

CHAPTER 4

Draft Section 4(f) Evaluation

4.1 INTRODUCTION

This evaluation assesses impacts of the proposed US 6/Wadsworth project on parks and historic properties. It was prepared in compliance with Section 4(f) of the Department of Transportation Act and is supported by other analyses in this EA and these reference documents available in Appendix C: *Alternatives Development and Screening Technical Memorandum* (CH2M HILL, 2008c), *Historic Resources Survey* (TEC, 2008), and *Determination of Effects to Historic Properties* (CH2M HILL et al., 2008d).

4.2 SECTION 4(f)

Section 4(f) of the Department of Transportation Act of 1966, as amended, and codified in 49 United States Code (U.S.C.) § 303, declares that “[i]t is the policy of the United States Government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites.” FHWA has adopted regulations to ensure its compliance with Section 4(f) (23 CFR 774).

Section 4(f) prohibits FHWA from approving the use of a publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance, or land of a historic site of national, state, or local significance unless:

- ◆ A determination is made that 1) there is no feasible and prudent avoidance alternative to use of land from the property, AND 2) the action includes all possible planning to minimize harm to the property resulting from such use, OR
- ◆ The use of the property, including any measures to minimize harm, will have a *de minimis* impact on the property.

There are three types of Section 4(f) uses: direct use, temporary use, and constructive use. Because this project would not result in any temporary or constructive uses, they are not discussed further.

4.2.1 DIRECT USES

A direct use takes place when the land is permanently incorporated into a transportation facility.

4.2.2 DE MINIMIS IMPACTS

Certain uses of Section 4(f) land may have a minimal or *de minimis* impact on the protected resource. When this is the case, FHWA can make a *de minimis* impact determination. Properties with a *de minimis* determination do not require an analysis of avoidance alternatives or a least harm analysis (23 CFR 774.17[5]; FHWA, 2005a).

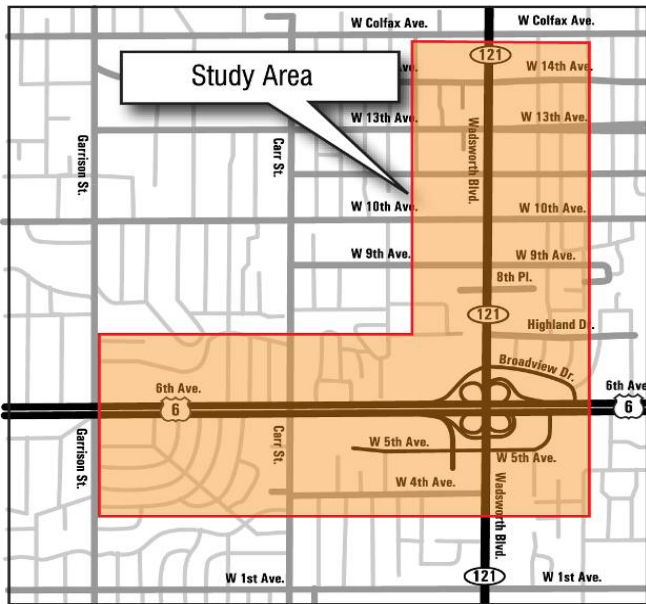
The *de minimis* criteria and associated determination are different for historic sites than for parks, recreation areas, and wildlife and waterfowl refuges.

- ◆ For publicly owned parks, recreation areas, and wildlife and waterfowl refuges, *de minimis* impacts are defined as those that do not “adversely affect the activities, features and attributes” of the Section 4(f) resource. The public must be afforded an opportunity to review and comment on the findings.
- ◆ For historic sites, *de minimis* impacts are based on the determination that no historic property is affected by the project or that the project will have no adverse effect on the historic property in accordance with Section 106 of the National Historic Preservation Act. FHWA must notify SHPO of its intent to make a *de minimis* finding.

4.3 PURPOSE AND NEED

The purpose of the US 6 and Wadsworth project is to improve traffic flow and safety, accommodate high traffic volumes, and increase multi-modal travel options and connections at the US 6 and Wadsworth interchange and along Wadsworth between 4th Avenue and 14th Avenue. The project is located entirely within central Lakewood in Jefferson County, Colorado (see Exhibit 4-1).

EXHIBIT 4-1: PROJECT LOCATION



Improvements are needed to:

- ◆ Improve safety for motorists, pedestrians, and bicyclists
- ◆ Improve the operational efficiency of the interchange and on Wadsworth
- ◆ Meet current and future traffic demands
- ◆ Support multi-modal connections

Chapter 1 of the EA provides additional details about the purpose and need for this project.

4.4 FEASIBLE AND PRUDENT ALTERNATIVES

The first test under Section 4(f) is to determine which alternatives are feasible and prudent. An alternative is feasible if it is technically possible to design and build. According to FHWA regulations (23 CFR 774.17), an

alternative may be rejected as not prudent for the following reasons:

- i) It compromises the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need;
- ii) It results in unacceptable safety or operational problems;
- iii) After reasonable mitigation, it still causes:
 - a) Severe social, economic, or environmental impacts;
 - b) Severe disruption to established communities;
 - c) Severe disproportionate impacts to minority or low-income populations; or
 - d) Severe impacts to environmental resources protected under other federal statutes;
- iv) It results in additional construction, maintenance, or operational costs of an extraordinary magnitude;
- v) It causes other unique problems or unusual factors; or
- vi) It involves multiple factors described above, that while individually minor, cumulatively cause unique problems or impacts of extraordinary magnitude.

Where sufficient analysis demonstrates that a particular alternative is not feasible and prudent, the consideration of that alternative as a viable alternative comes to an end. If an alternative is identified that avoids the use of Section 4(f) properties, it must be selected. No prudent and feasible avoidance alternative was identified for this project.

The US 6/Wadsworth project considered 9 interchange alternatives (including the No Build Alternative). Three additional alternatives were developed as Section 4(f) avoidance options. Exhibit 4-2 summarizes the Section 4(f) use and avoidance for all of these alternatives. Five were determined to be feasible and prudent but none of the feasible and prudent alternatives avoided Section 4(f) resources. Three avoid Section 4(f) resources but are not feasible and prudent. Additional details on these alternatives are available in reference documents included in Appendix C (CH2M HILL, 2008c; CH2M HILL et al., 2008d; CH2M HILL, 2009h).

EXHIBIT 4-2: SUMMARY OF FEASIBLE AND PRUDENT INTERCHANGE ALTERNATIVES

Alternative	Feasible and Prudent? ¹	Avoids 4(f) Use?
No Build Alternative ; no reconstruction of interchange	No. Not prudent (i). Does not meet purpose and need to improve safety, capacity, interchange operations, multimodal connections.	Yes
Tight Diamond with Loop Interchange (Build Alternative) ; similar to the Tight Diamond (see below) except it maintains a loop ramp in the NW quadrant of the interchange, and there would be no traffic signal at the intersection of the loop ramp with Wadsworth; maintains off-ramp and frontage road in NE quadrant	Yes	No. Requires use of four historic properties (5JF4536, 5JF4542, 5JF3549, and 5JF3548).
Traditional Diamond Interchange ; most common interchange type with one entrance and one exit in each direction; on- and off-ramps meet at two signalized intersections; ramps form a diamond shape when viewed from the air; maintains off-ramp and frontage road in NE quadrant	Yes	No. Requires use of four historic properties (5JF4536, 5JF4542, 5JF3549, and 5JF3548).
Tight Diamond Interchange ; like a traditional diamond, except entrance and exit ramps are shifted closer to the freeway; maintains off-ramp and frontage road in NE quadrant	Yes	No. Requires use of four historic properties (5JF4536, 5JF4542, 5JF3549, and 5JF3548).
Single Point Urban Interchange ; similar to a diamond interchange but with all ramps controlled by a single set of traffic signals; maintains off-ramp and frontage road in NE quadrant	Yes	No. Requires use of four historic properties (5JF4536, 5JF4542, 5JF3549, and 5JF3548).
Partial Cloverleaf Interchange ; uses loop ramps for two of the left-turn movements and straight ramps to handle the other two left-turn movements; maintains off-ramp and frontage road in NE quadrant	Yes	No. Requires use of four historic properties (5JF4536, 5JF4542, 5JF3549, and 5JF3548).
Partial Cloverleaf with Flyover Ramp Interchange ; like the partial cloverleaf except the highest-volume traffic movement (in NW quadrant) is handled on an elevated ramp; maintains off-ramp and frontage road in NE quadrant	No. Not prudent (iii). Would result in cumulatively severe impacts. Would result in unacceptable social impact from increased noise in a community already severely affected by traffic noise. Would result in increased community disruption from nearly twice as many relocations as compared with other alternatives. Would increase construction costs by more than 20 percent, which would be excessive given transportation budget constraints.	No
Full Cloverleaf Interchange with Collector-Distributor Roads ; enlarges the four loop ramps to meet current design standards and expands the frontage road system between ramps to eliminate weaving conflicts on mainline US 6; maintains off-ramp and expands frontage road in NE quadrant	No. Not prudent (i). Does not meet purpose and need to improve pedestrian and bicycle safety because pedestrians and bicycles would still need to cross free-flow loop ramps in all quadrants of the interchange. Would result in highest number of relocations and greatest cost of options considered.	No
Diverging Diamond Interchange ; rare interchange type that would remove left turns in the intersection by requiring Wadsworth drivers to briefly cross opposite lanes of traffic at two crossover intersections; maintains off-ramp and frontage road in NE quadrant	No. Not prudent (i). Does not meet purpose and need for improved capacity on Wadsworth. Drivers are not accustomed to crossing opposing traffic, and they would likely slow down due to their uncertainty. Crossing in front of opposing traffic (even though opposing traffic is stopped) violates expectations.	No
Folded Diamond Interchange ; folds westbound US 6 to northbound Wadsworth onto loop ramp in NW quadrant for westbound US 6 to southbound Wadsworth traffic; maintains existing frontage road but removed off-ramp in NE quadrant	No. Not prudent (i). Does not meet purpose and need. Would increase congestion along US 6 and at the US 6/Wadsworth interchange because all northbound and southbound Wadsworth traffic from westbound US 6 would exit at one location, and the deceleration lane would not be long enough to handle queues. Operational efficiency of the consolidated loop ramp exit would be compromised to the point that the loop ramp would not function as a free-flow ramp. A signal would be required for northbound Wadsworth, and a double-lane exit ramp would be inefficient and potentially confusing to drivers.	Yes
Close frontage road in NE quadrant and reconstruct interchange ; maintains an off-ramp in the NE quadrant but removes the frontage road and uses the frontage road area for off-ramp	No. Not prudent (iii). Would result in severe community disruption, as all properties along the frontage road, including historic properties, would need to be acquired because they would have no access.	No
Improve Kipling and/or Sheridan interchanges to divert Wadsworth traffic ; maintains existing Wadsworth interchange and focuses capacity improvements on the adjacent US 6 interchanges	No. Not prudent (i). Does not meet purpose and need for safety improvements at the Wadsworth interchange. Would not address traffic demands for access to destinations along Wadsworth or for north-south regional travel.	Yes

¹ As noted in Section 4.4, alternatives are defined as not prudent based on standards contained in 23 CFR 774.17. Where an alternative is deemed not prudent in Exhibit 4-2, the standard is noted. For instance if an alternative does not meet purpose and need, it is presented as "Not prudent (i)."

1 Because all feasible and prudent alternatives use land
2 from Section 4(f) resources, the next step in the
3 evaluation is to determine which alternative results in
4 the least overall harm to the 4(f) resources. The
5 discussion of least harm is presented in Section 4.6.3.

6 4.5 PARKS AND RECREATION RESOURCES

7 4.5.1 DESCRIPTION OF 4(f) RESOURCES

8 There is one Section 4(f) park resource within the
9 construction limits of the Build Alternative. Two Creeks
10 Park is a planned 3.35-acre recreational facility located
11 east of Wadsworth between 10th and 12th Avenues.
12 Only a small “finger” of the property associated with the
13 confined Dry Gulch drainage channel is adjacent to
14 Wadsworth. Dry Gulch runs through the southern
15 portion of the property. The boundaries of the park are
16 outlined in black in Exhibit 4-3.

17 EXHIBIT 4-3: BOUNDARIES OF TWO CREEKS PARK



18 The City of Lakewood acquired the Two Creeks Park
19 property in 2007. The acquisition was funded by
20 Jefferson County Open Space for the express use as a
21 park. The City Parks Manager identifies the planned
22 park as a significant recreation resource and envisions
23 developing trails and providing picnic tables to support
24 recreational use of the property (CH2M HILL, 2009g).

25 The property is not currently used for recreation or park
26 purposes, and Lakewood has neither a specific plan
27 nor funds to develop the property in the next 5 years.
28 The park is not reflected either in Lakewood’s
29 Comprehensive Plan or the adopted Neighborhood
30 Plan, yet both plans identify the need for a park in the
31 area. Although not formally designated in planning
32 documents as a park, FHWA determined that the Two
33 Creeks Park does qualify as a Section 4(f) recreation

34 resource because the property acquisition is recent,
35 the need for a park in the area is documented in land
36 use plans, the acquisition is expressly for a park, and
37 budgetary limitations, not intent, require development
38 of the park to be phased.

39 4.5.2 DE MINIMIS IMPACTS

40 Impacts to the proposed park area are associated with
41 replacing the Dry Gulch box culvert under Wadsworth.
42 The existing culvert (Exhibit 4-4) is undersized to carry
43 a 100-year flood and must be widened; it must also be
44 lengthened to accommodate the widened Wadsworth
45 roadway section.

46 EXHIBIT 4-4: DRY GULCH CULVERT



47 The new culvert would extend farther into the park
48 property, incorporating an additional 0.11 acre of the
49 drainage channel, resulting in a Section 4(f) use.
50 These impacts would not adversely affect the future
51 activities, features, or attributes of the planned Two
52 Creeks Park. The affected land could not support
53 active recreation because of the confined channel.

54 4.5.3 CONSULTATION AND COORDINATION

55 The project team has coordinated with Lakewood and
56 the Urban Drainage and Flood Control District. Each
57 contributed to the design of the Build Alternative and
58 recommended drainage improvements in the area of
59 the planned Two Creeks Park. Lakewood concurs that
60 expansion of the culvert would not adversely affect the
61 activities, features, and attributes that qualify Two
62 Creeks Park for protection under Section 4(f).

63 Public comments on the impacts to the planned park
64 will be solicited at the EA public hearing. After
65 consideration of public input, FHWA will make a final
66 determination on this *de minimis* finding.

4.6 HISTORIC RESOURCES

The US 6/Wadsworth project would require use of property from eight Section 4(f) historic resources. Four additional historic properties are present within the area of potential effect but have no Section 4(f) use. Section 3.8 of the EA contains additional information on all historic resources.

4.6.1 DE MINIMIS IMPACTS

The Build Alternative would result in *de minimis* impacts to two individual historic properties and two historic districts. The properties are illustrated in Exhibit 4-5, and impacts are summarized in Exhibit 4-6. Based on concurrence with the determinations of No Adverse Effect for these four Section 4(f) resources, FHWA has informed SHPO of its intent to make *de minimis* impact determinations.

EXHIBIT 4-5: HISTORIC PROPERTIES WITH DE MINIMIS IMPACTS



5JF4511



5JF4513



Lakewood School Historic District
(contributing building)



Green Acres Historic District
(contributing building)

EXHIBIT 4-6: SUMMARY OF *DE MINIMIS* IMPACTS FOR SECTION 4(f) HISTORIC RESOURCES

Site Number	Address	Date	Description	NRHP Eligibility	Impact
5JF4511	1215 Wadsworth Blvd.	1918, 1948/1949	Dutch Colonial Revival single-family residence	Officially eligible, Criterion A, association with Lakewood's agricultural history	Partial acquisition (0.08 acre) of historic property frontage
5JF4513	1230 Wadsworth Blvd.	1928	Craftsman Bungalow residence converted into a business	Officially eligible, Criterion C, representative architecture	Acquisition of portion of property (0.03 acre) that does not contribute to historic significance
Lakewood School Historic District	West of Wadsworth to Allison Street between 10th and 12th Avenues	1927 to 1977	Public school complex	Officially Eligible Historic District, Criteria A and C as early public school campus in Jefferson County, association with community development, period architecture	Acquisition of a portion of property adjacent to Wadsworth (0.20 acre) that does not contribute to historic significance; no buildings or contributing landscape features affected
Green Acres Historic District	North of US 6 to 9th Place between Emerald Lane and Reed Street	Late 1940s to early 1960s	Post-World War II residential subdivision	Officially Eligible Historic District, Criteria A and C for association with the development of Lakewood and as a representative post-World War II subdivision	Construction of noise wall near south and west boundaries of the district; permanent easement required from corner of one contributing property; beneficial effects of restoration of neighborhood roads and reduction in traffic noise

4.6.2 DIRECT USES

Under all feasible and prudent alternatives, four historic homes would be directly used. Photographs of these resources are presented in Exhibit 4-7. They are described briefly below, with additional details available in the *Historic Resources Survey* (TEC, 2008), included in Appendix C.

- ◆ **Property 5JF3548** (7395 W. 6th Ave. Frontage Road) is a one-story, single-family house built in 1946. It is eligible for listing in the NRHP under Criterion C for its representative English Norman Cottage architecture.
- ◆ **Property 5JF3549** (7423 W. 6th Ave. Frontage Road) is a one-story, single-family residence built in 1939. It is eligible for listing in the NRHP under Criterion C because it is representative of the Mediterranean Revival architectural style.
- ◆ **Property 5JF4542** (7433 W. 6th Ave. Frontage Road) is a one-story, single-family house built in 1940. It is eligible for listing in the NRHP under Criterion C because it is representative of the Minimal Traditional architectural style.
- ◆ **Property 5JF4536** (700 Wadsworth Blvd.) is a one-story residence that has been converted to commercial use. It was constructed in 1947 and is eligible for listing in the NRHP under Criterion C because it is a good example of a late 1940s residence that blends the Ranch and Usonian architectural styles.

EXHIBIT 4-7: SECTION 4(f) HISTORIC PROPERTIES WITH DIRECT USE



5JF3548



5JF3549



5JF4542



5JF4536

As summarized in Exhibit 4-8, all feasible and prudent interchange design concepts require use of these four historic properties. The use is the same for all because they share two primary features: the need for a longer deceleration lane for the westbound off-ramp on US 6 and the need for an improved frontage road connection to Wadsworth in the northeast quadrant of the interchange.

EXHIBIT 4-8: SUMMARY OF DIRECT USES OF SECTION 4(f) HISTORIC RESOURCES

Historic Property	Tight Diamond with Loop	Traditional Diamond	Tight Diamond	SPUI	Partial Cloverleaf	Relative Net Harm
5JF3548	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Equal
5JF3549	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Equal
5JF4542	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Equal
5JF4536	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Total acquisition and demolition of building	Equal

4.6.3 LEAST HARM ANALYSIS

The Section 4(f) regulation states that, if there is no feasible and prudent alternative that avoids use of Section 4(f) properties, FHWA “may approve only the alternative that causes the least overall harm in light of the statute's preservation purpose.” In determining the alternative that causes the overall least harm, the following factors must be balanced (23 CFR 774.3):

- i) The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property);
- ii) The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection;
- iii) The relative significance of each Section 4(f) property;
- iv) The views of the official(s) with jurisdiction over each Section 4(f) property;
- v) The degree to which each alternative meets the purpose and need for the project;
- vi) After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f); and
- vii) Substantial differences in costs among the alternatives.

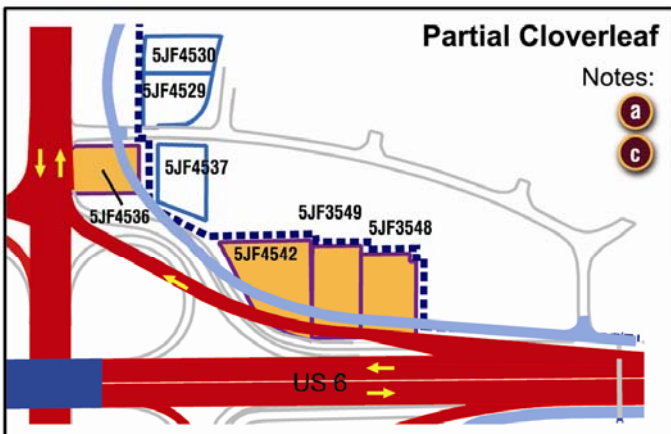
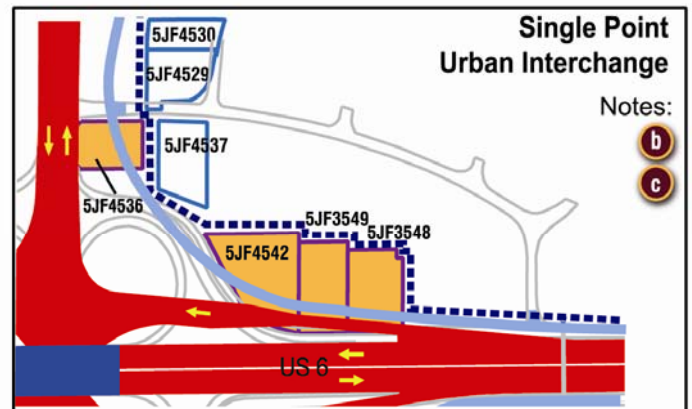
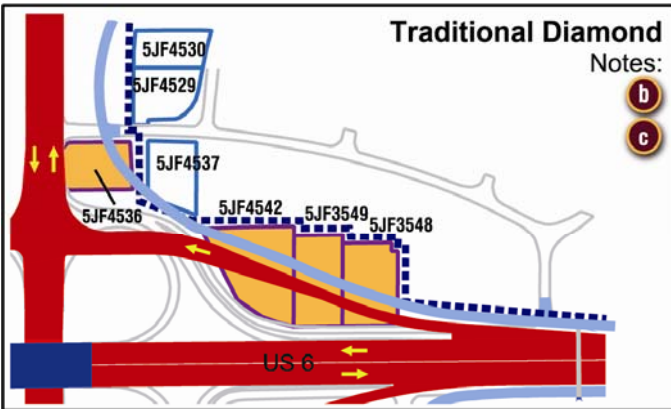
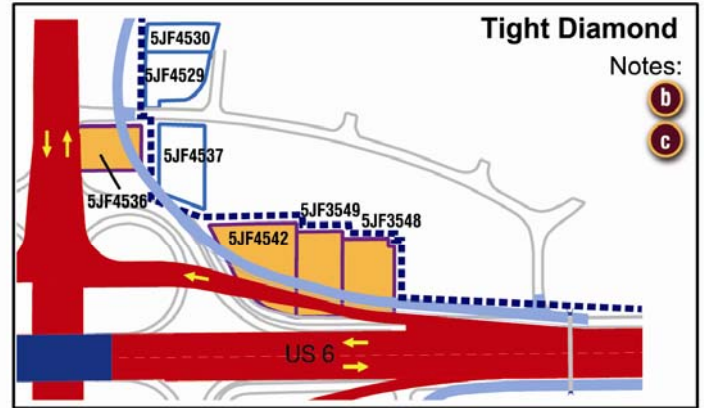
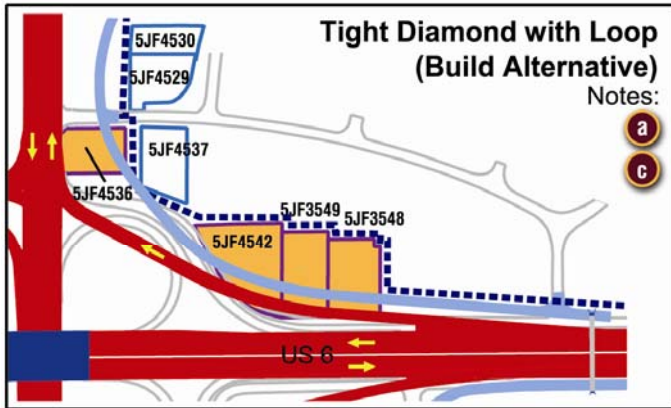
Exhibit 4-8 summarizes the uses associated with the feasible and prudent alternatives. Each requires total acquisition and demolition of the same four historic properties.

As illustrated in Exhibit 4-9, the three historic properties currently located on the frontage road (5JF3548, 5JF3549, and 5JF4542) would need to be acquired under each of the five options due to the requirements for the off-ramp design. The traditional diamond has the greatest encroachment into the historic properties because it shifts the ramp intersection with Wadsworth farther north. Despite slight differences in the design footprints, all alternatives require relocation of the primary residence. The tight diamond and single-point urban interchange (SPUI) alternatives intersect Wadsworth closer to US 6 but require a signal at Wadsworth and, therefore, need a wider, multi-lane intersection for vehicle storage on the ramp. The partial cloverleaf and tight diamond with loop alternatives require only a single lane intersection with Wadsworth but intersect Wadsworth farther north.

Site 5JF4536 (at the intersection of the frontage road and Wadsworth) would need to be acquired to widen Wadsworth and add an auxiliary lane for merging, which are features common to all of the alternatives.

Because the direct use is similar, many of the factors for least harm do not apply to the project (that is, factors i through iv). The Tight Diamond with Loop is determined to be the least harm alternative based on factors v, vi, and vii. It best meets the project's purpose and need, does not result in significant adverse impacts to other resources not protected by Section 4(f), and is not substantially more expensive than the other alternatives.

EXHIBIT 4-9: LEAST HARM ANALYSIS



LEGEND

	New Structure		Contributing to Historic District
	Existing Structure/Road		Individually Eligible for the NRHP
	Interchange		Total Acquisition
	New Frontage Road		Historic District Boundary

- a** Left turns for southbound traffic are handled through the loop ramp, and the auxiliary lane allows free-flow right turns for northbound traffic. The free-flow turn requires only a single lane to the intersection, resulting in a narrower footprint in the vicinity of historic properties.
- b** Multi-lane intersection required for vehicle queuing at Wadsworth traffic signal has larger footprint and encroaches farther into Section 4(f) properties. Need for wider intersection (more lanes) and proper intersection geometry (perpendicular rather than skewed) pushes frontage road through properties.
- c** Widening of Wadsworth to add northbound auxiliary merging lane for off-ramp requires acquisition of 5JF4536 regardless of frontage road configuration.

4.6.4 MEASURES TO MINIMIZE HARM

Before approving an action requiring use of any Section 4(f) property, FHWA is required to “include all possible planning to minimize harm” in that action. According to 23 CFR 774.17, “all possible planning means that all reasonable measures identified in the Section 4(f) evaluation to minimize harm or mitigate for adverse impacts and effects must be included in the project.” For historic sites, mitigation measures are generally identified through the Section 106 consultation process (36 CFR 800).

To determine if impacts could be avoided, minimized, or reduced while still maintaining a design that meets safety, capacity, and multimodal needs, interchange design elements of the Build Alternative that resulted in impacts to historic properties were considered carefully. As illustrated in Exhibit 4-10, the following design elements were evaluated:

- ◆ Location of the gore area (the area needed for cars to recover if they miss the exit) for the westbound US 6 off-ramp;
- ◆ Location of the taper area (speed change transition area where pavement width increases or decreases as cars enter or exit a traffic stream) for the westbound US 6 off-ramp;
- ◆ Distance of separation between the frontage road and off-ramp;
- ◆ Length of the deceleration lane for the loop ramp; and
- ◆ Inclusion of an auxiliary or add lane on Wadsworth associated with the northeast off-ramp.

As described in Exhibit 4-10, none of these design elements could be modified enough to avoid impacts to historic properties without compromising the purpose and need for the project.

In addition to modifying design elements, the project team evaluated moving the houses at historic properties 5JF3548, 5JF3549, and 5JF4542 farther back on their existing lots and maintaining the properties in residential use rather than demolishing the buildings. After evaluating this option, CDOT determined that moving the houses is not a practicable avoidance or minimization measure. Moving the properties would diminish the historic integrity of the resources to the point that they would no longer be eligible for listing in the NRHP (and thus, the properties would no longer qualify for Section 4(f) protection) and, therefore, would not minimize harm to these properties.

While measures to avoid, minimize, or reduce impacts to the four historic properties could not be incorporated into the project, compensatory mitigation measures for demolishing the properties have been included in a Memorandum of Agreement (MOA) among CDOT, FHWA, Colorado SHPO, and Lakewood. This MOA was prepared in accordance with the Section 106 consultation process. Mitigation measures focus on those that will add to the local historical record and support Lakewood’s historic preservation goals, including an interpretive sign and educational website. The MOA is expected to be finalized before CDOT and FHWA make a final decision about the US 6/Wadsworth project.

EXHIBIT 4-10: DESIGN FEATURES OF THE TIGHT DIAMOND WITH LOOP INTERCHANGE AND CONSIDERATION OF IMPACTS TO SECTION 4(f) RESOURCES

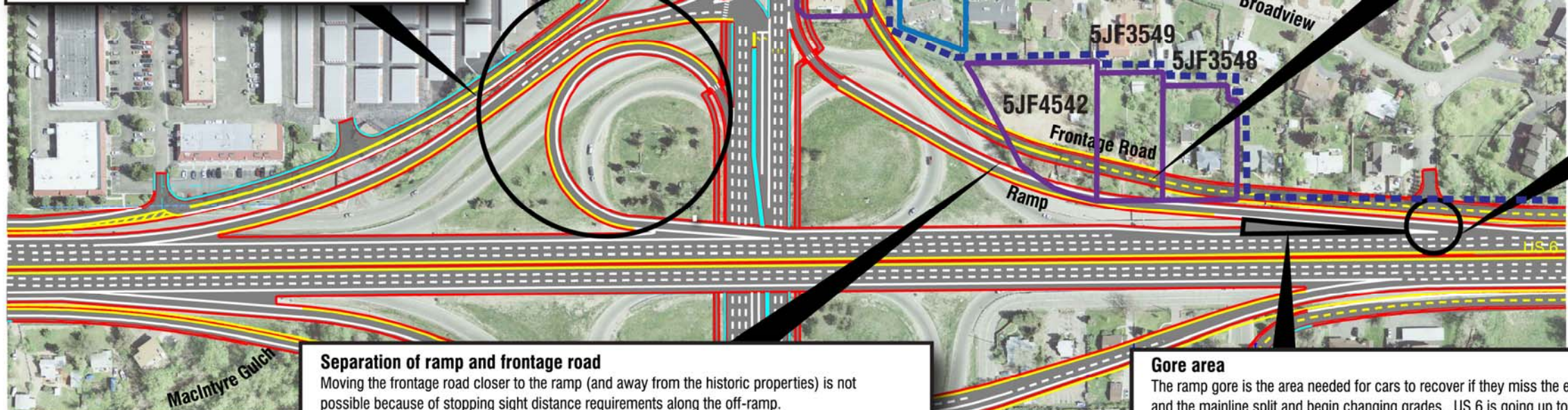
Fourth lane add for Wadsworth between off ramp and Highland Drive
 The fourth northbound lane on Wadsworth is needed to receive the dedicated right turn lane from the westbound to northbound exit ramp to ensure safety and avoid traffic operation issues on US 6 and Wadsworth.

Without a fourth northbound receiving lane:

- A single lane yield would create a queue on the ramp that extends to US 6 mainline. It would increase the probability of rear end collisions because of reduced stopping sight distance. Vehicles traveling at high speed on US 6 would have to stop in the through lanes.
- A signalized two-lane right turn would solve the queuing to US 6 and rear end collision problems but would adversely affect Wadsworth traffic, increasing congestion along Wadsworth as northbound through traffic would stop at an additional signal.

Radius of Loop Ramp
 Increasing the design speed of the loop ramp to 30 mph would reduce the required deceleration length on US 6 from 550 to 520 feet allowing the gore nose to move closer to Wadsworth to reduce impacts to historic properties. (However, the gore nose is controlled more by the grade issues than by the deceleration length of the loop ramp.)

- Radius of loop would increase from 150 to 231 feet
- Loop ramp is designed at 25 mph; 30 mph was desirable but resulted in significant property impacts in the northwest quadrant, including relocation of a large public storage area and office park, and McIntyre and Lakewood gulches. This resulted in significant impacts to waters and wetlands regulated by the Clean Water Act.



- Contributing to Green Acres Historic District
- Individually eligible for the NRHP
- Historic District Boundary

Separation of ramp and frontage road
 Moving the frontage road closer to the ramp (and away from the historic properties) is not possible because of stopping sight distance requirements along the off-ramp.

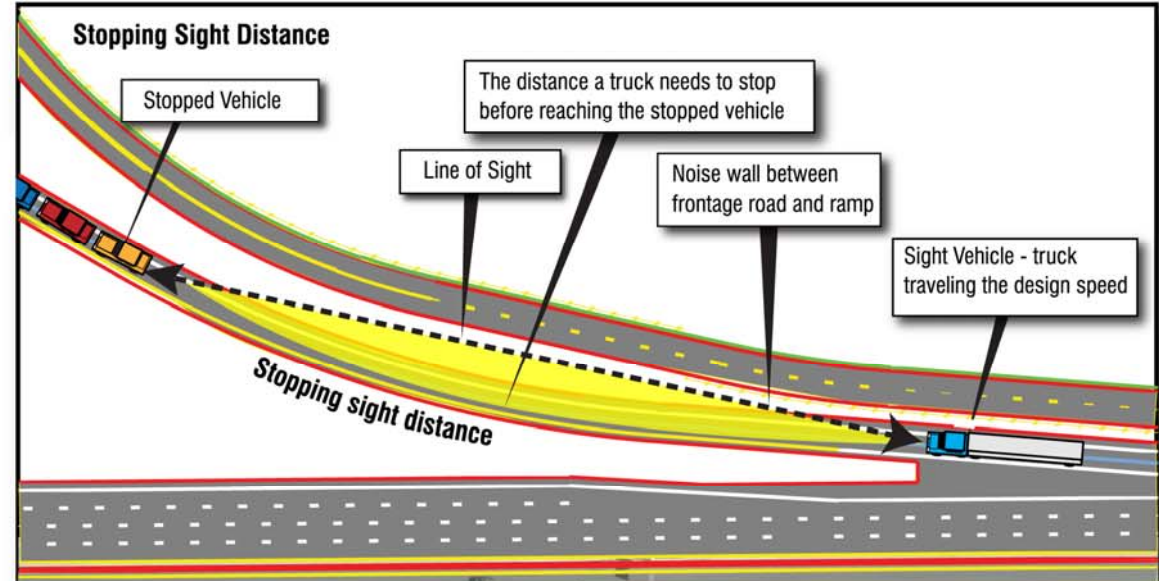
- If the frontage road were closer to the ramp, the roadway would create an obstruction blocking the line of sight for drivers exiting US 6 (see stopping sight distance illustration). Reducing speeds of the ramp to reduce sight distance requirement would cause queuing on US 6, which would not meet purpose and need and, therefore, not be prudent.

Move ramp closer to US 6

- Ramp could be moved closer to US 6 at the west end but not enough to save the historic properties, the gore nose location still controls the eastern end of the ramp (where 5JF 3548 is located).

Gore area
 The ramp gore is the area needed for cars to recover if they miss the exit. The end of the gore, or gore nose, is the point where the ramp and the mainline split and begin changing grades. US 6 is going up to get over Wadsworth, and the ramp is going down to meet Wadsworth.

- The off-ramp has been designed to minimize impacts to 5JF3548. Moving the gore west would raise its elevation and require a longer ramp to get back down to Wadsworth and move the merging intersection with Wadsworth north, decreasing the merge distance of the fourth lane.
- Moving the gore nose to the west also would impact the deceleration length for the westbound US 6 to southbound 25 mph Wadsworth loop ramp. Shortening the deceleration length would be possible if the loop was a higher design speed but the higher speed requires a larger loop creating significant additional property impacts (see Radius of Ramp Loop discussion).



Taper for off-ramp
 The length of the taper is controlled by deceleration length requirements and alignment constraints.

- Deceleration length is based on the mainline US 6 design speed of 70 mph to ramp design speed of 50 mph.
- The angle of deflection and location of taper is based on horizontal geometric constraints created by US 6 increasing in elevation to go over Wadsworth. Because of the need to elevate US 6 bridge over Wadsworth, moving the Wadsworth off-ramp departure west, shortens the distance for the ramp to meet Wadsworth grade and results in either too steep a grade or extending the ramp into northbound Wadsworth traffic lanes (essentially eliminating any fourth add lane).