush with or projecting beyond the face of a building, often molded to mark a division in the wall.

Surround: The trim, jamb, head, and other decorative elements surrounding an opening.

Symmetry: Correspondence of form on opposite sides of a dividing line or plane.

Terra-Cotta: Usually red fired clay.

Terrace: An open level area or group of areas adjoining a house or lawn.

Terrazzo: A poured flooring material, usually comprised of small pieces of stone or glass in a binding medium.

Tower: A structure high in proportion to its lateral dimensions, usually forming part of a larger building.

Transom: A window, usually operable, above the head of a door.

Trusses: A rigid framework, as of wooden beams or metal bars, designed to support a structure, such as a roof.

Turret: A structure (frequently curved) high in proportion to its lateral dimensions, forming part of a larger building.

Tuscan columns: Very simple columns with no fluting or other embellishment.

Veranda: A large, open porch, usually roofed, extending across the front and sides of a house.

Window Sash: One unit of an operable window, including the frame and glazing.

Wood shingle siding: A sheathing material composed of overlapping wood shingles.