Appendix

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Community Outreach Memorandum

Through a grant from the State Historical Fund (SHF), the Town of Crested Butte released a detailed Request for Proposal (RFP) for a qualified consulting firm to respond with proposals to address their need for a Historic Preservation Plan. Crested Butte narrowed down the most competitive bids and conducted interviews with the firms. Out of this process, Stan Clauson Associates, Inc. in conjunction with Tatanka Historical Associates were selected to complete the work outlined in the Town's scope of work, following the proposed schedule for the Historic Preservation Plan Process, and providing a concurrent Architectural Analysis. The Town assembled an Historic Preservation Plan Advisory Committee (HPPAC) that included one Town Council Member, one BOZAR member, and four community members with varying backgrounds: Architect, Sustainability and Design professional, and former Preservation Officer. A detailed schedule was created at the initial stages of the planning process to accommodate robust community outreach and engagement, ample time with the HPPAC, meetings and work sessions with Town Council and BOZAR, consultant meetings, stakeholder meetings, Navigation Committee meetings, and more.

Compass Navigation

"Navigation" is the term used to describe actions that are taken using the Community Compass for direction. The Transportation and Mobility Plan (2024) and the Climate Action Plan (2024) are concurrent plans that will work together with the Historic Preservation Plan and that utilize the Community Compass as a guide. These integrated Plans will lead to a Community Plan for Crested Butte. The Historic Preservation Plan (HPP) overlaps and melds with these other planning efforts in some of the following areas...

- Correlation and integration with infill planning. The Community Plan will focus on zoning and infill planning, while the HPP has a focus on architecture and infill planning.
- The HPP combines with Climate Action in considering historic architecture, embodied carbon in buildings, and building codes.
- The Plan directly addresses defining and retaining community character and authenticity, which is one of four community values defined in the Compass.
- Traffic, parking, and personal vehicles can have a negative impact in communities that prioritize recreation, the natural environment, and historic rights-of-way.

The HPP interfaces with the Transportation Mobility Plan (TMP) on these subjects. Crested Butte's public process is defined by the Crested Butte Community Compass. The steps associated with the process and how they were enacted for this Plan are below;

1) Understand the challenge and define a goal statement.

The challenge statement was drafted by Town staff after gaining significant feedback during the Compass outreach, their own lived experience, and the functional problems and contrasts that the town experiences when following town mandates, ordinances, and code as written and interpreted. The Challenge statement also gives a deserved nod to past stewards of the community's treasured historic resources:

> ***"We fought hard to protect Crested Butte's history and unique architecture.... But our newer buildings all look the same."***

It was clear to the town staff, and anyone who reviewed the challenge statement, that it captures the issues that are apparent to residents and visitors. Regulation and unclear mandates are leading the Town in a direction they do not want to go, toward excessive consistency and similarities that compete with creativity and authenticity. Truly historic structures are being diluted with stylistic knockoffs and the ability to be creative in design to create functional, affordable, and high-quality buildings is highly limited. The goal statement was born out of an understanding of the challenge and the Historic Preservation Plan's ability to explain how the Town will preserve its history and promote architectural diversity. The statement was tested in public engagement settings and was ultimately revised to read,

> ***"Ensure the Town's architectural identity is a reflection of Crested Butte's deep sense of community and its evolution over time."***

2) Commit to a community engagement strategy.

The strategy that the Town committed to for this planning effort and its outcomes are detailed in the Public Engagement Memorandum. A well-planned and robust engagement strategy allowed the Town to connect with a variety of stakeholders and residents in casual, conversational environments including at a Trivia Night at Kochevar's, an Open Mic event at The Eldo, a Night at the Museum at the Mountain Heritage Museum, a mixer at the Mallardi Theatre, a Melting Pot event, outreach at the high school, and summer Block Parties. The kick-off for the Plan project included a virtual webinar highlighting the economic development benefits of preservation. The webinar has been recorded for future reference and is available at [LINK].

In addition to these functions, there was a targeted stakeholder feedback session with invitees including designers, architects, general contractors, and attorneys that dealt with land use and development. This session resulted in some very thoughtful feedback and useful suggestions for plan development. It also signified a rather unified understanding of the issues facing Crested Butte.

3) Define success measures.

Success measures answer the question "What does success look like in Crested Butte when we combine the Goal with the community values of Authentic, Connected, Accountable, and Bold?" The Town initially drafted success measures, to be analyzed and revised as the planning process continued. The consultants, the HPPAC, Town Council, BOZAR, and the public had opportunities to review and comment on the success measures. The original success measures were modified during this stage of the process, until they were refined into three concise but comprehensive metrics.

4) Create alternatives and filter them through the success measures.

5) Make decisions based on informed consent.

Public Engagement Memorandum

This memorandum provides an overview of public outreach efforts associated with The Town of Crested Butte's 2024 Historic Preservation Plan. The Crested Butte Community Compass directs the Town and its hired consultants to follow a process called The Compass decision-making framework that includes committing to a community engagement strategy. The Town has been proactive, inclusive, and very thoughtful in its community engagement activities and their timing. The activities were educational, allowed opportunities for feedback, and were as unique as the community itself.

Public Engagement Activities

Kick-Off Webinar on 5 December 2023 (Virtual/Recorded): On 5 December 2023, at noon, Donovan Rypkema was a speaker for a webinar, which served as the kick-off for the plan. Economic Benefits of preservation planning was the topic. There was good participation in the webinar, but not much in the way of feedback or questions. This webinar is available through the HPP website for folks to watch a recording. [LINK]

Trivia Night on 5 December 2023 at Kochevar's (127 Elk Ave): From 6-8 pm, the first public engagement event was Trivia Night. Jessie Earley gave an overview of the Historic Preservation Plan and why the town was embarking on the path for this plan. Then, there were three rounds of questions relating to the history of Crested Butte: mining, ski and tourism, and random trivia. Some 50 people participated in the event. The questions were developed by a local history professor at Western State Colorado University, Duane Vandenbusche. The emcees for the evening were Chad Reich and Ben Eaton. The Crested Butte Mountain Heritage Museum helped to run the trivia app, which was new to them and a new technology for town events. This event was excellent in that it engaged a large group of folks who might not have otherwise known about the HPP. However, we learned from the event about ensuring that we get information out in different formats about the plan to ensure feedback. Feedback from this event was somewhat limited.

Open Mic Night held on 29 February 2024 at the Eldo (215 Elk Ave): The event was held from 6-8 pm. The town headed advertising for the open mic utilizing print, radio, website announcements, and word of mouth. The 2023 Flauschink King and Queen were excellent emcees and encouraged various community members to speak. In between, they told great stories themselves. It was a cheerful night of reminiscing. Residents took advantage of the opportunity to connect with town planning staff and give requested feedback about preservation issues, transportation issues, and infill issues.

- Written responses were collected on posters prepared for the event that were hung in the entry hallway to the event area at the Eldo stage. Primary topics explored on the posters included:

    1. Comparing images of various styles, materials, mass, form, and scale of buildings displayed next to a poster with a dividing line between what people want more of in town, and what they want less of.
    2. Presenting the Draft Goal & Success Measures.
    3. A flow chart to describe how the various planning processes will affect one another and contribute to future policy changes (see attached). This poster received a lot of attention because it was a great introduction for residents to understand how the Town is working to connect the various planning issues, and even if an individual had no opinion on historic preservation, at least something else on the poster was of importance; transportation, infill, etc. It also served as a reminder about the Community Compass and showed how the work that went into that document is directing the Town to complete these other important planning projects.
    4. Identifying Solutions and presenting some strategies for the Plan to consider.

Feedback

- There was mixed feedback concerning adding residential density in the town, mostly due to concerns about increased traffic, cars, and congestion.
- Residents voiced concerns over new construction looking alike or diluting the truly historic architecture by trying to match it.
- Attendees commented that they would like the demolition ordinance tightened.
- Responses included an acknowledgment that sustainability should become more of a focus.
- Attendees seemed to agree with adding a period of significance for the ski/recreation era (60s-80s)
- Attendees responded that, if handled properly, they would be supportive of changes to the design standards and guidelines to allow for more diversity.
- It was encouraging to hear from some of the tourists and visitors who stumbled upon the event that the historic architecture was a big part of the appeal in them coming to Crested Butte. They also commented that they knew they would be able to find unique shopping and dining opportunities here, and that supporting small businesses to become stewards of historic buildings should be a town priority.
- The success measures were generally supported, with some folks offering slight tweaks. For example, shrinking the historic district was suggested.
- The ideas on the more/less poster that people want to see more of included:
    - Color
    - Front porches
    - Protection of alleys
    - Keeping the funky culture alive, protecting the funky buildings
    - A-frames
    - Pedestrian-scale buildings
    - Solar panels, native grasses, and other sustainability-focused interventions
- The ideas on the more/less poster that people want to see less of included:
    - Height ruining the historic view corridors
    - Houses pretending to be historic
    - Height or bulk dwarfing neighboring structures
    - “BOZAR formula” leading houses to all look generally the same
    - Three or four-story buildings

Museum Phone Message Installation (331 Elk Ave): There was a phone audio message recording installation at the History Museum for March of 2024 until the Night at the Museum event on 2 April 2024. The Town has packaged up the relevant responses for the Historic Preservation Plan team to listen to. In summary:

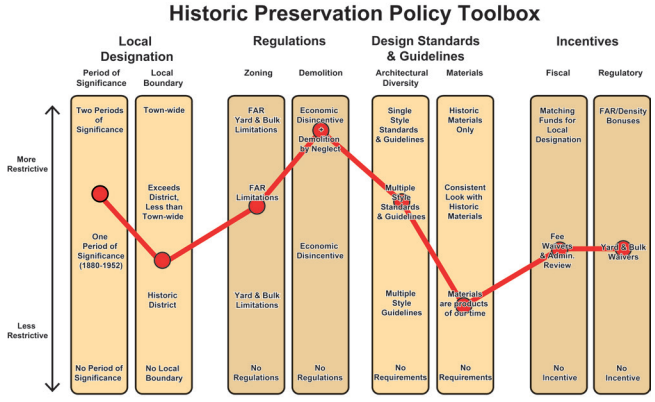
- Many of the favorite memories shared about Crested Butte centered around skiing.
- Many participants commented on the friendly community members.
- It was repeatedly shared that people enjoy the museum, and once enjoyed the former gas station, and the general store where the museum exists now.
- There were amusing stories told about "old-timers" and "mid-timers," terms of endearment for the folks that have called Crested Butte "home" for a while.
- A couple of young participants said their favorite buildings include the Company store building where Secret Stash is located, the Crested Butte Bagel shop, and the chocolate/candy store.
- People noted that Downtown is cool, interesting, or unique and that the stores are great.
- People want to preserve the community culture, and the natural landscapes. A few mentioned the ranching history of the area.
- A repeat story was that the participant or their family have been long-time visitors, some have been coming back for many decades, and some have purchased here.
- A notable story went back to the mining days- A young man was serving in the army after leaving the mines and was said to have made the right choice by leaving the very dangerous mines.
- The love for this community and the recreation in the area was shared among all participants.

Architect/Designer/Contractor Focus Group (507 Maroon Avenue): This focus group event was held on 28 March 2024. About a dozen members of the design/build community came to participate in hearing about the status of the HPP and participating in an activity to gain feedback on the policy toolkit. We asked for feedback on each of the following categories of the Policy Toolbox:

- Local Designation
  - Local Boundary
  - Period of Significance
- Regulations
  - Zoning: FAR & Yard and Bulk
  - Demolition
- Design Standards and Guidelines
  - Architectural Diversity
  - Materials
- Incentives
  - Fiscal
  - Regulatory

We were able to gather feedback on where participants wanted to see Crested Butte's policy decisions modified or kept the same. These policy options have been narrowed down to form a list of Alternatives, to be presented at the next public engagement event and to the HPP Committee. Here is a visual of the feedback received at this event:

Night at the Museum (331 Elk Ave): A Night at the Museum event was held on 2 April 2024. About a dozen community members came to participate and visit four tables, staffed by a member from the Town or SCA. The tables each had a different category of the Policy Toolbox:



Builders & Contractors Focus Group

- Local Designation
  - Local Boundary
  - Period of Significance
- Regulations
  - Zoning: FAR & Yard and Bulk
  - Demolition
- Design Standards and Guidelines
  - Architectural Diversity
  - Materials
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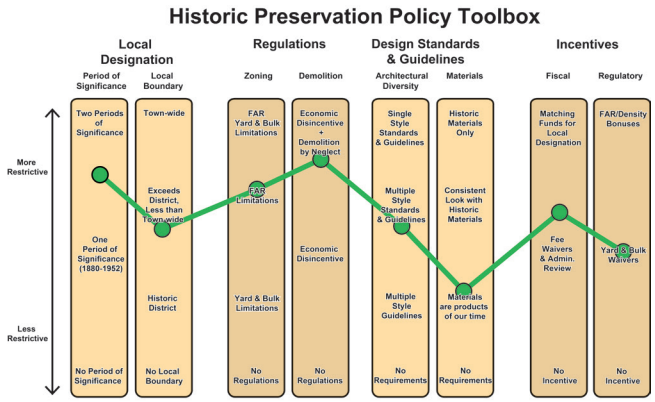

Crested Butte Community School, Junior History Class Focus Group (818 Red Lady Avenue): This focus group event was held on 26 April 2024. There were about 20 students in class this day to hear about the status of the HPP and participate in an activity to gain feedback on the policy toolkit. We asked for feedback on each of the following categories of the Policy Toolbox:

- Local Designation
  - Local Boundary
  - Period of Significance
- Regulations
  - Zoning: FAR & Yard and Bulk
  - Demolition
- Design Standards and Guidelines
  - Architectural Diversity
  - Materials
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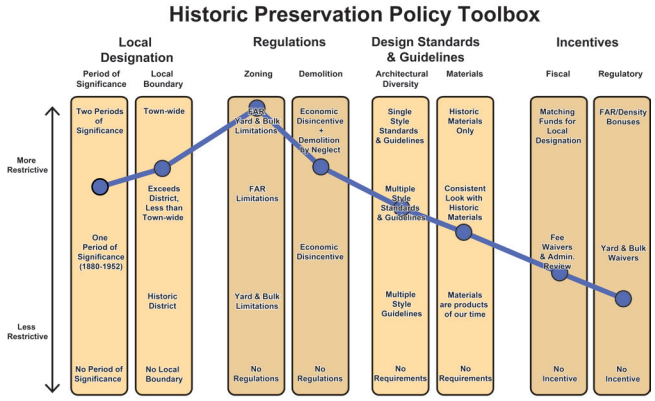

CBCS: Civic Class

Free Beer Event (Mallardi Theatre, 129 Elk Avenue): The Free Beer event was held on 26 April 2024. There were about 20 members of the public that came to hear about the status of the HPP and participate in an activity to gain feedback on the policy toolkit. We asked for feedback on each of the following categories of the Policy Toolbox:

- Local Designation
  - Local Boundary
  - Period of Significance
- Regulations
  - Zoning: FAR & Yard and Bulk
  - Demolition
- Design Standards and Guidelines
  - Architectural Diversity
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  - Regulatory

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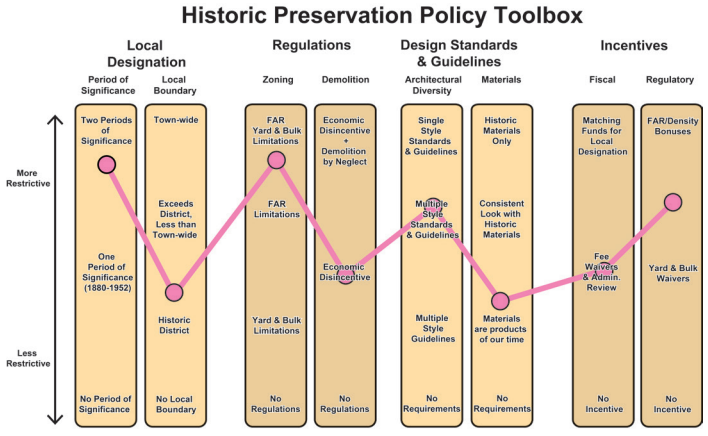


Free Beer Event

Melting Pot: This event was held May 30th at the Museum with walking tours around town. A school assignment led some of Crested Butte's young students to study a particular building's history and give a walking tour presentation of the buildings, pictured below.

You are invited to the

Crested Butte Melting Pot

Reimagined

A celebration of Preservation Month & Crested Butte Culture

Thursday, May 30th, 2024

4:00pm - 7:00pm

at the Museum - 331 Elk Ave

Free Open House Featuring:

- Unveiling of our new exhibit "331 Elk"
- Launch of our summer raffle
- New walking tour brought to you by CBCS 4th graders
- Historic sweets from "Crested Butte Melting Pot Cookbook"
- Membership renewal gifts
- Live music & more!

Presented by

CRESTED BUTTE MUSEUM & Historic Preservation Plan

Photos of the Melting Pot Student Tours | Top & Bottom Left: Elk Mountain House. Top Right: Jail.

Powerplant Tour | Above

Images Credit: Town of Crested Butte
Additional Images: Crested Butte News

Flauschink King and Queen, 2023 watch participants tell their Crested Butte stories

Stories about why Crested Butte is such a special place were told by the community

Flauschink King and Queen, 2023 wrap up the night at the Open Mic Night

The participant list for the Open Mic Night at the Eldo

Community members recall their Crested Butte history

Free Beer event discussions

Free Beer at the Mallardi

Showing the Policy Toolkit to community members to solicit feedback

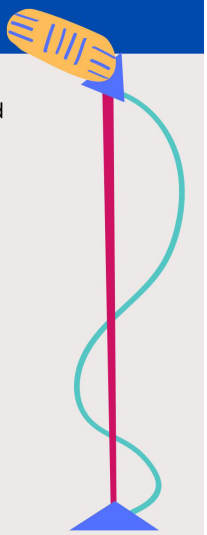
Presentations with a beer in-hand!

A performance to kick-off the Open Mic Night

Flyers for Public Outreach

TOWN OF CRESTED BUTTE PRESENTS

(HI)STORIES OF CB OPEN MIC NIGHT



Join us for an evening of Crested Butte Storytelling.

THURSDAY, FEBRUARY 29TH FROM 6-8 PM

AT THE ELDO

- Hosted by Ben Eaton
- 2 hours CB history themed performances
- Share your input on the Town's Historic Preservation Plan
- All ages and performers welcome

Historic Preservation Plan

TOWN OF CRESTED BUTTE & THE CRESTED BUTTE MUSEUM PRESENTS

RECORD YOUR CB HISTORY

FEBRUARY 12TH-MARCH 31ST

AT THE CRESTED BUTTE MUSEUM

Come share your Crested Butte history on our audio phone guest book.
Tell us:

- What is your favorite building?
- What you're most keen to preserve?
- What era of CB architecture is your favorite?

Learn more about the Town's Historic Preservation Plan here

CRESTED BUTTE MUSEUM

Historic Preservation Plan

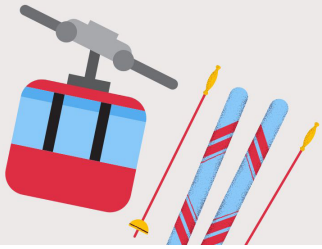
TOWN OF CRESTED BUTTE PRESENTS

NIGHT AT THE MUSEUM

TUESDAY, APRIL 2ND 6-8 PM

AT THE CRESTED BUTTE MUSEUM

Enjoy some snacks, learn about the Town's Historic Preservation Plan, and share your thoughts!



Historic Preservation Plan

TOWN OF CRESTED BUTTE PRESENTS

FREE BEER & HISTORIC PRESERVATION

FRIDAY, APRIL 26TH 4-6 PM

AT THE MALLARDI THEATRE

Enjoy a pint and share your thoughts on the Town's Historic Preservation Plan

Historic Preservation Plan

A retro phone ready to capture museumgoers recorded history

The Crested Butte Mountain Heritage Museum Ski History Exhibit

Feedback was gathered on posters at the Eldo

The Crested Butte Mountain Heritage Museum Bike History Exhibit

Contractors and Architects gather to discuss policy

Compass Navigation Meeting. Topic: Historic Preservation Plan

History of Crested Butte Trivia Night at the Eldo

Compass Navigation Meeting. Topic: Historic Preservation Plan

Another Open Mic Night performance

Crested Butte High School Students participate in the HPP and learn about civic engagement and planning processes

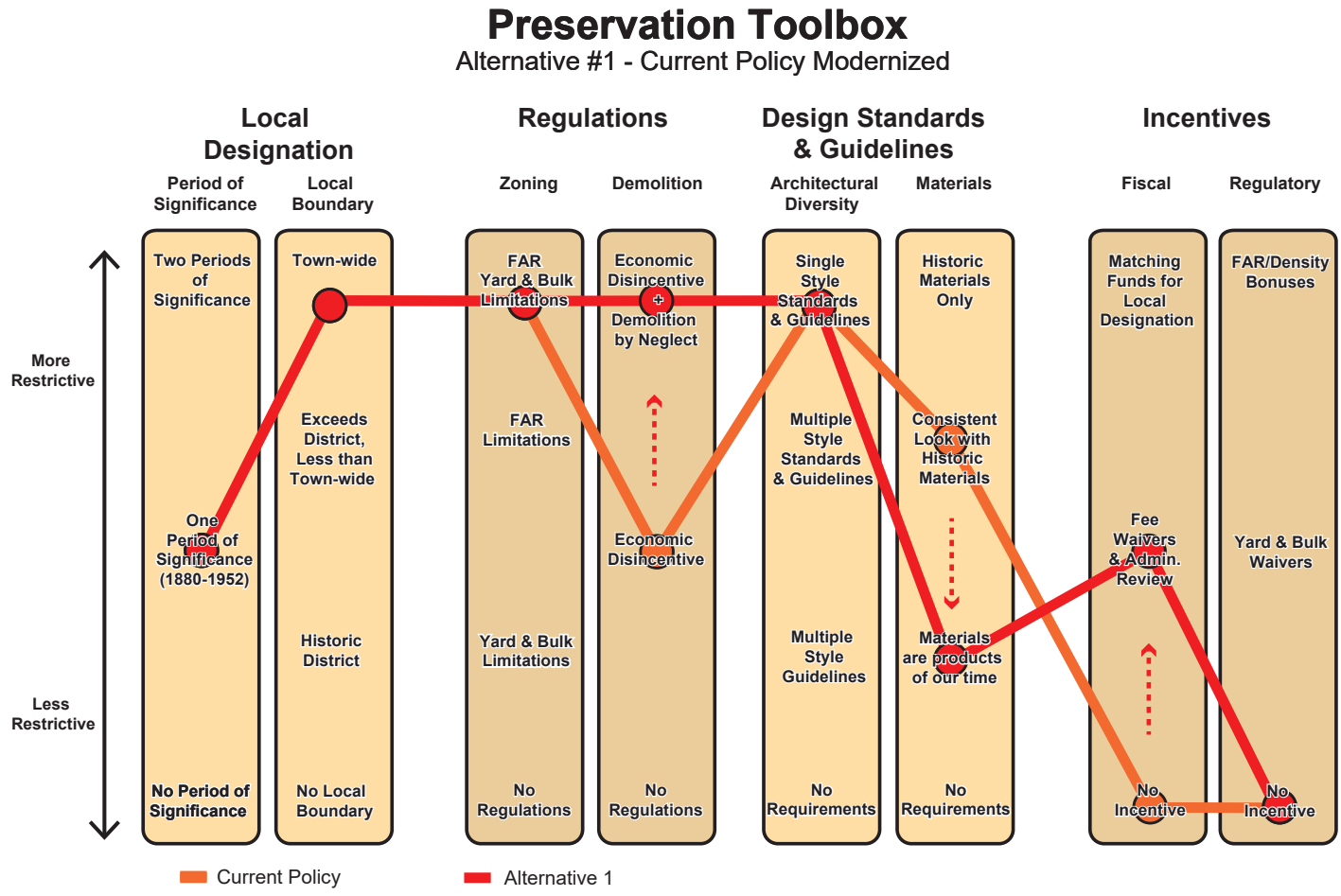
Draft Alternatives Considered

As a town, Crested Butte can offer regulatory protection, incentivize preservation efforts, award exceptional preservation projects, and align policy with the needs and desires of the community. An assessment of various policy tools was conducted throughout the process of formulating alternative preservation strategies for Crested Butte's preservation program (the "Alternatives"). The array of categories included:

- **Local Designation**
  - **Local District Boundaries**
  - **Period of Significance**
- **Regulation**
  - **Demolition Ordinance**
  - **Zoning**
- **Standards and Design Guidelines**
  - **Architectural Diversity**
  - **Materials**
- **Incentives**
  - **Fiscal**
  - **Regulatory**

Alternative 1: Current Policies Modernized

Alternative One seeks to ***modernize the current preservation policy***. Alternative one continues Crested Butte's current preservation policy of preserving the mining period of significance from 1880-1952 with a town-wide district that regulates architectural style to reflect the mining period. This alternative contemplates a few changes from current policy to modernize some practices that reflect community feedback.



Alternative #1 Overall strategy:

- Recognize climate risks, which encourages flexibility in materials.
- Recognize the risk of losing historic buildings. Tighten demolition ordinance.
- Recognize weaknesses of affordability. Sheds and upkeep/maintenance for token incentives for income-challenged folks.

This alternative considers the following changes from Crested Butte's current preservation strategy:

Tighten the demolition ordinance to reduce the risk of loss of historic buildings. Regulate demolition by neglect to further protect historic buildings.

This could look like: Fines and fees for the buildings and sheds that are neglected (criteria to be established). This is balanced with an incentive program to help owners avoid neglect, explained below.

Demolition by Neglect: Deferring maintenance of a structure for a long enough period of time that the structure is unsuitable to preserve and is demolished instead.

Relax materials requirements to be products of our time and recognize climate goals and wildfire risks associated with traditional materials.

This could look like: Metal shingles, more masonry, composite and fire-retardant wood substitutes, larger widows with higher energy ratings, etc.

Develop incentives in response to the recognition of affordability on upkeep/maintenance of historic buildings and sheds.

This could look like: Developing a historic building/shed maintenance support program for those in need where Historic Resource owners can apply for a maintenance assistance program and if they are eligible (criteria will be established) they can receive assistance from the Town. There may be potential for the Town to receive funds from grants or for the Town to assist the historic resource owner in maintaining or upgrading their building or structure.

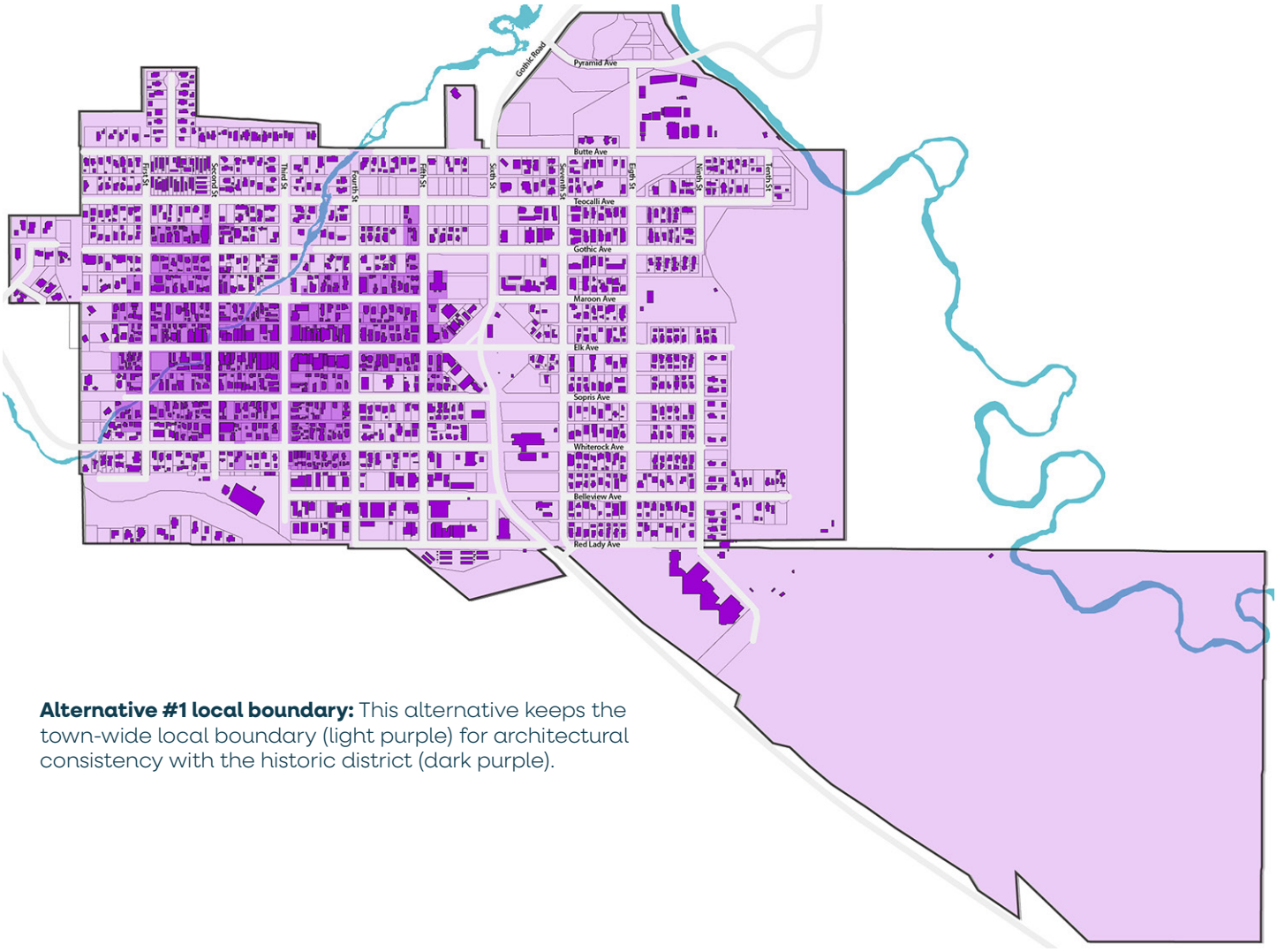
Allow for expedited and simplified administrative review of projects when applicants are following the zoning code and design guidelines and standards to incentivize following the rules.

This could look like: A shed conversion into an ADU or a compatible addition (criteria to be established) may warrant expedited review that skips the process outlined above in Crested Butte Current Preservation Program and is instead reviewed by the designated Town staff person for compliance with the Municipal code and Design Standards and Guidelines in lieu of BOZAR review.

Alternative 1: Current Policies Modernized	How it meets the Success Measure:	How it fails to meet the Success Measure:
SM #1. Protect the National Historic District and preserve structures.	Continuing to preserve historic structures and support the National Historic District meets SM. #1	
SM #2. Respect mass, scale, orientation.	Ensuring compatibility with the Historic District means that the mass, scale, and orientation of buildings will be respected.	
SM #3. Allow for flexibility in styles and materials	Slightly more flexibility in materials.	This Alternative does not allow for flexibility in styles, and only some flexibility in materials.
SM#4 Clearly represent the community's design expectation		This Alternative may not meet Success Measure 4 because it dilutes the historic integrity of the district by including new buildings that mimic historic buildings and cause confusion.

How does this alternative meet or not meet the success measures?

What is the architectural identity that this Alternative will encourage?
This Alternative will mean more of the same mining-era copycat homes and commercial buildings in Crested Butte. New buildings will need to prove compatibility with mining-era buildings. While the materials that are allowed may change, the overall feel of buildings will likely continue to be homogenous. Modern architecture will not have a place in the community. Ski-era buildings will not be protected as such. There will be more focus on preservation of historic buildings and tightening the demolition ordinance, along with some incentives.



Alternative #1 local boundary: This alternative keeps the town-wide local boundary (light purple) for architectural consistency with the historic district (dark purple).

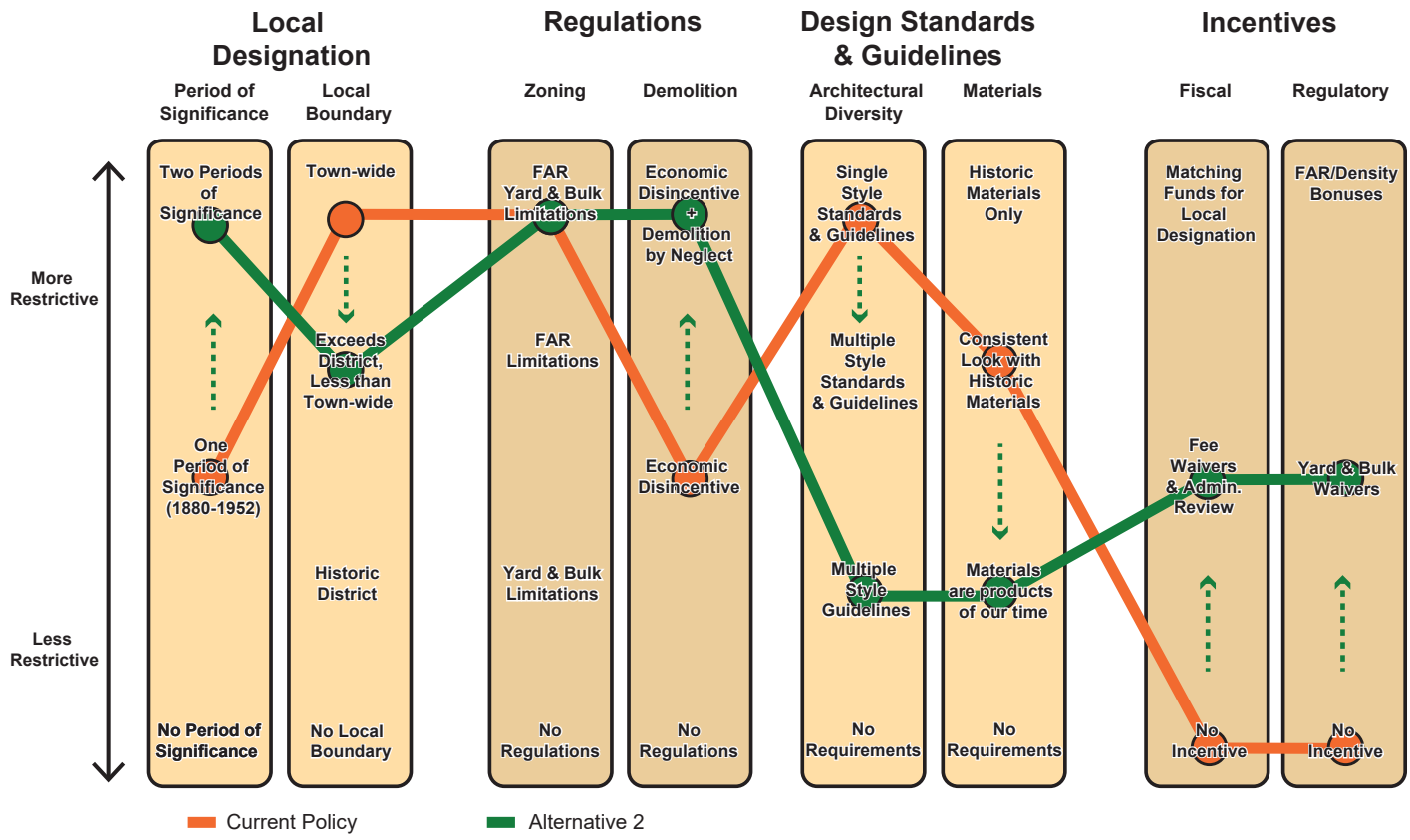
Alternative 2: Two Periods of Significance with Town-Wide Standards

Alternative Two ***adds a new period of significance to preserve the recreation/ski era in addition to the mining era.*** The recreation/ski era is classified as buildings that represent the organic growth that happened from 1953 – 1984 as ski area investments led to traction for newcomers to enter town and build their homes, institutions, and commercial buildings. Surveys of buildings in town show that after 1984, the size of structures, mostly homes, began to balloon through maximization of allowed square footage, resulting in a shift in the look and feel of buildings from modest homes for ski-era newcomers to a larger scale that aligns more closely with modern architecture.

Credit: Chairlift.com

Preservation Toolbox

Alternative #2 - Two Periods of Significance with Town-wide Design Standards



Alternative #2 Overall strategy:

- Preserve 1880-1952/mining period.
- Establish designation for the ski/recreation period.
- Retain mass/scale/form for new construction for areas outside of the period of significance.

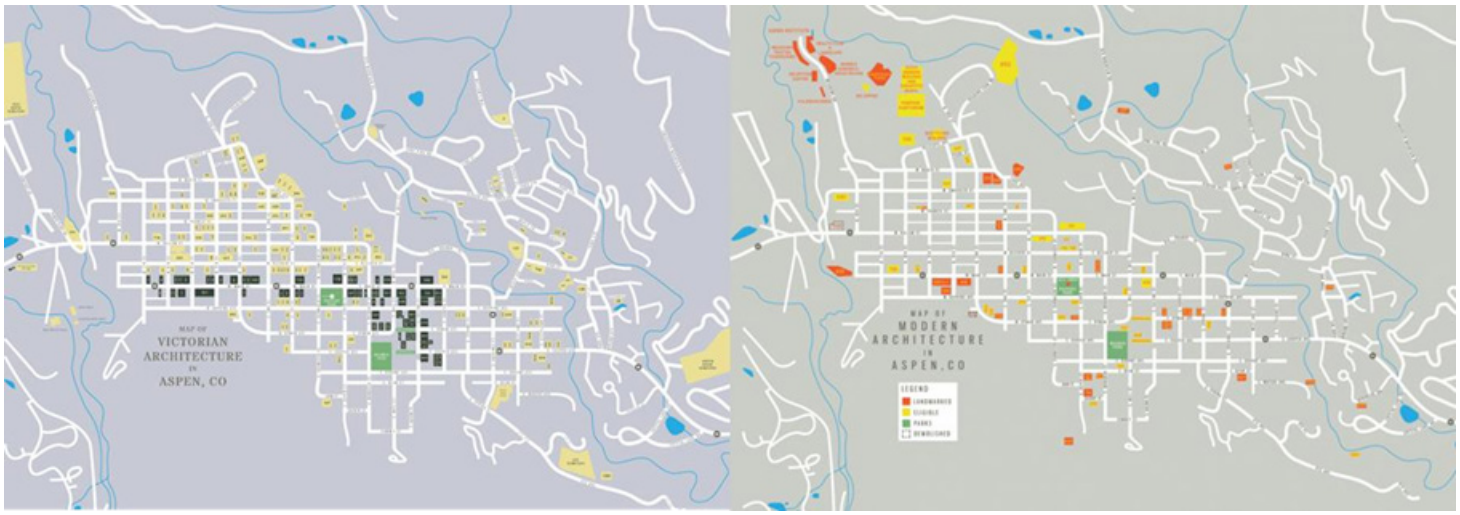
What is different about this new period from the Town's current mining period of significance, shown on the map on the next page, is that these buildings comprise a "salt and pepper" district, rather than a cohesive historic district like the mining era. Buildings that fall into this new period would be required to adhere to historic preservation requirements, including more stringent demolition requirements and architectural standards and guidelines to adhere to the styles of the recreation/ski era.

Outside both districts, this alternative would allow for a range of architectural styles by regulating mass, scale, and form and developing design standards and guidelines that provide a range of styles supported by the community. While the current design standards and guidelines reflect the mining era, this alternative would develop a new set of standards through a community process to identify a range of different styles that have evolved in Crested Butte's history and are compatible with Crested Butte's vernacular.

This alternative also contemplates various incentives. For all buildings, this alternative would allow administrative review for applications following the guidelines. For buildings within the new recreation/ski era period of significance, yard & bulk waivers would be allowed as an incentive to these structures to encourage/ allow additions onto buildings that may otherwise be inhibited by yard and bulk restrictions. This alternative considers the following changes from Crested Butte's current preservation strategy.

Add a new period of significance to reflect the recreation/ski era.

This could look like: An amendment to create another historic district (non-contiguous).



Maps of Historic Districts in Aspen. The map on the left highlights building that are part of the AspenVictorian District while the map on the right highlights the AspenModern District, their two Periods of Significance. Credit: AspenMod.com & AspenVictorian.com via the City of Aspen.

Modify the local boundary to create a buffer around the national historic district. Add a new non-congruous district for the recreation/ski era with a buffer for neighboring properties.

> **This could look like:** Modifications to the local boundary to encompass and buffer the National Historic District and include those buildings identified as contributing to the second period of significance, including a buffer around those buildings.

Tighten the demolition ordinance in recognition of the risk of losing buildings from any period of the town's history.

> **This could look like:** An amendment to the demolition ordinance to include historic buildings from two (2) periods of significance: Mining and recreation/ski eras. Increased demands on demolition like requiring a certain amount of demolished structure materials to be reused or recycled (Pre-demolition audits) or other requirements.

Govern mass, scale, and form for buildings outside the district and developing a new set of design standards and guidelines that allow for a range of styles and materials supported by the community.

> **This could look like:** Design Standards and Guidelines for each POS that carefully explain the character-defining features that contribute to the historic integrity associated with each time period.

Develop incentives in response to the recognition of affordability on upkeep/maintenance of historic buildings and sheds

> **This could look like:** Ski/recreation era buildings that remain architecturally sound may result in incentives for owners (criteria to be developed).

Allow for administrative review of projects when applicants are following the zoning code and design guidelines and standards to incentivize following the rules.

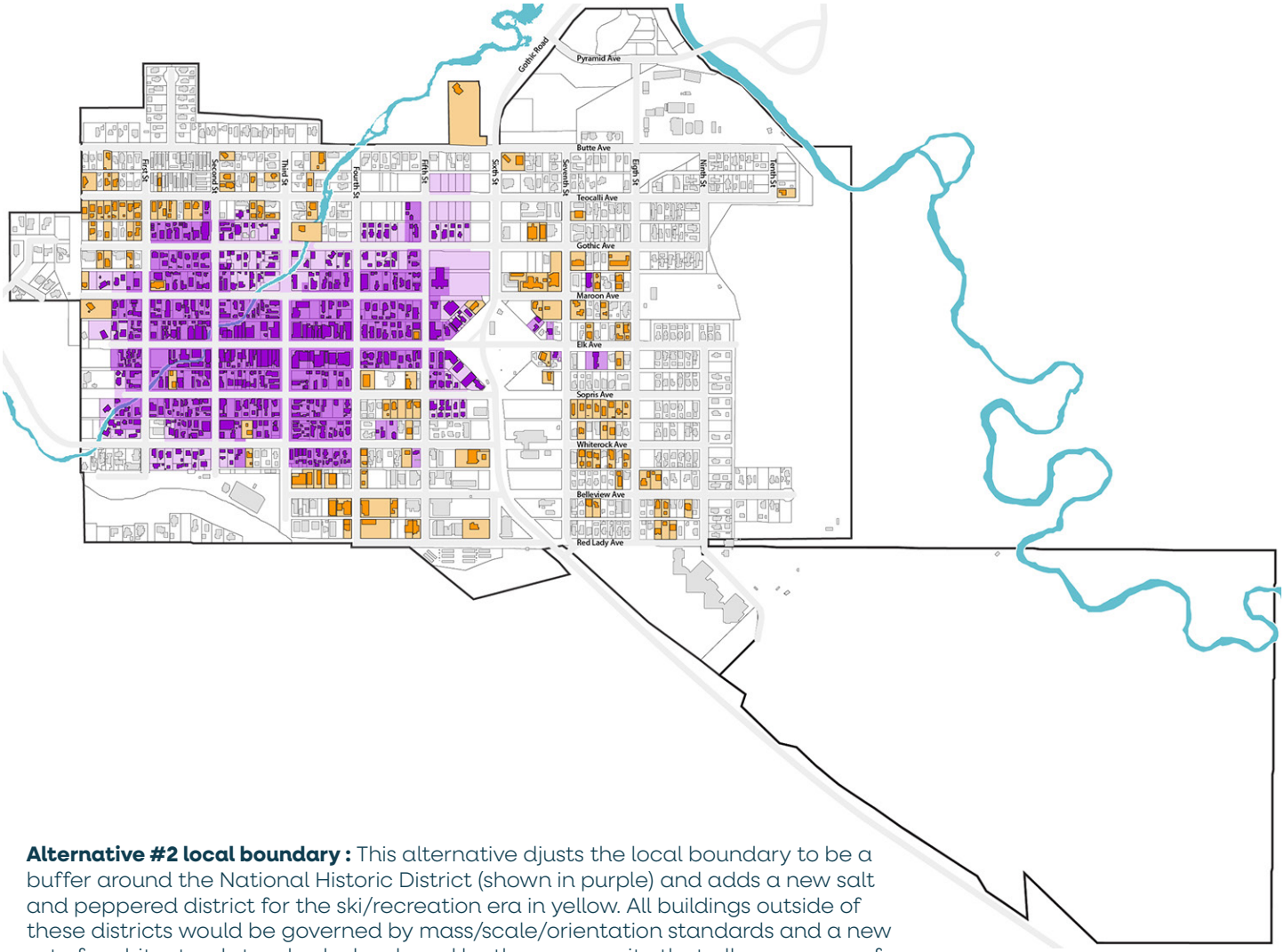
> **This could look like:** Projects that prove they are following their appropriate design standards and guidelines and meet the criteria (criteria to be established) may warrant expedited review that skips the process outlined above in section: ***Crested Butte Current Preservation Program*** and is instead reviewed by the designated Town staff person for compliance with the Municipal code and Design Standards and Guidelines in lieu of BOZAR review.

Credit: Chairlift.com

How does this alternative meet or not meet the success measures?

Alternative 2: Two POS with Town-wide Standards	How it meets the Success Measure:	How it fails to meet the Success Measure:
SM #1. Protect the National Historic District and preserve structures.	Continuing to preserve historic structures and support the National Historic District meets SM. #1	Maintains the National Historic District and preserves additional structures through a new POS
SM #2. Respect mass, scale, orientation.	Ensuring compatibility with the Historic District means that the mass, scale, and orientation of buildings will be respected.	Yard and Bulk waivers may lead to buildings that are presented as larger than those neighboring buildings.
SM #3. Allow for flexibility in styles and materials	This Alternative allows for a *range* of styles and additional materials.	
SM#4 Clearly represent the community's design expectation	This alternative would lead to the creation of a new set of design standards and guidelines developed with the community to clearly reflect and depict the range of styles the community supports outside the districts.	This Alternative may not meet Success Measure 4 because it dilutes the historic integrity of the district by including new buildings that mimic historic buildings and cause confusion

What is the architectural identity that this Alternative will encourage?
This Alternative will mean that new buildings or additions in the buffer (district) will need to prove compatibility with mining-era buildings or ski-era buildings. Appropriate material and styles will contain a larger range (to be decided by the community) outside of the districts, and there will be more flexibility in materials within the districts to account for resilience and affordability. Skiera buildings and mining era buildings will be carefully protected by an amended demolition ordinance. Incentives including yard and bulk waivers may lead to some variety in site layout.



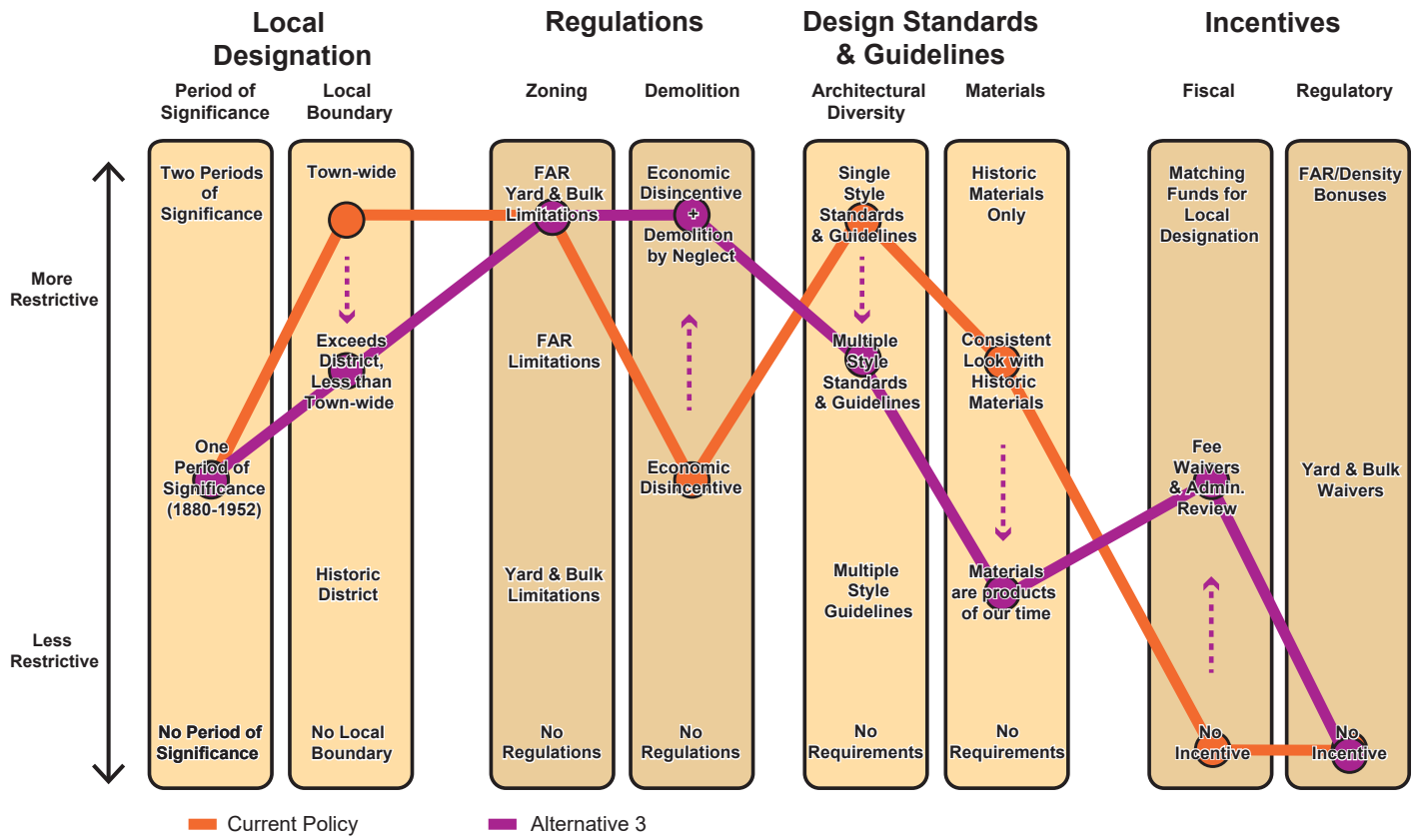
Alternative #2 local boundary : This alternative djusts the local boundary to be a buffer around the National Historic District (shown in purple) and adds a new salt and peppered district for the ski/recreation era in yellow. All buildings outside of these districts would be governed by mass/scale/orientation standards and a new set of architectural standards developed by the community that allow a range of styles that are flexible beyond today's standards.

Alternative 3: One Period of Significance with Town-Wide Standards

Alternative Three continues to preserve the mining period of significance by preserving the National Historic District with continued regulations and architectural standards within the historic district boundary, which is adjusted from town-wide to be a buffer around the national historic core of town. Outside of the district, the Town would regulate only the mass, scale, and orientation to ***encourage more architectural creativity and diversity in a way that is compatible with Crested Butte's scale***. This alternative considers the following changes from Crested Butte's current preservation strategy:

Preservation Toolbox

Alternative #3 - One Period of Significance with Town-wide Guidelines (M/S/F)



Alternative #3 Overall strategy:

- Preserve 1880-1952/mining period.
- Retain mass/scale/form for new construction while allowing for more flexibility with style in areas outside of the periods of significance.

Any architectural style or material would be permitted if buildings meet mass, scale, and orientation standards.

Within the District this could look like: Additions to historic homes with new materials and architectural styles. New construction that has modest mass, scale, and form to not detract from historic structures, but with new materials and styles of architecture.

Develop incentives in response to the recognition of affordability on upkeep/maintenance of historic buildings and sheds.

This could look like: Historic Resource owners can apply for a maintenance assistance program and if they are eligible (criteria will be established) they can receive assistance from the Town. There may be potential for the Town to receive funds from grants/tax credits or for the Town to assist the historic resource owner in maintaining or upgrading their building or structure.

Allow for administrative review of projects when applicants are following the zoning code and design guidelines and standards to incentivize following the rules.

This could look like: A shed conversion into an ADU, appropriate re-roof or a compatible addition (criteria to be established) may warrant expedited review that skips the process outlined above in Crested Butte Current Preservation Program and is instead reviewed by the designated Town staff person for compliance with the Municipal code and Design Standards and Guidelines in lieu of BOZAR review.

Credit: Modative.com ADU

Credit: HempBuild Magazine

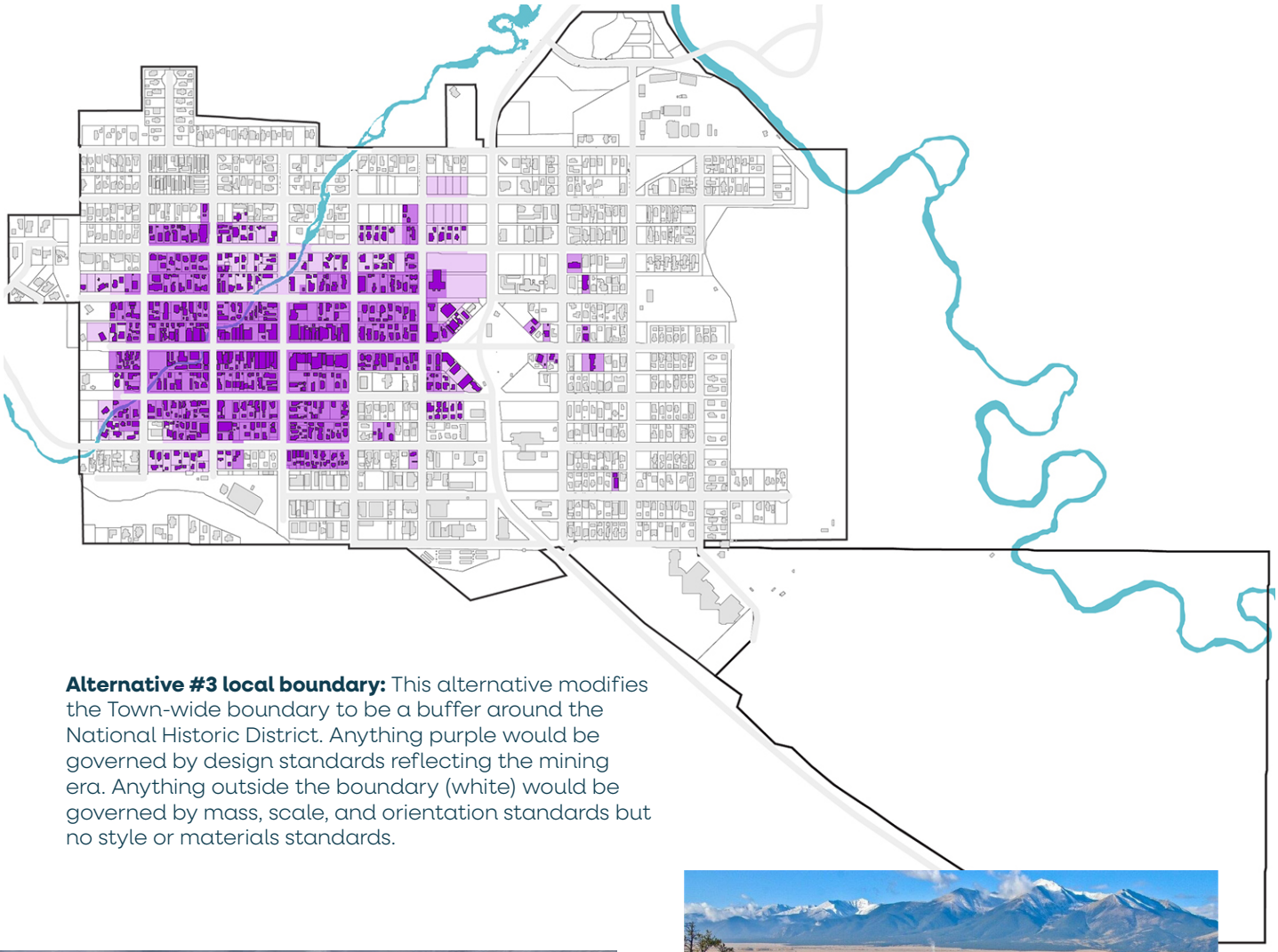
Credit: MarkStewart.com

How does this alternative meet or not meet the success measures?

Alternative 3: One POS with Town-wide Guidelines	How it meets the Success Measure:	How it fails to meet the Success Measure:
SM #1. Protect the National Historic District and preserve structures.	Continuing to preserve historic structures and support the National Historic District meets SM. #1	
SM #2. Respect mass, scale, orientation.	Mass, scale, and orientation of buildings will be governed for compatibility.	
SM #3. Allow for flexibility in styles and materials	This Alternative allows for flexibility in styles outside of the boundary. Materials will also be flexible, especially outside of the boundary.	
SM#4 Clearly represent the community's design expectation	This Alternative meets SM #4 when considering development inside of the buffer area and historic district and allows development to be a product of its own time outside of the boundary.	This is a big change from CB's history of regulating architectural style, which may result in lacking clarity in the early stages of policy development.

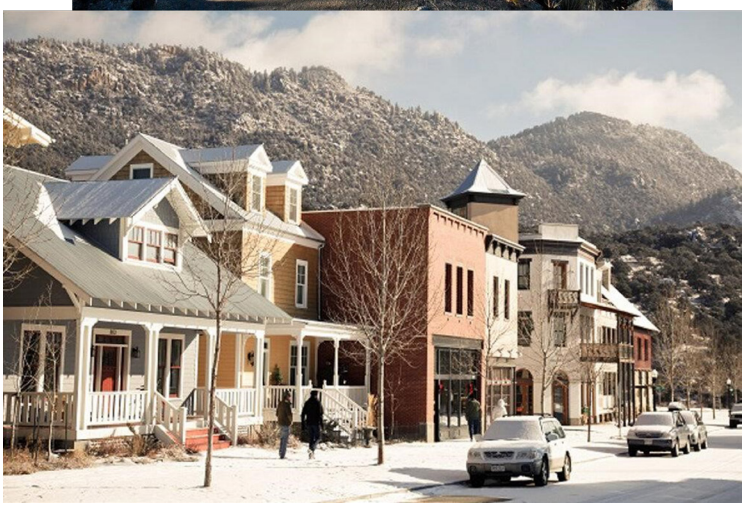
What is the architectural identity that this Alternative will encourage?

This Alternative will create more variety and flexibility in styles and materials. In the future, it's possible that homes from the ski era, mining era, and modern styles could stand in the same neighborhood, but there is protection from new construction competing with historic structures or detracting from community character. Buildings will be pedestrian-scale, site layouts will support the character and use of the Town's alleys.



Alternative #3 local boundary: This alternative modifies the Town-wide boundary to be a buffer around the National Historic District. Anything purple would be governed by design standards reflecting the mining era. Anything outside the boundary (white) would be governed by mass, scale, and orientation standards but no style or materials standards.

Credit: ArchitecturalDesigns.com



Credit: SouthMainCo.com | South Main Buena Vista

Potential Funding Sources and Partners

Crested Butte's historic preservation program has a few options for funding sources along with potential partners that can assist with various elements of its work.

In the area of funding, the most important, accessible and impactful source of grants continues to be the Colorado State Historical Fund, one of the largest historic preservation grant providers in the United States. Although the amount of money the fund has available varies from year to year, it remains substantial and the primary source of financial assistance for a variety of projects. These can include small studies and preservation efforts to larger surveys and rehabilitation projects. Crested Butte has already taken advantage of SHF grants to help fund its historic resource surveys along with the current preservation plan. It is expected that the Town will continue to pursue these grants for years to come.

Information about the program can be found at https://www.historycolorado.org/grants-incentives. Technical support is also provided by preservation specialists in this office, and they can be reached for consultation even if a grant is anticipated but not yet under contract. It is important to note that SHF grants often require cash matches from the recipients. The Town of Crested Butte will have to be prepared to support preservation efforts from its own budget, using local funds to leverage state grants when possible.

Another important funding source involves Certified Local Government (CLG) grants, which are federal funds sent to the Colorado SHPO by the US Department of the Interior's Historic Preservation Fund. While most of the funding is intended to support the work of the state office, the program requires that the SHPO sub-grant at least 10% of the funds to support local preservation efforts. These grants have smaller caps than what is offered by the SHF, so they are useful for small projects undertaken by the Town government. Examples include modest-sized surveys, studies and landmark nominations. The Town of Crested Butte is already registered as a CLG, so these grants are available for projects in the community. Local governments are eligible to apply for CLG grants with no requirement for matching funds.

In addition to these two primary funding sources in Colorado, the OAHP website provides links to grant-making organizations that might be approached for assistance with certain projects that meet their requirements. A list of these sources is published on History Colorado's website at https://www.historycolorado.org/additional-resources-funding. Some of the grant sources listed there appear to no longer provide funding, while others offer grants for small projects and a modest number of larger ones. Examples include the National Fund for Sacred Places and Peter Grant Preservation Fund for Colorado.

Another form of financial incentive that can help owners of private and non-profit properties involves the state and federal tax credit programs. Tax credits can turn a challenging historic preservation project into one that is financially viable. Information about these programs can be found at https://www.historycolorado.org/preservation-tax-credit-fact-sheet. Although the programs are somewhat complex, technical assistance is offered by staff at History Colorado's office in Denver. The website answers many questions about what types of projects and properties are eligible and how to apply.

In Colorado, various partners can assist with historic preservation projects. History Colorado is an important source of information and assistance and a good place to start. Staff members in the Office of Archaeology and Historic Preservation are available to guide those looking to landmark historic properties through the State Register of Historic Properties and National Register of Historic Places. Grants and tax credit staff can answer questions and provide technical assistance with applications.

Another partnership entity is Colorado Preservation Inc. (CPI), the statewide nonprofit organization with a focus upon saving historic places and supporting the preservation community. CPI organizes the annual

Saving Places conference that takes place every February. This event has long been recognized as one of the largest and best-organized and executed historic preservation conferences in the United States. The Town of Crested Butte should be sending as many of its staff members and preservation advocates to the conference each year as possible. It is the most important gathering in Colorado to gain education and make useful connections. CPI also administers the Colorado Endangered Places program, which highlights an annual slate of historic properties in need of attention from the preservation community.

Other organizations that could assist the Town of Crested Butte with its preservation program include the Main Street Program administered by the Colorado Department of Local Affairs (https://dlg.colorado.gov/main-street), the National Trust for Historic Preservation (https://savingplaces.org), and the Colorado Historical Foundation (https://www.cohf.org).

Resources

Period(s) of Significance

There are three distinct periods in Crested Butte's history, two of which are more significant that relate to the development of the town's buildings and infrastructure. The first is the Mining Era, which ran from 1881 to 1952 (when the Big Mine closed). The town then entered its Quiet Years, which ran from 1953 to 1969. During that period, Crested Butte lost population and there were few major events. Although the ski area was established nearby in the early 1960s, it faltered and resulted in very little growth in Crested Butte. The final period is the Skiing Era, or what we might correctly term the Ski/Recreation Era because it is not just limited to winter sports. This era runs from 1970 to the present and was spurred by a massive investment in the development of the ski resort and resulting impact upon Crested Butte's population and development.

Basis for Determining Significance

History Colorado has set criteria for consideration of properties for nomination and inclusion in the Colorado State Register that include:

1. The association of the property with events that have made a significant contribution to history;
2. The connection of the property with persons significant in history;
3. The apparent distinctive characteristics of a type, period, method of construction, or artisan;
4. The geographic importance of the property;
5. The possibility of important discoveries related to prehistory or history.

SEE ALSO: https://www.historycolorado.org/colorado-state-register-historic-properties

Architectural Analysis of Crested Butte

Crested Butte Development in the Post-WWII Years and Early Skiing Era, 1950s-1970s

Following closure of the Big Mine in August 1952 and abandonment of the Denver & Rio Grande Railroad's narrow-gauge line between Gunnison and Crested Butte three years later, the town entered a period of quiet isolation. Once its primary source of jobs and community investment disappeared, Crested Butte became an out-of-the-way former mining town with a depleted population and depressed economy. Federal census records show that the community's population dropped by 60% from 730 in 1950 to just 289 a decade later. It then rose to 372 in 1970. These numbers reflect the town's decline and subsequent revival, a story connected with the area's natural beauty, its recreational opportunities, and the affordability of its mining-era homes, commercial district, and lots that were waiting to be developed or redeveloped.

Crested Butte's coal mining days were over, but it held other natural resources that would rise in importance with Americans' changing values and interests, and these would become the basis of its resurgence and

growth starting in the 1960s and continuing through the present day. During the post-World War II years, many Americans were searching for new places, and new ways, to live their lives. Abundant jobs, a booming national economy, and a developing highway system gave them the resources to purchase automobiles and head west. Some relocated to the mountains of Colorado, where they found the opportunity to reestablish themselves in places that provided natural beauty, a sense of community, and abundant opportunities for outdoor recreation. Crested Butte was about to become one of those destinations.

Every winter, Crested Butte was blessed with an abundance of snow and in 1961 the Crested Butte Winter Sports Area opened two miles north of town. However, over the following years the small ski resort suffered from financial problems and fell into bankruptcy. In 1970, the stillsmall ski resort was acquired by the Crested Butte Development Corporation, owned by partners with substantial financial resources. Over the following years, an investment of $20,000,000 turned the ski area into a major resort capable of competing with Colorado's other premier locations such as Aspen, Vail and Steamboat Springs. The quiet town of Crested Butte suddenly awakened from its slumber and by 1980 its population had risen to 959, a remarkable increase of 157%. During the 1960s and 1970s, the historic commercial and residential districts were renewed one property at a time and new buildings began to be constructed. This trend has continued through the present day.

This section of the Crested Butte Preservation Plan looks at surviving buildings from the mining era, the development of properties during the subdued post-mining years of the 1950s, and the early skiing era that began in 1961 and extended through the 1970s. It is important to consider what constitutes Crested Butte as it exists today: a combination of mining-era buildings and structures that date from 1881 to 1952, a very small number of buildings from the quiet years of the 1950s, and many others from the early skiing era that date from the 1960s through the 1970s and beyond. Buildings that date from these periods are intermingled across Crested Butte and are not clearly defined by locations such as neighborhoods or districts or evenadditions to the town.

Survivors of the Mining Era – When the mine closed in 1952, Crested Butte still held numerous buildings that dated back as far as the 1880s. This is typical of mining communities throughout the Mountain West, where buildings were kept standing as long as they had some continuing utility and economic conditions did not encourage their replacement. While many of these buildings in Crested Butte survived into the postwar era, many others were demolished, including a number that succumbed to devastating commercial district fires in the 1890s. Others were likely demolished in the 1950s and 1960s, during the period when Crested Butte's population remained depressed. Unused buildings, decades old, would have fallen into disrepair and the idea of preserving the town's architectural heritage was a distant priority. Simply put, aging buildings were kept standing and in reasonably good shape because they were useful to their owners and the community.

During the process of writing a preservation plan for Crested Butte, it is important to first consider what remains standing from the mining era because this provides the context for what happened over the following decades as the town progressed through its quiet years, entered the early skiing era, and eventually developed a preservation ethic along with a municipal program to implement policy. This also sets the stage for how the town has developed since the 1950s and 1960s as historic buildings from the mining era either continued to be used, were removed or rehabilitated, or new ones emerged in their place or to fill vacant lots.

Over the years following the Big Mine's closure, its aboveground features were removed from the site. The only one that appears to have survived to the present day is the former Mule Barn that stands at 709 Maroon Avenue. In its new location, the building was modified and converted to apartments. This left the town with nothing to preserve or interpret at the mine site other than pointing out its previous location on a bench south of and above Crested Butte. What primarily remained from the mining era was the town itself, complete with an array of historic buildings and related features.

Big Mine with Crested Butte Below, 1951
Credit: Duane Smith, Crested Butte: From Coal Camp to Ski Town

Mule Barn from the Big Mine
709 Maroon Ave.
Credit: Ron Sladek

Commercial Buildings were concentrated in Crested Butte's downtown commercial district throughout the mining era. Most of these buildings lined the main east-west thoroughfare known as Elk Avenue. This area extended for just two blocks, from the intersection of Second Street to the intersection of Fourth Street, where the three-story Elk Mountain House hotel (no longer extant) stood on the southwest corner. Elk Avenue was the location of most of the town's offices, service shops, retail stores, restaurants and numerous saloons. Also along its length were the bank, livery stables and a lumberyard.

Elk Avenue
Looking West from Third Street
Credit: Ron Sladek

Commercial Buildings
300 Block of Elk Avenue (North Side)
Credit: Ron Sladek

Among the oldest commercial buildings still standing are the Crested Butte House hotel and saloon at 202 Elk Ave. and Crested Butte Hardware (now the Crested Butte Museum) at 331 Elk Ave. These date from the early 1880s, the initial period of coal mining in the vicinity. To the rear of the Crested Butte House is an Ice House, constructed around 1900 of locally quarried stone, The small building provided cold storage for the adjacent saloon.

Kochevar's Saloon at 127 Elk Ave. and the Bank of Crested Butte at 229 Elk Ave. were constructed about a decade later, in the early 1890s. The Colorado Supply Store was built around 1905 at 218 Elk Ave. In 1918, it was remodeled and converted into the Princess Theater, which screened silent movies. A sound system was added in 1932 and the theater remained in operation until it closed in 1988. In 1937, the Colorado Supply Company was constructed on the northeast corner of Third Street and Elk Avenue. This business was a subsidiary of the Colorado Fuel & Iron Company, owner of the mine and consequently the town's primary employer.

Crested Butte House and Saloon
202 Elk Ave., Built 1882
Credit: Ron Sladek

Crested Butte Hardware / Tony's Conoco
331 Elk Ave., Built 1883
Credit: Ron Sladek

Kochevar's Saloon
127 Elk Ave., Built circa 1891
Credit: Ron Sladek

Bank of Crested Butte
229 Elk Ave., Built circa 1890
Credit: Ron Sladek

Colorado Supply Store / Princess Theater
218 Elk Ave., Built 1905-1918
Credit: Ron Sladek

Colorado Supply Company
303 Elk Avenue, Built 1937
Credit: Ron Sladek

In addition to the properties that faced onto Elk Avenue, several mining-era commercial buildings were located along the intersecting streets. The southwest corner of First Street and Maroon Avenue held a creamery. Second Street to the south of Elk Avenue served as the main walking route to and from the mine, and along its length were saloons that served miners as they headed home from their shifts. On the northeast corner of Third Street and Maroon Avenue was the Sigman Lumberyard. The block of Fourth Street just north of Elk Avenue held a blacksmith shop and livery stables.

Most of Crested Butte's mining-era commercial buildings exhibit common architectural characteristics. These features are typical of the era and of buildings that were erected in Colorado's alpine mining towns between the 1880s and 1920s. First, they are built up to the front sidewalks and occupy the widths of the lots. Architectural details include wood-frame construction, a height of one or two stories, gabled roofs, and false fronts that were installed to make the buildings look more impressive from the street. Storefronts were typically built with large display windows, and many included recessed entries and clerestory window bands. The remaining walls and upper floors were typically finished with clapboards or weatherboard siding. Double-hung sash windows often contained multiple lights. Façade ornamentation appeared in the form of kickplates, dentil bands, cornices with brackets, and pressed tinwork. These details describe many of the early commercial buildings in Crested Butte. Exceptions are rare and include Kochevar's Saloon, which is constructed of logs, the Bank of Crested Butte, which is sided with metal panels, and the stuccoed Mission-style Colorado Supply Company building.

View of Second Street, Looking North
Credit: Ron Sladek

Creamery
SW Corner, First St. and Maroon Ave.
Credit: Ron Sladek

Public Buildings of various sorts were scattered throughout the commercial district and in the residential neighborhoods to the north, south and east. The Post Office was often situated within one of the general stores, a typical practice of the late 1800s and early 1900s. Utilities included the Crested Butte Light & Water Company's electric plant, built in 1888-1890 at 130 Elk Ave. This hydroelectric facility, which operated through 1941, was powered by the movement of water flowing through Coal Creek, with a water wheel used to run its generators. Another public utility was the Telephone Exchange, which occupied a small building that faced onto Third Street just north of the Bank of Crested Butte.

Crested Butte Light & Water Company, Electric Plant
130 Elk Ave., Built 1888-1890
Credit: Ron Sladek

The Croatian Hall / Knights of Pythias Building was built in the 1880s on Elk Avenue. Sometime between 1898 and 1904 it was moved to 512 Second St., where it remains standing today. For many years, the main floor held a saloon and the upper served as a fraternal lodge hall.

Croatian Hall / Knights of Pythias Building
512 Second St., Built circa 1885 / Moved circa 1900
Credit: Ron Sladek

Crested Butte's Town Hall, built in 1883, still stands on the southwest corner of Second Street and Elk Avenue. The building provided the town with offices for its administrative functions, a meeting room, and space for the volunteer fire department. A two-story outhouse was attached to the rear. In the 1990s, it was rehabilitated for new use and continues to stand as a prominent landmark in the community. To the south is the sandstone Marshal's Office and Jail. Built in 1883 of locally-quarried sandstone, the building held two jail cells formed of stacked and nailed wood planks. It remained in use, at least periodically, for almost a century.

Crested Butte Town Hall
132 Elk Ave., Built 1883
Credit: Ron Sladek

Marshal's Office and Jail
409 Second St., Built 1883
Credit: Ron Sladek

Crested Butte's public schools stood on the southeast corner of Fifth Street and Maroon Avenue. The Rock School House at 507 Maroon Ave. was built in 1883 using stone quarried from the west side of town. It continued to serve the community into the 1920s. The building was rehabilitated in the 1980s and since that time has served as the town's library. A smaller wood-frame school building to the east also held classrooms (it is no longer extant).

Rock School House
507 Maroon Ave., Built 1883
Credit: Ron Sladek

Crested Butte High School
507 Maroon Ave., Built 1927
Credit: Ron Sladek

In 1927, work was completed on the new Crested Butte High School, which was built just north of the Rock School House at 507 Maroon Avenue. The blonde brick building was designed by prominent Denver architect John J. Huddart. It served as the community's high school through 1952, when the Big Mine closed and school enrollment suddenly declined. For the next fifteen years, the building housed all of the town's students in grades K-12. It remained in use until 1997 and was then converted to the Crested Butte Town Hall.

The Denver & Rio Grande Railroad Depot was also built in 1883 at 716 Elk Avenue. A narrowgauge railroad line had been completed to Crested Butte two years earlier, connecting the community and its coal mine with the rest of Colorado. The combined passenger and freight depot remained in use until 1954, two years after the Big Mine closed.

Denver & Rio Grande Railroad Depot
716 Elk Ave., Built 1883
Credit: Ron Sladek

Two final mining-era buildings that were open to the public played a central role in the community. The Carpenter Gothic-Revival style Union Congregational Church, one of Crested Butte's most impressive examples of 19th-century architecture, was completed in 1882 at 403 Maroon Ave. St. Patrick's Catholic Church was built at 108 Maroon Ave. around 1890. These wood-frame buildings served the spiritual needs of the town's largely immigrant community and were the scene of numerous life-cycle events. St. Patrick's was sold in the early 1960s and became a private residence. The Union Congregational Church remains in use.

Union Congregational Church
403 Maroon Ave., Built 1882
Credit: Ron Sladek

St. Patrick's Catholic Church
108 Maroon Ave., Built circa 1890
Credit: Ron Sladek

Residential Properties that survive from the mining era are numerous and consist primarily of single-family houses. These were located toward the east and west ends of Elk Avenue and among the streets to the north and south. An unknown number of houses were likely demolished during the decades following closure of the Big Mine as they were left unoccupied and unmaintained or removed to make way for new development. Most of the houses were constructed of logs or milled lumber, reflecting the availability of wood (anaffordable resource) from forests in the Crested Butte area and a lack of sources for bricks (a more costly resource than wood). A small number were constructed using locally-quarried or collected stone.

Pioneer Log cabins are scattered throughout the town's residential areas. They were constructed in the town's earliest years of settlement during the 1880s and perhaps 1890s. Their small size and rustic character, with minimal foundations and showing evidence of hand hewing and assembly, identifies them as dating from the 19th century. While some of these buildings have been improved in various ways since they were built, they retain their essential features. Two examples of finer historic log houses in Crested Butte are located at 313 Sopris Ave. and 130 Gothic Ave. Built in the 1880s, they appear sturdier than the log cabins and exhibit characteristics of high-quality residential construction along with better doors, windows and decorative features. One is also built atop a substantial ashlar stone foundation. Another residential property from the mining era is the Colorado Fuel & Iron Company's

405 First St.
Credit: Ron Sladek

112 Second St.
Credit: Ron Sladek

301 Third St.
Credit: Ron Sladek

509 First St.
Credit: Ron Sladek

313 Sopris Ave., Built 1881
Credit: Ron Sladek

130 Gothic Ave., Built 1885
Credit: Ron Sladek

Boarding House and Hotel (now the Elk Mountain Lodge) at 129 Gothic Ave. CF&I owned the Big Mine and consequently had management personnel, consultants and others visiting Crested Butte on a regular basis. This facility provided them with a place to stay while in town. The building was constructed with cinder blocks formed using slag from the mine, and its exterior walls were stuccoed. In addition to the boarding house and hotel, the company arranged to have houses constructed on the same block to serve as residences for employees.

Colorado Fuel & Iron Company, Boarding House and Hotel
129 Gothic Ave., Built 1919
Credit: Ron Sladek

Employee Houses Built by CF&I, Gothic Avenue, circa 1920
Credit: Ron Sladek

Many of the single-family houses in Crested Butte are simple vernacular wood-frame buildings, constructed without an architect or plan to suit the needs of the owners. Others reflect popular styles of the era, including Queen Anne cottages, Foursquares, Gabled Ells, Classic Cottages, and at least one I-House. While some of these buildings have been enlarged and improved over the years, many retain elements of their original characteristics. These include features such as their overall shape and massing, along with siding materials, doors and windows, roof forms, porches, and decorative details. Together they form much of Crested Butte's character along with its architectural heritage.

109 Maroon Ave.
Credit: Ron Sladek

111 Maroon Ave.
Credit: Ron Sladek

210 Second St.
Credit: Ron Sladek

313 Maroon Ave.
Credit: Ron Sladek

329 Maroon Ave.
Credit: Ron Sladek

Vernacular Cottages
Credit: Ron Sladek

House Clad in Stones
207 Maroon Ave.
Credit: Ron Sladek

House Clad in Faux Bricks
210 Maroon Ave.
Credit: Ron Sladek

In addition to the houses, outbuildings dating from the mining era are also scattered across town. Many of these can be seen from the alleyways and others are visible from the streets. They include small barns, horse sheds, automobile garages, a variety of sheds used for other purposes, and at least one surviving outhouse.

Log Shed
Credit: Ron Sladek

Outhouse
Credit: Ron Sladek

Garages Facing First Street
Credit: Ron Sladek

Shed Facing Third Street
Credit: Ron Sladek

Barn at Fifth St. and Teocalli Ave.
Credit: Ron Sladek

The Postwar Years and Early Skiing Era – Following closure of the Big Mine in 1952, Crested Butte entered its years of population decline and quiet isolation. As shown above, the number of people living in the town did not really begin to increase in meaningful numbers until the 1970s, when the ski resort was enlarged and transformed into a major winter sports destination. New arrivals found that the town was filled with mining-era buildings of all sorts, most of which were likely in dire need of maintenance and rehabilitation. Vacant lots were also present, just waiting to be developed. This environment offered opportunities to remove and replace aging buildings, and for a preservation ethic to arise in town that sought to retain important characteristics of the town's past.

Development in the 1950s and 1960s was limited to around two dozen buildings. These included about fifteen residences, among which there was no consistency in style although all but one were constructed of wood. They included an A-Frame, three Rustic Revival or Chalet houses built with milled logs or log siding, a brick Tri-Level Ranch House, a Contemporary style two-story residence, and four Manufactured Homes (one of which was soon clad in extensive wood siding and ornamentation). Several of these residences were later enlarged or extensively remodeled. Other properties included a False-Front Rustic Revival commercial building on Elk Avenue and a two-story wood-frame lodge built in the Ranch Style with minimal chalet ornamentation.

The most interesting example of architecture from this period is the Queen of All Saints Church at 401 Sopris Ave. Built in 1961, it is one of the town's most iconic historic buildings. The A-frame church is characterized by its curved rooflines with deep eaves, and sandstone wall cladding with board and batten siding and tall narrow windows above. The sanctuary interior is a remarkable example of design from that period, employing curved laminated roof beams and rich wood paneling. This is one of Crested Butte's best examples of Mid-Century Modern architecture and is likely to be individually eligible for landmark designation.

Rustic Revival Log Residence
624 Elk Ave., Built 1956
Credit: Ron Sladek

Chalet Style Residence
102 Teocalli Ave., Built 1961
Credit: Ron Sladek

Rustic Revival Log Residence
426 White Rock Ave., Built 1968
Credit: Ron Sladek

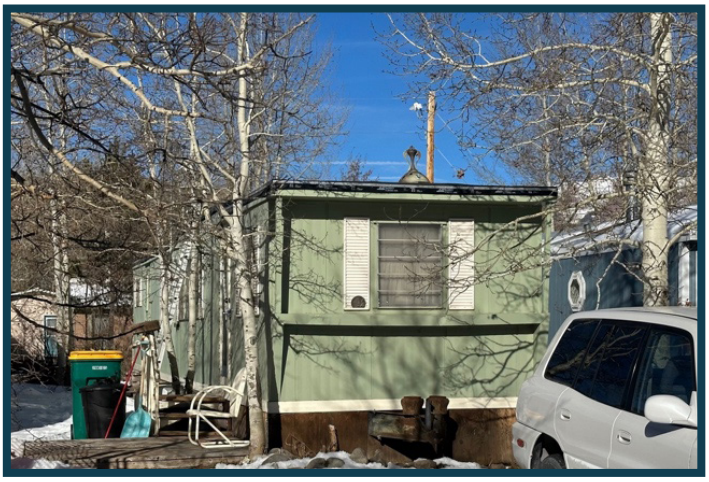
Vernacular Wood-Frame Residence
12 Second St., Built 1965
Credit: Ron Sladek

Contemporary Style Residence
103 Maroon Ave., Built 1963
Credit: Ron Sladek

Tri-Level Ranch Residence
301 Sixth St., Built 1966
Credit: Ron Sladek

Christiana Guesthaus
621 Maroon Ave., Built 1960
Credit: Ron Sladek

False Front Rustic Revival Commercial
429 Elk Ave., Built 1963
Credit: Ron Sladek



Manufactured Home
119 Teocalli Avenue, Built 1963
Credit: Ron Sladek

Manufactured Home
105 Teocalli Ave., Built 1960
Credit: Ron Sladek

A-Frame Residence
113 Sopris Ave., Built 1964
Credit: Ron Sladek

Queen of All Saints Church
401 Sopris Ave., Built 1961
Credit: Ron Sladek

Development in the 1970s included numerous residences and commercial buildings. All of these resulted from the expanding ski resort that supported growth and development in Crested Butte. Constructed primarily of wood, they differed in the details of their architectural designs but can be divided into two primary categories. Some were designed to look like idealized buildings of an earlier period, specifically the mining-era of the late 1800s and early 1900s. Others reflected the predominant architecture of the 1970s as it appeared across Colorado and the United States, but often localized to the relaxed ski resort and outdoor recreation atmosphere of Crested Butte.

Examples of Residential Buildings Designed to Resemble the Styles of an Earlier Era

Although a product of the 1970s, these buildings were intentionally designed to mimic the authentic character and earlier architectural styles of the mining period in Crested Butte. Consequently, they are not reflective of post-World War II architecture. Instead, their designs were shaped by local preferences, nostalgia that emerged around the centennial-bicentennial in 1976, and the emerging building and preservation codes that directed owners toward an idealized sense of the "Victorian Era" in Crested Butte's history. Examples of

Vernacular Residence
330 Sopris Ave., Built 1970
Credit: Ron Sladek

Queen Anne Cottage
10 Teocalli Ave., Built 1972
Credit: Ron Sladek

Half-Timbered Residence and Garage
618 Fourth St., Built 1972
Credit: Ron Sladek

Vernacular Residence
220 Teocalli Ave., Built 1973
Credit: Ron Sladek

Vernacular Residence
132 Whiterock Ave., Built 1973
Credit: Ron Sladek

Colonial Revival Residence
22 Teocalli Ave., Built 1974
Credit: Ron Sladek

Gabled Ell Residence
25 Whiterock Ave., Built 1974
Credit: Ron Sladek

Bungalow Residence
400 Sopris Ave., Built 1974
Credit: Ron Sladek

I-House Residence
112 Whiterock Ave., Built 1974
Credit: Ron Sladek

Vernacular Residence
120 Gothic Ave., Built 1975
Credit: Ron Sladek

Vernacular Residence
29 Gothic Ave., Built 1976
Credit: Ron Sladek

Vernacular Residence
110 Third St., Built 1976
Credit: Ron Sladek

I-House Duplex Residence
708-710 Whiterock Ave., Built 1976
Credit: Ron Sladek

Gabled-Ell Residence
28 Gothic Ave., Built 1977
Credit: Ron Sladek

Queen Anne Residence
18 Tenth St., Built 1977
Credit: Ron Sladek

Foursquare Residence
16 Third St., Built 1978
Credit: Ron Sladek

Queen Anne Residence
15 Third St., Built 1978
Credit: Ron Sladek

Queen Anne Residence
217 Teocalli Ave., Built 1978
Credit: Ron Sladek

Vernacular Residence
123 Maroon Ave., Built 1978
Credit: Ron Sladek

Vernacular Residence
111 Whiterock Ave., Built 1978
Credit: Ron Sladek

Foursquare Residence
227 Teocalli Ave., Built 1979
Credit: Ron Sladek

Vernacular Residence
122 Sopris Ave., Built 1979
Credit: Ron Sladek

Commercial Buildings Designed to Resemble the Style of an Earlier Era

Like the residences shown above, these buildings were a product of the 1970s but were intentionally designed to mimic the authentic character and architectural styles of the mining period in Crested Butte. Consequently, they are not reflective of post-World War II architecture. Instead, their designs were shaped by local preferences along with nostalgia that emerged around the centennial-bicentennial in 1976. They present an idealized sense of the "Victorian Era" in Crested Butte's history.

Commercial Building with False-Front and Victorian Detailing
126 Elk Ave., Built 1972
Credit: Ron Sladek

Commercial False-Front Building with Victorian Detailing
419 Sixth St., Built 1973
Credit: Ron Sladek

Commercial Building with Victorian Detailing
402 Belleview Ave., Built 1974
Credit: Ron Sladek

Firehouse with Victorian Detailing
306 Maroon Ave., Built 1974
Credit: Ron Sladek

Commercial False Front Building
311 Fifth St., Built 1975
Credit: Ron Sladek

Commercial Building with Victorian Detailing
302 Elk Ave., Built 1975
Credit: Ron Sladek

Commercial Building with Victorian Detailing
322 Belleview Ave., Built 1975
Credit: Ron Sladek

Commercial Building with Victorian Detailing
217 Elk Ave., Built 1976
Credit: Ron Sladek

Commercial False-Front Building
with Victorian Detailing
420 Belleview Ave., Built 1978
Credit: Ron Sladek

Commercial Building with Victorian Detailing
111 Elk Ave., Built 1979
Credit: Ron Sladek

The wood-frame commercial building at **601-607 Sixth St.** stands on a prominent lot at the entrance to Crested Butte. It houses a hardware store and offices, with a fueling station out front. The building was constructed in 1970 and expanded in 1978. Architectural features include weatherboard and board-and-batten siding, a front two-story tower with a clipped gabled roof, brackets and dentil banding along the cornice, and a flat roof. It was designed to present a faux Victorian appearance.

Examples of Residential Buildings that Clearly Reflect the Architecture of the 1970s

Distinct from the residences in Crested Butte that were designed to appear like buildings of an earlier era, the following houses exhibit strong elements of Contemporary Style architecture from the 1970s, the period in which they were built. Most are wood-frame, others are constructed of logs, and a few retain features of Rustic Revival or Chalet detailing. Common features include vertical board-and-batten siding, multiple window types and shapes, decks and balconies, and a combination of gabled, saltbox and shed roofs with varying slopes. All were likely constructed with modern building systems such as central heating and plumbing, features that were not always present in historic buildings of earlier eras.

2 Maroon Ave. - This wood-frame Contemporary Style house was built in 1970. Its architectural features include board-and-batten siding, sliding windows, and a two-level shed roof. Built on a slope, the garages are tucked under the building.

706 Gothic Ave. - This two-story wood-frame Contemporary Style apartment building was built in 1970. Its architectural features include board-and-batten siding, a two-story balcony on one side that is supported by posts with brackets, doors with cross-bracing and diamond lights, sets of fixed windows flanked by what appear to be casement windows, and a medium-sloped gabled roof.

711 Elk Ave. – This Contemporary Style wood-frame house was built in 1971. Architectural features include its board-and-batten siding, variety of window types, a balcony with an open rail, and a medium-sloped gabled roof.

1 Maroon Ave. – This Contemporary Style wood-frame house was built in 1972. Its architectural features include board-and-batten siding, fixed and possibly casement windows, a steeply-pitched saltbox roof with a boxed chimney, and a projecting entry vestibule with a matching saltbox roof.

30 Teocalli Ave. – This Contemporary Style combination log and wood-frame house was built in 1972. Rather than being hewn, it appears that the logs on the lower floor were milled. The upper walls are finished with board-and-batten siding. Windows are fixed or multi-light, some trapezoidal in shape. The roof consists of intersecting gables.

220 Whiterock Ave. – This Contemporary Style wood-frame house was built in 1972. Its architectural features include board-and-batten wall cladding with horizontal boards on the second story, a front entry deck, fixed windows with side lights, a boxed chimney, and a side-gabled saltbox roof.

430 Maroon Ave. – This Contemporary Style wood-frame house was built in 1972. Its architectural features include vertical exterior wall paneling, pairs and bands of large fixed or casement windows on the façade, a side-gabled roof, and two boxed chimneys.

117 Seventh St. – This Contemporary Style apartment building was built in 1973. Its architectural features include its three-story height with cantilevered upper floors, stuccoed exterior walls, bands of windows along with tall narrow windows, balconies, and broken gabled roof forms with varying slopes.

2 Teocalli Ave. – This Contemporary Style residence was built in 1973. Although its basic form may look like a throwback to an earlier era, the house features large fixed picture windows and a glass door with sidelights on the main floor along with rectangular and triangular windows in the gable end wall. These features distinguish it from historic buildings of prior years.

120 Teocalli Ave. – This Contemporary Style log residence was built in 1973. A raised foundation encloses a basement and supports the rustic milled log structure above. Board-and-batten siding was employed in the gable end walls. Also present on the building are a deck, stuccoed exterior wall chimney, shed dormer, and a variety of windows that include rectangular and triangular shapes in the gable end wall.

14 Gothic Ave. – This Contemporary Style log residence was built in 1973. Although it exhibits features of an older style, it appears to be a wood-frame building whose exterior walls are clad in log siding. Architectural elements include its tall height, open porch and a deck, a steeply-pitched roof, and multiple windows in the front gable end wall.

15 Whiterock Ave. – This Contemporary Style log residence was built in 1973. Its architectural features include log construction along with board-and-batten siding in the gable end walls. It also has steeply-pitched roof slopes with eave extensions, gabled dormers, a combination of window types, and corrugated metal panels on the roof.

418 Whiterock Ave. – This Contemporary Style Chalet residence was built in 1973. Its architectural features include board-and-batten siding, balconies on both levels, a front door with diamond patterns in the lower panel and upper lights, and a steeply-pitched roof.

118 Sopris Ave. – This simple Contemporary Style residence was built in 1974. Its architectural features include wide clapboard siding, fixed windows, and a steeply-pitched gabled roof with a taller intersecting shed roof.

211 Gothic Ave. – This Contemporary Style residence was built in 1974. Its architectural features include its two-story height, extensive use of board-and-batten siding, and saltbox roof with a boxed chimney and eave extension. Many of the tall rectangular windows are fixed and some have diagonal tops.

421 Whiterock Ave. – This Contemporary Style residence was built in 1974. Its architectural features include its tall three-story height, open decks, large brick exterior wall chimney, long flights of stairs, board-and-batten siding, and saltbox roof.

28 Whiterock Ave. – This Contemporary Style residential duplex was built in 1974. Its architectural features include vertical wood siding (possibly board-and-batten), variety of windows types and sizes, extensive stairs and decks, and multiple roof levels clad in standing seam metal panels.

32 Whiterock Ave. – This Contemporary Style residence was built in 1974. Its architectural features include vertical siding, open stairs and decks, a variety of window types and sizes, and a combination gabled and shed roof.

20 Teocalli Ave. – This Contemporary Style residence was built in 1975. Although it hints at a style of an earlier era, the building is modern with its board-and-batten siding, two-over-one double-hung sash windows, cutaway corner porch, and steeply-sloped roof with a shed dormer. This is a good example of a building that is contemporary but reflects the town's historic environment.

24 Teocalli Ave. – This Contemporary Style rustic log residence was built in 1975. Its architectural features include its construction using what appear to be milled logs that extend beyond the corners, a projecting entry vestibule, double-hung windows, a wood-frame extension on one side of the building, and a steeply-pitched roof with a wall dormer.

10 Gothic Ave. – This Contemporary Style log residence was built in 1975. Its architectural features include its construction using what appear to be milled logs whose ends extend beyond the corners, wood-frame extensions to the sides and above, a squared bay window, multi-light windows, and roof areas at different levels.

125 Whiterock Ave. – This simple Contemporary Style residence was built in 1975. Its architectural features include clapboard siding, a variety of window types and sizes, and gabled roofs at two levels.

202 Third St. – This Contemporary Style residence was built in 1976 but might have been remodeled in more recent years. Its architectural features include clapboard siding on the main floor with board-and-batten siding above, a variety of multi-light windows, a centered main entrance with a gabled hood above, a garage door, and a gabled roof with brackets at the eaves.

318 Gothic Ave. – This Contemporary Style log residence was built in 1976. Its architectural features include its two-story construction with what appear to be milled logs that extend beyond the corners, along with double-hung windows, board-and-batten siding and tall fixed windows in the gable end wall, a log projection at one end and a balcony at the other, and a steeply-pitched gabled roof.

207 Third St. – This Contemporary Style residence was built in 1976. Its architectural features include board-and-batten siding, double-hung windows, second-floor decks with open rails, and a steeply-pitched gabled roof with a long shed dormer just below the peak.

122 Teocalli Ave. – This Contemporary Style log residence was built in 1977. Its architectural features include its construction with what appear to be peeled logs that extend beyond the corners, its unusual three-sided front wall that extends to a height of 2½ stories, a variety of window types and sizes, the open cutaway front porch, and its steeply-pitched roof with shed dormers.

17 Maroon Ave. – This Contemporary Style residence was reportedly completed in 1977. Its architectural features include what appears to be wood-frame construction with a combination of log and board-and-batten siding, a variety of window sizes and types, large fixed windows with diagonal tops in the gable end wall, open decks, and a steeply-pitched roof with a large shed dormer and gabled ventilator along the ridgeline.

420 Sopris Ave. – This Contemporary Style residence was built in 1977. It appears to be of either log or wood-frame construction. Its architectural features include a front entry deck, windows of various sizes along with exterior wood shutters, and a low-pitched roof.

705 Belleview Ave. – This Contemporary Style residence was built in 1977. Its architectural features include horizontal weatherboard siding, multiple pairs of double-hung windows, a cantilevered upper floor supported by posts with knee braces, and a roof consisting of intersecting gables.

27 Teocalli Ave. – This Contemporary Style log residence was built in 1978. Its architectural features include milled log construction with the ends projecting beyond the corners, bands of large fixed windows, and a saltbox roof with intersecting gables.

104 Maroon Ave. – This simple Contemporary Style residence was built in 1978. Its architectural details include board-and-batten siding, a deck with a small balcony above, a variety of multi-light windows, and a front-gabled roof.

415 Fifth St. – This Contemporary Style log residence was built in 1978. Its architectural features include peeled log construction on the main floor with wood-frame construction above, vertical siding on the upper walls (possibly board-and-batten), singles and pairs of double-hung sash windows, a small hood above the main entry, and a side-gabled roof.

218 Sopris Ave. – This simple Contemporary Style residence along the alley was built in 1978. Its architectural details include vertical wood siding, a combination of fixed and two-light windows, a deck and balcony, board-and-batten siding in the gable end walls, and a medium-pitched gabled roof.

214 Sixth St. – This Contemporary Style 2½-story office building was built in 1978. Its architectural details include horizontal siding, a variety of windows sizes and types (including fixed picture windows, narrow casements, and central fixed windows with flanking casements), a covered walkway, gabled and pyramidal roof forms, and shed dormers.

1 Teocalli Ave. – This Contemporary Style rustic residence was built in 1979. Its architectural features include vertical natural wood siding, an open porch supported by log posts, an x-braced vertical board garage door with a corrugated hood above, saltbox roofs at three levels, and a boxed chimney. These features give the building the appearance of a mining structure.

13 Teocalli Ave. – This Contemporary Style log residence was built in 1979. Its architectural features include squared logs with white chinking on the main floor with wood-frame construction above and to one side, a front bay window, a gabled hood over the main entrance, double-hung windows, and a steeply-pitched roof consisting of intersecting gables.

31 Gothic Ave. – This Contemporary Style Chalet log residence was built in 1979. Its architectural features include its construction with logs on the lower half with wood-frame construction above and to the front. The front projection is lined with a band of six fixed rectangular windows, with a variety of windows and doors appearing on the rest of the building. The upper area of the house features Chalet detailing, including a centered balcony with a wood rail, and gable fascia and a bargeboard above that are decorated with floral patterns.

214 First St. – This Contemporary Style Bi-Level Ranch residence was built in 1979. Its architectural features include horizontal wood siding, three-part windows consisting of a central fixed light with flanking casements or sliders, and two levels of gabled roof areas.

Surveys and Contexts

In 1998 Crested Butte hired Front Range Research Associates, Inc. to prepare a Historic Buildings Survey and again in 2000 to continue this survey work. Initial work on this project revealed that 31 buildings had previously been recorded at the Colorado Historical Society Office of Archaeology and Historic Preservation. Because of outdated versions of forms that didn't include relevant information compared to the then-modern forms, new Historic Building Inventory Record forms were prepared for 29 of these from 1998-1999. The survey area for this intensive level survey covered approximately 59.3 acres of urban land and documented 187 primary and 185 secondary buildings.

The contents of the 1998-1999 survey document include: Purpose, Survey Area, Methodology, Research Design, Historic Context, and Results and Recommendations. Recommendations range from suggested nomination of eligible individual buildings from outside of the National Register District to the National Register or for the State Register and/or local landmark designation, to additional/further survey work and documentation, revisions to the nomination for the National Historic District to include more history, detail, and updated photographs. The recommendations also include continuation of education to promote understanding and appreciation of the built environment among residents of all ages, and to encourage research of historic properties, and promulgate the importance of historic preservation and protecting the Town's legacy. The recommendations encourage additional documentation of the Town's history, from individuals' oral histories, to photos, videotapes, newspapers, or other documents. The surveyors suggest reaching out to partners in documentation including the successor to CF&I (Rocky Mountain Steel Mills) to seek records of Crested Butte's history from company archives.

The 2000 Historic Buildings Survey, completed by the same company, explained that the Certified Local Government program of the Colorado Historical Society awarded Crested Butte a grant to complete the survey of historic resources in town and prepare National Register of Historic Places individual and district nominations. The 2000 survey recorded an additional 38 primary and 9 secondary buildings. The survey area was approximately 7.1 acres of urban land. The document contents included an Introduction and Purpose, Survey Area, Methodology, Additional Historical Background, and Results and Recommendations.

Recommendations from this survey included researching building history at a deeper level, oral history interview with Crested Butte's aging long-time residents to understand building histories, occupant history, construction or alterations, etc. Again, there was an emphasis on collecting and documenting historic photographs, documents, artifacts to the Crested Butte Museum. A suggestion to foster additional on-going public engagement with historic preservation as the focus included ideas like walking tours, publications, celebrations of Historic Preservation Week, and other activities.

The survey work from 1998-2000 found that many of the mining-era properties had undergone extensive modification, alterations, and enlargements during the "ski resort era", classified in the 2024 Historic Preservation Plan as part of the "recreation-era" which has been later defined as from the 1970s to the present. Vernacular wood frame construction was common among the surveyed buildings. Some of the styles, a wide variety, recorded throughout these surveys included False Front Commercial, False Front with 19th Century details, Queen Anne styles, Bungalow, Classic Cottage, Gothic Revival, Industrial, Log, Mission Revival styles.

Landmarks and Districts

Crested Butte has been successful with respect to Historic Districting and has created stringent ordinances protecting historic buildings on Elk Avenue and other historic resources in town. Elk Avenue is the instantly recognizable and treasured center of business and vibrant activities like the Sunday Farmer's Market, Arts Festivals, shopping, and dining. Live music, galleries, cafés, and lodging all exist on this colorful strip of Town and many of the town's public activities are centered around Elk Avenue. As part of this planning process, most outreach events were held on Elk Avenue; at Kochevar's Saloon, The Eldo Brewery, and The Crested Butte Museum. SEE ALSO Appendix Section: Community Outreach Memorandum.

The entire town is part of the local district which provides protection from incompatible development, substantial changes, or demolition before review from BOZAR, and is subject to the Design Standards and Guidelines (DS&G). The DS&G covers new construction, modifications to historic buildings, and provides additional guidance for various zone districts in the community.SEE ALSO: CHAPTER 5 Design Standards and Guidelines for the Neighborhoods of Crested Butte

Secretary of the Interior Standards

The Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR Part 68, 1995) consists of four treatment standards—Preservation, Rehabilitation, Restoration, and Reconstruction. Following Secretary of the Interior (SOI) standards closely is considered industry best practice. Each community is different, faces unique challenges, and emphasizes various community values, which means that best practices cannot be applied broadly. These standards can be assessed and contemplated for Crested Butte and refined to conform to community needs and values.

The Secretary of the Interior's Standards for Rehabilitation include the following:

1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.

2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.

6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired. (Morton, 1992)

According to the Secretary of the Interior Standards for Rehabilitation, replacement should be the last option considered for a character-defining feature in a historic structure. In practice, it is not always realistic to expect that all historic resources in a community remain protected and follow these standards stringently. It

is more realistic to expect and plan for individual property owners to make sure their property is meeting their personal needs and interests. Assessing resources, prioritizing, and regulating where necessary are sensible approaches for Crested Butte. Creating unrealistic or unreasonable mandates is not appropriate in many cases, but arguments could be made to strictly preserve the most significant community resources.

A number of resources from the US Department of the Interior National Parks Service have been made publicly available online. Standards Bulletins, Preservation Tech Notes, and Briefs cover a myriad of preservation topics and answer important questions:

- Standards Bulletins. These Bulletins explain rehabilitation project decisions made by the National Park Service in its administration of the Historic Preservation Tax Incentives program. Each bulletin references the relevant standards. The bulletins are case-specific and are provided as information only; they are not necessarily applicable beyond the unique facts and circumstances of each case. Interpreting the Standards Bulletins - Technical Preservation Services (U.S. National Park Service; nps.gov)

- Preservation Tech Notes are case studies in historic preservation. They provide practical information on traditional practices and innovative techniques for successfully maintaining and preserving cultural resources. Preservation Tech Notes - Technical Preservation Services (U.S. National Park Service; nps.gov)

- Preservation Briefs provide information on preserving, rehabilitating, and restoring historic buildings. These NPS Publications help historic building owners recognize and resolve common problems prior to work. The briefs are especially useful to Historic Preservation Tax Incentives Program applicants because they recommend methods and approaches for rehabilitating historic buildings that are consistent with their historic character. Preservation Briefs - Technical Preservation Services (U.S. National Park Service; nps.gov)

Some of the educational resources noted above were used as sources to create this section regarding best practices. There are additional considerations to “best practices” in respect to environmental, educational, economic, or cultural perspectives that may differ from historic preservation best practices. As consultants for the Historic Preservation Plan, we narrowed our focus to summarize best practices in Historic Preservation, but recommend for Crested Butte to use critical thinking skills when attempting to implement any of these best practices and to consider a wider view that is inclusive, thoughtful, innovative, and includes foresight.

16 PRESERVATION BRIEFS

The Use of Substitute Materials on Historic Building Exteriors

John Sandor, David Trayte, and Amy Elizabeth Uebel

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

The *Secretary of the Interior's Standards for Rehabilitation* generally require that deteriorated distinctive architectural features of a historic property be repaired rather than replaced. Standard 6 of the *Standards for Rehabilitation* further states that when replacement of a distinctive feature is necessary, the new feature must "match the old in composition, design, color, texture, and other visual properties, and, *where possible*, materials" (emphasis added). While the use of matching materials to replace historic ones is always preferred under the *Standards for Rehabilitation*, the Standards also purposely recognize that flexibility may sometimes be needed when it comes to new and replacement materials as part of a historic rehabilitation project. Substitute materials that closely match the visual and physical properties of historic materials can be successfully used on many rehabilitation projects in ways that are consistent with the Standards.

The flexibility inherent in the *Standards for Rehabilitation* must always be balanced with the preservation of the historic character and the historic integrity of a building, of which historic materials are an important aspect. Any replacement work reduces the historic integrity of a building to some degree, which can undermine the historic character of the property over time. With limited exceptions, replacement should only be considered when damage or deterioration is too severe to make repair feasible. When needed replacement is made with a material that matches the historic material, the impact on integrity can be minimal, especially when only a small amount of new material is needed. When a substitute material is used for the replacement, the loss in integrity can sometimes, although not always, be greater than that of a matching material. Also, whether historic or substitute material, there is a point where the amount of replacement can become excessive and the building's historic integrity is diminished to an unacceptable degree, regardless of the material used—that is, a loss of authenticity and the physical features and characteristics closely associated with the property's historic significance.

The term *substitute materials* is used to describe building materials that have the potential to match the appearance, physical properties, and related attributes of historic materials well enough to make them alternatives for use in current preservation practice when historic materials require replacement.

Compelling reasons to use a substitute material instead of the historic material include the unavailability or poor performance of the historic material, or environmental pressures or code-driven requirements that necessitate a change in material. When using a substitute material for replacement it is critical that it match the historic material in all of its visual and physical properties to preserve the historic character of the building and minimize the impact on its integrity.

Substitute materials can be cost-effective, permit the accurate visual duplication of historic materials, and provide improved durability. While the behavior of traditional, historic materials is generally well understood, the behavior of newer materials can be less established and sometimes less predictable. Substitute materials are most successful when the properties of both the original material and the substitute are thoroughly understood by all those involved in the design and construction process. The architect must be adept at the selection of substitute materials and their incorporation into architectural plans and specifications. The contractor or tradesperson in the field must also be experienced with their use.

This Preservation Brief provides general guidance on the use of substitute materials as replacement materials for distinctive features on the exterior of historic buildings. Due to the ever-evolving product market for construction materials, this Brief does not provide specifications for substitute materials. This guidance should be used in conjunction with qualified professionals who are knowledgeable in current construction and historic preservation practices.

This Brief includes a discussion of the appropriate use of substitute materials and provides a path for decision-making in their use. In considering the use of substitute materials, such issues as the deterioration or failure of the historic building component and material must be understood. The existing component's physical and visual properties, profile, surface texture, dimensions, and performance should be identified to establish the basis for evaluating a possible replacement material. The physical and visual properties of the various substitute materials available should also be assessed and compared to the original material for their physical and visual compatibility. Lastly, the suitability of a given substitute replacement material should be determined based on how well the material matches both the physical and visual properties of the existing material as well as any specific performance or application needs. The Brief's descriptions of common substitute materials are not meant to be comprehensive, and, as the performance history of newer materials continues to grow and new materials are developed, available options will change, and our understanding of current material performance will continue to evolve.

Historical Use of Substitute Materials

The tradition of using affordable and common materials in imitation of more expensive and less available materials is a long one. At Mount Vernon, for example, George Washington used wood painted with sand-impregnated paint to imitate rusticated stone. This technique, along with scoring stucco into block patterns, was common in Colonial America to imitate stone.

Nineteenth-century technology made a variety of materials readily available and widely used that were not only able to imitate traditional materials but were also cheaper to fabricate and easier to use. Traditionally, carved stone units were individually worked. Molded or cast materials greatly increased efficiency in creating repetitive elements. Cement-based products such as cast stone could provide convincing imitations of natural stone with carefully chosen aggregates and cements and was typically a commercially manufactured product. It could be tooled like natural stone, though that could reduce much of the cost advantage. These carefully-crafted cementitious products were widely used as trim elements for masonry structures or as the face material for an entire building. At the other end of the spectrum, mail-order catalogs provided a wide variety of forms for molding concrete that were merely evocative of natural stone and did little to match its appearance. Concrete masonry units could be fabricated locally and on site, avoiding expensive quarrying and shipping costs.

Offering similar efficiencies as cast stone for reproducing repetitive and even complex decorative shapes, terra cotta could mimic the surface characteristics of stone with various textures and glazes. It was popular in the late nineteenth and early twentieth centuries for details on stone or brick buildings as well as for the entire skin of large and elaborately detailed buildings.

Cast iron was also used to imitate stone, often with very decorative profiles, for a variety of architectural features ranging from window hoods to columns, piers, balustrades, and even whole façades. Cast iron offered its own set of efficiencies including cost, fabrication time, and weight, but required a painted finish.

While cast stone, terra cotta, and cast iron offered efficiencies over quarried and, particularly, carved stone, they were not cheap or impermanent materials. Less costly, but also less durable, stamped or brake-formed sheet metal, typically galvanized, could also be used instead of masonry for cornices, window hoods, roofing tiles, and even entire building façades.

Substitute Materials and Applying the Standards for Rehabilitation

The *Standards for Rehabilitation* are focused on preserving the important and distinctive character-defining features of a historic property (Standards 2 and 6), and they are to be applied in a reasonable manner, taking into account economic and technical feasibility (36 CFR 67.7 and 36 CFR 68). The Standards have an inherent flexibility that facilitates their application to diverse projects, historic properties, and conditions. They are to be applied on a "cumulative-effect" basis, when the overall effect of all work in the context of the specific conditions of the property and the project is consistent with the property's historic character.

The *Standards for Rehabilitation* require that the replacement of a distinctive feature match the old in physical and visual properties. While the use of matching materials is always preferred, the Standards purposely allow for the use of substitute materials when the use of original materials is not reasonably possible, such as in consideration of economic and technical feasibility or in new construction. They also provide additional flexibility in the treatment of secondary, less distinctive features that are less important in defining the historic character of the property. The *Standards for Rehabilitation* recognize that flexibility is appropriate to facilitate "a compatible use for a property … while preserving those portions or features which convey its historical, cultural, or architectural values" (definition of "Rehabilitation," 36 CFR 67.2(b)).

Examples of Historical Use of Substitute Materials

Figure 2a. Casting concrete blocks to mimic quarried stone was a popular late 19th- to mid 20th-century technique. Concrete masonry units could be completed by local craftsman, saving time and shipping costs. Photo: John Sandor, NPS.

Figure 2b: The 19th century also produced a variety of metal products used to imitate other materials. Across the country, cast iron was used in storefronts to imitate stone. Photo: John Sandor, NPS.

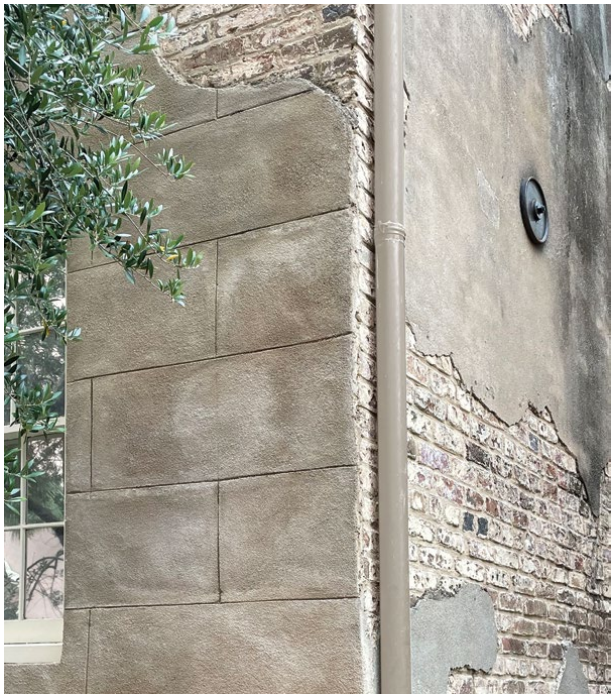


Figure 2c: Stucco has been used to imitate a number of building materials for many centuries. Seen here, stucco was applied to a brick structure and scored to represent a stone façade. Photo: John Sandor, NPS.

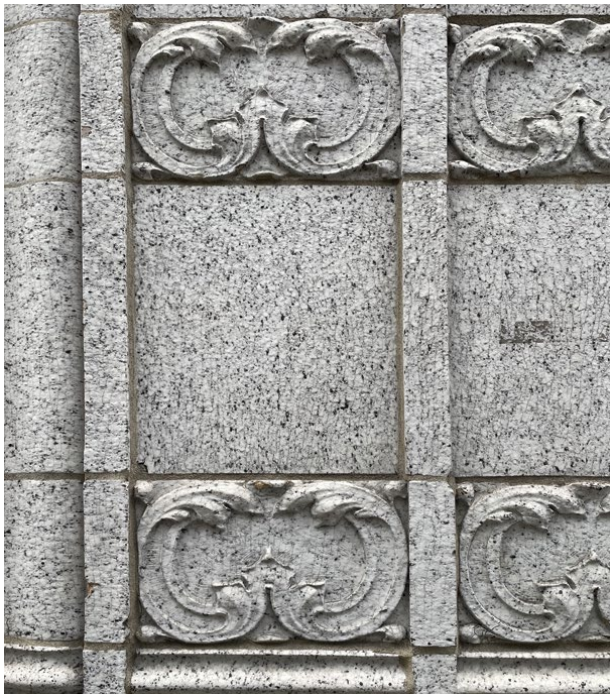


Figure 2d: Terra cotta gained popularity in the late 19th century as a cheap and lightweight alternative to stone. Glazing techniques allowed the blocks to imitate a variety of natural stone materials. Photo: John Sandor, NPS.

These examples of one material used to imitate another, more often in initial construction than for later repair and replacement purposes, are referred to as *imitative materials* in the *Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings*, updated in 2017, that accompany the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. These imitative materials, while evoking other materials, usually had distinctive qualities of their own and were not always a very close match in appearance to the historic material they were meant to imitate.

Many of the traditional materials discussed above are still available and used to replace damaged or missing original features, both to replace matching historic materials and sometimes as substitute materials. Because of their extensive use over time and their known physical and chemical properties, cast stone, cast iron, and terra cotta are well understood substitute materials. This continued usage and familiarity means their installation requirements and service life are well established, which in turn makes it easier to determine when and how to use these traditional materials as substitutes for a deteriorated material. However, innovation in replacement materials continues, and new products (many of them consisting of synthetic materials) are continually introduced. These non-traditional products are an increasing part of both the new construction and rehabilitation industries. Some materials, like glass fiber reinforced polymers, glass fiber reinforced concrete, or fiber cement, have been in use long enough for an accurate prediction of their service life and performance. Other newer, non-traditional materials may be too new to have established performance records, thus, understanding their material properties is critical, and their use should be approached with more caution.

When to Consider Using Substitute Materials in Preservation Projects

According to the *Standards for Rehabilitation*, deterioration should generally be addressed through repair if in repairable condition. Repair can entail a variety of treatments that retain the unit of building material and remove and patch or replace only the damaged portion. This approach can be done with traditional methods and materials such as a dutchman, where like-kind material is precisely inserted into wood or stone, or it may employ other materials such as epoxies for wood repair or cementitious compounds for masonry. As long as the repair methods are sound and do not damage or accelerate the deterioration of the historic material, repairs are generally preferable to replacement of an entire element. More complex manufactured products, typical of more recent historic materials (as well as a lot of modern building materials generally), may be more difficult to repair, if they can be repaired at all.

There are situations, however, when the level of deterioration makes localized repairs infeasible and entire features or units of historic material must be replaced. While achieving an effective match of all of the visual qualities of a material can be challenging, even when replacement is in kind, it can be even more challenging when the replacement is a substitute material. A good visual match is not the only consideration when a substitute material is to be used for incremental replacement within a larger assembly of historic material. When an individual siding board or a single block of ashlar is being replaced, it is usually best achieved with the original material. Introduction of a different material into an intact assembly requires that its inherent properties, such as expansion and contraction, moisture resistance, or permeability, be thoroughly considered relative to those of the surrounding historic materials to avoid causing damage.

Figure 3: Incremental repair is best done using in-kind material to minimize differences in the performance characteristics that could negatively affect the overall assembly. Photo: NPS.

Figure 4. While occasionally used to imitate other materials such as wood or slate shingle, many asbestos shingles and siding materials had their own distinct shape and profile. No longer manufactured today, alternative materials must be found to replace these materials when they are distinctive features on a historic structure. Drawing: Association for Preservation Technology, Building Technology Heritage Library.

Figure 5. (Left) Asbestos shingles were often used as a substitute for traditional slate roof shingles. The historic asbestos roof on this rehabilitation project had reached the end of its lifespan and required complete replacement. (Right) Given the limited replacement materials available to match the historic asbestos shingles, utilizing natural slate was determined to be the best visual match for the original shingles and design intent in this instance. Photos: Crosskey Architects.

Circumstances in which the use of substitute materials may generally be considered appropriate, taking into consideration technical and economic feasibility reasons, include: the unavailability of historic materials; the unavailability of skilled artisans or historic craft techniques; inadequate durability of the original materials; the replacement of a secondary feature; construction of a new addition; the reconstruction of a missing feature; code-required performance; and for enhanced resilience and sustainability:

- **Unavailability of historic material.** A common reason for using substitute materials is the difficulty in finding a good match using the historic material (particularly a problem for masonry materials where the color and texture are derived from the material itself). This may be due to the actual unavailability of the material or to protracted delivery dates, particularly if the material cannot be sourced domestically. It is not uncommon for a local quarry that is no longer in operation to have been the source of an original stone. If another quarry cannot supply a satisfactory match, a substitute material such as dry-tamp cast stone or textured precast concrete may be an appropriate alternative, if care is taken to ensure that the detail, color, and texture of the original stone are matched. Even when the color is successfully matched, the appearance of a cementitious product may diverge from that of the historic stone as the substitute material ages.

  Many manufactured materials that were used historically on buildings are no longer made. Terne-plated steel, which was the material most typically used for painted standing-seam or flat-seam roofing, is no longer made. However, because it was always painted, other metals including galvanized steel or copper can generally be substituted if painted. When the historic material needing to be replaced is a manufactured product developed as an imitation of a natural material, which was the case with asbestos shingles meant to imitate slate, the natural material may now be an appropriate substitute material to consider for the manufactured one that is no longer produced.

- **Unavailability of skilled artisans or historic craft techniques**. These two issues can complicate any preservation or rehabilitation project. This is particularly true for intricate ornamental work, such as carved wood, carved stone, wrought iron, or cast iron. While skilled craftsmen may not be as difficult to find as they once were, there can still be limitations geographically, even in finding less specialized skills, and particularly if a project is small. Technical advances have allowed some stone or wood carvers to take advantage of computerized equipment, but complex designs will likely still require hand work. It may also be possible to mimic a carved element using a material that can be cast in a mold, adding significant efficiency where an historic element survives from which a mold can be made. Options for casting include aluminum, cast stone, fiberglass, glass fiber reinforced concretes, and terra cotta, but not all carved elements can be duplicated by a casting, and mold-making and casting still require skilled craftsmen.

- **Inadequate durability of the original material.** Some historic building materials were of inherently poor quality or were not durable. In other cases, one material was naturally incompatible with other materials on the building, causing staining or galvanic corrosion. Examples of poor-quality materials are very soft sandstones, which eroded quickly, and brownstone, which is vulnerable to delamination. In some cases, more durable natural stones may be visually similar enough to stand in for these soft stones but cast stone or another material may be needed to achieve an appropriate match.

The ready availability of manufactured ornamental wood features fed a nineteenth-century taste for decorative architectural details that were often used on the exterior of buildings with little concern for how they would be affected by moisture or maintained. Even old-growth wood from decay-resistant species often could not prevent features with severe exposure from eventually needing to be replaced. Today's available commercial supplies of lumber no longer provide the denser, more decay-resistant wood of old-growth forests, so even careful matching to species, which is not always possible, will not yield a replacement equal in performance to the historic material. Old-growth wood is likely to be very expensive, if it can be found, and may not be available from a sustainable, environmentally responsible source. When features with severe exposure need to be replaced or reproduced, substitute materials that are less susceptible to decay can have a longer life, and when the feature is painted, as exterior wood features generally are, the visual effect of a substitute material can be minimal.

- **Replacement of a secondary feature.** When it is necessary to replace a less distinctive, secondary feature that is less important in defining the historic character of the property, there is more flexibility in how it can be replaced. While it may be less important to find an exact match in materials when replacing such a feature, the retention of the overall historic character should still guide selection of an appropriate replacement material. For example, replacing secondary features such as those with limited visibility (e.g., siding materials on a rear elevation) may permit replacement materials that are similar in appearance or character without having to be a perfect match.

Figure 6. The dramatic difference in the number of growth rings between old-growth wood and wood that was recently harvested from second- or third-growth forests is indicative of the diminished dimensional stability and durability of most lumber currently available. Photo: Zachary Dettmore.

- **Construction of a new addition.** The *Standards* require that new additions to historic buildings and related new construction be differentiated from the old as well as be compatible with the historic character of the property and its site and environment. Using materials that evoke, without matching, the historic material can be an effective means of achieving the needed balance between compatibility and

Figure 7. A new addition replaced non-historic construction on the rear elevation of this building. Fiber cement gives the addition a compatible appearance without replicating the exposure for thickness of the historic siding. Photo: Ward Architecture + Preservation.

differentiation for new additions and new construction. Even if differentiation is achieved through design rather than materials, there generally is no basis for requiring the use of matching historic materials for new additions and new construction as part of a rehabilitation project.

- **Reconstruction of a missing feature.** Many buildings lose significant features over the course of their lives for reasons such as those previously discussed. When a missing feature is to be reconstructed, the importance of matching the original material may be less important to the effect replacing the missing feature may have on the overall historic character and appearance of the building. Though replacement of missing features must be substantiated by documentary, physical, or pictorial evidence, in many cases the authenticity of the material may be secondary to the overall visual qualities. The use of a more cost-effective substitute material for the construction of a missing feature can often be an important factor in the feasibility of undertaking such work.

- **Code-required performance.** Modern building codes are regularly amended to require higher performance levels for new and existing buildings in such areas as life safety, seismic retrofits, and accessibility. Rehabilitation projects often trigger compliance with code requirements that were not in place when a building was constructed. Although building codes may often allow for the retention of historic materials and assemblies, substitute materials can offer an alternative in situations when the historic materials are non-compliant and cannot otherwise be reasonably retained. In these instances, a change in material may be appropriate to meet code requirements, while in other instances selecting the optimal code compliance method for the project may achieve code-compliant solutions that also allow for the preservation of a building's historic materials and finishes.

  For example, fire codes may require increased resistance to flame spread for buildings within dense urban environments where building proximity and separation between buildings is a concern. Some substitute materials are non-combustible, have good ratings for flame spread, and can provide an alternative to help meet

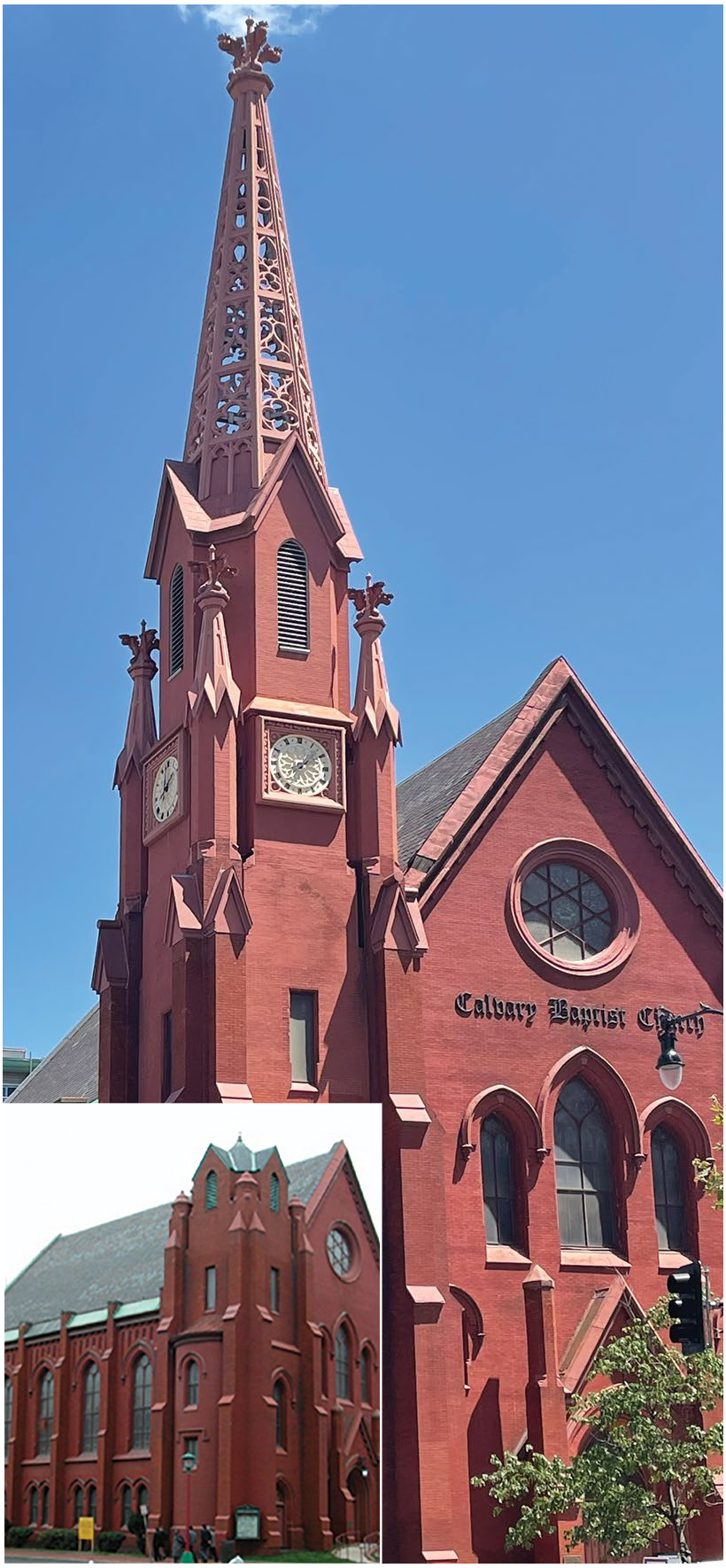


Figure 8. A long-missing cast-iron steeple was reconstructed in aluminum and fiber-reinforced polymer (FRP). Photo: John Sandor, NPS, Inset: Quinn Evans.

fire code requirements. Depending on the building component and the material, however, a substitute material may not resist fire any better than the historic material. In addressing code issues, all feasible alternatives should be considered to minimize the impact on the historic character of the building while still meeting code requirements.

With specific provisions in building code related to issues such as seismic hazards, the choice of materials for features inherently unstable in a seismic event can be a key part of a code-compliant retrofit solution. Elements at risk of falling such as parapets, finials, and overhanging cornices may be made safe by anchoring them to new structural frames. However, for some heavy masonry features, especially where there is deterioration or the feature is difficult to effectively brace, adequately anchoring the existing feature may not prove feasible. In such cases removing and replacing these features with lighter-weight replicas that incorporate a resilient structural framework can help preserve the historic character of the building while improving life safety performance.

- **Enhanced resilience and sustainability.** Wildfires, earthquakes, floods, hurricanes, and other extreme weather events put historic buildings and their occupants at risk and may require adaptive treatments that are more invasive than might be accepted in other circumstances, including related to the use of substitute materials. In these contexts, it is still necessary to try to minimize impacts on a building's historic character as much as possible while still adapting it to be more resilient. Widespread wildfires, for example, have increased demand for fire resistant materials for the exterior building envelope. Flood events may necessitate the replacement of historic materials that have been damaged or inundated with hazardous substances in contaminated floodwaters. When undertaking repairs in such circumstances, substitute materials may offer greater resilience to anticipated future exposure to natural hazard risks.

  Similarly, efforts to improve energy efficiency and performance may include the use of substitute materials as replacement components when modifications to building assemblies are required and the historic materials cannot be preserved. When evaluating substitute materials in the context of sustainability objectives, factors such as the environmental impact of production, the full life cycle of products, and the embodied carbon of the materials already in place should be carefully analyzed. There may be more sustainable choices for a replacement material, including the use of more traditional materials in place of manufactured products that may consist of non-renewable resources or hazardous materials. While some synthetic substitute materials are made from recycled materials or are otherwise sustainably produced, many are not repairable, salvageable, or recyclable themselves, and they may have shorter lifespans to their historic material counterparts. When either greater resilience or sustainability is a factor, all feasible alternatives should be considered in finding a balanced approach that maintains historic character while meeting resilience and sustainability goals.

Substitute Materials and Economic Feasibility

Economic feasibility is inevitably a concern when choosing a material for any part of a project, whether a historic or substitute material, but it should not be the sole determinant factor at the expense of maintaining the historic character and historic integrity of a building. Other factors may prompt the consideration of a substitute material, such as the cost of maintaining the historic material, because it is comparatively difficult or costly to reach or access, or the frequency of required maintenance the historic material needs. Additionally, where in-kind replacement material is found to be prohibitively expensive, it may be reasonable to consider a substitute that offers an alternative and is a good physical and visual match. Not all substitute materials are, however, cost-effective replacements. Long-term durability and maintainability are other factors that should be considered in conjunction with initial cost.

Figure 9. Previously bricked-in openings below the flood line were reopened and new aluminum windows installed with cellular PVC trim detailed to hold back moderate flood waters and survive exposure to water. Photo: John Sandor, NPS.

Maintenance of a material, particularly where accessibility is difficult or expensive, can be an important part of a

cost evaluation. Maintenance costs should not be considered without also considering life-cycle expenses. While some substitute materials may offer reduced initial costs, they may be as or more costly than traditional materials to maintain over time. For example, many substitute materials are not readily repairable, necessitating full replacement when damaged. The cost to replace a material or assembly at the end of its lifespan may also be greater than the accumulated incremental expense to maintain the historic material, particularly if it is a more traditional, repairable material. Maintenance cost should never be the sole reason for replacing a historic material that is not deteriorated.

Criteria for the Appropriate Use of Substitute Materials

Substitute materials must meet three basic criteria to be considered: they must be compatible with the historic materials in appearance; their physical properties must be similar to those of the historic materials, or the materials must be installed in a manner that tolerates differences; and they must meet certain basic performance expectations over an extended period of time.

- **Matching the Appearance of the Historic Material**
  Any material's appearance varies depending on the nature of the material and how it is used. Some historic materials, such as wood and ferrous metals, were typically painted, making the color of the substitute unimportant, though the texture of the surface, which telegraphs through a paint layer, is still an important consideration. Texture can be a large part of distinguishing a material formed by hand from one that is machine-made. Many historic materials, such as most building stones, are used without any coating, making the color, pattern, and reflectivity, as well as surface texture, dependent on the material itself. Matching the color and surface characteristics of a historic natural material with a man-made substitute can often be quite difficult.

  When the color and surface characteristics of an existing material are important, cleaning the material should be the starting point for evaluating a potential matching material. In situations where there are subtle variations in color and texture within the original material, the substitute material should be similarly varied so that it is not conspicuous by its uniformity. If a material is custom fabricated, a sufficient number of samples should be supplied to permit on-site comparison of color, texture, detailing, and other critical visual qualities. For a manufactured product with preset choices of color or texture, it may be necessary to look at samples from more than one manufacturer to find the best match. Similarly, prefabricated products, such as roofing slate, may offer limited, if any, choice of unit size, which can be a critical factor for achieving a good match. A substitute material should not be used to replace distinctive, character-defining materials and features if an adequate match in design and appearance is not possible.

  As all exposed materials are subject to ultraviolet degradation, samples of a new material, particularly when custom formulated, should be prepared during the early planning phases to allow for evaluation of the effects of weathering on color stability. When that is not possible, or if a prefabricated product is used, the fabricator or manufacturer may be able to identify regional locations where equivalent products have been installed long enough ago to get a better sense of how the material weathers and performs.

  While a perfect match is the desired goal for replacing distinctive features, it is not always possible, even when the same matching material is chosen for the replacement. When any compromise

Figure 10. Polymer slates offer a choice of shapes but not sizes, limiting their ability to achieve a good visual match for some historic slate. With the size of the polymer slates (right) being nearly twice that of the historic slates (left), the scale of the entire feature is incompatibly altered. The molded edges of this material, which contribute to its ability to replicate slate, would be lost if each shingle was resized by cutting. Photo: John Sandor, NPS.

Figure 11. The thickness of the wood siding on the front (left) creates a deeper shadow line than is achieved with the fiber cement siding used on the side (right) elevation. While the exposure can be adjusted, fiber cement siding is not available in a matching thickness. Photo: John Sandor, NPS.

must be made in the precision of the match, it is wise to consider the vantage point from which the material will be seen. Sometimes what seems important at close range, such as variations in the texture of a surface, may be secondary to other aspects of the material when viewed from some distance. The closer a feature is to the viewer, the more closely the material and craftsmanship should match the original. An on-site mock-up using a sample of the proposed material can help evaluate whether it is an adequate visual match.

- **Matching the Physical Properties of the Historic Material**
  Carefully chosen substitute materials can often closely match the appearance of historic materials, but their physical properties may differ greatly. These differences are most critical when incrementally replacing components of a larger assembly that retains significant historic material. The chemical composition of the material (e.g., the presence of acids, alkalis, salts, or metals) should be evaluated to ensure that the replacement materials will be compatible with the adjacent historic materials. Materials that will cause galvanic corrosion or other chemical reactions must be isolated from one another.

  The thermal- and moisture-driven expansion and contraction coefficients of each adjacent material must be within narrow limits or be accommodated

Figure 12. Cellulose composite materials, like wood, expand and contract with moisture. Here it was used to reconstruct a missing storefront. Unlike solid wood that is dimensionally stable parallel to the grain, this composite moves equally in all dimensions, resulting in gaps that were not adequately anticipated in the design. Photo: John Sandor, NPS.

by carefully designed joints and fasteners. Joints can play a role both in accommodating movement of materials as well as in managing moisture, either to keep it from entering the enclosure assembly or to let it escape from the building envelope, or both. Because some synthetic materials are less permeable to moisture than more traditional materials, installations must take into account the potential to trap moisture and cause deterioration of historic and new materials. An assembly incorporating new and historic materials should be designed so that if material failures occur, the failures occur within the new material rather than the historic one.

During installation, surface preparation is critical to ensure proper attachment. Deteriorated underlying material must be removed or stabilized. Non-corrosive anchoring devices or fasteners that are designed to carry the new material and to withstand wind, rain, snow, and other destructive elements should be used. Since physical failures often result from poor anchorage or improper installation techniques, a structural engineer should be included in planning any major project. For readily available, off-the-shelf materials, manufacturers' recommendations for attachment and spacing should be followed.

Nearly all substitute materials have some properties that are different from the historic materials they may replace. Even when substitute materials are isolated from historic materials and features, it is important to understand the substitute materials' properties in order to use them successfully.

- **Performance of the Material Over Time**
  When more traditional materials are used to replace damaged historic materials and features, their performance is predictable in most cases. An exception may be modern wood that has durability and other prop-

erties different than those of historic wood from old-growth forests. Many of the materials used as substitutes have been in use long enough to provide some idea of how they perform over time. Other material may only have test results from accelerated weathering. The length of manufacturer warranties may be an indicator of expected durability and lifespan. Warranties only predict a manufacturer's expectation of a product's performance and are no guarantee that the manufacturers will still be in business at the time needed to stand behind them. Just as new manufacturers emerge with new materials, others disappear. Where possible, projects involving substitute materials in similar installations and exposures should be examined before selecting a new, less-tested material. It is unrealistic to expect a substitute material, which can be quite different in composition than the historic material, not to age differently.

Even traditional materials will not perform well if not used or detailed appropriately, and experienced architects, engineers, fabricators, and installers rely on their professional knowledge and experience to ensure proper installation and techniques when working with familiar materials. This is just one of many reasons that using the original materials for needed replacement is usually the best choice. Some of the materials now available as substitutes have properties that differ greatly from the traditional materials they may be used to replace. It is critical to the successful performance of substitute materials that everyone involved in the selection, design, and installation fully understands the material's properties, especially how it is different than the material it is replacing, and how that will affect the surrounding materials and building systems.

Many traditional building materials can be repaired either with traditional methods and materials or with more modern conservation techniques using substances like epoxies. However, many modern substitute materials (particularly synthetic ones) are not as easily repaired, if repairable at all, as their more traditional counterparts. Confirming that a material is repairable may be important for those used, e.g., where impact or significant wear or abrasion is likely.

Finally, it is critical that the substitute materials be documented as part of the historical record of the building so that proper care and maintenance of all of the building materials continue, ensuring the continued life of the historic building.

Choosing an Appropriate Substitute Material

Once all reasonable options for repair and replacement in kind have been considered and sufficient justification for substitute materials has been established, the choice among the variety of substitute materials currently available must be made. Rapidly developing technologies allow a wide variety of materials to choose from that are intended to mimic historic materials. Many of the materials that were historically used as substitutes for more traditional historic materials have themselves become historic, and some of these early substitutes continue to be reasonable options as substitute materials today. No substitute material will exactly match the historic material in all aspects, but many are able to adequately match the appearance and relevant physical attributes to make for a potential substitute. If a substitute material is not

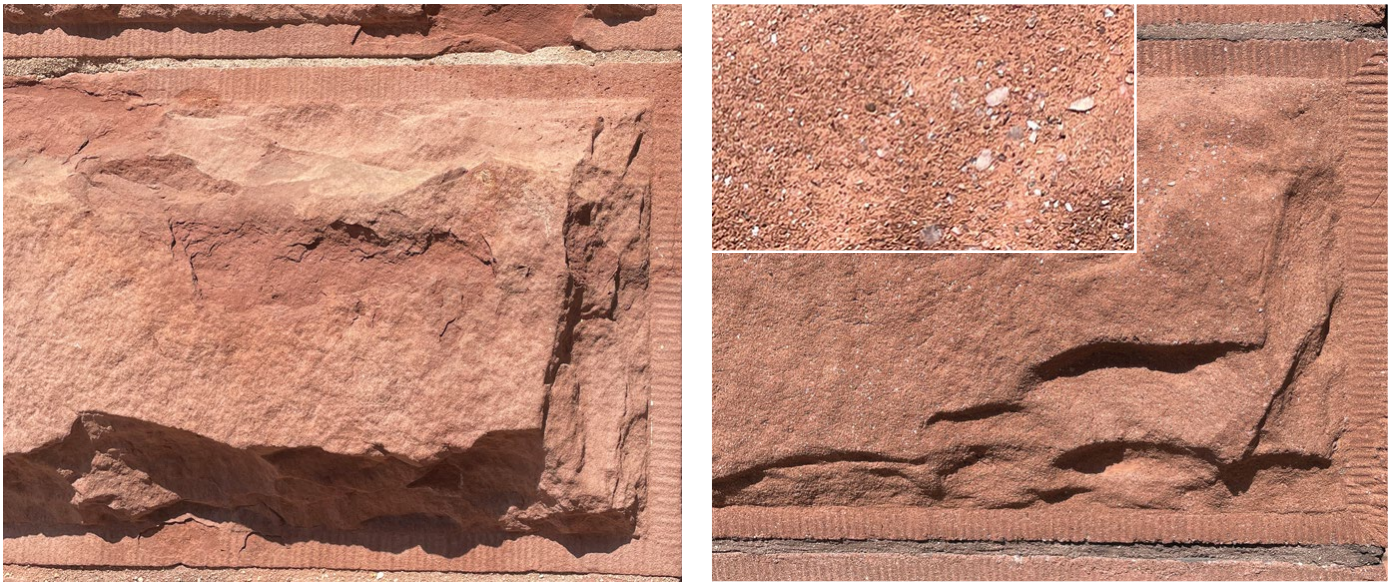


Figure 13. Cast stone was used to effectively replace individual blocks of sandstone. Both the original (left) and the substitute material (right) retain similar physical and visible properties. Having weathered for over 30 years, some erosion of the binder has revealed quartz grains of the aggregate (inset), but it is only noticeable upon close inspection. Photo: John Sandor, NPS.

an adequate physical and visual match given the specific conditions of the building and the project, then it should not be used to replace distinctive, character-defining materials and features.

Listed below are various building components or features and the substitute materials which may, in some circumstances, be considered for use as possible replacement materials in a historic rehabilitation project consistent with the *Standards for Rehabilitation*. This list includes different substitute material options available today for these building features and poses questions that should be asked and considered when choosing between the original material and various types of substitute materials. This is followed by a list of some of the more commonly used, currently available materials that may have some applications as substitute materials and the properties of each that affect their suitability for use as substitutes. This list should not be read as an endorsement of any of these materials, generally, or their appropriateness for use as a substitute material, but it serves as a reminder that the successful use of any building material requires a careful consideration of its properties relative to where and how it will be used.

Considering Substitute Materials

Considering the use of a substitute material should begin with the following questions about the conditions and location where it will be used:

- Will the significance or visibility of the historic feature require a very precise match?
- Is the entire feature being replaced or just a component of it?
- Are pre-existing conditions contributing to the failure of the existing material, and, if so, how will they be addressed/corrected?
- Is the need for replacement due to inherent deficiencies of the original material?
- Will the material need to resist any environmental hazards such as flooding or fire?

Historic Features and Substitute Materials

Historic Building Features

Potential Substitute Materials

	Masonry Stone, terra cotta	**Architectural Metals** Cast & wrought iron, steel, pressed metal	**Siding** Wood, asbestos	**Roofing** Wood shingle, slate, tile	**Decking** Tongue and groove & square edge wood	**Molding / Trim** Wood
Aluminum	●	●	●			●
Cast Stone & Precast Concrete	●			●		
Fiber Reinforced Concretes	●					
Glass Fiber Reinforced Polymers	●	●				
Fiber Cement			●	●		●
Mineral / Polymer Composite			●	●	●	●
Cellulose Fiber / Polymer Composite			●	●	●	●
Non-composite Polymers		●			●	●
Cellular PVC			●		●	●

The above chart lists materials that are sometimes used as substitutes for replacement of historic building features. Even within a given category, all materials may not be equally suitable as a substitute replacement material for the actual historic material or feature. Any substitute material should be selected based on its specific physical and visual characteristics, conditions, and intended application consistent with the Secretary of the Interior's Standards for Rehabilitation.

Historic Building Features: Criteria for selecting an appropriate replacement material

Masonry

FEATURES: corbels, brackets, balusters, cornices, window and door surrounds, friezes, wall surfaces, horizontal surfaces, incidental ornament, columns

HISTORIC MATERIALS: terra cotta, cast stone, stone, concrete

POTENTIAL SUBSTITUTES: cast stone, pre-cast concrete, GFRC, GFRP, non-composite polymers (polyurethane), cast or stamped metal

Questions to ask about the replacement material:

- Can it serve a structural function?
- How is the material affected by moisture?
- Can the material survive flooding and be reused?
- Can it reproduce the surface texture of the original?
- Is its shrinkage in curing low enough to allow it to be molded from existing stones?
- Can matching color be achieved without a coating and with UV stability?
- Can an adequate match of the surface (color and texture) be achieved with a coating?
- Is a coating required?
- If it is not self-supporting, is it lightweight enough to be supported by an underlying framework?
- Can multiple original units be replicated with a single replacement piece?
- Where thermal movement is different from the original material, how will joints accommodate?
- Is the material combustible?

Architectural Metals

FEATURES: pilasters, door and window surrounds, cornices, incidental ornament, columns, spandrels, ceilings, sheathing, roofing

HISTORIC MATERIALS: cast and wrought iron, steel, bronze, lead, aluminum, and stamped steel (usually galvanized or terne-coated)

POTENTIAL SUBSTITUTES: GFRP, aluminum, non-composite polymer (polyurethane), GFRC, metallic/polymer composite

Questions to ask about the replacement material:

- Will the replacement material serve a structural or cosmetic role?
- Will it expand and contract with temperature change enough to require special accommodation in its installation?
- If part of an assembly of mixed materials, how will any expansion and contraction of the dissimilar materials be accommodated?
- Will the replacement material increase deterioration of the historic or surrounding elements, for instance due to galvanic corrosion, moisture entrapment, jacking of original material, off-gassing creating a corrosive environment, or poor original design of the historic material?
- How will the replacement material mimic the surface color/patination of the original material?
- If a coating is needed, what preparation is needed, and what is its durability or service life of the finish?
- What attachment and support systems are necessary?
- If the original element is structural, but the new material is not, how can supplemental structure be introduced to support the new?

Figure 14. Surface texture is an important aspect in matching the appearance of a historic material, especially when a material is viewed at close range. As seen in these two images, many of the substitute materials produced for siding and trim have an embossed wood grain, making them incompatible for replacing historic wood that was typically planed to a smooth surface. Some substitute products are available with a smooth surface as well. Photos: John Sandor, NPS.

Siding

FEATURES: clapboard, tongue-and-groove or shiplap siding, board and batten, shingles

HISTORIC MATERIALS: wood and asbestos

POTENTIAL SUBSTITUTES: cellular PVC, wood fiber/polymer composite, fiber cement, mineral/polymer composite

Questions to ask about the replacement material:

- What are the widths, lengths, profiles, thicknesses, and textures available?
- What, if any, are the finishing requirements, and/or is it available factory-finished?
- How well does it hold paint, and can prefinished surfaces be renewed?
- What tools are needed to cut it, and can it be machined?
- Does it absorb moisture and, if so, to what effect?
- Can the material survive flooding and be reused?
- Will it expand and contract with temperature change enough to require special accommodation in its installation?
- What characteristics can affect its handling (e.g., weight, flexibility, brittleness)?
- Does it have specific fastening requirements?
- Is it susceptible to insect damage?
- What is its impact resistance?
- Does it have a flame spread rating?
- What is the expected lifespan and/or warranty?

Roofing

HISTORIC MATERIALS: wood shingle, slate shingle, asbestos shingle, clay tile, concrete tile, metal

POTENTIAL SUBSTITUTES: fiber cement, mineral/polymer composite, wood fiber/polymer composite, pre-cast concrete, metal

Questions to ask about the replacement material:

- What sizes and shapes are available?
- What are color choices?
- What is the color stability of the new material, and how will it age/weather?
- What is the impact resistance?
- What is its flame spread rating?
- What are the installation requirements of the new material?
- Can the feature being replaced be custom-produced if ready-made ones of the new material are not an accurate match?
- What is the expected lifespan and/or warranty?

Decking

FEATURES: tongue-and-groove, square-edge flooring

HISTORIC MATERIALS: wood

POTENTIAL SUBSTITUTES: cellular PVC, wood fiber/polymer composite, mineral/polymer composite, non-composite polymers (solid PVC)

Questions to ask about the replacement material:

- What are the widths, lengths, and textures available?
- Is it site painted or prefinished?
- How well does it hold paint, and can prefinished surfaces we renewed?
- What tools are needed to cut it, and can it be machined?
- What dimensional span does its strength allow?
- Does it absorb water, and if so, to what effect?
- Can the material survive flooding and be reused?
- Does it require a drainage plane, or can it be installed atop a membrane?
- Will it expand and contract with temperature change enough to require special accommodation in its installation?
- Is it susceptible to insect damage?
- Is it impact resistant?
- Does it have a flame spread rating?
- What is the expected lifespan and/or warranty?

Molding / Trim

FEATURES: run moldings, flat boards, casings, cornice, frieze, railings, balustrade, columns

HISTORIC MATERIALS: wood, metal

POTENTIAL SUBSTITUTES: cellular PVC, wood fiber/polymer composite, mineral/polymer composite, non-composite polymer (polyurethane), GFRP, sheet metal

Questions to ask about the replacement material:

- What are the widths, lengths, and textures available?
- What, if any, are the finishing requirements and/or is it available factory-finished?
- How well does it hold paint, and can prefinished surfaces be renewed?
- What tools are needed to cut it, and can it be machined?
- Does it absorb moisture, and if so, to what effect?
- Can the material survive flooding and be reused?
- Will it expand and contract with temperature change enough to require special accommodation in its installation?
- What characteristics can affect its handling (e.g., weight, flexibility, brittleness)?
- Does it have specific fastening requirements?
- Is it susceptible to insect damage?
- What is its impact resistance?
- Does it have a flame spread rating?
- What is the expected lifespan and/or warranty?

Figure 15. Tongue-and-groove porch flooring is manufactured in several different substitute materials. Each type has different properties, though most are more moisture-resistant than wood. The prefinished product shown can be painted when worn, but repainting is not recommended for some product choices. Photo: Oak Alley Foundation.

Potential Substitute Materials: Matching properties and performance needs

Physical Composition and Properties

After assessing different material options based on the intended application, the appropriateness of a substitute material should also be considered in context of the material's physical composition, associated properties, and necessary visual match.

Aluminum

MATERIAL: Aluminum is a highly corrosion-resistant alloy that can be cast, wrought, or extruded. Molten aluminum is cast into permanent (metal) molds or one-time sand molds forming cast aluminum. Extruded aluminum is formed by passing heated aluminum through a die which produces the desired form. Wrought aluminum is worked using the heated metal and then bending, stamping, and otherwise shaping the metal. If not self-supporting, aluminum elements are generally screwed or bolted to a structural frame. Aluminum can be welded, but more often sections, particularly extruded ones, are mechanically connected.

PROPERTIES:

- Isotropic
- Lightweight
- Thermal movement greater than cast iron or wood
- Corrosion-resistant, but direct contact with other metals may trigger galvanic corrosion
- Lower structural strength that iron or steel
- Ductile - less brittle than cast iron
- Non-combustible
- Retains high definition through molding process and produces crisp profiles through extrusion
- Can be given a durable metallic finish through anodization. Surface etching required for paint adhesion
- Can be machined into a large variety of shapes/ dimensions

Figure 16. Aluminum is a highly corrosion-resistant metal that is commonly used as a substitute material for cast iron. Aluminum can be a more affordable and lightweight alternative to cast iron that retains a similar texture, shape, and maintenance cycle. Photo: NPS.

Figure 17. The balustrade consists of multiple prior campaigns of using cast stone to replace the natural stone. The effective match for the surface texture and color of the original stone allowed individual elements to be incrementally replaced only when they had failed, thus retaining the maximum amount of original material as long as possible. Photo: EverGreene Architectural Arts.

Cast Stone & Precast Concrete

MATERIAL: A cement lime and aggregate mixture that is dry-tamped into a mold is generally referred to as cast stone. Cast stone is one of the original substitute materials. Its longevity has proved that the material ages compatibly with stone. A wet mix of cement and aggregate poured into molds also has a long history of being used to produce concrete masonry units mimicking stone and roofing tiles mimicking clay tile. Both methods have minimal shrinkage during curing, though they employ different curing and finishing techniques. Both can include reinforcing bars and anchorage devices installed during fabrication. The dry-tamp fabrication method is especially effective at producing an outer surface with the appearance of stone.

PROPERTIES:

- Isotropic
- Weight equivalent to stone
- Expansion/contraction similar to stone
- Water absorption may differ from that of any particular stone
- Can be structural
- Non-combustible
- Vapor-permeable
- May achieve a wide range of color and surface textures by varying mix, but use of pigments may reduce UV stability
- Can be coated
- May be tooled to match the appearance of tooled stone
- Repairs similarly to stone

Figure 18. Missing historic terra cotta spandrel panels on all floor levels were recreated utilizing glass fiber reinforced concrete (GFRC) replacements. New spandrels were fabricated as individual components and attached with metal clips between historic terra cotta piers. Photo: Kris Frail, Dewberry.

Fiber Reinforced Concretes (GFRC, CFRC)

MATERIAL: Fiber reinforced concretes are lightweight concrete compounds modified with additives and reinforced with alkaline resistant glass fibers (GFRC), or less frequently carbon fibers (CFRC). They are generally fabricated as thin-shelled panels and applied to a separate structural frame or anchorage system. GFRC is typically sprayed into forms, although it can be poured, and anchoring devices are included in the fabrication. The color is derived from the natural aggregates and, if necessary, a small percentage of added pigments. Because of its low shrinkage in curing, it can be produced using molds taken directly from the building.

PROPERTIES:

- Isotropic
- Lighter weight than solid masonry
- Expansion/contraction similar to stone
- No load bearing capacity, so underlying framework must be used to accommodate any loads
- Material can be fire-rated
- Vapor-permeable
- Can be produced in larger sections efficiently reproducing repetitive elements or features that were originally made up of small individual units
- Large range of colors achievable by varying aggregates, but when pigments are needed UV stability may be reduced
- May be left uncoated or may be painted

Figure 19. A new, lightweight fiber reinforced polymer is attached to a new metal armature to replicate damaged and missing elements of a terra cotta cornice. Photo: Quinn Evans.

Glass Fiber Reinforced Polymers (FRP, Fiberglass)

MATERIAL: Fiberglass is the most well-known of the FRP products generally produced as a thin, rigid, laminate shell formed by pouring a polyester or epoxy resin gelcoat into a mold. When tack-free, layers of chopped glass or glass fabric are added along with additional resins. The surface gel coat can be pigmented or painted. Reinforcing rods and attachment devices can be added when necessary. Because of is low shrinkage in curing, it can be produced using molds taken directly from the building. Rather than being produced as standard components, FRP is custom fabricated for individual applications.

PROPERTIES

- Isotropic
- Lighter weight than masonry, similar to sheet metal
- More thermally driven expansion than masonry or metals
- No load bearing capacity, so underlying framework must be used to accommodate any loads
- High strength to weight ratio
- Flammable
- Not vapor-permeable
- Can be produced in larger sections efficiently reproducing repetitive elements or features that were originally made up of small individual units
- May be difficult to match false joints in multi-unit assemblies to actual joints that need to accommodate movement
- Color can be incorporated into the surface gel-coat, or the surface may be coated

Figure 20. Cement board was used to replace a non-historic infill and mimics the configuration of a typical vehicular door of the period. Photos: Historic Augusta.

Fiber Cement

MATERIAL: Fiber cement products are made from fiber, sand that is ground to a powder, cement, and proprietary additives to reduce moisture absorption. The fiber used in roof products is glass fiber alone, whereas siding and trim board products are primarily wood fiber. The material is formed with a smooth or textured surface, cut to standard sizes of panels, boards, or shingles, and cured in an autoclave. Roofing material has integral color, but board and siding products are produced with a primer, if not fully factory finished. Most siding and trim boards are embossed with a wood grain on one surface and are smooth on the other, the smooth side being the appropriate surface to imitate planed wood.

PROPERTIES:

- Products are minimally orthotropic
- Heavier and more brittle than wood, limiting available lengths
- Very little thermal- and no moisture-driven movement
- Low water absorption, but not recommended for ground or roof contact
- Class A flame spread
- Resists insect damage
- Available in limited thicknesses and widths
- Not machinable, but may be cut with special carbide blades; cutting requires dust collection and personal protective equipment
- Cut edges require sealing
- Available unfinished, primed, or prefinished, and must be painted (with latex paint)
- 15-year limited warranty typical

Figure 21. A mineral polymer composite siding was available in the profile very similar to the historic siding. The replacement siding was used where the original material was almost completely missing beneath a more modern covering. Areas where the original wood was largely intact were replaced with matching wood to sustain more of the material integrity of the building. Photo: Belk Architecture.

Mineral / Polymer Composite

MATERIAL: Calcium carbonate or fly ash are mineral ingredients held in a matrix of various polymers to produce materials formed or molded into a number of building products. Additives found in some of the roofing products include pigments and UV stabilizers. Some use a substantial portion of recycled material. Different combinations yield products with different properties, each formulated for a specific building component. When the material is fly ash with some glass fibers bound in a matrix of polyurethane, it is identified as polyash. Siding, trim, bead board, and deck products are primed or prefinished, whereas roof products have integral color.

PROPERTIES:

Fly ash (siding and trim)

- Isotropic
- Heavier and more brittle than wood, and lacking structural capacity
- Little thermal or moisture-driven movement
- Sufficiently low water absorption to permit ground contact
- Class C flame spread
- Resists insect damage
- Available in limited thicknesses and widths
- Machinable with carbide tools blades; requires dust collection
- Cut edges do not require sealing
- Must be painted
- 30-year limited warranty typical

Calcium carbonate or recycled rubber (roofing)

- Isotropic
- More thermally-driven movement than slate or wood
- Little to no moisture absorption
- As shingles: lighter and more flexible than slate
- As tongue-and-groove decking: heavier and harder than wood
- Not vulnerable to insect damage
- Available in limited dimensions
- As shingles: Class 4 impact resistance, and flame spread ratings ranging from Class A to Class C depending on the specific product
- As shingles: integral color, that may be subject to fading
- As tongue-and-groove decking: prefinished with non-renewable finish, and can be cut with woodworking tools
- 50-year limited warranties on roofing products typical

Cellulose Fiber / Polymer Composite

MATERIAL: Wood strands or fibers are coated with resin for moisture resistance and zinc-borate for insect and fungal-decay resistance, then consolidated under heated pressure. Solid composite core boards are cut from sheets of material, then factory-primed or finished. Resulting siding and trim board products can be referred to as engineered wood, fiber board, or hardboard. Products may be embossed with a wood grain or have a smooth finish, the smooth side being the appropriate surface to imitate planed wood. Siding, trim, and tongue-and-grove decking with a slightly different properties are produced by extruding polyvinyl chloride (PVC) combined with non-wood cellulose. Roofing shingles are molded from fine wood fibers, color additives, and UV stabilizers bound with polypropylene or polyethylene (thermoplastics).

Figure 22. A porch was reconstructed using posts fabricated on site from a smooth-surface cellulose/polymer composite material. Though the face of the posts are painted, the lack of paint on the bottom at the cut ends is not consistent with manufacturers' recommendations. This treatment will allow moisture to be absorbed, shortening the life of the new replacement feature. Photo: John Sandor, NPS.

PROPERTIES:

Predominantly Cellulose (siding, trim and decking)

- Minimal thermal movement
- Resistant to moisture-driven movement
- Lighter and more flexible than solid wood, but lacks structural capacity
- Rice hull cellulose: can span typical floor-framing spacing as decking
- Low water absorption (for wood, no ground or roof contact)
- Class A or Class C flame spread
- Resists insect damage
- Available in limited dimensions
- Machinable with woodworking tools
- Wood cellulose: Cut edges must be sealed and may need additional surface prep for finish; must be painted if unfinished or primed, also available prefinished
- Rice hull cellulose: Accepts stain/paint, but no finish required
- 30–50 year limited warranty, depending on manufacturer

Predominantly Polymer (roofing)

- Minimal thermal movement
- Little to no moisture absorption
- Lighter and more flexible than slate
- Class 4 impact-resistance
- Class A flame spread
- Available in limited shingle size
- 50-year limited warranty typical

Figure 23. 3-D printing using various polymers is occasionally used to replicate missing metal or wood features. This new application is continually being refined, but the application can be successful when a painted, lightweight feature needs to be replicated. Photo: NPS.

Non-composite Polymers

MATERIALS: The main two polymer materials used without significant other components are polyurethane and polyvinyl chloride (PVC). Polyurethane millwork is constructed of urethane foam created by mixing isocyanate and resin. The polyurethane mixture is kept under pressure in a mold as it expands to any desired shape. These molded products have a closed-cell, foamed core with a denser surface skin. Polyurethane products can have exterior applications but are more often used for interior features. Polyvinyl chloride (PVC) in a solid extruded form is another polymer that can have architectural application as tongue-and-groove decking. Various polymers formed using 3-D printing are also being explored as replacements for painted metal or wood ornamental features.

PROPERTIES: Each of the two groupings has distinct physical properties

Urethane Foam (moldings and decorative elements)

- Lightweight and flexible, but lacking structural capacity
- More thermally-driven movement than wood or stone, but less than cellular PVC
- Does not absorb water
- Flammable
- Resists insect damage
- Can be cut with standard woodworking tools
- Adhesive and mechanical fasteners both recommended for installation
- Supplied primed and must be painted (latex paint)
- Lifetime limited warranty typical

Solid PVC (flooring)

- Isotropic
- Heavier and less flexible that wood
- Minimal thermal movement
- Does not absorb water
- Strength to span typical floor-framing spacing
- Impact-resistance greater than wood
- Class A flame spread
- No insect susceptibility
- Good paint adhesion, but also available prefinished
- 20-year warranty typical

Cellular Polyvinyl Chloride (PVC)

MATERIAL: Varying amounts of calcium carbonate and a foaming agent are added to melted PVC before passing through an injection die and then a calibrator to produce the shape and size of the finished product. Cellular PVC is produced as sheets, boards, and moldings. Differences in the specifics of the equipment and the rate of cooling create two varieties of product, with distinct properties. One is known as free-foam, having a fairly consistent structure throughout its section, and the other is identified as Celuka, having a skin that is denser than its core. This primarily affects the ease with which the product can be milled and shaped. The material is white and needs no applied finish. When produced for decking the material has a colored and textured wear layer over the PVC core.

PROPERTIES

- Isotropic
- Lighter and more flexible than wood
- Less strong than wood (in tension and shear), but can span typical floor- framing spacing as decking
- More impact-resistance than wood
- Negligible water absorption; no moisture-driven movement, unlike wood
- Subject to thermal expansion and contraction significantly greater than wood, though the thermal movement is less for the same dimension than the cross-grain moisture-driven movement of wood
- For longer pieces, thermal movement requires manufacturer's specifications to be followed for attachment, and inclusion of expansion joints when installed at low temperature (joints should be glued)
- Class A flame spread
- Resists insect damage
- Machinable with woodworking tools, though cut edges may need additional surface prep for finish
- Good paint adhesion; if painted, high light reflectance (HLV) is recommended to minimize heat driven expansion
- 25–30-year limited warranty, depending on manufacturer

Figure 24. Cellular PVC when painted can be used to replace deteriorated wood features. This beadboard set in a wood frame was not historically designed to shed water effectively and had deteriorated. Cellular PVC was able to match the appearance of the wood details, while its properties were well matched to the shady location, painted finish, and limited size and configuration within the overall assembly; thus, it should provide a long-lasting solution for this application. Photo: Jennifer Balson Alvarez, NPS.

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