Phase 1 Alternative Analysis Final Report
Volume I

Dallas-Fort Worth High-Speed Transportation Connections Study

May 2023

HIGH-SPEED TRANSPORTATION
DALLAS-FORT WORTH

North Central Texas Council of Governments

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1.0 Introduction

The North Central Texas Council of Governments (NCTCOG), in cooperation with the Federal Railroad Administration (FRA) and Federal Transit Administration (FTA), is conducting engineering and environmental studies for the high-speed passenger service between downtown Dallas and downtown Fort Worth; a distance of approximately 31 miles. Locally, the Project is known as the Dallas-Fort Worth High-Speed Transportation Connections (DFWHSTC) Study.

The study objective is to modernize and enhance mobility between Dallas and Fort Worth by evaluating high-speed transportation alternatives. The goal is to identify a reliable and viable alternative which enhances the regional transportation system and connects Dallas-Fort Worth with other proposed high-performance passenger systems in the state.

1.1 Project Background

The Dallas-Fort Worth area has a population of over eight million today and is estimated to be home to 11.4 million by 2045. As the region continues to grow and roadway congestion increases, there is a need to study transportation choices in North Central Texas that do not require the expansion of freeways. The NCTCOG long-range transportation plan, Mobility 2045: The Metropolitan Transportation Plan for North Central Texas - 2022 Update (Mobility 2045 Update), recommends a high-speed connection between Dallas and Fort Worth as a future transportation choice.

High-speed service between Dallas and Fort Worth is planned to connect to a separate high-speed passenger rail service being planned between Dallas and Houston, Texas and high-speed passenger rail services linking Fort Worth to south Texas metropolitan areas. A high-speed transportation service would improve mobility between Dallas and Fort Worth by providing more mobility choices for regional and intercity travel, while providing a safer and more reliable alternative to driving between these major cities.

In 2017, FRA issued a Tier 1 Environmental Impact Statement and Record of Decision for the Texas Oklahoma Passenger Rail Study (TOPRS)[1]. The study identified corridors between Oklahoma City through to Dallas, Fort Worth, Austin, and San Antonio and to Laredo, Corpus Christi, and Brownsville in south Texas to serve as the framework for future investment in conventional and high-speed passenger rail service between Oklahoma City and south Texas. This Study seeks to further investigate and develop the Dallas-Fort Worth corridor that was identified in TOPRS and could connect to other TOPRS corridors. A Tier 2 Environmental Impact Statement is required prior to Project implementation. At this time, no funding has been identified for further study of the TOPRS corridors. Building on the TOPRS Tier 1 Record of Decision, NCTCOG led the Fort Worth to Laredo High-Speed Transportation Study in partnership with five other Metropolitan Planning Organizations representing Waco, Killeen-Temple, Austin area, San Antonio area, and Laredo. The goal of this study was to develop

[1] https://railroads.dot.gov/environment/environmental-reviews/texas-oklahoma-passenger-rail-study-corridor-south-texas-oklahoma

potential alternatives for both corridors and technologies, including additional high-speed modes like maglev and hyperloop, to include in a future Tier 2 environmental document(s).

Additionally, the Dallas to Fort Worth corridor may have the potential to connect with the planned high-speed passenger rail service between Dallas and Houston. FRA issued a Record of Decision and final rule of applicability[2] for the Dallas to Houston high-speed service in September of 2020. A private company, Texas Central Railroad, will build and operate the Dallas to Houston corridor. As of April 2023, information on the timing of construction activities is not publicly available.

The DFWHSTC Study is evaluating high-speed options in the Dallas-Arlington-Fort Worth region by analyzing potential routes, technology alternatives, operations/service planning, and preparing preliminary engineering and environmental documentation for high-speed passenger service. Transportation technology alternatives include conventional rail, higher speed rail, high-speed rail, magnetic levitation (maglev), next generation magnetic levitation (e.g., hyperloop), and other emerging technologies. The Project scope of work consists of two phases. Phase 1 of the study, the subject of this report, developed and evaluated transportation modes/technologies and alignments. Phase 2 will refine and evaluate the reasonable alternatives recommended in Phase 1, further develop engineering design, and document these efforts in the National Environmental Policy Act process.

1.2 Report Intent

The intent of this Phase 1 Alternatives Analysis Report is to document the evaluation of high-speed passenger transportation alternatives (both alignments and technology) conducted between April 2020 and September 2022. This report includes the Phase 1 methodologies, development of alternatives, analysis, results, and recommendations.

1.3 Study Area

The Phase 1 Project Study Area was approximately bounded by Interstate Highway (I-)35E, I-35W, State Highway (SH) 183, and US 287/Spur 303/Loop 12. The Study Area encompassed portions of Dallas and Tarrant counties and the cities of Dallas, Irving, Cockrell Hill, Grand Prairie, Arlington, Pantego, Dalworthington Gardens, Hurst, Euless, Bedford, Richland Hills, North Richland Hills, Haltom City, and Fort Worth, over a distance of approximately 31 miles. Figure 1 shows the Study Area covering over 230 square miles.

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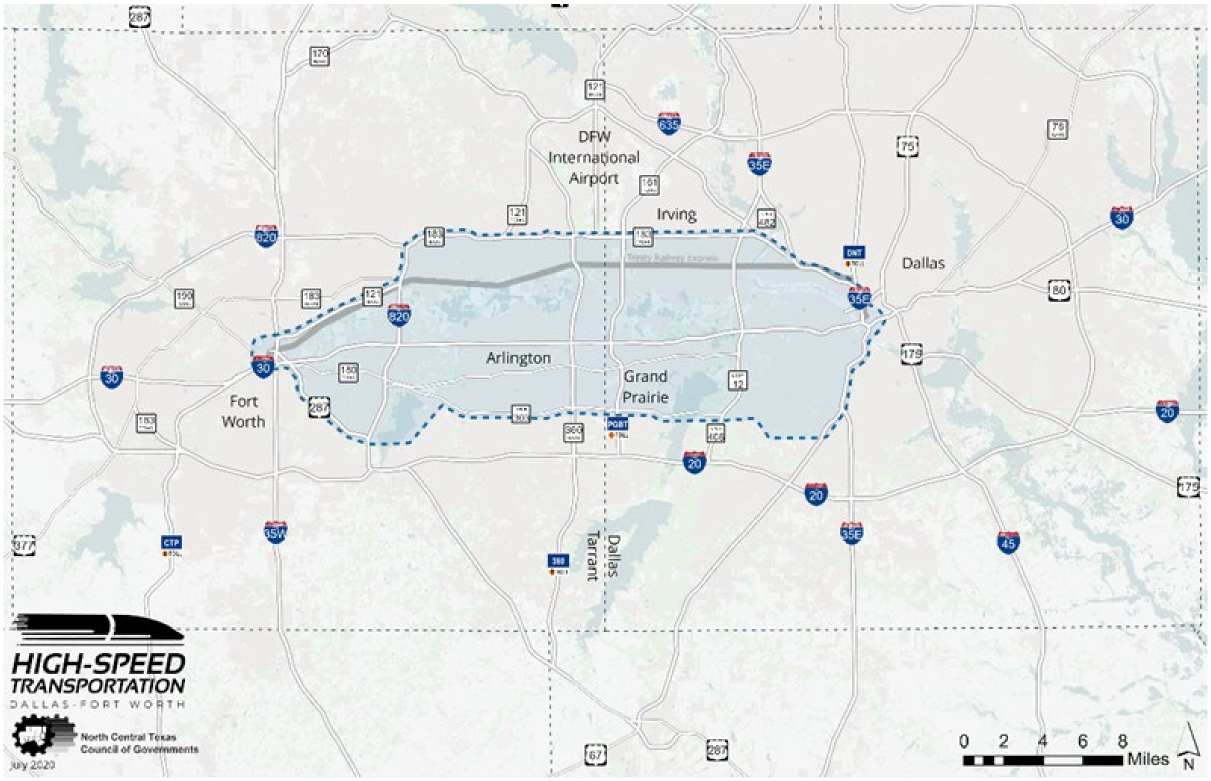
[2] https://railroads.dot.gov/sites/fra.dot.gov/files/2020-09/2130-AC84%20TCRR%20final%20RPA%20clean.pdf

Figure 1. High Speed Transportation Connections Study Area



Source: NCTCOG, 2020

1.4 Preliminary Project Purpose and Need

An early study task of Phase 1 was to develop and refine the preliminary purpose and need to establish objectives based on identified needs for the Project. The preliminary Project purpose developed is to create high-speed passenger rail service or an advanced high-speed ground transportation technology connecting downtown Dallas and downtown Fort Worth.

1.4.1 FTA/FRA Objectives

The objectives for the Dallas-Fort Worth High-Speed Transportation Connections Study reflect both the FRA mission statement "to enable the safe, reliable, and efficient movement of people and goods for a strong America, now and in the future" and FTA mission statement "…provide…for safe, technologically advanced public transportation which enhances all citizens' mobility and accessibility, improves America's communities and natural environment, and strengthens the national economy." The Project is being developed to:

- Provide a safe, convenient, efficient, fast, and reliable alternative to existing ground transportation travel options;
- Advance the state of high-performance rail transportation network by linking the Dallas-Fort Worth region with other planned high-performance passenger rail corridors connecting the large metropolitan areas in Texas, such as the Dallas to Houston high-speed rail project on the east and the high-speed passenger services linking Fort Worth to south Texas metropolitan areas on the west;

- Enhance connectivity within the Dallas-Fort Worth region to existing and planned transportation services including passenger rail, automobile, pedestrian, bicycle, and other services in the Dallas-Fort Worth region; and
- Support economic development opportunities in the Dallas-Fort Worth region by providing improved access to employment, education, entertainment, health, and shopping for residents of, and visitors to, the region and the State.

1.4.2 NCTCOG Objectives

In addition to the FTA/FRA objectives, NCTCOG has identified an approximate 20-minute travel time between downtown Dallas and downtown Fort Worth as an additional purpose for the Project. Currently, traveling between the city centers by automobile can take 30 to 60 minutes when traffic and roadway conditions are favorable. The 20-minute threshold was considered a reasonable improvement in travel time, which would be reliably available any time of day, regardless of traffic conditions, and could encourage people to switch to high-speed transit to help.

1.4.3 Project Needs

Existing and future transportation issues to be addressed by the Project include:

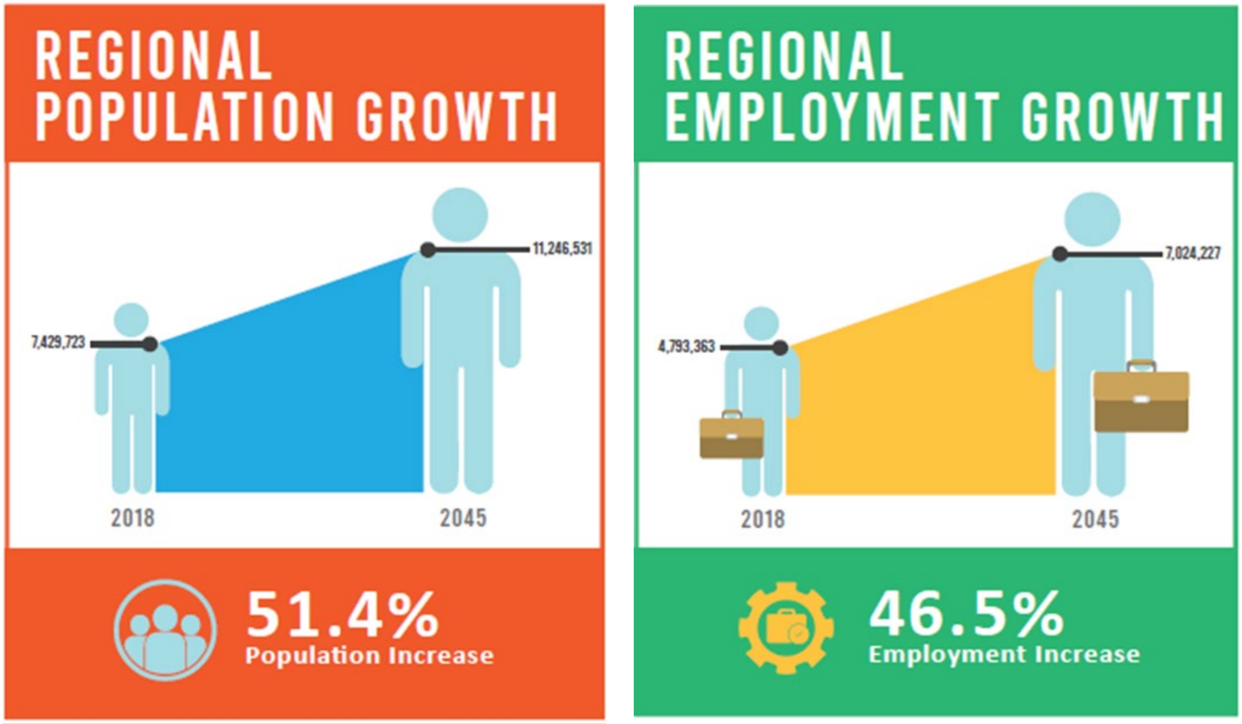
- Expected population and employment growth will continue to increase travel demand and place greater pressure on existing transportation services
- Existing transportation network and services have unreliable and lengthy travel times
  - The existing roadway system is increasingly congested
  - Travel times on the existing passenger rail system are lengthy
- More transportation choices are needed to support:
  - Connectivity to and from large employment centers and major activity centers within North Central Texas
  - Creation of and connectivity to the planned high-performance passenger systems connecting major metropolitan regions in Texas

The following sections provide more detailed information to document these needs.

1.4.3.1 Population and Employment Growth

Population and employment in the Dallas-Fort Worth region is predicted to continue to grow based on past and current trends. Between 2018 and 2045, the region is expected to experience a 51 percent increase in population (from 7.4 million to 11.2 million people) and a 47 percent increase in employment (see Figure 2).

Figure 2. Dallas-Fort Worth Regional Population and Employment Growth



Source: https://www.nctcog.org/getmedia/66dc8b0a-d48c-4383-a2d6-7528c5489787/M2045exsummary_Digital_1.pdf

The Dallas-Fort Worth region represents 30 percent of the gross domestic product of Texas. Key industries are transportation, technology, finance, and defense. Goods and freight come into the area by rail, truck, and air to be distributed to other locations in Texas and surrounding states. The diverse economy of North Central Texas is the sixth-largest retail market and ninth-largest export market in the US and is home to 24 Fortune 500 companies.

1.4.3.2 Travel Time and Reliability

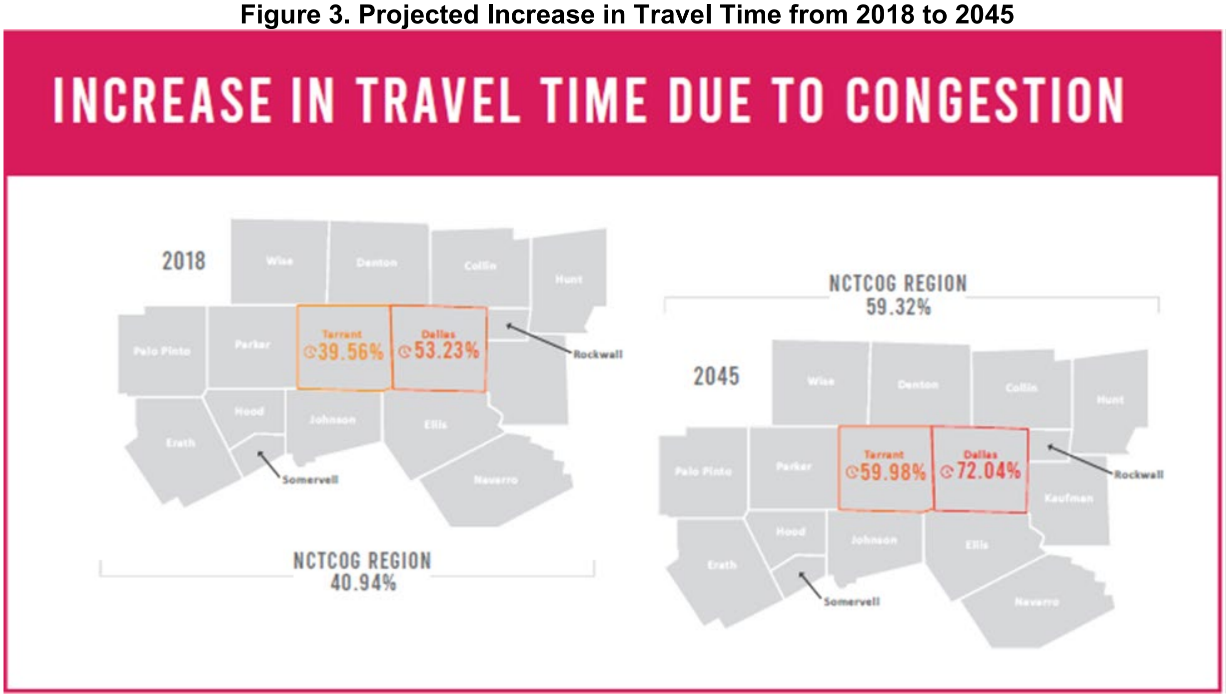
A reliable transportation system is central to continued growth because it provides users with a consistent range of predictable travel times and allows for the more efficient movement of people and goods. State and regional growth will continue to increase travel demand and place greater pressure on transportation systems and services.

Through Mobility 2045 Update, NCTCOG has defined a vision for the multimodal transportation system in the 12-county Dallas-Fort Worth Metropolitan Planning Area. Mobility 2045 provides a systemic approach to solving regional transportation challenges by using strategies to maximize the existing transportation system and making strategic infrastructure investment. The plan provides a range of transportation options to serve the needs of North Central Texans now and into the future. As a region, it will require a maturing transportation system of roads, public transportation, and bicycle and pedestrian facilities, complemented by local policies and programs to enhance infrastructure investment and provide transportation choices to the traveling public.

Travel times and congestion in Dallas-Fort Worth are increasing. In 2018, NCTCOG estimated travel on roadways in the region took approximately 41 percent longer in the congested conditions that occur during peak travel times than in uncongested conditions. Forecasts indicate that by 2045, trips in congested conditions will take 59 percent longer to complete than in uncongested conditions assuming Mobility 2045 recommendations are implemented. This trend is also observed in Dallas and Tarrant Counties, with travel times increasing in Dallas County by 72 percent and 60 percent in Tarrant County during congested conditions by 2045 (see Figure 3).

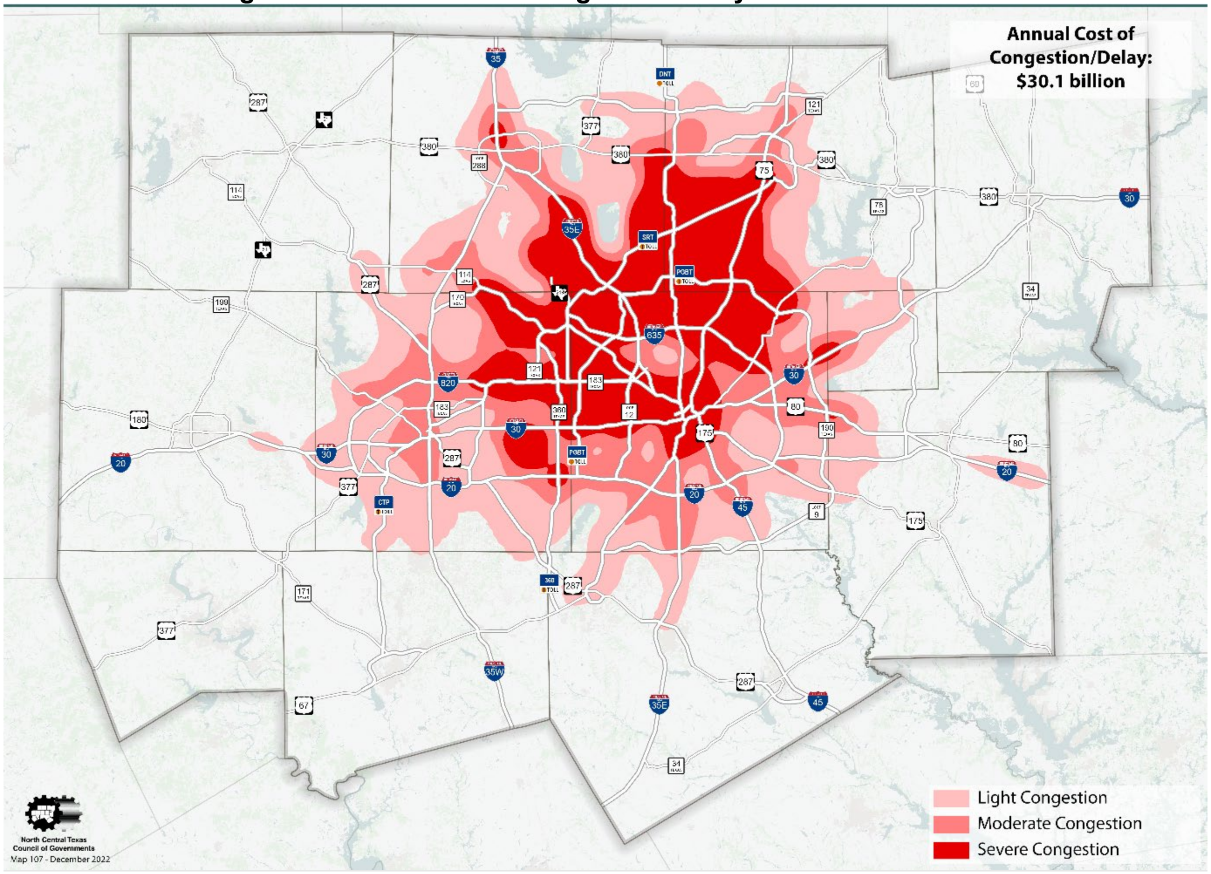
The annual cost of congestion in terms of lost productivity was calculated to be $12.1 billion in 2018 and estimated to rise to $27.3 billion in 2045, a 125 percent increase. The recommended improvements included in the Mobility 2045 will help slow the growth of congestion, but congestion is still anticipated to grow as shown in Figure 4 because of increasing population and employment. These levels of congestion/delay figures are based on re-occurring congestion and do not include congestion due to crashes or incidents.

Figure 3. Projected Increase in Travel Time from 2018 to 2045



Source: Mobility 2045 (Chapter 8 and Appendix G)

Figure 4. 2045 Levels of Congestion/Delay in North Texas in 2045



Source: Mobility 2045 Update (Chapter 8 and Appendix G)

These increasing travel times and congestion also affect public transportation. In the North Central Texas region, there are three transit authorities (Trinity Metro, Dallas Area Rapid Transit, and Denton County Transportation Authority) that provide a variety of services through fixed-route bus, passenger rail, and demand-response services. Two of these services, bus and on-demand, travel on the same congested roadway network as autos and trucks and do not provide a reliable travel option.

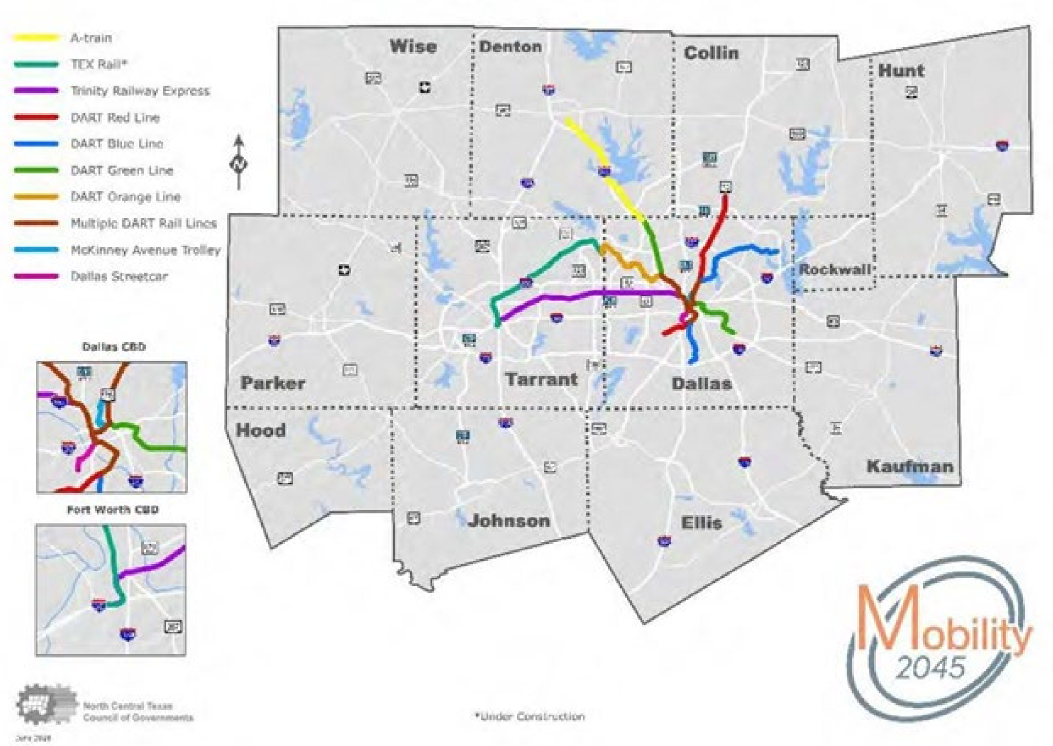
1.4.3.3 Transportation Choice and Regional/Statewide Connectivity

A focus of Mobility 2045 is to offer a range of transportation options to serve the varied travel needs of the region now and into the future. Existing passenger rail service within the NCTCOG region is shown in Figure 5.

The Dallas-Fort Worth High-Speed Transportation Project is proposed to terminate at the Fort Worth Central Station and the proposed Texas Central Railroad Dallas High-Speed Rail Station to provide connectivity to future state-wide high-speed transportation corridors.

While passenger rail service currently exists between downtown Fort Worth and Downtown Dallas via the Trinity Railway Express (TRE), the travel time along the 34-mile route is 61 minutes. The TRE consists of 10 stations, including a station at the Fort Worth Central Station, but does not have a station in Arlington and does not connect to the proposed Dallas High-Speed Rail Station. The TRE predominantly serves riders traveling between the various intermediate stations as opposed to serving full end-to-end riders.

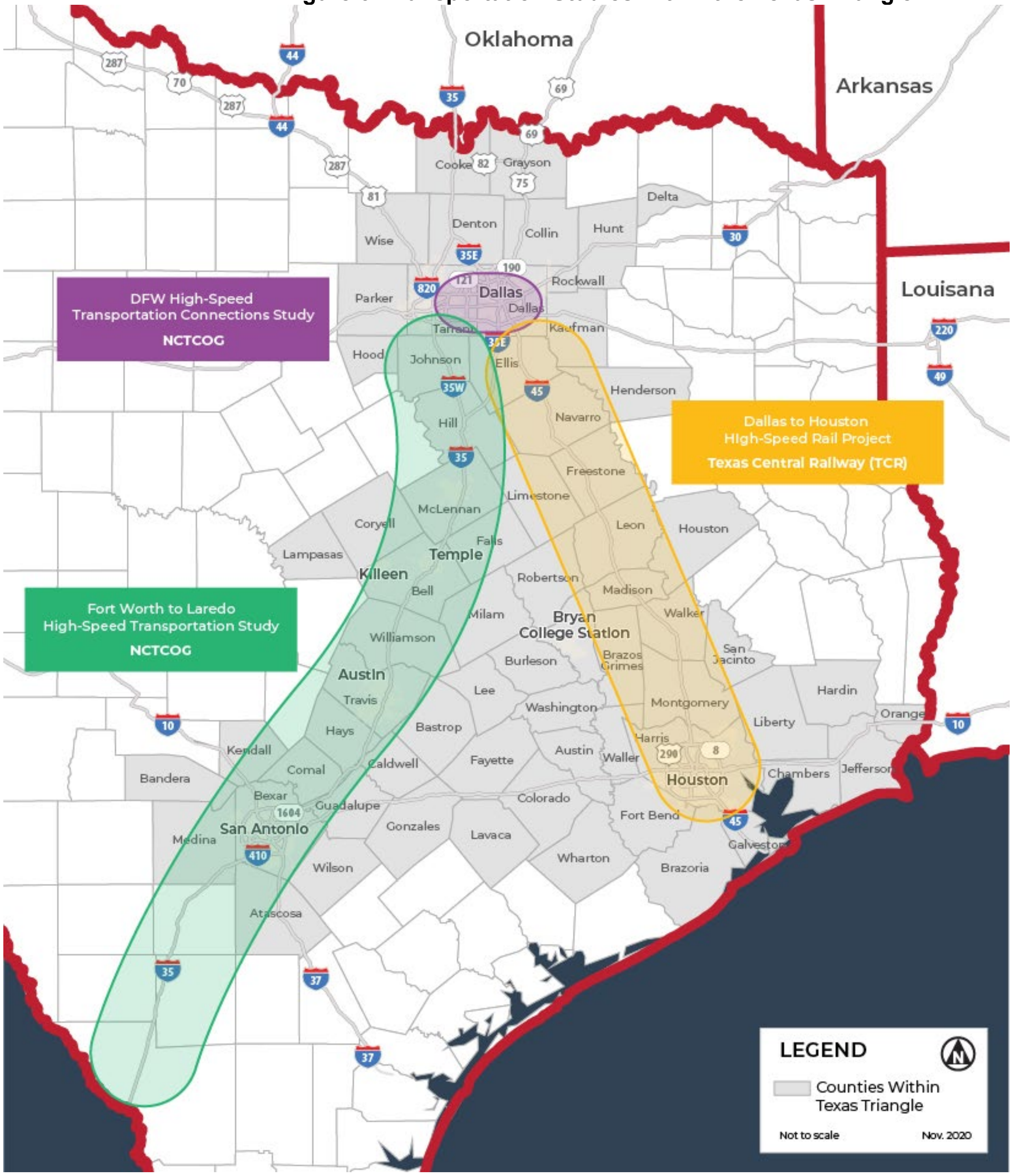
Figure 5. Passenger Rail Service in NCTCOG Region



Source: https://www.nctcog.org/nctcg/media/Transportation/DocsMaps/Plan/MTP/6-Mobility-Options.pdf

In response to regional and statewide growth, there have been several studies to invest in high-speed transportation connections between Dallas and Fort Worth and Houston and south Texas (see Figure 6). A high-speed passenger system is not only needed to connect and serve the growing Dallas-Fort Worth region, but also provide seamless connectivity to these planned high-performance passenger systems serving major metropolitan regions in Texas.

Figure 6. Transportation Studies within the Texas Triangle



Source: HNTB, 2020

1.5 Organization of this Report

This report provides a summary of the alternatives that were analyzed, the criteria used for evaluations, and the results of the evaluations. The Phase 1 evaluation of alternatives included three separate levels to determine adherence of alternatives to the preliminary project purpose and need (Level 1), to identify fatal flaws (Level 2), and to perform a more detailed evaluation of alternatives once engineering principles had been applied to remaining alternatives (Level 3).

This report contains six additional sections that provide detail about the alternatives, criteria, and results. The following can be found in each section:

2.0 **Alternatives Analysis Process** – the section describes the overall process generally used for this study including a description of public and agency engagement and how that information was incorporated.

3.0 **Overview of Alignment Alternatives** – this section provides a detailed description of the various alignment alternatives considered.

4.0 **Overview of Mode Alternatives** – this section provides a detailed description of the various mode alternatives considered.

5.0 **Level 1: Ability to Meet Purpose and Need** – this section provides a detailed description of the Level 1 criteria used to evaluate alignments and modes and provides a table of evaluation results along with a detailed description of alignment and modes results.

6.0 **Level 2: Fatal Flaws and Ranking** – similar to Section 5.0, this section provides detail about Level 2 criteria and results.

7.0 **Level 3: Detailed Evaluation** – similar to Section 5.0, this section provides detail about Level 3 criteria and results.

8.0 **Concept Refinement** – this section describes the development and evaluation of alignment concepts connecting the high-speed transportation alignment to stations in Fort Worth, Arlington, and Dallas.

9.0 **Summary of Results and Next Steps** – this section summarizes the results from Phase 1 and describes the activities to be taken during Phase 2.

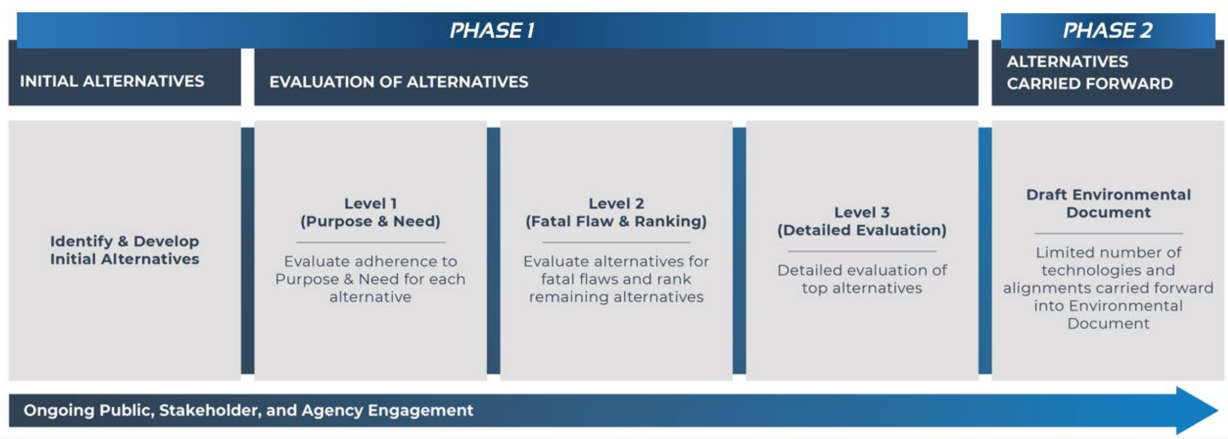
2.0 Alternatives Analysis

This section describes the screening process used to evaluate the alignments and modes during Phase 1. The screening process provided a technical framework though which potential alignments/corridors, and modes/technologies were comparatively analyzed. Both quantitative and qualitative measures were used. The application of environmental, community, and economic-related criteria and measures was intended to assist in pinpointing major differences in the alternatives and help facilitate the decision of which alternatives should be developed further. Therefore, some factors that would be the same or similar for all alternatives were not included. The evaluation criteria and results of each level of screening were documented and presented to stakeholders and the public for review and comment. This collaborative and integrated approach to transportation decision-making is known as Planning and Environmental Linkages. It considers environmental, community, and economic goals early in the transportation planning process and uses that information to inform the environmental review process.

2.1 Process

The overarching process applied to the evaluation of alignments and modes for the DFWHSTC Study is shown in Figure 7. This two-phase process was developed to help identify, develop, and analyze a wide variety of alignments and modes in Phase 1 (Alternatives Analysis) to narrow down the alignment(s) and mode(s) to be carried forward into Phase 2 (Engineering/Environmental Analysis).

Figure 7. Evaluation Process



Source: HNTB, 2021

In Phase 1, the study employed a three-level screening process to narrow down the initial large number of possible alignment and mode options to a limited number of viable options to be studied in Phase 2. Figure 8 shows the types of criteria for each level. The process began with the identification of reasonable alternatives. The Level 1 screening determined if an alternative met the preliminary purpose and need (see Section 1.4); the alternatives passing this screening were forwarded into the Level 2 evaluation. More detailed information on the process for each of the levels of evaluation and how the data were used to differentiate alternatives can be found in Sections 5.0 (Level 1), 6.0 (Level 2), and 7.0 (Level 3) of this report.

Figure 8. Screening Criteria by Levels

Source: HNTB, 2021

The Level 2 evaluation focused on identifying major flaws (e.g., proximity to sensitive social, biological, or cultural areas; inability to meet engineering design criteria), which could preclude an alternative from being built and ranked the remaining alternatives. This effort resulted in a short-list of viable alternatives to move into the Level 3 evaluation.

In the Level 3 screening, the study conducted a detailed evaluation of remaining alternatives based on potential impacts, costs, and constructability criterion. To support this effort, five percent design plans were developed for the remaining alternatives to provide more engineering information. Again, this effort resulted in a recommended short-list of alternatives to move into Phase 2 of the study.

In Sections 5.0, 6.0, and 7.0 of this report, each of the three levels of evaluation for alignments and modes are described in more detail. Table 1 offers an example of the evaluation result tables with the criteria listed on the left-hand side and alignments or modes listed across the top. High, medium, and low ratings based on the analysis are symbolized using full, half-full and empty Harvey Balls as indicated here:

● = High	◒ = Medium	○ = Low

Table 1. Sample Table of Evaluation Results

Criteria		Hypothetical Alignments							
		1	2	3	4	5	6	7	8
Criteria Topic	Criterion #1	◒	◒	◒	●	●	◒	○	○
	Criterion #2	◒	◒	○	◒	●	●	●	○
Alignment Recommendations		No	No	No	Yes	Yes	Yes	No	No

Source: HNTB, 2021

Various thresholds for high, medium, and low were set for each criterion based primarily on differentiation between the alternatives as they were measured against the available data associated with each criterion. Some criteria were yes or no questions, while others were based on industry best practices, engineering principles, or more complex data sets. The criteria were valued the same at every level and high, medium, and low ratings were determined for each alternative across all the criteria associated with each respective level of analysis.

The bottom row of each table indicates whether a given alternative should advance to the next level of analysis with a "Yes" to advance, or "No" to discontinue analysis and document the reason for such. To highlight these recommendations, the highest performing alternatives are shown in green on each table. In the sample provided in Table 1, hypothetical Alignments 4, 5, and 6 are shown to have higher overall ratings (half circles and solid circles), so they are shown in green with a "Yes" and were recommended to advance to the next level of analysis.

2.2 Supporting Analysis and Efforts

To support the development and evaluation of the various alignment alternatives and modes, public and agency engagement, a technology forum, environmental constraint mapping, travel time forecasts, travel demand forecasts, and conceptual engineering efforts were conducted during Phase 1. The following sections highlight these activities.

2.2.1 Public and Agency Engagement

A Public and Agency Engagement Plan was specifically developed for the study. The plan outlined public and agency engagement activities and tools to support the development and analysis of alternatives. Multiple outreach and communications strategies (e.g., public meetings, project website, social media, presentations/briefings, newsletters) were used to engage a diverse audience in public input opportunities and provide information about the Project. The Public and Agency Engagement Plan and the Public Meeting and Open House summaries can be found in Volume I, Appendix A.

2.2.1.1 Public Meetings

During the Phase 1 Alternative Analysis, NCTCOG hosted three series of public meetings to help identify alternatives, provide information about the analysis, and solicit public and stakeholder feedback. Input from the public and stakeholders helped to check the progress and approach as the study was developed and to offer insights about various parts of the alignments that may not be captured in the available data sets. The three series of public meetings were held in September 2020, January 2021, and May 2021, each having the purpose of sharing information on the progress and soliciting feedback. Due to the ongoing COVID-19 pandemic, the meetings were all held virtually rather than in-person. The virtual meetings allowed for the observation of social distancing requirements while maintaining the overall study schedule and gathering input at appropriate points in the study process. Individuals could participate in the live public meetings either online through the Public Information Management Application (PIMA) or by telephone through a Telephone Town Hall service. The presentations were also pre-recorded and available a week before the meeting on the project website. The primary purpose for each series of public meetings included the following:

Series 1 (September 2020) – Provided a study overview, including the various modes and alignments being considered for the initiative, and requested input and comments on the study information thus far, including the draft preliminary purpose and need. This occurred as the Level 1 screening was just beginning.

Series 2 (January 2021) – Provided a study overview and recap as well as an update on the results of the Level 1 and Level 2 screenings and discussed modes and alignments to be analyzed moving forward into the Level 3 screening. This meeting also solicited input and comments on the study information presented at that time. This series occurred as the Level 3 screening was about to begin.

Series 3 (May 2021) – Provided a study overview and recap and provided an update on the Level 3 screening results, which included the alignments and modes recommended to be analyzed further in Phase 2. This meeting also solicited input and comments on the study information presented at that time. This series occurred once the Level 3 screening was completed.

In October 2021, a series of Open Houses were held in the four cities along the preferred alignment. Due to the ongoing COVID-19 pandemic, safety measures were taken at the open houses and the materials presented were also shared online on the project website. The Open Houses provided an opportunity for the public to walk through Phase 1 and speak to the Project team directly about any questions or concerns.

Public meeting summaries documenting meeting notices, public comments, the presentation/meeting materials, and participants were prepared for each series of meetings. These summaries along with the pre-recorded presentations are posted on the project website (www.nctcog.org/dfw-hstcs under Presentations & Public Outreach Efforts).

2.2.1.2 Stakeholder and Agency Engagement

The Project team engaged with a variety of stakeholders and agencies throughout Phase 1 of the study. In total, the team held 185 meetings, including regularly scheduled meetings/briefings with FTA and FRA, the Project Technical Work Group, elected officials, the NCTCOG Regional Transportation Council, and NCTCOG Surface Transportation Technical Committee.

The Project Technical Work Group was created in mid-2020 and held their first meeting in September 2020. NCTCOG invited representatives from all local municipalities, transit providers, and transportation agencies within the Study Area to participate in Technical Work Group meetings. This group provided input on the development and evaluation of alternatives and helped provide information and expertise to guide the Project team throughout the Phase 1 process. Eight meetings of the Technical Work Group were held as shown in Table 2.

Individual project update and stakeholder feedback meetings were held with state and federal agencies and organizations along the potential alignments, including Dallas and Tarrant Counties; Cities of Dallas, Fort Worth, Arlington, and Grand Prairie; DART; Trinity Metro; Texas Department of Transportation (TxDOT) Dallas and Fort Worth Districts; federal and state resource agencies such as US Army Corps of Engineers and Texas Historic Commission; and interested organizations such as the Sierra Club, Trinity Park Conservancy, and various neighborhood associations, among others. Private entities were engaged as well, including BNSF Railroad, Union Pacific Railroad, and major property owners. As the Project progresses into Phase 2, additional stakeholder and agency engagement will occur, including continued outreach to private entities and organizations along the potential alignments as alignment refinement occurs.

Table 2 provides a comprehensive list of all engagement meetings held during Phase 1 of the study.

Table 2. Engagement Meetings

Meeting Audience	Date
FRA/FTA Coordination Meeting	3/1/2020
Regional Transportation Council	5/14/2020
FRA/FTA Coordination Meeting	5/14/2020
FRA/FTA Coordination Meeting	6/18/2020
FRA/FTA Coordination Meeting	7/16/2020
Elected Official Project Kick-Off Meeting	7/17/2020
Project Technical Work Group Meeting	7/21/2020
The Boring Company	8/4/2020
Arlington Councilmember Dr. Ignacio Nunez	8/8/2020
Virgin Hyperloop staff	8/14/2020
FRA/FTA Coordination Meeting	8/20/2020
Project Technical Work Group Meeting	8/21/2020
Sue Philips with East Arlington Renewal	9/2/2020
Alicia Gray with Heart of Arlington	9/3/2020
FRA/FTA Coordination Meeting	9/3/2020
Hardt Hyperloop staff	9/3/2020

Meeting Audience	Date
Jo Anna Cardoza with Arlington Tomorrow Fund	9/9/2020
Fort Worth Councilmember Cary Moon	9/10/2020
Dallas Councilmember Chad West	9/14/2020
Kennedy Jones with Greater Community Missionary Baptist Church	9/14/2020
Dallas Councilmember Omar Narvaez	9/17/2020
Yen Nguyen with Tarrant Asian-American Chamber of Commerce	9/17/2020
Grace McDermott with US Pan Asian American Chamber of Commerce	9/18/2020
Project Public Meeting	9/23/2020
Project Public Meeting	9/24/2020
FRA/FTA Coordination Meeting	10/2/2020
Union Pacific Railroad	10/12/2020
Downtown Fort Worth Inc. Board of Directors	10/15/2020
Project Technical Work Group Meeting	10/16/2020
NCTCOG Surface Transportation Technical Committee	10/23/2020
FRA/FTA Coordination Meeting	11/5/2020
City of Fort Worth City Council Transportation Committee	11/10/2020
Downtown Fort Worth Inc. Transportation Committee	11/11/2020
NCTCOG Regional Transportation Council	11/12/2020
Project Technical Work Group Meeting	11/20/2020
FRA/FTA Coordination Meeting	12/3/2020
Technology Forum Workshop	12/9/2020
Project Technical Work Group Meeting	12/18/2020
Federal, State, and Local Resource Agencies	12/18/2020
Technology Forum Meeting with Talgo	1/4/2021
Technology Forum Meeting with Hardt Hyperloop	1/6/2021
FRA/FTA Coordination Meeting	1/7/2021
Technology Forum Meeting with Virgin Hyperloop	1/7/2021
Technology Forum Meeting with AirTrac	1/8/2021
Technology Forum Meeting with Alstom	1/11/2021
Technology Forum Meeting with The Boring Company	1/11/2021
North Dallas Chamber of Commerce Surface Transportation Committee	1/12/2021
Technology Forum Meeting with SNCF	1/12/2021
City of Arlington elected officials and staff	1/13/2021
Elected Officials Briefing	1/15/2021
City of Fort Worth Staff	1/15/2021
Technology Forum Meeting with Hyperloop TT	1/20/2021
Technology Forum Meeting with Texas Central Railroad	1/20/2021
NCTCOG Surface Transportation Technical Committee	1/22/2021
US Army Corps of Engineers	1/22/2021
Union Pacific Railroad	1/25/2021
Project Public Meeting	1/27/2021
Project Public Meeting	1/28/2021

Meeting Audience	Date
Dallas College	2/2/2021
FRA/FTA Coordination Meeting	2/4/2021
NCTCOG Public Meeting	2/4/2021
DART and TRE staff	2/10/2021
Virgin Hyperloop staff	2/11/2021
TxDOT-Dallas District staff	2/25/2021
Technology Forum Meeting with Stadler	2/26/2021
Virgin Hyperloop staff	3/2/2021
Technology Forum Meeting with NineAI	3/3/2021
FRA/FTA Coordination Meeting	3/4/2021
Greater Dallas Planning Council	3/4/2021
TxDOT-Fort Worth District staff	3/9/2021
NCTCOG Regional Transportation Council	3/11/2021
City of Grand Prairie staff	3/16/2021
City of Arlington staff	3/17/2021
Project Technical Work Group Meeting	3/19/2021
FRA/FTA Coordination Meeting	3/29/2021
TxDOT-Fort Worth District	4/1/2021
Trinity Park Conservancy	4/1/2021
North Texas Tollway Authority	4/7/2021
FRA/FTA Coordination Meeting	4/12/2021
TxDOT-Dallas District	4/14/2021
University of Texas at Arlington Student Government Presentation	4/16/2021
Rotary Club of Arlington	4/22/2021
Project Technical Work Group Meeting	4/23/2021
NCTCOG Surface Transportation Technical Committee	4/23/2021
Trinity Park Conservancy	4/29/2021
Union Pacific Railroad	5/5/2021
FRA/FTA Coordination Meeting	5/6/2021
Metroplex Mayors Council	5/11/2021
NCTCOG Regional Transportation Council	5/13/2021
Elected Officials Briefing	5/14/2021
VisitDallas Meeting	5/18/2021
Project Public Meeting	5/19/2021
Project Public Meeting	5/20/2021
Central Meadowbrook Neighborhood Association	5/25/2021
Federal, State, and Local Resource Agencies	5/27/2021
Trinity Metro	5/28/2021
DFW Bicycle Coalition	6/2/2021
FRA/FTA Coordination Meeting	6/3/2021
TxDOT Fort Worth District	6/3/2021
Sierra Club	6/3/2021

Meeting Audience	Date
TxDOT Dallas District	6/4/2021
Project Technical Work Group Meeting	6/4/2021
City of Fort Worth	6/7/2021
Fort Worth Housing Solutions	6/7/2021
Transpod	6/11/2021
Leagues of Women Voters (Dallas, Tarrant, Irving) and American Association of University Women	6/17/2021
BNSF Railroad	6/18/2021
FRA Meeting	6/22/2021
North Texas C? Water Infrastructure Council	6/23/2021
NCTCOG Surface Transportation Technical Committee	6/25/2021
Tarrant County	6/30/2021
City of Grand Prairie	7/7/2021
City of Dallas	7/7/2021
NCTCOG Regional Transportation Council	7/8/2021
White Lake Hills Neighborhood Association	7/12/2021
Trinity Metro Coordination	7/13/2021
Bike DFW	7/20/2021
Union Pacific Railroad	7/21/2021
Dallas Convention Center Master Plan Coordination	7/26/2021
WTS	7/30/2021
FRA/FTA Coordination Meeting	8/5/2021
TxDOT Dallas District	8/9/2021
National Association for the Advancement of Colored People Arlington	8/10/2021
Sierra Club Fort Worth/Tarrant County	8/12/2021
Greater Fort Worth Association of Realtors	8/20/2021
Trinity Metro	8/24/2021
East Fort Worth Business Association	9/2/2021
BNSF Railroad	9/9/2021
North Texas Tollway Authority	9/10/2021
TxDOT Fort Worth District	9/13/2021
City of Fort Worth	9/13/2021
Roadis	9/15/2021
Texas Institute of Transportation Engineers - Greater Fort Worth Section	9/16/2021
TxDOT Dallas District	9/17/2021
Union Pacific Railroad	9/22/2021
City of Arlington	9/22/2021
Tarrant County	9/30/2021
Greater Dallas Planning Council Board of Directors	10/5/2021
Dallas County	10/6/2021
Grand Prairie Open House	10/12/2021

Meeting Audience	Date
Fort Worth Open House	10/19/2021
Dallas Open House	10/26/2021
Arlington Open House	10/30/2021
Trinity Park Conservancy	11/1/2021
Arlington Conservation Council	11/3/2021
FRA/FTA Coordination Meeting	11/4/2021
Sundance Square	11/16/2021
Texas Society of Professional Engineers (Mid-Cities)	11/18/2021
TransPod	12/16/2021
FRA/FTA Coordination Meeting	1/6/2022
City of Grand Prairie	1/25/2022
TransPod	1/25/2022
City of Arlington Staff	2/2/2022
Tarrant Regional Transportation Coalition	2/2/2022
FRA/FTA Coordination Meeting	2/3/2022
City of Dallas	2/8/2022
Roadis	2/9/2022
Trinity Park Conservancy	2/9/2022
Dallas County Elected Official	2/9/2022
NCTCOG Regional Transportation Council	2/10/2022
TxDOT Dallas District	2/14/2022
BNSF	2/14/2022
City of Fort Worth	2/15/2022
Dallas County	2/16/2022
Grand Prairie	2/18/2022
Union Pacific Railroad	2/21/2022
Trinity Metro and Tarrant County	2/24/2022
TxDOT Fort Worth District	3/1/2022
FRA/FTA Coordination Meeting	3/3/2022
Texas A&M University	3/23/2022
US Army Corps of Engineers	4/4/2022
City of Arlington	4/6/2022
FRA/FTA Coordination Meeting	4/7/2022
Texas A&M University	4/12/2022
American Railway Engineering and Maintenance-of-Way Association Committees 11 (Commuter and Intercity Rail Systems) and 17 (High-Speed Rail Systems)	4/25/2022
FRA/FTA Coordination Meeting	5/5/2022
Hunt Realty Investments	5/16/2022
FRA/FTA Coordination Meeting	6/2/2022
Hunt Realty Investments	6/3/2022
FRA/FTA Coordination Meeting	7/72022

Meeting Audience	Date
FRA/FTA Coordination Meeting	8/4/2022
Hunt Realty Investments	8/23/2022
TxDOT Transportation Planning & Programming Division (Interstate Highway 20 Corridor Study Group)	9/8/2022
Texas Civil Engineering Conference (CECON)	9/15/2022

Note: Formal opportunities for public input via meetings are indicated in bold. A public comment summary was created for each opportunity and is included in Volume I, Appendix A.

2.2.2 Technology Forum

In addition to the public and agency engagement effort, a Technology Forum was hosted as a series of events conducted from September 2020 to March 2021, involving high-speed transportation technology professionals. The forum was structured to educate the industry about the potential alignments between Dallas and Fort Worth, share opportunities for industry involvement as the Project advances toward a future delivery opportunity, and obtain industry input to help inform the next steps to be taken toward developing a successful high-speed solution.

Technical feedback received from high-speed transportation technology professionals was incorporated into the Project design criteria and operational characteristics used to evaluate modes during the Level 2 and Level 3 modes screening in the alternative analysis. The Technology Forum was held in four phases, the first three of which involved industry professionals with an interest in the Project, with the last phase involving a review of information received by independent industry professionals. Each phase of the Technology Forum included the following:

Phase I (Technology Scan) – In preparation for the Technology Forum Workshop, invitations were extended to known high-speed transportation industry professionals, input on the workshop agenda and specific information about the products or services provided by each workshop participant was requested. Responses from participants were combined with input provided by the local stakeholders about the various transportation modes being studied at the September 2020 public meeting and used to shape the workshop format and support the ongoing development of alternatives screening criteria and design criteria.

Phase II (Workshop) – The workshop was structured to educate technology professionals about the DFWHSTC Study and facilitate open discussion amongst participants regarding the challenges and opportunities associated with developing and implementing high-speed transportation between Dallas and Fort Worth. Workshop discussion topics included subjects such as favorable transportation mode characteristics, best practices for high-speed transportation projects, and technology readiness for market.

Phase III (One-on-One Sessions) – The workshop was followed by a series of one-on-one sessions where the Project team invited select workshop participants to visit about various aspects of their specific technology and how it should be considered during the final alternatives screening. Participants for one-on-one sessions were primarily selected based upon the level of technology readiness and applicability to the DFWHSTC Study.

Phase IV (Independent Review) – An independent review was conducted by industry experts who were uninvolved in the first three phases of the forum. The purpose of this peer review of the Technology Forum was to evaluate information gathered during the forum and ensure it was appropriately applied to transportation technology mode screening where the independent review team served as a neutral party to the technology providers and the Project team, ensuring the fidelity of the analysis. The review assessed the process used to administer the Technology Forum, the results from each phase, and the resulting value to the industry and the Project. The independent team concluded their review with recommendations on how to build upon the Technology Forum throughout the remainder of the DFWHSTC Project.

For more detailed information on the Technology Forum, please refer to the *Technology Forum Summary Report* dated July 2021 posted on the project website (posted on the project website www.nctcog.org/dfw-hstcs).

2.2.3 Environmental Constraints Mapping

To support the evaluation of alternatives, environmental constraint mapping was also developed (see Volume II, Appendix II-A) based on available data and information. The mapping reflected existing community facilities, flood plains, wetlands, water bodies, parks, Environmental Justice populations and historic resources. The maps were used at public meetings, in presentations to stakeholders, and at the public open houses in Fall 2021, while the data and analyses behind the constraints maps were used to inform the level 2 and level 3 evaluations.

2.2.4 Travel Time Forecasting

The purpose of the travel time forecasting analysis was to develop a general travel time to compare alignments and modes through the screening process, not to generate accurate end-to-end travel times. Once limited alignments are advanced into Phase 2, more accurate travel time estimates will be produced. The Phase 1 travel time forecasts were developed using a spreadsheet model calculating travel time based on distance, maximum technology speed, design guidance (minimum curve radius and superelevation), acceleration, and deceleration. The model was used to forecast travel times for a one-way trip (in the eastbound direction). Each alignment was divided into straight, tangent, and curve segments and travel time and average speed was calculated for each alignment segment based on technology capabilities and operating assumptions. Design capabilities for each technology (minimum horizontal curve radius and superelevation assumption) constrain travel speed in curve segments, and the model accounts for acceleration and for deceleration required to slow to the design speed on curve segments.

Travel time in the Level 1 evaluation considered terminus locations in Dallas and Fort Worth, and competitiveness of travel times with existing ground transportation options as the primary criterion. The initial travel time screening identified which of the modes could make the trip in 20 minutes or less across each of the unique alignment alternatives. The purpose of the Level 1 travel time analysis was to eliminate any mode that could not meet the 20-minute threshold on any of the 43 alignments. In Level 2, a similar travel time model run was conducted as part of the overall evaluation, though the threshold was increased to 22 minutes to allow for stopping at a mid-point station. The purpose of the Level 2 travel time analysis was to support the mode evaluation by identifying the number of alignments that each mode could meet the 22-minute threshold. In Level 3, the travel time model was first refined to reflect any modifications to alignment alternatives that resulted from the conceptual engineering, then employed to support the mode evaluation. The purpose of the Level 3 travel time analysis was to differentiate between the slowest travel times among remaining modes and alignment alternatives. For more detail on the travel time forecasting, see Volume I, Appendix F.

2.2.5 Travel Demand Estimation

To help inform the analysis of alignments and modes in Phase 1, travel demand modeling was conducted to evaluate the potential demand for high-speed service based on service characteristics, connectivity to other high-speed corridors, and travel time. The intent of this modeling was to provide a sufficient level of detail to differentiate between modes and alignments, it was not intended as a substitute for actual ridership estimation. Estimated ridership, specific to an alignment and mode, will be developed in Phase 2 once a reduced number of alignments and modes have been established at the end of Phase 1. For more information, see the *Phase 1 Travel Demand Methodology and Findings Report*.

2.2.6 Conceptual Engineering

Five percent conceptual engineering was completed to support the Level 3 evaluation of the alignment alternatives that were advanced from the Level 2 screening. Adjustments were made as needed to achieve priorities such as maintaining the use of existing public transportation right-of-way and avoiding critical infrastructure, private properties, and sensitive environmental areas when reasonable. It was assumed that the guideway would be on an elevated structure along each remaining alignment. Design considerations for double tracking (or double tube) were assumed to provide proper spacing compliant with design criteria for each mode. As engineering principles were applied to the alignments, refinements were made accordingly. Potential locations for stations and maintenance yards were also identified. Additionally, rough order of magnitude capital costs were developed. These more detailed alignments were then used to support the Level 3 screening of alignment alternatives. For more detail on the five percent conceptual engineering, see Volume II, Appendix II-E.

3.0 Overview of Alignment Alternatives

Alignment alternatives were identified by building upon work completed for previous high-speed passenger transportation studies in the Study Area; for more information, see Volume I, Appendix B. Based on technology requirements and previous studies, new alignments and previously considered alignments with some revisions were developed. Where feasible, alternative alignments in this study were proposed primarily along existing transportation corridors to avoid and/or minimize social, economic, and environmental impacts. For this Project specifically, the preliminary draft project purpose established during Phase 1 was to create high-speed passenger rail service or an advanced high-speed ground transportation technology connecting downtown Dallas and downtown Fort Worth.

The alternatives analysis started with 43 unique alignments that travel between Fort Worth and Dallas along five general alignments, creating five "families" of alignments. Figure 9 shows all alignments considered in this study, with each of the five families of alignments shown in a different color. Volume II, Appendix II-B includes larger scale, individual maps of each alignment. Note, all alignments in this section are described from downtown Fort Worth to downtown Dallas.

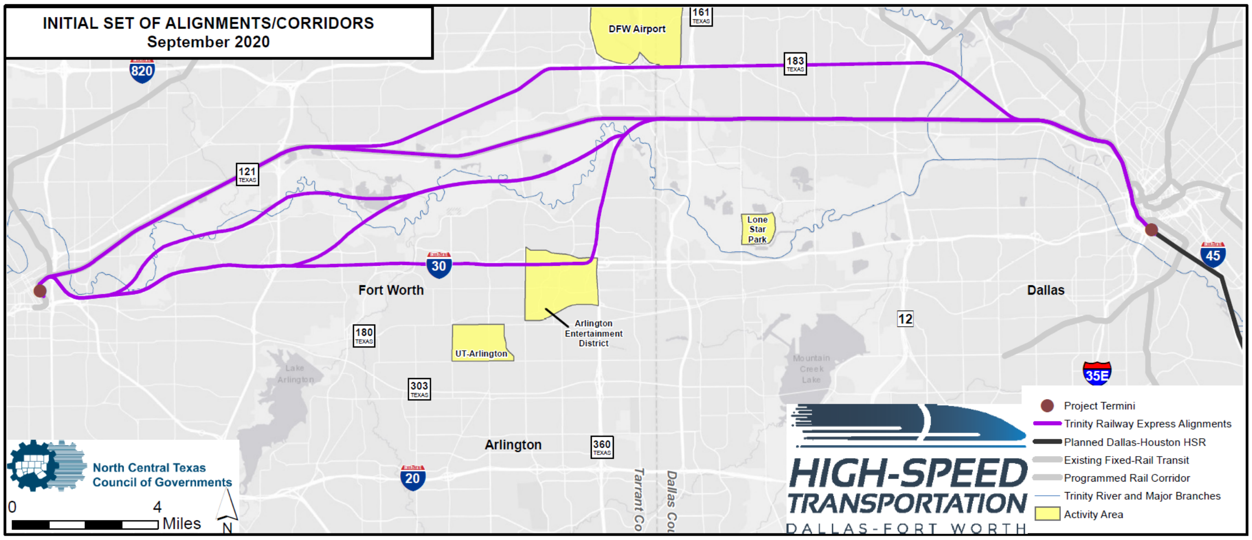
Figure 9. High-Speed Transportation Connections Study Alignments

Source: HNTB, 2021

3.1 Trinity Railway Express (TRE) Alignments

The northern-most family of alignments generally follows the Trinity Railway Express (TRE) between Fort Worth and Dallas. The TRE is an existing commuter rail line between Fort Worth and Dallas using conventional locomotive-hauled rail technology and is jointly operated by the two major transit agencies –Trinity Metro and Dallas Area Rapid Transit (DART). Each of the five alignment alternatives included in this family travel within or are adjacent to all or part of the TRE. Figure 10 shows the TRE family of alignments.

Figure 10. TRE Alignments

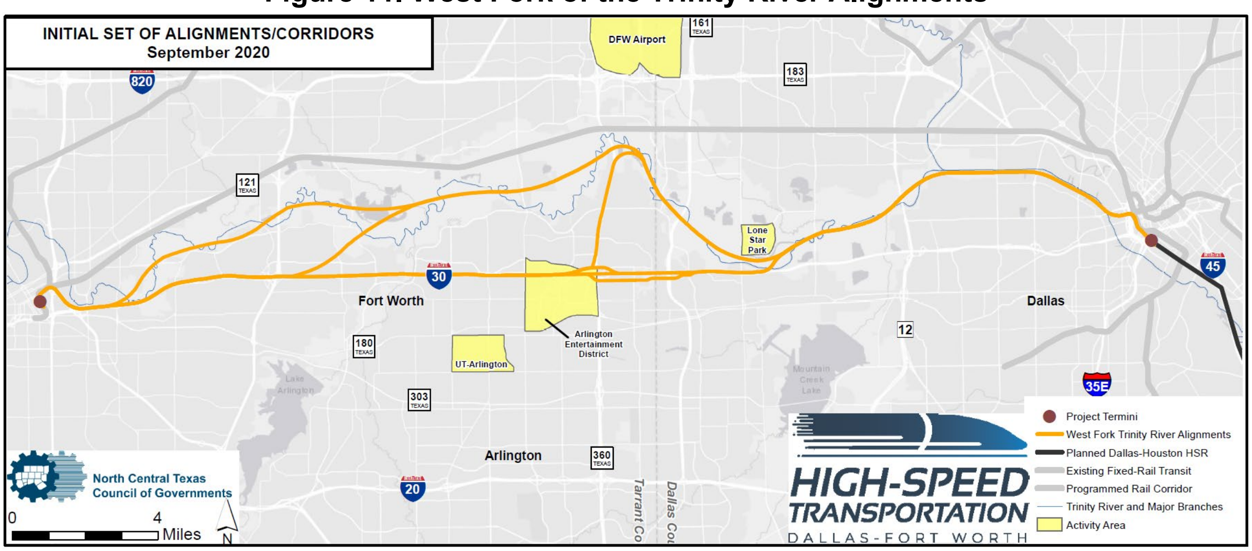


Source: HNTB, 2021

3.2 West Fork of the Trinity River Alignments

The next family of alignments generally follows the West Fork of the Trinity River between Fort Worth and Dallas. The Trinity River flows from North Central Texas to Galveston Bay just east of Houston. The West Fork of the Trinity River flows from Fort Worth to Dallas and is a tributary of the Trinity River. Each of the six alignment alternatives included in this family travel within or are adjacent to all or part of the West Fork of the Trinity River. Figure 11 shows the West Fork of the Trinity River family of alignments.

Figure 11. West Fork of the Trinity River Alignments

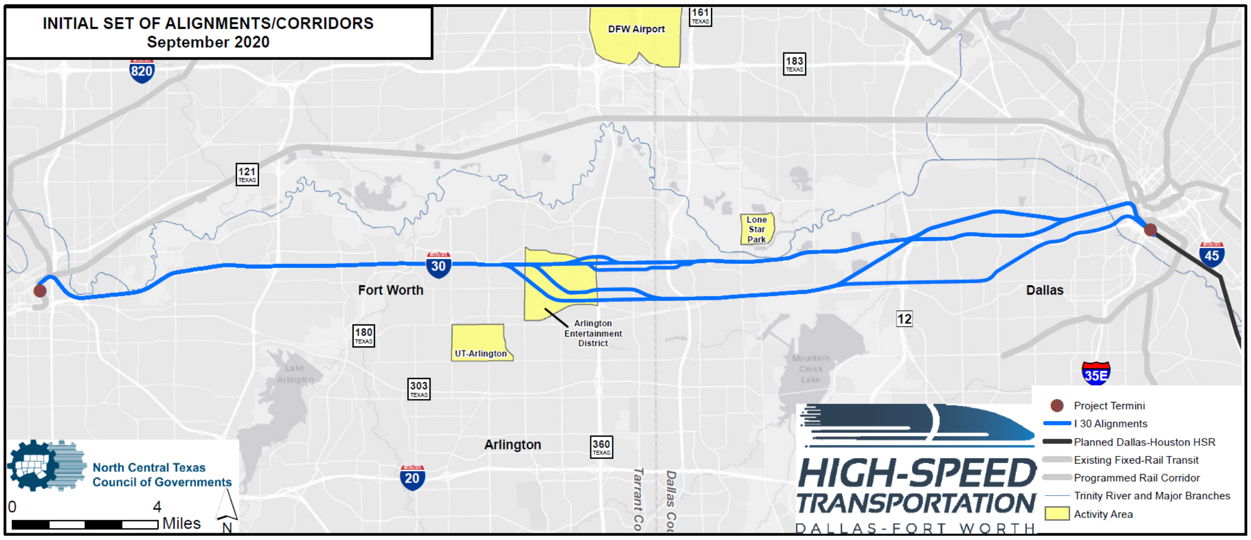


Source: HNTB, 2021

3.3 I-30 Alignments

The next family of alignments generally follows I-30 between Fort Worth and Dallas. I-30 is the most direct existing transportation facility connecting the two city centers. Each of the 17 alignment alternatives included in this family travel within or are adjacent to all or part of I-30. Figure 12 shows the I-30 family of alignments.

Figure 12. I-30 Alignments

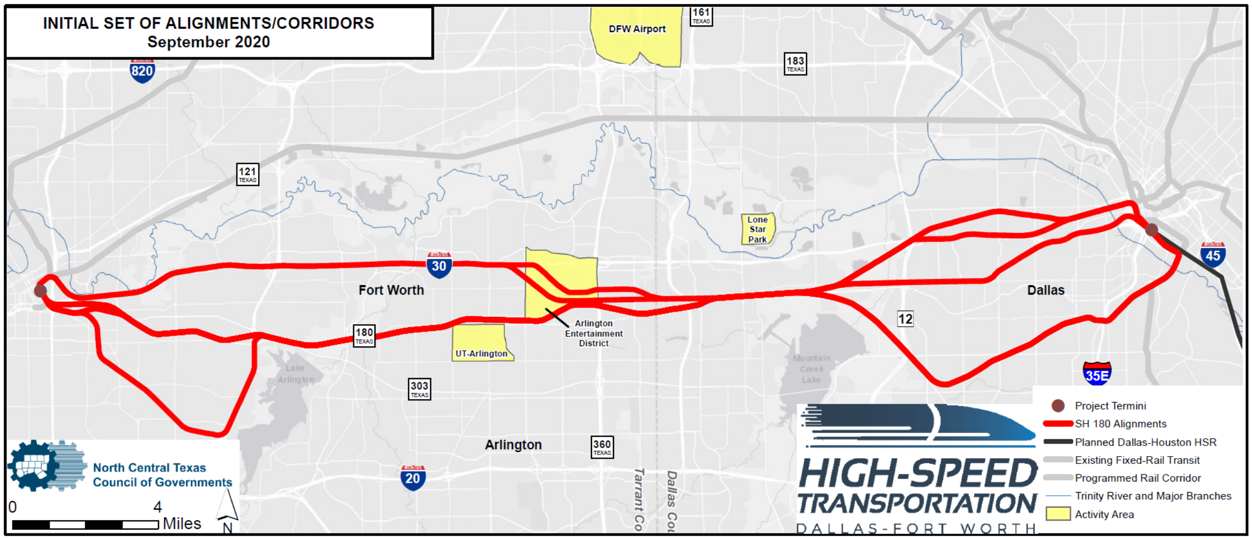


Source: HNTB, 2021

3.4 SH 180 Alignments

The next family of alignments generally follows the Union Pacific Railroad that runs parallel to SH 180 between Fort Worth and Dallas. SH 180 is a direct transportation facility connecting the two city centers. Each of the 13 alignment alternatives included in this family travel within or are adjacent to all or part of the Union Pacific Railroad that runs parallel to SH 180. Figure 13 shows the SH 180 family of alignments.

Figure 13. State Highway 180 (SH 180) Alignments

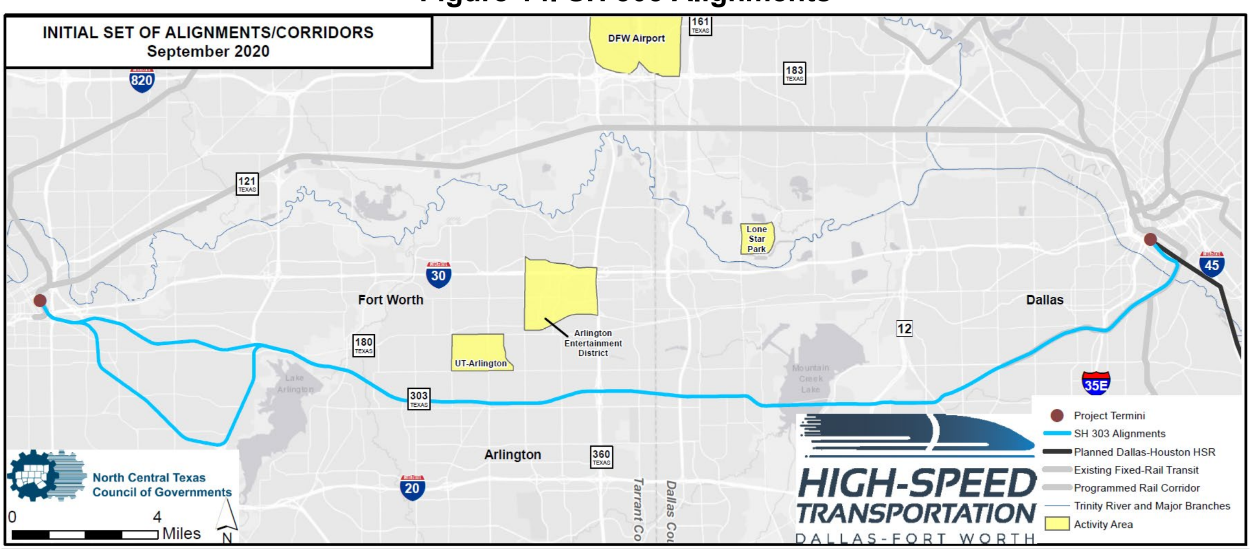


Source: HNTB, 2021

3.5 State Highway 303 (SH 303) Alignments

The southern-most family of alignments generally follows SH 303 between Fort Worth and Dallas. SH 303 is a somewhat direct transportation facility connecting the two city centers. Both alignment alternatives included in this family travel within or are adjacent to all or part of SH 303. Figure 14 shows the SH 303 family of alignments.

Figure 14. SH 303 Alignments



Source: HNTB, 2021

3.6 Detailed Descriptions of Alignment Alternatives

Table 3 includes detailed descriptions of each of the 43 alignment alternatives that were part of this evaluation. Volume II, Appendix II-B includes larger scale, individual maps of each alignment.

Table 3. Detailed Descriptions of Alignment Alternatives

Alternative #	Alignment Family	Description
1	TRE	Follows the TRE alignment from downtown Fort Worth and near Norwood Drive, merges onto Hurst Boulevard and Euless Boulevard, then continues east along State Highway 183 (SH 183) until merging back with the TRE alignment, continuing into downtown Dallas.
2	TRE	Follows the full TRE alignment from downtown Fort Worth to downtown Dallas.
3	TRE	Follows the West Fork of the Trinity River from downtown Fort Worth to Trinity Boulevard where it merges with the TRE alignment and travels east into downtown Dallas.
4	TRE	Follows Interstate Highway 30 (I-30) from downtown Fort Worth east to Loop I-820 where it begins to merge with the West Fork of the Trinity River at Greenbelt Road and follows the same path as Alignment into downtown Dallas.
5	TRE	Follows I-30 from downtown Fort Worth to State Highway 360 (SH 360), where if travels north along SH 360 to the TRE alignments where it then travels east to downtown Dallas.
6	West Fork Trinity River	Follows the West Fork of the Trinity River from downtown Fort Worth to downtown Dallas.
7	West Fork Trinity River	Follows I-30 from downtown Fort Worth to Loop I-820 where it veers northeast until it merges with the West Fork of the Trinity River at Greenbelt Road and follows the West Fork of the Trinity River east into downtown Dallas.
8	West Fork Trinity River	Follows I-30 from downtown Fort Worth to SH 360, where it travels north along SH 360 to the West Fork of the Trinity River where it follows the river east into downtown Dallas.
9	West Fork Trinity River	Follows the I-30 from downtown Fort Worth, bypassing the interchange with SH 360 to the north before merging back onto I-30. Continuing east, the alignment merges with the West Fork of the Trinity River near Belt Line Road where it continues east into downtown Dallas.
10	West Fork Trinity River	Follows the I-30 from downtown Fort Worth, continuing through the interchange with SH 360, then merges with the West Fork of the Trinity River near Belt Line Road where it continues east into downtown Dallas.
11	West Fork Trinity River	Follows the I-30 from downtown Fort Worth, bypassing the interchanges with SH 360 and SH 161 to the south of both before merging back onto I-30. Continuing east, the alignment merges with the West Fork of the Trinity River near Belt Line Road where it continues east into downtown Dallas.

Alternative #	Alignment Family	Description
12	I-30	Follows I-30 from downtown Fort Worth, bypassing the interchange with SH 360 to the north before merging back onto I-30. Continuing east, at Loop 12 the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.
13	I-30	Follows I-30 from downtown Fort Worth, continuing through the interchange with SH 360, then at Loop 12, the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.
14	I-30	Follows I-30 from downtown Fort Worth, bypassing the interchanges with SH 360 and SH 161 to the south of both before merging back onto I-30. Continuing east, at Loop 12 the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.
15	I-30	Follows I-30 east from downtown Fort Worth, continuing through the interchange with SH 360, then at Hampton Road, the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.
16	I-30	Follows I-30 east from downtown Fort Worth, continuing through the interchange with SH 360 along I-30 into downtown Dallas.
17	I-30	Follows I-30 east from downtown Fort Worth, bypassing the interchanges with SH 360 and SH 161 to the south of both before merging back onto I-30. Continuing east, at Hampton Road, the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.
18	I-30	Follows I-30 east from downtown Fort Worth, bypassing the interchange with SH 360 to the north before merging back onto I-30. Continuing east, at Hampton Road, the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.
19	I-30	Follows I-30 east from downtown Fort Worth, bypassing the interchange with SH 360 to the north before merging back onto I-30 and continuing into downtown Dallas.
20	I-30	Follows I-30 east from downtown Fort Worth, bypassing the interchanges with SH 360 and SH 161 to the south of both before merging back onto I-30 and continuing into downtown Dallas.
21	I-30	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad continuing east into downtown Dallas.
22	I-30	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad before merging with I-30, continuing east to Hampton Road, where it merges back with Union Pacific Railroad, traveling east into downtown Dallas.

Alternative #	Alignment Family	Description
23	I-30	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad before merging with I-30, continuing east into downtown Dallas.
24	I-30	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad continuing east before merging with West Davis Street. From there, the alignment continues east, merging with Fort Worth Avenue before merging with I-30, traveling east into downtown Dallas.
25	I-30	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad continuing east into downtown Dallas.
26	I-30	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad before merging with I-30, continuing east to Hampton Road, where it merges back with Union Pacific Railroad, traveling east into downtown Dallas.
27	I-30	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad before merging with I-30, continuing east into downtown Dallas.
28	I-30	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad continuing east before merging with West Davis Street. From there, the alignment continues east, merging with Fort Worth Avenue before merging with I-30, traveling east into downtown Dallas.

Alternative #	Alignment Family	Description
29	SH 180	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad. At South Baghdad Road, the alignment veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.
30	SH 180	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad. At South Baghdad Road, the alignment veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.
31	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad, traveling east to downtown Dallas.
32	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad. The alignment continues east before merging with I-30, and at Hampton Road, merges back with Union Pacific Railroad, traveling east into downtown Dallas.
33	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad. The alignment continues east before merging with I-30, traveling into downtown Dallas.
34	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad and continues east until merging with West Davis Street. From there, the alignment continues east, merging with Fort Worth Avenue before merging with I-30, traveling east into downtown Dallas.
35	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad and continues east. At South Baghdad Road, the alignment veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.
36	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth. At South Baghdad Road, the alignment veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.
37	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth to downtown Dallas.

Alternative #	Alignment Family	Description
38	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth. The alignment continues east before merging with I-30, and at Hampton Road, merges back with Union Pacific Railroad, traveling east into downtown Dallas.
39	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth. The alignment continues east before merging with I-30, traveling into downtown Dallas.
40	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth. The alignment continues east until merging with West Davis Street. From there, the alignment continues east, merging with Fort Worth Avenue before merging with I-30, traveling east into downtown Dallas.
41	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth until merging with US Highway 287 (US 287), traveling southeast until veering northeast along Loop I-820. The alignment merges back with the Union Pacific Railroad, and at South Baghdad Road, veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.
42	SH 303	Follows the Union Pacific Railroad east from downtown Fort Worth until merging with State Highway 303 (SH 303) at Mims Street. The alignment continues east across Mountain Creek Lake and at Loop 12 veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.
43	SH 303	Follows the Union Pacific Railroad east from downtown Fort Worth until merging with US Highway 287 (US 287), traveling southeast until veering northeast along Loop I-820. The alignment merges SH 303 and continues east across Mountain Creek Lake, and at Loop 12 veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.

4.0 Overview of Mode Alternatives

As mentioned in Section 2.2.2, outreach to high-speed transportation technology professionals was conducted to help assess the viability of various high-speed passenger technologies. Based on the information gathered, five passenger transportation rail technologies or modes were considered. These include conventional rail, higher-speed rail, high-speed rail, magnetic levitation (maglev), and next generation magnetic levitation, also known as hyperloop. Other high-performance rail technologies tailored for local or regional travel were not considered as they would not meet the purpose and need for the project to provide connectivity to the planned intercity high-performance rail transportation network within the state. The level of connectivity desired between the DFWHSTC Project and other planned intercity systems in the state is further defined by Mobility 2045 – 2022 Update as fostering high-speed rail interoperability, resulting in a “one-seat” ride system (see Section 5.2.3 and Section 8.1). As such, any high-performance rail mode not considered viable for intercity travel was not considered. The following sections describe each mode.

4.1 Conventional Rail

Conventional passenger rail trains generally utilize existing railroad rights-of-way, often shared with freight rail operations. The trains are usually diesel locomotive-powered or are diesel multiple unit trains using power infrastructure within individual train cars or groups of cars as shown in Figure 15. Conventional rail trains typically operate at speeds of up to 80 miles per hour and typically operate on fixed schedules. Local examples of conventional rail include the TRE service currently operating between Dallas and Fort Worth and the TEXRail service operating between downtown Fort Worth and Dallas Fort Worth International Airport. Amtrak, the national passenger rail service, is another example of conventional rail service.

Conventional passenger rail services offered by Amtrak and regional transit agencies operate at varying headways, often influenced by speed, the number of tracks, and temporal separation from freight operations. Conventional passenger train configurations vary considerably across the United States. A typical trainset operates with four to twelve passenger coaches. Actual passenger capacity varies between operators based on several factors including the trainset configuration, frequency of service along the line, and the number of tracks and/or sidings allowing the service to operate in both directions.

Right-of-way requirements in either configuration vary greatly according to topography, drainage, operating speeds, construction methods, and maintenance responsibilities along with many other considerations. Typical right-of-way widths in either case for single track are approximately 55 feet and 100 feet for double tracking.

Figure 15. Conventional Rail – TEXRail, Fort Worth, Texas

Source: Danazar, 2019

Currently, a network of intercity and regional conventional rail lines serves a few major corridors in Texas. Intercity conventional rail service provided by Amtrak operates three routes through Texas along I-10, I-20, and I-35. Regional conventional commuter rail services already operating in the North Central Texas region are the TRE, TEXRail, and the A-Train to Denton. In Texas, conventional passenger rail is limited both in coverage (number of routes) and in frequencies. Historically, service deficiencies have typically been a result of shared railway tracks between passenger and freight rail operators leading to on-time performance inconsistencies.

4.2 Higher-Speed Rail

Higher-speed passenger rail trains generally utilize existing railroad rights-of-way, often shared with freight rail operations. Trains can be powered in a variety of ways, including diesel, electric. For the purpose of this study, higher-speed rail trains typically operate at speeds up to 125 miles per hour; however, some newer higher-speed rail technologies can operate up to approximately 185 miles per hour depending on alignment length, number of desired stations, and track geometry. The trains operate on fixed schedules and are operational throughout the world as well as within the United States.

Like conventional passenger rail systems, headway and frequencies can vary greatly depending on system demand. Higher-speed rail train configurations are typically powered by overhead electric wires. Amtrak Acela service operates with six passenger cars between two power locomotives, though train configurations can vary worldwide according to demand. Actual passenger capacity varies between operators based on several factors including the trainset configuration, frequency of service along the line, and the number of tracks and/or sidings allowing the service to operate in both directions. Right-of-way requirements vary greatly according to topography, drainage, operating speeds, construction methods, and maintenance responsibilities, along with many other considerations. Right-of-way can range from 55 to100 feet in width or it can be grade-separated or exclusive to offer greater overall reliability and safety benefits.

Currently, the only operational higher-speed line in the United States is the Amtrak Northeast Corridor between Washington D.C. and Boston (see Figure 16). The Brightline in Florida between Miami and West Palm Beach is schedule to begin service to Orlando in early 2023. Other routes are in various stages of planning in the United States and other higher-speed rail services currently operate in Australia, China, and India. While higher-speed rail can operate on existing at-grade railroads, as it pertains to this study, it is preferrable to operate in completely separate rights-of-way.

Figure 16. Higher-Speed Rail – Amtrak Acela, Washington D.C. Union Station

Source: Edward Orde, 2018

4.3 High-Speed Rail

High-speed passenger rail trains require the construction of a dedicated guideway and operates in a grade-separated configuration for the entire alignment. These requirements allow high-speed travel at speeds up to 250 miles per hour. The trains operate on a fixed schedule and typically are powered through overhead catenary electrified power lines. There are examples of high-speed rail trains in operation throughout Europe and Asia that have operated safely and reliably for decades, and high-speed passenger rail is also planned in Texas between Houston and Dallas and in California between Los Angeles and San Francisco.

Similar to conventional passenger rail systems, headway and frequencies for high-speed rail can vary greatly depending on system demand. In dense cities, such as Tokyo, the Shinkansen (Figure 17) high-speed rail system has trains arriving and departing every three minutes. Comparatively, the planned Texas Central Railroad high-speed rail system would operate an initial service between Dallas and Houston at 30-minute headways, or a frequency of two trains per hour. As the system matures or demand increases, headways could be increased through operational changes.

Figure 17. High-Speed Rail – Shinkansen, Odawara Station, Japan

Source: HNTB, 2018

In many parts of the world where high-speed rail is common, rail services can include food and beverage services, wireless internet, and restrooms. Platforms are elevated for level boarding to accommodate people of all abilities and can often accommodate luggage and other passenger needs. While not unique to high-speed rail, these services and accommodations tend to come standard with high-speed rail applications. Ride quality is controlled by a variety of factors, including high-quality suspension systems, high tolerance track geometry and maintenance requirements. Large radius curves and superelevation of the rails are also carefully designed and matched to trainset performance characteristics to ensure ride comfort and smooth running of vehicles through curves.

Typical right-of-way widths vary from 50 to 120 feet due to urban form and physical constraints. Despite the success of international systems, the technology is not in operation in the United States for several reasons including the difficulty in securing right-of-way, funding, and regulatory processes. Examples of such projects include California High-Speed Rail and Texas Central Railroad.

4.4 Magnetic Levitation (Maglev)

Maglev trains require the construction of a dedicated guideway and operate in a grade-separated configuration for their entire alignment. As with high-speed rail, this is required because the train can travel at speeds of up to 300 miles per hour. Maglev trains operate on a fixed schedule and are propelled by opposing magnets (one set of magnets on the track and another set on the bottom of the train) allowing the train to levitate slightly above the track.

Levitating the vehicles creates less friction and thus requires less energy to propel the train. There are currently no examples of operating maglev trains in the United States; however, maglev trains currently operate in South Korea, Japan, and China (Figure 18).

Figure 18. Maglev – Shanghai Transrapid, Longyang Station, China

Source: Lars Plougmann, 2012

Typical right-of-way widths range from 75 to 100 feet due to urban form and physical constraints. Maglev is a technology that has been pushing the boundary of high-speed transportation for decades outside of the United States. The operational systems in Asia have shown the technology is feasible and safe. Maglev provides high-speed performance, electrification, and mature safety systems and operations in a package that is recognizable and easily understood by regulators and the public. Despite this relative success in international markets, the technology has not yet been adopted or deployed domestically due to the challenges of securing right-of-way, funding, and regulatory processes.

4.5 Next-Generation Magnetic Levitation (Hyperloop)

Hyperloop is an emerging technology currently in the prototype and testing phase. Hyperloop requires the construction of separate elevated structures or subsurface tunnels and is expected to operate within a near-vacuum tube with the vehicles magnetically levitated and propelled within the tube (Figure 19). Hyperloop speeds are estimated to exceed 650 mph over long distances. Unlike the other modes considered at the outset of this study, the hyperloop operating concept is defined as “on-demand” service and does not adhere to a fixed schedule.

Figure 19. Hyperloop Concept – Artist Rendering

Source: Neuhausengroup, 2014

Several of the systems and technologies needed to operate hyperloop as advertised are still in varying levels of concept and prototype development with no operational passenger service in place; therefore, many operational characteristics such as on-demand service and typical fares are theoretical at this time. Most developers of hyperloop technology have proposed an average travel speed of 600 mph over distances between 300 to 500 miles. Traveling at these speeds has an additional consideration for passenger comfort and tolerance for horizontal acceleration and stopping.

Hyperloop guideways, like maglev, would be specialized infrastructure with no interoperability between transportation technologies. Hyperloop shares many of the same foundational concepts of maglev but introduces many concepts from the aviation industry, such as the low-pressure vacuum tube. Components of the guideway may include the pressurized tube, pylons, vacuum pumps, and emergency egress structures. Right-of-way widths are anticipated to be 40 to 100 feet. In theory, hyperloop should be able to minimize land acquisition costs through use of existing public rights-of-way, though to achieve proposed operating speeds for hyperloop would necessitate large horizontal curve radii, which may not fit existing right-of-way geometries. Hyperloop stated performance benefits, design criteria, and other major considerations are still in the development phase.

4.6 Technical Overview of Modes

Four of the five modes being evaluated in this study are currently operating and transporting passengers, however, maglev and high-speed rail do not currently operate in the United States. Table 4 provides a high-level summary/comparison of each mode.

Table 4. Technical Overview of Modes

	Conventional Rail	Higher-Speed Rail	High-Speed	Maglev	Hyperloop
Top Speed	80 mph	125 mph	250 mph	300+ mph	650+ mph
Need for an Exclusive Guideway	No	No	Yes	Yes	Yes
Peak Hour Headways	20-30 minutes	20-30 minutes	3-30 minutes	15-20 minutes	Estimated at 2 minutes
Operating Style	Fixed schedule	Fixed schedule	Fixed schedule	Fixed schedule	On demand
Construction Cost per Mile (2021 $)[1]	$10 million to $50 million[2]	$70 million	$95 million	$180 million	$90 million
Annual Operating and Maintenance Cost per Mile	Varies	Varies	$1 to $2 per route mile[3]	Not known	Not known
Technology Readiness	Operational	Operational	Operational	Operational	Prototypes in testing
Examples	TRE, TEXRail, A-Train	AMTRAK, Acela Express	Asia, Europe, under construction in California	China, Germany, Japan, South Korea, under study from DC to Baltimore	Test facilities in Nevada and France

Source: HNTB, 2022

1. Does not include rolling stock, maintenance facilities, or right-of-way
2. Costs associated with improving an existing rail alignment for passenger service
3. High-Speed Rail Operating and Maintenance Cost for Use in EIR/EIS Project Level Analysis, California High-Speed Rail Technical Memorandum, February 2017

5.0 Level 1 Evaluation: Ability to Meet Purpose and Need

The purpose of the Level 1 evaluation was to identify alternative alignments and modes that met the preliminary purpose and need for the DFWHSTC Study. As discussed in Section 3.0, alternative alignments were developed and modes identified (see Section 4.0). Level 1 included a fatal flaw screening to determine whether the alternative alignments and modes met the basic requirements of connecting downtown Dallas and downtown Fort Worth with a high-speed solution (travel time). Alignments and modes that passed the fatal flaw criterion were then subjected to a secondary screening in Level 1 (Figure 20). The secondary screenings measured alignments and modes in separate, parallel evaluations using different criteria that were specific to alignment and mode, respectively.

Figure 20. Level 1 Screening

Source: HNTB, 2021

5.1 Level 1: Fatal Flaw Screening

The fatal flaw Level 1 screening evaluated alignments and modes in combination.

5.1.1 Fatal Flaw Screening Criteria

The fatal flaw criteria included in Level 1 comprised of an evaluation to identify which alignment/mode combinations could meet a 20-minute travel time criterion (Section 1.4.3.2) between downtown Dallas and downtown Fort Worth. Currently, traveling between the city centers by automobile can take 30 to 60 minutes, with the former being when traffic and roadway conditions are favorable and with existing commuter rail service, the travel time is 61 minutes. The 20-minute threshold was considered a reasonable improvement in travel time (i.e., a “significant” travel time savings over the baseline of automobile travel time in the off-peak period), which would be reliably available any time of day, regardless of traffic conditions, and encourage people to switch to high-speed transit. The travel time forecasts were developed using a spreadsheet model that calculated travel time based on distance, maximum technology speed, design guidance (minimum curve radius and superelevation), acceleration, and deceleration. For more detail on the travel time forecasting, see Volume I, Appendix F.

Alignment alternatives were also evaluated for safety, convenience, connectivity, and access. The intent of this evaluation process was to identify alignments possessing the fewest infrastructural challenges, convenient access to other transportation options, connectivity to regional transit services, and had the best opportunity to offer access to the greatest number of activity centers between Dallas and Fort Worth.

Similarly, mode alternatives were evaluated for safety, reliability, convenience, and linkage to other future high-speed passenger services in Texas. This evaluation was meant to test whether any modes would be able to perform and deliver services in a manner consistent with the preliminary purpose and need. Table 5 lists the Level 1 criterion used for both alignments and modes.

Table 5. Level 1 Screening Criteria

Criteria		Description
Fatal Flaw	Serves Downtown Dallas and Fort Worth Central Station	Serve downtown Dallas station and downtown Fort Worth station locations
	Travel Time	Travel time of 20 minutes or faster from proposed high-speed rail station in Downtown Dallas to Central Station in Downtown Fort Worth
Alignment Criteria	Safe	Number of infrastructural challenges to building a closed corridor
	Convenient	Ease of access to other existing and planned transportation options (roadways, trails, existing Park & Rides, etc.)
	Connect to Existing Regional/Light Rail in Dallas-Fort Worth	Could the alternative provide connections to existing light, regional, and commuter rail
	Improved Access to Major Activity Centers	Does the alignment and/or technology offer the potential for mid-alignment station alternatives access to major activity centers (e.g., 2,000+ employment in an area, activity areas significant to the community) within 1/4 mile of each alignment in the middle portion of the Study Area (between Loop 12 and 820)?
Mode Criteria	Safe	Have design and safety guidelines been established (foreign or domestic)?
	Reliable	Can the alternative mode perform reliably under all most routinely occurring North Central Texas weather conditions?
		Can the alternative mode perform reliably under all traffic conditions (rail or roadway) on this alignment?
	Convenient	Passenger experience (comfort with technology paradigm)
		Technology convenience
	Linkages to Other High-Performance Systems in Texas	Ease of transfer to Dallas-Houston high-speed rail
		Ease of transfer to Fort Worth-Laredo System
		Long Distance Capability/Expandability

Source: HNTB, 2021

5.1.2 Fatal Flaw Analysis Results

In the fatal flaw analysis, each of the 43 alignments were determined to have the ability to connect to the proposed high-speed rail station in downtown Dallas and Central Station in downtown Fort Worth.

For the travel time criterion, the travel time for each of the five modes was measured along each of the 43 alignments using the alignment length and available travel speed data by mode and accounting for slower speeds in turns and entering/exiting stations in each of the two downtowns. The analysis effectively determined:

- Maglev and hyperloop were able to meet or exceed the 20-minute threshold discussed previously on each of the 43 alignments
- High-speed rail met the 20-minute threshold on 39 of the 43 alignments
- Higher-speed rail met the 20-minute threshold on eight of the 43 alignments
- Conventional rail was not able to reach the 20-minute threshold on any of the alignments

The higher and high-speed rail alignments that were able to meet the 20-minute threshold were carried forward. Because conventional rail was not able to meet the travel time threshold on any alignments, it was eliminated from further consideration. The Level 1 fatal flaw analysis results are displayed in Table 6. More detailed results of the Level 1 Screening Analysis are provided in Appendix C.

Table 6. Level 1 Fatal Flaw Analysis Results (Alignment and Mode)

			TRE Alignments					West Fork Trinity River Alignments						I-30 Alignments																	SH 180 Alignments													SH 303 Alignments	
Criteria			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Purpose & Need Criteria (Fatal Flaw Analysis)	Serve Downtowns of Dallas & Fort Worth		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Travel Time (20 minutes)	Conventional Rail	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
		Higher-Speed Rail	No	Yes	No	No	No	No	No	No	No	Yes	No	No	Yes	No	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
		High-Speed Rail	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
		Maglev	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Hyperloop	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: HNTB, 2021

5.2 Level 1 Screening

The Level 1 screening evaluated alignments and modes separately.

5.2.1 Alignment Criteria

When considering the preliminary purpose and need, the alignments were evaluated to determine the potential challenges to building a safe, separate corridor, ease of access to other transportation networks, and the ability to connect to regional activity centers in the future. The criteria can be found in Table 7.

Table 7. Overview of Level 1 Alignment Criteria

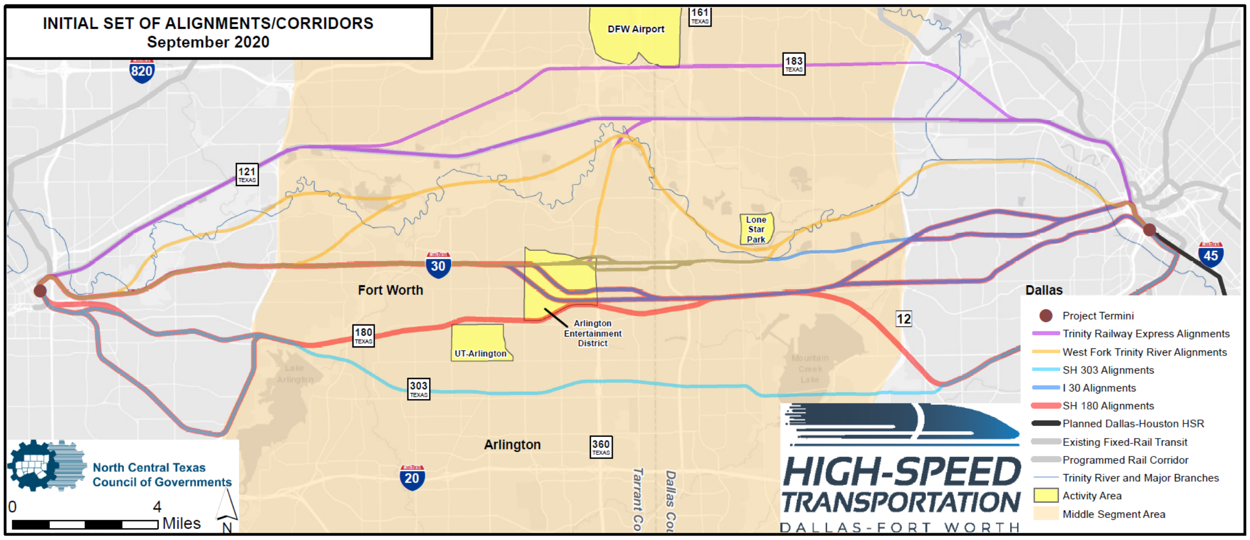
Criteria		Description	Measurement	Thresholds
Purpose & Need Criteria (Alignments)	Safe	Number of infrastructural challenges to building a closed corridor	Number of Locations	High ≤ 3 Medium = 4-5 Low ≥ 6
	Convenient	Ease of access to other existing and planned transportation options (roadways, trails, existing Park & Rides, etc.)	Yes/No	High = Yes Low = No
	Connects to existing regional/light rail in Dallas-Fort Worth	Could the alternative provide connections to existing regional, commuter and light rail	Yes/No	High = Yes Low = No
	Improves access to major activity centers	The alignment and/or technology offer the potential for mid-alignment station alternatives access to major activity centers (e.g., 2,000+ employment in an area, activity areas significant to the community) within 1/4 mile of each alignment in the middle segment of the Study Area (between Loop 12 and I-820)?	Number of Locations	High ≥ 4 Medium = 2-3 Low ≤ 1

Source: HNTB, 2021

Alignments that had a greater number of infrastructural challenges to constructing an exclusive-use corridor were rated lower than those with fewer such challenges. Each alignment was checked for its convenience of providing access to other transportation options and connections to regional and light rail services. This connectivity can be found at the downtown stations in each city.

Each alignment capable of improving access to major activity centers received higher ratings than those that did not. Major activity centers were defined as nodes having 2,000 or more employees within a ¼ mile of each alignment or large generators of special events and community activity. Because high-speed modes have greater distances between stations and to support the regional aspiration of three stations, these activity centers were only identified in the middle segment (between Loop 12 and I-820) of the Study Area and are shown in Figure 21 where a mid-point station could feasibly serve these major activity centers.

Figure 21. Activity Centers in Middle Segment of Study Area



Source: HNTB, 2021

5.2.2 Alignment Evaluation Results

The convenience of connecting to other transportation networks and connectivity to other rail services in the region was met by each of the 43 alignments offering connections to the stations located in downtown Dallas and downtown Fort Worth. As shown in Table 8**,** the criteria “Convenient” and “Connects to existing regional/light rail in Dallas-Fort Worth” were both rated affirmative across all alignments, with no differentiation between alternatives. Similarly, a majority of alignments would be able to “Improve access to major activity centers” in the future, with little differentiation between alignments. However, neither of the two SH 303 alignments (Alignments 42 and 43) or four of the I-30 alignments (3, 4, 6, and 7) offered an opportunity to connect to major mid-point activity centers and were therefore eliminated from further consideration. Because two of the four alignment criteria had no differentiation among alternatives, and a third criterion had very little differentiation, an alternative receiving a “low” rating under any criterion- was eliminated from further consideration since there were better potential alignments to meet the goals of the Project. More detailed results of the Level 1 Screening Analysis are provided in Appendix C.

Table 8. Level 1 Alignment Analysis Results

		TRE Alignments					West Fork Trinity River Alignments						I-30 Alignments																	SH 180 Alignments													SH 303 Alignments	
	Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Purpose & Need Criteria	Safe	○	○	○	○	○	◒	○	○	○	○	○	◒	◒	◒	◒	○	◒	◒	○	○	◒	◒	○	◒	◒	◒	○	◒	●	●	◒	◒	○	◒	●	●	◒	◒	○	◒	●	●	●
	Convenient	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Connects to existing regional/light rail in Dallas-Fort Worth	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Improves access to major activity centers	●	◒	○	○	◒	○	○	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	●	◒	◒	◒	◒	◒	◒	◒	◒	○	○
Level 1 alignment recommendations to advance into Level 2 screening		No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No

Source: HNTB, 2021

The main differentiator for the alignment analysis was the number of “Infrastructural challenges to building a closed corridor” along a given alignment. The analysis found all five TRE alignments (Alignments 1, 2, 3, 4, and 5) and all six West Fork Trinity River alignments (Alignments 6, 7, 8, 9, 10, and 11) would have the greatest number of infrastructural challenges and these alignments were therefore eliminated from further consideration. Typical infrastructure challenges identified along these alignments include major highway interchanges, freight rail yards, freight rail line crossings, and major utility infrastructure (see Figure 22). Most of the 17 I-30 alignments and 13 of the SH180 alignments had a moderate number of infrastructural challenges and all offered connectivity to major activity centers, resulting in 23 out of 30 remaining alignments (Alignments 12, 13, 14, 15, 17, 18, 21, 22, 24, 25, 26, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 40, and 41) advancing into the Level 2 evaluation.

Figure 22. Examples of Infrastructural Challenges to Building a Closed Corridor
Left: Bridges crossing Trinity River along Alignment 9; Right: SH 280/I-35W Interchange along Alignment 1

Source: HNTB, 2021

5.2.3 Mode Criteria

The four modes that passed the primary screening (higher-speed rail, high-speed rail, maglev, and hyperloop) were evaluated using similar criterion types to the alignments such as “Safe” and “Convenient,” though employing measures more specific to the performance of each technology or mode. The mode analysis also included criteria to measure reliability and potential for linkages to other similar planned high-performance systems.

The mode analysis looked at whether each technology had safety guidelines in place and whether each mode could perform reliably under North Central Texas weather conditions. The analysis also considered passenger familiarity with the technology, or travel paradigm, and the scheduling convenience that might be expected based on industry standards for each mode.

Looking toward the future, the Level 1 mode screening also considered the ability for each technology to act as an extension of the planned Dallas to Houston high-speed rail system, as well as future high-speed connections to a planned system in the Fort Worth to Laredo corridor. As mentioned in Section 8.1, Mobility 2045 – 2022 Update has a policy that supports high-speed rail system interoperability through a “one-seat” ride. This would require the Dallas to Fort Worth high-speed alignment to connect to the TCR station platform in Downtown Dallas. However, Mobility 2045 – 2022 Update also states if regulatory, environmental, financial, or other challenges prohibit the timely development of a one seat/one ticket connection through the Dallas station, the region will support and coordinate with high-speed passenger rail system implementers to develop a cross-platform transfer solution for all rail passengers that is as close to a one seat/one ticket connection as possible. Therefore, all Dallas station connection concepts terminated at the proposed TCR Dallas Station. The specific mode criteria can be found in Table 9.

Table 9. Overview of Level 1 Mode Criteria

Criteria		Description	Measurement	Thresholds
Purpose & Need Criteria (Modes)	Safe	Have design and safety guidelines been established (foreign or domestic)?	Yes/No	High = Yes Medium = Yes, Foreign Only Low = No
	Reliable	Can the alternative mode perform reliably under all most routinely occurring North Central Texas weather conditions?	Yes/No	High = Yes Low = No
		Can the alternative mode perform reliably under all traffic conditions (rail or roadway) on this alignment?	Yes/No	High = Yes Low = No
	Convenient	Passenger experience (comfort with technology paradigm)	Mode Familiarity	High = Mode format and service delivery familiar to passengers Low = Mode format and service delivery unfamiliar to passengers
		Technology convenience	Expected Wait Times	High = Industry Standard wait times ≤ 20 min Low = Industry Standard wait times > 20 min
	Linkages to other high-performance systems in Texas	Ease of transfer to Dallas-Houston high-speed rail	Relative Location	High = One-seat ride possible Med = cross platform or short transfer (2 min walk or less) Low = long transfer (greater than 2 min walk)
		Ease of transfer to Fort Worth-Laredo System	Relative Location	High = One-seat ride possible Med = cross platform or short transfer (2 min walk or less) Low = long transfer (greater than 2 min walk)

Criteria		Description	Measurement	Thresholds
		Long distance capability/expandability	Standard Travel Distance	High = Industry Standard ≥ 100-mile trips Low = Industry Standard < 100-mile trips

Source: HNTB, 2021

5.2.4 Mode Evaluation Results

As discussed previously in Section 5.1, conventional rail was eliminated from further consideration as a high-speed connection through a fatal flaw analysis. The four remaining modes met the criteria for reliability and the capability to operate a longer distance service. All modes also have the potential to act as extensions of a future Fort Worth to Laredo high-speed system, which at the time of this analysis had not been officially adopted.

Key differences between the modes include current safety guidelines, technology familiarity by potential passengers, and the expected wait times at stations based on industry averages. While safety guidelines are currently available for three of the four modes, this information is only available domestically for high-speed and higher-speed rail. Hyperloop rated ‘low’ for passenger familiarity as this technology is currently under development and is not operational. Passengers have used rail-based transportation for several decades, though never traveled through a vacuum tube at air-travel speeds, making hyperloop rate lower than the other modes for passenger familiarity with the technology. Schedule convenience would likely be lower on higher-speed rail based on industry standards, as the other three modes can offer much shorter wait times or on-demand schedules for passengers. All modes offer a convenient transfer to the planned Dallas to Houston high-speed rail, though the high-speed rail offers the possibility to act as an extension of that service continuing to Fort Worth. As the Fort Worth to Laredo system mode is currently unknown, potentially all modes considered for the Dallas to Fort Worth corridor could extend seamlessly to the Fort Worth to Laredo corridor. The opposite could also be true; so, all modes were rated the same for this particular criteria.

Because none of the Level 1 Mode Criteria were considered a fatal flaw and all four of the remaining modes scored an overall “medium” ranking or higher, each were advanced into the Level 2 analysis. Results from the Level 1 mode analysis can be found in Table 10 and more detailed Level 1 screening results are provided in Appendix C.

Table 10. Level 1 Mode Evaluation Results

Criteria		Modes: Higher-Speed Rail	Modes: High-Speed Rail	Modes: Maglev	Modes: Hyperloop
Purpose & Need Criteria (Modes)	Safety Guidelines	●	◒	◒	○
	Reliable (Weather)	●	●	●	●
	Reliable (Traffic)	●	●	●	●
	Convenient (Passenger)	●	●	●	○
	Convenient (Technology)	○	●	●	●
	Linkage to Dallas-Houston Corridor	◒	●	◒	◒
	Linkage to Fort Worth-Laredo Corridor	◒	◒	◒	◒
	Long-Distance Capability	●	●	●	●
Level 1 mode recommendations to advance into Level 2 screening		Yes	Yes	Yes	Yes

Source: HNTB, 2021

6.0 Level 2: Fatal Flaws and Ranking

The purpose of the Level 2 evaluation was to identify which of the remaining 23 alternative alignments and four modes had fatal flaws with respect to how each might impact sensitive areas within the community and/or natural environment. A map of the Level 2 alignments is included in Volume II, Appendix II-C. During Level 2, the remaining alignments were only evaluated between Beach Street on the west and Beckley Avenue on the east because of the complexities of entering and exiting the downtowns and specific station locations in Dallas and Fort Worth. Specific connections into downtown Dallas and downtown Fort Worth were evaluated separately and only for the preferred alignment alternatives determined by the Level 3 analysis; these connections are discussed further in Section 8.0.

6.1 Alignment Criteria

For the Level 2 evaluation of alignments, criteria included potential impacts to residential areas, commercial districts, natural resources, parks, and other public facilities. These potential environmental constraints were mapped out within the Study Area to determine proximity of proposed alignments to potential constraints to identify which alignments had the least potential for creating environmental impacts. In all cases, alignments that were found to have fewer potential impacts on or interactions with environmental and community resources were rated higher than those that had more interactions. The criteria can be found in Table 11.

Table 11. Overview of Level 2 Alignment Criteria

Criteria		Description	Measurement	Thresholds
Proximity to Sensitive Social, Biological, or Cultural Areas	Potential Residential Impacts	Percentage of alignment length that is adjacent to residential areas; 500 feet (250 feet on each side of centerline)	Percentage of Route Length	High < 40% of route Medium = 40%-44% of route Low ≥ 45% of route
	Potential Major Commercial/Industrial/ Warehouse Impacts	Number of potential impacts to major commercial, industrial, and warehouse facilities	Number of Locations	High = 0-2 Medium = 3-6 Low = 7+
	Potential Wetland, Water Body, and Floodplain Impacts	Percentage of alignment length that is adjacent to wetlands, water bodies, and floodplains; 500 feet (250 feet on each side of centerline)	Percentage of Route Length	High ≤ 15% of route Medium = 16%-30% of route Low ≥ 31% of route
	Potential Parks Impacts	Percentage of alignment length that is adjacent to parks and designated open spaces; 500 feet (250 feet on each side of centerline)	Percentage of Route Length	High < 10% of route Medium = 10-19% of route Low ≥ 20% of route

Criteria		Description	Measurement	Thresholds
Potential Community Impacts	Potential Community Facility Impacts	Number of community facilities within 500 feet (250 feet on each side of centerline)	Number of Locations	High ≤ 39 Medium = 40-49 Low ≥ 50
	Potential Community Cohesion Impacts	Number of neighborhoods with potential community cohesion impacts (guideway running through neighborhoods)	Number of Locations	High = 0 Medium = 1-5 Low = 6+
	Potential Environmental Justice Impacts	Total Environmental Justice Index in Above-Average Block Groups; 500 feet (250 feet on each side of centerline)	Total Number of Census Block Groups	High = 50-65 Medium = 66-79 Low ≥ 80

Source: HNTB, 2021

Level 2 criteria were measured by either the percentage of route length within 250 feet on either side of the alignment centerline or number of resource locations within a similar buffer from each alignment. Social, biological, and cultural resources considered in the Level 2 analysis included residential areas; commercial, industrial and warehouse districts; wetlands, water bodies and floodplains; and parks and designated open spaces.

Potential community impacts considered event centers, schools, and places of worship, as well as recreational, public, and medical facilities. Community cohesion impacts considered the number of neighborhoods that could potentially be affected by the location of the guideway relative to each neighborhood. Potential impacts to low-income and minority neighborhoods (environmental justice populations) were considered using an environmental justice index, which accounted for census block groups where residential data show that low-income, minority, and a combination of the two are higher than the regional average. The number of these block groups located within 250 feet of either side of the alignment centerline were calculated to identify ratings for this criterion.

6.2 Alignment Results

The 23 alignments evaluated in Level 2 had more differentiation among the criteria than was the case in Level 1. The 12 remaining I-30 alignments were identified to have potential impacts to adjacent wetlands, water bodies, and floodplains pending further analysis in Phase 2. Alignments which were more favorable based on the criteria had low potential for impacting environmental justice communities, residential areas, and community facilities. As none of the criteria used were considered to be a fatal flaw in the Level 2 alignment screening, the alignments that scored a “medium” or higher in the overall ranking were advanced. The Level 2 evaluation determined seven of the 12 I-30 alignments (Alignments 12, 13, 14, 15, 17, 18, and 26) should be advanced into Level 3. Most of these seven alignments were very similar in nature with key differences focused on how each navigates specific highway interchanges along the alignment.

With respect to the 11 remaining SH 180 alignments, the primary challenge was the potential impact to community facilities. While alignments along SH 180 rated more favorably because of their lesser potential to impact parks or major commercial and industrial areas, the majority of the SH 180 alignments were determined to have high potential for community impacts and were in proximity to sensitive social, biological, and cultural areas. The Level 2 evaluation determined three of the 11 SH 180 alignments (Alignments 32, 37, and 38) scored high enough overall to be advanced into Level 3. Each of these three alignments are very similar with the primary differences being in how each approaches downtown Dallas and Fort Worth termini. The results can be found in Table 12 and more detail on the Level 2 screening results can be found in Appendix D.

Table 12. Level 2 Alignment Evaluation Results

		I-30 Alignments												SH 180 Alignments										
Criteria		**12**	**13**	**14**	**15**	**17**	**18**	**21**	**22**	**24**	**25**	**26**	**28**	**29**	**30**	**31**	**32**	**34**	**35**	**36**	**37**	**38**	**40**	**41**
Proximity to Sensitive Social, Biological, or Cultural Areas	Potential Residential Impacts	◒	●	●	●	●	●	◒	◒	○	◒	●	◒	○	◒	◒	●	○	◒	◒	◒	◒	○	○
	Potential Major Commercial/Industrial/ Warehouse Impacts	◒	●	●	●	●	◒	◒	◒	○	◒	◒	○	◒	◒	●	●	◒	●	●	●	●	◒	●
	Potential Wetland, Water Body, and Floodplain Impacts	○	○	○	○	○	○	◒	◒	◒	◒	●	◒	○	○	○	◒	◒	○	○	◒	◒	◒	○
	Potential Parks Impacts	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	◒	○	○	●	●	●	◒	◒	●	●	●	◒
Potential Community Impacts	Potential Community Facility Impacts	●	●	●	●	●	●	◒	◒	◒	◒	◒	◒	◒	◒	○	○	○	○	○	○	○	○	○
	Potential Community Cohesion Impacts	●	●	◒	●	◒	●	◒	◒	◒	◒	◒	◒	○	○	◒	◒	◒	◒	◒	●	●	●	◒
	Potential Environmental Justice Impacts	●	●	●	●	●	●	●	●	●	●	●	◒	◒	◒	◒	◒	◒	○	○	◒	◒	◒	○
Level 2 alignment recommendations to advance into Level 3 screening		Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	No	No	No	Yes	No	No	No	Yes	Yes	No	No

Source: HNTB, 2021

6.3 Mode Criteria

The Level 2 mode analysis focused on maturity of the technology used to operate each mode and various operational considerations. The criteria used can be found in Table 13.

Table 13. Overview of Level 2 Mode Criteria

Criteria		Description	Measurement	Thresholds
Technology Maturity, Regulatory Approval	Technology Maturity (Guideway Infrastructure)	Technology Readiness Levels (TRLs) for guideway infrastructure including rail, tunnel, tube, switching, etc.	Technology Readiness Levels	High = 8-9 Medium = 6-7 Low ≤ 5
	Technology Maturity (Wayside Infrastructure)	Technology Readiness Levels (TRLs) for wayside infrastructure including substations, vacuum systems, emergency response systems, etc.	Technology Readiness Levels	High = 8-9 Medium = 6-7 Low ≤ 5
	Available Design Criteria	Design criteria available for technology	Yes/No	High = Yes Low = No
	Regulatory Approval Complexity	U.S. Regulatory framework by technology (process in place)	Processes in Place	High = Process in place, agencies experienced with process Medium = Process in place, few if any instances of application Low = No process in place and limited experience with mode
Operational Considerations	Business plan to move goods in addition to passengers	Vehicle and infrastructure configuration support the transportation of high-volume goods and are addressed in business or operations plans	Yes/No	High = Yes Low = No
	Ability to interline with connections to Dallas	Ability to interline with committed Dallas to Houston High-Speed Rail project (No Build)	Yes/No	High = Yes Low = No
	Ability to interline with connections to Fort Worth	Ability to interline with future planned projects not yet committed	Yes/No	High = Yes Low = No
	System Capacity	Operational system capacity based on the combination of service frequency with vehicle capacity, which determines passengers per hour	Capacity	High = High Frequency & Capacity Med = High Capacity Only Low = Low Frequency & Capacity

Criteria		Description	Measurement	Thresholds
	Travel Demand	Projected maximum daily passengers added to state-wide high-performance system with mode linking connections in Dallas and Fort Worth through the corridor	Demand	High = Adds 20,000+ riders Medium = Adds 10,000-19,999 riders Low = Adds fewer than 10,000 riders
	Ease of adding infill stations	Ease of integrating future infill stations for each technology	Difficulty to Add Station	High = Easy Medium = Moderate Low = Hard
	Travel Time	Number of alignments viable by technology based on a 22-minute or less travel time, assuming a mid-point station	Number of Alignments	High ≥ 23 Medium = 10-22 Low ≤ 10

Source: HNTB, 2021

To determine technology maturity, the Technology Readiness Levels (TRL) system developed by National Aeronautics and Space Administration (NASA) and adopted by the Department of Transportation and Department of Energy was used to evaluate the readiness of an unproven technology. The nine-level scale measures technologies to determine whether outcomes are predictable, a prototype can perform in a relevant operating environment, or if the prototype can fully and reliably demonstrate the operational requirements. Technology maturity of various systems such as guideway, wayside infrastructure, safety systems and operational systems were evaluated for each technology/mode. In the Level 2 mode analysis, the maturity of the guideway infrastructure (track system) and wayside infrastructure (stationary track-side support systems) were evaluated. The guideway includes infrastructure necessary for mode operation such as the track, tunnel, tube, or switches allowing vehicles to change tracks. The wayside infrastructure includes systems such as traction power substations, vacuum systems, and emergency response systems.

As shown in Figure 23, the nine-level TRL framework was applied to this analysis by giving systems a “High” rating if the final product has been demonstrated or if it has performed reliably (Levels 8 or 9). Technologies were given a “Medium” rating if a prototype system has performed in an operational environment (Levels 6 or 7), and a “Low” rating if the system has only been simulated, shown to perform predictably, or less (Levels 1 through 5). This is essentially differentiating whether a technology can be considered a reliable product, a tested prototype, or a predictable simulation in terms of its current state of development. In addition to technology readiness, the maturity criteria considered whether there was a domestic regulatory framework in place to develop a capital project using each mode, and if so, to what degree Federal regulatory agencies had experience using that process. Maturity criteria also considered whether a mode had readily available design criteria or not.

Figure 23. NASA TRL Framework

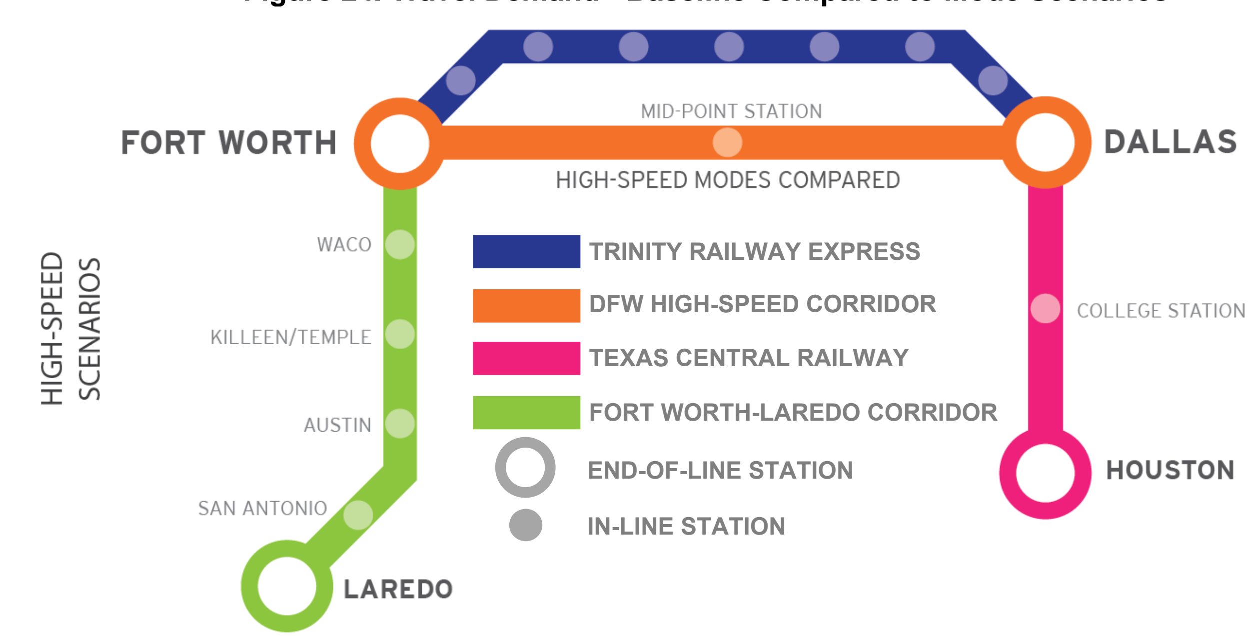
Source: NASA Systems Engineering Processes and Requirements, NPR 7123.1C

Operational characteristics considered in the Level 2 analysis included potential for whether developers of each mode had business development plans to move freight in addition to passengers using the mode, interoperability with other high-performance systems in the State, passenger capacity per hour, travel demand generated if the system were in place, ability to add new infill stations, and travel time performance across alignments. The freight plans and interoperability considerations with high-performance systems were yes or no considerations. The locally preferred modal alternative for connecting Dallas to Houston is high-speed rail, which would be the only compatible mode for that criterion to continue that service to Fort Worth. The Fort Worth to Laredo connection has not been formally adopted though previous feasibility studies for that corridor include the possibility for high-speed rail, maglev, or hyperloop.

System capacity is a function of vehicle capacity and service frequency, or vehicles per hour. For this criterion, modes were checked for industry-standard service frequency and typical train seating capacity. Modes with high frequency and high capacity were rated the highest.

Future travel demand was projected using the 2045 NCTCOG regional travel demand model (see Section 2.2.5). A 2045 travel demand forecast with only the existing TRE and DART light rail in place and no intercity connections to Houston or Laredo was established to provide a baseline ridership projection comparison. Scenarios were then developed that alternatively included high-speed connections to Houston and Laredo, testing each mode between Dallas and Fort Worth (Figure 24), for illustrative purposes only.

Figure 24. Travel Demand - Baseline Compared to Mode Scenarios



Source: HNTB, 2021

Other operational considerations in the Level 2 mode analysis include ease of adding infill stations and travel time. The infill station criterion was a relative comparison for how difficult it would be to come back and build an additional station at a future date once the infrastructure is already in place. Travel time was measured in a slightly different manner than in the Level 1 analysis. In Level 1, the analysis assessed whether each mode could make it directly from Dallas to Fort Worth in 20 minutes or less along each alignment (express scenario); the Level 2 criterion measured if a combination of alignment and mode could make the trip in 22 minutes. The time assumed there would be a mid-point station, therefore adding two minutes to account for dwell time based on industry average (standard dwell time at a station allowing for passengers to board and depart) at that station.

6.4 Mode Results

As shown in Table 14, hyperloop lags the other three technologies in terms of technology maturity because it is not currently operating in a commercial application. Moving forward with maglev or hyperloop would include varying degrees of challenge in terms of readiness for service and regulatory approval. Operational considerations where high-speed rail, maglev, and hyperloop were more favorable to the criteria included preliminary travel demand estimates and ease of integrating future infill stations. Additionally, maglev and hyperloop were more favorable to the criterion where the mode was being designed to move goods in addition to passengers, The travel demand model indicated that higher speed systems would generate higher demand for people traveling between the two downtowns. Additionally, travel time and system capacity made the higher-performance systems rate more favorably. More detail regarding the Level 2 screening results is provided in Appendix D.

Table 14. Level 2 Mode Evaluation Results

		Modes			
Criteria		**Higher-Speed Rail**	**High-Speed Rail**	**Maglev**	**Hyperloop**
Technology Maturity, Regulatory Approval	Technology Maturity (Guideway Infrastructure)	●	●	●	◒
	Technology Maturity (Wayside Infrastructure)	●	●	●	◒
	Available Design Criteria	●	●	●	○
	Regulatory Approval Complexity	●	◒	○	○
Operational Considerations	Business Plan to move goods in addition to passengers	○	○	●	●
	Ability to Interline with connections to Dallas	○	●	○	○
	Ability to Interline with connections to Fort Worth	○	●	●	●
	System Capacity	◒	●	●	●
	Travel Demand	○	◒	◒	●
	Ease of adding infill stations	◒	○	◒	●
	Travel Time	○	◒	●	●
Level 2 mode recommendations to advance into Level 3 screening		No	Yes	Yes	Yes

Source: HNTB, 2021

Higher-speed rail and high-speed rail are the only modes that have completed a Federal regulatory process, thereby gaining the ability to operate in the United States. Despite previous implementation in the United States, higher-speed rail did not rate well to the operational criteria such as ability to interline with future planned projects, system capacity, and travel time along the remaining alignments in the Level 2 evaluation. Higher-speed rail was therefore eliminated from further consideration in the Level 3 evaluation. High-speed rail, maglev, and hyperloop modes were carried forward into the Level 3 evaluation.

7.0 Level 3: Detailed Evaluation

The purpose of the Level 3 analysis was to perform a more detailed analysis on each of the alignments and modes by taking a closer look at potential for community and environmental impacts and constructability. Prior to conducting the Level 3 evaluation, the 10 recommended alignments that advanced from Level 2 were developed to a five percent level of design (see Section 2.2.6) to apply available design requirements to each alignment while trying to minimize impacts.

Level 3 evaluated each alignment concept between Beach Street on the west (in Fort Worth) and Beckley Avenue on the east (in Dallas). A more detailed effort was conducted to define and analyze alignment concepts near downtown Fort Worth and downtown Dallas because of the complexities of entering and exiting the terminus station areas. See Section 8.0 of this document for more information.

7.1 Applying Design Principles to Remaining Alignments

The existing built environment along the remaining I-30 and SH 180 alignments has numerous highways, railroads, highways, city streets, interchanges, flood plains, and buildings. Before performing the detailed evaluation in Level 3, each of the 10 remaining alignments was reviewed individually and adjustments were made to minimize impacts. This effort resulted in slight modifications to the Alignments 12, 13, 14, 15, 17, 18, 26, 32, 37, and 38.

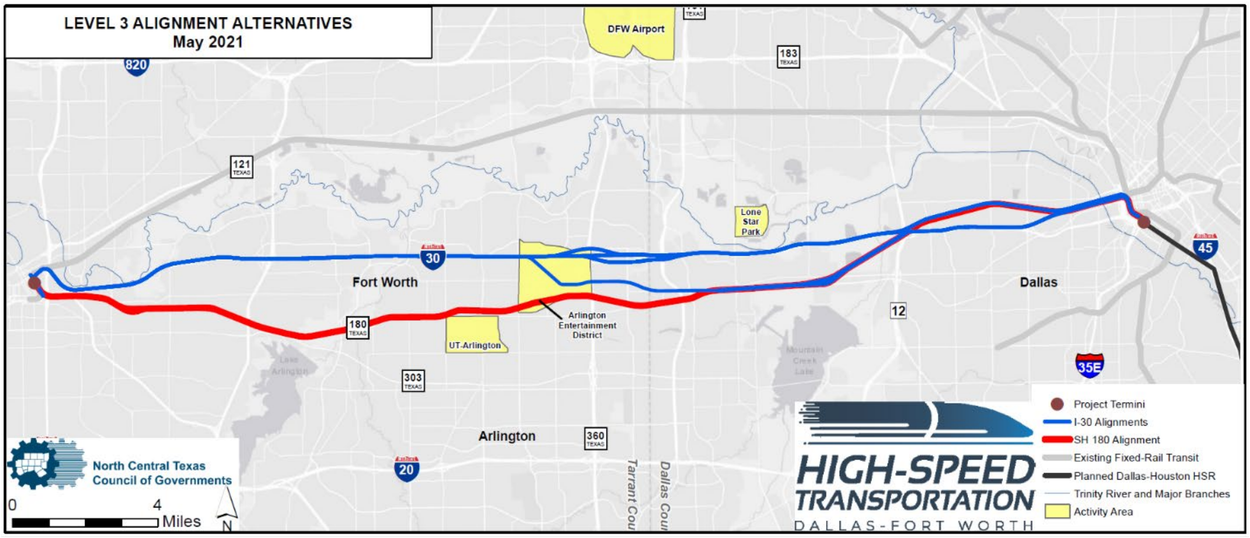
The following general design assumptions were applied to concepts developed for each alternative alignment.

- Maintain the conceptual intent of the alignment concepts as presented during the Level 2 screening analysis. Avoid deviating significantly from these alignment concepts during the five percent design.
- Adjust alignments as needed to achieve priorities such as maintaining the use of public transportation right-of-way and avoiding critical infrastructure, private properties, and sensitive environmental areas when reasonable. Examples of environmentally sensitive areas include features such as wetlands, wildlife habitats, areas of historical or cultural significance, biological resources, and parks.
- Guideway will be 100 percent elevated during the five percent design.
- Double track (or double tube) along the entire length of the alignment with centerline spacing that complies with design criteria for each mode of transportation.
- Placement of high-speed transportation operation infrastructure, such as crossovers and turnouts, and hyperloop equivalents were not evaluated but will be considered in future design phases.

Through this five percent design process, several challenges were found along each of the three remaining SH 180 alignments. Recommended design changes were informed by geometric challenges to maintain high travel speeds. These changes resulted in an alignment very similar to the original Alignment 37; so these were combined and reduced from three separate alignments (Alignments 32, 37, and 38) into a single SH 180 alignment (Alignment 37).

Similar challenges were found along Alignment 26 on the east side of the alignment nearest Dallas, and the alignment was shifted off I-30 and along an alignment parallel to the Union Pacific Railroad. For more detail on the five percent design process including these changes, see Volume II, Appendix II-E. Following this review, the total number of alignments to be analyzed in Level 3 was reduced from 10 to eight (Figure 25).

Figure 25. Level 3 Alignment Alternatives



Source: HNTB, 2021

7.2 Alignment Criteria

In the Level 3 alignment analysis, the criteria were developed to focus on potential community and environmental impacts along the refined alignments and considered constructability criteria consistent with the design assumptions discussed previously in Section 7.1. The criteria can be found in Table 15. With more definitive horizontal alignments, preliminary right-of-way assumptions were used to analyze alignments against many of the criteria. Proposed right-of-way widths were assumed to be 100 feet wide, or 50 feet to either side of the alignment centerline. Community impact criteria such as noise and vibration and visual/aesthetic receptors continued to use the 500-foot buffer used in the Level 2 analysis because the potential for impacts would be beyond the right-of-way limits for these specific criteria.

Table 15. Overview of Level 3 Alignment Criteria

Criteria		Description	Measurement	Threshold
Potential Impacts to Sensitive Social, Biological, or Cultural Areas	Potential Water Body and Floodplain Impacts	Total length (linear feet) of alignment that crosses a water body or floodplain	Total Length (feet)	High < 20,000 feet Medium = 20,000-30,000 feet Low > 30,000 feet
	Potential Wetland Impacts	Total acres of wetland within the proposed right-of-way	Total Acres	High = 0 - 0.99 acres Medium = 1 - 10 acres Low = 10+ acres
	Existing structures that could be impacted by the potential right-of-way	Number of structures located within the proposed right-of-way (house, out-buildings, business, public buildings, billboards, etc.)	Total Number	High ≤ 20 Medium = 21-50 Low > 50
	Potential Parks/Public Recreational Area Impacts	Total acres of parks and public recreational areas within proposed right-of-way	Total Acres	High = 0 acres Medium = 0.1-2 acres Low > 2 acres
	Potential Historic Resources Impacts	Are there any national or state historic sites within the proposed right-of-way?	Yes/No	High = No Low = Yes
Potential Community Impacts	Noise & Vibration (number of receptors)	Number of sensitive receivers (residences, educational facilities, hospitals, childcare facilities, senior housing, theaters) within 500 feet (250 feet on each side of centerline)	Number of Locations	High < 300 Medium = 300-400 Low > 400
	Visual/Aesthetic (number of receptors)	Number of sensitive receivers (historic neighborhoods, historic places, cultural landmarks or districts, parks, and open space) within 500 feet (250 feet on each side of centerline)	Number of Locations	High = 0 Medium = 1+

Criteria		Description	Measurement	Threshold
Constructability	Required Non-Public right-of-way	Total distance of new or non-public right-of-way needed	Total Miles	High ≤ 7.0 miles Medium = 7.1-10.0 miles Low > 10.0 miles
Constructability	Potential Adverse Impacts to Transportation Systems During Construction	Potential adverse impact to existing transportation systems during construction.	Severity of Impacts	High = Minimal Modification/Closure Medium = Substantial Modification/Closure Low = Significant Modification/Reconstruction and long-term closure
Constructability	Potential Opportunity to improve Transportation Systems	Potential opportunity to improve safety, capacity, and/or state of good repair of existing transportation systems during construction.	Opportunity for Improvement	High = Opportunities for Project to require improvement to safety, capacity and/or state of good repair of existing transportation infrastructure Medium = No opportunities for Project to require improvement to safety, capacity and/or state of good repair of existing transportation infrastructure
Design Considerations	Vertical Profile	Does the known profile of the alignment create opportunity for the possible use of multiple high-speed transportation modes?	Yes/No	High = Yes Low = No

Source: HNTB, 2021

Potential impacts to floodplains, wetlands, and parks were reassessed by calculating the total acreage of wetlands and parks potentially affected by the proposed right-of-way and total length of guideway that would cross over floodplains and water bodies. The actual number of potentially impacted structures as well as whether any national or state historic sites could be impacted at all were identified. Similarly, the total number of sensitive receptors was calculated in relation to potential for noise and vibration impacts or visual/aesthetic receptors. Noise and vibration receptors included residences, educational and childcare facilities, hospitals, senior housing, and theaters; while visual/aesthetic receptors included historic neighborhoods and places, cultural landmarks or districts, and parks.

Constructability was focused primarily on potential adverse impacts to transportation systems and opportunities to improve existing transportation systems during construction. This also calculated the total mileage of non-public right-of-way that would need to be acquired to build an alignment. The lack of potential opportunities to improve transportation systems during construction was not assigned a Low rating because it was not a requirement of Project to necessarily improve existing systems. From a design perspective, a vertical profile criterion was used to determine if any of the alignments would prohibit use of any of the remaining modes based on the vertical requirements associated with the path of the alignment.

7.3 Alignment Results

Significant differentiation between alignment ranking was evident after applying the Level 3 evaluation criteria (see Table 16). The major challenge for the remaining I-30 alignments was potential impacts to adjacent water bodies and floodplains, though no fatal flaws were identified. Alignments which ranked more favorably had low potential for impacting wetlands, parks, and historic resources. With respect to Alignments 26 and 37, the primary challenge was the potential displacement of existing structures such as residential, commercial, public buildings, and billboards. While these potential impacts are not necessarily a fatal flaw, the impacts to the communities would be much greater than those of the other I-30 alignments. Alignments 26 and 37 would require the acquisition to more non-public right-of-way, increasing community impacts and increasing Project cost and were not recommended for further study in Phase 2. More detail regarding the Level 3 screening results is provided in Appendix E.

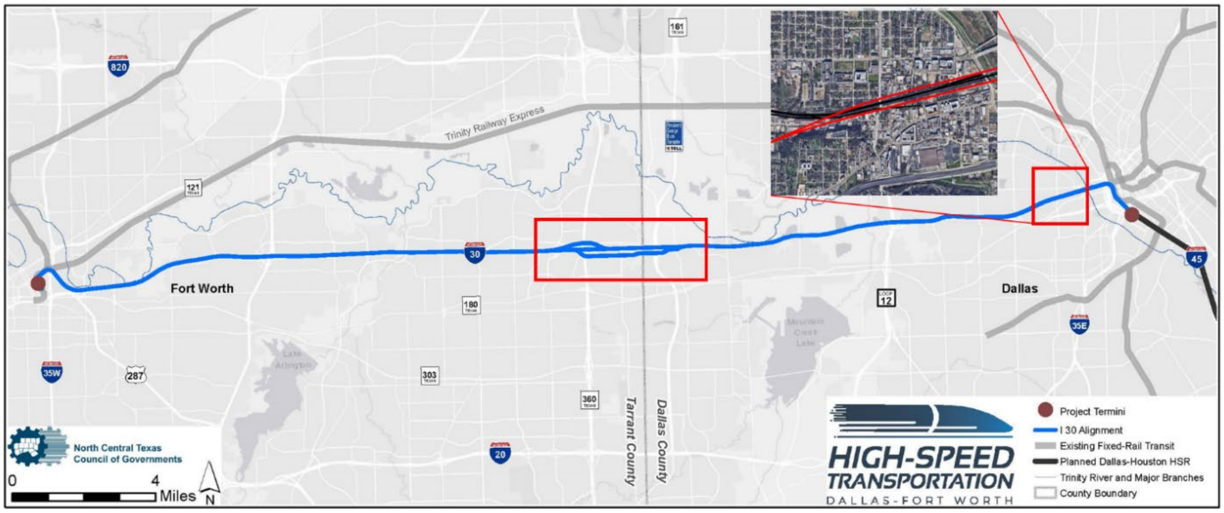
Table 16. Level 3 Alignment Evaluation Results

		I-30 Alignments							SH 180
Criteria		12	13	14	15	17	18	26	37
Potential Impacts to Sensitive Social, Biological, or Cultural Areas	Potential Water Body and Floodplain Impacts	○	○	○	○	○	○	●	●
	Potential Wetland Impacts	●	●	●	●	●	●	●	●
	Existing structures that could be impacted by the potential right-of-way	◒	◒	○	●	◒	●	○	○
	Potential Parks/Public Recreational Area Impacts	○	○	●	●	●	◒	◒	◒
	Potential Historic Resources Impacts	●	●	●	●	●	●	●	○
Potential Community Impacts	Noise & Vibration (number of receptors)	◒	◒	◒	●	●	◒	○	◒
	Visual/Aesthetic (number of receptors)	◒	◒	◒	◒	●	◒	●	◒
Constructability	Required Non-Public right-of-way	◒	◒	◒	●	●	●	○	○
	Potential Adverse Impacts to Transportation Systems During Construction	◒	◒	◒	●	●	◒	◒	○
	Potential Opportunity to improve Transportation Systems	●	●	●	●	●	●	●	◒
Design Consider-ations	Vertical Profile	●	●	●	●	●	●	●	●
Level 3 alignments recommendations to advance into Phase 2		No	No	No	Yes	Yes	Yes	No	No

Source: HNTB, 2021

The Level 3 evaluation concluded three of the seven I-30 alignments should advance into the Phase 2 of the study. Specifically, Alignments 15, 17, and 18, each along I-30, were recommended for further study. Differences between these three alternatives are relatively minor, with only slight differences related to which side of the Union Pacific Railroad to travel adjacent to for approximately four miles in west Dallas, and how to navigate through or around highway interchanges along I-30 at SH 360 in Arlington and SH161 in Grand Prairie (Figure 26). Ultimately, 22 of the 30 total miles are shared between all three recommended I-30 alignments. Therefore, these alignments are similar enough that these differences can be treated as design options for consideration that can be better defined and evaluated with further design.

Figure 26. Alignments Recommended to Advance to Phase 2



Source: HNTB, 2021

7.4 Mode Criteria

The Level 3 mode analysis focused on maturity of additional technology used to operate each mode, costs, and operations and maintenance considerations (see Table 17). This analysis included use of TRLs to determine technology maturity as shown previously in Figure 18. Technology maturity of safety systems such as fire and life safety as well as operations systems like autonomous vehicle operations were analyzed using the TRL framework. Technology maturity was also measured more generally according to the number of operational systems in service worldwide for each mode. As this criterion is a significant indicator of the viability of a technology to operate in this corridor, it is important to use examples of each technology in use around the world to provide a “level playing field” for all high-performance rail technologies in this analysis, not just domestic examples. The ability of each mode to serve as an extension to planned high-speed passenger systems was evaluated in addition to determining whether any mode-specific impacts to adjacent transportation infrastructure stemming from operations and maintenance requirements. Mode-specific capital (construction) costs were developed at a high level to establish a rough order-of-magnitude comparison between modes. The capital costs were developed based on general cost-per-mile information obtained from available capital costs developed for other relevant projects and studies.

Table 17. Overview of Level 3 Mode Criteria

Criteria		Description	Measurement	Thresholds
Construction/Operability	Technology Maturity (Safety Systems)	Technology Readiness Levels (TRLs) for safety systems requirements including emergency response, ventilation, fire life safety, etc.	Technology Readiness Levels	High = 8-9 Medium = 6-7 Low ≤ 5
Construction/Operability	Technology Maturity (Operations Systems)	Technology Readiness Levels (TRLs) for operational systems requirements including signaling, autonomous vehicle operations, control systems, etc.	Technology Readiness Levels	High = 8-9 Medium = 6-7 Low ≤ 5
Construction/Operability	Technology Maturity (Revenue Operation)	Number of Routes (10+ miles) currently in revenue operation worldwide	Number of Routes	High ≥ 10 Medium = 1-9 Low = 0
Construction/Operability	Potential to serve as an extension to planned high-speed systems	Ability of mode to serve as an extension to planned high-speed systems assuming specific chosen technology, equipment and specifications are appropriately compatible.	Yes/No	High = Yes Low = No
Construction/Operability	Potential Adverse Impacts to Transportation Systems	Are there any potential adverse impacts to existing transportation systems due to mode-specific operations or maintenance?	Level of Impact	High = able to conduct O&M with little impact Medium = able to conduct O&M with moderate impact Low = able to conduct O&M with high impact
Cost	Capital (Construction) Cost	Rough Order of Magnitude Construction cost for the guideway, ancillary facilities, maintenance facilities and vehicles, per mile	Cost per mile	High ≥ $75 million Medium = $75 - $150 million Low < $150 million
Operations and Maintenance	Travel Time	The slowest running time for each mode between Dallas and Fort Worth under a mid-point station scenario	Travel Time	High ≤ 15 minutes Medium = 16 – 19 minutes Low ≥ 20 minutes
Operations and Maintenance	Vertical Profile	How well can each technology accommodate steeper grades?	Percent Grade	High > 5% Med ≤ 5%
Operations and Maintenance	Maximum Curve Speed	Theoretical design speed at which a mode is able to travel through the tightest curves in the alignment (1,000' radius).	Speed (mph)	High ≥ 100 mph Medium = 51 – 99 mph Low ≤ 50 mph

Source: HNTB, 2021

Operations and maintenance costs were not developed because these costs can vary greatly and are heavily dependent on operating plans which have not been developed at this early phase of the study. Additionally, modes were re-evaluated for their travel time along the more detailed alignments. In this iteration of the travel time criterion, a mid-point station was assumed as was done in Level 2, and the travel time between the Dallas and Fort Worth station areas was compared between the modes, the fastest of which were rated higher.

Modes were evaluated for their relative performance abilities related to vertical profile and maximum curve speed as well. Modes that could continue to perform well at grades steeper than five percent were rated more highly. No Low rating was assigned to this criterion because the guideway design could be adjusted to accommodate if necessary. For the maximum curve speed criterion, the travel time model was used. In the travel time model, each curve along each alignment was calculated and maximum curve speeds for each mode were applied to provide more precise travel times as each vehicle traveled from Dallas to Fort Worth. The tightest curve used along any of the alignments was a 1,000-foot turning radius and modes that could travel through that curve without sacrificing speed were rated the most highly.

7.5 Mode Results

The Level 3 mode evaluation determined that high-speed rail and maglev have comparable technology maturity while hyperloop is further behind regarding these criteria as real world applications of high-speed rail and maglev exist around the word, while hyperloop is still in prototype and testing phases. As with the Level 2 evaluation, the TRL framework was applied to determine readiness level. To further differentiate readiness, the number of fully operational systems in revenue service for each mode were counted to understand familiarity within the industry for each. High-speed rail was determined to be the most likely to be compatible with the planned high-speed rail project between Dallas and Houston from a technology standpoint and able to provide the opportunity for a true “one-seat ride.” However, high-speed rail and maglev have a slightly higher potential for adverse impacts to adjacent transportation infrastructure due to mode-specific operations and maintenance activities occurring in open air and in some cases above other transportation infrastructure, while preliminary information indicates that hyperloop operations and maintenance activities would occur predominantly within the hyperloop tubes.

When comparing rough order-of-magnitude construction costs, all publicly available information shows that maglev could potentially cost twice as much as high-speed rail or hyperloop, with high-speed rail and hyperloop capital costs similar on a per-mile basis. Rough order-of-magnitude construction costs per mile for maglev, high-speed rail and hyperloop are $175M, $95M and $97M, respectively. The Level 3 mode evaluation results can be found in Table 18 and more detail regarding the results is found in Appendix E.

Table 18. Level 3 Mode Evaluation Results

Criteria		Modes		
		High-Speed Rail	**Maglev**	**Hyperloop**
Construction/Operability	Technology Maturity (Safety Systems)	●	●	◒
	Technology Maturity (Operations Systems)	●	●	◒
	Technology Maturity (Revenue Operation)	●	◒	○
	Potential to serve as an extension to planned high-speed systems	●	○	○
	Potential Adverse Impacts to Transportation Systems	◒	●	●
Cost	Capital (Construction) Cost	◒	○	◒
Operations and Maintenance	Travel Time	◒	◒	●
	Vertical Profile	◒	◒	●
	Maximum Curve Speed	○	◒	●
Level 3 alignments recommendations to advance into Phase 2		Yes	No	Yes

Source: HNTB, 2021

As project engineering advances, capital costs will become more defined and applicable to the Project being designed. The operations and maintenance of each mode will present unique challenges. As it pertains to travel time, hyperloop stands out as the fastest, though any of the three modes would offer a much faster connection between Dallas, Fort Worth, and a future potential mid-point station than any other travel option available in the region in 2021. Hyperloop also offers greater flexibility in terms of vertical profiles and maximum curve speeds: that is, how steep the guideway can be at any point along the alignment and how fast the vehicle can travel through curves along the route, respectively.

Due to challenges related to compatibility with planned high-speed passenger service and high order-of-magnitude cost relative to high-speed rail and hyperloop, it was recommended that maglev not be considered. Based on the level 3 mode analysis, this would advance both high-speed rail and hyperloop into Phase 2 to determine which would be the right mode for premium high-speed passenger service between downtown Dallas and Fort Worth. However, since completion of the Phase 1 analysis, continued coordination with FTA and FRA resulted in hyperloop being eliminated from further consideration in Phase 2. Considering the preliminary level of hyperloop technology readiness, this mode of transportation could not yet be advanced through safety rulemaking in sufficient time to support the environmental clearance timeframe for this Project. Therefore, high-speed rail will be the singular mode carried into Phase 2 of the Project.

8.0 I-30 Corridor Concept Refinements

Based on the Level 3 recommendation of the I-30 corridor, the Project team continued to refine design concepts in several areas that had denser development and infrastructure challenges: downtown Fort Worth, Arlington entertainment district to Belt Line Road in Grand Prairie along I-30, and downtown Dallas.

8.1 Station Connections

Prior to the initiation of the DFWHSTC Study, NCTCOG prepared feasibility studies for station locations in Fort Worth and Arlington. The Dallas station location was determined as part of the Dallas to Houston high-speed rail Project. These proposed station locations were guided by four regional high-speed rail policies included in the mobility transportation plan.

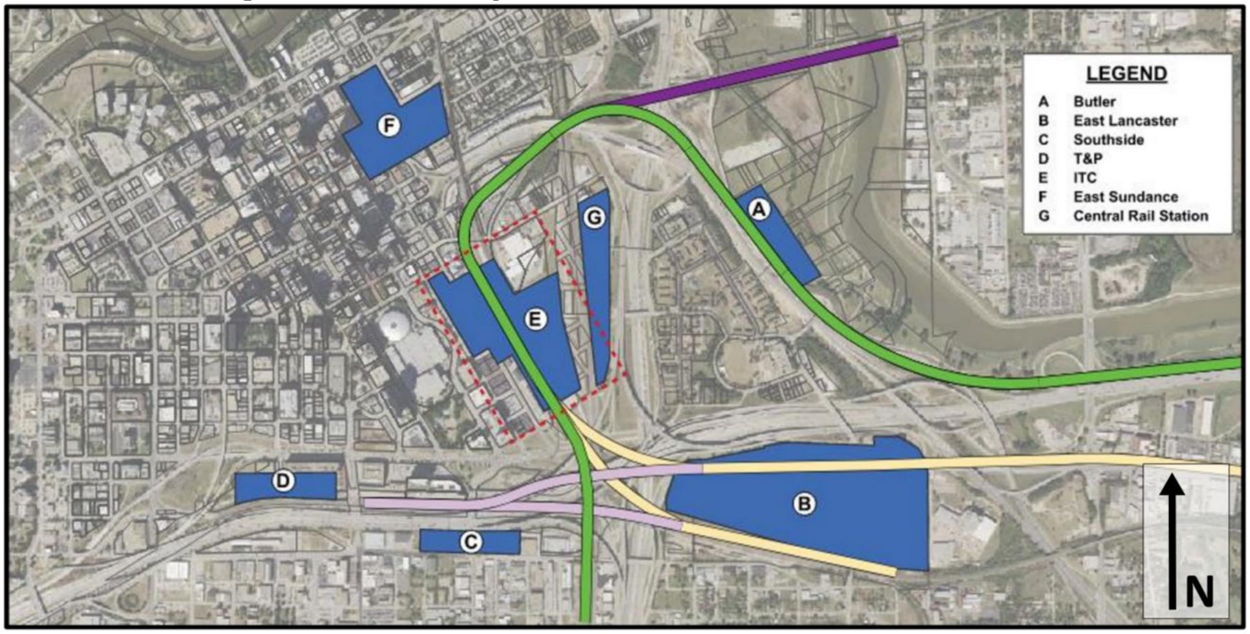
- TR3-011: Establish policies fostering high-speed rail system interoperability, resulting in a “one-seat” ride system operation to, through, and within the North Central Texas region.
- TR3-012: Establish policies encouraging regional access by identifying grade-separated high-speed rail station locations in downtown Fort Worth, Arlington, and downtown Dallas.
- TR3-013: Support the planning and development of sustainable land uses near grade-separated high-speed rail locations by coordinating with the cities of Fort Worth, Arlington, and Dallas.
- TR3-014: Support the planning and development of sustainable land uses near at-grade high-speed rail locations by coordinating with the cities’ hosting stations.

Though these previous studies did review potential alignments to the stations, the studies did not recommend an alignment. The following sections discuss potential station locations and the development of alignments to connect to the stations in Fort Worth, Arlington, and Dallas.

8.1.1 Fort Worth Station

The *Fort Worth High-Speed Rail Station Area Planning Study* (dated 2017) identified multiple potential station locations in downtown Fort Worth. The study determined the preferred station location to be adjacent to the Intermodal Transportation Center in the area identified as “E” in Figure 27. The Intermodal Transportation Center has since been renamed as the Fort Worth Central Station. For more information on the station location identification and evaluation process see https://www.nctcog.org/getmedia/c98a35ce-43e5-437b-9382-b96ad2525564/FW-HSR-FINAL-Report-09-11-2017.pdf.

Figure 27. Previously Studied Fort Worth Station Locations

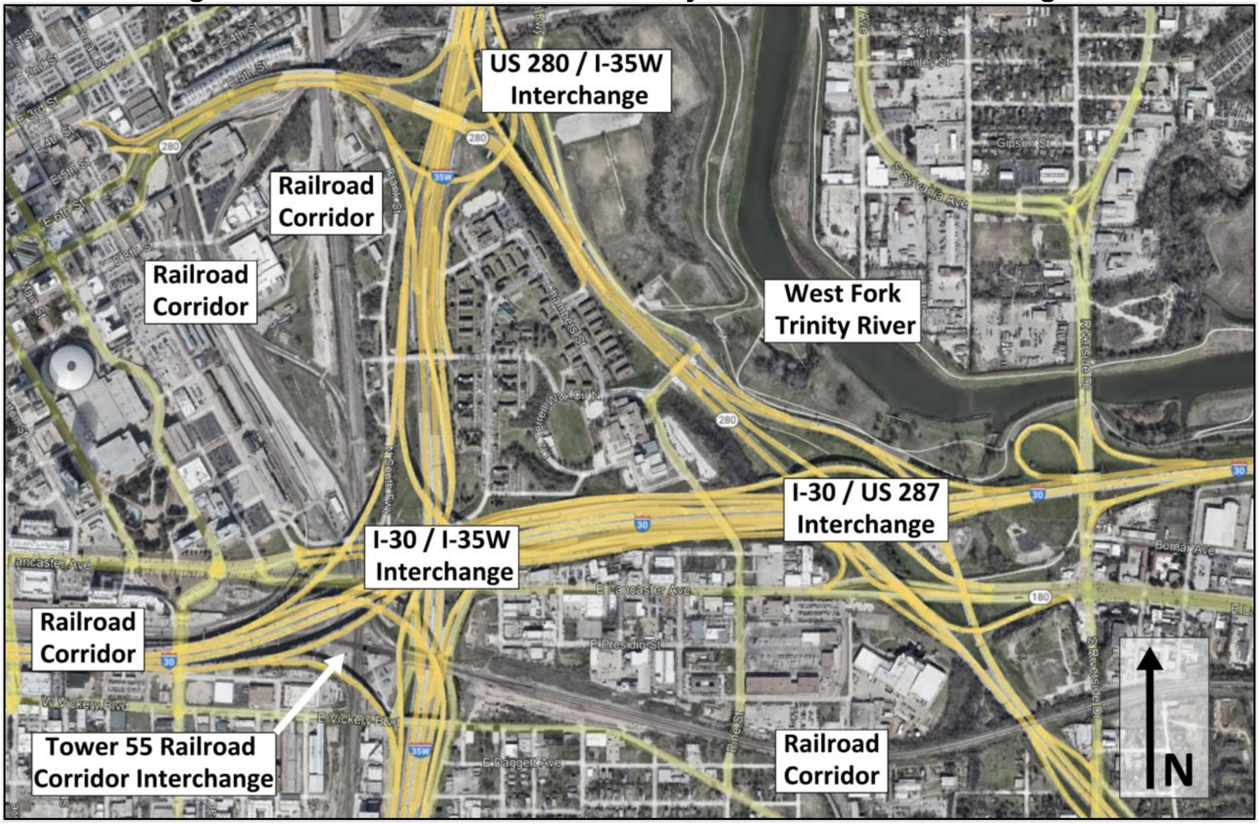


Source: Fort Worth Station Area Planning Study by NCTCOG, 2017

In Fort Worth, concept refinement began with the preferred station location identified in the *Fort Worth High-Speed Rail Station Area Planning Study* and then alignments were developed to connect from the recommended alignment along I-30 to the proposed station location. However, during the development of station connections, other previously considered station locations were revisited.

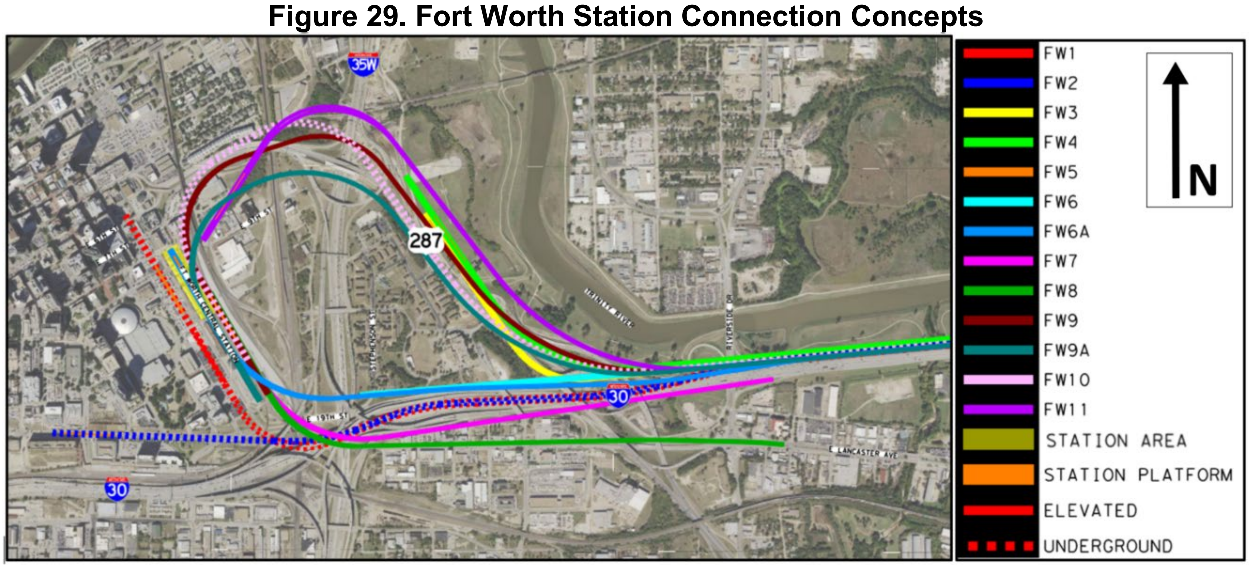
Major infrastructure challenges in the vicinity of the Fort Worth station area included the I-30/ I-35W interchange, I-30/US 287 interchange, I-35W/US 280 interchange, West Fork Trinity River, multiple railroad corridors, Tower 55 railroad corridor interchange (see Figure 28). As mentioned in Section 1.4, this Project is being developed to help advance the state high-performance rail transportation network by linking the Dallas-Fort Worth with other planned high-performance passenger rail corridors/stations such as high-speed passenger services from Fort Worth to south Texas metropolitan areas. Therefore, the proposed alignment to the Fort Worth Central Station must also accommodate future high-speed rail alignments routing northward to Oklahoma and southward to south Texas.

Figure 28. Fort Worth Station Area Major Infrastructure Challenges



To avoid surface infrastructure and minimize impacts to the built and natural environments, 13 concepts were developed and included aerial structure and tunnel configurations (see Figure 29).

Figure 29. Fort Worth Station Connection Concepts



For more detail maps of each concept, see Volume II Appendix II-F. These concepts were shown to the City of Fort Worth, Tarrant County, Trinity Metro, and the TxDOT Fort Worth District for review and comment. Table 19 provides a description of each concept and identifies potential pros and cons.

Table 19. Fort Worth Station Connections Pros and Cons

Fort Worth Concept #	Pros	Cons
1	**Description:** The concept is a tunnel beneath I-30. Just west of the I-30/I-35W interchange the alignment would turn north and parallel the west side of Jones Street. The concept includes a below-grade station west of Fort Worth Central Station.	
	• Connectivity to economic development in the vicinity of Texas A&M University Law School campus • Connectivity to high-density development in downtown • Supports multimodal connectivity to existing transit facility • Mostly within public right-of-way and undeveloped property • Underground station and guideway would allow the land above for development • Goes under Tower 55 and avoids any impact to future freight railroad expansion • No potential for visual impact from an elevated guideway	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Tunnel infrastructure complexity leads to higher cost • Tunnel through railroad right-of-way introduces increased costs to support railroad infrastructure • Increased design complexity and cost of underground station • Requires excessively slower speeds on station approach • Would require permanent easements from private properties the tunnel concept would be under
2	**Description:** The concept is a tunnel beneath I-30. Just west of the I-30/I-35W interchange, the alignment tunnel routes under West Lancaster Avenue and terminates at a below-grade station north the T&P Station.	
	• Minimizes impacts to properties by aligning with I-30 and public road right-of-way • Goes under Tower 55 and avoids any impact to future freight railroad expansion • No potential for visual impact from an elevated guideway • Horizontal alignment provides higher speed entering/exiting the station	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Station location would not be adjacent to the Fort Worth Central Station • Tunnel infrastructure complexity leads to higher cost • Tunnel through railroad right-of-way introduces increased costs to support railroad infrastructure • Increased design complexity and cost of underground station • Could require long-term closure of Lancaster Avenue during construction • Would require permanent easements from private properties the tunnel concept would be under

Fort Worth Concept #	Pros	Cons
3	**Description:** This aerial concept routes adjacent to the east side of SH 280, terminating at an elevated station east of SH 280.	
	• Shorter alignment length • Minimizes impact to existing and planned developments • Mostly within public right-of-way • Minimizes construction impacts to downtown and freeways • No impact or interface with Tower 55	• Station location would not be adjacent to the Fort Worth Central Station and have limited opportunities for multimodal connectivity to the existing transit system • Presents alignment challenges when connecting to future southern and northern high-speed rail corridors • Potential direct and visual impacts to Harmon Field Park • Aerial infrastructure complexity over I-30/US 287 interchange • Low speed curve from I-30 to station • Further away from central business district • Requires excessively slower speeds on station approach
4	**Description:** This aerial concept is similar to Fort Worth Concept 3, routing adjacent to the east side of SH 280 and terminating at an elevated station east of SH 280. This concept routes through the I-30/ US 287 interchange at a location further east than Concept 3.	
	• Shorter alignment length • Minimizes impact to existing and planned developments • Mostly within public right-of-way • Minimizes construction impacts to downtown and freeways • No impact or interface with Tower 55	• Station location would not be adjacent to the Fort Worth Central Station and have limited opportunities for multimodal connectivity to the existing transit system • Presents alignment challenges when connecting to future southern and northern high-speed rail corridors • Potential direct and visual impacts to Harmon Field Park • Aerial infrastructure complexity over existing I-30/US 287 interchange Low speed curve from I-30 to station • Further away from central business district • Requires excessively slower speeds on station approach

<table>
<tr><th>Fort Worth Concept #</th><th>Pros</th><th>Cons</th></tr>
<tr><td rowspan="2">5/6</td><td colspan="2">Description: This aerial concept routes along the north side of I-30 and terminates at an elevated station located on the northeast corner of the I-30/I-35W interchange. A below-grade version of this concept could be considered.</td></tr>
<tr><td>Station location adjacent to future development property
Straight alignment allows for higher speeds prior to station when compared to other alternatives
No impact or interface with Tower 55
Minimizes construction impacts to downtown and freeways</td><td>Impacts to private property
Station location would not be adjacent to the Fort Worth Central Station and have limited opportunities for multimodal connectivity to the existing transit system
Presents alignment challenges when connecting to future southern and northern high-speed corridors
Potential visual impact to Butler Place area from elevated guideway over US 287 direct connector ramps
Aerial infrastructure complexity over I-30/ US 287 interchange
Due to alignment being elevated over US 287 direct connector ramps, station could be over 100 feet above ground</td></tr>
<tr><td rowspan="2">6A</td><td colspan="2">Description: This aerial concept routes along the north side of I-30, crossing over the I-30/I-35W direct connector ramps before turning northward on west side of the existing north-south railroad corridor servicing the Fort Worth Central Station. The concept terminates an at aerial station adjacent to the east side of Fort Worth Central Station.</td></tr>
<tr><td>Connectivity to high-density development in downtown
Supports multimodal connectivity to existing transit facility
Minimizes impact to current and planned developments
No impact to Tower 55</td><td>Impacts to private property
Potential visual impact to Butler Place by elevated structure
Aerial infrastructure complexity over existing I-30/US 287 interchange and Fort Worth Central Station area
Construction impacts to Fort Worth Central Station and I-35W
Elevation challenges to integrate with potential southern high-speed route that would go over the I-30/I-35W interchange
Requires excessively slower speeds on station approach</td></tr>
</table>

Fort Worth Concept #	Pros	Cons
7	**Description:** This aerial concept routes along the south side of I-30, crossing over the I-30/I-35W as it turns northward along the existing north-south railroad corridor servicing the Fort Worth Central Station. The concept terminates an at aerial station adjacent to east side of Fort Worth Central Station. A below-grade version of this concept could be considered.	
	• Connectivity to high-density development in downtown • Supports multimodal connectivity to existing transit facility • No impact to Fort Worth Central Station buildings	• Impacts to private property • Potential visual impact to properties south on I-30, along Lancaster Avenue by elevated structure • Aerial infrastructure complexity over I-30/ US 287 interchange, I-30 / I-35W interchange, and Fort Worth Central Station area • Station area would need to be elevated over 100 feet to integrate with potential southern route that would go over the I-30/I-35W interchange • Potential impact to freight railroad facilities • Alignment would directly impact numerous community facilities that support lower income and homeless • Potential impact to future Tower 55 freight railroad expansion • Requires excessively slower speeds on station approach
8	**Description:** This aerial concept routes along East Lancaster Avenue On the south side of I-30, crossing over the I-30/I-35W as it turns northward along the existing north-south railroad corridor servicing the Fort Worth Central Station. The concept terminates an at aerial station adjacent to east side of Fort Worth Central Station. A below-grade version of this concept could be considered.	
	• Connectivity to high-density development in downtown • Supports multimodal connectivity to existing transit facility • No impact to Fort Worth Central Station buildings	• Impacts to private property • Potential visual impact to properties along Lancaster Avenue from elevated structure • Aerial infrastructure complexity over I-30 / I-35W interchange and Fort Worth Central Station area • Station area would need to be elevated over 100 feet to integrate with potential southern route that would go over the I-30/I-35W interchange • Alignment would directly impact numerous community facilities that support lower income and homeless • Potential impact to freight railroad facilities • Potential impact to future Tower 55 freight railroad expansion • Property impacts along East Lancaster Avenue • Potential impact to future roadway plans on Lancaster Avenue • Construction impacts to Lancaster Avenue

<table>
<tr><th>Fort Worth Concept #</th><th>Pros</th><th>Cons</th></tr>
<tr><td rowspan="2">9</td><td colspan="2">Description: This aerial concept routes adjacent to the east side of US 287, crossing over I-35W just north of the I-35W/US 287 interchange. The concept routes southward along the west side of the existing north-south railroad corridor servicing the Fort Worth Central Station, terminating at an aerial station located southeast of the Fort Worth Central Station.</td></tr>
<tr><td>• Connectivity to high-density development in downtown
• Supports multimodal connectivity to existing transit facility
• No impact or interface with Tower 55
• No impact to existing Fort Worth Central Station buildings</td><td>• Impacts to private property
• Potential direct and visual impact from elevated structure to Harmon Fields Park
• Potential visual impacts to residential and commercial properties near SH 280
• Complex aerial infrastructure over freight railroad right-of-way
• Potential impact to freight railroad facilities
• Longest alignment results in higher costs
• Aerial infrastructure complexity over US 287 connector ramps, I-35W/SH 280 interchange, rail roads, and Fort Worth Central Station area
• Would require the future north/south high-speed rail route to go over I-30/I-35W interchange introducing visual impact and construction complexity
• Station area would need to be elevated over 100 feet to integrate with potential southern route that would go over the I-30/I-35W interchange
• Requires excessively slower speeds on station approach</td></tr>
<tr><td rowspan="2">9A</td><td colspan="2">Description: This aerial concept routes adjacent to the west side of US 287, crossing over I-35W just south of the I-35W/US 287 interchange. The concept routes southward along the west side of the exiting railroad corridor, terminating at an aerial station located south of the Fort Worth Central Station.</td></tr>
<tr><td>• Connectivity to high-density development in downtown
• Supports multimodal connectivity to existing transit facility
• No impact or interface with Tower 55
• Eliminates potential impact to Harmon Fields Park from the Fort Worth Concept 9</td><td>• Impacts to private property
• Potential visual impact from elevated structure to Butler Place area
• Complex aerial infrastructure over freight railroad right-of-way
• Potential impact to freight railroad facilities
• Aerial infrastructure complexity US 287 connector ramps, I-35W/SH 280 interchange, and Fort Worth Central Station area
• Longest alignment results in higher costs
• Potential impacts existing Fort Worth Central Station buildings
• Would require the future north/south high-speed rail route to go over I-30/I-35W interchange introducing visual impact and construction complexity
• Station area would need to be elevated over 100 feet to integrate with potential southern route that would go over the I-30/I-35W interchange
• Requires excessively slower speeds on station approach</td></tr>
</table>

Fort Worth Concept #	Pros	Cons
10	**Description:** This tunnel concept routes northward under US 287, turning westward in the vicinity of the I-35W/US 287 interchange. The concept routes southward along the west side of the exiting railroad corridor, terminating at an aerial station located southeast of the Fort Worth Central Station.	
	• Connectivity to high-density development in downtown • Supports multimodal connectivity to existing transit facility • Goes under Tower 55 and avoids any impact to future freight railroad expansion • No potential for visual impact from an elevated guideway	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Tunnel infrastructure complexity leads to higher cost • Tunnel through railroad right-of-way introduces increased costs to support railroad infrastructure • Relative long alignment concept introduces increase construction and maintenance cost • Increased design complexity and cost of underground station • Requires excessively slower speeds on station approach • Would require permanent easements from private properties the tunnel concept would be under
11	**Description:** This aerial concept routes adjacent to the east side of US 287, crossing over I-35W just north of the I-35W/US 287 interchange. The concept routes southward over SH 280 terminating in an aerial station located east of Fort Worth Central Station.	
	• Horizontal alignment geometry reduces impact to highway infrastructure • No impact to Tower 55 • No impact existing Central Station buildings	• Impacts to private property • Potential direct and visual impact from elevated structure to Harmon Fields Park • Potential impact to freight railroad facilities • Less favorable station location for multimodal connectivity and development • Requires excessively slower speeds on station approach • Would require the future north/south high-speed rail route to go over I-30/I-35W interchange introducing visual impact and construction complexity

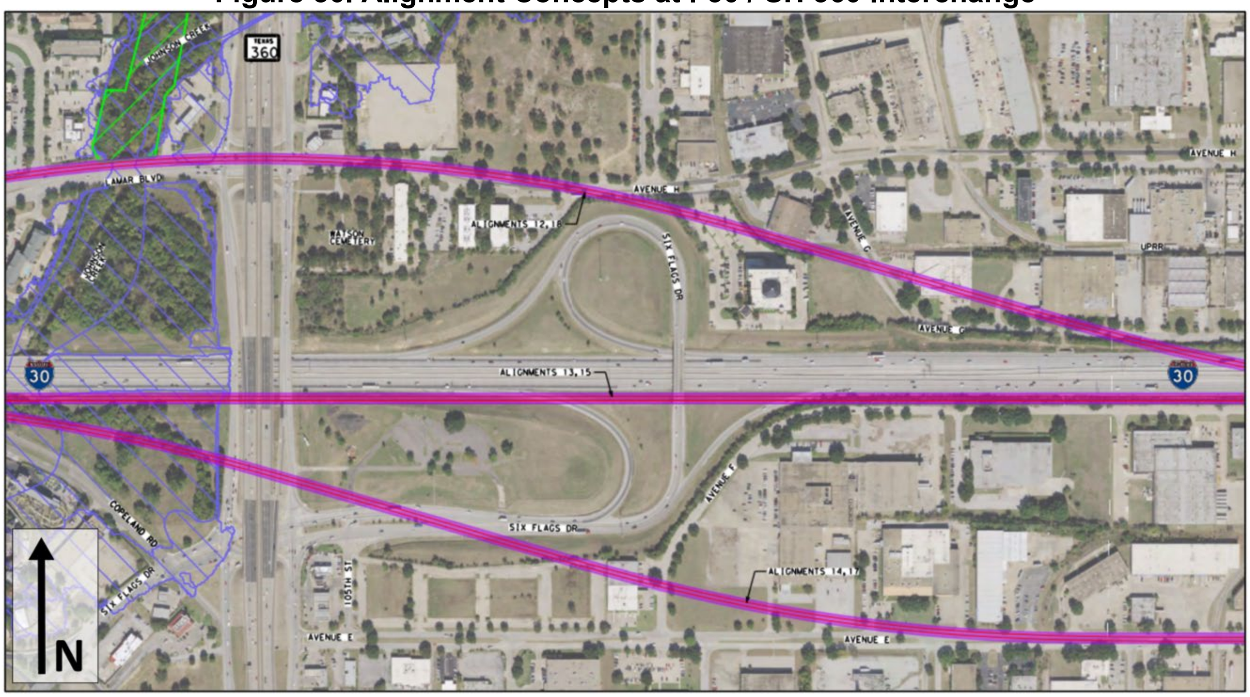
The Project team evaluated the 13 concepts with the staffs from City of Fort Worth, Tarrant County, Trinity Metro, and the TxDOT Fort Worth District. Based on this collaborative effort, the Project team identified Concept 1 (tunnel) and Concept 9 (aerial) for further evaluation during Phase 2. These concepts provide connectivity between I-30 and the station area in a manner that avoids and/or minimizes impacts to the built and natural environments and supports current and future development of the area.

8.1.2 Highway Infrastructure Challenges Associated with Mid-Point Station

In Arlington and Grand Prairie, there are two areas of significant conflict along I-30 at the interchanges with SH 360 and SH 161 that need to be addressed prior to locating a mid-point station. These multilevel highway interchanges include direct connector ramps, main lane overpasses and underpasses, and columns. Additionally, the areas around these interchanges are built-out with commercial and residential properties.

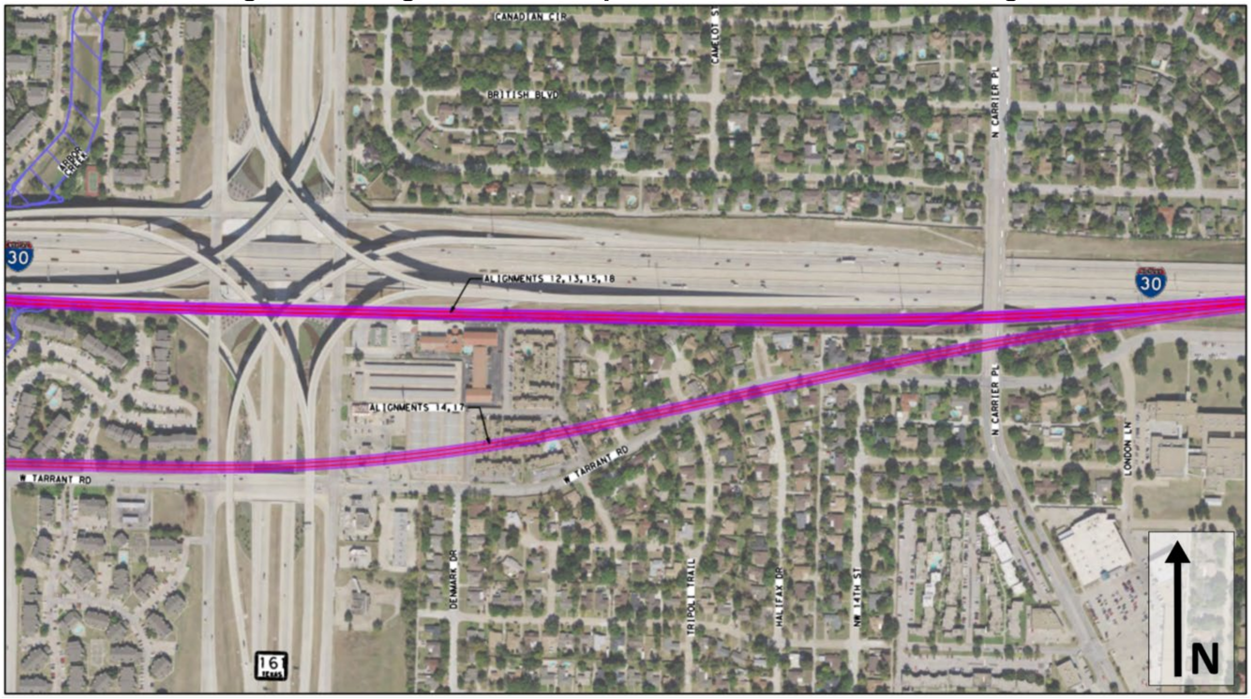
Multiple concepts were considered at the I-30/SH 360 interchange; this major interchange is currently undergoing reconstruction and is scheduled to be completed in 2024. The concepts included a route north of I-30 crossing over SH 360 around Lamar Boulevard, a route along the south side of the I-30 main lanes crossing over the top of the interchange, and a route along the south side of the interchange, crossing over SH 360 between Six Flags Road and I-30 (see Figure 30). The interchange design under construction is not depicted in Figure 25 but was considered during concept development.

Figure 30. Alignment Concepts at I-30 / SH 360 Interchange



These same alignments introduced two concepts at the SH 161 interchange – one along the south side of the I-30 main lanes crossing over the top of the SH 161 interchange and another route to the south to cross over SH 161 at a lower elevation in the vicinity of West Tarrant Road. Potential alignments routing to the north side of the SH 161 interchange were not developed because of the density of residential properties and potential adverse impacts to the neighborhoods (see Figure 31).

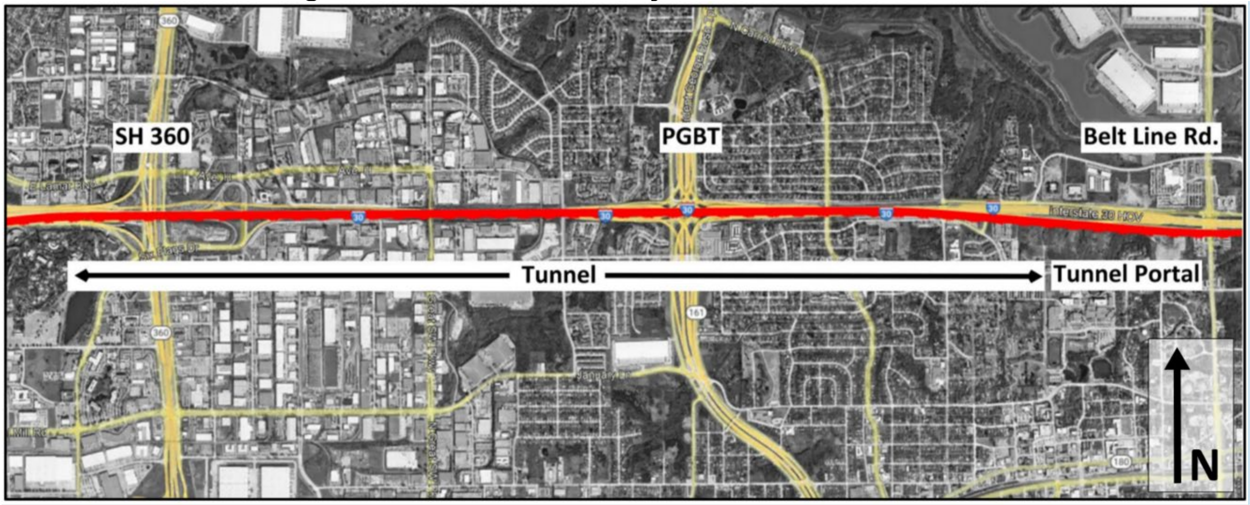
Figure 31. Alignment Concepts at I-30 / SH 161 Interchange



Conceptual alignments crossing over the top of these expansive interchanges would require a substructure of over 90 feet in height, creating challenges for column size and spacing, beam type, constructability, and access for emergency and maintenance purposes. Conceptual alignments routing around the north and south sides of the interchange imposed significant impacts to a high number of residences, business, and commercial structures.

Considering the potential magnitude of infrastructure and impacts at the SH 360 and SH 161 interchanges, additional below-grade (tunnel) alignments were considered. The I-30 highway alignment is relatively straight in this area and the lack of physical obstructions below the highway interchange foundations could make a below-grade/tunnel configuration of high-speed transportation in this area possible. The depth of the below-grade alignment concepts and proximity of the two highway interchanges (two miles apart) precluded the ability to create separate below-grade solutions with an at-grade segment between the interchanges. The below-grade concept would require a continuous tunnel with a portal beginning west of SH 360 and ending with a portal east of the SH 161 (see Figure 32).

Figure 32. Tunnel in Vicinity of SH 161 and SH 360



8.1.3 Arlington Entertainment District Station

To support the NCTCOG Regional Transportation Council directive for a three-station concept, a mid-point station location was investigated. The *Arlington High-Speed Rail Station Area Planning Study* (dated 2017) identified multiple potential station locations in the vicinity of the Arlington entertainment district. The study determined the preferred station location to be between AT&T Way and Ballpark Way, just south of IH-30 in the area identified as “B” in Figure 33 but also supported locations C and D. For more information on the station location identification and evaluation process see https://www.nctcog.org/getmedia/140b6afe-d7a0-4da6-b276-9a9f7a966b37/AHSR-SP-FINAL-Report-09-15-2017.pdf.

Figure 33. Previously Studied Arlington Station Locations

Source: Arlington Station Area Planning Study by NCTCOG, 2017

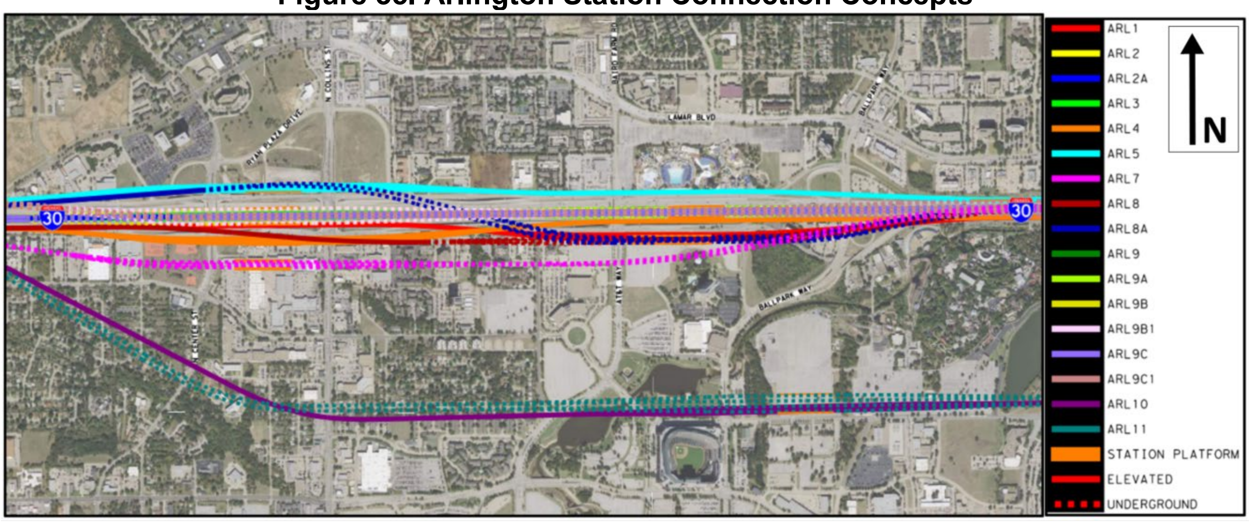
Concept refinement began with the preferred station location identified in the *Arlington High-Speed Rail Station Area Planning Study* and then alignments were developed to connect from the recommended alignment along I-30 to the proposed station location. However, during the development of station connections, other previously considered station locations were revisited and new location opportunities identified.

Major infrastructure challenges in the vicinity of the Arlington station area included the I-30/ SH 360 interchange that is under construction, I-30 managed lanes, I-30 service roads, Johnson Creek, and various venues and developments located throughout the Arlington Entertainment District. Major infrastructure challenges in the Arlington Station area are shown in Figure 34.

Figure 34. Arlington Station Area Major Infrastructure Challenges

To avoid surface infrastructure and minimize impacts to the built and natural environments, 18 concepts were developed and included aerial structure and tunnel configurations (see Figure 35).

Figure 35. Arlington Station Connection Concepts



For more detailed maps of each concept, see Volume II Appendix II-G. The alignment concepts were developed to support a station location in the Arlington Entertainment District. These concepts were developed through collaboration with the City of Arlington, considering current and future developments along I-30 and within the Arlington Entertainment District. Table 20 provides a description of each concept and identifies potential pros and cons.

Table 20. Arlington Entertainment District Pros and Cons

Arlington Concept #	Pros	Cons
1	**Description:** Concept routing toward the south side of I-30 to an elevated station located south of I-30, between AT&T Way and Ballpark Way. The concept is elevated through the SH 360 interchange and through Arlington Entertainment District.	
	• Increased speeds due to minimal curves in horizontal alignment • Station could be near the primary activity in entertainment district • Minimizes impact to private properties by aligning with I-30 right-of-way	• Impacts to private property • Aerial alignment through SH 360 interchange cannot be built because of highway infrastructure conflicts. • Potential visual impact by elevated structure for viewing entertainment center from I-30 • Shift from south side of I-30 to north side of I-30 west of North Cooper Street would increase cost and design complexity and could require straddle bents or a “pergola’ type structure and construction of column foundations between I-30 main lanes and frontage road • Would require property acquisition for guideway and parking and other multimodal features that are desired
2	**Description:** Concept routing along the center of I-30 with an elevated station located within I-30, between AT&T Way and Ballpark Way. The concept is elevated through the SH 360 interchange and through the Arlington Entertainment District.	
	• Increased speeds due to straighter horizontal alignment geometry, improves travel time for through movement • Station could be near the primary activity in entertainment district • No impact from guideway to private properties by aligning with I-30 right-of-way • Station access could be provided from both sides of I-30	• Aerial alignment through SH 360 interchange cannot be built because of highway infrastructure conflicts. • Conflicts with existing I-30 managed lanes • Increased cost and complexity for very large structure over I-30 for elevated station • Would require property acquisition on both sides of I-30 for station access, parking and other multimodal features that are desired

Arlington Concept #	Pros	Cons
2A	**Description:** Concept routes along the center of I-30 with an elevated station located within I-30 between AT&T Way and Ballpark Way. The concept excludes an express track and is elevated through SH 360 interchange and through the Arlington Entertainment District.	
	• Increased speeds due to minimal curves in alignment geometry • Station could be near the primary activity in entertainment district • No impact from guideway to private properties by aligning with I-30 right-of-way • Station access could be provided from both sides of I-30	• Aerial alignment through SH 360 interchange cannot be built because of highway infrastructure conflicts. • Alignment conflicts with existing I-30 managed lanes • No express tracks for through high-speed rail movement • Increased cost and complexity for very large structure over I-30 for elevated station • Would require property acquisition on both sides of I-30 for station access, parking and other multimodal features that are desired
3	**Description:** Concept routes along the center of I-30 with an elevated station located within I-30 between North Center Street and North Collins Street. The concept is elevated through SH 360 interchange and through the Arlington Entertainment District.	
	• Increased speeds due to minimal curves in alignment geometry • No impact from guideway to private properties by aligning within I-30 right-of-way • Station access could be provided from both sides of I-30	• Aerial alignment through SH 360 interchange cannot be built because of highway infrastructure conflicts. • Alignment conflicts with existing I-30 managed lanes • Increased cost and complexity for very large structure over I-30 for elevated station • Would require property acquisition on both sides of I-30 for station access, parking and other multimodal features that are desired

Arlington Concept #	Pros	Cons
4	**Description:** Concept routes along the south side of I-30 with an elevated station located south of I-30 between North Center Street and North Collins Street. The concept is elevated through the SH 360 interchange and through the Arlington Entertainment District.	
	• Minimizes impact to private properties by aligning with I-30 right-of-way	• Impacts to private property • Aerial alignment through SH 360 interchange cannot be built because of highway infrastructure conflicts • Potential visual impact by elevated structure for viewing entertainment center from I-30 • Would require property acquisition for guideway and station, parking, and other multimodal features that are desired Shift from south side to north side would result in large straddle bents or a “pergola’ type structure • Shift from south side of I-30 to north side of I-30 west of North Cooper Street would increase cost and design complexity and could require straddle bents or a “pergola’ type structure and construction of column foundations between I-30 main lanes and frontage road. • Complexity and impacts to I-30 for constructing pier foundations between main lanes and frontage road
4A	**Description:** Concept routes along the south side of I-30 with an elevated station located south of I-30 between North Center Street and North Collins Street. East of the station, this concept is a tunnel through the SH 360 interchange. The concept through the Arlington Entertainment District is aerial to the west and below grade to the east.	
	• Minimizes impact to private properties by aligning with I-30 right-of-way beyond Center Street to Ballpark Way limits	• Impacts to private property • Potential visual impact by elevated structure for viewing entertainment center from I-30 • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Would require property acquisition along south side of I-30 for station, guideway, and tunnel portal • Would require permanent easements from private properties the tunnel concept would be under • Shift from south side of I-30 to north side of I-30 west of North Cooper Street would increase cost and design complexity and could require straddle bents or a “pergola’ type structure and construction of column foundations between I-30 main lanes and frontage road • Convention Center Drive and Copeland Road east of AT&T Way would require reconfiguration

Arlington Concept #	Pros	Cons
5	**Description:** Concept routes along the north side of I-30 with an elevated station located north of I-30 between North Center Street and North Collins Street. The concept is elevated through the SH 360 interchange and through the Arlington Entertainment District.	
	• Minimizes impact to private properties by aligning with I-30 right-of-way • Could serve as a catalyst for development on north side of I-30 between North Collins Street and North Center Street.	• Impacts to private property • Aerial alignment through SH 360 interchange cannot be built because of highway infrastructure conflicts • Would require property acquisition for guideway and station, parking, and other multimodal features that are desired Station location is furthest away from center of Arlington Entertainment District from other concepts
6	Concept 6 Omitted	
7	**Description:** Concept routes along the south side of I-30 in a below-grade configuration to a below-grade station located south of I-30 between North Center Street and North Collins Street. The concept is in a tunnel through the SH 360 interchange with a below-grade open trench located in the vicinity of the station platform.	
	• Below-grade station leaves at-grade potential for development over station • Station offset from I-30 for development opportunities between the station and I-30	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Steep vertical grade heading west out of station to get over Cooper Street • Shift from south side of I-30 to north side of I-30 west of North Cooper Street would increase cost and design complexity and could require straddle bents or a “pergola’ type structure and construction of column foundations between I-30 main lanes and frontage road • Would require permanent easements from private properties the tunnel concept would be under

Arlington Concept #	Pros	Cons
8	**Description:** Concept routes along the south side of I-30 in a below-grade configuration to a below-grade station located between AT&T Way and Ballpark Way. The concept is in a tunnel through the SH 360 interchange with a below-grade open trench located in the vicinity of the station platform.	
	• Station could be near the primary activity in entertainment district • Below-grade station leaves at-grade potential for development over station	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Steep vertical grade heading west out of station to get over Collins Street • Shift from south side of I-30 to north side of I-30 west of North Cooper Street would increase cost and design complexity and could require straddle bents or a “pergola’ type structure and construction of column foundations between I-30 main lanes and frontage road • Would require property acquisition for open trench, guideway, station, parking, and other multimodal features that are desired • Would require permanent easements from private properties the tunnel concept would be under
8A	**Description:** Concept routes along the south side of I-30 in a tunnel to a station located between AT&T Way and Ballpark Way. The concept is a tunnel through the SH 360 interchange, continuing through the station platform and beneath I-30 with portal on north side of I-30.	
	• Station could be near the primary activity in entertainment district • Underground station and guideway would allow the land above for development	• Impacts to private property • Reduced speed due to curves in alignment geometry • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Increased complexity and cost of underground station • Reduced speed compared to straight alternatives • Would require property acquisition for open trench, guideway, station, parking, and other multimodal features that are desired • Impact to properties at portal location west of North Cooper Street • Would require permanent easements from private properties the tunnel concept would be under

Arlington Concept #	Pros	Cons
9	**Description:** The concept is a tunnel located beneath I-30 with a station located on the south side of I-30 between AT&T Way and Ballpark Way. Tunnel through SH 360 interchange continuing beneath I-30 through the Arlington Entertainment District with a portal located west of North Cooper Street between the future I-30 managed lanes.	
	• Increased speeds due to minimal curves in alignment geometry • Station could be near the primary activity in entertainment district • No impact to private properties from guideway by aligning with I-30 right-of-way • Station access could be provided from both sides of I-30	• Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Increased complexity and cost of underground station • Would require property acquisition on both sides of I-30 for station access, parking and other multimodal features that are desired
9A	**Description:** The concept is a tunnel located beneath I-30 with a station located between AT&T Way and Ballpark Way. Tunnel through SH 360 interchange continuing beneath I-30 through the Arlington Entertainment District with portal on north side of I-30. Tunnel portal located north of I-30, west of North Cooper Street.	
	• Station could be near the primary activity in entertainment district • Station access could be provided from both sides of I-30	• Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Increased complexity and cost of underground station • Would require property acquisition on both sides of I-30 for station access, parking and other multimodal features that are desired • Impact to properties at portal location west of North Cooper Street
9B	**Description:** The concept is a tunnel located beneath I-30 with a station located between North Collins Street and North Center Street. Tunnel through SH 360 interchange continuing beneath I-30 through the Arlington Entertainment District with portal on north side of I-30.	
	• Increased speeds due to minimal curves in alignment geometry • No impact to private properties by aligning with I-30 right-of-way • Station access could be provided from both sides of I-30	• Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Increased complexity and cost of underground station • Would require property acquisition on both sides of I-30 for station access, parking and other multimodal features that are desired

Arlington Concept #	Pros	Cons
9B1	**Description:** The concept is a tunnel located beneath I-30 with a station located between North Collins Street and North Center Street. Tunnel through SH 360 interchange continuing beneath I-30 through the Arlington Entertainment District with portal located north of I-30, west of North Davis Street.	
	• Station access could be provided from both sides of I-30	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Increased complexity and cost of underground station • Would require property acquisition on both sides of I-30 for station access, parking and other multimodal features that are desired • Impact to private properties at portal location west of North Cooper Street
9C	**Description:** The concept is a tunnel located beneath I-30 with a station located between Ballpark Way and SH 360. Tunnel through SH 360 interchange continuing beneath I-30 through the Arlington Entertainment District with the portal emerging in the center of I-30.	
	• Increased speeds due to minimal curves in alignment geometry • No impact to private properties by aligning with I-30 right-of-way • Station access could be provided from both sides of I-30	• Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Increased complexity and cost of underground station • Would require property acquisition on both sides of I-30 for station access, parking and other multimodal features that are desired
9C1	**Description:** The concept is a tunnel located beneath I-30 with a station located between Ballpark Way and US 360. Tunnel through SH 360 interchange continuing beneath I-30 through the Entertainment District. Tunnel portal located north of I-30, west of North Cooper Street.	
	• Station access could be provided from both sides of I-30	• Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Increased complexity and cost of underground station • Would require property acquisition on both sides of I-30 for station access, parking and other multimodal features that are desired • Impact to properties at portal location west of North Cooper Street

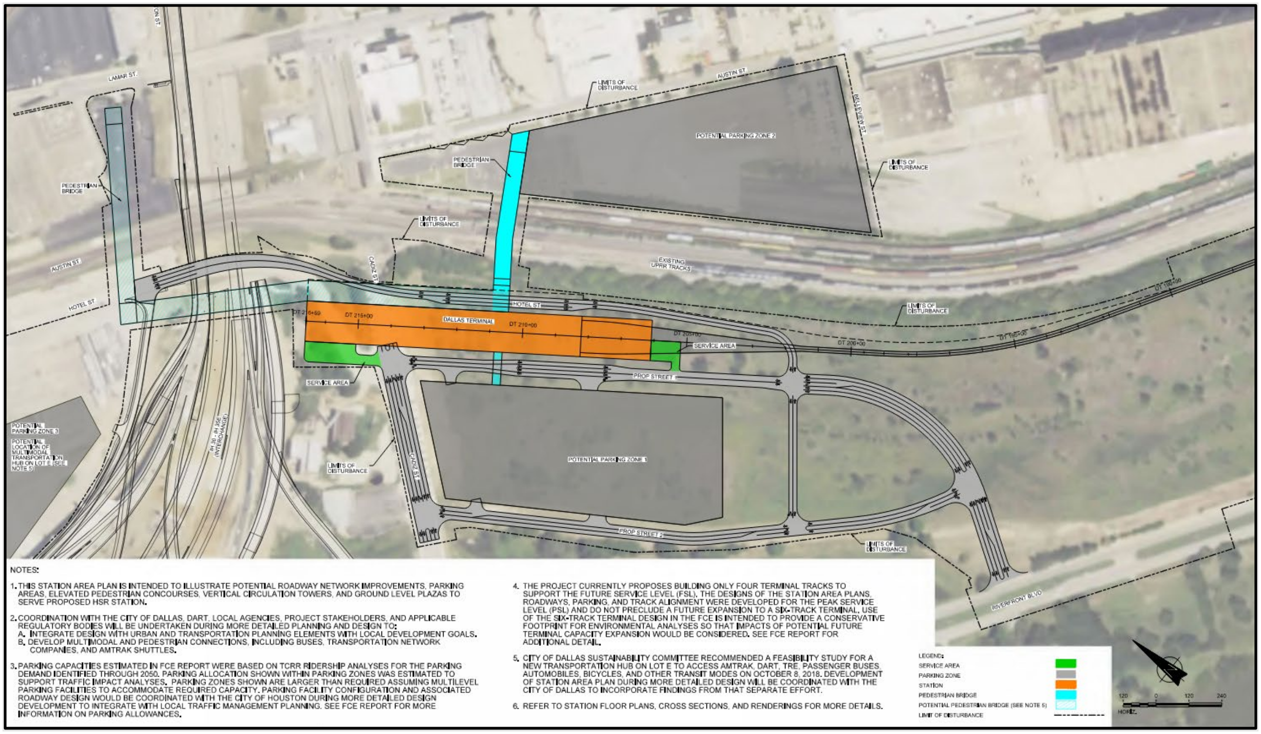
Arlington Concept #	Pros	Cons
10	**Description:** Aerial concept diverting from I-30 between North Cooper Street on the west and North Carrier Parkway on the east to connect to a station located in the vicinity of the stadiums.	
	• Alignment avoids conflict with SH 161 and SH 360 interchanges • Convenient access to stadiums and Six Flags • Station adjacent to parking lots, could be catalyst for transit-oriented development in the vicinity of the stadiums	• Impacts to private property • Significant impacts to residential properties, access, and community cohesion • Significant impacts to commercial properties • Visual impacts by elevated structure in residential areas • Increase travel time due to longer alignment and curves in alignment geometry • Low speed geometry to connect back to I-30
11	**Description:** Tunnel concept diverting from I-30 between North Cooper Street on the west and Great Southwest Parkway on the east to connect to a station located in the vicinity of the stadiums.	
	• No potential for visual impact from an elevated guideway Alignment avoids conflict with SH 161 and SH 360 interchanges • Convenient access to stadiums and Six Flags • Station adjacent to parking lots, could be catalyst for transit-oriented development • Underground station and guideway would allow the land above for development • Station adjacent to parking lots, parking lots could serve as staging area for underground station construction without the need to displace existing structures	• Impacts to private property • Increase travel time due to longer alignment and curves in alignment geometry • Increased cost due to increased length of tunnel section • Low speed geometry to connect back to I-30 • Impact to private properties at portal location • Would require permanent easements from private properties the tunnel concept would be under

The Project team evaluated the 18 concepts with City of Arlington staff to identify station connection options. Based on this collaborative effort, the Project team identified Concept 4A (aerial/tunnel) and Concept 9A (tunnel) for further evaluation during Phase 2. These concepts provide connectivity between I-30 and the station area in a manner that avoids and/or minimizes impacts to the built and natural environment.

8.1.4 Dallas Station

As previously mentioned, a separate high-speed passenger rail service is being planned by Texas Central Railroad (TCR) between Dallas and Houston. As part of the Project, TCR proposes to build a terminal station in Dallas just south of I-30 (south of downtown Dallas), between South Riverfront Boulevard and the Union Pacific Railroad right-of-way west of Lamar Street (see Figure 36). The station platform will be approximately 75 feet above the ground and parallel to and west of the Union Pacific Railroad. The Final Environmental Impact Statement (published May 2020) notes provisions would need to be made for any future expansion of the high-speed rail system if service were to extend beyond the Dallas Terminal Station.

Figure 36. Proposed Dallas High-Speed Rail Station Location

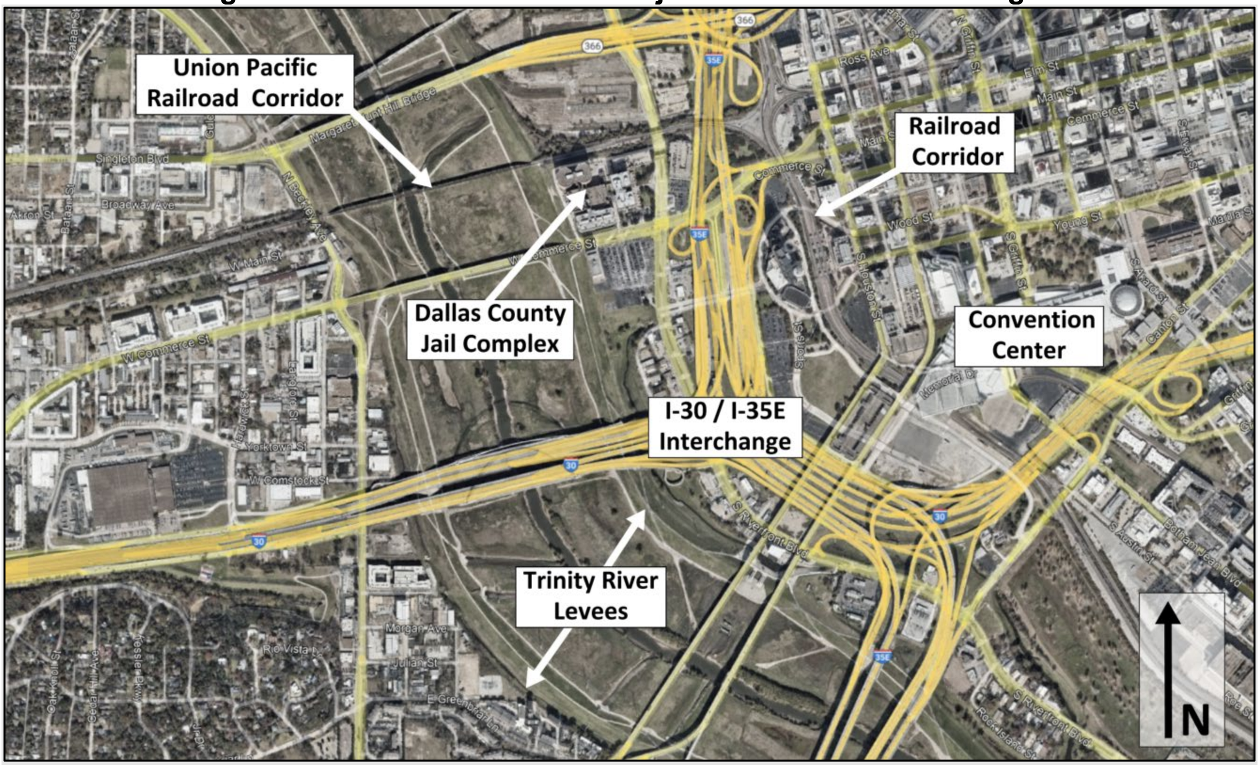


Source: Dallas to Houston High-Speed Rail Final Environmental Impact Statement by Texas Central, Appendix G, 2020

As mentioned in Section 8.1, Mobility 2045 – 2022 Update has a policy that supports high-speed rail system interoperability through a "one-seat" ride. This would require the Dallas to Fort Worth high-speed alignment to connect to the TCR station platform. However, Mobility 2045 – 2022 Update also states if regulatory, environmental, financial, or other challenges prohibit the timely development of a one seat/one ticket connection through the Dallas station, the region will support and coordinate with high-speed passenger rail system implementers to develop a cross-platform transfer solution for all rail passengers that is as close to a one seat/one ticket connection as possible. Given this regional policy direction, all Dallas station connection concepts terminated at the proposed TCR Dallas Station to provide the opportunity for a "one-seat" ride or, at the very least, a cross-platform transfer with the TCR project. While high-speed rail is the technology advanced for the DFWHSTC Project (as noted in Section 7.5), the proprietary high-speed rail technology currently being advanced on the TCR project may or may not be selected by a future DFWHSTC Project implementer. Future operational decisions between the two projects will determine the viability of a "one-seat" ride.

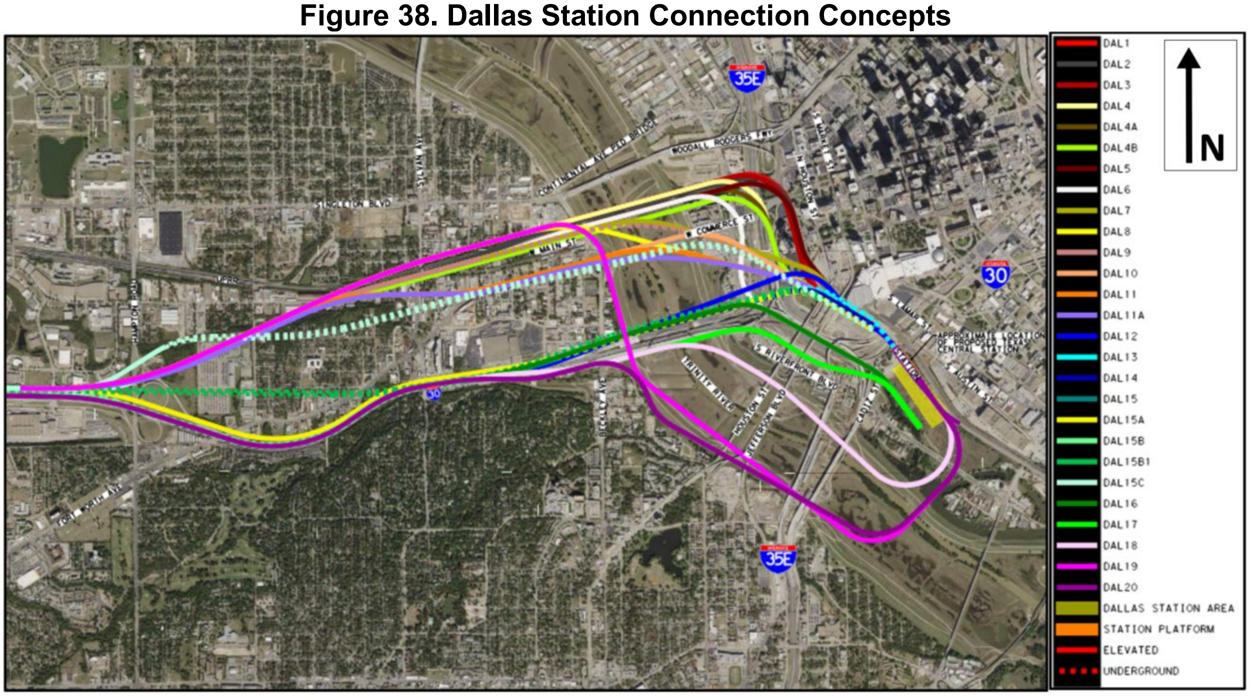
The concept refinement began with developing alignments to connect to the station location identified by TCR. Major infrastructure challenges in the vicinity of the Dallas station area include the I-30/I-35E Interchange, Union Pacific Railroad corridor over the Trinity River, the railroad corridor east of the Trinity River, Trinity River levees, Dallas County jail complex, historic resources, Dallas Convention Center, and other various developments located throughout the Dallas station area. Major infrastructure challenges in the Dallas station area are shown in Figure 37.

Figure 37. Dallas Station Area Major Infrastructure Challenges



To avoid surface infrastructure and minimize impacts to built and natural environments, 27 concepts were developed and included aerial structure and tunnel configurations (see Figure 38).

Figure 38. Dallas Station Connection Concepts



For more detailed maps of each concept, see Volume II Appendix H. These concepts were shown to the City of Dallas, Dallas County, DART, US Army Corps of Engineers, and the TxDOT Dallas District for review and comment. Table 21 provides a description of each concept and identifies potential pros and cons.

Table 21. Dallas Station Connections Pros and Cons

Dallas Concept #	Pros	Cons
1	**Description:** This concept is an elevated structure that deviates from I-30 west of Hampton Road and crosses over the Union Pacific Railroad west of Sylvan Avenue and follows along the north side of the Union Pacific Railroad. Crosses Trinity River and follows the Union Pacific Railroad corridor to the south. Terminates at the proposed Dallas high-speed rail platform.	
	• Minimizes hydraulic and visual impacts at Trinity River by paralleling the existing Union Pacific Railroad bridge • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Potential noise and visual impacts to Martyr's Park and historic-listed resources such as Triple Underpass and Dealy Plaza • Potential visual impacts by elevated structure through residential areas in West Dallas • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Very low speed geometry through downtown • Impacts to buildings north of Union Pacific Railroad between west of Sylvan Avenue and Canada Drive

Dallas Concept #	Pros	Cons
2	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and crosses over the Union Pacific Railroad east of Sylvan Avenue and follows along the north side of the Union Pacific Railroad. Remains south of Union Pacific Railroad for longer distance on east side of Trinity River. Crosses Trinity River and follows the Union Pacific Railroad corridor to the south. Terminates at the proposed Dallas high-speed rail platform.	
	• Minimizes hydraulic and visual impact at Trinity River by paralleling the existing Union Pacific Railroad bridge • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Potential noise and visual impacts to Martyr's Park and historic-listed resources such as Triple Underpass and Dealy Plaza • Potential visual impacts by elevated structure through residential areas in West Dallas • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Crosses Union Pacific Railroad twice (once in west of the Trinity River and then south of Union Station) and DART, which increases cost and design complexity. Both Union Pacific Railroad crossing would require a large 'pergola' type overpass • Very low speed geometry through downtown
3	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and crosses Trinity River north of and adjacent to Union Pacific Railroad corridor. Elevated configuration aligned along the west side of the freight corridor, located within Hyatt Regency Hotel Drive. Terminates at the proposed Dallas high-speed rail platform.	
	• Minimizes hydraulic and visual impact at Trinity River by paralleling the existing Union Pacific Railroad bridge • Minimizes use of Union Pacific Railroad right-of-way • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Potential noise and visual impacts to Martyr's Park and historic-listed resources such as Triple Underpass and Dealy Plaza • Potential visual impacts by elevated structure through residential areas in West Dallas • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Impact to Hyatt Regency Hotel Drive • Crosses Union Pacific Railroad twice, increasing capital and operating costs and potentially restricts maintenance activities. • Very low speed geometry through downtown • Impacts to buildings north of Union Pacific Railroad between west of Sylvan Avenue and Canada Drive

Dallas Concept #	Pros	Cons
4	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and crosses Trinity River north of and adjacent to Union Pacific Railroad corridor. Elevated configuration aligned along the east side of I-35E and Hotel Street. Terminates at to the proposed Dallas high-speed rail platform.	
	• Minimizes hydraulic and visual impacts at Trinity River by paralleling existing Union Pacific Railroad bridge • Minimizes use of Union Pacific Railroad right-of-way • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Potential noise and visual impacts to Martyr's Park and historic-listed resources such as Triple Underpass and Dealy Plaza • Potential visual impacts by elevated structure through residential areas in West Dallas • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Very low speed geometry through downtown • Does not integrate well with proposed convention center expansion • Impacts to buildings north of Union Pacific Railroad between west of Sylvan Avenue and Canada Drive
4A	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and remains south of Union Pacific Railroad corridor and crosses Trinity River adjacent to Union Pacific Railroad corridor. Elevated configuration aligned along the east side of I-35E and Hotel Street. Terminates at the proposed Dallas high-speed rail platform.	
	• Minimizes hydraulic and visual impacts at Trinity River by paralleling existing Union Pacific Railroad bridge • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology • Does not cross Union Pacific Railroad	• Impacts to private property • Potential noise and visual impacts to Martyr's Park and historic-listed resources such as Triple Underpass and Dealy Plaza • Potential visual impacts by elevated structure through residential areas in West Dallas • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Impacts Dallas County parking garage • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Very low speed geometry through downtown • Shared structure with Union Pacific Railroad over Trinity River increases capital and operating costs and restricts maintenance activities

Dallas Concept #	Pros	Cons
4B	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and remains south of Union Pacific Railroad corridor and crosses Trinity River adjacent to Union Pacific Railroad corridor, remaining at least 102 feet outside from the Union Pacific Railroad right-of-way. Elevated configuration aligned along the east side of I-35E and Hotel Street. Terminates at the proposed Dallas high-speed rail platform.	
	• Minimizes hydraulic and visual impacts at Trinity River by paralleling existing Union Pacific Railroad bridge • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology • Does not cross Union Pacific Railroad	• Impacts to private property • Potential noise and visual impacts to Martyr's Park and historic-listed resources such as Triple Underpass and Dealy Plaza • Potential visual impacts by elevated structure through residential areas in West Dallas • Impacts Dallas County parking garage • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Very low speed geometry through downtown • Impacts to buildings north of Union Pacific Railroad between west of Sylvan Avenue and Canada Drive • Shared structure with Union Pacific Railroad over Trinity River increases capital and operating costs and restricts maintenance activities • Impacts to properties south of Union Pacific Railroad • Impact to Dallas County jail complex

Dallas Concept #	Pros	Cons
5	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and remains south of Union Pacific Railroad corridor and crosses Trinity River adjacent to Union Pacific Railroad corridor. Elevated configuration aligned along the west side of the freight corridor, located within Hyatt Regency Hotel Drive. Terminates at the proposed Dallas high-speed rail platform.	
	• Minimizes hydraulic and visual impacts at Trinity River by paralleling existing Union Pacific Railroad bridge • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Potential noise and visual impacts to Martyr's Park and historic-listed resources such as Triple Underpass and Dealy Plaza • Potential visual impacts by elevated structure through residential areas in West Dallas • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Impact to Hyatt Regency Hotel Drive • Crosses Union Pacific Railroad twice, increasing capital and operating costs and potentially restricts maintenance activities. • Crossing of Union Pacific Railroad east of the Trinity would result in a large 'pergola' type overpass • Crossing of Union Pacific Railroad and DART south of Union Station would result in a large 'pergola' type overpass • Very low speed geometry through downtown • Shared structure with Union Pacific Railroad over Trinity River increases capital and operating costs and restricts maintenance activities

Dallas Concept #	Pros	Cons
6	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and remains south of Union Pacific Railroad corridor and crosses Trinity River adjacent to Union Pacific Railroad corridor. Elevated configuration aligned along the west side of I-35E. Terminates at a separate elevated platform located to the west of the proposed Dallas high-speed rail station.	
	• Minimizes hydraulic and visual impacts at Trinity River by paralleling existing Union Pacific Railroad bridge • Does not cross Union Pacific Railroad	• Impacts to private property • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Potential visual impacts by elevated structure through residential areas in West Dallas • Direct impacts to businesses west of I-35E between Commerce Street and I-30 • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Very low speed geometry through downtown • Shared structure with Union Pacific Railroad over Trinity River increases capital and operating costs and restricts maintenance activities • Does not tie directly with proposed TCR station, one-seat ride or cross platform connection not possible
7	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and remains south of Union Pacific Railroad corridor and aligns along Main Street. Crosses over the Trinity River then turns diagonally toward the southeast crossing I-35E near Reunion Boulevard and terminates at the proposed Dallas high-speed rail platform.	
	• Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Potential visual impacts by elevated structure through residential areas in West Dallas • Potential visual impact from elevated structure crossing Trinity River diagonally • Direct impacts to businesses west of I-35E between Commerce Street and I-30 • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Very low speed geometry through downtown

Dallas Concept #	Pros	Cons
8	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and aligns north of the Union Pacific Railroad corridor then turn diagonally to the southeast before crossing the Trinity River. Crossing I-35E south of Reunion Boulevard and continues southeast and terminates at the proposed Dallas high-speed rail platform.	
	• Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Potential visual impacts by elevated structure through residential areas in West Dallas • Potential visual impact from elevated structure crossing Trinity River diagonally • Direct impacts to businesses west of I-35E between Commerce Street and I-30 • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Impacts to properties north of Union Pacific Railroad • Crosses Union Pacific Railroad twice
9	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and remains south of Union Pacific Railroad corridor. Transitions to a tunnel before crossing the Trinity River below grade, turning diagonally toward the southeast. Remains below grade and terminates in a below-grade station beneath the proposed Dallas high-speed rail platform.	
	• Minimizes impact to current and planned developments through use of a tunnel • Tunnel reduces visual and noise impact from an elevated guideway. Does not cross Union Pacific Railroad • Underground station leaves property above for transit-oriented development • Improved speed over elevated guideway concepts	• Impacts to private property • Potential visual impacts by elevated structure through residential areas west of Sylvan Avenue • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Increased complexity and cost of underground station • Impacts to properties south of Union Pacific Railroad • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible, would require a vertical transfer • Would require permanent easements from private properties the tunnel concept would be under

<table>
<tr><th>Dallas Concept #</th><th>Pros</th><th>Cons</th></tr>
<tr><td rowspan="2">10</td><td colspan="2">Description: Elevated structure. Deviates from I-30 alignment west of Hampton Road and remains south of Union Pacific Railroad corridor and aligns along Commerce Street. Crosses over the Trinity River then turns diagonally toward the southeast. Crosses I_35E near Reunion Boulevard and terminates at the proposed Dallas high-speed rail platform.</td></tr>
<tr><td>Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology
Avoids Union Pacific Railroad right-of-way</td><td>Impacts to private property
Potential visual impacts by elevated structure through residential areas in West Dallas
Potential visual impact from elevated structure along Commerce Street including the historic bridge crossing the Trinity River
Direct impacts to businesses west of I-35E along Commerce Street
Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30
Low speed geometry through downtown
Impacts to properties along Commerce Street</td></tr>
<tr><td rowspan="2">11</td><td colspan="2">Description: This elevated concept deviates from I-30 alignment west of Hampton Road and remains south of Union Pacific Railroad corridor and aligns along the north side of Commerce Street. At the mid-point of bridge over the river the alignment turns southeast and crossing I-35E south of Reunion Boulevard, then terminates at the proposed Dallas high-speed rail platform.</td></tr>
<tr><td>Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology
Avoids Union Pacific Railroad right-of-way</td><td>Impacts to private property
Potential visual impacts by elevated structure through residential areas in West Dallas
Potential visual impact from elevated structure along Commerce Street including the historic bridge crossing the Trinity River
Direct impacts to businesses west of I-35E along Commerce Street
Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30
Low speed geometry through downtown
Impacts to properties along Commerce</td></tr>
</table>

Dallas Concept #	Pros	Cons
11A	**Description:** This elevated concept deviates from I-30 alignment west of Hampton Road and remains south of Union Pacific Railroad corridor and aligns along the center of Commerce Street. Begins to cross over the Trinity River then at the east levee and turns diagonally toward the southeast. Crossing I-35E south of Reunion Boulevard and continues southeast to terminate at the proposed Dallas high-speed rail platform.	
	• Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology • Avoids Union Pacific Railroad right-of-way	• Impacts to private property • Potential visual impacts by elevated structure through residential areas in West Dallas • Potential visual impact from elevated structure along Commerce Street including the historic bridge crossing the Trinity River • Direct impacts to businesses west of I-35E along Commerce Street • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Low speed geometry through downtown • Impacts to properties along Commerce
12	**Description:** Elevated structure follows the I-30 managed lanes. Near Beckley Avenue the concept crosses to the north side of I-30 and crosses over the Trinity River north of and adjacent to the I-30 highway bridge. The alignment crossesI-35E south of Reunion Boulevard and then turns south and terminates at the proposed Dallas high-speed rail platform.	
	• Minimizes impact to private properties by aligning significantly within I-30 and public road right-of-way west of the Trinity River • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology • Stays mostly within I-30 right-of-way and avoids Union Pacific Railroad right-of-way	• Impacts to private property • Potential visual impacts by elevated structure through residential areas • Potential visual impact from elevated structure crossing Trinity River • Direct impacts to businesses northwest of the I-30/I-35E interchange • Alignment adjacent to and within railroad right-of-way increases capital and operating costs and potentially restricts maintenance activities. • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, parking garage between Houston Street and Jefferson Boulevard, and I-30 • Very slow speed geometry through downtown • Skewed bridge leading from center of I-30 to north side of I-30 would result in a large 'pergola' type structure • Lower speed following I-30 • Potential visual impact and design complexity at Hampton Road • Impact to I-30 managed lanes

Dallas Concept #	Pros	Cons
13	**Description:** Elevated structure follows along the I-30 managed lanes. West of Beckley Avenue the concept transitions to a below-grade (tunnel) configuration and crosses under the Trinity River, aligning north of and adjacent to the I-30 highway bridge. Continuing east the concept turns southeast to generally follow Hotel Street and terminates in a below-grade station beneath the proposed Dallas high-speed rail platform.	
	• Minimizes impact to private properties by aligning significantly within I-30right-of-way west of the Trinity River • Minimizes impact to current and planned developments through use of a tunnel	• Impacts to private property • Potential visual impacts by elevated structure through residential areas in West Dallas • Typically, construction, operations, and maintenance costs of a tunnel structure are higher than for an aerial structure • Increased complexity and cost of underground station • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible. Would require a vertical transfer. • Skewed bridge leading from center of I-30 to north side of I-30 would result in a large 'pergola' type structure • Lower speed following I-30 • Property impacts for tunnel portal and staging area on west side of the Trinity River • Potential visual impact and design complexity at Hampton Road • Displaces I-30 managed lanes west of the Trinity River. • Would require permanent easements from private properties the tunnel concept would be under
14	**Description:** Elevated structure follows along the I-30 managed lanes. West of Beckley Avenue the concept remains elevated and crosses over the Trinity River north of and adjacent to the I-30 highway bridge. Continuing east the concept turns southeast to generally follow Hotel Street and terminates at an elevated platform northwest of the high-speed rail platform.	
	• Minimizes impact to private properties by aligning significantly with I-30 and public road right-of-way west of the Trinity River • Stays mostly within TxDOT right-of-way and avoids Union Pacific Railroad right-of-way	• Impacts to private property • Potential visual impacts by elevated structure through residential areas • Aerial infrastructure complexity over I-35E, Houston Street, Jefferson Boulevard, and parking garage between Houston Street and Jefferson Boulevard • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible • Lower speed following I-30 • Skewed bridge leading from center of I-30 to north side of I-30 would result in a large 'pergola' type structure • Potential visual impact and design complexity at Hampton Road • Displaces I-30 managed lanes west of the Trinity River.

Dallas Concept #	Pros	Cons
15	**Description:** Elevated structure follows along the I-30 managed lanes. West of Beckley Avenue the concept transitions to a below-grade configuration and crosses under the Trinity River, aligning north of and adjacent to the I-30 highway bridge. Continuing east the concept turns southeast to generally follow Hotel Street and terminates in a below-grade station beneath the proposed Dallas high-speed rail platform.	
	• Minimizes impact to private properties by aligning significantly with I-30 right-of-way west of the Trinity River • Minimizes impact to current and planned developments through use of a tunnel • Visual and noise impacts substantially reduced by tunnel	• Impacts to private property • Potential visual impacts by elevated structure through residential areas west of Sylvan Avenue • Typically, construction, operations, and maintenance costs of a tunnel structure are higher than for an aerial structure • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible. Would require a vertical transfer. • Increased complexity and cost of underground station • Skewed bridge leading from center of I-30 to north side of I-30 would result in a large 'pergola' type structure • Lower speed following I-30 • Potential visual impact and design complexity at Hampton Road arch bridge • Displaces I-30 managed lanes west of the Trinity River. • Would require permanent easements from private properties the tunnel concept would be under
15A	**Description:** Elevated structure follows along north side of I-30. West of Beckley Avenue transitions to a tunnel configuration and crosses under the Trinity River, aligning north of and adjacent to the I-30 highway bridge. Continuing east the concept turns southeast to generally follow Hotel Street and terminates in a below grade station beneath the proposed Dallas high-speed rail platform.	
	• Minimizes impact to private properties by aligning significantly within I-30 and public road right-of-way west of the Trinity River • Minimizes impact to current and planned developments through use of a tunnel • Visual and noise impacts substantially reduced by tunnel	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure are higher than for an aerial structure • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible. Would require a vertical transfer. • Increased complexity and cost of underground station • Lower speed following I-30 • Potential visual impact and design complexity at Hampton Road • Would require permanent easements from private properties the tunnel concept would be under

Dallas Concept #	Pros	Cons
15B	**Description:** Elevated structure aligned along north side of I-30 that transitions to a below-grade configuration between Westmoreland Road and Hampton Road. This concept is in a tunnel under I-30 and crosses under the Trinity River, aligning north of and adjacent to the I-30 highway bridge. Continuing east the concept turns southeast to generally follow Hotel Street and terminates in a below-grade station beneath the proposed Dallas high-speed rail platform.	
	• Minimizes impact to private properties by aligning significantly with I-30 right-of-way • Minimizes impact to current and planned developments through use of a tunnel • Visual and noise impacts substantially reduced by tunnel	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure are higher than for an aerial structure. • Length of tunnel is approximately double the length of the tunnel section in other concepts, increasing construction costs • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible. Would require a vertical transfer. • Increased complexity and cost of underground station • Lower speed following I-30 • Would require permanent easements from private properties the tunnel concept would be under
15B1	**Description:** This concept transitions to a below-grade configuration between Westmoreland Road and Hampton Road. East of Hampton Road this concept transitions to a tunnel in an easterly direction and then rejoins the I-30 right-of-way just west of Sylvan Avenue. The tunnel continues under the Trinity River, aligning north of and adjacent to the I-30 highway bridge. Continuing east the concept turns southeast to generally follow Hotel Street and terminates in a below-grade station beneath the proposed Dallas high-speed rail platform.	
	• Minimizes impact to private properties by aligning significantly within I-30 and public road right-of-way • Minimizes impact to current and planned developments through use of a tunnel • Visual and noise impacts substantially reduced by tunnel • Improved speed with straighter alignment	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure are higher than for an aerial structure. • Length of tunnel is approximately double the length of the tunnel section in other concepts, increasing construction costs • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible. Would require a vertical transfer. • Increased complexity and cost of underground station • Would require permanent easements from private properties the tunnel concept would be under

Dallas Concept #	Pros	Cons
15C	**Description:** Elevated structure aligned along north side of I-30. Turns northeast before Hampton Road then lines up with Commerce Street. Transitions to a tunnel configuration east of Hampton Road. This concept would be below-grade heading east under Commerce Street. The tunnel would cross under the Trinity River, aligning south of and adjacent to the Commerce Street bridge. East of the Trinity River, this concept turns southeast to generally follow Hotel Street and terminates in a below-grade station beneath the proposed Dallas high-speed rail platform.	
	• Minimizes impact to current and planned developments through use of a tunnel • Visual and noise impacts substantially reduced by tunnel • Improved speed compared to alignments that run along I-30	• Impacts to private property • Typically, construction, operations, and maintenance costs of a tunnel structure and trench structure are higher than for an aerial structure. • Length of tunnel is approximately double the length of the tunnel section in other concepts, increasing costs. • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible. Would require a vertical transfer. • Increased complexity and cost of underground station • Would require permanent easements from private properties the tunnel concept would be under
16	**Description:** Elevated structure aligned along the I-30 managed lanes. West of Beckley Avenue, this concept transitions to the north side of I-30 and remains elevated and crosses over the Trinity River north of and adjacent to the I-30 highway bridge. The concept then turns to the southeast within I-30 and I-35E and terminates at a separate elevated platform located to the west of the proposed Dallas high-speed rail station.	
	• Minimizes impact to private properties by aligning significantly with I-30 and public road right-of-way	• Impacts to private property • Potential visual impacts by elevated structure through residential areas • Potential visual impact from elevated structure crossing Trinity River • Aerial infrastructure complexity over I-30 and I-35E interchanges • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible. • Skewed bridge leading from center of I-30 to north side of I-30 would result in a large 'pergola' type structure • Lower speed following I-30 • Potential visual impact and design complexity at Hampton Road • Displaces I-30 managed lanes west of the Trinity River.

Dallas Concept #	Pros	Cons
17	**Description:** Elevated structure aligned along the I-30 managed lanes. West of Beckley Avenue, this concept transitions to the south side of I-30 and remains elevated and crosses over the Trinity River south of and adjacent to the I-30 highway bridge. This concept then turns to the southeast and would be located west of I-30 and I-35E and terminate at a separate elevated platform located to the west of the proposed Dallas high-speed rail station.	
	• Minimizes impact to private properties by aligning significantly with I-30 and public road right-of-way	• Impacts to private property • Potential visual impacts by elevated structure through residential areas in West Dallas • Potential visual impact from elevated structure crossing Trinity River next to existing signature bridge • Potential visual impact of high structure over I-30 and I-35E direct connector ramps • Does not tie directly with proposed TCR station. One-seat ride or cross platform connection not possible. • Requires significant transfer distance. • Skewed bridge leading from center of I-30 to south side of I-30 would result in a large 'pergola' type structure • Lower speed following I-30 • Potential visual impact and design complexity at Hampton Road • Displaces I-30 managed lanes west of the Trinity River.
18	**Description:** Elevated structure aligned along the I-30 managed lanes. West of Beckley Avenue, this concept transitions to the south side of I-30 and remains elevated and crosses over the Trinity River south of and adjacent to the I-30 highway bridge. The concept then turns diagonally toward the southeast to generally follow the eastern levee of the Trinity River. South of I-35E the concept turns northward then terminates at an elevated platform adjacent to the proposed Dallas high-speed rail platform.	
	• Minimizes impact to properties by aligning significantly within I-30 right-of-way and Trinity River • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Significant longitudinal impacts to Trinity River levee and would require a Section 408 permit from the US Army Corps of Engineers • Potential visual impact from elevated structure crossing Trinity River • Skewed bridge leading from center of I-30 to south side of I-30 would result in a large 'pergola' type structure • Lower speed following I-30 • Potential visual impact and design complexity at Hampton Road • Displaces I-30 managed lanes west of the Trinity River. • Low speed 180-degree curve for south entry may have increased noise and rail / wheel maintenance

Dallas Concept #	Pros	Cons
19	**Description:** This elevated concept follows along I-30 to Hampton Road. East of Hampton Road the concept follows the north side of the Union Pacific Railroad in West Dallas. At Beckley Avenue, the concept turns south and runs along the west levee side of the Trinity River. It continues south crossing over I-30 and I-35E. It turns east to cross the Trinity River and then connects to proposed Dallas high-speed rail platform on the south side.	
	• Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Longest route, resulting in higher costs • Significant longitudinal impacts to Trinity River levee and would require a Section 408 permit from the US Army Corps of Engineers • Potential visual impact from elevated structure crossing Trinity River • Potential visual impact to the neighborhoods south of I-30 and along the Trinity River with elevated structures going over I-30, Houston Street, Jefferson Boulevard, and I-35ECrossing of Union Pacific Railroad west of the Trinity would result in a large 'pergola' type overpass • Crosses Union Pacific Railroad twice • Low speed geometry leaving station • Impacts to properties on north side of Union Pacific Railroad
20	**Description:** This elevated concept follows along I-30 managed lanes. West of Beckley Avenue it shifts to south side of I-30. It then turns south and runs on the west levee of the Trinity River. It continues south crossing over I-35E. It turns east to cross the Trinity River and then connects to proposed Dallas high-speed platform on the south side.	
	• Minimizes impact to properties by aligning significantly within I-30 and public road right-of-way • Can connect to proposed TCR Dallas station for potential one-seat ride if the same technology is used or at an adjacent platform of a different technology	• Impacts to private property • Longest route • Significant longitudinal impacts to Trinity River levee and would require a Section 408 permit from the US Army Corps of Engineers • Potential visual impact from elevated structure crossing Trinity River • Skewed bridge leading from center of I-30 to south side of I-30 would result in a large 'pergola' type structure • Lower speed following I-30 • Potential visual impact and design complexity at Hampton Road • Displaces I-30 managed lanes west of the Trinity River. • Potential visual impact along to the neighborhoods south of I-30 and along the Trinity River levee and elevated structures going over Houston Street, Jefferson Boulevard, and I-35E

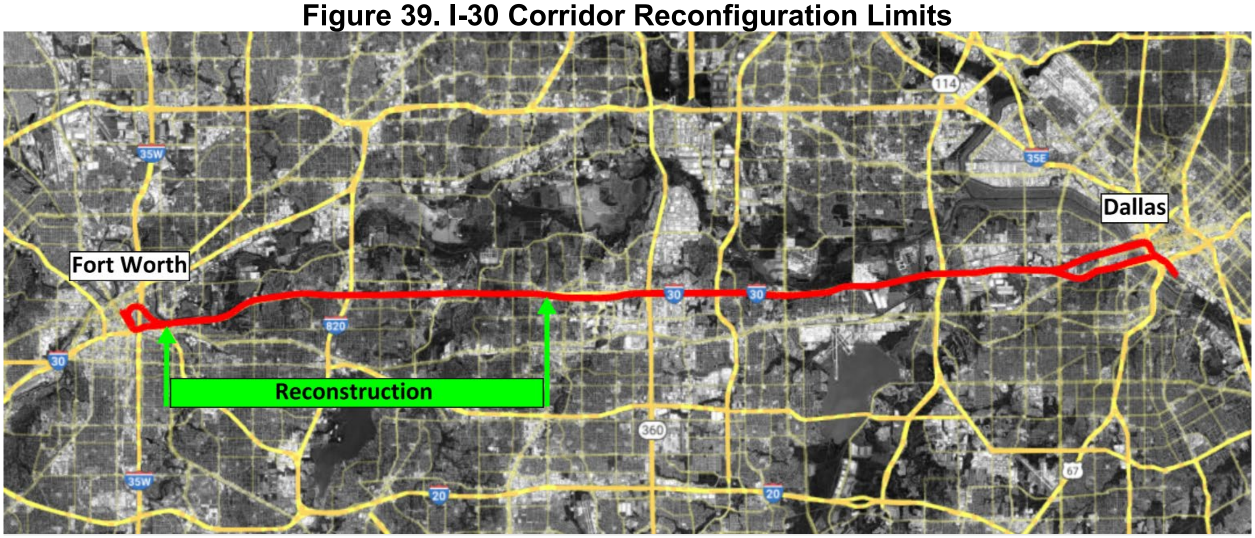
The Project team evaluated the 27 concepts with staff from the City of Dallas, Dallas County, DART, US Army Corps of Engineers, and the TxDOT Dallas District to identify station connection options. Based on this collaborative effort, the Project team identified Concept 4B (aerial) and Concept 15C (tunnel) for further evaluation during Phase 2. These concepts provide connectivity between I-30 and station area in a manner that avoids and/or minimizes impacts to the built and natural environments.

8.2 Use of the I-30 Corridor

The recommendation of a high-speed rail alignment within the existing I-30 right-of-way reduces impacts to private property and the overall right-of-way cost for the Project. However, the concept for integrating high-speed transportation infrastructure within the right-of-way footprint of I-30 differs.

In Tarrant County, the majority of I-30 dates from the original tollway constructed over 65 years ago. TxDOT Fort Worth District is beginning the planning process to reconstruct the freeway between I-35W in Fort Worth and Cooper Street in Arlington. The general limits of proposed I-30 reconstruction are depicted in Figure 39. This creates an opportunity to fully integrate high-speed transportation within the reconstruction of the highway.

Figure 39. I-30 Corridor Reconfiguration Limits



The portion of IH-30 between Dallas and Fort Worth located in Dallas County has already been reconstructed to its ultimate configuration. TxDOT Dallas District does not have any current plans to significantly modify the main lanes, managed lanes, and/or service road configuration along this portion of the interstate. Therefore, the high-speed transportation concept must align through this segment in a manner to avoid major conflicts with features of the existing highway.

NCTCOG collaborated with the Dallas and Fort Worth Districts of TxDOT throughout Phase 1 to coordinate the development and evaluation of alignment alternatives for high-speed transportation. Possible options considered by the Project team for the high-speed alignment through the I-30 infrastructure included aligning along the managed lanes. The existing and future managed lanes network is expected to eventually connect the Dallas and Fort Worth urban centers, with plans to include future managed lanes between Arlington and Fort Worth according to Mobility 2045 – 2022 Update, the current regional Metropolitan Transportation Plan. However, to ensure all possible options were considered comprehensively as a part of this study, NCTCOG and TxDOT agreed to evaluate the managed lanes as a potential alignment alternative for this Project.

The managed lane alignment would meet a few objectives of the Project, including maximizing use of existing transportation corridor right-of-way, minimizing impacts to highway service roads, and minimizing impacts to highway interchange infrastructure. However, the managed lane alignment would negatively impact highway general purpose lanes as existing managed lane widths are not wide enough in some areas to accommodate high-speed infrastructure, resulting in impacts to general purpose lanes. Additionally, implementation of high-speed transportation within the existing managed lanes facility would result in a reduction or elimination of managed lanes automobile capacity by constraining the number of managed lanes, would restrict future highway infrastructure expansions (i.e., more impactful in center of highway as opposed to along the side of the highway), and would restrict access for maintenance and safety issues associated with the high-speed facility.

Considering the limited benefit and significant challenges associated with the managed lanes alignment, the Project team will focus on advancement of the general-purpose lane adjacent alignment concept during preliminary engineering. For further information, see the *Consideration of Interstate Highway 30 Managed Lanes for High-Speed Transportation Corridor Alignment* technical memorandum for details regarding the managed lanes corridor evaluation.

9.0 Summary of Results, Recommendations, and Next Steps

The Phase 1 Alternatives Analysis for the DFWHSTC Study evaluated 43 separate alignments between the two city centers and five modes. The analysis identified three preferred alignments of the 43 considered (Alignments 15, 17, and 18 generally following I-30) and two preferred modes (high-speed rail and hyperloop) of the five were initially considered to move into Phase 2 environmental documentation and preliminary engineering.

The Regional Transportation Council, the independent transportation policy body of NCTCOG that oversees the metropolitan transportation planning process, approved the Phase 1 recommendations on July 8, 2021. Since completion of the Phase 1 analysis, continued coordination with FTA and FRA resulted in hyperloop being eliminated from further consideration in Phase 2 (as noted in Section 7.5). Considering the preliminary level of hyperloop technology readiness, this mode of transportation could not yet be advanced through safety rulemaking in sufficient time to support the environmental clearance timeframe for this Project. Therefore, high-speed rail would be the singular mode carried into in Phase 2 of the Project. Based on this decision, the revised recommendation was taken back to Regional Transportation Council on February 10, 2022, and the Regional Transportation Council approved the revised Phase 1 recommendation to advance only high-speed rail along I-30. Summary tables of alignment and mode alternatives analyses are provided in Tables 22 and 23, respectively.

Phase 2 will consist of preliminary engineering and environmental analysis/documentation on the approved high-speed rail alignments. The three recommended alignments approved for Phase 2 analysis are all in I-30 with key differences in how to navigate through or around highway interchanges along I-30 at SH 360 in Arlington and SH 161 in Grand Prairie.

Phase 2 will include the development of the design to a 30 percent level of design as well as ridership estimates, capital costs, operations and maintenance costs, and financial and operational plans. The Project design will continue to be refined to avoid and minimize impacts and help define the area of potential effect and understand potential impacts of implementing the Project.

The recommended alignments will also be analyzed further to determine potential effects to social, cultural, and natural resources in accordance with the National Environmental Policy Act (NEPA). For federally funded transportation projects, NEPA requires transportation agencies to consider potential impacts to the social and natural environment. NEPA requires consideration of the direct, indirect, and cumulative impacts of a proposed action and its alternatives on the environment. Direct effects are those that are caused by the action and occur at the same time and place. Indirect effects are those that are caused by the action and occur later or farther away (off-site) but are still reasonably foreseeable. Cumulative impacts are defined as the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Potential measures to mitigate adverse environmental effects also must be considered.

Specific resource areas requiring analysis in a NEPA document that will be analyzed in Phase 2 of the DFWHSTC Study include:

- Air Quality
- Noise and Vibration
- Water Resources
- Biological Resources
- Threatened and Endangered Species
- Floodplains
- Farmland
- Hazardous Materials
- Historic Resources
- Archeological
- Parkland/Section 4(f) and 6(f) properties
- Visual
- Community Cohesion
- Environmental Justice
- Land Use and Right-of-Way Needs
- Economic
- Energy Consumption
- Construction Impacts
- Indirect Effects
- Cumulative Impacts

In addition to evaluating the potential environmental effects, transportation agencies must consider the transportation needs of the public in reaching a decision that is in the best overall public interest. Public, agency, and stakeholder engagement will continue throughout the NEPA process with outreach occurring early and often. The extensive public and agency engagement efforts from Phase 1 will continue in Phase 2. The preliminary engineering and NEPA documentation will help the elected officials and community to make an informed decision about the Project.

Table 22. Summary of Alignment Alternative Results

Alternative #	Alignment Family	Description	Advancement of Alternatives		
			Level 1	Level 2	Level 3
1	TRE	Follows the TRE alignment from downtown Fort Worth and near Norwood Drive, merges onto Hurst Boulevard and Euless Boulevard, then continues east along State Highway 183 (SH 183) until merging back with the TRE alignment, continuing into downtown Dallas.	X	X	X
2	TRE	Follows the full TRE alignment from downtown Fort Worth to downtown Dallas.	X	X	X
3	TRE	Follows the West Fork of the Trinity River from downtown Fort Worth to Trinity Boulevard where it merges with the TRE alignment and travels east into downtown Dallas.	X	X	X
4	TRE	Follows Interstate Highway 30 (I-30) from downtown Fort Worth east to Loop I-820 where it begins to merge with the West Fork of the Trinity River at Greenbelt Road and follows the same path as Alignment into downtown Dallas.	X	X	X
5	TRE	Follows I-30 from downtown Fort Worth to State Highway 360 (SH 360), where if travels north along SH 360 to the TRE alignments where it then travels east to downtown Dallas.	X	X	X
6	West Fork Trinity River	Follows the West Fork of the Trinity River from downtown Fort Worth to downtown Dallas.	X	X	X
7	West Fork Trinity River	Follows I-30 from downtown Fort Worth to Loop I-820 where it veers northeast until it merges with the West Fork of the Trinity River at Greenbelt Road and follows the West Fork of the Trinity River east into downtown Dallas.	X	X	X
8	West Fork Trinity River	Follows I-30 from downtown Fort Worth to SH 360, where it travels north along SH 360 to the West Fork of the Trinity River where it follows the river east into downtown Dallas.	X	X	X
9	West Fork Trinity River	Follows the I-30 from downtown Fort Worth, bypassing the interchange with SH 360 to the north before merging back onto I-30. Continuing east, the alignment merges with the West Fork of the Trinity River near Belt Line Road where it continues east into downtown Dallas.	X	X	X
10	West Fork Trinity River	Follows the I-30 from downtown Fort Worth, continuing through the interchange with SH 360, then merges with the West Fork of the Trinity River near Belt Line Road where it continues east into downtown Dallas.	X	X	X
11	West Fork Trinity River	Follows the I-30 from downtown Fort Worth, bypassing the interchanges with SH 360 and SH 161 to the south of both before merging back onto I-30. Continuing east, the alignment merges with the West Fork of the Trinity River near Belt Line Road where it continues east into downtown Dallas.	X	X	X
12	I-30	Follows I-30 from downtown Fort Worth, bypassing the interchange with SH 360 to the north before merging back onto I-30. Continuing east, at Loop 12 the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.	✔	✔	X
13	I-30	Follows I-30 from downtown Fort Worth, continuing through the interchange with SH 360, then at Loop 12, the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.	✔	✔	X

Alternative #	Alignment Family	Description	Advancement of Alternatives		
			Level 1	Level 2	Level 3
14	I-30	Follows I-30 from downtown Fort Worth, bypassing the interchanges with SH 360 and SH 161 to the south of both before merging back onto I-30. Continuing east, at Loop 12 the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.	✔	✔	X
15	I-30	Follows I-30 east from downtown Fort Worth, continuing through the interchange with SH 360, then at Hampton Road, the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.	✔	✔	✔
16	I-30	Follows I-30 east from downtown Fort Worth, continuing through the interchange with SH 360 along I-30 into downtown Dallas.	X	X	X
17	I-30	Follows I-30 east from downtown Fort Worth, bypassing the interchanges with SH 360 and SH 161 to the south of both before merging back onto I-30. Continuing east, at Hampton Road, the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.	✔	✔	✔
18	I-30	Follows I-30 east from downtown Fort Worth, bypassing the interchange with SH 360 to the north before merging back onto I-30. Continuing east, at Hampton Road, the alignment merges with the Union Pacific Railroad and travels east into downtown Dallas.	✔	✔	✔
19	I-30	Follows I-30 east from downtown Fort Worth, bypassing the interchange with SH 360 to the north before merging back onto I-30 and continuing into downtown Dallas.	X	X	X
20	I-30	Follows I-30 east from downtown Fort Worth, bypassing the interchanges with SH 360 and SH 161 to the south of both before merging back onto I-30 and continuing into downtown Dallas.	X	X	X
21	I-30	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad continuing east into downtown Dallas.	✔	X	X
22	I-30	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad before merging with I-30, continuing east to Hampton Road, where it merges back with Union Pacific Railroad, traveling east into downtown Dallas.	✔	X	X
23	I-30	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad before merging with I-30, continuing east into downtown Dallas.	X	X	X
24	I-30	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad continuing east before merging with West Davis Street. From there, the alignment continues east, merging with Fort Worth Avenue before merging with I-30, traveling east into downtown Dallas.	✔	X	X
25	I-30	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad continuing east into downtown Dallas.	✔	X	X

Alternative #	Alignment Family	Description	Advancement of Alternatives		
			Level 1	Level 2	Level 3
26	I-30	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad before merging with I-30, continuing east to Hampton Road, where it merges back with Union Pacific Railroad, traveling east into downtown Dallas.	✔	✔	X
27	I-30	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad before merging with I-30, continuing east into downtown Dallas.	X	X	X
28	I-30	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad continuing east before merging with West Davis Street. From there, the alignment continues east, merging with Fort Worth Avenue before merging with I-30, traveling east into downtown Dallas.	✔	X	X
29	SH 180	Follows I-30 from downtown Fort Worth to North Center Street where the alignment travels southeast through the Arlington Entertainment District, then east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad. At South Baghdad Road, the alignment veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.	✔	X	X
30	SH 180	Follows I-30 from downtown Fort Worth to North Collins Street where the alignment travels southeast through the Arlington Entertainment District, then east along East Randol Mill Road. At North Great Southwest Parkway, the alignment merges with and travels east along Dalworth Street. At Southwest 2nd Street, the alignment merges with the Union Pacific Railroad. At South Baghdad Road, the alignment veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.	✔	X	X
31	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad, traveling east to downtown Dallas.	✔	X	X
32	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad. The alignment continues east before merging with I-30, and at Hampton Road, merges back with Union Pacific Railroad, traveling east into downtown Dallas.	✔	✔	X
33	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad. The alignment continues east before merging with I-30, traveling into downtown Dallas.	X	X	X

Alternative #	Alignment Family	Description	Advancement of Alternatives		
			Level 1	Level 2	Level 3
34	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad and continues east until merging with West Davis Street. From there, the alignment continues east, merging with Fort Worth Avenue before merging with I-30, traveling east into downtown Dallas.	✔	**X**	**X**
35	SH 180	Follows East Lancaster Avenue from downtown Fort Worth to South Beach Street where the alignment merges with the Union Pacific Railroad and continues east. At South Baghdad Road, the alignment veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.	✔	**X**	**X**
36	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth. At South Baghdad Road, the alignment veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.	✔	**X**	**X**
37	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth to downtown Dallas.	✔	✔	**X**
38	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth. The alignment continues east before merging with I-30, and at Hampton Road, merges back with Union Pacific Railroad, traveling east into downtown Dallas.	✔	✔	**X**
39	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth. The alignment continues east before merging with I-30, traveling into downtown Dallas.	**X**	**X**	**X**
40	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth. The alignment continues east until merging with West Davis Street. From there, the alignment continues east, merging with Fort Worth Avenue before merging with I-30, traveling east into downtown Dallas.	✔	**X**	**X**
41	SH 180	Follows the Union Pacific Railroad east from downtown Fort Worth until merging with US Highway 287 (US 287), traveling southeast until veering northeast along Loop I-820. The alignment merges back with the Union Pacific Railroad, and at South Baghdad Road, veers southeast past Mountain Creek Lake to Loop 12, then veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.	✔	**X**	**X**
42	SH 303	Follows the Union Pacific Railroad east from downtown Fort Worth until merging with State Highway 303 (SH 303) at Mims Street. The alignment continues east across Mountain Creek Lake and at Loop 12 veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.	**X**	**X**	**X**
43	SH 303	Follows the Union Pacific Railroad east from downtown Fort Worth until merging with US Highway 287 (US 287), traveling southeast until veering northeast along Loop I-820. The alignment merges SH 303 and continues east across Mountain Creek Lake, and at Loop 12 veers northeast just past Duncanville Road, following the DART Rail Red Line northeast into downtown Dallas.	**X**	**X**	**X**

✔ – Alternative advanced to next level of analysis
X – Alternative did not advance to next level of analysis

Table 23. Summary of Mode Alternative Results

Alternative	Top Speed	Technology Readiness	Description	Advancement of Alternatives Level 1	Level 2	Level 3
Conventional Rail	80 mph	Operational	Conventional passenger rail services operate at varying frequencies depending on peak travel times. Trains typically operate headways ranging from 10 to 30 minutes during peak hours. Headways are often influenced by speed, the number of tracks, and temporal separation from freight operations.	X	X	X
Higher-Speed Rail	125 mph	Operational	Higher-Speed passenger rail services operate at varying frequencies depending on peak travel times. Higher-speed rail train configurations are typically powered by overhead electric wires. Actual passenger capacity varies between operators based on several factors.	✓	X	X
High-Speed Rail	250 mph	Operational	High-Speed passenger rail services operate at varying frequencies depending on peak travel times and system demand. In dense cities, high-speed rail systems have trains arriving and departing every three minutes. As a system matures or demand increases, headways could be increased.	✓	✓	✓
Maglev	300+ mph	Operational	Maglev trains require the construction of a dedicated guideway and operate in a grade-separated configuration for their entire alignment. This is required because the train can travel at speeds of up to 300 miles per hour. Maglev trains operate on a fixed schedule and are propelled by opposing magnets allowing the train to levitate slightly above the track.	✓	✓	X
Hyperloop	650+ mph	Prototypes undergoing testing	The Hyperloop operating concept is defined as "on-demand" service and does not adhere to a fixed schedule, which makes the operation quite similar to a smart elevator in a high-rise building. Hyperloop guideways would be specialized infrastructure with no interoperability between transportation technologies. Hyperloop shares many of the same foundational concepts of maglev but introduces other special systems such as the low-pressure vacuum tube.	✓	✓	✓*

✓ – Alternative advanced to next level of analysis
X – Alternative did not advance to next level of analysis
***** – Alternative did not advance to Phase 2 due to required timeframe for safety rulemaking