Appendix I

Aesthetics and Visual Resources Technical Study

Texas Department of Transportation

TEXAS-OKLAHOMA PASSENGER RAIL STUDY

Aesthetics and Visual Resources

Technical Study

Texas Department of Transportation

U.S. Department of Transportation Federal Railroad Administration

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Acronyms and Abbreviations

DUS	Dallas Union Station
EIS	environmental impact statement
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
GIS	geographic information system
IH-35	Interstate Highway 35
ITC	Intermodal Transportation Center
KCS	Kansas City Southern
mph	miles per hour
Program	Texas-Oklahoma Passenger Rail Program
Study	Texas-Oklahoma Passenger Rail Study
TRE	Trinity Railway Express
TxDOT	Texas Department of Transportation

1.0 Introduction

The Texas Department of Transportation (TxDOT), along with the Federal Railroad Administration (FRA), is preparing a service-level environmental impact statement (EIS) to evaluate intercity passenger rail service alternatives for the Texas-Oklahoma Passenger Rail Program (Program). The purpose of the Program is to enhance intercity mobility by providing enhanced passenger rail service as a transportation alternative that is competitive with automobile, bus, and air travel. Preparation of the service-level EIS, in support of which this technical study has been prepared, is one of two primary objectives of the Texas-Oklahoma Passenger Rail Study (Study). In addition to the service-level EIS, TxDOT and FRA are preparing a service development plan for the corridor to guide further development and capital investment in passenger rail improvements identified in the EIS Record of Decision. The Oklahoma Department of Transportation (ODOT) is a partnering state agency for the Study and the EIS.

The 850-mile corridor analyzed for the Study runs north-south and roughly parallels Interstate Highway 35 (IH-35), with the northern point in Edmond, Oklahoma (i.e., northern end of the Oklahoma City portion of the corridor), and the southern end in south Texas, potentially in Corpus Christi, Brownsville, Laredo, or the Rio Grande Valley, as shown on Figure 1-1. For this service-level analysis, a preliminary alignment was developed to represent each EIS alternative, based on conceptual engineering that considered and avoided obvious physical or environmental constraints. These alignments were not refined to optimize performance, reduce cost, avoid specific properties or individual environmental resources, or for any other such considerations. If an alternative is selected at the service-level for further development, the above considerations would be assessed at the project level. For the service-level EIS, a broad corridor of study with a width of 500 feet has been identified along each route for most environmental resources being analyzed.[1] The 500 foot-wide EIS Study Area corridor provides an envelope that could accommodate areas for associated effects, including necessary roadway shifts, grade separations, construction activities, and affiliated features such as stations and parking, traction-power substations, power lines, and maintenance-of-way facilities. This corridor is composed of areas 500 feet on either side of the preliminary alignment and is the area used to identify aesthetic and visual resources that could be potentially affected by the build alternatives. Typically, county-wide data were collected for counties partially or completely within the Study Area.

The analysis provides quantitative information about aesthetic and visual resources within the EIS Study Area for each alternative and compares it against the No Build Alternative and other build alternatives in the same geographic region. The discussion of effects also provides qualitative differences in permanent, temporary, and direct and indirect effects that are associated with the service type (conventional rail, higher-speed rail, or high-speed rail) relative to the environmental context. However, because the 500-foot EIS Study Area does not represent the actual footprint of operation or construction phases, the analysis is primarily comparative, based on the presence of

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[1] Other environmental resource issues, such as transportation, air quality, and noise and vibration, also use broader study areas to determine impacts.

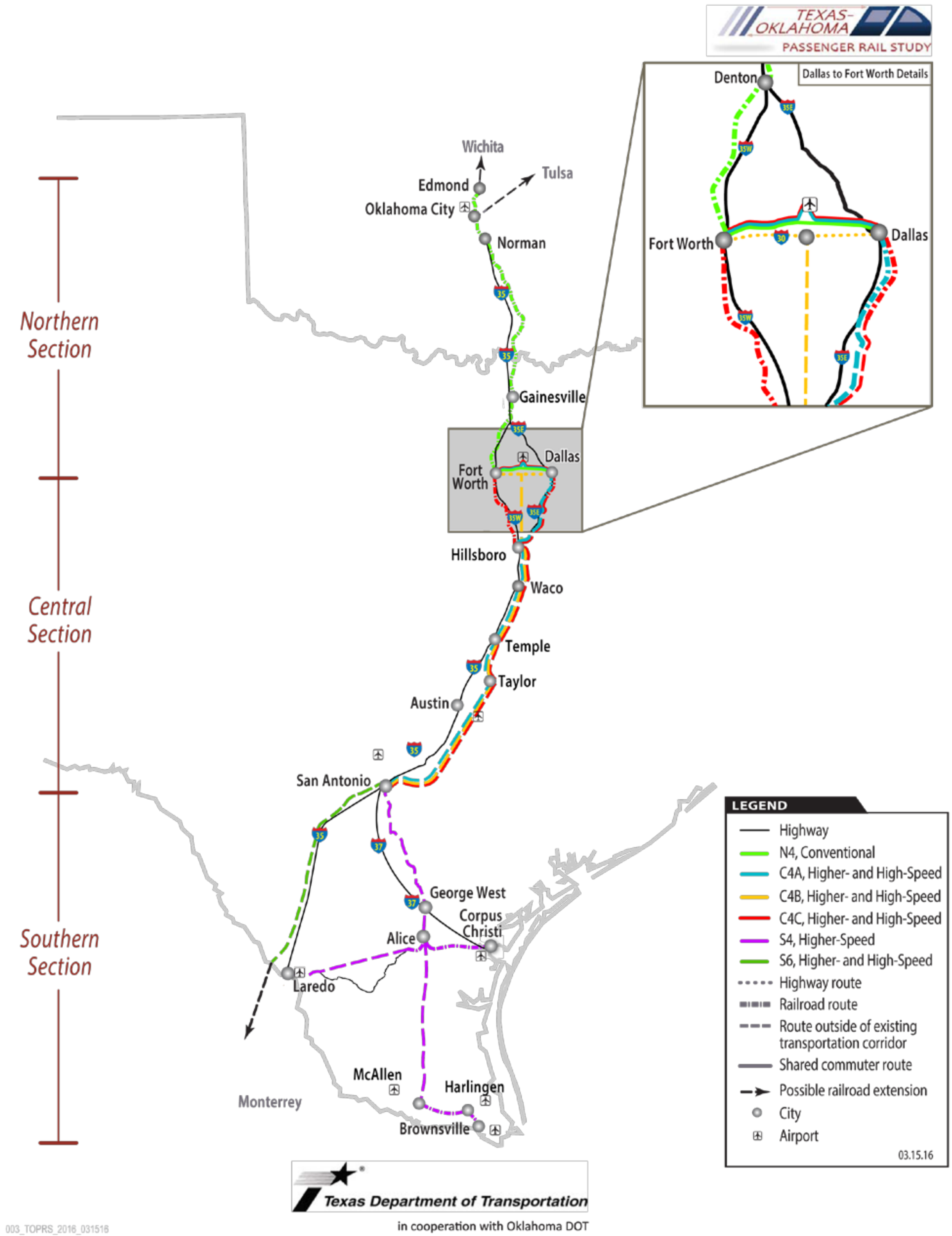

Figure 1-1: Build Alternatives

the resources within the EIS Study Area and the likelihood of effects as appropriate for this service-level analysis.

The build alternatives are divided into the following three geographic sections based on the key regional markets that could be served by passenger rail improvements:

- Northern Section: Oklahoma City to Dallas and Fort Worth
- Central Section: Dallas and Fort Worth to San Antonio
- Southern Section: San Antonio to South Texas

In addition, the alternatives consist of both a route, which refers to the specific corridor that a potential alignment follows, and a service type, which refers to the speed or category of rail transportation (conventional rail, higher-speed rail, or high-speed rail). The alternatives that have been carried forward for analysis in the EIS, including their geographic sections, routes, and service types, are listed in Table 1-1.

Table 1-1: Alternatives Carried Forward for Further Evaluation

Route	Service Type[a]
Northern Section	
N4A	CONV
Central Section	
C4A	HrSR
	HSR
C4B	HrSR
	HSR
C4C	HrSR
	HSR
Southern Section	
S4	HrSR
S6	HrSR
	HSR

[a] CONV = conventional rail (up to 79 to 90 miles per hour [mph]); HrSR = higher-speed rail (up to 110 to 125 mph); HSR = high-speed rail (up to 220 to 250 mph)

The route alternatives were based on the alignments of existing transportation networks with corridors potentially suitable for passenger rail operations[2] (i.e., the existing railroad network and the existing interstate highway network) or they were located on new alignments outside existing transportation corridors. Potential alignments described as "following" railway corridors share existing tracks, are located within an existing right-of-way, or are generally adjacent to existing tracks, depending on the service type. Alternatives that are outside the existing transportation corridor could have greater direct and indirect effects than those located in the existing transportation corridor; for example, alternatives outside existing corridors could divide neighborhoods or wildlife communities or create a potential new barrier.

1.1 Service Type Descriptions

The three service types (conventional rail, higher-speed rail, and high-speed rail) considered in this EIS are described below.

1.1.1 Conventional Rail

Conventional rail typically includes diesel-powered, steel-wheeled trains operating on steel tracks. Roadway crossings may be grade-separated depending on the type of roadway and amount of traffic, and rail rights-of-way may be fenced. Conventional rail would be operated at speeds up to 79 to 90 miles per hour (mph) and would mostly use existing railroad rights-of-way. For conventional rail alternatives, existing railroad track may be used, or in some cases, modifications such as double-tracking could be constructed within the existing right-of-way to accommodate additional trains.

1.1.2 Higher-Speed Rail

Higher-speed rail is similar to conventional rail in several respects. In many cases, higher-speed rail trains can run on the same steel tracks that support conventional rail, but higher speeds can require improvements such as upgrading wooden ties with concrete ties, improving signaling, and upgrading roadway crossings. In this case, higher-speed rail trains are assumed to be diesel-powered. Higher-speed rail would be operated at speeds up to 110 to 125 mph. Where proposed within an existing railroad right-of-way, a shared right-of-way with separate tracks for freight and passenger services would be constructed. Because of its maximum speed and because train frequency would be similar to conventional rail, higher-speed rail could operate on a single track with passing locations and would not require double-tracking. Where higher-speed rail is proposed outside an existing transportation corridor, the new alignment would be designed with curves and other features that could accommodate high-speed rail service if warranted by ridership and economically feasible in the future. However, unlike high-speed rail, the design would not include electrification or a full double track, and some grade crossings would remain.

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[2] The term "operations" includes maintenance of the facilities as well.

1.1.3 High-Speed Rail

High-speed rail includes electric trains powered by an overhead power supply system. Train sets are steel wheel on steel rail, but are designed to operate at high speeds with an aerodynamic shape, and suspension and braking systems are designed for high-speed travel. High-speed rail would be operated at speeds up to 220 to 250 mph. The entire right-of-way would be fenced and fully grade-separated. The alignment would be electrified and double-tracked. This service type could only reach its maximum speeds outside existing transportation corridors because existing railroad alignments are not compatible with the speeds required and they do not have the required space for separation of freight and high-speed rail. In areas where this service type is within existing transportation corridors, it would operate at lower speeds.

1.2 Alternative Descriptions

For this service-level analysis, a preliminary alignment was developed to represent each route alternative, based on conceptual engineering that considered obvious physical or environmental constraints. They are not detailed alignments that have been refined to optimize performance, reduce cost, avoid specific properties or individual environmental resources, or similar considerations, which would be assessed at the project-level phase for alternatives carried forward for further analysis.

The alternatives evaluated in the service-level EIS, shown on Figure 1-1, have been developed to a level of detail appropriate for a service-level analysis: the route alternatives represent a potential corridor where rail improvements could be implemented but do not specify the precise location of the track alignment. When a route is refined to include a service type (conventional, higher-speed, or high-speed rail), it is then referred to as an alternative. Alternatives in the Northern, Central, and Southern sections could be built as individual, stand-alone projects or in combination with alternatives in another section. In addition, more than one alternative in the Central Section and Southern Section could be built in the future because the alternatives provide different service types for independent destinations. Details on connecting the alternatives would be determined during project-level studies.

Potential alignments are described below in terms of nearby transportation corridors and cities.

The Southern Section alternatives include a potential extension to Monterrey, Mexico. The EIS evaluates alignment corridors only within the United States; however, the potential extension to Monterrey has been included for ridership analysis purposes, and FRA and TxDOT have initiated coordination with the Mexican government about the potential extension.

1.2.1 No Build Alternative

The No Build Alternative would not fulfill the Program's purpose and need but is carried forward as a baseline alternative against which the build alternatives are compared. The No Build Alternative would consist of the existing transportation network, including roadway, passenger rail, and air travel in the Study Vicinity and committed improvements to these systems. The No Build Alternative includes existing and planned roadway, passenger rail, and air travel in the Study Vicinity (including operation, maintenance, and expansion). Information was collected from current regional transportation plans within the Study Vicinity and websites describing services such as train schedules. These improvements and their evaluation at this service-level stage would require project-specific assessment.

1.2.2 Northern Section: Oklahoma City to Dallas and Fort Worth

Due to feasibility based on initial ridership and cost information, only one route alternative with one service type was considered feasible in the Northern Section: Alternative N4A with conventional rail.

1.2.2.1 Alternative N4A Conventional Rail

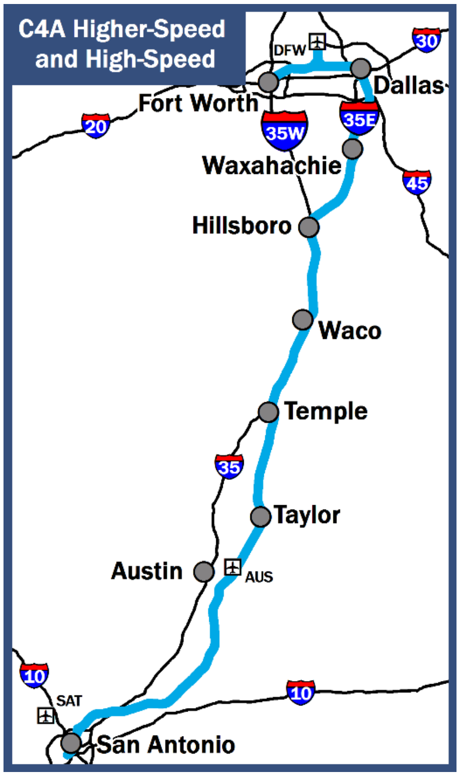
Alternative N4A would begin in Edmond, Oklahoma, and follow the BNSF rail alignment south to Oklahoma City. The alternative would continue south along the BNSF rail alignment to Norman, Oklahoma; through Metro Junction, near Denton, Texas; and on to Fort Worth (as does the Heartland Flyer). From Fort Worth, the alternative would continue east to Dallas following the Trinity Railway Express (TRE) tracks. From Edmond to Dallas, the route would be approximately 260 miles long. Because existing freight traffic would not preclude passenger service along this section of track, the route would provide passenger rail service on the existing BNSF track, with potential improvements within the existing BNSF right-of-way.

Alternative N4A would provide several improvements over the existing Heartland Flyer service. Alternative N4A would increase the number of daily round trips along this route (the Heartland Flyer currently offers one round trip per day), and the N4A route would extend from Fort Worth to Dallas without requiring a transfer (the Heartland Flyer service currently terminates in Fort Worth). In addition, Alternative N4A would provide improvements to existing station facilities and new train equipment with more onboard amenities, including business class available for a premium price.

Alternative N4A assumes diesel-locomotive hauled equipment running three to six daily round trips. Two or three of the round trips would operate on an accelerated schedule, making roughly seven stops, with the remaining local trains making up to 12 stops.

1.2.3 Central Section: Dallas and Fort Worth to San Antonio

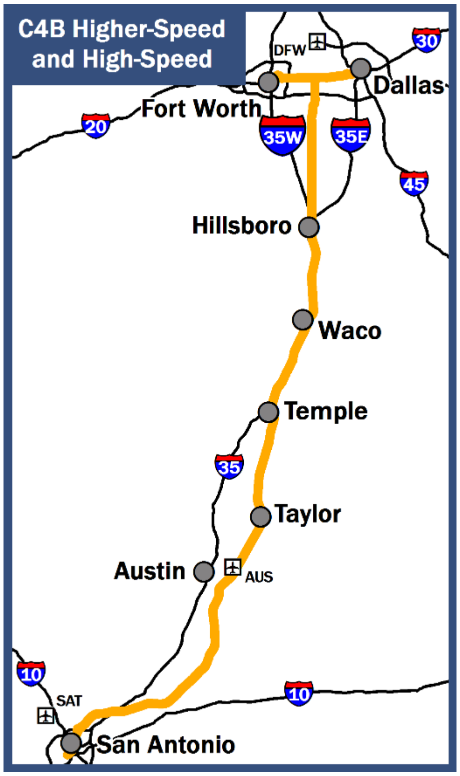
Three route alternatives, each with higher-speed and high-speed rail options, were evaluated in the Central Section: Alternatives C4A, C4B, and C4C.



The Central Section alternatives would provide several improvements over the existing Texas Eagle service in this corridor. All of the alternatives would increase the number of daily round trips along this route (the Texas Eagle currently offers one round trip per day), The high-speed rail options would provide faster service between Dallas and Fort Worth and Antonio — 2 hours versus 8 hours for the Texas Eagle Service. In addition, the Central Section alternatives would provide improvements to existing station facilities and new train equipment.

1.2.3.1 Alternative C4A Higher-Speed and High-Speed Rail

Alternative C4A would begin in Fort Worth and follow the TRE tracks east to Dallas. From Dallas, it would follow the BNSF alignment south toward Waxahachie where it would enter a new alignment outside existing highway and rail corridors to accommodate maximum operating speeds. Though outside existing transportation corridors, the southern portion of Alternative C4A would generally follow the BNSF alignment for about 250 miles, traveling south from Waxahachie through Hillsboro, Waco, Temple, Taylor, and Austin to San Antonio.



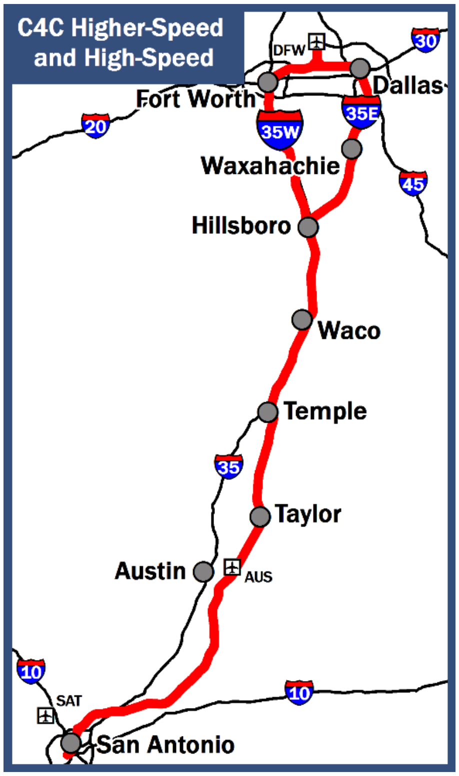
Alternative C4A Higher-Speed Rail assumes new high-performance diesel-locomotive hauled equipment running six to 12 daily round trips. Express trains would likely make seven stops, and local trains would make up to 12 stops.

Alternative C4A High-Speed Rail assumes true electric-powered, high-speed service running 12 to 20 daily round trips. Express trains would likely make six stops, and local trains would make up to nine stops.

1.2.3.2 Alternative C4B Higher-Speed and High-Speed Rail

Alternative C4B would serve both Fort Worth and Dallas, with trains following a new elevated high-speed rail alignment over IH-30. In Arlington (between Dallas and Fort Worth), the alternative would turn south to Hillsboro on an alignment outside existing transportation corridors. The alternative would then follow the same high-speed rail alignment as Alternative C4A from Hillsboro to San Antonio.

Alternative C4B Higher-Speed Rail assumes new high-performance diesel-locomotive hauled equipment running six to 12 daily round trips. Express trains would likely make seven stops, and local trains would make up to 12 stops.



Alternative C4B High-Speed Rail assumes true electric-powered, high-speed service running 12 to 20 daily round trips. Express trains would likely make six stops, and local trains would make up to eight stops.

1.2.3.3 Alternative C4C Higher-Speed and High-Speed Rail

Alternative C4C would follow the same potential alignment as Alternative C4A from Fort Worth east to Dallas and south to San Antonio, but would include a link from Hillsboro directly to Fort Worth parallel to the UPRR alignment. Service on the Alternative C4C route would operate in a clockwise direction, running from Hillsboro to Fort Worth, to Dallas, back to Hillsboro, and south to San Antonio in order to serve Fort Worth directly (while also being compatible with the general service for Alternative C4A).

Alternative C4C Higher-Speed Rail assumes new high-performance diesel-locomotive hauled equipment running six to 12 daily round trips. Express trains would likely make seven stops, and local trains would make up to 12 stops.

Alternative C4C High-Speed Rail assumes true electric-powered high-speed service running 12 to 20 daily round trips. Express trains would likely make six stops, and local trains would make up to nine stops.

1.2.4 Southern Section: San Antonio to South Texas

Two route alternatives were evaluated in the Southern Section: Alternative S4, with higher-speed rail, and Alternative S6, with higher-speed and high-speed rail options.

1.2.4.1 Alternative S4 Higher-Speed Rail

Alternative S4 Higher-Speed Rail would begin in San Antonio and travel southeast along the UPRR alignment to George West, where it would continue outside existing transportation corridors to Alice. At Alice, the alternative would divide into three legs at a stop. The first leg would travel west along the Kansas City Southern (KCS) Railway to San Diego, Texas; it would then travel outside existing transportation corridors to east of Laredo in an alignment that would allow higher speeds and rejoin the KCS Railway to enter the highly developed Laredo area. The second leg would travel south along abandoned railroad tracks to McAllen and east to Harlingen and Brownsville. The third leg would travel east along the KCS Railway to Corpus Christi.

Alternative S4 Higher-Speed Rail assumes new high-performance diesel-locomotive hauled equipment running four to six daily round trips. Depending on corridor demand model forecasts, the primary service may be designated as Laredo-Alice-San Antonio and Corpus Christie-Alice-San Antonio, with a connecting feeder from Brownsville, Harlingen, and McAllen.

1.2.4.2 Alternative S6 Higher-Speed and High-Speed Rail

Alternative S6 would begin in San Antonio and travel south on a new alignment outside existing transportation corridors to a station near the Laredo-Columbia Solidarity Bridge, which crosses the Rio Grande north of Laredo. The alternative would then cross on a new railway bridge to join a new rail line being constructed in Mexico, which would continue to Monterrey. This study only examines the physical effects of the U.S. component of this new line, but it does consider the ridership effect of such a connection.

Alternative S6 Higher-Speed Rail assumes new high-performance diesel-locomotive hauled equipment running four to six daily round trips between San Antonio and Laredo, which would be the only U.S. stops for the alternative. If an extension from Laredo to Monterrey is added, the frequency of trips to Monterrey is assumed to be the same as those from San Antonio to Laredo.

Alternative S6 High-Speed Rail assumes true electric-powered, high-speed service running eight to 12 daily round trips between San Antonio and Laredo. If an extension from Laredo to Monterrey is added, the frequency of trips to Monterrey is assumed to be the same as those from San Antonio to Laredo.

1.2.5 Station Cities

The study does not evaluate specific station locations, and no conclusion about the exact location of stations will be made as part of the service-level EIS process. However, based on ridership data and transit connectivity information developed as part of the Alternatives Analysis (TxDOT 2014), and based on stakeholder input, the cities in which stations would most likely be located have been assumed. The size and design of stations would be appropriate for the service type and the route of the alternative. Cities that could have stations are listed in Table 1-2.

Table 1-2: Cities with Potential Stations

Oklahoma	
Edmond	Pauls Valley
Oklahoma City	Ardmore
Norman	
Texas	
Gainesville	Austin
Fort Worth	San Antonio
Arlington	Alice
Dallas	Corpus Christi
Waxahachie	Harlingen
Waco	McAllen
Temple (also serving Killeen)	Brownsville
Taylor	Laredo

2.0 Regulatory Context and Purpose

FRA's *Procedures for Considering Environmental Impacts* states: "The EIS should identify any significant changes likely to occur in the natural landscape and in the developed environment" (64 Federal Register 102). There are no applicable laws, regulations, or executive orders regarding the specific assessment of aesthetic and visual resources. Additional local and regional laws, regulations, and orders may be applicable and will be addressed in project-level analysis.

This technical study includes a corridor-level analysis of where the alternatives would have potential effects on visual and aesthetic resources associated with the natural landscape and developed environment. The analysis compares potential effects of the alternatives to assist in developing a preferred alternative. This technical study, prepared in support of a service-level EIS, does not include a detailed evaluation of potential effects on visual and aesthetic conditions, which would be associated with a project-specific environmental review.

3.0 Evaluation Methods

This assessment is generally based on the Federal Highway Administration (FHWA) visual assessment methodology. The FRA does not have specific visual assessment guidelines, and defers to the FHWA guidance for visual impact assessment. This methodology has been successfully applied by FHWA and state highway departments on a variety of transportation projects (such as rail), to evaluate impacts from these projects on visual and aesthetic resources. The FHWA methodology published in the *Visual Impact Assessment for Highway Projects* provides a systematic and objective approach to evaluating the visual changes that would potentially result from implementation of proposed projects (FHWA 1988). It should be noted that FHWA recently published new guidelines for visual impact assessment of highway projects (FHWA 2015) that suggested changes to the previous methodology. According to the new guidelines "State Departments of Transportation and other project sponsors may use an alternative approach and alternatives methodologies if the requirements of the applicable statutes and regulations are satisfied. Although not required, State Departments of Transportation and other project sponsors are encouraged to discuss proposed alternative approaches and alternative methodologies with the FHWA environmental staff in the Division office for the State wherein a proposed project is located, preferably during the scoping period of project development." Components of the guidelines may be used for the subsequent analysis after consultation with FHWA (see Section 7.0, Subsequent Analysis).

There are a few key steps in the FHWA approach that are common to all visual impact assessments: determining existing landscape character and visual quality; identifying sensitive viewers that may view the changes caused by the proposed project and where they are located; and determining what would be the change (enhancement or degradation) to existing landscape character and visual quality from a proposed project after application of avoidance and minimization measures. The following sections describe the approach used for project-specific environmental reviews and how it has been modified for this service-level assessment.

3.1 Characterizing Existing Aesthetic and Visual Conditions

Establishing the existing character and visual quality of the landscape a proposed project would pass through requires a detailed knowledge of the location. One of the first steps used in the FHWA assessment methodology to characterize the existing aesthetic and visual conditions is to establish a project's area of visual influence, which is composed of areas from which a proposed project could be seen. For this technical study the area of visual influence is considered to be the 500-foot-wide corridor that is used as the study area for aesthetic and visual resources.

Describing the landscape character and visual quality of the area in which a proposed project would be located is also an important step in describing existing conditions. Landscape character is an impartial description of the viewed landscape and is defined by relationships between existing visible natural and built landscape features. Visual quality is an assessment of the composition of the character-defining features and typically uses selected views, or key observation points, to depict and describe visual quality. The FHWA assessment methodology determines visual quality by considering the three visual characteristics that together establish visual quality. These three characteristics are described as follows:

- *Vividness* is the degree of drama, memorability, or distinctiveness of the landscape components. Vividness is composed of four elements that usually influence the degree of vividness: landform, vegetation, water features, and manmade elements.
- *Intactness* is a measure of the visual integrity of the natural and manmade landscape and their freedom from encroaching elements. This factor can be present in well-kept urban and rural landscapes, as well as in natural settings. High intactness means that the landscape is free of eyesores and is not broken up by features that appear to be out of place.
- *Unity* is the degree of visual coherence and compositional harmony of the landscape considered as a whole. High unity frequently attests to the careful design of individual components and their relationship in the landscape.

The FHWA assessment methodology uses a numeric rating system to assign values to these three characteristics, which together determine visual quality. For detailed assessments, visual quality is assigned a number from 1 to 7, with 1 representing the lowest visual quality, 4 average, and 7 representing the highest. Assigning values requires the use of specific views or key observation points near portions of projects for which there is enough engineering detail available to develop photographic-simulations of the proposed project for comparison to existing conditions. That level of detail is not available for service-level assessments; therefore, when existing visual quality is discussed in this technical study, it is discussed at a conceptual level as either low, medium, or high.

3.2 Approach Used for the Service-Level Assessment

This service-level assessment used a modified FHWA approach that depended heavily on qualitative descriptions of the areas where the alternatives would pass through. This approach was employed to characterize existing aesthetic and visual conditions and served as the basis for determining the potential effects of the alternatives. General descriptions of the aesthetic and visual characteristics of the areas the alternatives would pass through are included in Section 4.0, Baseline/Affected Environment. The characteristics of the landscapes are generally described in terms of human-built and/or natural landscape features. No specific views were used for any of the alternatives. A number of sources were consulted to assist in characterizing existing aesthetic and visual conditions, including the following:

- 3-D Google map applications
- Knowledge of the Oklahoma and Texas environment and landscape types
- Geographic information system (GIS) mapping data, which included aerial photographs

3.3 Characterizing and Locating Sensitive Viewers

The FHWA visual impact assessment system recognizes that a project would be seen by a variety of people (or viewer types) with different sensitivities to changes in the viewed environment or landscape. The degree of sensitivity (high, medium, or low) to changes in the viewed environment varies among viewer types and affects viewer response to changes associated with a proposed project. Viewer sensitivity is strongly influenced by a viewer's awareness of his or her surroundings, the activities they are engaged in, and the amount of time spent looking at a view (viewer duration). Table 3-1 identifies typical visual sensitivity categories (high, medium, low) and describes viewer types for each category.

Table 3-1: Typical Viewer Sensitivity Categories and Types

Sensitivity Category	Viewer Type	Justification for Categorization
High	Resident, park user, tourist, sightseeing	Viewers who seek scenic areas; surroundings are likely to influence their location choice and affect their overall experience of the place or their quality of life.
Medium	Office worker, business or retail customers, students, faculty, members of religious congregations	Viewers who expect a somewhat pleasant visual setting for the establishments; however, their focus is on daily activities other than viewing the landscape.
Low	Commuters, industrial workers	Viewers who cannot be attentive to the landscape because they are focusing on other activities and therefore are accustomed or indifferent to views.

A purpose of the technical study was to identify sensitive viewers along the routes of the alternatives to determine the likely effects of the alternatives on these sensitive viewers. Viewers with high viewer sensitivity would be most likely be affected. The assessment focused on residents but also considered other viewers with high sensitivity, such as park users and visitors to cemeteries. Four general types of sensitive viewers are found along the routes of the alternatives. The four types of areas containing sensitive viewers are described below. It should be noted that viewers who view a landscape that currently contains major transportation infrastructure (i.e., railroads or major highways) would likely be less sensitive to changes to the viewed landscape caused by a proposed project compared with viewers who do not currently view railroad or major highway corridors. The four types of sensitive viewers used in this technical study are described as follows:

- **Urban Residential**: Densely populated areas found in urban areas. These include multifamily buildings or dense groupings of single-family dwellings. In the EIS Study Area, many of the urban residential areas that the alternatives would be near are located along existing railroads or major highways that extend through urban areas.

- **Suburban Residential**: Less dense than urban residential areas and generally composed of single-family dwellings. They are generally found in suburban communities or residential areas of small towns. Similar to the urban residential areas, many suburban residential areas, particularly in small to mid-sized towns that were built along railroads lines, are also located in the vicinity of major transportation infrastructure that extends through the suburban areas.
- **Rural Residential**: Isolated rural residences are found throughout the EIS Study Area, as are clusters or concentrations of rural residences. Because there are many small, scattered areas containing clusters of rural residences in the EIS Study Area, selected areas were identified and used to represent potential effects on rural residential areas.
- **Other Areas with Sensitive Viewers**: In addition to residential viewers, people engaged in recreational activities and/or visiting cultural and/or historic sites, as well as cemeteries, are also frequently concerned with the appearance of the landscape surrounding the locations in which they are participating in activities. These people are also considered sensitive viewers.

The GIS data used in this technical study included aerial photographs along with 3D Google map applications to determine where along the routes of the alternatives the four sensitive viewer types were located. Features such as parks or cemeteries that were contained in the GIS data and observed by an analyst were noted and identified as other areas with sensitive viewers. GIS markers were placed at the beginnings and ends of sections of sensitive viewer types so that the linear distances of potential viewer could be measured for each alternative.

Although the section lengths of various types of sensitive viewers are not precise due to the limitations of GIS aerial photographs, the quantified data are useful for comparing potential effects among alternatives. It should also be noted that although actual numbers of residents in the areas were not obtained, the numbers of residences per mile in the areas containing sensitive residential viewers are represented as different densities; urban residential areas would contain more residents than suburban residential areas, which would in turn have more residents than areas classified as rural residential.

3.4 Determining Potential Effects on Sensitive Viewers

The determination of the intensity of the effects that the alternatives would have on sensitive viewers considered the likely relative change to existing landscapes seen by the sensitive viewers. Throughout alternatives development, avoidance and minimization measures would be applied. Although the alternatives would use avoidance and minimization measures, specific measures are not considered for this service-level assessment.

To identify potential effects, this service-level assessment relies primarily on the following factors:

- Determination of existing landscape setting: Primary considerations included whether the alternative would closely parallel an existing transportation feature such as existing rail or major highway corridors, pass through areas outside existing transportation corridors, or pass through urban, suburban, or rural areas.
- Determination of anticipated changes to the existing landscape by service type: Analysts reviewed the key physical differentiators between conventional rail, higher-speed rail, and high-speed rail that would be seen in the viewed landscape.
- Consideration of the degree of viewer sensitivity to infrastructure-induced changes to the viewed landscape: This factor is based on the categories of urban, suburban and rural residents, and other sensitive viewers, as described in Section 3.3, Characterizing and Locating Sensitive Viewers.

4.0 Baseline/Affected Environment

The following sections provide a generalized description of the landscape and aesthetic environment within the EIS Study Area for the alternatives in the three geographic sections. Due to the scale and variety of environments evaluated in this service-level EIS, a specific determination of the high, medium, or low existing visual quality was not made. It can be assumed that the visual quality of most of the areas the build alternatives would pass through would be average, which is the most common category of visual quality. It can also be assumed that there would be areas of both high and low visual quality along the alternatives, although these areas were not specifically identified as part of this service-level assessment.

4.1 Physical Characteristics

4.1.1 Northern Section: Oklahoma City to Dallas and Fort Worth

4.1.1.1 Alternative N4A

The northern portion of this alternative is in southern Oklahoma in an area of gently rolling topography. From Edmond south through Purcell and Lexington at the southern end of Norman, Alternative N4A would follow the BNSF rail corridor as it travels through an area that is heavily urbanized. South of Purcell and Lexington, the landscape is rural and composed of rolling hills covered with a mosaic of grasslands, forests, dispersed parcels devoted to field and row crops, and small communities. Just north of Pauls Valley, the BNSF corridor starts to parallel the Washita River, and it travels along the river and through the Washita Valley as it cuts through the Arbuckle Mountains. In the river valley, the BNSF corridor travels through a flat landscape, much of which is devoted to agriculture, but also includes forested areas and a number of small communities located at regular intervals along the rail corridor. South of Daugherty, the BNSF tracks travel through a narrow section of river valley known as Big Canyon, where the rapids in the river, the forest cover and dramatic rock outcrops on the 350-foot high canyon walls create an area of outstanding scenery. South of the Arbuckle Mountains end of Big Canyon, the BNSF corridor travels across a rolling landscape. In this area, the rail corridor passes through the large zone of urbanization in and around Ardmore, but most of the areas along the rail corridor are rural, consisting of a mosaic of agricultural lands and forest.

At the Red River, the BNSF corridor leaves Oklahoma and enters Texas. The landscape in this area is flat to rolling and most of the land in the rural portions of this area is devoted to large-scale agriculture. In the northern portion of this area, the corridor passes through a series of widely separated communities. South of Krum, the urbanized areas are closer together. From the Tarrant County line southward to the Fort Worth Intermodal Transportation Center (ITC), areas the corridor passes through are nearly totally urbanized. From the Fort Worth ITC to Dallas Union Station (DUS), the TRE corridor in which Alternative N4A would be located passes through a region of flat lands that are heavily urbanized. Just east of downtown Fort Worth, the TRE corridor is adjacent to

Harmon Field Park. In the area just west of downtown Dallas, the TRE corridor crosses the Trinity River.

4.1.2 Central Section: Dallas and Fort Worth to San Antonio

All three Central Section alternatives would provide access between Fort Worth and Dallas and south to San Antonio. The combinations of routes that would provide access to these three cities and areas in between them would differ by alternative. The areas they would pass through are described below. Each route in the Central Section has a higher-speed and high-speed alternative, which vary slightly due to factors such as the requirement of wider turning radii for high-speed trains compared to higher-speed trains. However, the higher-speed and high-speed routes would be similar enough that the existing conditions descriptions below apply to both service types.

4.1.2.1 Alternative C4A

From the Fort Worth ITC east to the DUS, Alternative C4A would follow the TRE. A spur from this alternative would head north and connect with the Dallas/Fort Worth International Airport. It would pass through urbanized areas containing a mix of adjacent land uses including residential, commercial, industrial, airport related, and vacant lands. From the DUS south to Waxahachie, Alternative C4A would travel along the BNSF corridor through a largely urbanized region, where it would pass through industrial areas, lower-density suburban residential areas, and the centers of established communities (including residential neighborhoods) that originally developed along the railroad. South of Waxahachie, the alternative would leave the metropolitan region and, in a new rail alignment, would travel through a rural landscape to just north of Hillsboro. In the area between Waxahachie and Hillsboro the alternative would closely parallel IH-35 through a generally flat landscape. Most of the land along this portion of the alternative is devoted to agriculture, but there are several small communities nearby.

From Hillsboro south to San Antonio,[3] the alternative would generally parallel IH-35 and pass near or through a number of small rural communities as well as the larger communities of Waco and Temple. In Waco, the alternative would pass through the downtown area, cross the Brazos River, and travel near a park, a cemetery, and the Baylor University campus. Between Temple and Austin the alternative would pass through flat agricultural lands and travel near the City of Granger and through the City of Taylor. As the alternative approaches the northeast side of Austin, it would pass more rural residential areas and cross the Colorado River several times (over oxbows) before connecting with and traveling through the Austin-Bergstrom International Airport. After departing the airport, the alternative would pass through parklands and continue along a new rail alignment through an agricultural landscape and areas of scattered rural residential development. The

[3] From Hillsboro south to San Antonio, all Central Section alternatives (C4A, C4B, and C4C) would follow the same route.

alternative would pass the western outskirts of Lockhart, cross the San Marcos River, travel between New Braunfels and Seguin, pass over the Guadalupe River, and continue southwest to San Antonio. At Shertz, the alternative would enter the San Antonio urbanized region and pass adjacent to areas of residential development. After crossing Texas Loop 1604 (Charles Anderson Loop), the alternative would follow the UPRR corridor as it travels through heavily urbanized areas into an area west of downtown San Antonio. As it travels toward downtown, the route would pass several parks, the San Antonio International Airport, and through areas devoted to residential and commercial use. Parts of this section of the UPRR corridor parallel major roads. The alternative would end at the site of a new station that would be developed on a site west IH-10/IH-35, approximately 1 mile west of downtown San Antonio.

4.1.2.2 Alternative C4B

This alternative forms a "T"-shape route before connecting with the segment between Hillsboro and San Antonio, as shown in Section 1.2, Alternative Descriptions. The upper, horizontal part of the "T" would begin in Fort Worth and continue east to Dallas. The bottom, vertical part of the "T" would begin between Arlington and Grand Prairie and continue south to Hillsboro where it would connect with the route between Hillsboro and San Antonio.

From the Fort Worth ITC, Alternative C4B would head east along the TRE and pass near Harmon Field Park just east of downtown Fort Worth. It would continue east along the TRE through a flat area that is primarily industrial in character. At Haltom Road, the alternative would leave the TRE corridor and follow the median of IH-30, an interstate highway whose large scale creates a visually distinct corridor that cuts through the adjacent heavily developed residential and commercial areas. At State Highway (SH-360) in Arlington, the alternative would make a right turn and head south.

From the east end of the top of the "T" in Dallas, Alternative C4B would head west toward the SH-360. Alternative C4B would begin at the DUS and head west within the UPRR corridor. It would cross along and over the Trinity River on lands that are part of Trinity Park. The alternative would continue westward in the UPRR corridor through industrial areas and several residential neighborhoods. Near West Westmoreland Road, the alternative would follow a rail spur that travels in southwestwardly to IH-30, where the alternative would continue in the median of the freeway to the SH-360 (the Angus G. Wynne Jr. Freeway) departure point.

From the SH-360 departure point, Alternative C4B would head south past Joe Pool Lake to US-287. This portion of the alternative travels through rolling and heavily developed areas, with residential areas separated by undeveloped lands. South of US-287, the alternative would leave the SH-360 corridor and continue south along a new rail alignment to just north of Hillsboro, where it would connect with the IH-35 corridor and follow the same route to San Antonio described above for Alternative C4A. This portion of the route is rural in character and contains scattered and clusters of rural residences.

4.1.2.3 Alternative C4C

Alternative C4C would form a loop from Hillsboro that would head north to Fort Worth, east to Dallas, and south back to Hillsboro, as shown in Section 1.2, Alternative Descriptions. The portion of the loop between Fort Worth and Dallas and south from Dallas to Hillsboro would be the same as the route that would be used for Alternative C4A, described in Section 4.1.2.1. The portion of the alternative from Fort Worth to Hillsboro is unique and is described below.

From the Fort Worth ITC, Alternative C4C would head south through urbanized Fort Worth along an existing BNSF rail corridor and connect with a UPRR corridor. The northern part of this alternative would pass a mixture of land uses including industrial, commercial, and urban residential neighborhoods. Between the IH-82 loop and the town of Burleson, Alternative C4C would pass near a series of residential subdivisions and open areas, including parks. From Burleson south to Hillsboro, the route would travel past generally flat agricultural lands and small communities such as Alvarado, Grandview, and Itasca before passing through Hillsboro.

4.1.3 Southern Section: San Antonio to South Texas

Both of the route alternatives in the Southern Section would begin in San Antonio, but each would take a different route to its terminus. The northern leg of Alternative S4 would connect San Antonio with Alice. The southern leg would leave Alice and extend south to McAllen before continuing south to Brownsville. The western leg of Alternative S4 would provide access from Alice southwest to Laredo and the eastern leg would connect Alice to Corpus Christi. The S6 alternative (both service types) would provide a connection between San Antonio and Mexico at a location approximately 20 miles northwest of Laredo. With the exception of residential areas in San Antonio, on the outskirts of smaller towns, and within the McAllen–Brownsville corridor, these two route alternatives would pass through very sparsely populated areas. The following sections describe the characteristics of the routes of the Southern Section alternatives.

4.1.3.1 Alternative S4

From San Antonio, Alternative S4 would follow the UPRR corridor southeast through a mix of land uses that include industrial, commercial, and numerous residential areas. After passing under the IH-410 loop, the alternative would pass between Texas A&M University San Antonio and Mitchell Lake and weave its way southwest of US-281 past the towns of Leming and Pleasanton to IH-37. The UPRR corridor generally follows IH-37/US-281 through the Lipan Hills to north of the town of Three Rivers. From near Three Rivers, the alternative would depart the UPRR corridor and travel via a new rail alignment east of US-281 to the town of Alice. The area between San Antonio and Alice is a mixture of agriculture, undeveloped areas, and lands that have received extensive energy exploration and development. This area is generally sparsely populated, but isolated rural residences and clusters of rural residences are found on the outskirts of towns like Leming and Pleasanton.

From Alice, the alternative has legs that would head in three different directions. The leg that continuing south past Alice would first pass isolated rural residences, as well as clusters of rural residences and before traveling through a series of oil fields where exploration activities and production are very evident. It would parallel US-281 through the towns of Fremont and Falfurrias and would depart US-281 north of Encino. From this point, the alternative would travel south through flat sparsely populated areas to the Rio Grande Valley and on to McAllen. The alternative would pass near a number of suburban and urban residential areas in the McAllen area. From McAllen, Alternative S4 would head east through the Rio Grande Valley along an existing rail corridor to Harlingen. This portion of the alternative would pass through urbanized developed areas that include residential areas and a number of small towns.

The Alternative S4 leg that heads west from Alice would follow the KCS railroad corridor and pass scattered residential areas before traveling through the town of San Diego. From San Diego, the alternative would travel towards Laredo along a new rail alignment that would traverse a series of oil fields and sparsely populated areas. As the alternative approaches Laredo it would pass residential areas and Casa Blanca Lake before ending near Laredo International Airport.

The leg of the alternative that heads east from Alice would travel along the KCS railroad corridor. It would pass through flat agricultural lands and near several small towns, such as Agua Dulce, Banquete, and Robstown. The alternative would pass isolated rural residences, clusters of rural residences, and suburban residential areas before terminating at Corpus Christi International Airport.

4.1.3.2 Alternative S6

From San Antonio, Alternative S6 (higher-speed rail and high-speed rail) would follow the UPRR corridor southwest past industrial lands and scattered residential areas. It would pass under the IH-410 loop and travel to the eastern edge of the Von Ormy Oil Field. The alternative would depart the UPRR corridor in the oil field and continue southwest between IH-35 to the south. The alternative would continue southwest through unpopulated areas that are undeveloped or have received extensive energy exploration. The alternative would pass the outskirts of small towns such as Lytle, Devine, and Pearsall, where it would pass isolated rural residences as well as clusters of rural residences. The alternative would pass over features such as the Nueces River and US-83 on its way to its terminus at the Mexico border.

4.2 Existing Sensitive Viewers Near the Alternatives

The descriptions above provide a general overview of the landscape the alternatives would pass through. To assess potential effects, it was necessary to establish where sensitive viewers were located along the alignment types associated with the alternatives. Table 4-1 identifies the miles of existing sensitive viewers (by type) found along the alternatives. While actual design development may change the detail of the final alignments, for this technical study, higher-speed and high-speed alternatives that pass through the same aesthetic and visual resource study area were assumed to pass by the same existing sensitive viewers identified in Table 4-1.

Table 4-1: Miles of Existing Sensitive Viewer Types Adjacent to Each Alternative

Viewer Types	Alignment Type (miles)			Total Miles Near Sensitive Viewers
	Existing Rail Corridor	New Rail Alignment	New Rail Alignment Next to Major Highway	
Alternative N4A (Conventional Rail)				
Urban Residential	3	1	1	5
Suburban Residential	22	1	1	24
Rural residential	10	1	2	13
Other Areas with Sensitive Viewers	6	0	1	7
Total Miles Near Sensitive Viewers	**41**	**3**	**5**	**49**
Alternative C4A (Higher- and High-Speed Rail)				
Urban Residential	2	0	1	3
Suburban Residential	16	1	4	21
Rural Residential	3	8	2	13
Other Areas with Sensitive Viewers	6	2	2	10
Total Miles Near Sensitive Viewers	**27**	**11**	**9**	**47**
Alternative C4B (Higher- and High-Speed Rail)				
Urban Residential	2	1	9	12
Suburban Residential	10	1	7	18
Rural Residential	3	10	0	13
Other Areas with Sensitive Viewers	3	1	2	6
Total Miles Near Sensitive Viewers	**18**	**13**	**18**	**49**

Viewer Types	Alignment Type (miles)			Total Miles Near Sensitive Viewers
	Existing Rail Corridor	New Rail Alignment	New Rail Alignment Next to Major Highway	
Alternative C4C (Higher- and High-Speed Rail)				
Urban Residential	5	0	1	6
Suburban Residential	25	1	4	30
Rural Residential	5	8	2	15
Other Areas with Sensitive Viewers	7	2	2	11
Total Miles Near Sensitive Viewers	**42**	**11**	**9**	**62**
Alternative S4 (Higher-Speed Rail)				
Urban Residential	5	1	0	6
Suburban Residential	16	7	10	33
Rural Residential	3	5	2	10
Other Areas with Sensitive Viewers	0	0	1	1
Total Miles Near Sensitive Viewers	**24**	**13**	**13**	**50**
Alternative S6 (Higher- and High-Speed Rail)				
Urban Residential	0	0	0	0
Suburban Residential	0	2	0	2
Rural Residential	0	16	0	16
Other Areas with Sensitive Viewers	0	0	0	0
Total Miles Near Sensitive Viewers	**0**	**18**	**0**	**18**
Source: The data source for the information in this table was from the GIS data developed internally by CH2M HILL.				

5.0 Potential Effects on Aesthetics and Visual Resources

This section assesses whether the alternatives would lower or potentially enhance the visual quality of the existing environment seen by sensitive viewers. Because high-speed alignments would require the greatest changes to the viewed landscape, they would have the most potential to affect aesthetic and visual resources. Higher-speed alignments would require fewer changes to the landscape and would likely have less effect than high-speed alignments. The conventional rail alternative (N4A) would use existing railroad rights-of-way and would have the least potential to affect aesthetic and visual resources.

For this study, a substantial effect represents the high likelihood that the alternative would lower the existing visual quality of the landscape viewed by nearby sensitive viewers. A substantial effect would occur where there would likely be a reduction of general visual quality from high to average or from average to low. Although the existing visual quality of areas along the alternatives was not determined as part of this assessment (see Section 3.1, Characterizing Existing Aesthetic and Visual Conditions), it is assumed that the general visual quality of most of the areas that the alternatives would pass through is average, with areas of high visual quality and low visual quality occurring. A moderate effect would occur when there would likely be a reduction in visual quality so that sensitive viewers would notice the change, but not enough of a change to be a substantial effect. A negligible effect would have a low potential to change existing visual quality, regardless of viewer sensitivity.

Table 5-1 provides an overview by speed convention (higher-speed and high-speed) of the level of potential influence the alternatives would likely have on the visual quality of views seen by nearby viewers. The overview provided assisted in determining the intensity of effect on sensitive viewers from higher-speed rail and high-speed rail alternatives that are discussed and analyzed in the environmental consequences discussions provided below. Because the entire length of Alternative N4A would essentially use existing railroad rights-of-way, the required modifications would result in relatively minor physical changes to the landscape and its contributing features. In addition, because these changes are already present in the views of nearby sensitive viewers they would likely be minor or unnoticeable, and therefore Alternative N4A is not included in Table 5-1.

Where higher-speed rail alternatives are proposed to be located in or parallel to existing rail corridors, the new rail tracks would be similar in character to the transportation corridors they are currently located in or near. The additional tracks would have a low likelihood of detracting from the existing visual quality of views seen by sensitive viewers; therefore, in these situations effects would be negligible.

Table 5-1: Likelihood That Higher-Speed and High-Speed Rail Alignment Types Would Affect the Visual Quality of Views Seen by Sensitive Viewers

Sensitive Viewer Type	Alignment Type		
	New Rail Alignment Within or Next to Existing Rail Corridor	New Rail Next to Major Highway	New Rail Alignment Outside of Existing Transportation Corridors
Higher-Speed Rail Alternatives			
Urban Residential	Low	Low	High
Suburban Residential	Low	Low	High
Rural Residential	Low	Low	Medium
Other Areas with Sensitive Viewers	Low	Low	Medium
High-Speed Rail Alternatives			
Urban Residential	Medium	Medium	High
Suburban Residential	Medium	Medium	High
Rural Residential	Medium	Medium	High
Other Areas with Sensitive Viewers	Medium	Medium	High

The presence of higher-speed tracks next to major highways would not be out of character for a transportation corridor containing major infrastructure elements that are currently part of the viewed landscape. Elevated structures for the higher-speed alternatives might in some locations contrast with at-grade sections of existing highways. However, although the locations of elevated structures near sensitive viewers adjacent to existing major highways have not been identified at the service level of analysis, because views of these elements by sensitive viewers would probably include major highways, it was assumed that the higher-speed alternative elements would be consistent with the transportation corridor character of major highways and would have a low likelihood of affecting visual quality; therefore, effects would be negligible.

Where new tracks (and support features such bridges and fencing) outside of existing transportation corridors would be constructed near sensitive viewers in densely populated areas containing urban and suburban residential viewers, there would be a high likelihood that they would lower visual quality. Therefore, effects on urban and suburban residents would be substantial. Although these potential effects could also be experienced by sensitive rural residential and other viewers (for example, from parks), it is assumed that views of the new higher-speed rail alignments outside of existing transportation corridors would change the viewed landscape to a lesser degree than in more densely populated areas and have a medium likelihood of lowering visual quality. This is based upon a broad assessment of the rural areas where there are fewer viewers than in urban and suburban areas. A service-level review of rural residential areas along several alignments using GIS aerial maps indicted that existing vegetation and other outbuildings would frequently screen or partially screen views from residences toward the alignments. Therefore, effects on rural residents and viewers from other sensitive areas are considered to be moderate.

High-speed rail alternatives are the least adaptable of the service types in terms of attempting to align them in ways that would reduce effects on visual and aesthetic resources. This is because they require greater turning radii than higher-speed alignments. The greater radii would result in more alteration of the landscape beyond existing rail corridors than would be required for the higher-speed rail alternatives. In addition, high-speed rail alternatives would require more elevated structures to maintain grade-separations than the other service-types. Where new tracks (and support features such as bridges and fencing) would be constructed in, or near, an existing railway or major highway corridor, their likelihood of lowering visual quality would be medium. Therefore, effects on all sensitive viewer types are considered moderate. New high-speed rail alternatives near sensitive viewers that would be located outside of existing transportation corridors would alter the viewed landscape and be very noticeable to all sensitive viewer types. In these situations the likelihood of visual quality being lowered would be high; therefore, the effects on all sensitive viewer types are considered substantial.

Almost the entire length of the conventional rail alternative (N4A) would use existing railroad rights-of-way as would 46 of the 49 miles that would pass near sensitive viewers. Modifications that would be required would result in relatively minor physical changes to the landscape. Because the changes occur within existing railroad rights-of-way (which are already present in the views of nearby sensitive viewers), changes to visual quality along existing railroad rights-of-way associated with conventional rail would likely be low and were determined to have negligible effects. In the few places where new rail alignments outside of existing transportation corridors would be required next to urban and suburban residential areas, the likelihood of visual quality being lowered would be high. The effects of the new rail alignments on these viewer types are considered substantial. Where new rail alignments would be required near rural residential areas, the likelihood of visual quality being changed would be medium and the effects of the new rail alignment would be moderate.

5.1 No Build Alternative

The No Build Alternative would result in neither property acquisition nor changes to transit operations. The No Build Alternative is used as a basis for comparison with the build alternatives. Because the No Build Alternative would not include the construction, alteration, or improvement of transportation facilities in relation to the construction of the alternatives, it would have no potential effect on visual resources.

5.2 Northern Section: Oklahoma City to Dallas and Fort Worth

5.2.1 Alternative N4A Conventional Rail

Most of the 49 miles of Alternative N4A Conventional that would pass sensitive viewers would use existing railroad rights-of-way, as reflected in Table 4-1. Modifications that would be required along existing railroad rights-of-way would result in relatively minor physical changes to the landscape. These changes would likely be unnoticeable to sensitive viewers and would have negligible effects. In areas were new rail would be required next to sensitive viewers in urban and suburban areas, the alternative would have a high likelihood of lowering visual quality and would produce approximately 2 miles of substantial effects. New rail next to areas containing scattered rural residences would have a medium likelihood of lowering visual quality and would produce moderate effects along approximately 1 mile of the alternative (see Table 5-1).

Light and glare associated with passing trains and support facilities could affect sensitive viewers during night-time operation of the trains in areas where there is no existing transportation infrastructure, at stations and parking facilities, and at maintenance facility locations. Generally, the larger the infrastructure, the more potential there would be for light and glare affecting nearby sensitive viewers. Therefore, conventional rail would have the least potential for light- and glare-related effects, followed by higher-speed rail. High-speed rail would have the highest likelihood for light- and glare-related effects. At the service level of analysis, however, the details required for a more specific evaluation are not available.

Temporary effects on visual resources and sensitive viewers that could occur during construction of the alternatives activities would likely include mobilization and ground preparation, including utility relocation. Fencing would be required around some work sites, which could be a temporary negative visual impact. Staging areas for storing materials and equipment would be located on vacant land or within right-of-way that would be closed for construction and would likely be surrounded by fencing. Mechanized equipment, lights for evening work, material storage and delivery, and the removal of excavated material would be seen to varying degrees by viewers near the construction. The closer the construction location is to nearby sensitive viewers, the greater the likelihood that the viewers would find construction activities aesthetically and visually disruptive. Because construction activities would be experienced by the sensitive viewers who would be affected by project operations as previously discussed in this technical study, and because locations where construction-related activities would occur are not known at this time, this service-level evaluation does not differentiate between effects associated with the construction and operations phases.

Based on the assessment and considering the miles of this alternative (49 miles) that would pass near sensitive viewers, along with the context of potential effects (2 miles of substantial and 1 mile of moderate effects) the overall intensity of effects for Alternative N4A Conventional Rail would be negligible.

5.3 Central Section: Dallas and Fort Worth to San Antonio

5.3.1 Alternative C4A Higher-Speed Rail

Alternative C4A Higher-Speed Rail would pass approximately 47 miles of sensitive viewers. The alternative would have substantial aesthetic and visual effects on the landscape viewed by sensitive viewers along approximately 1 mile of its route, moderate effects along 10 miles, and negligible effects along 36 miles. The 1 mile of substantial effects would be attributed to new rail alignments outside existing transportation corridors that would be adjacent to suburban residential areas that would substantially change the appearance of the viewed landscape. Substantial effects would occur along small segments of the new rail alignments in or near Lancaster, Waco, Lorena, Bruceville-Eddy, Troy, and Temple. Approximately 10 miles of moderate aesthetic and visual effects would occur along new rail alignment in areas outside existing transportation corridors where sensitive viewers in rural residences would see changes to the landscape. These moderate effects would be found along segments of the alignment in the vicinity of IH-35 between Dallas and Waxahachie, Waxahachie and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma. Moderate effects on the viewed landscape as the result of introducing new rail alignments outside existing rail transportation corridors would also occur near other areas with sensitive viewers, in areas such as Harmon Field Park and the East Fork Trinity River in Fort Worth; sections of the Trinity River in Fort Worth and Dallas; Country View Golf Course and Bear Creek Nature Park south of Lancaster; Red Oak Valley Golf Club in Red Oak; Waxahachie City Cemetery and Rickards Park in Waxahachie; Lake Waxahachie; Lions Park and Greenwood Cemetery in Bellmead; Fort Fisher Park and First Street Cemetery in Waco; a park on S. 11th Street and W. Central Avenue in Temple; and Richard Moya Park in Del Valle.

The potential effects of light and glare described under Alternative N4A Conventional would be similar to the sections of this alternative that would require new alignments near sensitive viewers and who would also view the light and glare produced from passing trains. As described above, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative would disrupt more of the landscape and potentially temporarily affect more sensitive viewers than Alternative N4A Conventional. Therefore, the description of construction impacts that were identified for Alternative N4A Conventional would be greater due to the additional areas of new rail alignment.

Based on the assessment and considering the miles of this alternative (47 miles) that would pass by sensitive viewers, along with the context of potential effects (10 miles of moderate and 1 mile of substantial effects) the overall intensity of effects for Alternative C4A Higher-Speed Rail would be moderate.

5.3.2 Alternative C4A High-Speed Rail

The alterations to the landscape that would be required with Alternative C4A High-Speed Rail would result in substantial effects on sensitive viewers along approximately 11 miles of its 47-mile route and moderate effects along its remaining 36 miles. Substantial effects would occur where new rail alignments outside of existing transportation corridors would be required and would change the appearance of the landscape seen by sensitive viewers. Substantial aesthetic and visual effects on the landscape seen from approximately 1 mile of suburban residential areas and 8 miles near rural residences would occur along segments of the route in, near, or between Lancaster, Waco, Lorena, Bruceville-Eddy, Troy, and Temple. Substantial effects on approximately 2 miles of areas where other sensitive viewers are located would occur in or near areas such as Harmon Field Park and the East Fork Trinity River in Fort Worth; sections of the Trinity River in Fort Worth and Dallas; Country View Golf Course and Bear Creek Nature Park south of Lancaster; Red Oak Valley Golf Club in Red Oak; Waxahachie City Cemetery and Rickards Park in Waxahachie; Lake Waxahachie; Lions Park and Greenwood Cemetery in Bellmead; Fort Fisher Park and First Street Cemetery in Waco; a park on S. 11th Street and W. Central Avenue in Temple; and Richard Moya Park in Del Valle. Moderate effects from this high-speed alternative would occur where it would be sited in or near existing rail corridors and major highways that would be seen by nearby sensitive viewers. Moderate effects on the landscape that would be seen by sensitive viewers would occur along the portion of the alternative that would follow the TRE between Fort Worth and Dallas. These effects would also occur along existing rail and highway corridors between Dallas and Waxahachie; within or near Hillsboro and San Antonio; and in communities between Hillsboro and San Antonio such as West, Waco, Lorena, Bruceville, Temple, and Taylor.

The potential effects of light and glare described under Alternative N4A Conventional would be similar to the sections of this alternative that would require new alignments near sensitive viewers and who would also view the light and glare produced from passing trains. As described above, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for this alternative would disrupt more of the landscape and potentially temporarily affect more sensitive viewers than Alternative N4A Conventional. Therefore, the description of construction impacts that were identified for Alternative N4A Conventional would be greater due to the additional areas of new rail alignment.

Based on the assessment and considering the miles of this alternative (47 miles), along with the context of potential effects (11 miles of substantial and 36 miles of moderate effects) the overall intensity of effects for Alternative C4A High–Speed Rail would be substantial.

5.3.3 Alternative C4B Higher-Speed Rail

Alternative C4B Higher-Speed Rail would pass approximately 49 miles of areas containing sensitive viewers. Changes to the viewed landscape would result in substantial aesthetic and visual effects on sensitive viewers along approximately 2 miles of its route, moderate effects along 11 miles, and negligible effects along 36 miles. The substantial effects would occur near urban and suburban residential areas where new rail alignment outside existing transportation corridors would be required. Most of these areas of substantial effects would be located along small segments of the route between Waco and San Antonio. The approximately 11 miles of moderate effects that the alternative would produce would occur along a series of small rural residential areas and areas with other sensitive viewers near new rail alignment outside existing transportation corridors. These areas would include rural residences between US-287 and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma. Negligible aesthetic and visual effects on the viewed landscape would occur along the portion of the route between the ITC in Fort Worth and DUS in Dallas that would follow the IH-30 corridor and the portion of the route that would follow SH-360 between Arlington and Hillsboro. Areas south of Hillsboro that would follow rail corridors and would not require new alignments outside of existing transportation corridors would also have negligible effects on sensitive viewers.

The effects of light and glare described under Alternative C4A Higher Speed Rail would be similar to the sections of this alternative in areas that would require new alignments in areas containing sensitive viewers who would view the light and glare produced from passing trains. This is particularly applicable to the new elevated alignment over IH-30 in Arlington. As discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for with this alternative would be similar to the temporary effects associated with the C4A Higher-Speed Rail Alternative.

Based on the assessment conducted and evaluating the length of this alternative (49 miles near sensitive viewers), while also considering the context of potential effects (11 miles of moderate and 2 miles of substantial effects) the overall intensity of effects for Alternative C4B Higher-Speed Rail would be moderate.

5.3.4 Alternative C4B High-Speed Rail

This high-speed rail alternative would pass near approximately 49 miles of sensitive viewers. Changes to the viewed landscape would result in substantial aesthetic and visual effects along approximately 13 miles of the alternative near sensitive viewers and moderate effects along 36 miles. Substantial effects would occur along new rail alignments required for the high-speed rail that would be located outside existing transportation corridors. Substantial effects on urban and suburban residential areas would occur along small segments of the alternative between Waco and San Antonio. Moderate effects from the alternative on rural residential areas and other areas with sensitive viewers would occur along portions of the alternative that would require new rail alignments outside of existing transportation corridors between US-287 and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma. Moderate effects on urban and suburban residents would occur were the alternative would follow existing transportation corridors along IH-30 between Fort Worth and Dallas and along SH-360 between Arlington and US-287. The alternative would have moderate effects on sensitive viewers for portions of its route that would follow existing rail corridors between Hillsboro and San Antonio. Areas of moderate effects would also occur along a series of segments of the route in the vicinity of West, Waco, Lorena, Bruceville, Temple, Taylor, and San Antonio.

The effects of light and glare described under Alternative C4B Higher-Speed Rail would be similar for this alternative in areas that would require new alignments near sensitive viewers who would view the light and glare produced from passing trains. As discussed for the C4B Higher-Speed Rail alternative the new elevated alignment over IH-30 in Arlington would be an additional and applicable feature. Also as discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for with this alternative, based on an access controlled and grade separated alignment, would likely disrupt more of the landscape and temporarily affect more sensitive viewers than the C4B Higher-Speed Rail Alternative.

Drawing from the assessment conducted and length of this alternative (49 miles), along with the context of potential effects (36 miles of moderate and 13 miles of substantial effects), the overall intensity of effects for Alternative C4B High-Speed Rail would be substantial.

5.3.5 Alternative C4C Higher-Speed Rail

Alternative C4C Higher-Speed Rail would travel past approximately 62 miles of areas containing sensitive viewers. It would have substantial aesthetic and visual effects on the landscape viewed by sensitive viewers along approximately 1 mile of its route, moderate effects along 10 miles, and negligible effects along the remaining 51 miles. Substantial effects would occur along portions of the alterative near suburban residential areas where new rail alignment would be required. These effects would be found along small segments of the new rail alignment in or near Lancaster, Waco, Lorena, Bruceville-Eddy, Troy, and Temple. Moderate effects on the landscape viewed from rural residences and areas with other viewers would occur where new rail alignments outside of existing transportation corridors would be required. These effects would be found adjacent to a series of small rural residential areas between US-287 and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma.

The effects of light and glare described under Alternative C4B Higher-Speed Rail would be similar for Alternative C4C Higher-Speed Rail in areas that would require new alignments near sensitive viewers who would view the light and glare produced from passing trains. As discussed in the previous alternatives, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for with this alternative would be similar to the temporary effects associated with the C4A and C4B Higher-Speed Rail alternatives.

Drawing from the assessment conducted and considering the length of this alternative (62 miles near sensitive viewers), along with the context of potential effects (10 miles of moderate and 1 mile of substantial effects) the overall intensity of effects for Alternative C4C Higher-Speed Rail would be moderate.

5.3.6 Alternative C4C High-Speed Rail

The 62-mile-long Alternative C4C High-Speed Rail would have substantial effects on the landscape seen by sensitive viewers along 11 miles of its route and moderate effects along 51 miles. The substantial effects from this high-speed rail alternative would occur near areas containing sensitive viewers that would require new rail alignments outside existing transportation corridors. Approximately 1 mile of the substantial effects would be adjacent to urban and suburban areas along small segments of the route in or near Lancaster, Waco, Lorena, Bruceville-Eddy, Troy, and Temple, and 10 miles would occur near a series of small rural residential areas and areas with other sensitive viewers between US-287 and Hillsboro, Hillsboro and Waco, Waco and Temple, Temple and Austin, and Austin and the outskirts of San Antonio near Selma. Moderate effects would occur along approximately 51 miles of the alternative, much of which would be along existing transportation corridors between Fort Worth and Dallas, Dallas and Waxahachie, Waxahachie and Hillsboro, Hillsboro and San Antonio, and Fort Worth and Hillsboro.

The effects of light and glare described under Alternative C4C High-Speed Rail would be similar for Alternative C4C Higher-Speed Rail in areas that would require new alignments near sensitive viewers who would view the light and glare produced from passing trains. As discussed in the previous alternatives, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for with this alternative, based on an access controlled and grade separated alignment, would likely disrupt more of the landscape and temporarily affect more sensitive viewers than the C4C Higher-Speed Rail Alternative.

Drawing from the assessment conducted and considering the length of this alternative (62 miles near sensitive viewers), along with the context of potential effects (11 miles of substantial and 51 miles of moderate effects) the overall intensity of effects for Alternative C4C High-Speed Rail would be substantial.

5.4 Southern Section: San Antonio to South Texas

5.4.1 Alternative S4 Higher-Speed Rail

Alternative S4 Higher-Speed Rail would pass approximately 50 miles of sensitive viewers. Substantial effects on the viewed landscape seen by sensitive viewers would occur along 8 miles of new rail alignment outside existing transportation corridors in areas containing suburban (7 miles) and urban (1 mile) residential areas. Most of these substantial effects would occur in and near communities such as Alice, Falfurrias, McAllen, Mercedes, and Harlingen. Moderate effects on the landscape viewed by sensitive viewers would occur along 5 miles of the alternative that would pass a series of rural residential areas most of which would be along the IH-37 corridor. Negligible effects would occur along 37 miles of this alternative.

The effects of light and glare described under Alternative C4A Higher-Speed Rail would be similar to the sections of this alternative in areas that would require new alignments. This would be applicable in areas near sensitive viewers who would view the light and glare produced from passing trains. As discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for with this alternative would be similar to the temporary effects associated with the C4A Higher-Speed Rail Alternative.

Drawing from the assessment conducted and considering the length of this alternative (50 miles near sensitive viewers), along with the context of potential effects (8 miles of substantial and 5 miles of moderate effects) the overall intensity of effects for Alternative S4 Higher-Speed Rail would be moderate.

5.4.2 Alternative S6 Higher-Speed Rail

Alternative S6 Higher-Speed Rail would pass near approximately 18 miles of areas with sensitive viewers. It would have substantial effects on the landscape viewed by sensitive viewers along approximately 2 miles of its route and moderate effects along 16 miles. The substantial effects would be on suburban residential areas in San Antonio that would be adjacent to areas of new rail alignment outside existing transportation corridors. Moderate effects on the viewed landscape would occur along areas of new rail alignment that would pass rural residential areas between San Antonio and a location west of Dilley.

The effects of light and glare described under Alternative C4A Higher-Speed Rail would be similar to the sections of this alternative in areas that would require new alignments. This would be applicable in areas near sensitive viewers who would view the light and glare produced from passing trains. As discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for with this alternative would be similar to the temporary effects associated with the C4A Higher-Speed Rail alternative.

Drawing from the assessment conducted and considering sensitive viewers within the length of this alternative (18 miles near sensitive viewers), along with the context of potential effects (2 miles of substantial and 16 miles of moderate effects) the overall intensity of effects for Alternative S6 Higher-Speed Rail would be moderate.

5.4.3 Alternative S6 High-Speed Rail

This high-speed rail alternative would pass near approximately 18 miles of areas with sensitive viewers. The alternative would require new rail alignment outside of existing transportation corridors adjacent to the 18 miles of areas with sensitive viewers and would produce substantial effects along all 18 miles. The areas where the substantial effects would occur include 2 miles of residential areas in southwest San Antonio and 16 miles of the route near suburban and rural residential areas south of San Antonio and west of Dilley.

The effects of light and glare described under Alternative C4A High-Speed Rail would be similar to the sections of this alternative in areas that would require new alignments. This would be applicable in areas near sensitive viewers who would view the light and glare produced from passing trains. As discussed previously, detailed analysis regarding the potential for effects from light and glare will be conducted during project-level analysis. Construction activities for with this alternative would be similar to the temporary effects associated with the C4A Higher Speed Rail Alternative. Construction activities for with this alternative, based on an access controlled and grade separated alignment, would likely disrupt more of the landscape and temporarily affect more sensitive viewers than Alternative S6 Higher-Speed Rail.

Drawing from the assessment conducted and considering the length of this alternative (18 miles near sensitive viewers), along with the context of potential effects (18 miles of substantial effects) the overall intensity of effects for Alternative S6 High-Speed Rail would be substantial.

5.5 Summary of Potential Effects

Because high-speed rail alignments would require greater turning radii, more elevated structures to maintain grade-separations, and more new rail alignment outside of existing transportation corridors than other service types, high-speed rail alternatives would have a greater potential to alter the landscape seen by sensitive viewers than other service-type alternatives. All of the high-speed rail alternatives would potentially have substantial effects on more miles of landscape seen by sensitive viewers than the higher-speed alternatives for the same route. The high-speed alternatives for the Central Section would also have more moderate effects than their corresponding higher-speed rail alternatives.

Table 5-2 summarizes the effects of the alternatives on sensitive viewers.

Table 5-2: Effects of Alternatives on Sensitive Viewers

Section	Alternative	Effect Category (miles)			Total Miles of Impact Near Sensitive Viewers	Intensity of Effect
		Negligible	Moderate	Substantial		
No Build Alternative[a]		0	0	0	0	
Northern	N4A CONV	46	1	2	49	Negligible
Central	C4A HrSR	36	10	1	47	Moderate
	C4A HSR	0	36	11	47	Substantial
	C4B HrSR	36	11	2	49	Moderate
	C4B HSR	0	36	13	49	Substantial
	C4C HrSR	51	10	1	62	Moderate
	C4C HSR	0	51	11	62	Substantial
Southern	S4 HrSR	37	5	8	50	Moderate
	S6 HrSR	0	16	2	18	Moderate
	S6 HSR	0	0	18	18	Substantial

[a] The No Build Alternative, as identified, includes existing and potential expansion of roadway, passenger rail, and air travel facilities within the EIS Study Area; however, for the service-level evaluation, identifying levels of effect from potential expansion of those facilities is speculative and would be dependent on project-specific analysis.

6.0 Avoidance, Minimization, and Mitigation Strategies

At the service level, detailed avoidance, minimization, and mitigation strategies are only presented and developed as proposed strategies and according to service type (conventional, higher-speed, or high-speed rail). The pursuit of avoidance and minimization of effects will be incorporated when feasible. If effects cannot be avoided or minimized, mitigation strategies will be implemented.

The ability to minimize visual disruption during construction and from construction activities will include adherence to local jurisdiction's construction requirements. Additional construction minimization elements will include, but not be limited to, the following activities:

- Minimize pre-construction clearing.
- Limit the removal of buildings to those that would obstruct project components.
- When possible, preserve existing vegetation, particularly vegetation along the edge of construction areas that may help screen views.
- After construction, regrade areas disturbed by construction, staging, and storage to original contours and revegetate with plant material similar in replacement numbers and type.
- Avoid locating construction staging sites within immediate foreground distance (0 to 500 feet) of the sensitive viewer types.
- To minimize light disturbance during construction the lighting will be shielded and directed downward.

The potential mitigation strategies for operational effects will be adapted to the environment where the alternative would be located. The strategies will include use of specific design guidelines applicable to major design features, while also taking into account the surrounding visual quality features where they would be located. Application of the design guidelines to project elements will allow for integration into their settings. Additional strategies will include the use of appropriate materials, color, finishes, and vegetation evaluated and developed in conjunction with the local jurisdictions during final design.

Minimization strategies will include treatments that would vary by location but will be compatible with the context of adjacent areas. Treatments will include, but not be limited to, some or all of the following:

- Minimize visual disruption by screening elevated guideways adjacent to residential areas.
- Establish consultation with local jurisdictions to identify and integrate local design features into the key project features and future station designs through a collaborative, context-sensitive solutions approach.
- Where appropriate, plant trees along the edges of the rights-of-way in locations adjacent to residential areas.

- Incorporate fencing or screening in areas with new project features in proximity to sensitive viewers.
- Include full shielding of all new and replacement lighting features.
- Incorporate vegetation around structures, columns, and other components associated with the alternatives.
- Utilize complimentary and consistent colors, patterns, and textures on structures, columns, and noise barriers associated with the alternatives.
- Incorporate pavement treatments at future stations commensurate with context sensitive solutions.
- Utilize vegetation (to block access) and surface coatings on alternative components that would be resistant to graffiti and weather.
- Minimize and mitigate visual disruption from sound barriers by providing surface treatments (color and texture) along with the use of alternate materials (transparent mediums where appropriate).

The following avoidance, minimization, and mitigation strategies are consistent with the approaches included in Chapter 7 of the FHWA (1988) *Visual Impacts Guidance Manual*, which discusses various landscapes and elements of the built and natural environments associated with similar scale transportation projects. The manual indicates (page 101) that highway agencies must coordinate environmental assessment activities with subsequent design, construction, and maintenance phases of a project in order to fully realize mitigation actions.

7.0 Subsequent Analysis

A project-level evaluation would involve a more detailed assessment of the existing visual conditions of the landscape through which each alternative would pass. This would involve identifying landscape units that are composed of consistent visual characteristics so that the study area could be broken down into smaller, more understandable geographic areas. In addition, key observation points would be selected as representative views within each landscape unit to establish existing visual character and quality. The use of key observation points would also provide the analysts and public reviewers the ability to visualize and assess the actual change to visual character and quality of that landscape unit, in terms of the composite change on the vividness, intactness, and unity of the landscape. The updated information would allow more specific identification of the locations of the various types of sensitive viewers discussed in this technical study, their orientation to the alignment if possible, and locations of other types of areas (such as historic areas, parks, and trails) that should be considered when identifying locations that might contain sensitive viewers. Also, the assessment would describe effects of construction, as well as light and glare.

More specific engineering data related to alternatives that would be evaluated in the project-level would be required and the locations of components of the alternatives would need to be identified. The next level of design will describe stations, parking areas, and maintenance facilities, as well as more detail on the profile and alignment of the alternatives. The following summarizes aspects of the alternatives for which data will be required in order to conduct a project-level aesthetics and visual resource assessment:

- Conventional Rail
  - At-grade in existing or expanded rail corridors
  - At-grade outside of existing or expanded rail corridors
- Higher-Speed Rail
  - At-grade in existing or expanded rail corridors
  - At-grade outside of existing or expanded rail corridors
  - Elevated in expanded corridors or corridors outside existing transportation corridors
  - In trenches in existing, expanded, or outside existing transportation corridors
  - In tunnel
- High-Speed Rail
  - At-grade in existing, expanded, or rail corridors outside existing transportation corridors
  - At-grade in rail corridors outside existing transportation corridors
  - Elevated in expanded or rail corridors outside existing transportation corridors
  - In trenches in existing, expanded, or new rail corridors outside existing transportation corridors
  - In tunnel

As discussed in Section 3.0, Evaluation Methods, components of the new FHWA guidelines for visual impact assessment (FHWA 2015) may be used or incorporated into the subsequent analysis.

8.0 References

Federal Highway Administration (FHWA). 1988. *Visual Impact Assessment for Highway Projects.* FHWA Publication HI-88-054.

Federal Highway Administration (FHWA). 2015. *Guidelines for the Visual Impact Assessment for Highway Projects*. January. Available at https://www.environment.fhwa.dot.gov/guidebook/documents/VIA_Guidelines_for_Highway_Projects.asp.

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