

October 13, 2022

Joshua Wayland
Surface Transportation Board
Environmental Filing, Docket No. FD 36500
c/o VHB
940 Main Campus Drive Suite 500
Raleigh, NC 27606

RE: Docket No. FD 36500, Canadian Pacific Railway Limited, et al.—Control of—Kansas City Southern, et al.; Issuance of Draft Environmental Impact Statement and Notice of Public Comment Period and Meetings

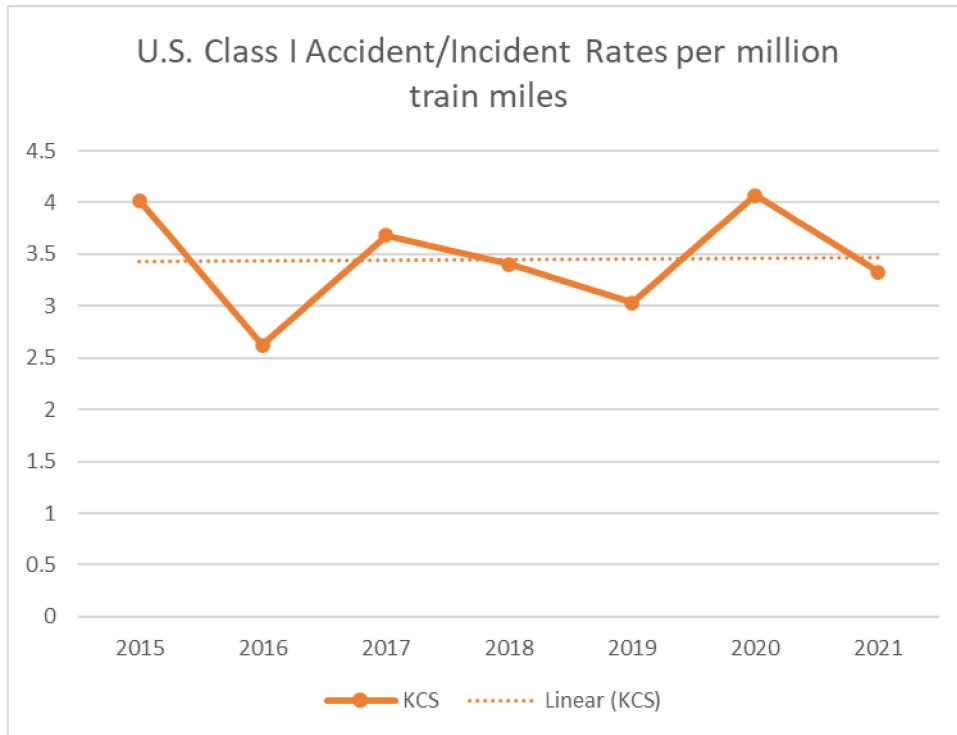
Dear. Mr. Wayland:

Environmental Defense Fund (EDF) working in Greater Houston Area, Texas has reviewed the draft Environmental Impact Statement for the Canadian Pacific Acquisition of Kansas City Southern dated August 5, 2022. Most of our comments relate to the assessment of the UP Beaumont to Rosenberg Subdivision (U-BEAU-01) and associated railyards and intermodal facilities. The proposed merger is estimated to increase the number of trains per day by 7.57 and increase annual gross ton miles by 4.73 million along this rail segment. As noted by the OEA, this segment passes through Harris County, which is an area of serious non-attainment for ozone. There are no planned capital improvements for the U-BEAU-01 segment. EDF has concerns with several aspects of the EIS.

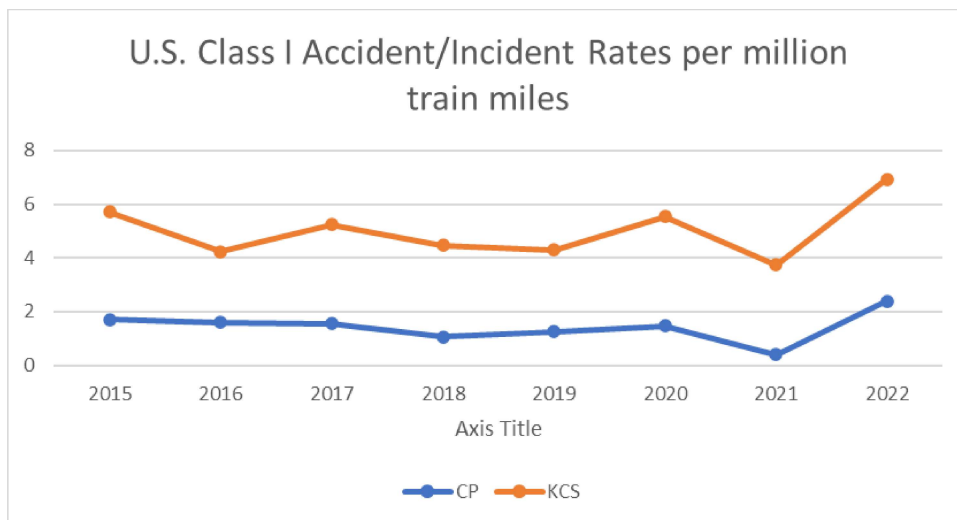
Comments and Recommendations

3.1 Freight and Passenger Rail Safety

The EIS uses a five-year analysis period of 2015-2019, citing that 2020 was an outlier year due to the pandemic. On page 3.1-5, OEA stated that “overall, both railroads trended downward for the five-year analysis period.” EDF recommends the final EIS include analysis with data through year-to-date 2022. Using data from the [Federal Railroad Administration](#), EDF's initial analysis indicates that accident/incident rates on the KCS line are trending upward from 2015-2021.



If data can be extrapolated from January-July 2022 incident rates to suggest what 2022 end of year numbers will be, (multiply January-July incident rate number by two), safety trends for both railroads are more worrisome.



Including data from 2015 through 2022 (extrapolated from data from January – July), the combined incident rate is 2.51, which is trending upward from the stated combined incident rate of 2.39 from 2015-2019 and closer to the U.S. Class I railroad average of 2.66 (page 3.1-5).

On page 3.1-6 OEA stated that “Of the 272 reportable incidents over the five-year review period, there were zero lay person injuries or fatalities reported by either railroad. There were zero reported crew fatalities and only nine reported crew injuries among seven incidents. This means that less than 0.03 percent of incidents produced any injury to any person at all. ”

Continuing, “of the 14,842 railcars and 537 locomotives involved in trains in reportable incidents, only 903 (0.06 percent) railcars and 54 (0.10 percent) locomotives derailed.” Could OEA please clarify the source and whether this is for just CP and KCS lines or for total rail. EDF requests a more detailed analysis of fatalities and derailments, including the contents of rail cars that derailed, and if there were any environmental mitigation measures that were taken, including a timeline of events.

On page 3.1-7 OEA stated that “CPKC would have a projected annual incident rate of 2.39 incidents per million train-miles across all types of track. As described in Section 3.1.1.1, Approach (also see Appendix F), OEA used the CP incident rates received from FRA for 2015 to 2019 to represent the average annual incident rate for 2027 under the Proposed Acquisition.” However the table refers to a systemwide incident rate of 1.44. EDF requests clarification and reiterates its request to incorporate more recent incident rate data. When new data is incorporated, it should project the systemwide incident rates based on the combined incident rate of the two railroads, not just CP’s incident rates. We suggest the same calculation for the mainline incident rates analysis.

On page 3.1-8 OEA stated that “incident rates on the CP and KCS systems have declined in recent years at least likely in part due to the implementation of PTC and other industry-wide improvements in safety.” As demonstrated above, incident rates have not declined in recent years if data from 2020-2022 is incorporated, therefore, it is incorrect to conclude that the implementation of PTC and other industry-wide improvements have had any effect, and as such, more stringent safety mitigation measures should be taken by the Applicants.

Table 3.1-6 on page 3.1-14 only includes Hazardous Materials Incidents data through 2019. EDF requests the final EIS include data through year-to-date 2022.

Chemical security is a serious concern for the Houston area. Canadian Pacific has had four derailments in 2022 alone. Given the fact that one railcar associated with this merger can haul up to 27,000 gallons of crude oil CP’s recent derailment history is a major cause for concern. As OEA acknowledges, among the energy commodities to be transported along the CPKC system is, bitumen, or crude oil extracted from tar sands. If a freight train carrying bitumen were to derail, the consequences would be devastating and more difficult and more costly to clean and further exacerbate ongoing environmental concerns regarding creosote contamination of the Englewood UP site, the site adjacent to two known cancer clusters. Such a spill would result in the release of benzene, a dangerous carcinogen. Tar sands oil sinks to the bottom of rivers and lakes, suffocating wildlife and polluting the water, and hardens in the sun on

land. EDF recommends the final freight safety analysis include increased risk inherent with hauling more hazardous materials.

3.2 Grade Crossing Safety

On page 3.2-1 OEA stated “In 2020, FRA published a report that includes statistics on the safety performance of more than 105,000 public grade crossings in the U.S. that are not closed and not grade-separated (FRA 2020). During the five-year period from 2014 to 2018, there were 8,467 crashes at those grade crossings, representing an average of 0.016 crashes per grade crossing per year.” On page 3.2-4 OEA stated that “Adding together all potential crashes at the 1,134 crossings resulted in a total of 24.9 predicted crashes per year, as compared to the No-Action Alternative of 19.1 total crashes per year.” This means under the No-Action Alternative, the system averages 0.017 crashes per gate and under the proposed merger, the system averages 0.022 crashes per crossing. Both numbers are higher than the industry average. EDF requests the final EIS incorporate the most recent crash data, including extrapolating the full year 2022 from year-to-date crash information. EDF reiterates the need for more voluntary mitigation measures to protect safety since the proposed CPKC network safety data includes incident rates that are trending upward and are higher than the overall industry average.

According to table F.1-5 on page F-8, OEA omitted analysis of the Beaumont to Rosenberg rail segment from its analysis of Grade Crossing Safety because the segment does not meet the seemingly arbitrary threshold of 8+ trains per day in order to be included. However, since the connecting 537.4 miles of rail segment on either side of the U-BEAU-01 segment does meet the threshold and was analyzed, EDF recommends analysis of the U-BEAU-01 segment also be included in the final EIS.

3.3 Grade Crossing Delay

On page 3.3-1 OEA stated “long delays can also occur when a train stops unexpectedly due to a crash or breakdown while traversing a crossing, but such events are relatively rare.” EDF requests further data analysis on whether this is true for the Harris County region. At a crossing with Lawndale Street, where KCS has trackage rights, the City of Houston found “the street was blocked 107 times for one hour or more over 26 days, with one delay lasting nearly 15 hours. Of the stoppages, 32 lasted for more than three hours, according to an initial [analysis by the Mayor’s Office of Innovation.](#)” EDF requests that the final EIS include full grade crossing delay analysis, inclusive of areas where the merger will have trackage rights.

On page 3.3-5 OEA stated that “across all 277 grade crossings in the study area with an AADT of 2,500 or more vehicles per day, the Proposed Acquisition would result in an average increase in delay of approximately 0.7 seconds per vehicle. Average delay would be approximately 4.7 seconds per vehicle under the Proposed Acquisition, compared to 4.0 seconds per vehicle under the No-Action Alternative.” EDF requests that the final EIS calculate average delay in terms of total minutes per train per day versus seconds per vehicle. It is difficult for readers to understand delay in seconds per vehicle since the time spent delayed by a train is experienced equally by all the delayed vehicles and not divided among them.

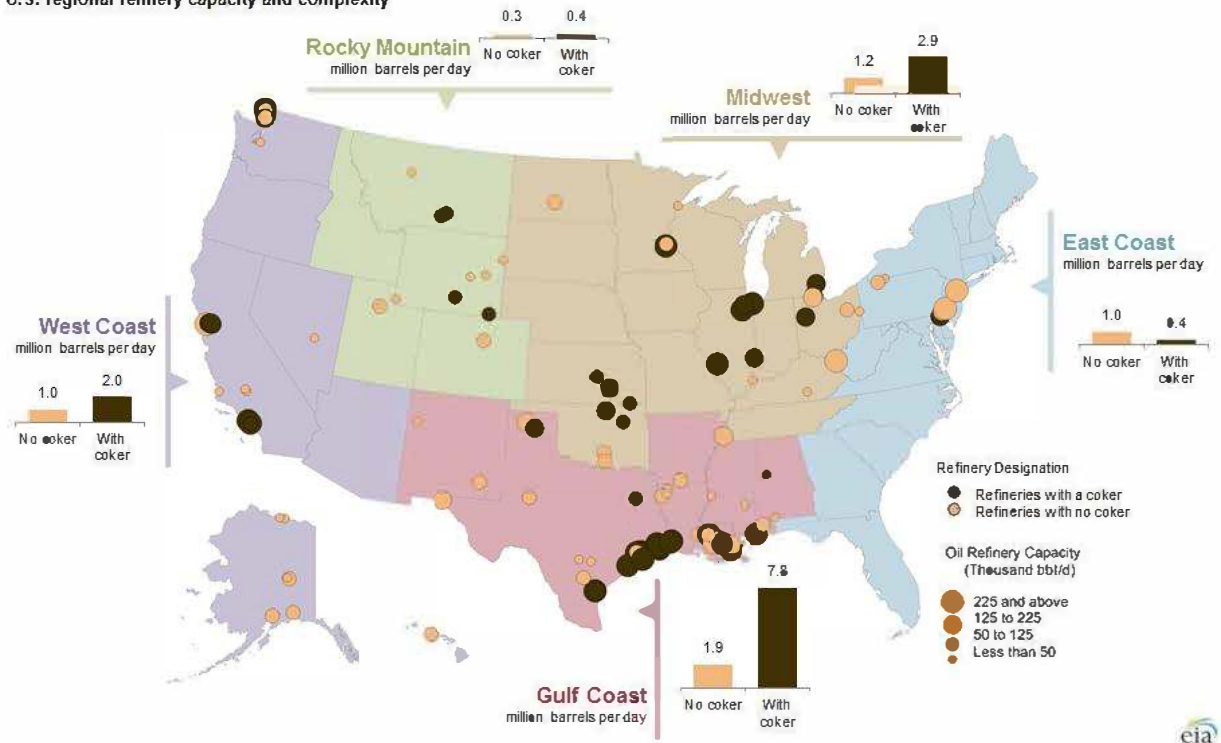
EDF analysis finds that even if total delay is reduced from 4.0 minutes to 3.6 minutes per train due to shorter train length, because the number of trains per day is going to increase, total delay overall will increase. EDF questions the assumption that train length will remain shortened and requests further analysis to include projections on expected train length in future years and provide justification for any assumption that train lengths will remain shorter.

On page 3.3-5 OEA stated “however, if train speed were to increase as a result of the Proposed Acquisition, then average delay at grade crossings would be lower.” EDF requests further analysis to support a claim that train speed may increase. As stated in section 3.7, “best practice for rail operations is typically to reduce speeds when ambient temperatures exceed the limits for that particular track, resulting in decreased efficiency.” EDF requests further analysis on delays that factors in average and rising temperatures in Houston, Harris County.

3.4 Truck-to-Rail Diversion

OEA stated on page 3.4-1 that “the truck-to-rail diversion study area includes highways on which truck traffic would decline as a result of the Proposed Acquisition.” EDF questions the scope of the study area. All highways with truck traffic that may be impacted by the proposed merger should be included in the study area to understand the net effect on truck traffic. The draft EIS does not make any claims regarding how truck traffic in the Houston area will be impacted, as seen on the map on page 3.4-4. OEA acknowledges that the CPKC system will be moving energy commodities including liquefied petroleum gas from Alberta, Canada, and other production areas, chemical products from the chemical plants along the Gulf Coast, and bitumen and crude oil from Alberta. Houston is the Energy Capital of the world, with the highest concentration of refineries, and one of the busiest ports by tonnage. Because Houston and the Gulf Coast will likely be handling these energy products, EDF requests the final EIS include more in-depth truck diversion analysis for the Houston, Harris County and Gulf Coast region.

U.S. regional refinery capacity and complexity



<https://www.eia.gov/todayinenergy/detail.php?id=19591>

Note: It is necessary for a refinery to have a “coker” to process bitumen.

However, EDF also questions the fundamental assumption that just because rail capacity is increased companies will switch their shipping method from truck to rail. Trucking allows for faster delivery times than railroads. Shipping by truck also has more flexible service options, such as drop offs or pick-ups in the middle of a shipment's route and less cargo restrictions due to size and weight constraints. EDF requests further analysis to support the claim that truck diversion is feasible. In a [study done by the Washington state Department of Transportation](#), they conclude that “even if there was a targeted effort to use railroads more frequently [than trucks], the goods would need to travel by truck on regional roads and freeways to arrive at rail terminals. In fact, most of the goods produced or received from the rail system must dray those goods by truck to or from the rail lines; and, increased rail service would likely lead to greater use of truck for this very reason...Shippers and customers are aware of the region’s rail service and use it where appropriate and advantageous to their needs. As with all business matters, shipping practices are based on market conditions including service, cost, and schedule conditions.”

3.5 Intermodal Facility Traffic

There was no analysis of Houston, Harris County for intermodal traffic. Again, Houston is the Energy Capital of the world, with the highest concentration of refineries, and one of the busiest ports by

tonnage. Because Houston and the Gulf Coast will likely be handling these energy products, EDF requests the final EIS include more in-depth analysis on intermodal facility traffic to include Houston, Harris County.

3.6 Noise and Vibration

The OEA concludes that, “apart from train noise, which could result in adverse impacts at some locations, the potential adverse impacts of the Proposed Acquisition would be negligible, minor, and/or temporary (p S-7, Draft EIS)”. During the presentations about the EIS and on page 3.6-9, the OEA stated that the acquisition, “would increase average noise levels at many noise-sensitive receptors, such as residences” and identified 6,307 receptors that would experience an adverse noise impact with an “adverse noise impact” being defined as an increase of at least 3 decibels (dBA) above an average sound level of 65dBA or higher. They further conclude that, “receptors located near existing CP and KCS rail lines already experience intermittent train noise and have for many years.”

EDF finds this line of thinking about the communities “already experiencing intermittent train noise” misguided and dismisses both the existing conditions for residents living next to rail yards and rail lines, as well as the large body of scientific literature documenting the impacts of noise pollution on health and well-being. It demonstrates a disregard to the existing conditions among communities dealing with noise impacts from rail by ignoring the potential cumulative or additive impacts of this acquisition on community health and well-being. By stating that communities adjacent to rail yards and rail lines have been living with train noise for many years, this highlights the difficulties these communities have had to obtain mitigation of the impacts of noise on their daily life. EDF recommends further analysis on existing impacts as well as any potential future impacts. While a series of proposed mitigation measures are included in the acquisition, OEA acknowledges that “even if the Board imposes these mitigation measures, however, OEA expects that the Proposed Acquisition would result in unavoidable adverse noise impacts.”

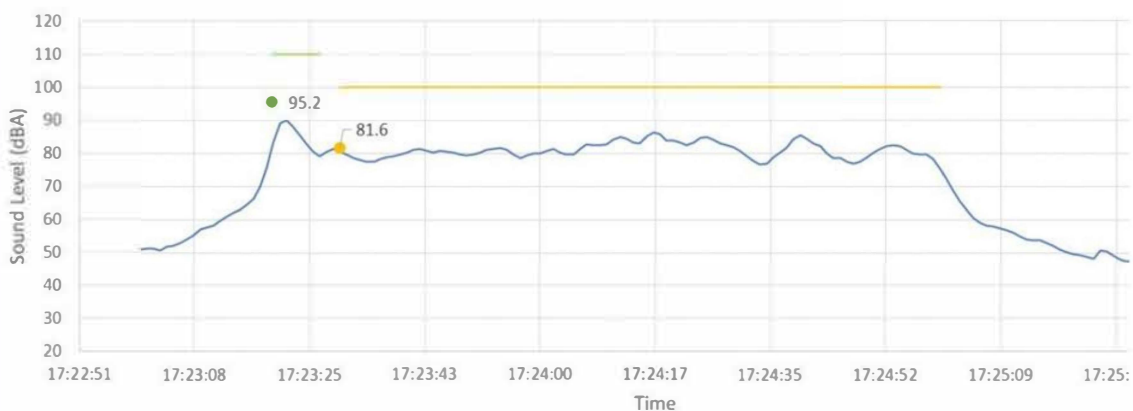
On page 3.6-7, OEA describes noise sampling conducted at 10 locations in the study area, however, no noise samples were collected in the City of Houston, the most populated city in Texas, and a city inundated with rail impacts (See: [“Blocked crossings continue to vex Houston leaders, railroads and residents, with few options for fast relief”](#) and [“Trains Block Communities and Create Safety Hazards”](#)). EDF recommends further noise sampling and analysis, particularly in EJ communities, in the Houston Harris County area.

Noise pollution defined as [“unwanted sound”](#) is a threat to public health. Recent studies have demonstrated the connection between the noise and vibration of freight rail traffic on [sleep disturbances](#), [cardio vascular disease mortality](#), [risk of myocardial infarction \(heart attack\)](#), [decreased cognitive functioning](#) (resulting from increased levels of adrenaline and noradrenaline), [hearing impacts](#) (especially among children or at levels above 85dB). A [2022 Harvard report](#) reviewing the health effects of noise stated, “[N]oise pollution not only drives hearing loss, tinnitus, and hypersensitivity to sound,

but can cause or exacerbate cardiovascular disease; type 2 diabetes; sleep disturbances; stress; mental health and cognition problems, including memory impairment and attention deficits; childhood learning delays; and low birth weight.”

In addition to health impacts, according to an [Old Dominion University study in 2016](#), a residential property’s consistent exposure to 65 decibels or greater of railroad noise pollution reduces property value between 14% and 18%. Freight trains emit on average between 81-95 dBA when they pass by (see results from testing in Figure M.1-1 below).

Figure M.1-1. Freight Train Pass-By Sounds Level Time History



Source: VHB 2022

Locomotives generated sound levels from 85 to 100 dBA (SEL), with an average of 92 dBA (SEL) depending on train speed. Horns typically ranged from 106 to 116 dBA (SEL) with an average of 108 dBA (SEL) at locations between ¼-mile and 1/8-mile from grade-crossings and 111 dBA (SEL) at the grade-crossing.

3.7 Air Quality and Climate Change

Because EDF questions the assumption that truck-diversion is feasible, it rejects the conclusion, as stated by OEA on page 3.7-1, that there will not be a net increase of air pollution or greenhouse gas emissions.

EDF recommends analysis of all segments as opposed to using the Board Threshold described on page 3.7-2 (where rail traffic increases 100% or 8+ trains per day, or yard activity 100% or increased truck traffic more than 10% of AADT). Transportation emissions are the largest source of GHG emissions and all increases should be analyzed and counted in attainment and nonattainment areas.

On page 3.7-4 OEA stated they did not evaluate the short-term emissions associated with implementation of the planned capital improvements since they are temporary. EDF requests the final analysis include even temporary emissions of GHGs since the effects of GHGs are not temporary.

The table included on page 3.7-9 shows emissions from increased rail traffic; emissions from increased vehicular delay at at-grade roadway/rail crossings (grade crossings); and emissions from trucks, cranes, and other equipment related to increased activities at rail yards and intermodal facilities that would occur under the Proposed Acquisition. OEA acknowledges that “NOx is the air pollutant of greatest concern from locomotive emissions, and OEA estimates that increased rail traffic on rail lines in the study area would result in the emission of approximately 5,703 tons of NOx each year. OEA expects that these NOx emissions could be offset by lower NOx emissions on other rail lines outside of the CPKC network.” Increasing NOx emissions in one area creates corresponding negative health effects in that area, even if net emissions are achieved system wide. EDF requests an analysis on where the negative health effects will be distributed on a county level.

NOx plays a major role in the production of ozone, and the Houston area has been recently reclassified to severe nonattainment for ozone. Ozone pollution in Houston has been trending upward. Since Sept 6, 2022 the TCEQ has issued 19 Ozone Action Days for the Houston area. While NOx emissions in Houston have been trending downwards overall, the increase in 30 tons of NOx emissions from these added trains is a 2.91% increase in ozone precursors and would be concentrated in the areas adjacent to the railyards. These communities - Fifth Ward, Kashmere, Settegast - contain large EJ populations. EDF recommends the final EIS include updated NOx and VOC emissions assessment with new severe nonattainment de minimus standard.

Because EDF questions the assumption that truck-diversion is feasible, it rejects the conclusion, as stated by OEA on page 3.7-11, that emissions will be offset. OEA requests further in-depth analysis of any claims of potential emissions reductions due to truck diversions be done at the county level for Harris County. As previously stated, EDF believes truck diversions will not be achieved in Harris County. As stated on page 3.7-12, “OEA did not consider the emissions benefits of truck-to-rail diversions at the county level because truck traffic would likely decrease on many different highways in many different counties throughout North America, so the benefits from truck-to-rail diversions would be diffuse and the truck traffic reductions would not necessarily align with the counties experiencing increases in rail-related emissions.” Even if it were true that truck-to-rail diversions occurred and created net emissions reductions, it redistributes the health impacts of such emissions. EDF requests further analysis of where any claimed emissions reductions will be achieved, where they will be increased and the corresponding health impacts.

On page 3.7-13 OEA notes that “the anticipated increases in emissions due to rail activity in these nonattainment areas should be accounted for in future State Implementation Plan inventories, sometimes requiring offsets in emissions budgets in order to achieve the required reductions in emissions from the base year inventories.” Harris County is an area of serious nonattainment for ozone and should the NAAQS for PM 2.5 be revised to be more stringent, as is currently under consideration, the county will likely reach nonattainment within three years. Without any mitigation efforts on the part of the Applicants, it shifts the burden to the state to make up the difference to come into attainment.

EDF requests further analysis in Harris County on how increased NOx and PM emissions will affect our attainment status and recommends OEA work with the Texas Commission on Environmental Quality to determine specifically how those emissions will affect the SIP and the region's ability to achieve compliance with ozone and PM 2.5 under scenarios where the NAAQS for PM is revised or not.

OEA stated on page 3.7-26 that "average annual precipitation projections indicate small changes overall, but that projected climate change impacts could include more intense and frequent events of extreme heat, drought, flooding, and severe storms (USGCRP 2018)." EDF requests the final EIS include analysis at the County level (versus) region. Houston has experienced several 100+ year flooding events in recent years. As OEA acknowledges on page 3.7-29, "flooding causes a serious risk to railroad infrastructure, and under the Proposed Acquisition, there would potentially be impacts to bridges, tracks, ties, and ballast." EDF recommends [incorporating data on flooding in Houston, Harris County](#) in the final EIS.

On page 3.7-30 OEA stated that "electrical equipment is susceptible to overheating and malfunction, particularly at ambient air temperatures of 90 degrees Fahrenheit or greater (OFCM 2002). Overheating may lead to electronics melting or temporary shutdown in cases for which temperature thresholds result in an automatic shutdown. The possibility of malfunction within track and signal sensors also increases with higher air temperatures." EDF recommends [incorporating data on heat island effects](#) in its final EIS analysis and to provide information on how such shutdowns and malfunctions will impact delay.

OEA goes on to further describe how temperatures of 110 degrees Fahrenheit are more likely to buckle and how heat index values at or above 105 increase the risk of derailment. EDF requests the final EIS [include data on how many days in Houston Harris County currently reach these thresholds, and how many more days will reach these thresholds in the future](#). The analysis should include how these temperatures and their related infrastructure impacts will affect delay since, as previously noted, it is best practice to reduce speeds when temperatures are higher. Analysis should be done seasonally and not on average.

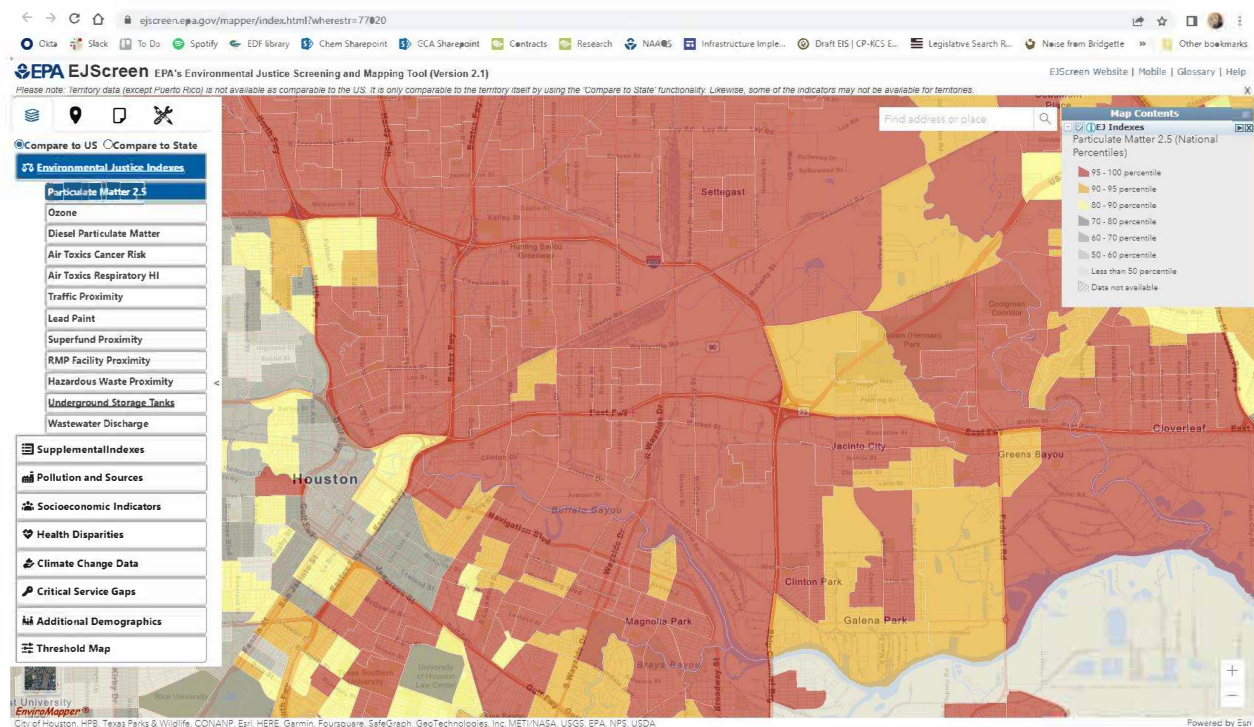
3.13 Environmental Justice

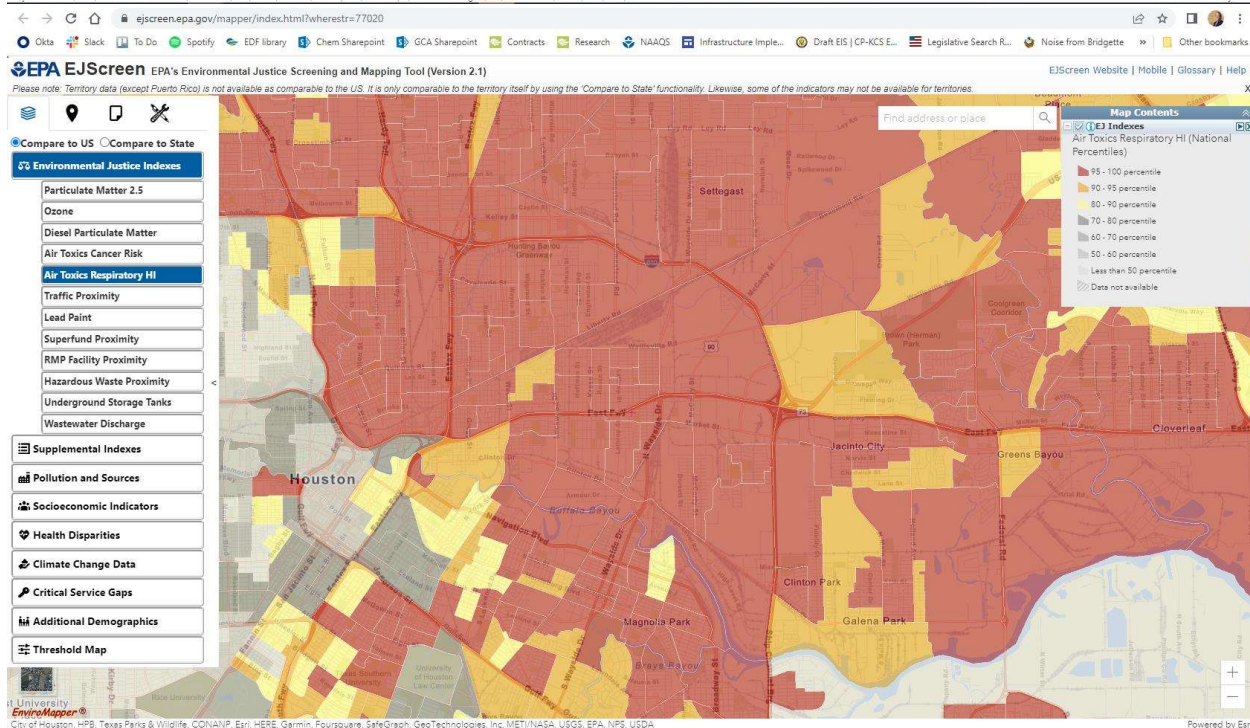
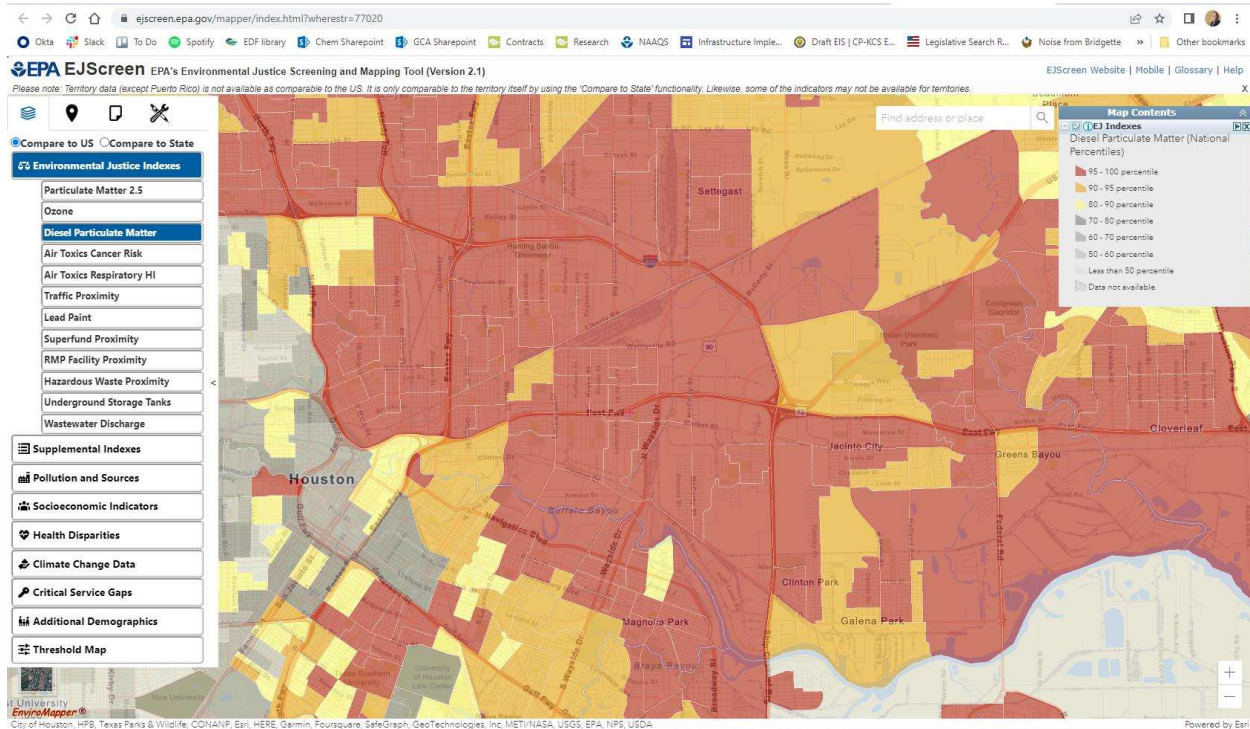
On page 3.13-1, OEA described their approach in identifying EJ communities:

- OEA identified all potentially high and adverse impacts of the Proposed Acquisition. OEA defined potentially high and adverse impacts as impacts that would be significant under NEPA or above generally accepted norms.
- Based on the identified high and adverse impacts, OEA defined the study area within which the Proposed Acquisition could adversely affect potential EJ populations.
- OEA identified potential EJ populations (low-income and minority populations, including American Indians) in the study area using the best available demographic data

EDF recommends that the final EIS alter the approach and that OEA use the [Environmental Protection Agency's EJScreen tool](#) to first identify EJ communities, as recommended by the [EPA's Office of General Counsel Office of Policy](#) and then see how all potential impacts of the Proposed Acquisition are situated in EJ communities. OEA should use the EJScreen EJIndexes. The EJ index highlights block groups with the highest intersection of low-income populations, people of color, and a given environmental indicator. As public health literature supports, any additional impact, not just high and adverse impacts, will disproportionately impact communities that are more severely burdened by environmental hazards before the impact, so it is important to identify those communities first, instead of high impact areas first.

In the screenshots below, for example, the Fifth Ward/Kashmere Gardens neighborhoods of Houston are identified by the EJIndex feature of EJScreen to contain block groups with the highest intersection (in the 95th percentile compared to the rest of the nation) of low-income and minority populations when considering exposure to particulate matter 2.5, diesel particulate matter and air toxics respiratory hazards. Every additional amount of emissions affects an already overburdened community disproportionately.





On page 3.13-2 OEA stated that “based on the assessment of the potential environmental impacts of the Proposed Acquisition, OEA determined that noise from the projected increased rail traffic would be the

only type of impact that could potentially result in high and adverse impacts on EJ populations.” EDF recommends further analysis on how and whether this implication affects the Biden Administration’s stated goals to deal with historically disproportionate impacts through its Justice 40 initiative.

EDF finds it problematic that OEA used the categories listed on 3.13-4 of “Black or African American alone,” “American Indian and Alaska Native alone,” “Asian alone,” “Native Hawaiian and Other Pacific Islander alone,” “Some Other Race alone” (non-white), and/or “Hispanic or Latino.” when identifying EJ communities. Using the EPA EJScreen will eliminate this mistake.

Revising the approach may lead to the conclusion that more of the scoping comments made by EJ populations are relevant to the EJ analysis sections (pg. 3.13-8).

OEA stated on page 3.13-8 that direct outreach to community leaders was made. EDF requests that the final EIS include a list to describe to whom OEA reached out. EDF recommends that if OEA did not make meaningful contact with local, county and regional planning organizations or environmental justice communities (as defined by EJScreen for pertinent environmental issues such as PM 2.5, diesel emissions and air toxics risks) in the Houston Harris County regions, they should do so and incorporate feedback from those leaders in their final EIS.

On page 3.13-10, OEA stated that “based on the distribution of adverse noise impacts throughout the study area, OEA concludes that adverse noise impacts would not be borne disproportionately by EJ populations. Most of the block groups in which adverse noise impacts would occur do not include EJ populations, and most of the receptors that would experience adverse noise impacts are in non-EJ block groups. Although the Proposed Acquisition would affect low-income populations and minority populations, including Native American tribes, impacts on those populations would be similar to or less than the impacts experienced by non-EJ populations.” EDF finds this reasoning faulty. The concern of environmental justice advocates is not to achieve equal and proportionate impacts for environmental justice communities, but to have historical, systemic and institutionalized oppression of certain groups be factored into decisions so that equitable outcomes may be achieved. As stated above, any additional impact on an already vulnerable community creates a disproportionate outcome, which again, is why OEA must reconsider their approach in identifying EJ communities and analyzing impacts.

3.14 Cumulative Impacts

OEA described the “cumulative impacts of the Proposed Acquisition and other past, present, and reasonably foreseeable future projects and actions” (pg. 3.14-1). However, the draft EIS contains no analysis of the cumulative impacts to air quality that would result from the additional processing of energy commodities that will be transported by rail to the Gulf Coast and Houston, Harris County region by local refineries and chemical processing plants. EDF recommends these impacts be considered in the final EIS.

Recommended Mitigation Efforts

Air Alliance Houston submitted written comments on October 14, 2022 regarding the draft EIS. EDF recommends OEA and the Applicants consider the results of the survey obtained through Air Alliance Houston's community engagement efforts. EDF recommends the Applicants incorporate Air Alliance Houston's method for community engagement with affected communities. EDF stands in solidarity with residents who oppose the merger and recommends The Board not approve it.

However, since the draft EIS contains mitigation efforts, EDF does have comments regarding what is proposed. EDF supports the voluntary and recommended mitigation efforts outlined in *Chapter 4, Mitigation*, but believes they do not go far enough to protect the health and safety of the impacted residents of the Houston, Harris County region and provides some additional recommendations.

- EDF invites the Applicants to visit Houston to continue good faith outreach efforts with impacted community members. EDF recommends the Applicants participate in a tabletop exercise with the City of Houston, Harris County, Port Houston Authority, and other local jurisdictions and emergency management teams to clarify roles and responsibilities, establish lines and means of communication and identify preparedness and response mitigations in the event of any accident or disaster related to the railroads.
- The Texas Department of Transportation released a Houston-Beaumont Region Freight Study in September 2021 (attached). It outlines several necessary improvements along the U-BEAU-01 rail segment. EDF recommends consulting with community members and TXDOT to see which projects are of the most concern and for The Applicants to fund the near-term and mid-range projects that are acceptable to the community in order to improve safety.
- EDF recommends consulting with community members and the City of Houston to identify key crossings where delays due to train traffic or stalled trains are a problem and for the Applicants to fund and install cameras and laser detectors to monitor train traffic. Further, EDF recommends the applicants develop an app or dashboard so residents can see in real-time when a train is stalled on the tracks and find an alternate route to avoid it.
- EDF recommends the Applicants consult with community members to identify areas where noise pollution is greatest and that the Applicants fund and install noise monitors and noise barriers where necessary, if noise should consistently reach unacceptable levels.
- Regarding OEA recommendation MM-Noise-05, EDF recommends and volunteers to assist The Applicants to share with community members how they can inquire about the establishment of Quiet Zones and assist communities in identifying supplemental or alternative safety measures, practical operational methods, or technologies that may enable the community to establish Quiet Zones in accordance with FRA's final rule on the "Use of Locomotive Horns at Highway-Rail Grade Crossings." EDF also recommends the Applicants define "promptly" and the expected timeline for when communities can receive assistance.
- EDF recommends after health impacts related to emissions are analyzed at the county level that the Applicants consult with community members on how to best mitigate health impacts and fund interventions.

- EDF recommends serious air quality mitigation measures be taken by the Applicants in Harris County (and everywhere along the system, regardless of attainment status) to prevent as many NOx, PM and GHG emissions as possible.
- EDF recommends the Applicants consult with City of Houston, Harris County officials and recommends consultation with the community regarding infrastructure-hardening efforts and also recommends the Applicants to fund infrastructure-hardening to withstand impacts in Houston, Harris County from extreme weather.
- EDF requests and volunteers to help coordinate Transportation Community Awareness and Emergency Response Program (TRANSCAER) workshops (training for communities through which dangerous goods are transported) in potentially affected communities offered by the Applicants in English and Spanish.
- EDF recommends the Applicants set a target for Scope 3 greenhouse gas emissions reductions.

Sincerely,

Stephanie Coates, Community Air Quality Tom Graff Fellow
Ellu Nasser, Senior Manager, Climate & Health
Grace Tee Lewis, Senior Health Scientist
Environmental Defense Fund

Enclosure: Houston-Beaumont Region Freight Study DRAFT September 2021

HOUSTON-BEAUMONT

Region Freight Study

DRAFT September 2021



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Executive Summary

Overview

The Houston-Beaumont Freight Rail Study (HBFRS) is an update to a previous study prepared for the Houston and Beaumont region focused on potential improvements related to railroad capacity and roadway-railroad crossings. The *Houston Region Freight Study*, issued in 2007 by the Texas Department of Transportation (TxDOT), was the start of a conversation to address deficiencies within the region's freight network (roads, ports, and railroads) and to develop ways to accommodate future freight movements. Since the completion of the *Houston Region Freight Study*, some of the projects within that study were implemented with many of those remaining projects not funded or constructed over the past decade.

This study encompasses 11 counties bounded by the Houston-Galveston Area Council (H-GAC) and the South East Texas Regional Planning Commission (SETRPC), including Brazoria, Chambers, Fort Bend, Galveston, Jefferson, Hardin, Harris, Liberty, Montgomery, Orange, and Waller Counties. Over the past two years, TxDOT along with a stakeholder group comprised of representatives from local governments, transportation and transit agencies, major railroad companies, ports, chamber of commerce, industry representatives, MPOs, and other interested parties had an opportunity to provide feedback and strategic direction on the study.

The region's freight rail network not only contributes to the economic vitality of the 11-county area but transports vital goods to Texas residents and businesses as well as nationwide. The existing rail infrastructure, equipment, and facilities serve a diverse business profile including local and international companies, and combined imports and exports exceed \$1 billion annually¹ with freight rail infrastructure being vital to providing a mobility solution for commerce.

Recognizing the continued growth of freight movement in the Houston region, the most recent Texas Freight Mobility Plan (2018) prepared by TxDOT identified 23 grade-crossing separations, 3 rail-bridge projects, 5 mainline rail expansion projects, and various other projects. The HBFRS reviews applicable regional projects from the Freight Mobility Plan and other plans and studies and further evaluates the railroad and roadway infrastructure through Rail Traffic Controller (RTC) modeling software, crossing priority index, and further stakeholder conversations to detail additional projects for potential future implementation.

¹ Source: <https://www.houston.org/houston-data/monthly-update-foreign-trade>. Accessed on 11/2019.

Through the study of the freight rail network, the HBFRS aims to identify alternatives for rail and roadway system improvements, including grade separation, crossing closure, and rail capacity, to address vehicular/rail and freight rail performance within the 11-county region, and ultimately provide recommendations on execution strategies and funding opportunities.

These proposed projects are anticipated to reduce vehicular and train delays, increase transportation system capacity, reduce the potential for incidents, and improve the quality of life for users. These recommendations may be used to form the basis for an infrastructure plan focused around railroad-related efforts following these principles.

Methodology for Determining Projects

This study reviews existing conditions, constraints, and infrastructure to identify potential projects within the roadway and railroad networks that may provide the most benefits to the users of that infrastructure. The methodology used to identify railroad network projects is generally based on railroad operations modeling, while the roadway-rail grade crossing methodology focuses on quantitative reviews of data and qualitative reviews of other factors such as business and residential access, impacts to major utilities, and constructability.

Railroad Network

A model of the rail network within the region was created using RTC modeling software, and existing conditions were developed through available information and coordination with participatory Class I railroads. Once the existing model was finalized, the network was reviewed to determine constraints within the region such as bottlenecks, crew change points, and yard operations. Potential solutions to these constraints were developed and evaluated in a model in groupings, or scenarios, to determine effectiveness of the scenario to railroad operations. The identified scenarios and associated projects are included as part of section 3 in this study.

Benefit-cost analyses were also developed for these scenarios and are included as part of Appendix D in the study.

Roadway Network

Grade crossings within the study region were reviewed in a two-step process that concluded with the identification of potential grade separation or crossing closure candidates.

The first step is a quantitative review based on calculations that use inputs such as average daily traffic, train volumes, crossing protection, and incidents at each existing at-grade crossing within the region. The second step is a qualitative analysis defining feasibility of implementing a potential grade separation due to existing constraints at or near the crossing. Qualitative measures include change in access, additional infrastructure adjustments to freeways, impacts to major utilities, and potential environmental factors.

Identification of grade crossing candidates for closure focused on existing at-grade crossing locations with low traffic volumes that were adjacent to an existing or potential grade separation within this study. Other grade crossing closures were considered in areas along potential railroad capacity improvements that require staging areas for trains.

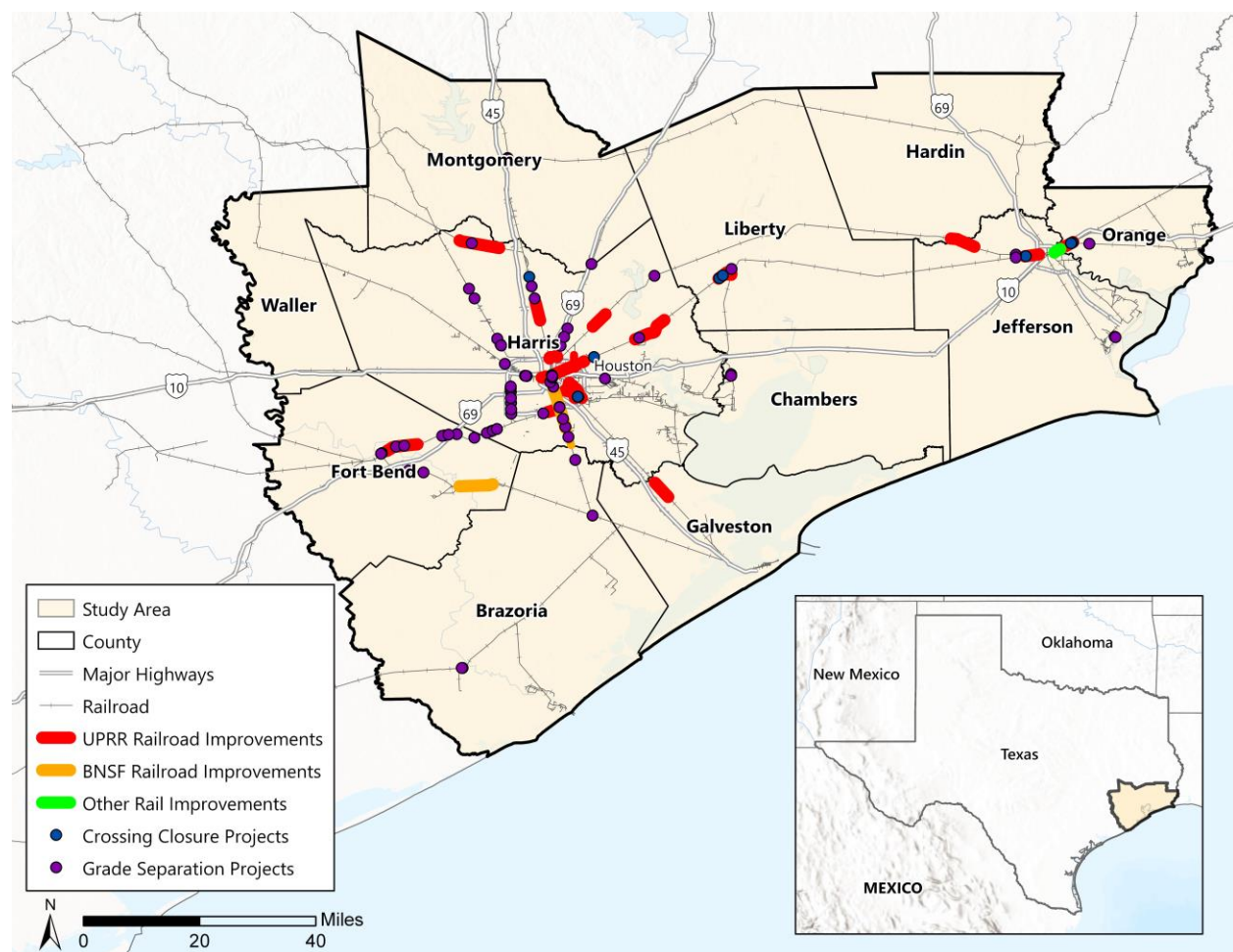
Proposed Improvements

The study compiled the results of the railroad and roadway network reviews into projects along each applicable railroad subdivision. Potential projects within the study include:

- 29 proposed railroad improvements,
- 59 proposed grade separations, and
- 22 proposed crossing closures.

Figure 1 details the locations of the proposed roadway and railroad improvements within the 11-county region.

Figure 1. Proposed Roadway and Railroad Improvements Map



For each potential improvement, this study describes existing conditions, implementation challenges, potential environmental challenges, and anticipated construction costs and implementation timeframe for planning purposes.

Benefit-cost analyses (BCAs) for the railroad scenarios have been completed to evaluate a project's benefits against its costs. The results focus on benefits related to vehicular delay and train movement efficiencies based on USDOT guidance for those benefits. These results can be found in Appendix D of the study.

Next Steps

The study identifies a process for moving the potential grade separation, crossing closure, and railroad capacity improvement projects forward through prioritizing improvements, determining an implementation schedule, and adding into local, regional, or state transportation plans. The study also discusses some opportunities for funding these projects by available grant programs and federal, state, and regional programs.

The grade separation, crossing closure, and rail capacity improvements are the foundation for a conversation of the regional needs for freight and vehicular movements involving railroad crossings and corridors. Stakeholders within the Houston-Beaumont region should review the initial findings of this study and further evaluate the projects to validate their benefits to the region. Projects, as deemed by the stakeholders, should be included as part of state, regional, and local transportation planning documents as well as planning documents of private stakeholders and identify potential funding for the projects based on anticipated implementation timeframes.

Section 1: Introduction & Background

This study is an update to a previous study prepared for the Houston and Beaumont region focused on railroad capacity enhancements and roadway-railroad crossings. The *Houston Region Freight Study*, issued in 2007 by the Texas Department of Transportation (TxDOT), was the start of a conversation to address deficiencies within the Houston region's freight network (roads, ports, and railroads) and to develop ways to accommodate and prioritize the anticipated growth of future freight movements. It also identified improvements that may provide relief to residents and the traveling public adversely affected by delays, interruptions, and noise attributed to the movement of freight within the region.¹

The goal of this study update is to determine freight rail network and associated roadway constraints and identify for the identification of alternatives for rail and roadway system improvements to address vehicular/rail and freight rail performance within the 11-county region bounded by the Houston-Galveston Area Council (H-GAC) and the South East Texas Regional Planning Commission (SETRPC). The study area, shown in Figure 1.1, includes Brazoria, Chambers, Fort Bend, Galveston, Jefferson, Hardin, Harris, Liberty, Montgomery, Orange, and Waller Counties. The study also details methodology and recommendations for near-term, mid-range, and long-range projects that may improve freight mobility in the region and evaluates freight infrastructure, freight movements, and operations; identify opportunities to increase freight movement efficiency; and determine the physical and financial viability of potential improvements.

¹ http://ftp.dot.state.tx.us/pub/txdot-info/rail/freight/houston_study.pdf

Figure 1.1 Study Area Map

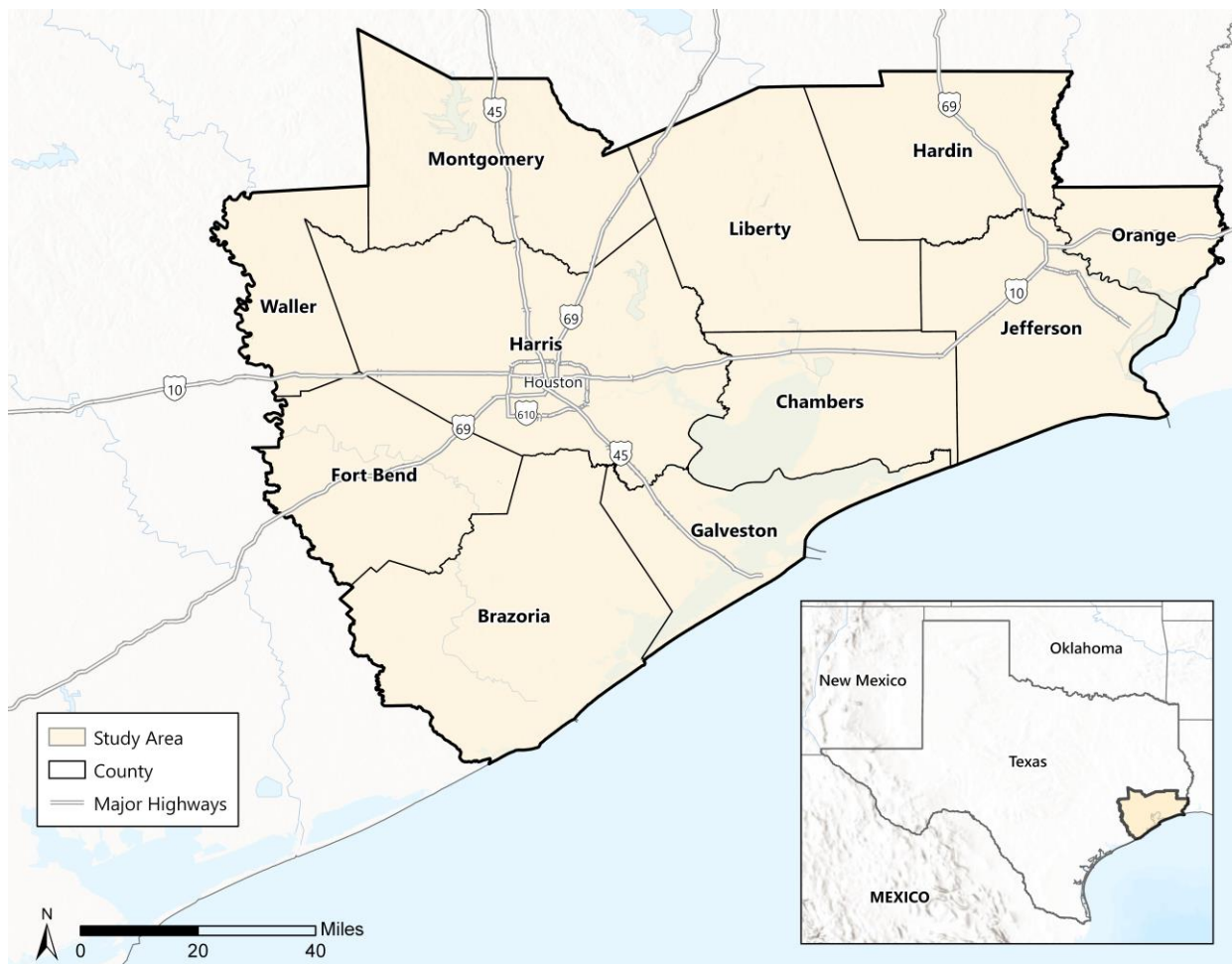
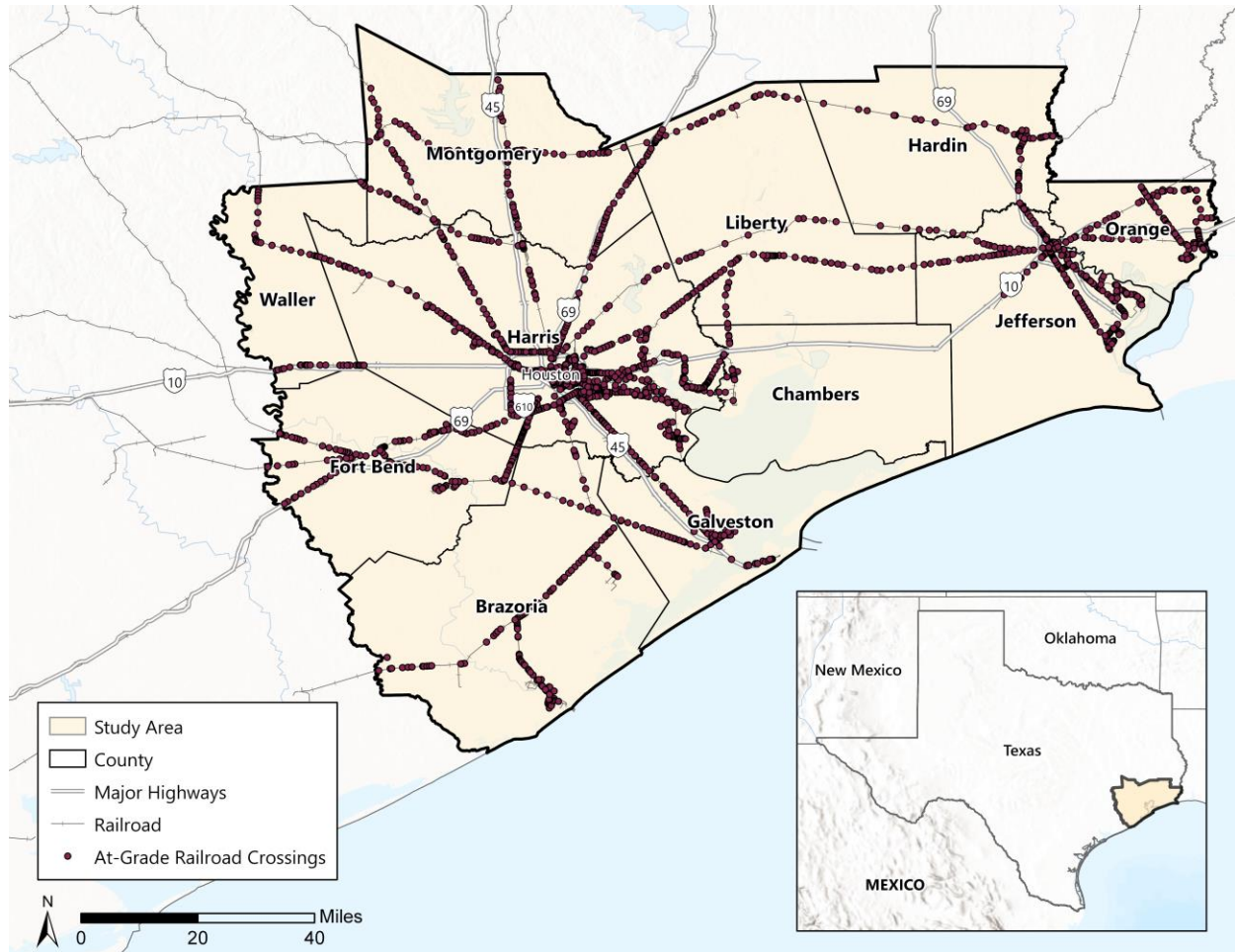


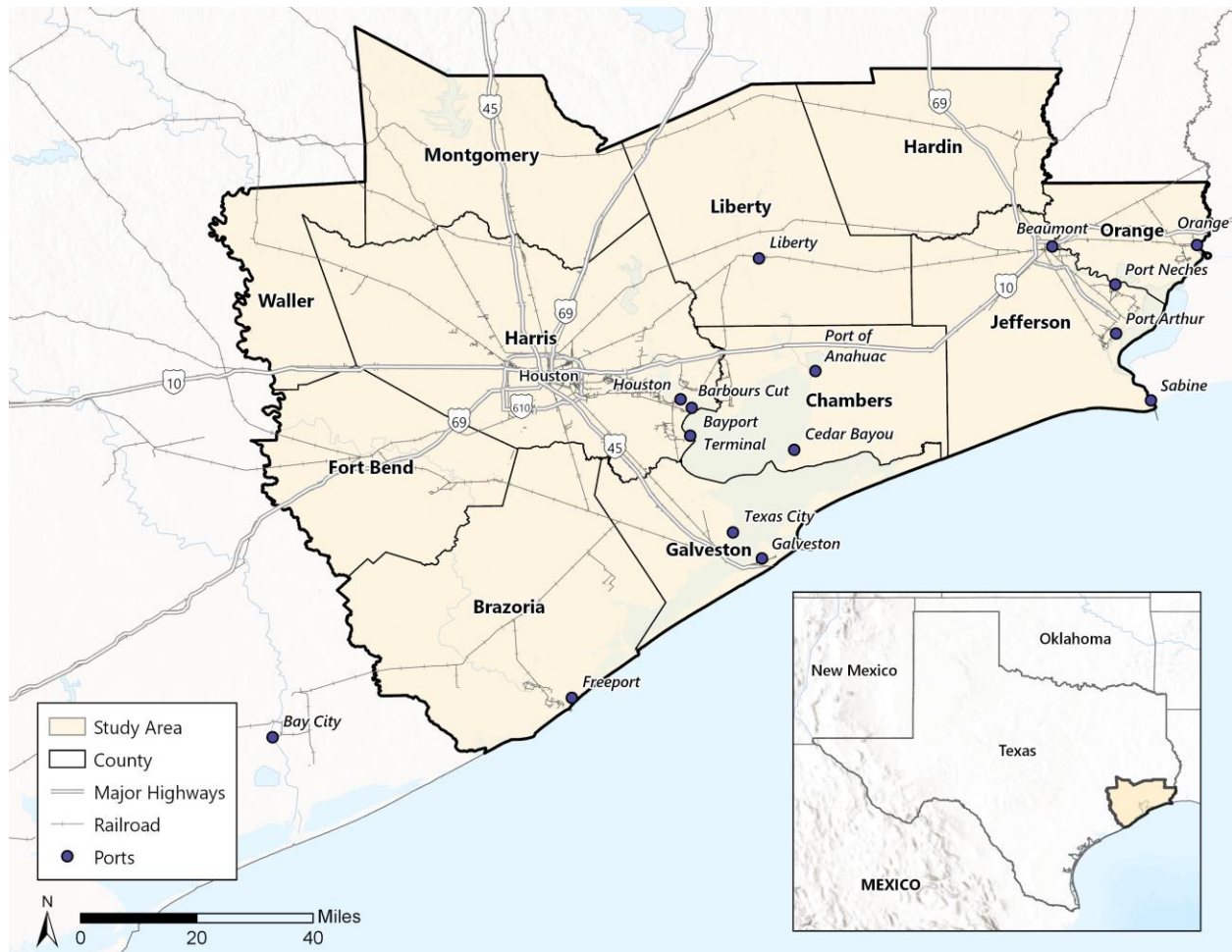
Figure 1.2 details the more than 2,000 at-grade roadway-rail crossings within the study area. These at-grade roadway-rail crossings present challenges to both the roadway and rail networks due to vehicular delays during train passage, potential for incidents between trains and vehicles, noise impacts, and ongoing maintenance costs. However, opportunities to mitigate some of the challenges at these locations also abound through grade separations, crossing closures, quiet zones, and other infrastructure and operational methods. This report looks at all grade crossings within the study area to identify potential grade separation and crossing closure candidates through quantitative and qualitative methodologies.

Figure 1.2. Railroad At-grade Crossings within Study Area



Efficient movement of freight to and from businesses, yards, and ports is imperative for long-term growth of both the region and the nation. Figure 1.3 defines the locations of ports within the study and the rail lines that provide connectivity to that critical infrastructure. Some of the rail lines and yards within the region have been constrained to their current sizes due to continued development in the region, especially in the core Houston city limits, and this is a factor in the railroads' abilities to expand capacity to meet freight demand as more freight enters and leaves the area. These limitations have led to capacity constraints and challenges in efficiency that may impact other areas of the freight and roadway networks. This study reviews the existing constraints within the regional rail network through Rail Traffic Controller (RTC) models and identifies potential scenarios to alleviate those constraints.

Figure 1.3. Railway Network Map and Port Connectivity



This study is separated into sections that focus on methodology, improvements, and next steps. A list of each section is below with a brief description on the contents of that section.

- **Executive Summary** – This includes an overarching review of the findings of the study and recommendations to move forward within the region.
- **Section 1 – Introduction and Background.** The section provides a summary of some of the previously completed reports and a brief overview of the scope of this study.
- **Section 2 – Data Collection and Existing Conditions.** This section of the study reviews the available data used in the methodology and analysis of the roadway and railroad infrastructure and a synopsis of the existing features within the region with a focus on the existing railroad lines.
- **Section 3 – Railroad Project Determination and Results.** The section details the methodology for the efforts related to the railroad modeling in RTC, including existing train data/inputs, growth scenarios, and rail capacity projects, and identifies results of those modeling efforts.
- **Section 4 – Grade Crossing Screening Methodology and Results.** This focuses on the quantitative and qualitative screening methodologies for potential grade separation and

crossing closure candidates and includes a discussion on blocked crossings and findings from the grade separations/crossing closures reviews.

- Section 5 – Comprehensive List of Improvements. This provides an overall summary of roadway and railroad improvements by railroad subdivision with detailed descriptions, estimates, and challenges for each infrastructure improvement.
- Section 6 – Recommendation and Implementation Strategy. The section discusses high-level planning strategy for implementation of the improvements and potential funding sources for certain types of projects.

As noted in the beginning of this section, this study is part of an ongoing process within the region to define projects that will move rail freight efficiently while reducing delay and impacts to the traveling public. Below are other studies within the region and state that have been reviewed and considered within the breadth of this report. These studies helped better understand the region's freight network, projects previously considered by stakeholders, and current programmed projects.

Houston Region Freight Study, 2007

The *Houston Region Freight Study* (2007) was developed by the Texas Department of Transportation (TxDOT) under the guidance of a regional steering committee. This study established a needs assessment report for the stakeholders in the Houston region to address deficiencies in the Houston region's freight network (roads, ports, and railroads) and to develop ways to accommodate and capitalize on future freight movements. The report identifies \$3.4 billion in improvements in four areas: grade separations, grade crossing closures, existing railroad infrastructure (improving capacity and connectivity on existing rail lines), and new railroad corridors.

Texas Freight Mobility Plan, 2017

The *Texas Freight Mobility Plan* (March 2018) was performed by TxDOT in collaboration with a wide range of stakeholders to guide current and future freight transportation investment strategies in Texas. The study provides the state of Texas with a blueprint for facilitating continued economic growth through a comprehensive, multimodal strategy for addressing freight transportation needs and moving goods efficiently and safely throughout the state. The plan identifies multimodal challenges, policies, programs, investment strategies and data needed to enhance freight mobility; to provide efficient, reliable and safe freight transportation; and to improve the state's economic competitiveness.

Texas Rail Plan Update, 2019

The *2019 Texas Rail Plan Update* (October 2019) was performed by TxDOT to update the 2016 State Rail Plan. It is a federally mandated document detailing the state of the rail system in Texas and opportunities for improvement. It sets the direction for rail planning and project development. The Plan was developed in conjunction with the Texas Freight Mobility

Plan and the Texas Transportation Plan 2040 and recommends potential short- and long-range freight and passenger projects to meet the state's identified rail needs.

Houston-Galveston Area Council (H-GAC) Regional Thoroughfare Plan Map, 2020

H-GAC's *Regional Thoroughfare Plan Map* (revised October 2020) is comprised of existing thoroughfare plans located within the eight-county transportation management area (Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties). This long-range (50+ years) map identifies the general location and type of transportation corridor needed to meet projected long-term growth in the region; it is a tool that allows a City or County to preserve right-of-way for the development of a transportation system as the need arises. The thoroughfare plans of the eight-county transportation management area complement each other so the roadway network performs as a well-coordinated, efficient, and effective roadway system.

Houston-Galveston Area Council Regional Goods Movement Plan, 2013

The *H-GAC Regional Goods Movement Plan* (June 2013) was developed to present a long-range plan for the goods movement system in the Houston-Galveston region. The plan is the final product of the H-GAC Regional Goods Movement Study, a multi-year effort to collect data, conduct analysis, and engage with regional stakeholders covering multiple aspects of the region's goods movement system. The study identifies short-term and long-term physical, operational, and institutional deficiencies; it concludes presenting project solutions and policy recommendations that are designed to address all these deficiency types. Examples of short-term actions include: formally define and designate the freight-significant network; create a regional goods movement subcommittee; develop a concept of operations for a freight ITS Program. Examples of long-term actions include: provide access to growing economic centers outside of the urban core; update freight-significant network with each long-range plan update; and develop climate change adaptation strategies.

Economic Impact of Freight Rail Improvements in Texas, 2016

The *Economic Impact of Freight Improvements in Texas* (December 2016) was developed by TxDOT and examines the "business case" for public sector participation in freight rail investment by TxDOT by providing an understanding of the economic impact of freight rail in Texas at both current and projected future levels of freight activity. The study's findings support the development of an evaluation framework by which the appropriate State role in the implementation of future freight rail projects can be assessed as each opportunity arises. The report includes a macroeconomic impact analysis and benefit-costs analysis, case studies of previous freight rail investments in Texas, a local economic development assessment, and an economic impact analysis of the selected potential investments.

Ports Area Mobility Study, 2020

The *Ports Area Mobility Study Draft Report* (January 2020) was developed by H-GAC as a follow-up study to the H-GAC Regional Goods Movement Plan completed in 2013 to analyze supply chain connections between the four major ports located within the H-GAC region; Port of Freeport, Port of Galveston, Port of Houston, and Port of Texas City. The report provides a better understanding of the supply chains linking these four ports and identifies potential port-related mobility improvements and alternatives. The study also identifies and assess a range of suggested infrastructure and multimodal improvements as well as operational strategies and policy-level changes to improve mobility.

Gulf Coast Rail District HB&T West Belt Improvements Study, 2012

The *HB&T West Belt Improvements Study* (January 2012) was developed by the Gulf Coast Rail District. The Houston Belt & Terminal Railroad's West Belt Subdivision is an approximately 9-mile double-track rail line, which runs between East Downtown Houston and the Greater East End. The study identifies improvements to eliminate all twelve at-grade crossings on the West Belt Subdivision between Cullen Boulevard and railroad Tower 26 near Lyons Avenue just north of I-10 in order to create a grade-separated sealed corridor on one of the busiest rail lines in Houston.

Neches River Bridge Feasibility Study, 2013

The *Neches River Bridge Feasibility Study* (June 2013) was developed by TxDOT and evaluates the feasibility of rail corridor system improvements at or near the existing Neches River rail bridge crossing in the City of Beaumont, Texas. The Neches River is a navigable waterway, and the railroad lift bridge is raised in order to allow river traffic to pass but restricts train movements during those times. The study evaluates rail movements and operations within the study area, identifies opportunities to increase rail efficiency, analyzes potential alternatives and improvements to the existing bridge and rail alignment, and determines the physical and financial viability of such potential improvements. A preferred alternative is not identified; the material presented is intended to inform decision makers for potential advancement.

Fort Bend Bypass Report, 2010 and Phase 2, 2015

The *Fort Bend Bypass Report* (June 2010) was developed by the Gulf Coast Rail District (GCRD) and summarizes the evaluation of the feasibility of a freight rail bypass corridor to enhance mobility in Fort Bent County. Multiple options were investigated for rerouting freight trains from the Union Pacific Railroad's (UPRR) Glidden Subdivision to create opportunities for commuter rail along US 90A through Fort Bend County while simultaneously creating potential value for Union Pacific Railroad as the owner. Ten alternative bypass freight routes, reaching from San Antonio to Houston, were developed, and based on several factors

(operations, environmental impacts, capital cost and economic potential) two were selected to be evaluated in further detail.

The *Fort Bend Bypass Study – Phase 2* (June 2015) is a benefit-cost analysis of three alternatives for a Fort Bend Bypass corridor in Greater Houston and Fort Bend counties based on the initial report. This analysis calculates the economic impact of each alternative compared with present freight railroad operations. Non-monetized impacts of the bypass also were identified and graded qualitatively, and the bypass options were then compared among themselves based upon the monetized and non-monetized impacts. The study concludes that the implementation of a freight rail bypass through Fort Bend County is technically feasible; potential public and private sector benefits could arise from the implementation of each of the three potential bypass corridors.

The report notes selection of the preferred bypass option to advance for further study will depend upon the weight given by the public and private railroad stakeholders to the public non-monetized impacts and the private railroad monetized impacts.

Section 2: Data Collection & Existing Conditions

This section provides a summary of the data available for review within this report and the existing land features, rail network, and roadway network.

2.1 Data Collection

Information was collected as available via public sources and railroad owners through use of non-disclosure agreements (NDAs). Data from public sources include:

- Federal Railroad Administration (FRA) Grade Crossing Inventory database
- Texas Railroad Information Management System (TRIMS) database
- Available applicable studies within the region and state
- Traffic volumes as available from city, county, and state sources
- TxDOT Crash Records Information System (CRIS)
- Identified roadway and rail improvements in the Statewide Transportation Improvement Program (STIP), H-GAC 2040 Regional Transportation Plan (RTP), and the South East Texas Regional Planning Commission (SETRPC) Metropolitan Plan – 2040
- State, city, and county improvements identified in respective plans or discussions
- Aerial mapping and photos/street view through Google Maps and Google Earth
- GIS information such as publicly available utility (Texas Railroad Commission), Federal Emergency Management Agency (FEMA) floodplain, land use (ESRI, H-GAC, Texas Historical Commission, TxDOT, Texas Natural resources Information System), public buildings, facilities and infrastructures (H-GAC, THC, Open Street Map (OSM), TxDOT, National Audubon Society, Texas Education Agency), archaeological (THC, TxDOT), environmental data (Texas Park & Wildlife, US Fish and Wildlife Services, Texas Water Development Board, Texas Commission on Environmental Quality, US Forest Service, Natural Resources Conservation Service), and survey data (US Geological Survey)
- Public information as applicable for estimating ROW acquisition costs
- Unit cost data for construction from TxDOT and other sources

Additional railroad information was provided by Union Pacific Railroad and BNSF Railway as part of each owner's NDA. Kansas City Southern Railway was not participatory in this study and did not provide additional data for use. Railroad data include:

- Track charts for subdivisions within the region
- Timetables for subdivisions within the region
- Train volumes for modeling purposes

- Additional operating details through stakeholder input

Stakeholder meetings comprised of railroad owners, Houston-Galveston Area Council (H-GAC), South East Texas Regional Planning Commission (SETRPC), Gulf Coast Rail District (GCRD), TxDOT districts, City of Houston, and regional ports also provided input and data through discussions.

Data utilized for portions of the report are summarized in the applicable report sections.

2.2 Existing Conditions

The 11-county study area includes Brazoria, Chambers, Fort Bend, Galveston, Hardin, Harris, Jefferson, Liberty, Montgomery, Orange, and Waller Counties, and these counties contain major railroad, roadway, and port facilities vital to the national freight network. The following subsections discuss the study area's general geography and population centers, critical origin/destination locations, its regional rail network, and its roadway system.

Regional Geography

The study area lies largely in the northern portion of the Gulf coastal plain, a 40- to 50-mile-wide swath along the Texas Gulf Coast. Elevation increases approximately one foot per mile inland and is generally flat. Northern and eastern portions of the study area are largely forested, while the southern and western portions are predominantly prairie grassland with coastal areas comprised of primarily prairie and sand.

Surface water in the Houston region generally consists of lakes, rivers, and an extensive system of bayous and manmade canals that are part of the rainwater runoff management system. Many of these features are either formed or managed through dams, spillways, and reservoirs. As an example, approximately 25% to 30% of Harris County lies within the FEMA 100-year floodplain.¹

The region's flat topography, susceptibility to high-intensity rainfall events, high percentage of impervious (paved) surface, and inadequately sized natural drainage channels make it particularly susceptible to catastrophic flooding events.²

Regional Population Centers

The 11-county study area encompasses 142 incorporated cities with a total population of 7.4 million in 2019 and a projected population of 9.5 million and 13.6 million in 2030 and

¹ <http://www.texasbest.com/houston/geograph.html>

² Vartabedian, Ralph (August 29, 2017). "For years, engineers have warned that Houston was a flood disaster in the making. Why didn't somebody do something?". *Los Angeles Times*.

2050, respectively³. Harris County, with a population of 4.7 million in 2019, is the third most populous county in the nation; the city of Houston, with a population of 2.3 million in 2019, is the fourth-most populous city in the nation⁴.

Other major population centers with greater than 100,000 inhabitants include League City (Galveston County), Pasadena (Harris County), Pearland (Brazoria, Fort Bend, and Harris Counties), Sugar Land (Fort Bend County), and Beaumont (Jefferson County).

Population is expected to further concentrate in urbanized areas and existing population centers. As population concentrates in the state's urban areas, freight movement to consumers will be focused in these areas, increasing pressure on already congested roadways. In addition, as population increases in urban areas, so do land prices. This has the effect of pushing more freight industry and freight-intensive activities to the rural regions where land is more cost-effective⁵.

Critical Origin/Destination Locations

Harris County is the largest origin/destination port related trucking pair for imports and for exports within the region, and 40% of internal port-related truck origin/destination patterns within the study area move within the three port counties (Harris, Brazoria, and Galveston). These same three counties account for 25% of truck tons moving outbound and 36% of truck tons moving inbound within the region. For outbound port-related truck movements, the leading Texas destinations include Fort Bend, Jefferson, Montgomery, Dallas, Bexar, Tarrant, Matagorda, and Travis counties⁶.

The study area is a major origination and termination point as well as an extensive overhead throughput route within the national rail network rather than a hub or transit point⁷. In a broader context, Texas serves as a critical gateway for the nation's strategic trade relationships with Mexico, Central America, and South America with I-35, I-10, and multiple rail corridors connect these countries. Trade with Mexico relies on efficient highway and rail transportation in Texas, including both freight destined for the state and freight moving through to another market⁸.

³ Texas Demographic center, <https://demographics.texas.gov/Data/TPEPP/Projections/>, accessed October 2020

⁴ Houston Facts 2020, Greater Houston Partnership: https://www.houston.org/sites/default/files/2020-08/Houston%20Facts%202020_1.pdf

⁵ Texas Freight mobility Plan 2018; <https://ftp.txdot.gov/pub/txdot/move-texas-freight/studies/freight-mobility/2018/plan.pdf>

⁶ H-GAC Greater Houston Freight Committee, August 27, 2018; <http://h-gac.com/freight-planning/greater-houston-freight-committee/documents/20190827%20FINAL%20GHFC%20Presentation.pdf>; access October 2020

⁷ H-GAC Regional Good Movement Plan, June 2013; <http://www.h-gac.com/freight-planning/documents/HGAC-regional-goods-movement-plan-12-05-13.pdf>; access October 2020

⁸ Texas Freight Mobility Plan 2018; <https://ftp.txdot.gov/pub/txdot/move-texas-freight/studies/freight-mobility/2018/plan.pdf>

Existing Rail System

Three Class 1 Railroads operate within the project's study area: Union Pacific Railroad (UPRR), BNSF Railway (BNSF), and Kansas City Southern Railway (KCS). The Port Terminal Railroad Association (PTRA) provides access to facilities along the Port of Houston Ship Channel, and the three Class 1 railroads within the region and the Houston Belt and Terminal Railway Company (HB&T) are partners in PTRA's infrastructure improvements. These railroads are the focus of the RTC modeling and proposed capacity enhancements as they constitute nearly all railroad freight movements within the region.

UPRR, BNSF, and KCS own an approximate length of 1,010 subdivision miles located throughout the 11-county study area. Table 2.2.1 summarizes the track mileage by railroad owner within each county within the region. Note that these lengths do not include trackage rights provided by the railroad owner to other railroads.

Table 2.2.1 Class 1 Subdivision Mileage by Railroad and County within Study Area

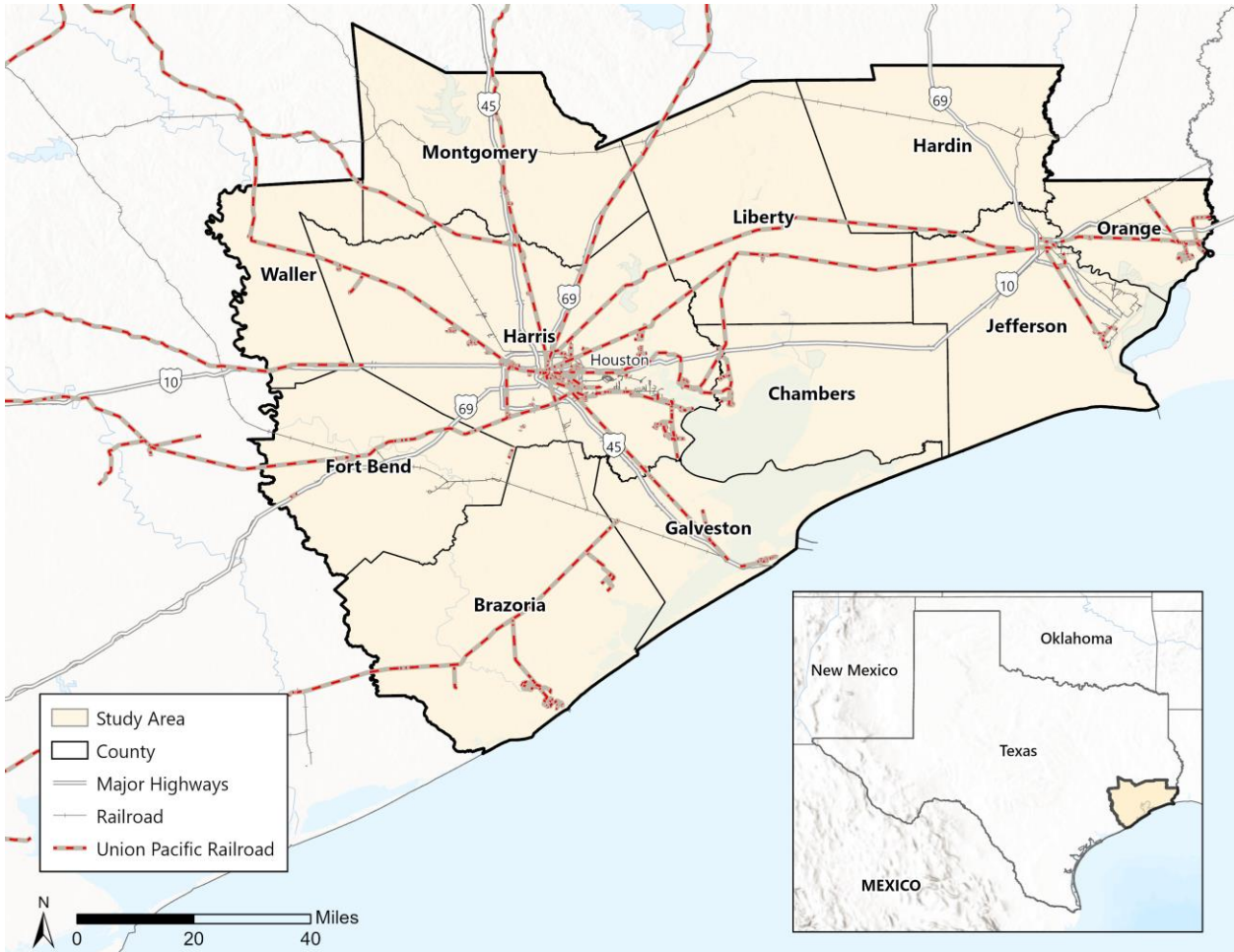
County	UPRR Subdivision Length	BNSF Subdivision Length	KCS Subdivision Length	HB&T Subdivision Length	Total Miles Subdivisions
Brazoria	46	12	-		58
Chambers	4	-	-		4
Fort Bend	38	38	12		88
Galveston	26	25	-		51
Jefferson	32	19	22		73
Hardin	17	45	-		62
Harris	254	50	-	15	319
Liberty	84	28	-		112
Montgomery	57	72	-		129
Orange	73	-	20		93
Waller	21	-	-		21
Total	652	289	54	15	1,010

(Mileage reflected in this table includes corridor length on subdivisions only. Additional mainline tracks, industrial leads, sidings, and trackage rights are not included.)

Union Pacific Railroad

UPRR is the primary Class 1 railroad within the region and owns the majority of the mainline track and maintains the highest percentage of operable track (owned and trackage rights) of the Class 1 railroads. UPRR owns most of the tracks within the central Houston area; has major classification yards Englewood, Settegast, and Lloyd Yards; two intermodal facilities Bringhurst and Settegast (note that since this study started the Bringhurst facility has been consolidated with Settegast); and a number of smaller yards operating in this area. Figure 2.2.1 shows the UPRR-owned tracks and major facilities within the study area.

Figure 2.2.1. UPRR Rail Infrastructure within Study Area



Generally, UPRR routes near downtown Houston have multiple mainline tracks while the outlying subdivisions are single-mainline track with sidings. The primary subdivisions downtown that have significant double-track segments are the Glidden, Palestine, and Strang Subdivisions. Table 2.2.2 summarizes the existing UPRR-owned track by subdivision, county, and begin/end points of the subdivision.

Table 2.2.2 Existing UPRR Subdivisions within Study Area

UPRR Subdivision	Length within Study Area (miles)	Counties within Study Area	Subdivision Start	Subdivision End
Angleton	47	Brazoria, Galveston	Placedo, TX	Algoa, TX
Baytown	49	Harris, Chambers, Liberty	Houston, TX – North Shore Jct.	Dayton, TX
Beaumont	79	Harris, Liberty, Hardin, Jefferson	Houston, TX – Gulf Coast Jct.	Beaumont, TX
Eureka	54	Harris, Waller	Navasota, TX	Houston, TX - Eureka Jct.
Galveston	47	Harris, Galveston	Houston, TX - South GH&H Jct.	Galveston, TX
Glidden	34	Fort Bend	Houston, TX – West Junction	Kirby, TX
Harrisburg	11	Harris	Houston, TX – West Junction	Houston TX - Harrisburg Junction
Houston	98	Harris, Liberty, Jefferson, Fort Bend	Houston, TX – West Junction	Beaumont, TX
Lafayette	75	Jefferson, Orange	Beaumont, TX	Iowa Junction, LA
Lufkin	46	Harris, Liberty, Montgomery	Houston, TX – Tower 20	Cleveland, TX
Navasota	27	Harris, Waller, Montgomery	Spring, TX – Spring Junction	Fetzer, TX
Palestine	50	Harris, Montgomery	Houston, TX – Belt Junction	New Waverly, TX
Rosenberg	3	Fort Bend	Rosenberg, TX	Rosenberg, TX
Strang	21	Harris	Houston, TX – South Tower 68	La Porte, TX

(Mileage reflected in this table includes corridor length on subdivisions only. Additional mainlines, industrial leads, sidings, and trackage rights are not included.)

BNSF Railway

BNSF is a Class 1 railroad that owns five major subdivisions and has trackage rights on many of UPRR's subdivisions within the study area. BNSF also owns or leases yards within the region, including Mykawa, New South, and Old South Yards. Generally, BNSF subdivisions are single-mainline tracks with sidings at strategic locations within the study area. Figure 2.2.2 shows the BNSF-owned tracks and major facilities within the study area, while Table 2.2.3 summarizes the existing BNSF-owned track by subdivision, county, and begin/end points of the subdivision.

Figure 2.2.2. BNSF Rail Infrastructure within Study Area

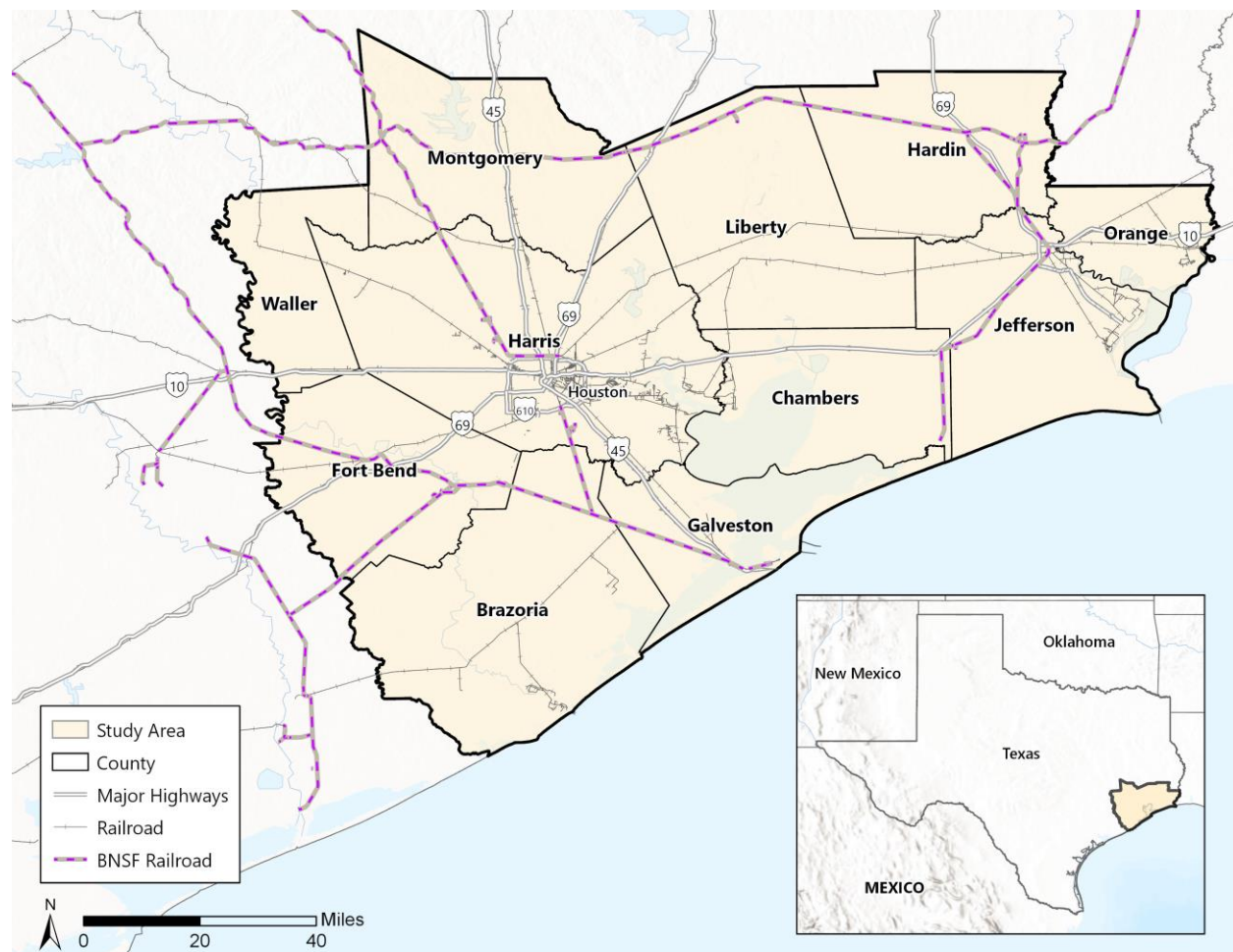


Table 2.2.3 Existing BNSF Subdivisions within Study Area

BNSF Subdivision	Length within Study Area (miles)	Counties	Subdivision Start	Subdivision End
Conroe	105	Montgomery, Liberty, Hardin	Dobbin, TX	Silsbee, TX
Galveston	80	Harris, Galveston, Fort Bend	Galveston, TX	Arcola, TX
Houston	55	Harris, Montgomery	North Houston, TX – Shepherd Dr.	Dobbin, TX
Mykawa	19	Brazoria, Harris	Alvin, TX	Cullen, TX - T&NO Junction
Silsbee	30	Jefferson, Hardin	Beaumont, TX	Silsbee, TX

(Mileage reflected in this table includes corridor length on subdivisions only. Additional mainlines, industrial leads, sidings, and trackage rights are not included.)

Kansas City Southern Railway

KCS is a Class 1 railroad that owns 54 miles of track within the study area on the Rosenberg and Beaumont Subdivisions. KCS also has trackage rights on about one-third of the UPRR and BNSF subdivisions in the region. Figure 2.2.3 shows the KCS-owned tracks and major infrastructure within the study area (including the Neches River bridge), while Table 2.2.4 summarizes the existing KCS-owned track by subdivision, county, and begin/end points of the subdivision.

Figure 2.2.3. KCS Rail Infrastructure within Study Area

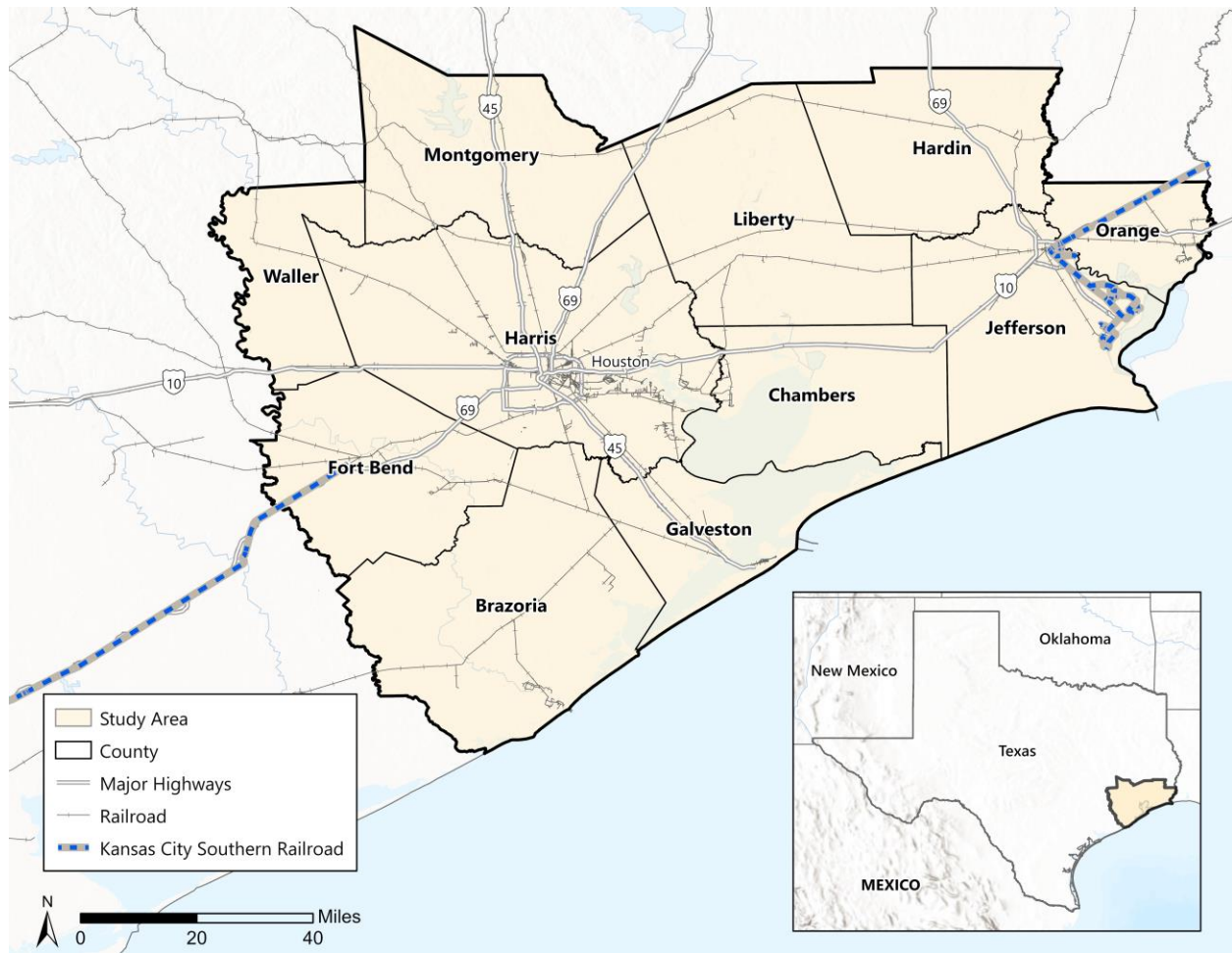


Table 2.2.4 Existing KCS Subdivisions within Study Area

KCS Subdivision	Length within Study Area (miles)	Counties	Subdivision Start	Subdivision End
Rosenberg	12	Fort Bend	Rosenberg, TX	Kendleton, TX
Beaumont	42	Jefferson, Orange	Port Arthur, TX	Mauriceville, TX

(Mileage reflected in this table includes corridor length on subdivisions only. Industrial leads, sidings, and trackage rights are not included.)

Houston Belt & Terminal Railway

The Houston Belt and Terminal Railway (HB&T) provides trackage rights to UP, BNSF, and KCS along the West Belt and East Belt Subdivision. The subdivision runs from Belt Junction south to Tower 81/T&NO Junction. Figure 2.2.4 shows the HB&T-owned tracks and major

infrastructure within the study area, while Table 2.2.5 summarizes the existing HB&T-owned track by subdivision, county, and begin/end points of the subdivision.

Figure 2.2.4. HB&T Rail Infrastructure within Study Area

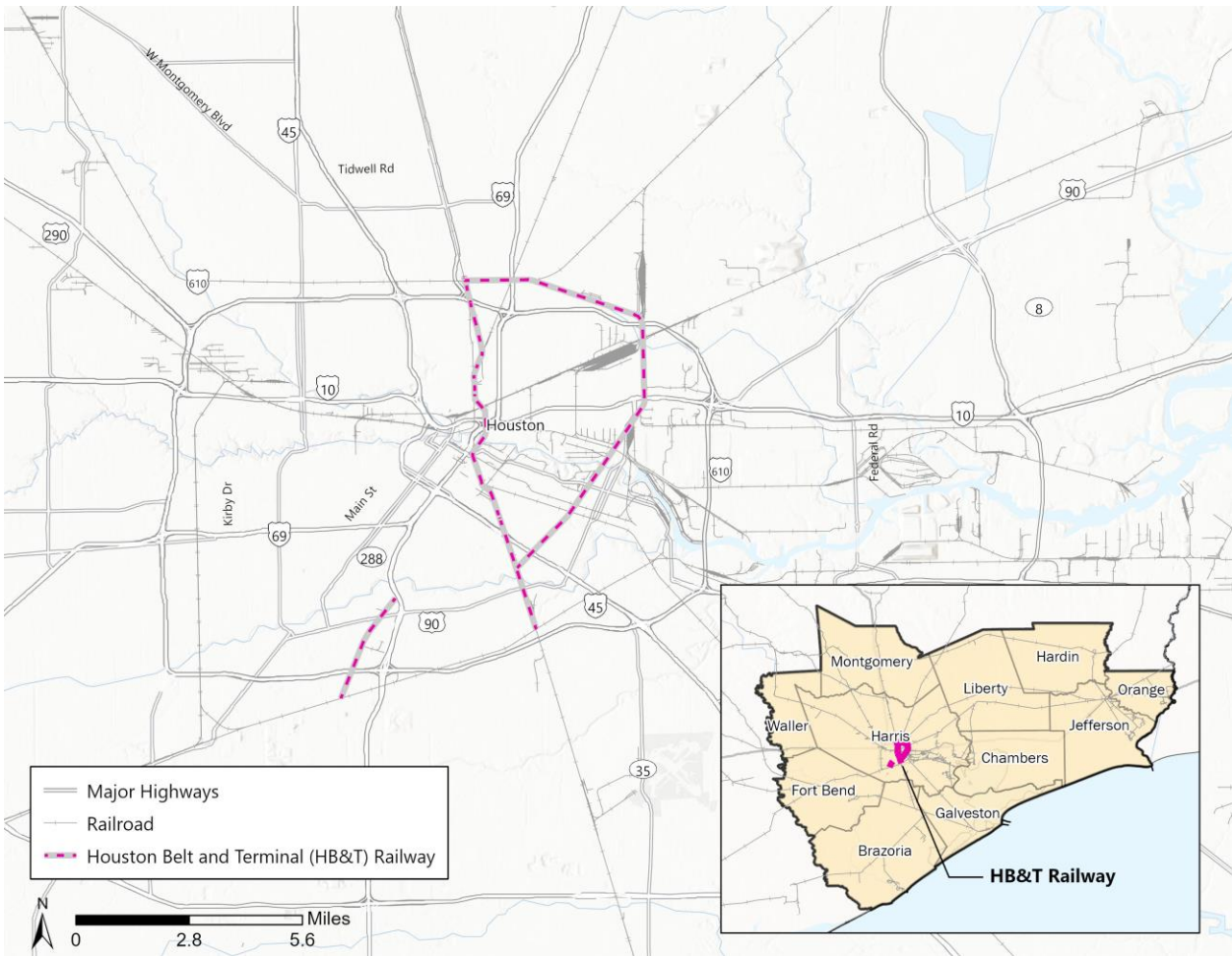


Table 2.2.5 Existing HB&T Subdivisions within Study Area

HB&T Subdivision	Length within Study Area (miles)	Counties within Study Area	Subdivision Start	Subdivision End
Houston East Belt	11	Harris	Houston, TX – Texas Spur 5	Houston, TX – Belt Junction
Houston West Belt	15	Harris	Houston, TX – T&NO Junction (Tower 81)	Houston, TX – Belt Junction

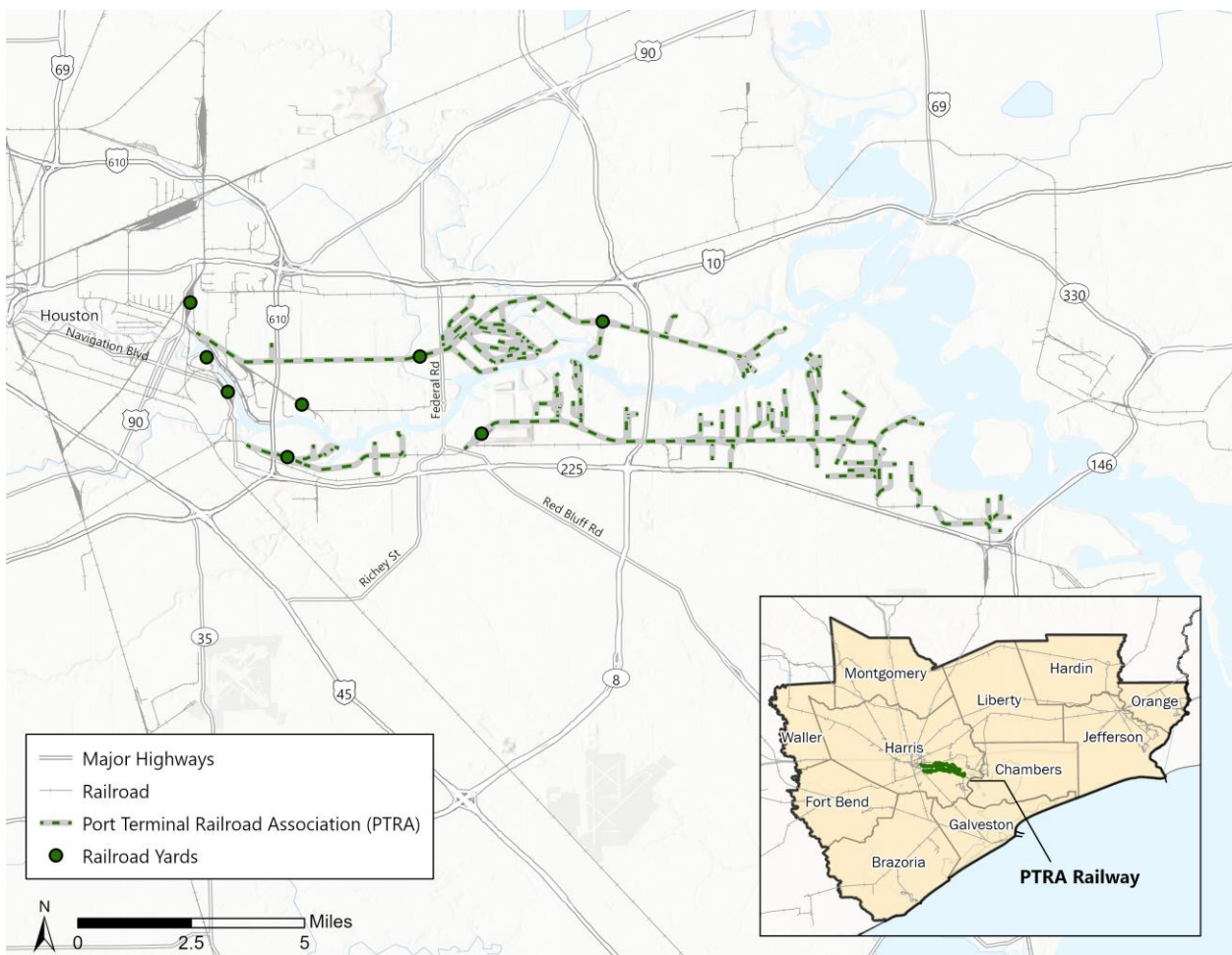
(Mileage reflected in this table includes corridor length on subdivisions only. Industrial leads, sidings, and trackage rights are not included.)

Port Terminal Railroad Association

PTRA is a terminal switching company in Houston that was formed in 1924 to provide access to the industries along the Port of Houston Ship Channel for all railroads entering Houston. Through mergers and acquisitions, the PTRA is an Association of the Port of Houston, UPRR, BNSF, and KCS.

The PTRA has a total yard capacity of 5,000 railcars, and spots and pulls 2,500 industry cars per day. PTRA services 226 local customers from 7 serving yards from both sides of the Port of Houston Ship Channel and maintains 154 miles of track and 20 bridges.⁹ Major yards include North Yard, Manchester, and Pasadena. Figure 2.2.5 shows the PTRA-owned tracks and major infrastructure within the study area.

Figure 2.2.5. PTRA Rail Infrastructure within Study Area



⁹ PTRA Website: <https://www.ptra.com/index.php/about-us/ptra-operationsinfrastructure.html>

Existing Roadway Network

The roadway network and the trucks that use it play an important role in the freight last-mile distribution in the region; trucks perform these final pick-up and delivery operations for millions of tons of commodities that are handled not only by the truck industry but also by other transportation modes.

The interstate system forms the backbone of the study area's roadway freight network. The east-west route of I-10 and the north-south route of I-45 provide connectivity to the major cities within the region, and the I-69/US 59 corridor moves freight along the Texas Gulf Coast south toward the U.S.-Mexico border. Additionally, corridors that also connect other portions of the region include loops such as I-610, Beltway 8/Sam Houston Parkway, and Grand Parkway.

The region's roadway network is densest within Harris County and adjacent areas within the Grand Parkway loop. Other areas of noted roadway density are the Beaumont city limits, the I-45 corridor south to Galveston, and along I-69 to Richmond/Rosenberg.

Connectivity to the ports via the roadway network is facilitated by intermodal connectors. These are short roadway segments averaging less than two miles in length that link airport, seaport, and rail terminal facilities to mainline transportation corridors. There are 21 freight-related intermodal connectors in the H-GAC region¹⁰.

¹⁰ H-GAC Regional Goods Movement Plan, June 2013; <http://www.h-gac.com/freight-planning/documents/HGAC-regional-goods-movement-plan-12-05-13.pdf> ; access October 2020

Section 3: Railroad Project Determination and Results

To determine constraints and potential solutions within the region's freight rail network, a Rail Traffic Controller model was created. The section provides a summary of the railroad operations modeling methodology, railroad project determination and results.

3.1 Railroad Operations Modeling Methodology

In order to quantify the potential impact of an infrastructure or operational change, a railroad operations simulation model is used. The model used for this study is Berkeley Simulation Software's RTC. RTC is used by all Class 1 railroads and is the railroad industry standard for the simulation of both passenger and freight train operations.

RTC requires detailed operations and infrastructure inputs and attempts to resolve conflicts between trains in the same manner as an actual railroad dispatcher. This allows for quantification of "what-if" scenarios including increased volumes, changes in infrastructure, and changes in operations. This tool was used to identify potential projects and calculate the potential benefits the proposed projects.

In order to quantify the benefits of the projects, first a "Base" model is built and validated using current infrastructure and operations. From this model, anticipated future train growth and already planned or under construction infrastructure are added as the "No Build" Scenario. The models were reviewed to identify current bottlenecks in order to identify potential projects and corresponding operational changes. Finally, these operational and infrastructure "Build" scenarios were modeled to determine their potential benefit. This is the standard methodology used by all users of the model.

RTC Model

RTC models require detailed inputs in order to accurately reflect current railroad operations. The track infrastructure in the model is based on links and nodes with each link containing information on the type (mainline, yard, grade crossing, etc.), speed and direction. Each node contains operational information (if it is a switch or signal), milepost, and elevation. Each train in the model is developed separately with characteristics including type, route, dwell time, priority, length, weight, and number of locomotives. This detailed information requires cooperation from the host railroads to accurately represent the current state of the railroad network.

Once the data has been input into the model the simulation logic runs the trains through their routes. During this trip, when a train wants to be in same place at the same time as another train a conflict is created. The model logic attempts to resolve these conflicts

between trains in the same manner as an actual railroad dispatcher. Generally, RTC and human dispatchers make their decisions based on many factors involved in train performance including:

- Priority
- Type of train
- Time available for the train and engine crew to work (allowable work hour limits)
- Train length and weight
- Locomotive power
- Scheduled work (i.e. locations and times trains drop off and/or pick up cars)

All other factors being equal, the model will generally minimize the total cost of delay to the trains involved in a “conflict”. The RTC dispatching logic will do this for all trains involved in any conflict or series of conflicts. Examples of conflicts are two opposing trains on single track lines or wye junction tracks and the need for a higher priority train to overtake a train ahead traveling in the same direction. Sometimes 25 or 30 trains may be involved in a related series of conflicts resulting in a ripple effect throughout the network.

While the model is good at measuring infrastructure capacity when dispatcher decisions are the sole constraint, there are many operational factors beyond dispatching conflicts that impact railroad capacity. These can include:

- Train failures or derailments
- Severe weather
- Grade-crossing incidents
- Maintenance-of-way track outages for capital programs
- Resource availability (crews and locomotives)
- Customer availability

Consequently, the model has the potential to provide more optimistic operational results than can be obtained in real-world railroad operations. Proper coding and discretion when evaluating simulation results are taken into account to help ensure that RTC results are reasonable and not overly optimistic.

Each simulation is based on a random “seed” that randomizes set variables in the model. This randomization helps represent the variability in train operations and makes sure the model is not providing results that are representative of any specific condition. RTC has the built-in ability to randomize a number of different factors including departure time, dwell time, and operator handling using a uniform distribution. However, North American freight railroad operation are highly variable and frequently do not follow a uniform distribution.

Therefore, in addition to the built-in RTC randomization tools, HNTB proprietary tools are used to allow for randomization of departure times so that each station dwell and train consist is randomized with a uniform, triangular, normal, log-normal or gamma distribution. This higher degree of randomization was used for future volume train lengths and dwell times, since the exact characteristics for future train traffic are unknown. This study uses at least twenty simulations per studied scenario.

Each RTC case will consist of a model warm-up, statistical period, and a cool-down. Only the trains that start during the statistical period are included in the statistical results. The purpose of the model warm-up and cool-down is to obtain a steady state of network operation. During the model warm-up period, trains populate the network allowing for the trains to enter into a fully populated network. The model cool-down period provides time for the trains that started during the statistical period to fully complete their simulation. For this study, each RTC case will consist of nine days with one day of model warm-up, seven simulation days, and one day of model cool-down.

Once a simulation is complete, the model provides detailed information for each train in the statistical period. These metrics include the simulated time and distance a train traveled by node as well as delay, fuel consumption, and train stop time.

Study Case Development

The RTC base case was developed using information provided by the railroads, which included RTC infrastructure, track charts, timetables, and train operations data. The RTC model was updated to match current track infrastructure including the location of signals, switches, grade crossings, sidings, and yard tracks.

On this infrastructure, operational files were constructed from records and data received from the railroads for the period of April 7-14, 2019. Railroads keep dispatching records of all train movements over subdivisions which can be produced from the dispatching system. The dispatching records include the identity of the train, consist, route, and time when it passed certain key recording points. Where railroad data was incomplete or not received, train volumes from the FRA Grade Crossing Inventory database were used. Once completed the model included over 2,500 trains of multiple types.

Railroad dispatching systems capture only part of the total rail activity. Rail movements in and around yards and terminals seldom appear in the dispatching data with enough detail to be described to a simulation model. Consequently, personnel at the railroads were interviewed to obtain this more detailed train information. Finally, this base case was reviewed in order to validate that it represents current operations in the complex.

Future Growth and No-Build Case Development

Once the “Base” case was validated, an adjusted base case, representing 2020, was developed to account for changes in operations and seasonal traffic. From this case 2030 and 2040 scenarios were developed.

Future train volumes were developed utilizing the Federal Highway Administration Freight Analysis Framework (FAF)¹. The framework provides, by commodity, projected freight growth by location and by transportation mode. The commodities were assigned to logical train types: merchandise, intermodal, bulk, auto, and oil to determine the railroad growth into and out of the Houston zone. These tons were used to determine the growth between 2020, 2030, and 2040 (Table 3.1.1).

Table 3.1.1 Percentage Growth in Freight Traffic from 2020

Train Type	2020-2030	2020-2040
Merchandise	22%	50%
Intermodal	58%	95%
Bulk	4%	11%
Auto	22%	52%
Oil	0%*	0%

*FAF Data has a growth rate of -16%, this was left at zero percent due to account for announced facility expansions since numbers were published.

These growth rates were applied to the existing train volumes in the model. These rates were reviewed with the railroad to correctly assigned the growth to existing lanes of traffic.

In addition to the general growth from FAF there is specific growth from customers in the region in the next five years that will increase train volumes. Using information on known new developments that will result in railroad traffic increases trains were added to the 2030 train volumes.

This projected future train growth represents growth that can occur assuming there is sufficient capacity on the freight rail network. Any demand the railroad network cannot

¹ https://ops.fhwa.dot.gov/freight/freight_analysis/faf/

support will be moved via modal shift (trucking). The network was unable to meet the projected 2030 train volumes.

Any additional projected growth that cannot be met without track infrastructure expansion will be assumed to be moved via modal shift (trucking). The capacity of the network is reached when the simulation cannot successfully complete the simulation or the operations result in unacceptable delays. The volumes will be added incrementally with the results evaluated for each volume level.

3.2 Railroad Project Selection

When a railroad has capacity constraints it has the potential to negatively impact the public. Any time the model attempts to move more trains through a section of track that is already occupied trains must wait (creating a delay) until the track clears. These delayed trains occupy track capacity and can delay subsequent trains. As the track nears capacity these delays become more common and can ripple throughout the network.

Railroad Congestion Impacts

Identifying and removing railroad capacity constraints are potentially beneficial to both the public and the private operator. Railroad congestion directly impacts the public through blocked at-grade crossings, increased truck traffic through modal shift, and increased emissions. Grade crossings blockage time increases due to trains sitting on crossings and more trains traveling slower. As trains back up the best locations to sit trains become occupied, ultimately to avoid gridlock on the railroad network trains end up sitting across crossings. Additionally, the increased delays reduce overall system velocity which result increased durations of blockages.

When routes reach capacity railroads are unable to add traffic without increases in operating cost and delays. This results in railroads unable to support additional traffic or the traffic must be rerouted, increasing travel times and costs. This results in diversion of traffic that would travel on the railroad onto trucks, increasing highway congestion.

When trains are delayed, they emit exhaust while sitting with engines running in idle; further, the additional trucks on the road from modal shift increase emissions that can negatively impact the health and livelihood of residents.

Types of Railroad Capacity Projects

Projects were identified through review of the results of the “Base” case RTC and discussions with key stakeholders. Three types of projects were identified:

- Mainline capacity
- Staging capacity
- Processing capacity

Mainline capacity adds track to allow for additional capacity between terminals for trains to meet or pass. Staging capacity provides locations for trains to sit due to constraints in terminals or for customers. Processing capacity provides mainline tracks in terminals to provide locations for trains to sit while crew changing or working in adjacent yards. Processing capacity can also be provided in yards to increase the ability of yards to process cars, allowing for trains to enter the and exit the yard more rapidly. Each of the types can provide multiple purposes; for example, mainline capacity can be used to hold trains out of terminals if needed.

3.3 Railroad Modeling Projects and Scenarios

After the “Base” case was developed and validated by participating Class I railroads, a review of the “Base” case’s current and future years was undertaken to better understand the network, train movements, and opportunities within the region. Proposed railroad improvement scenarios were developed for additional modeling through:

1. Identifying constraints within the network and verifying with stakeholders
2. Determining possible solutions for those constraints
3. Modeling solutions and adjusting improvements/train operations as appropriate

The “Base” case model was reviewed to identify initial constraints in the region’s network. These constraints were identified based on locations where a high number of trains experience delays. Delays are indicators of trains unable to advance due to congestion due to limited capacity ahead in the system. The limited capacity may be due to lack of sufficient track infrastructure or train operations that occupy the available track capacity.

The identified projects were combined into nine scenarios to study different constraint areas in the Houston complex. The following scenarios were developed and modeled within RTC to determine the impacts of the improvements as compared with the “Base” case. Exhibits have been created for these scenarios in Appendix A.

Simulation Findings and Results

Train delay is the primary output analyzed to assess the effectiveness of each railroad project on network performance. As discussed previously, when a railroad reaches capacity, they are unable to add traffic without increases in operating cost and further delays. Delays increase the probability and length of trains blocking public grade crossings as well as emit additional exhaust while trains sit idle.

For the purposes of comparing delay, this analysis focuses on mainline delay since this is both the most impactful to the public, but also the reflective of the network fluidity achieved by the projects. For each project, relevant subdivisions were analyzed to observe percent change in train delay compared to the “base” scenario. 2020 traffic was analyzed for these comparisons because 2030 simulations included train growth, making them unfit to compare to the “base” scenario. In this analysis the data for the UPRR Houston Subdivision is split at the historical boundary between the Terminal and Lafayette Subdivisions at Dawes (MP 353), which corresponds to the area in the central terminal area (Terminal) and the route between Beaumont and Houston (Lafayette).

Scenario 1 – Houston Terminal Yard Improvements

Background

Yard track lengths are shorter than most arriving and departing trains from two of the major UPRR yards within Houston (Englewood and Settegast). This causes many of the trains entering these yards to have to be split into multiple tracks and trains departing to be pulled from multiple tracks. This movement blocks mainline and yard track space, resulting in delays to all trains entering, departing or passing by the yard. Scenario 1 looks to lengthen tracks within the yards, which aims to minimize delays to other trains and increase the capacity of the terminal as a whole.

This scenario includes the following modeled improvements:

- Englewood Arrival Track Expansion – A portion of the tracks within Englewood Yard would be extended to 11,500 for arriving/departing trains. To accomplish this, intermodal services at adjacent Bringham Yard will be closed and transferred to Settegast Yard.
- Settegast Intermodal Yard Expansion – Existing tracks within Settegast Yard would be adjusted and connected to provide additional length for additional intermodal capacity.

Simulation Findings and Results

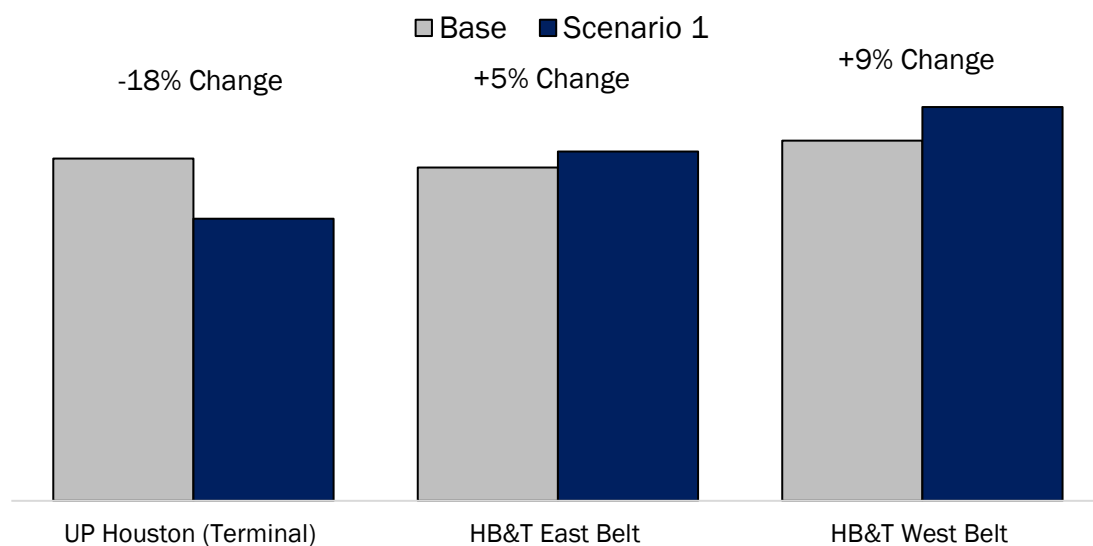


Figure 3.2.1 Scenario 1 Delay Analysis

Modeling showed that Scenario 1 is effective at reducing the delay on the UPRR Houston (Terminal) Subdivision by 18%, as seen in Figure 3.2.1. The increased track lengths allow longer trains to use the yard tracks without blocking the main lines and grade crossings.

However, this reduction in delay also results in some small increases in delay on the HB&T Houston East Belt and HB&T Houston West Belt. The expansion of Englewood modeled has limitations that resulted in additional delays on the other subdivisions. The track expansion, while eliminating the congestion caused by trains building into and out of the yard, also removed the parallel movements into and out of the yard. Additionally, trains leaving the new longer yard tracks towards the Strang Subdivision are now required to use the Belt Line, a 10 mph route with time-of-day limitations. Changes to the design might provide a higher benefit than obtained in this study. The longer yard tracks in Englewood improves the ability of the yard.

A benefit-cost analysis has been performed for Scenario 1, and a B/C ratio of 3.59 was calculated for all projects within the scenario based on USDOT-recognized benefits and anticipated construction cost. This includes public benefits such as reduction in emissions and avoided truck trips due to additional freight capacity. See Appendix D for additional information.

Scenario 2 – Houston Terminal Mainlines

Background

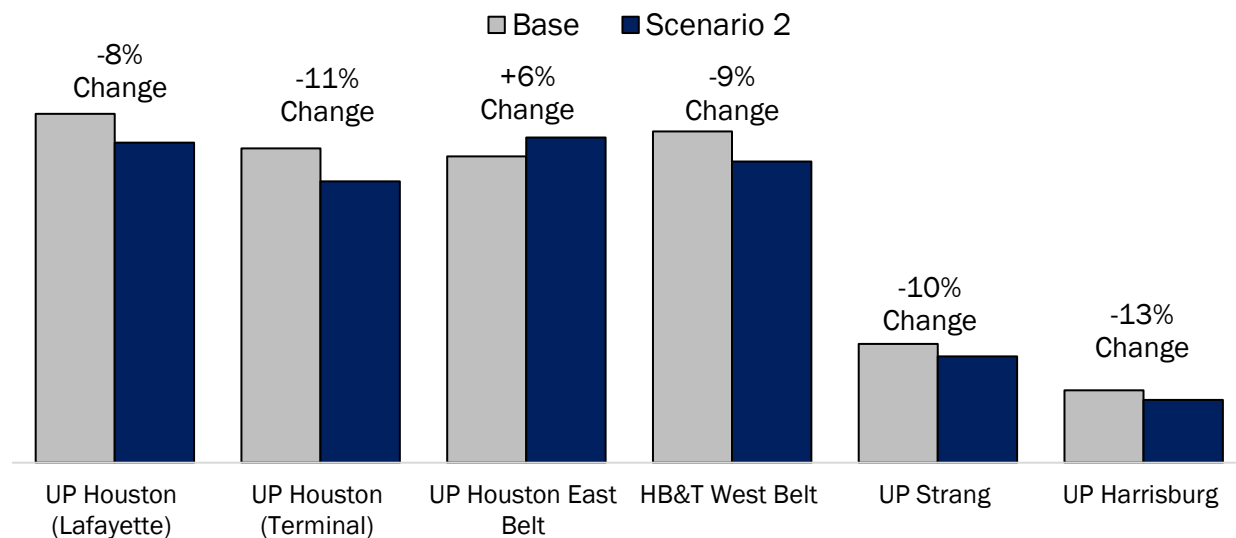
Due to the large number of trains passing through the Houston complex mainline tracks are often blocked due to trains departing and arriving, traveling between yards, and receiving crews. Current track configurations limit flexibility of train movements and require extra distance for a train to reach its destination. Further, existing single-track bridges create bottlenecks into and out of the complex.

The goal of Scenario 2 is to provide additional operational flexibility and capacity in the Houston complex area and includes improvements to the HB&T West Belt, HB&T East Belt, and UPRR Strang Subdivisions in the area. Additional track consists of additional mainlines, switching leads, and wye connections.

The following improvements are modeled as part of this scenario:

- Booth Second Mainline (Manchester Junction to PTR A North Yard) – This improvement adds a second track on the UPRR Strang Subdivision to provide extra flexibility on this track segment and includes two structures over Buffalo Bayou and Brays Bayou.
- Buffalo Bayou Bridge Second Mainline – This additional mainline track provides a new structure over Buffalo Bayou on the HB&T East Belt Subdivision to connect existing double-track areas on either side of Buffalo Bayou.
- Englewood Connection Track – The improved wye track connection near Englewood Yard between the Houston and West Belt Subdivisions is anticipated to provide a higher-speed movement and prevent trains from blocking trains working in the yard to increase capacity in the area.
- Belt Junction SE Wye Connection – This additional track at the wye connection at Belt Junction offers additional capacity between the HB&T West Belt and HB&T East Belt Subdivisions.
- Tower 76 Wye Connection – This improvement provides connectivity between the HB&T East Belt and Lufkin Subdivisions in the northwest quadrant of Tower 76. This allows for trains traveling to and from the Lufkin Subdivision to directly enter Settegast yard instead of additional distance through the terminal and worsening existing congestion. Potential impacts to properties in the area of this improvement are anticipated.
- Englewood Bypass – This proposed third mainline track would support bypassing Englewood Yard congestion from trains entering Settegast Yard from the south.

Figure 3.2.2 Scenario 2 Delay Analysis



Scenario 2 reduces delay for many of the subdivisions in the central terminal area including the UPRR Houston, HB&T West Belt, UPRR Strang and UPRR Harrisburg Subdivisions, as seen in Figure 3.2.2. The Buffalo Bayou Bridge Second Mainline provides a location in the terminal to hold trains clear of crossing, but also eliminates delays due to the single main track over the bridge. Trains that previously were delayed on other subdivisions now dwell on the HB&T East Belt increasing the delay on the subdivision but reducing overall delay and making it less likely for trains to blocking crossings on the UPRR Harrisburg and HB&T West Belt Subdivisions. The additional capacity enables additional trains on the UPRR Strang Subdivision.

A benefit-cost analysis has been performed for Scenario 2, and a B/C ratio of 1.90 was calculated for all projects within the scenario based on USDOT-recognized benefits and anticipated construction cost. This includes public benefits such as reduction in emissions and avoided truck trips due to additional freight capacity. See Appendix D for additional information.

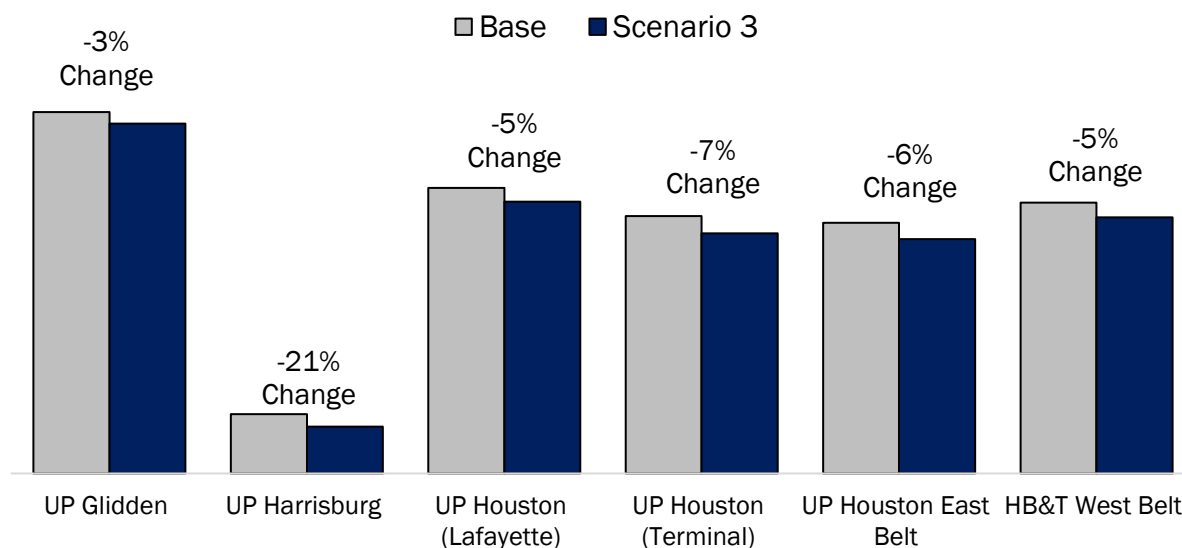
Scenario 3 – Houston Subdivision Mainline Consolidation

Background

The Houston Subdivision near downtown Houston currently splits into two mainline tracks. One track (freight main) traverses further north, traveling through the middle of a residential community while the other track (passenger main) travels to the south and through the edge of downtown. The Amtrak station is situated on the passenger main, and a reverse move from the passenger to freight main is needed to allow eastbound Amtrak trains to continue their routes. This scenario combines the freight and passenger mains across White Oak Bayou northwest of downtown to consolidate mainline services. The scenario would also move the Amtrak station closer to the Houston METRO (METRO) Burnett Station for connectivity to local transit service and would close grade crossing along the old freight and passenger mains. The scenario is understood to be contingent on adjustments at I-10 and I-45 to accommodate the realignment of tracks.

Simulation Findings and Results

Figure 3.2.3 Scenario 3 Delay Analysis



Scenario 3 is able to reduce delay on multiple subdivisions in the terminal, as seen in Figure 3.2.3, but is most impactful at reducing delay on the UPRR Harrisburg Subdivision. Trains travel between the Glidden Subdivision and Tower 26 via either T&NO Junction or Eureka and the segment with the proposed project. The project reduces congestion and provides a location near Englewood Yard to hold a train clear of grade crossings. This allows for trains to route via the new project and not T&NO Junction and the congestion on the HB&T West Belt. Consequently, this project reduces crossing blockage time due to slow moving trains or stopped trains both on the UPRR Houston (Terminal) and HB&T West Belt Subdivisions.

While there are operational benefits throughout the terminal the project does not enable additional growth.

A preliminary benefit-cost analysis has been performed for Scenario 3 based on USDOT-recognized benefits and anticipated construction cost. A B/C ratio of 0.44 was calculated for all projects within the scenario. This scenario is located within the project limits of the North Houston Highway Improvement Project, it is recommended that further analysis be conducted to determine additional benefits that could be recognized through coordination of both the highway and the rail projects together. See Appendix D for additional information.

Scenario 4 – Houston to Beaumont Improvements

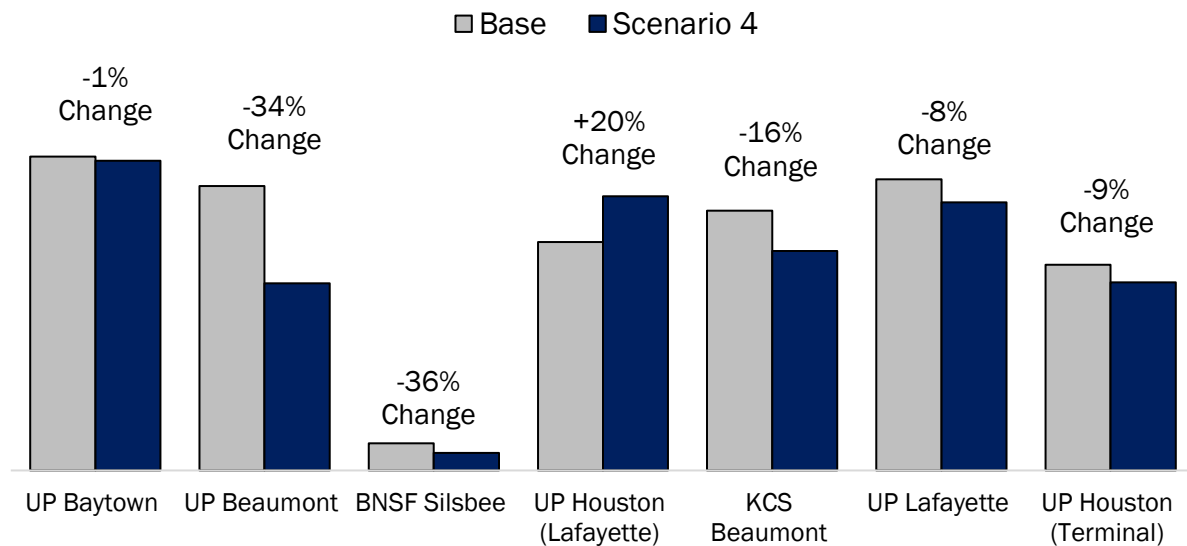
Background

Beaumont is a major junction to the east of Houston. KCS, BNSF, and UPRR all connect and share tracks in the Beaumont complex. Trains work at the local yards, and many trains stop to switch crews on the mainline in the complex. All three railroads use the UPRR Houston Subdivision for westbound movement and UPRR Beaumont Subdivision for eastbound movements. Congestion in Beaumont on the east end and Houston the west end creates delays on the two subdivisions. Dayton on the Houston Subdivision is major source of volume from the connection with the UPRR Baytown Sub and BNSF and UPRR yards.

The priority of Scenario 4 is to increase capacity through mainline yard bypasses, add mainlines at system constraint points, and extend or add new sidings to accommodate longer trains for passing/staging and crew changes.

This scenario includes the following modeled improvements:

- **Houston Subdivision Second Mainline Track (Fauna to Crosby)** – This second mainline track, which would connect existing sidings into a continuous track segment, would provide additional capacity closer to the Houston complex and storage as needed if there is congestion ahead in the Houston complex.
- **Neches River Bridge Second Mainline Track** – The existing Neches River bridge is a single-mainline lift bridge and is a constraint for train traffic in the area. The improvements include converting the structure to add a second mainline track to provide additional capacity across the river.
- **Dayton SE Wye Connection** – A design for changing the connection between the Baytown and Houston Subdivisions would relocate the existing wye tracks and add a southeast wye connection to eliminate the reverse move from the Dayton siding into Dayton Yard. As part of this effort, US 90 would be grade-separated to eliminate train-vehicle conflicts at the roadway.
- **Dayton Siding Extension** – This siding extension coincides with the Dayton track connection improvement and allows for staging of trains for Dayton Yard.
- **Kolander Siding** – The proposed siding between Houston and Beaumont allows for staging of trains outside of the Beaumont area.
- **Dyersdale Siding Extension** – The additional track length at Dyersdale siding would provide a second mainline track the crew change point and would provide a location for staging trains if there is congestion in the Beaumont area.
- **Beaumont Yard Bypass Track** – A proposed third mainline around the Beaumont Yard intends to improve fluidity at Beaumont Yard to limit impacts of trains entering and leaving the yard area.
- **Vidor South Siding Extension** – The additional track length on the southern side of Vidor Siding is proposed to be used to allow a storage and passing location for longer trains as well as a allowing for trains to change crews off the single-track mainline.

Figure 3.2.4 Scenario 4 Delay Analysis

Scenario 4 results in reduced delay on many subdivisions, but it most impactful on the UPRR Beaumont and BNSF Silsbee subdivisions, with a -34% and -36% reduction in delay respectively, as seen in Figure 3.2.4. This project results in an increase in delay on the UPRR Houston subdivision. The existing infrastructure has limited locations to hold trains clear of grade crossings between Beaumont and Houston. The Houston Subdivision Second Mainline Track and Dayton Siding enable trains, that were previously being held near Beaumont to be held closer to Houston. While increasing delay on the Houston Subdivision it has a net benefit on the region. The combination of the Beaumont Yard Bypass Track, Neches River Bridge, and Vidor Siding extension reduces delays 16% and enables westbound KCS trains that previously would need to sit across at-grade crossings while changing crews or waiting for trains to pass to not be delayed for sit clear of crossings. In the 2030 growth scenario, it is estimated that these improvements allow for two to four additional daily trains to run from Houston to Beaumont.

A benefit-cost analysis has been performed for Scenario 4, and a B/C ratio of 1.77 was calculated for all projects within the scenario based on USDOT-recognized benefits and anticipated construction cost. This includes public benefits such as reduction in emissions, avoided truck trips due to additional freight capacity, and reduction in traffic delay and crashes. See Appendix D for additional information.

Scenario 5 – BNSF Mykawa Yard Expansion

Background

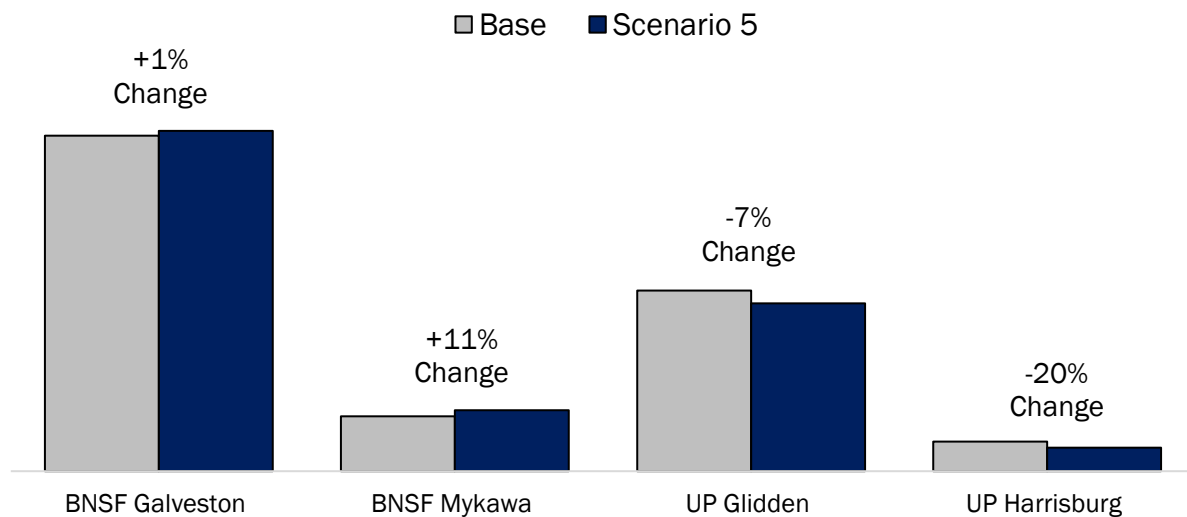
Besides the area near the UPRR Englewood and Settegast yards, the area near the BNSF New and Old South yards is a major source of congestion. The three yards, near the University of Houston, are the origin, destination, or crew change location for BNSF trains from the east, west, and south. The yard tracks in the two yards are much shorter than existing trains resulting in trains needing to switch on the mainlines.

The goal of Scenario 5 is to expand an existing BNSF yard in order to move the yard activities out of the mainlines on the HB&T West Belt Subdivision in the complex. Currently, many of BNSF trains traveling to the existing New and Old South Yards coming from the BNSF Galveston Sub connect onto the UPRR Glidden at Rosenberg. The trains then travel west from the Glidden Subdivision onto the UPRR Harrisburg Subdivisions and turn north at T&NO Junction. The expanded Mykawa yard is south of T&NO and it is not possible to construct the southwest wye at T&NO Junction, requiring trains to take a different route to the new yard. The trains will travel a longer distance by continuing on the BNSF Galveston Sub, location of Duke Siding, and then turning north onto the Mykawa Subdivision.

The following improvements are modeled as part of this scenario:

- Mykawa Yard Expansion – The expansion of the yard consists of additional tracks to the existing yard and replacement of existing hand-throw switches to power switches.
- Duke Second Track – To support adjusted train flows due to the expansion of Mykawa Yard, an increase in length to the Duke siding would be implemented to increase capacity. The limits extend to the Brazos River due to constraints of adding the bridge over the river.

Figure 3.2.5 Scenario 5 Delay Analysis



As would be expected, due the new routing of trains, delays increased on the BNSF Galveston and BNSF Mykawa Subdivisions with a reduction on the UPRR Glidden and Harrisburg Subdivisions as seen in Figure 3.2.5. The Duke Siding Extension does mitigate most of the impacts of the additional train traffic on the BNSF Galveston Subdivision. These improvements are intended to accommodate larger trains and increase yard fluidity, not just reduce main line delay. Because this is primarily a yard improvement, yard delay is significantly decreased on the HB&T West Belt Subdivision due to improved performance of the BNSF Mykawa Subdivision, which now takes on some additional traffic and delay. The rerouting of trains removes trains from the congested UPRR Glidden Subdivision with its large number of at-grade crossings.

A benefit-cost analysis has been performed for Scenario 5, and a B/C ratio of 6.12 was calculated for all projects within the scenario based on USDOT-recognized benefits and anticipated construction cost. This includes public benefits such as reduction in emissions, avoided truck trips due to additional freight capacity, and reduction in traffic delay and crashes. See Appendix D for additional information.

Scenario 6 – BNSF South Improvements

Background

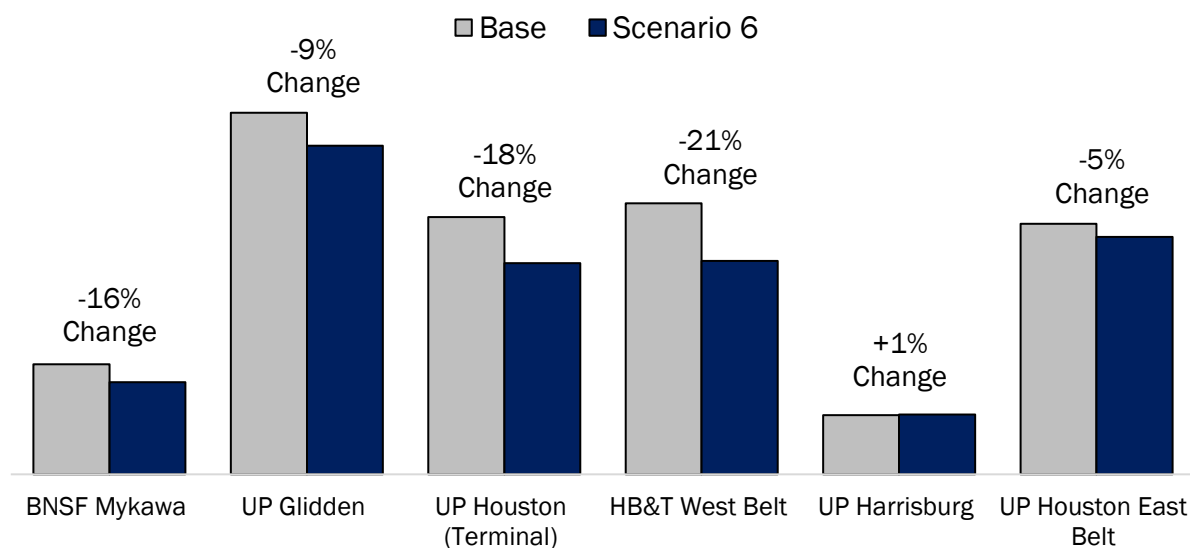
As discussed with Scenario 5, the BNSF yards are a source of congestion in the complex. To relieve this congestion additional mainline capacity is proposed. This will improve the ability to stage trains and bypass trains working in the nearby yards. The improvements look to increase mainline capacity near these BNSF yards through a mainline bypass track and an additional segment of mainline track.

This scenario includes the following modeled improvements:

- Texas Spur Third Main – The additional third mainline track would be utilized to bypass the BNSF North and South Yards near T&NO Junction and would provide bypass and staging capacity next to the yards.
- Mykawa Subdivision Second Track (T&NO Junction to Mykawa) – Adding a second track between T&NO Junction and Mykawa Yard is intended to increase the ability to switch trains out of the yard and move trains past those working at Mykawa Yard.
- MLK Siding – The siding is proposed to provide a location to stage trains before entering the HB&T West Belt Subdivision or the BNSF yards. This includes a grade separation of MLK Blvd to provide a sealed staging area.

Simulation Findings and Results

Figure 3.2.6 Scenario 6 Delay Analysis



The Scenario 6 projects all provide benefits to the HB&T West Belt Subdivision and correspondingly to the rest of the terminal as noted in Figure 3.2.6. The Texas Spur Third Main enables trains to crew change or bypass the congestion of the BNSF yard without blocking train movements. The extra track also provides a location to hold a train clear of

any grade crossings, reducing the risk of blocked crossings on the subdivision. The Mykawa Second Main reduces the delays of trains traveling from the West Belt to the South and allows trains switching the BNSF Old South Yard to not block those trains movements. The UPRR Harrisburg Subdivision had a slight increase in delay, but that is due to the MLK Siding that now provides an additional location to hold or meet trains clear of a crossing.

A benefit-cost analysis has been performed for Scenario 6, and a B/C ratio of 2.74 was calculated for all projects within the scenario based on USDOT-recognized benefits and anticipated construction cost. This includes public benefits such as reduction in emissions, avoided truck trips due to additional freight capacity, and reduction in traffic delay and crashes. See Appendix D for additional information.

Scenario 7 – Galveston Subdivision Improvements

Background

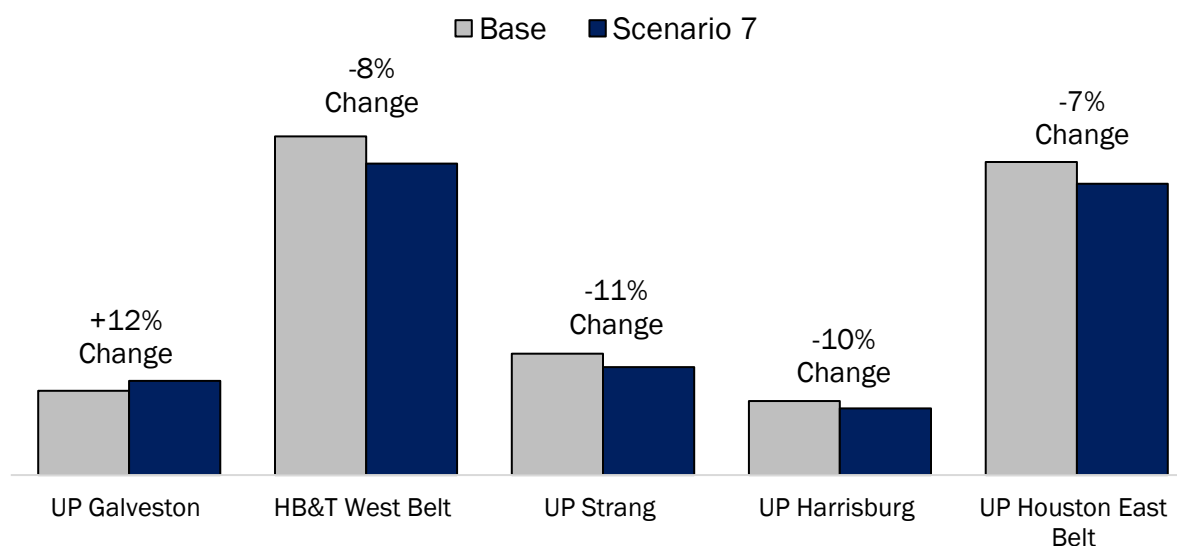
The Port of Galveston is an origin and destination of train traffic for both Union Pacific and BNSF. Union Pacific's connection is via the UPRR Galveston Subdivision. The subdivision is mostly not signaled and has short sidings that cannot accommodate train lengths over 6,700 feet. When multiple trains need to use the subdivision trains must hold at the port on the in Houston complex. At the north end of the subdivision the construction of a new wye track at Katy Neck and a second track will allow for increased flexibility of traffic to bypass the BNSF yards if there is congestion.

The goal of this scenario is to increase capacity along the mainline while providing additional connectivity through a new wye track. Other improvements include additional mainline track and a siding extension for staging/passing of longer trains.

The following improvements are modeled as part of this scenario:

- Tower 85 to Katy Neck Second Track – Adding a second mainline between the Katy Neck and Tower 85 is intended to reduce train traffic on the Bell Line and would increase capacity to bypass Booth Yard.
- Katy Neck NW Wye Connection – This new wye track in the Katy Neck's northwest quadrant would support movement from the Harrisburg Subdivision to the UPRR Galveston Subdivision. This improvement would also support future consolidation of tracks and reduce traffic around the BNSF operations on the West Belt Subdivision.
- Shell Siding Extension – The additional length of this siding allows for staging of trains and a passing location for longer trains along the UPRR Galveston Subdivision.

Figure 3.2.7 Scenario 7 Delay Analysis



The improvements from Scenario 7 provide benefit to multiple subdivisions in the terminal as seen in Figure 3.2.7. The delay on the UPRR Galveston Subdivision increases due to the ability to now meet or hold longer trains on the subdivision as compared to in the more congestion terminal area with the high density of crossings. The Katy Neck projects allow for trains to bypass the congested Houston West Belt reducing delays on the neighboring UPRR Strang, UPRR Harrisburg, UPRR Houston East Belt and HB&T West Belt Subdivisions.

A benefit-cost analysis has been performed for Scenario 7, and a B/C ratio of 1.46 was calculated for all projects within the scenario based on USDOT-recognized benefits and anticipated construction cost. This includes public benefits such as reduction in emissions, avoided truck trips due to additional freight capacity, and reduction in traffic delay and crashes. See Appendix D for additional information.

Scenario 8 – Hardy Improvements

The section of track adjacent to the Hardy Toll Road between Belt Junction and Spring is a major staging and crew change location. There is also a major UPRR yard and an automotive facility at the north end near Spring. Trains arriving from the Navasota or Palestine Subdivisions often stage and crew change for multiple hours just north of Belt Junction. If these staging/crew change locations are full of trains they must dwell on the mainlines, creating congestion for both north and south movements. Also, the tracks at the automotive facility are short resulting in originating and terminating trains blocking the mainlines.

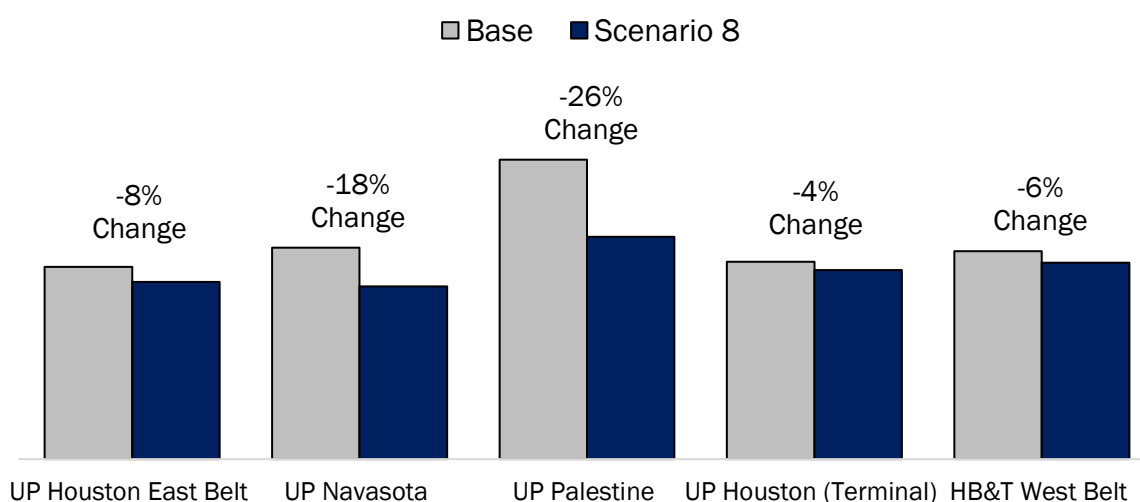
These improvements along the UPRR Palestine and Navasota Subdivisions are proposed to increase mainline capacity through creating additional staging and crew change points while providing solutions for potential constrained areas near Westfield Yard.

This scenario includes the following modeled improvements:

- Westfield Yard Lead Extension – A lengthening of the yard tracks at Westfield Yard is designed to reduce mainline blockage for building trains and yard work.
- Hardy Third Main – The additional mainline track would extend the slotting track to provide additional crew change capacity along the Palestine Subdivision.
- Hufsmith Second Track (Hufsmith to Spring Junction) – This second mainline track on the Navasota Subdivision is intended to increase mainline capacity and provide a staging location for longer trains.

Simulation Findings and Results

Figure 3.2.8 Scenario 8 Delay Analysis



As shown in Figure 3.2.8, the projects reduce delay on the UPRR Palestine Subdivision. Since this subdivision does not have many at-grade crossings it does not provide a new location to hold train, instead the Hardy Third Main and the Westfield Yard Leads move sitting trains off the two main lines, keeping them clear for train movements. The Hufsmith Double Track project eliminates any delays that would occur on the UPRR Palestine Subdivision and UPRR Navasota Subdivision due to the elimination of meet delays between Hufsmith and Spring Junction. The Hufsmith Double Track also reduces the risk of needing to block the crossings in the existing Hufsmith Siding that occurs when trains currently meet at the siding. In addition, less delay on the Palestine Subdivision trains means trains are less likely to need to hold on the subdivision while waiting for congestion to clear. Since trains are no longer holding on the main lines, there appears to be a residual effect on the delay for the UPRR Houston (Terminal), UPRR Houston East Belt and HB&T West Belt Subdivisions.

A benefit-cost analysis has been performed for Scenario 8, and a B/C ratio of 3.14 was calculated for all projects within the scenario based on USDOT-recognized benefits and anticipated construction cost. This includes public benefits such as reduction in emissions, avoided truck trips due to additional freight capacity, and reduction in traffic delay and crashes. See Appendix D for additional information.

Scenario 9 – Glidden Subdivision Improvements

The UPRR Glidden Subdivision from the Houston complex to Rosenberg has high volumes and includes BNSF, UPRR, and KCS train traffic within certain segments of the subdivision. Rosenberg is a major junction with traffic splitting between the KCS Rosenberg Subdivision, BNSF Galveston Subdivision, and the UPRR Glidden Subdivision. The Glidden Subdivision east of Rosenberg is single-track and a bottleneck for the high volumes of train traffic.

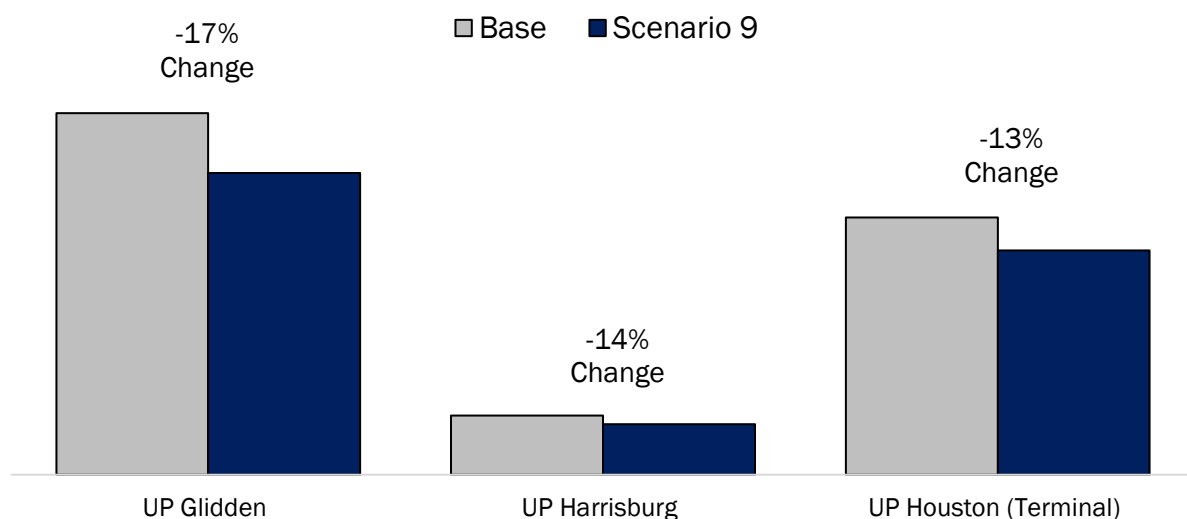
The Glidden Subdivision has large train volumes and has a priority of increased capacity. The proposed project aims to increase capacity by extending mainline tracks for entering yards within the Houston complex.

The following improvements are modeled as part of this scenario:

- Glidden Second Track (Harlem to Brazos River) – This additional mainline track essentially lengthens the Harlem siding to increase train capacity from the BNSF Galveston and Glidden Subdivisions.

Simulation Findings and Results

Figure 3.2.9 Scenario 9 Delay Analysis



As shown in Figure 3.2.9, the addition of the Glidden Second track reduces in delay on the UPRR Glidden Subdivision since the additional double track reduces any delays of trains waiting to traverse the single track and the corresponding possibility of blocking crossings. This increased fluidity also has a positive effect on the UPRR Harrisburg and UPRR Houston (terminal) Subdivisions delay performance.

A benefit-cost analysis has been performed for Scenario 9, and a B/C ratio of 2.59 was calculated for all projects within the scenario based on USDOT-recognized benefits and anticipated construction cost. This includes public benefits such as reduction in emissions, avoided truck trips due to additional freight capacity, and reduction in traffic delay and crashes. See Appendix D for additional information.

Section 4: Grade Crossing Screening Methodology and Results

There are over 2,000 roadway-rail grade crossings on freight railroad lines within the 11-county Houston-Beaumont region that allow interactions with automobiles/trucks and freight and passenger trains. While most of the time these crossings are free of through freight train movements, at other times delay to the traveling public occurs when trains are at the crossing and, in a worst-case scenario, incidents occur that may result in injury and/or delays to the railroad owner as well.

This report section reviews each grade crossing for potential impacts to vehicles through delay and incidents to determine potential projects for implementation to minimize or eliminate these challenges.

4.1 Screening Methodology

Potential Grade Separations

The methodology for identification of proposed grade separation locations uses a two-step process. First is a quantitative review based on calculations that focus on vehicular delay and incidents at the existing at-grade crossing. The second step is a qualitative analysis defining feasibility of implementing a potential grade separation due to existing constraints at or near the crossing.

Ongoing roadway-rail grade separation construction projects and funded near-term roadway-rail grade separation projects were identified prior to review of the grade crossings. These locations were removed from consideration due to anticipated near-term implementation.

The quantitative screening methodology for review of potential grade separation candidates is based on previous work completed by TxDOT for the November 2017 *Central Texas Grade Crossing Study*,¹ which evaluated highway-railroad at-grade crossings in Williamson, Travis, Hays, Comal, and Bexar Counties. The screening involves use of two primary quantitative determinants, the Texas Priority Index and Accident History, to prioritize highway-railroad at-grade crossing locations within the 11-county region.

In alignment with previous work completed from the *Central Texas Grade Crossing Study*, the Texas Priority Index will serve as the principal quantitative determinant of action at each

¹ TxDOT Rail Division. *Central Texas Grade Crossing Study*, November 2017. Includes Williamson, Travis, Hays, Comal, and Bexar Counties.

crossing. TxDOT's Texas Priority Index² formula is calculated using average daily vehicular traffic, train volumes, train speed, number of tracks, and other information as illustrated in Figure 4.1. Utilizing FRA Grade Crossing Inventory information, a database of every roadway-railroad at-grade crossing within the region is compiled for the quantitative review with iterative verification of data during the analysis, and accident history is based on crash history for the last five years (2014 to 2018). A high-level review of data with the FRA Grade Crossing Inventory was also completed to verify at-grade crossing status, traffic volumes, and other identified anomalies.

Figure 4.1.1 Texas Priority Index Formula

Priority Index Formula

The Priority Index (PI) formula is

$$PI = V \times T \times (S \times 0.10) \times P_f \times A^{1.15} \times 0.01$$

where:

V = average daily traffic — number of vehicles per day

T = number of trains in a 24-hour period

S = speed — maximum speed of the trains

P_f = protection factor — a factor weighted according to the type of existing traffic control device as shown in the following table:

Protection Factors	
Existing Traffic Control Device	Protection Factor
Gates	0.10
Cantilever Flashers	0.15
Mast Flashers	0.70
Crossbucks or Other	1.00

A = number of crashes in the last five years to the 1.15 power (when $A = 0$ or $A = 1$, then $A = 1$)

² TxDOT. *Technical Provisions: Amendments for Traffic Operations Manual, Railroad Operations Volume*. September 2012. Section 4; PDF page 65.

The top fifty grade crossings from the quantitative review as well as other prioritized grade separation projects from other planning documents (Texas Rail Plan, Texas Mobility Plan, etc.) were further evaluated qualitatively.

The qualitative review for each of the grade separation candidates includes feasibility of the implementation of the grade separation infrastructure while minimizing impacts to other public and private infrastructure and operations. These potential impacts may include:

- Substantial access impacts and implications to businesses and residences;
- Challenges due to connecting roadway infrastructure, such as at-grade frontage roads and elevated freeways adjacent and parallel to the tracks, or major right-of-way acquisition; and
- Other potential major environmental, utility, and constructability challenges as identified through reviews of online and publicly available databases.

Identification of any substantial impacts to businesses and residences focuses on the potential elimination of or changes to access to those structures for residents and emergency personnel that may significantly and adversely affect the ability to conduct business or reasonably enter/exit residences.

Potential roadway infrastructure challenges related to proposed grade separation construction are generally considered for locations where major additional improvements would be required to existing roadway infrastructure for implementation. These challenges include:

- Existing freeways adjacent/parallel to the railroad with elevated freeway overpasses and at-grade frontage roads;
- Areas where maintaining access to existing businesses and residences may be cost-prohibitive; and
- Acquisition of right of way in major business districts or residential areas.

The impacts and infrastructure challenges, while not considered fatal flaws, may be a determination in implementation timeframe and agency coordination in moving the project forward toward design and construction.

While the qualitative reviews did not eliminate potential grade separation candidates, the review is a criterion in identification of an implementation strategy for the improvements. This is discussed in more detail in Section 5.

Exhibits prepared for some of the proposed grade separations and crossing closures within the report used available aerial photography and profile information as available. The conceptual grade separation exhibit designs followed the *TxDOT Roadway Design Manual* and the *Union Pacific Railroad – BNSF Railway Guidelines for Railroad Grade Separation Projects*. Additional exhibits that were previously part of other studies including the *Gulf Coast Rail District HB&T West Belt Improvements Study*.

The qualitative review resulted in identification of improvements for conceptual design. Appendix B includes these conceptual designs that provided additional opportunity for near-term implementation due to reduced challenges within the qualitative review. These locations went through an additional review, including:

- High-level environmental review – A desktop review was conducted for each proposed grade separation conceptual design to identify any potential fatal-flaw features within the infrastructure limits. See Appendix C for Constraints Map Exhibits. The review comprised of available desktop features such as archaeological, wetlands, brownfield locations, floodplains, and infrastructure (schools, hospitals, parks). While there are no fatal flaws identified within these project limits, potential considerations are included within each project's detailed information in Section 5 that may require additional documentation, study, or remediation.
- Review of utility infrastructure – Identification of major utilities was conducted for each proposed grade separation. This high-level review is limited to utilities that may pose a fatal flaw to implementation of the grade separation or significant cost impacts to the overall project cost. No fatal flaws were determined due to utilities for the grade separation exhibits, but many locations had potential major utility impacts with additional anticipated construction costs.
- Constructability – Potential phasing will be key for future implementation of the grade separation projects. A conceptual review of potential phasing for each project exhibit has been undertaken to verify that the proposed infrastructure can be built while maintaining vehicular traffic during the construction activities. No fatal flaws are found within the conceptual designs, but some of the projects may require additional phases due to existing constraints or proposed features.

Findings of the grade separation reviews are included in Section 5. These findings include the crossings identified in the quantitative review and details from the qualitative review.

Potential Crossing Closures

The identification of grade crossing candidates for closure focuses on finding those that provide both public (roadway user) and private (railroad owner) benefits. Review of closure

candidates follows a methodology that attempts to minimize potential delay to roadway vehicles by trains through alternate routes that also eliminate roadway-rail crossings.

There are two distinct quantitative reviews to identify closure candidates. The first focuses on proposed projects within this study that, through the new infrastructure improvements such as grade separations, bypasses, siding extensions, yard extensions, etc., may facilitate the option for closures. The other emphasizes low-volume roadways with alternate access around the railroad (through grade separations or other means) to eliminate potential roadway-rail incidents. Once the quantitative reviews are complete, a qualitative review to verify each closure make sense from an operations standpoint is completed to ensure viability.

The quantitative reviews consist of:

- Proximity to existing and proposed grade separations – The use of grade-separated routes for closure candidates was prioritized to minimize or eliminate vehicle and train interactions and avoids the potential of shifting traffic to another adjacent grade crossing.
- Low-volume roadways – A focus on roadways with fewer vehicles strategically impacts fewer users while providing additional safety benefits and possible staging locations for railroads.
- Reasonable alternate routes – A review of potential routes around closure candidates focuses on short, efficient paths and eliminates long detours due to the closure from consideration.
- Impacts due to proposed railroad improvements – Through review of possible improvements to railroad infrastructure, the improvements may require the closure of certain roadway-rail crossings within the region.

Once the quantitative reviews provide a list of possible closures candidates, the subsequent qualitative reviews look at:

- Practicality of closure – A verification that the closure meets priorities from the roadway owner and railroad ensure that agencies and railroad owners can justify the closure.
- Impacts to adjacent roadway-rail at-grade crossings – Shifting vehicles from one at-grade crossing on a railroad to another nearby one does not typically increase safety for the traveling public. Identifying these scenarios may remove a closure from consideration.

The list of crossing closure candidates identified in this study meet the quantitative and qualitative requirements noted in this methodology or were provided by stakeholders as priority locations for grade separation implementation.

Potential Blocked Crossings

Blocked crossings are noted by some stakeholders as a challenge within the region, especially near rail yards and staging areas along the tracks. Grade crossings with extended delays due to slow train movements, yard movements, or idling trains can require a vehicle to take an alternate route or, if no alternate routes are available, wait for an extended timeframe to get to its destination. Many of these consistently blocked crossings have been detailed by agencies within the region.

While these situations are considered as challenges within the roadway network, this study does not review potential solutions at many of the locations of identified blocked crossings. To more fully detail the delays at these grade crossings, data is needed to identify the causes of the blocked crossing and impacts to traffic/delay and provide coordination with the railroad owner on possible solutions to alleviate the delay. Solutions may be undertaken to determine potential short-term (alternate route signage, traffic alerts) and long-range (grade separations, crossing closures, railroad improvements) solutions for each blocked grade crossing.

4.2 Grade Crossing Screening Results

Based on the screening methodologies, lists were comprised of proposed grade separation and crossing closure candidates identified in Tables 4.2.1 and 4.2.2 by railroad owner, railroad subdivision, county, city, and priority index ranking if applicable. Further details for each proposed grade separation and crossing closure candidate are included in Section 5.

Table 4.2.1 Proposed Grade Separations List Area

Rank	DOT #	Street	RR Owner	Subdivision	County	City
1	755624C	Fondren Rd	UP	Glidden	Harris	Houston
2	755622N	Hillcroft Ave	UP	Glidden	Harris	Houston
3	022645V	Gordon St	BNSF	Galveston	Brazoria	Alvin
4	758534N	N Shepherd Dr	UP	Houston	Harris	Houston
5	448400J	E Richey Rd	UP	Palestine	Harris	Spring
6	427257T	Rankin Rd	UP	Palestine	Harris	Houston
7	023228P	Airport Blvd	BNSF	Mykawa	Harris	Houston
8	430076S	Kuykendahl Rd	UP	Navasota	Harris	Spring
9	023214G	Long Dr	BNSF	Mykawa	Harris	Houston
10	023215N	Griggs Rd	BNSF	Mykawa	Harris	Houston
11	762721D	FM 364	UP	Houston	Jefferson	Beaumont
12	023211L	W Bellfort Ave	BNSF	Mykawa	Harris	Houston
13	758513V	Westheimer Rd	UP	Houston	Harris	Houston
14	758518E	Bellaire Blvd	UP	Houston	Harris	Houston
15	450654Y	FM 2100	UP	Beaumont	Harris	Huffman
16	023207W	Almeda Genoa Rd	BNSF	Mykawa	Harris	Houston
17	435873A	SH 36	UP	Angleton	Brazoria	Brazoria
18	597091H	FM 1960	BNSF	Houston	Harris	Houston
19	597085E	W Little York Rd	BNSF	Houston	Harris	Houston
20	758533G	Durham St	UP	Houston	Harris	Houston
21	758512N	San Felipe Rd	UP	Houston	Harris	Houston
22	743695P	Kirkwood Rd	UP	Glidden	Fort Bend	Stafford

Table 4.2.1 Proposed Grade Separations List Area

Rank	DOT #	Street	RR Owner	Subdivision	County	City
23	755327J	Scott St	UP	Harrisburg	Harris	Houston
24	755876D	Kingwood Dr	UP	Lufkin	Montgomery	Houston
25	427962W	FM 364/Major Dr	UP	Beaumont	Jefferson	Beaumont
26	912021M	I-610 WB frontage Rd	UP	Houston	Harris	Houston
27	023227H	Walnut St	BNSF	Mykawa	Brazoria	Pearland
28	912020F	I-610 EB frontage Rd	UP	Houston	Harris	Houston
29	758514C	Richmond Ave	UP	Houston	Harris	Houston
30	762892E	Sheldon Rd	UP	Houston	Harris	Houston
31	743689L	S Gessner Rd	UP	Glidden	Fort Bend	Missouri City
32	758517X	Bissonnet St	UP	Houston	Harris	Houston
33	745044J	S Dairy Ashford Rd	UP	Glidden	Fort Bend	Sugar Land
34	755621G	Chimney Rock Rd	UP	Glidden	Harris	Houston
35	089370C	Tidwell Rd	BNSF	Houston	Harris	Houston
36	743699S	Eldridge Rd	UP	Glidden	Fort Bend	Sugar Land
37	022675M	FM 762	BNSF	Galveston	Fort Bend	Richmond
38	435486H	SH 105/Phillips St	UP	Palestine	Montgomery	Conroe
39	755863C	Mt Houston Rd	UP	Lufkin	Harris	Houston
40	743726L	FM 3155/Collins Rd	UP	Glidden	Fort Bend	Richmond
41	762483M	FM 105/S Main St	UP	Lafayette	Orange	Vidor
42	762790L	US 90	UP	Baytown	Liberty	Dayton
43	743270B	Long Point Rd	UP	Eureka	Harris	Houston

Table 4.2.1 Proposed Grade Separations List Area

Rank	DOT #	Street	RR Owner	Subdivision	County	City
44	597084X	Antoine Rd	BNSF	Houston	Harris	Houston
45	675158C	Cypresswood Rd	BNSF	Houston	Harris	Tomball
46	758519L	Beechnut St	UP	Houston	Harris	Houston
47	758750G	Tidwell Rd	UP	Lufkin	Harris	Houston
48	435446K	Federal Rd	UP	Baytown	Harris	Jacinto City
49	743716F	Pitts Rd	UP	Glidden	Fort Bend	Sugar Land
50	743713K	Harlem Rd	UP	Glidden	Fort Bend	Sugar Land
51	758757E	Little York Rd	UP	Lufkin	Harris	Houston
52	762810V	FM 565	UP	Cedar Bayou Ind Ld	Harris	Baytown
53	762944U	FM 1405	UP	Cedar Bayou Ind Ld	Harris	Baytown
54	022673Y	Royal Lakes Blvd	BNSF	Galveston	Fort Bend	Richmond
55	288228X	York St	HB&T	West Belt	Harris	Houston
56	288129A	Commerce St	HB&T	West Belt	Harris	Houston
57	288098D	Nance St	HB&T	West Belt	Harris	Houston
58	288095H	Lyons Ave	HB&T	West Belt	Harris	Houston
59	329559B	Dr Ransom Howard St	KCS	Beaumont	Jefferson	Port Arthur

Table 4.2.2 Proposed Crossing Closures List

DOT #	Street	RR Owner	Subdivision	City	County
869706B	Medina St	PTRA		Houston	Harris
869705U	Fennell St	PTRA		Houston	Harris
435874G	Market St	UP	Angleton	Brazoria	Brazoria
329559B	9th St	KCS	Beaumont	Port Arthur	Jefferson
329474Y	Canary St	KCS	Beaumont	Beaumont	Jefferson
329473S	Mockingbird Dr	KCS	Beaumont	Beaumont	Jefferson
329472K	N Dewitt	KCS	Beaumont	Vidor	Orange
755623V	Haviland St	UP	Glidden	Houston	Harris
743725E	Morton St	UP	Glidden	Richmond	Fort Bend
745055W	Gillingham Ln	UP	Glidden	Fort Bend	Sugar Land
859544Y	Fennell St	UP	Harrisburg	Houston	Harris
762852G	CR 601	UP	Houston	Dayton	Liberty
762853N	CR 602	UP	Houston	Dayton	Liberty
745074B	Oates Rd	UP	Houston	Houston	Harris
758535V	Parker St	UP	Houston	Houston	Harris
758532A	Roy St	UP	Houston	Houston	Harris
758284D	West St	UP	Houston	Houston	Harris
762719C	Langham Rd	UP	Lafayette	Beaumont	Jefferson
435484U	Avenue A	UP	Palestine	Conroe	Montgomery
435487P	Lewis St	UP	Palestine	Conroe	Montgomery
427259G	Westfield Loop Rd	UP	Palestine	Spring	Harris
748688W	West St	HB&T	West Belt	Houston	Harris

Section 5: Comprehensive List of Improvements

This report section combines potential railroad and roadway projects defined in sections 3 and 4 within the 11-county Houston and Beaumont region into a comprehensive list of improvements. These improvements and subsequent recommendations may be used to form the basis for an infrastructure plan focused around efforts to reduce impacts by trains on roadway users, to improve safety, and to increase efficiency on the railroad network.

5.1 Methodology

The methodology for identification of improvements on the regional railroad network and at roadway-rail grade crossings is detailed in Sections 3 and 4 of this report. The methodology for railroad network projects is generally based on identified constraints within the “Base” case of the Rail Traffic Controller modeling effort, while the roadway-rail grade crossing methodology focuses on quantitative reviews of data and qualitative reviews of other factors.

Construction cost estimates are determined in a couple different methods depending on level of design. These methods are generally based on the available development of design, if any, to provide costs for planning purposes. As projects are further defined with additional design beyond this study, construction costs should be refined and incorporated into planning documentation.

- Estimates for proposed grade separations with conceptual design exhibits have costs developed for those designs with appropriate level of detail on quantities and unit costs.
- Estimates for grade separations and closures without conceptual designs are based on high-level assumed construction costs and not defined by specific unit items or quantities. A general range of costs are provided and would vary based on project designs and constraints.
- Railroad network projects are defined at a high-level and use typical per-mile costs for many of the infrastructure components.

A limited set of projects benefit-cost analyses (BCAs) have been completed to evaluate a project’s or scenario’s benefits against its costs. This spreadsheet-based framework focuses on benefits related to vehicular delay and train movements and efficiencies to identify applicable costs based on USDOT guidance for those benefits. BCAs are included in Appendix D.

Potential high-level implementation timeframes have been assigned to each of the improvements identified on the regional railroad network and at roadway-rail grade crossings. Potential implementation timeframes are labeled as near-term, mid-range, and long-range and are a starting point for further planning activities. These potential timeframes are based on anticipated challenges toward implementation as well as other associated projects (i.e. a grade separation and associated closure have the same implementation timeframe).

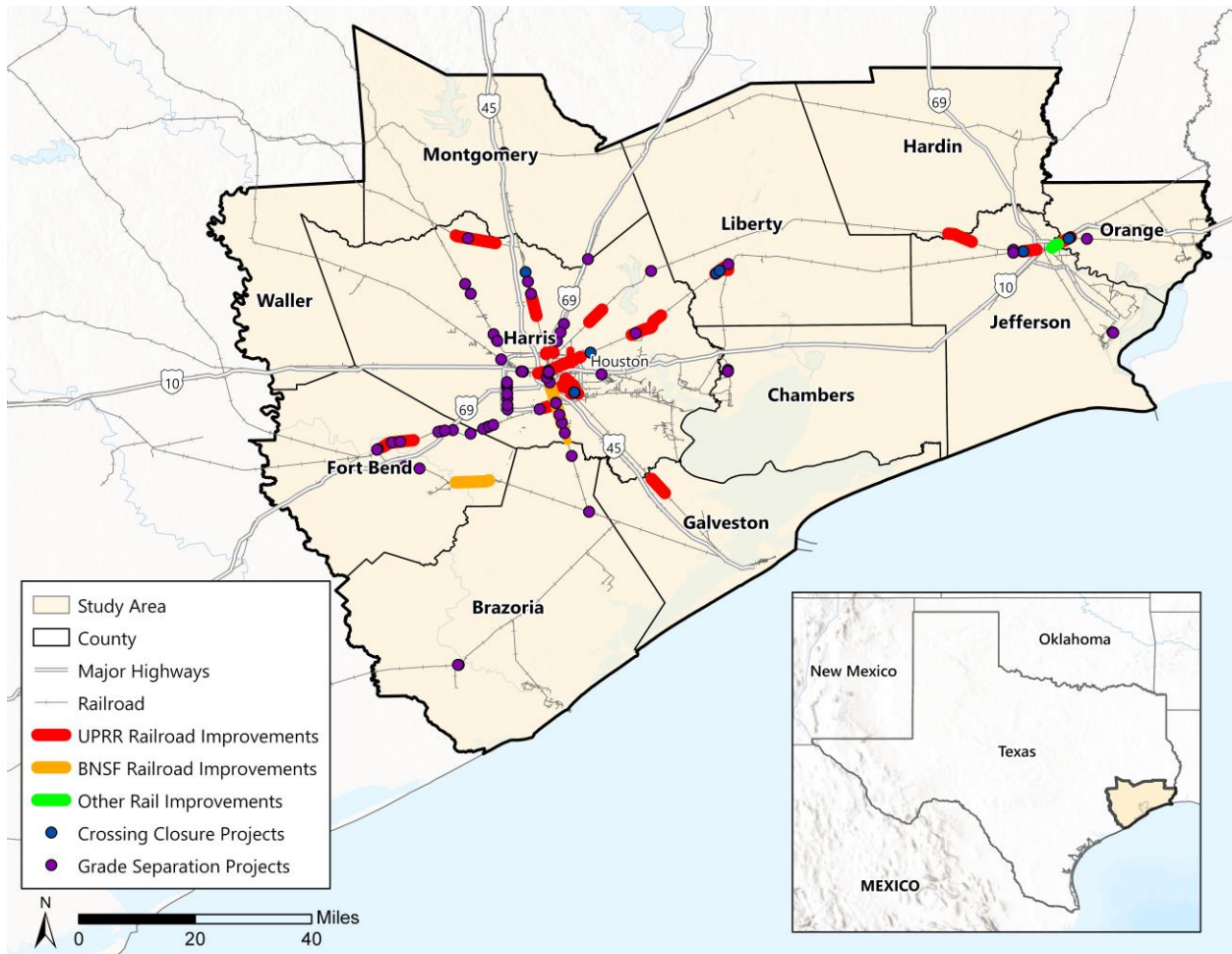
5.2 List of Improvements by Railroad Subdivision

A total of 109 roadway and railroad improvements are proposed within this report. These improvements include:

- 29 proposed railroad improvements,
- 59 proposed grade separations, and
- 22 proposed crossing closures.

Figure 5.2.1 details the locations within the 11-county region of the proposed roadway and railroad improvements.

Figure 5.2.1. Proposed Roadway and Railroad Improvements Map



Improvements are sorted within this section by railroad owner and railroad subdivision. Each railroad subdivision subsection includes a list of the proposed improvements and a detailed description of each improvement with information such as:

- Existing conditions;
- Proposed improvement and potential challenges with implementation;
- Findings associated with environmental, utility, and constructability/phasing reviews, as applicable;
- Potential cost of construction;
- Potential benefit-cost analysis, as applicable;
- Potential timeframe/range of project implementation; and
- Exhibit location, as applicable.

Additional information utilized in the review of grade crossing includes:

- Data provided by the City of Houston and Gulf Coast Rail District on historically blocked crossings and existing/proposed quiet zone locations,
- New capital investments as part of Transportation Improvement Programs (TIP) and Metropolitan Transportation Plans (MTP), and
- Guidance from TxDOT, cities, H-GAC, and other stakeholders

Union Pacific Railroad – Angleton Subdivision

The UPRR Angleton Subdivision is a predominately single-track railroad that runs between Algoa and Placedo, Texas and through Brazoria and Galveston counties within the study area. Rail traffic on this subdivision is bidirectional with an average train count of approximately 19 to 22 trains per day. BNSF also has trackage rights along the Angleton Subdivision. The areas adjacent to the Angleton Subdivision's right of way are typically rural in nature except through towns along the route.

Table 5.2.1. details the proposed improvements identified in this study on the UPRR Angleton Subdivision.

Table 5.2.1 Proposed Improvements on UPRR Angleton Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
435873A	Grade Separation	SH 36	UP	Angleton	Brazoria	Brazoria
435874G	Crossing Closure	Market St	UP	Angleton	Brazoria	Brazoria

Grade Separations

SH 36 at UPRR Angleton Subdivision

SH 36 (DOT #435873A) is currently a four-lane roadway with approximately 12,900 vehicles per day that crosses the railroad at-grade in the city of Brazoria in Brazoria County. The identified grade separation location would separate vehicular traffic from the UPRR Angleton Subdivision. According to crash data collected over a five-year period, four crashes occurred in the vicinity of the SH 36 at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would require either access roads adjacent to SH 36 or closure of side streets at SH 36. Additional impacts to businesses adjacent to the proposed grade

separation may occur due to right-of-way and access requirements, including possible impacts to a fire station north of the crossing.

The grade separation of SH 36 at the Angleton Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Crossing Closures

Market St at UPRR Angleton Subdivision

Currently a two-lane roadway with an estimated 147 vehicles per day, Market St (DOT #435874G) is an at-grade crossing in the city of Brazoria in Brazoria County. Market St is proposed to be closed at the intersection with the UPRR Angleton Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separation at SH 36. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Market St is anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separation at SH 36, which is included as a grade separation candidate in this study. The use of Market St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Market St at the Angleton Subdivision is estimated to cost \$60,000 (not including the SH 36 grade separation). Implementation of the crossing closure would be anticipated to coincide with the SH 36 grade separation project.

Union Pacific Railroad – Baytown Subdivision

The UPRR Baytown Subdivision is a predominately single-track railroad that runs between North Shore Junction east of Houston and Dayton, Texas and through Chambers, Harris, and Liberty counties within the study area. Rail traffic on this subdivision is bidirectional with an average train count of approximately 23 trains per day. BNSF also has trackage rights along the Baytown Subdivision. The Baytown Subdivision's right of way generally abuts suburban or industrial areas.

Table 5.2.2 details the proposed improvements identified in this study on the UPRR Baytown Subdivision.

Table 5.2.2 Proposed Improvements on UPRR Baytown Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
762790L	Grade Separation	US 90	UP	Baytown	Liberty	Dayton
435446K	Grade Separation	Federal Rd	UP	Baytown	Harris	Jacinto City

Grade Separations

US 90 at UPRR Baytown Subdivision

US 90 (DOT #762790L) is currently a five-lane roadway with approximately 22,000 vehicles per day that crosses the railroad at-grade in the city of Dayton in Liberty County. The at-grade crossing is skewed diagonally across the intersection of US 90 and Waco Street. The identified grade separation would be in concert with additional railroad improvements and crossing closures of CR 601 and CR 602 in this study to relocate the roadway-rail crossing at US 90 further to the west and is proposed to consist of two roadway overpass locations. According to crash data collected over a five-year period, three crashes occurred in the vicinity of the US 90/Waco Street at-grade crossing.

The railroad exhibit for the extension of Dayton Siding in Appendix B shows the anticipated locations of the two grade separation location. Potential impacts due to the grade separation have not been identified as part of this effort. Funding for a portion of this project has been secured through HGAC. There is significant railroad relocation that is required to facilitate the grade separation which public agencies will have to consider. This rail relocation will require acquisition of new right of way.

The grade separation of US 90 at the Baytown Subdivision is estimated to cost \$65 million. TxDOT and Liberty County will have to coordinate with Union Pacific Railroad for the rail relocation that would be required to implement the grade separations. The rail relocation has a cost estimate of \$200 million.

Federal Rd at UPRR Baytown Subdivision

Federal Rd (DOT #435446K) is currently a six-lane roadway with approximately 25,590 vehicles per day that crosses the railroad at-grade in the city of Jacinto City in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Baytown Subdivision. According to crash data collected over a five-year period, three crashes occurred in the vicinity of the Federal Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Federal Rd/Market St intersection and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Federal Rd at the Baytown Subdivision is estimated to cost \$40 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad – Beaumont Subdivision

The UPRR Beaumont Subdivision is a predominately single-track railroad with sidings that runs between Gulf Coast Junction in Houston and Beaumont, Texas and through Hardin, Harris, Jefferson, and Liberty counties within the study area. Rail traffic on this subdivision is primarily eastbound with an average train count of approximately 19 trains per day. BNSF, KCS, and Amtrak also have trackage rights along the Beaumont Subdivision. The areas adjacent to the Beaumont Subdivision's right of way are typically rural in nature except through towns along the route and for a significant portion of the route is along US 90.

Table 5.2.3 details the proposed improvements identified in this study on the UPRR Beaumont Subdivision.

Table 5.2.3 Proposed Improvements on UPRR Beaumont Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
450654Y	Grade Separation	FM 2100	UP	Beaumont	Harris	Huffman
427962W	Grade Separation	FM 364/ Major Dr	UP	Beaumont	Jefferson	Beaumont
	Railroad	Dyersdale Extension	UP	Beaumont	Harris	Houston
	Railroad	Kolander Siding	UP	Beaumont	Jefferson	Beaumont

Grade Separations

FM 2100 at UPRR Beaumont Subdivision

FM 2100 (DOT #450654Y) is currently a three-lane roadway with approximately 12,800 vehicles per day that crosses the railroad at-grade in the city of Huffman in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Beaumont Subdivision. According to crash data collected over a five-year period, four crashes occurred in the vicinity of the FM 2100 at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the FM 2100/FM 1960 intersection and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of FM 2100 at the Beaumont Subdivision is estimated to cost \$30 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

FM 364/Major Dr at UPRR Beaumont Subdivision

FM 364/Major Dr (DOT #427962W) is currently a five-lane roadway with approximately 17,920 vehicles per day that crosses the railroad at-grade in the city of Beaumont in Jefferson County. The identified grade separation location would separate vehicular traffic from the UPRR Beaumont Subdivision. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the FM 364/Major Dr at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead transmission/distribution lines and a gas pipeline may be required for overpass construction. A place of worship within the grade separation limits was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the FM 364/Phelan Blvd intersection and would require additional access to provide connectivity between Phelan Blvd and FM 364/Major Dr. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of FM 364/Major Dr at the Beaumont Subdivision is estimated to cost \$43 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Railroad Capacity Enhancements

Dyersdale Extension

The Dyersdale Extension project adds 15,000 ft of second main track near Settegast Yard. The existing siding is currently around three miles in length but has four at-grade crossings. The new track allows the extension allows trains to stage without blocking a single mainline track or at-grade crossings during crew changes or while staging to traffic ahead. The proposed improvement location is shown in Appendix A as part of Scenario 4.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

The Dyersdale siding extension on the Beaumont Subdivision may be considered a long-range implementation timeframe for planning purposes.

Kolander Siding

The Kolander Siding project is a new 20,000 ft siding between Houston and Beaumont. The siding allows for a location longer trains can sit clear of the main line while being passed or while staging of longer trains staging waiting to travel through Beaumont. The proposed improvement location is shown in Appendix A as part of Scenario 4.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

The Kolander siding on the Beaumont Subdivision may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad – Cedar Bayou Industrial Lead

The UPRR Cedar Bayou Industrial Lead is a seven-mile single-track railroad that connects with the Baytown Subdivision in Chambers County. Rail traffic on this subdivision is bidirectional with an average train count of approximately 6 trains per day. BNSF also has trackage rights along the Cedar Bayou Industrial Lead. The railroad's right of way is generally rural but provides access to yards and port businesses along its length.

Table 5.2.4 details the proposed improvements identified in this study on the UPRR Cedar Bayou Industrial Lead.

Table 5.2.4 Proposed Improvements on UPRR Cedar Bayou Industrial Lead

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
762944U	Grade Separation	FM 1405	UP	Cedar Bayou Ind Ld	Harris	Baytown
762810V	Grade Separation	FM 565	UP	Cedar Bayou Ind Ld	Harris	Baytown

Grade Separations

FM 1405 at UPRR Cedar Bayou Industrial Lead

FM 1405 (DOT #762944U) is currently a three-lane roadway with approximately 4,800 vehicles per day that crosses the railroad at-grade in the city of Baytown in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Cedar Bayou Industrial Lead. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the FM 1405 at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. There are not anticipated impacts to major utilities due to the construction of the grade separation based on a high-level utility review. Similarly, no fatal-flaw environmental impacts were found during a preliminary environmental review.

The proposed design is shown to be within the existing roadway right of way and is not anticipated to have right-of-way or access impacts.

The grade separation of FM 1405 at the Cedar Bayou Industrial Lead is estimated to cost \$24 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes. This potential project is included within the Texas State Rail Plan.

FM 565 at UPRR Cedar Bayou Industrial Lead

FM 565 (DOT #762810V) is currently a two-lane roadway with approximately 7,600 vehicles per day that crosses the railroad at-grade in the city of Baytown in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Cedar Bayou Industrial Lead. According to crash data collected over a five-year period, one crash occurred in the vicinity of the FM 565 at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay.

Based on a high-level utility review, utility adjustments for overhead distribution lines may be required for overpass construction. No fatal-flaw environmental impacts were found during a preliminary environmental review.

It is anticipated that the grade separation would not impact the FM 565/FM 1405 intersection but would require additional access to provide connectivity between FM 565 and adjacent businesses. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of FM 565 at the Cedar Bayou Industrial Lead is estimated to cost \$15 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes. This potential project is included within the Texas State Rail Plan, as well as HGAC planned projects. TXDOT's Beaumont District started designs on this during this study and estimates to complete designs in four to five years. The project would be expected to let after designs are completed and would take an estimated 1.5 years to construct.

Union Pacific Railroad – Eureka Subdivision

The UPRR Eureka Subdivision is a predominately single-track railroad with sidings that runs between Tower 13 at the Houston Subdivision in Houston and Navasota, Texas and through Harris and Waller counties within the study area. Rail traffic on this subdivision is bidirectional with an average train count of approximately 4 trains per day. Other railroads do not have trackage rights along the Eureka Subdivision. The areas adjacent to the Eureka Subdivision's right of way are typically urban/suburban in nature and for a significant portion of the route is along U.S. 290 and Hempstead Road.

Table 5.2.5 details the proposed improvements identified in this study on the UPRR Eureka Subdivision.

Table 5.2.5 Proposed Improvements on UPRR Eureka Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
743270B	Grade Separation	Long Point Rd	UP	Eureka	Harris	Houston

Grade Separations

Long Point Rd at UPRR Eureka Subdivision

Long Point Rd (DOT #743270B) is currently a three-lane roadway at the grade crossing with approximately 10,810 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Eureka Subdivision. According to crash data collected over a five-year period, seven crashes occurred in the vicinity of the Long Point Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Long Point Rd/Hempstead Rd intersection and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Long Point Rd at the Eureka Subdivision is estimated to cost \$30 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad - Galveston Subdivision

The UPRR Galveston Subdivision is a predominately single-track railroad that runs between South GH&H Junction off the Houston West Belt Subdivision and Galveston, Texas and through Galveston and Harris counties. Rail traffic on this subdivision is bidirectional with an average train count of approximately 5 trains per day. Other railroads do not have trackage rights along the Galveston Subdivision. The Galveston Subdivision's right of way typically abuts urban and suburban infrastructure and generally is aligned with SH 3.

Table 5.2.6 details the proposed improvements identified in this study on the UPRR Galveston Subdivision.

Table 5.2.6 Proposed Improvements on UPRR Galveston Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
	Railroad	Katy Neck Second Main	UP	Galveston	Harris	Houston
	Railroad	Shell Siding Extension	UP	Galveston	Harris	Dickinson

Railroad Capacity Enhancements

Katy Neck Second Main

The Katy Neck Second Main project is a 11,000 ft second mainline track between Katy Neck and Tower 85. When combined with the proposed Katy Neck connection, the project provides additional capacity enabling trains to bypass congestion on the HB&T West Belt Subdivision and reduces the number of blocked crossings. The proposed improvement location is shown in Appendix A as part of Scenario 7.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a long-range implementation timeframe for planning purposes.

Shell Siding Extension

The proposed Shell Siding Extension project extends the existing siding 8,000 ft to the east and 2,000 ft to the west, installs centralized traffic control and dispatcher control switches, and closes the existing at-grade crossings at Olive St (DOT #859558G) and a grade separate the at-grade crossing with FM 646 (DOT #859559N). The existing Shell Siding has limited utility since it is shorter than most of the trains and has hand thrown switches at each end, requiring a train to stop when before entering the siding. The improved Shell Siding provides a location between Galveston and Houston for trains to meet and sit outside the congested terminal if needed. The proposed improvement location is shown in Appendix A as part of Scenario 7.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad – Glidden Subdivision

The UPRR Glidden Subdivision is a predominately double-track railroad that runs between West Junction on the Houston Subdivision and San Antonio (Kirby), Texas and through Fort Bend and Harris counties within the study area. Rail traffic on this subdivision is bidirectional with an average train count of approximately 34 trains per day. Amtrak and BNSF have trackage rights along this section of the Glidden Subdivision. In addition, KCS also has trackage rights along the Glidden Subdivision from Houston to Rosenberg. The areas adjacent to the Glidden Subdivision's right of way are typically urban or suburban along the route and for a significant portion of the route is along US 90A.

Table 5.2.7 details the proposed improvements identified in this study on the UPRR Glidden Subdivision.

Table 5.2.7 Proposed Improvements on UPRR Glidden Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
743689L	Grade Separation	S Gessner Rd	UP	Glidden	Fort Bend	Missouri City
743726L	Grade Separation	FM 3155/Collins Rd	UP	Glidden	Fort Bend	Richmond
743695P	Grade Separation	Kirkwood Rd	UP	Glidden	Fort Bend	Stafford
745044J	Grade Separation	S Dairy Ashford Rd	UP	Glidden	Fort Bend	Sugar Land
743699S	Grade Separation	Eldridge Rd	UP	Glidden	Fort Bend	Sugar Land
743716F	Grade Separation	Pitts Rd	UP	Glidden	Fort Bend	Sugar Land
743713K	Grade Separation	Harlem Rd	UP	Glidden	Fort Bend	Sugar Land
755624C	Grade Separation	Fondren Rd	UP	Glidden	Harris	Houston
755622N	Grade Separation	Hillcroft Ave	UP	Glidden	Harris	Houston
755621G	Grade Separation	Chimney Rock Rd	UP	Glidden	Harris	Houston
743725E	Crossing Closure	Morton St	UP	Glidden	Fort Bend	Richmond
745055W	Crossing Closure	Gillingham Ln	UP	Glidden	Fort Bend	Sugar Land
755623V	Crossing Closure	Haviland St	UP	Glidden	Harris	Houston

Table 5.2.7 Proposed Improvements on UPRR Glidden Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
	Railroad	Glidden Second Track - Harlem to Brazos River	UP	Glidden	Fort Bend	Rosenberg

Grade Separations

S Gessner Rd at UPRR Glidden Subdivision

S Gessner Rd (DOT #743689L) is currently a four-lane roadway with approximately 13,600 vehicles per day that crosses the railroad at-grade in the city of Missouri City in Fort Bend County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the S Gessner Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the S Gessner Rd/US 90A intersection. US 90A is currently elevated over S Gessner Rd just south of the roadway-rail crossing with at-grade frontage roads and would provide an additional challenge for a grade separation for S Gessner Rd over the Glidden Subdivision. The grade separation would require traffic connectivity to adjacent properties as well as Industrial Drive and potentially other side streets. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of S Gessner Rd at the Glidden Subdivision is estimated to cost \$35 million. Based on known constraints, this project may be considered a long-range implementation timeframe for planning purposes.

FM 3155/Collins Rd at UPRR Glidden Subdivision

FM 3155/Collins Rd (DOT #743726L) is currently a five-lane roadway with approximately 11,720 vehicles per day that crosses the railroad at-grade in the city of Richmond in Fort Bend County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the FM 3155/Collins Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay.

Based on a high-level utility review, there are not any major utilities identified for overpass construction. A cemetery within the grade separation area was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the FM 3155/US 90A intersection. Access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of FM 3155/Collins Rd at the Glidden Subdivision is estimated to cost \$30 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Kirkwood Rd at UPRR Glidden Subdivision

Kirkwood Rd (DOT #743695P) is currently a six-lane roadway with approximately 18,980 vehicles per day that crosses the railroad at-grade in the city of Stafford in Fort Bend County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Kirkwood Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Kirkwood Rd/US 90A intersection. US 90A is currently elevated over Kirkwood Ave just south of the roadway-rail crossing with at-grade frontage roads and would provide an additional challenge for a grade separation for Kirkwood Rd over the Glidden Subdivision. The grade separation would require traffic connectivity to adjacent businesses and Wright Rd. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Kirkwood Rd at the Glidden Subdivision is estimated to cost \$45 million. Based on known constraints, this project may be considered a long-range implementation timeframe for planning purposes.

S Dairy Ashford Rd at UPRR Glidden Subdivision

S Dairy Ashford Rd (DOT #745044J) is currently a six-lane roadway with approximately 17,390 vehicles per day that crosses the railroad at-grade in the city of Sugar Land in Fort Bend County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, one crash occurred in the vicinity of the S Dairy Ashford Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the S Dairy Ashford Rd/US 90A intersection. The grade separation would require traffic connectivity to adjacent properties, and additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of S Dairy Ashford Rd at the Glidden Subdivision is estimated to cost \$35 million. Based on known constraints, this project may be considered a long-range implementation timeframe for planning purposes.

Eldridge Rd at UPRR Glidden Subdivision

Eldridge Rd (DOT #743699S) is currently a five-lane roadway with approximately 12,800 vehicles per day that crosses the railroad at-grade in the city of Sugar Land in Fort Bend County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Eldridge Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead distribution lines may be required for overpass construction. A place of worship within the grade separation area was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the Piedmont St and Neal Dr intersections. It is not anticipated that access to adjacent properties will be required via access roads. Additional impacts to properties adjacent to the proposed grade separation are anticipated to be limited based on initial review.

The grade separation of Eldridge Rd at the Glidden Subdivision is estimated to cost \$24 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Pitts Rd at UPRR Glidden Subdivision

Pitts Rd (DOT #743716F) is currently a five-lane roadway with approximately 6,860 vehicles per day that crosses the railroad at-grade in the city of Sugar Land in Fort Bend County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Pitts Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, there are not any major utilities identified for overpass construction. No fatal-flaw environmental impacts were found during a preliminary environmental review.

It is anticipated that the grade separation would impact the Pitts Rd/US 90A intersection, and the proposed design shows utilization of the unpaved median area for an elevated intersection. Access to adjacent properties along the grade separation are provided via access roads, while access along US 90A is intended to remain the same. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Pitts Rd at the Glidden Subdivision is estimated to cost \$34 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Harlem Rd at UPRR Glidden Subdivision

Harlem Rd (DOT #743713K) is currently a five-lane roadway with approximately 6,590 vehicles per day that crosses the railroad at-grade in the city of Sugar Land in Fort Bend County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, one crash occurred in the vicinity of the Harlem Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, there are not any major utilities identified for overpass construction. No fatal-flaw environmental impacts were found during a preliminary environmental review.

It is anticipated that the grade separation would impact the Harlem Rd/US 90A intersection, and the proposed design shows utilization of the unpaved median area for an elevated intersection. Access to adjacent properties along the grade separation are provided via access roads, while access along US 90A is intended to remain the same. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Harlem Rd at the Glidden Subdivision is estimated to cost \$30 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Fondren Rd at UPRR Glidden Subdivision

Fondren Rd (DOT #755624C) is currently a six-lane roadway with approximately 21,935 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, four crashes occurred in the vicinity of the Fondren Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Fondren Rd/US 90A intersection. US 90A is currently elevated over Fondren Rd just south of the roadway-rail crossing with at-grade frontage roads and would provide an additional challenge for a grade separation for Fondren Rd over the Glidden Subdivision. The grade separation would require traffic connectivity to adjacent properties and Hampton Circle. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Fondren Rd at the Glidden Subdivision is estimated to cost \$45 million. Based on known constraints, this project may be considered a long-range implementation timeframe for planning purposes.

Hillcroft Ave at UPRR Glidden Subdivision

Hillcroft Ave (DOT #755622N) is currently a four-lane roadway with approximately 16,315 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, three crashes occurred in the vicinity of the Hillcroft Ave at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Hillcroft Ave/US 90A intersection. US 90A is also currently elevated over Hillcroft Ave just south of the roadway-rail crossing and would provide an additional challenge for a grade separation for Hillcroft Ave over the Glidden Subdivision. The grade separation would require traffic connectivity to adjacent businesses and GreenCraig Dr. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Hillcroft Ave at the Glidden Subdivision is estimated to cost \$30 million. Based on constraints and potential funding, this project may be considered a long-range timeframe for implementation.

Chimney Rock Rd at UPRR Glidden Subdivision

Chimney Rock Rd (DOT #755621G) is currently a five-lane roadway with approximately 5,618 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Glidden Subdivision. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the Chimney Rock Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Chimney Rock Rd/US 90A intersection. US 90A is currently elevated over Chimney Rock Rd just south of the roadway-rail crossing with direct connector ramps between US 90A and south Chimney Rock Rd as well as at-grade frontage roads and would provide an additional challenge for a grade separation for Chimney Rock Rd over the Glidden Subdivision. The grade separation would require traffic connectivity to adjacent businesses and Southminster Dr. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Chimney Rock Rd at the Glidden Subdivision is estimated to cost \$35 million. Based on known constraints, this project may be considered a long-range implementation timeframe for planning purposes.

Crossing Closures

Morton St at UPRR Glidden Subdivision

Currently a two-lane roadway with an estimated 430 vehicles per day, Morton St (DOT #743725E) is an at-grade crossing in the city of Richmond in Fort Bend County. Morton St is proposed to be closed at the intersection with the UPRR Glidden Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separation at FM 3155/Collins Rd. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Morton St is anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separation at FM 3155/Collins Rd, which is included as a grade separation candidate in this study. The use of Morton St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Morton St at the Glidden Subdivision (not including the FM 3155/Collins Rd grade separation) is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the FM 3155/Collins Rd grade separation project.

Gillingham Ln at UPRR Glidden Subdivision

Gillingham Ln (DOT #745055W) is a two-lane roadway with an estimated 4750 vehicles per day at an at-grade crossing in the city of Sugar Land in Fort Bend County. Gillingham Ln is proposed to be closed at the intersection with the UPRR Glidden Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separation at Eldridge Rd.

Access to adjacent properties along Gillingham Ln is anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separation at Eldridge Rd, which is included as a grade separation candidate in this study. The use of Gillingham Ln traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety. The crossing closure of Gillingham Ln at the Glidden Subdivision (not including the Eldridge Rd grade separation) is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the Eldridge Rd grade separation project.

Haviland St at UPRR Glidden Subdivision

Haviland St (DOT #755623V) is a two-lane roadway with an estimated 1700 vehicles per day at an at-grade crossing in the city of Houston in Harris County. Haviland St is proposed to be closed at the intersection with the UPRR Glidden Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separation at Hillcroft Ave. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Haviland St is anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separation at Hillcroft Ave, which is included as a grade separation candidate in this study. The use of Haviland St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Haviland St at the Glidden Subdivision (not including the Hillcroft Ave grade separation) is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the Hillcroft Ave grade separation project.

Railroad Capacity Enhancements

Glidden Second Track – Harlem to Brazos River

The Glidden Second Track project extends the existing Harlem Siding 9,000 ft to the west, 2,000 ft to the east, and the grade separation of two existing at-grade crossings, Pitts Rd (DOT #743716F), and Harlem Rd (DOT#743713K). The project connects to double track to the east, reducing the amount of single main on the heavily used segment between Rosenberg and Houston. The additional double tracks allows for shorter meets, increasing capacity for the trains coming to and from the BNSF Galveston, KCS Rosenberg and UPRR Glidden Subdivisions. The proposed improvement location is shown in Appendix A as part of Scenario 9.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad – Harrisburg Subdivision

The UPRR Harrisburg Subdivision is a predominately single-track railroad that runs between West Junction off the Houston Subdivision and Harrisburg Junction on the Strang Subdivision in Houston, Texas and Harris County. Rail traffic on this subdivision is bidirectional with an average train count of approximately 4 to 14 trains per day. BNSF also has trackage rights along the Harrisburg Subdivision. The Harrisburg Subdivision's right of way typically abuts urban residential and commercial properties and generally is aligned with Holmes Road and Griggs Road.

Table 5.2.8 details the proposed improvements identified in this study on the UPRR Harrisburg Subdivision.

Table 5.2.8 Proposed Improvements on UPRR Harrisburg Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
755327J	Grade Separation	Scott St	UP	Harrisburg	Harris	Houston
859544Y	Crossing Closure	Fennell St	UP	Harrisburg	Harris	Houston
	Railroad	Katy Neck NW Wye Connection	UP	Harrisburg	Harris	Houston
	Railroad	MLK Siding	UP	Harrisburg	Harris	Houston

Grade Separations

Scott St at UPRR Harrisburg Subdivision

Scott St (DOT #755327J) is currently a four-lane roadway with approximately 20,450 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Harrisburg Subdivision. According to crash data collected over a five-year period, six crashes occurred in the vicinity of the Scott St at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Scott St/Holmes Rd intersection and potentially the I-610 eastbound frontage road and mainlines grade separation. The grade separation would require traffic connectivity to adjacent properties and side streets. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Scott St at the Harrisburg Subdivision is estimated to cost \$30 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Crossing Closures

Fennell St at UPRR Harrisburg Subdivision

Currently a two-lane roadway with an estimated 240 vehicles per day, Fennell St (DOT #859544Y) is an at-grade crossing in the city of Houston in Harris County. Fennell Street is proposed to be closed at the intersection with the UPRR Harrisburg Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the existing grade separation at Broadway St. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Fennell St are anticipated to remain up to the grade crossing closure, and connectivity to the existing yard area may either be maintained through San Antonio St or through temporary closures with gates. The identified alternate route to this crossing location uses the existing grade separation at Broadway St. The use of Fennell St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Fennell St at the Harrisburg Subdivision is estimated to cost \$60,000. This can be considered a near-term implementation timeframe since grade separation infrastructure is in place at Broadway St.

Railroad Capacity Enhancements

Katy Neck NW Wye Connection

The Katy Neck Wye project constructs a wye on the northwest quadrant of the Katy Neck junction between the UPRR Harrisburg and UPRR Galveston Subdivisions. The connection provides additional connectivity, enabling trains to bypass the congestion HB&T West Belt Subdivision. This effort will require right-of-way acquisition, most of it in a recycling center. The proposed improvement location is shown in Appendix A as part of Scenario 7.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

MLK Siding

This MLK Siding project constructs a 9,000 ft of siding west of T&NO Junction (Tower 81). The project provides a location for trains to stage or meet other trains coming from the HB&T West Belt Subdivision. The proposed improvement location is shown in Appendix A as part of Scenario 6.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad – Houston Subdivision

The UPRR Houston Subdivision is a predominately double-track railroad within the Houston complex and single-track with sidings east of Houston that runs between West Junction of the Glidden Subdivision and Beaumont, Texas with KCS and through Hardin, Harris, Jefferson, and Liberty counties. Rail traffic on this subdivision is primarily westbound with an average train count of approximately 25 trains per day. BNSF, KCS, and Amtrak also have trackage rights along the Houston Subdivision. The areas adjacent to the Houston Subdivision's right of way are typically urban within the complex and suburban or rural through the rest of the route.

Table 5.2.9 details the proposed improvements identified in this study on the UPRR Houston Subdivision.

Table 5.2.9 Proposed Improvements on UPRR Houston Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
758534N	Grade Separation	N Shepherd Dr	UP	Houston	Harris	Houston
758513V	Grade Separation	Westheimer Rd	UP	Houston	Harris	Houston
758518E	Grade Separation	Bellaire Blvd	UP	Houston	Harris	Houston
758533G	Grade Separation	Durham St	UP	Houston	Harris	Houston
758512N	Grade Separation	San Felipe Rd	UP	Houston	Harris	Houston
912021M	Grade Separation	I-610 WB frontage rd	UP	Houston	Harris	Houston
912020F	Grade Separation	I-610 EB frontage rd	UP	Houston	Harris	Houston
758514C	Grade Separation	Richmond Ave	UP	Houston	Harris	Houston
762892E	Grade Separation	Sheldon Rd	UP	Houston	Harris	Houston
758517X	Grade Separation	Bissonnet St	UP	Houston	Harris	Houston
758519L	Grade Separation	Beechnut St	UP	Houston	Harris	Houston
762721D	Grade Separation	FM 364	UP	Houston	Jefferson	Beaumont
745074B	Crossing Closure	Oates Rd	UP	Houston	Harris	Houston
758284D	Crossing Closure	West St	UP	Houston	Harris	Houston
758532A	Crossing Closure	Roy St	UP	Houston	Harris	Houston

Table 5.2.9 Proposed Improvements on UPRR Houston Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
758535V	Crossing Closure	Parker St	UP	Houston	Harris	Houston
762852G	Crossing Closure	CR 601	UP	Houston	Liberty	Dayton
762853N	Crossing Closure	CR 602	UP	Houston	Liberty	Dayton
	Railroad	Englewood Third Main	UP	Houston	Houston	Harris
	Railroad	Englewood Arrival Track Expansion	UP	Houston	Houston	Harris
	Railroad	Second Mainline Track - Fauna to Crosby	UP	Houston	Houston	Harris
	Railroad	Englewood Connection Track	UP	Houston	Houston	Harris
	Railroad	Houston Subdivision Mainline Consolidation	UP	Houston	Houston	Harris
	Railroad	Dayton SE Wye Connection	UP	Houston	Liberty	Dayton
	Railroad	Dayton Siding Extension	UP	Houston	Liberty	Dayton

Grade Separations

N Shepherd Dr at UPRR Houston Subdivision

N Shepherd Dr (DOT #758534N) is currently a three-lane one-way roadway with approximately 18,470 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, four crashes occurred in the vicinity of the N Shepherd Dr at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the N Shepherd Dr and Maxie St, Eli St, Allen St, and Nett St intersections and would require traffic connectivity to adjacent businesses and side streets. This grade separation may be in concert with Durham Dr since these are one-way pairs. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of N Shepherd Dr at the Houston Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Westheimer Rd at UPRR Houston Subdivision

Westheimer Rd (DOT #758513V) is currently a five-lane roadway with approximately 15,730 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the Westheimer Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would require access roads to provide connectivity to businesses and side streets along the grade separation. Similarly, impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Westheimer Rd at the Houston Subdivision is estimated to cost \$35 million. Based on known constraints, this project may be considered a long-range implementation timeframe for planning purposes.

Bellaire Blvd at UPRR Houston Subdivision

Bellaire Blvd (DOT #758518E) is currently a six-lane roadway with approximately 32,940 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR

Houston Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Bellaire Blvd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would require access road along the grade separation to provide traffic connectivity to adjacent businesses and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements. A major transmission corridor adjacent to the tracks may impact design.

The grade separation of Bellaire Blvd at the Houston Subdivision is estimated to cost \$40 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Durham St at UPRR Houston Subdivision

Durham St (DOT #758533G) is currently a four-lane one-way roadway with approximately 20,710 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Durham St at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Durham St and Maxie St, Eli St, Allen St, Schuler St, and Nett St intersections and would require traffic connectivity to adjacent businesses and side streets. This grade separation may be in concert with N Shepherd Dr since these are one-way pairs. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Durham St at the Houston Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

San Felipe Rd at UPRR Houston Subdivision

San Felipe Rd (DOT #758512N) is currently a four-lane roadway with approximately 27,700 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, one crash occurred in the vicinity of the San Felipe Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would require access road along the grade separation to provide traffic

connectivity to adjacent businesses, residences, and side streets. Additional impacts to businesses and residences adjacent to the proposed grade separation may occur due to right-of-way and access requirements. A major transmission corridor adjacent to the tracks may impact design.

The grade separation of San Felipe Rd at the Houston Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

I-610 WB Frontage Rd at UPRR Houston Subdivision

The I-610 WB Frontage Rd (DOT #912021M) is currently a two-lane one-way roadway with approximately 21,050 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, one crash occurred in the vicinity of the I-60 WB Frontage Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would have minimal impacts to adjacent properties and side streets. This grade separation may be in concert with I-610 EB frontage road since they are one-way pairs. Additional impacts to properties adjacent to the proposed grade separation may be minimal due to right-of-way requirements. A major transmission corridor adjacent to the tracks may impact design.

The grade separation of the I-610 WB Frontage Rd at the Houston Subdivision is estimated to cost \$15 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

I-610 EB Frontage Rd at UPRR Houston Subdivision

The I-610 EB Frontage Rd (DOT #912020F) is currently a two-lane one-way roadway with approximately 20,330 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the I-60 EB Frontage Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the I-610 EB Frontage Rd/Bassoon Dr intersection. This grade separation may be in concert with I-610 WB frontage road since they are one-way pairs. Additional impacts to properties adjacent to the proposed grade separation may be minimal due to right-of-way requirements. A major transmission corridor adjacent to the tracks may impact design.

The grade separation of the I-610 EB Frontage Rd at the Houston Subdivision is estimated to cost \$15 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Richmond Ave at UPRR Houston Subdivision

Richmond Ave (DOT #758514C) is currently a six-lane roadway with approximately 21,360 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, one crash occurred in the vicinity of the Richmond Ave at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for a major overhead transmission corridor, overhead distribution lines, and a 66-inch waterline may be required for overpass construction. No environmental fatal flaws were identified during a preliminary environmental review that would require additional review during project design.

It is anticipated that the grade separation would impact connections between Richmond Ave and Mid Ln/Drexel Dr and would require additional access to provide connectivity for those streets. Similarly, access to adjacent businesses along the grade separation are provided via access roads. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Richmond Ave at the Houston Subdivision is estimated to cost \$42 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Sheldon Rd at UPRR Houston Subdivision

Sheldon Rd (DOT #762892E) is currently a four-lane roadway with approximately 7,740 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, three crashes occurred in the vicinity of the Sheldon Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead transmission/distribution lines and gas pipelines may be required for overpass construction. No

environmental fatal flaws were identified during a preliminary environmental review that would require additional review during project design.

It is anticipated that the grade separation would impact the Sheldon Road/US 90 intersection and would require an elevated intersection since US 90 and the Houston Subdivision are parallel and adjacent. Access to adjacent businesses along the grade separation are provided via access roads and roadway connections. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Sheldon Rd at the Houston Subdivision is estimated to cost \$43 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Bissonnet St at UPRR Houston Subdivision

Bissonnet St (DOT #758517X) is currently a four-lane roadway with approximately 19,370 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Bissonnet St at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Bissonnet St/Community Dr intersection and would require traffic connectivity to adjacent residences, businesses, and side streets. Additional impacts to residences and businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements. A major transmission corridor adjacent to the tracks may impact design.

The grade separation of Bissonnet St at the Houston Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Beechnut St at UPRR Houston Subdivision

Beechnut St (DOT #758519L) is currently a four-lane roadway with approximately 13,250 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Beechnut St at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would require traffic connectivity to adjacent businesses, residences, and side streets. Additional impacts to residences and businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements. A major transmission corridor adjacent to the tracks may impact design.

The grade separation of Beechnut St at the Houston Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

FM 364/S Major Dr at UPRR Houston Subdivision

FM 364/S Major Dr (DOT #762721D) is currently a four-lane roadway with approximately 15,100 vehicles per day that crosses the railroad at-grade in the city of Beaumont in Jefferson County. The identified grade separation location would separate vehicular traffic from the UPRR Houston Subdivision. According to crash data collected over a five-year period, three crashes occurred in the vicinity of the FM 364/S Major Dr at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the FM 364/US 90 intersection and would require traffic connectivity to adjacent businesses and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of FM 364/S Major Dr at the Houston Subdivision is estimated to cost \$35 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Crossing Closures

Oates Rd at UPRR Houston Subdivision

Currently a two-lane roadway with an estimated 1,560 vehicles per day, Oates Rd (DOT #745074B) is an at-grade crossing in the city of Houston in Harris County. Oates St is proposed to be closed at the intersection with the UPRR Houston Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed roadway improvements and an existing grade separation at Mesa Dr. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to properties served by Oates Rd are anticipated to remain up to the grade crossing closure or provided by an extension of Spikewood Dr. The identified alternate route to this crossing location uses the existing grade separation at Mesa Dr. The use of Oates Rd traffic

over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Oates Rd at the Houston Subdivision is estimated to cost \$60,000 (not including the associated Spikewood Dr extension). This can be considered a near-term implementation timeframe due to anticipated coordination with landowners.

West St at UPRR Houston Subdivision

West St (DOT #758284D) is a two-lane roadway with an estimated 310 vehicles per day at an at-grade crossing in the city of Houston in Harris County. West St is proposed to be closed at the intersection with the UPRR Houston Subdivision and HB&T West Belt Subdivision to eliminate the potential for crossing incidents at this at-grade crossing in concert with a proposed grade separation at Lyons Ave and use of the existing grade separation at Jensen Dr. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along West St are anticipated to remain up to the grade crossing closure and through an extension of Opelousas St. The identified alternate route to this crossing location uses the proposed grade separation at Lyons Ave and the existing grade separation at Jensen Dr. The use of West St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of West St at the Houston Subdivision and HB&T West Belt Subdivision is estimated to cost \$60,000 (not including the Lyons Ave grade separation). Implementation of the crossing closure is anticipated to coincide with the Lyons Ave grade separation project and additional railroad improvements.

Roy St at UPRR Houston Subdivision

Currently a two-lane roadway with an estimated 2,560 vehicles per day, Roy St (DOT #758532A) is an at-grade crossing in the city of Houston in Harris County. Roy St is proposed to be closed at the intersection with the UPRR Houston Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separations at Shepherd Dr and Durham Dr. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Roy St are anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separations at Shepherd Dr and Durham Dr, which are included as grade separation candidates in this study. The use of Roy St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Roy St at the Houston Subdivision is estimated to cost \$60,000 (not including the Shepherd Dr and Durham Dr grade separations). Implementation of the crossing closure is anticipated to coincide with the Shepherd Dr and Durham Dr grade separation projects.

Parker St at UPRR Houston Subdivision

Parker St (DOT #758535V) is a two-lane roadway with an estimated 270 vehicles per day at an at-grade crossing in the city of Houston in Harris County. Parker St is proposed to be closed at the intersection with the UPRR Houston Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separations at Shepherd Dr and Durham Dr. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Parker St are anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separations at Shepherd Dr and Durham Dr, which are included as grade separation candidates in this study. The use of Parker St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Parker St at the Houston Subdivision is estimated to cost \$60,000 (not including the Shepherd Dr and Durham Dr grade separations). Implementation of the crossing closure is anticipated to coincide with the Shepherd Dr and Durham Dr grade separation projects.

CR 601 at UPRR Baytown Subdivision

Currently a two-lane roadway with an estimated 440 vehicles per day, County Road (CR) 601 (DOT #762852G) is an at-grade crossing in the city of Dayton in Liberty County. CR 601 is proposed to be closed at the intersection with the UPRR Houston Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separation at US 90 and additional railroad improvements.

Access to adjacent properties along CR 601 are anticipated to remain up to the grade crossing closure. The anticipated alternate route to this crossing location may use the proposed at-grade crossing at Waco Street.

The crossing closure of CR 601 at the Houston Subdivision is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the US 90 grade separation project and additional railroad improvements included in the Dayton Siding Extension and Dayton SE Wye Connection projects.

CR 602 at UPRR Baytown Subdivision

County Road (CR) 602 (DOT #762853N) is a two-lane roadway with an estimated 1300 vehicles per day at an at-grade crossing in the city of Dayton in Liberty County. CR 602 is proposed to be closed at the intersection with the UPRR Houston Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separation at US 90 and additional railroad improvements.

Access to adjacent properties along CR 602 are anticipated to remain up to the grade crossing closure. The anticipated alternate route to this crossing location may use the proposed at-grade crossing at CR 603.

The crossing closure of CR 602 at the Houston Subdivision is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the US 90 grade separation project and additional railroad improvements included in the Dayton Siding Extension and Dayton SE Wye Connection projects.

Railroad Capacity Enhancements

Englewood Third Main

The Englewood Third Main project adds a 16,000 ft third main between Tower 26 and Tower 87 next to the Englewood Yard. The track provides additional capacity in an area where trains crew change, switch cars in the yard, and travel in both directions. The proposed improvement location is shown in Appendix A as part of Scenario 2.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Englewood Arrival Track Expansion

The Englewood Arrival Track Expansion project extends tracks in the existing Englewood Yard. The track extensions necessitate the closure of the Bringhurst Intermodal Yard and relocation of its current traffic to the Settegast Intermodal Yard. The longer tracks allow for trains to arrive or prepare to depart without needing to “double over” the process of splitting a train into two tracks that blocks the entrances to the yards and the mainline. This improvement may require right-of-way acquisition in a residential area. The proposed improvement location is shown in Appendix A as part of Scenario 1.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a long-range implementation timeframe for planning purposes.

Second Mainline Track – Fauna to Crosby

This project adds four miles of track connecting the existing Fauna and Crosby sidings and providing a continuous two-track segment of 13 miles. The project provides locations clear of at-grade crossings to hold trains and provides additional capacity for trains to pass each other, especially important with Amtrak. The proposed improvement location is shown in Appendix A as part of Scenario 4.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a long-range implementation timeframe for planning purposes.

Englewood Connection Track

The Englewood Connection Track project adds track to improve the connection in the southeast quadrant of the junction between HB&T East Belt and UPRR Houston Subdivisions at Tower 87. Trains currently must travel at restricted speed through Englewood Yard, blocking yard movements. The improved connection will allow trains to exit the mainlines quicker and allows for yard movements to continue unimpeded. Right-of way acquisition is expected as part of this effort. The proposed improvement location is shown in Appendix A as part of Scenario 2.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Houston Subdivision Mainline Consolidation

The Houston Subdivision Mainline Consolidation concept includes track realignment, removal of tracks, and relocation of the Amtrak Houston downtown station on the UPRR Houston Subdivision between Chaney Junction and Tower 26. Portions of the existing freight (9,000 ft) and passenger main tracks (8,000 ft), including 12 at-grade crossings will be permanently closed. The remaining tracks would be realigned creating a new alignment through the I-10/I-45 corridor. As part of this effort, the Amtrak Houston downtown station is proposed to be relocated about 5,000 ft east of its current location near the Houston Metro Burnett Transit Center. The new alignment provides a location clear of at-grade crossings for

trains to sit when there is congestion in the terminal. Right-of-way acquisition would be required for this project. The proposed improvement location is shown in Appendix A as part of Scenario 3.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a near-term implementation timeframe for planning purposes due to various roadway and drainage projects in the area that may benefit from this new alignment. This concept has minimal benefits from a rail perspective, but various public benefits, so this will require a coordinated effort by public agencies to identify funding for this project.

Dayton SE Wye Connection

For US 90 to be grade-separated to eliminate train-vehicle conflicts at the roadway. The Dayton SE Wye project relocates the existing connection between the UPRR Baytown and UPRR Houston Subdivisions, adding a new wye track. The primary train movement from the Baytown to Houston Subdivision is a west bound move. For a couple of trains that move east, the existing configuration requires trains to shove from the Baytown Subdivision and reversing direction to travel east of the UPRR Houston Subdivision. The improvements allow for progressive train movements without any delay of a turnaround move.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a near-term implementation timeframe for planning purposes due to anticipated funding commitments.

Dayton Siding Extension

The Dayton Siding Extension project extends the existing Dayton Siding 4,000 ft to the south and closes two existing at-grade crossings at CR 602 (DOT #762853N) and CR 601 (DOT #762852G) to replace lost rail capacity from the new wye connection. The project is required to replace lost capacity in UPRR's Old Dayton Yard for the rail relocation and would coincide with the Dayton SE Wye Connection project and increases the length of the siding that can be used to hold trains clear of at-grade crossings as part of this proposed effort. The proposed improvement location is shown in Appendix A as part of Scenario 4.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a near-term implementation timeframe for planning purposes due to anticipated public funding commitments.

HB&T – Houston East Belt Subdivision

HB&T is a 50/50 joint ownership between BNSF & UPRR. The HB&T Houston East Belt Subdivision is a predominately double-track railroad that runs between the HB&T West Belt Subdivision and HB&T tracks in Houston and Harris County. Rail traffic on this subdivision is bidirectional with an average train count of approximately 20 to 40 trains per day. BNSF and UPRR operate on the HB&T Houston East Belt Subdivision. The Houston East Belt Subdivision's right of way is generally within urbanized commercial and industrial areas.

Table 5.2.10 details the proposed improvements identified in this study on the HB&T Houston East Belt Subdivision.

Table 5.2.10 Proposed Improvements on HB&T Houston East Belt Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
	Railroad	Second Mainline - Buffalo Bayou	HB&T	East Belt	Harris	Houston
	Railroad	Settegast Intermodal Yard Expansion	HB&T	East Belt	Harris	Houston

Railroad Capacity Enhancements

Second Mainline – Buffalo Bayou

The Buffalo Bayou Second Main project constructs a double track bridge over Buffalo Bayou. The new bridge removes the only single-track bottleneck on the HB&T Houston East Belt Subdivision between Tower 85 and Tower 86. This improvement eliminates delays caused by trains waiting for an opposing train to cross the bridge which would reduce blocked crossings in this area. The proposed improvement location is shown in Appendix A as part of Scenario 2.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a long-range implementation timeframe for planning purposes.

Settegast Intermodal Expansion

The Settegast Intermodal Expansion project adds new tracks and extends the existing tracks in the Settegast Intermodal Yard, removing existing yards tracks. This will increase the intermodal capacity and reduce the classification capacity of the yard. This project is

proposed to be completed in conjunction with the Englewood Arrival Track Expansion project which will create additional classification capacity and close the Bringham Intermodal Yard. The longer intermodal tracks will result in fewer trains needing to “double in” or “double out,” the process of breaking a train into or building a train from multiple tracks and reduce the number of blocked vehicle crossings. No right-of-way acquisition is expected for this effort. The proposed improvement location is shown in Appendix A as part of Scenario 1.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a long-range implementation timeframe for planning purposes.

Union Pacific Railroad – Lafayette Subdivision

The UPRR Lafayette Subdivision is a predominately single-track railroad with limited sidings that runs between Beaumont, Texas and Iowa Junction east of Lake Charles, Louisiana and through Jefferson and Orange counties within the study area. Rail traffic on this subdivision is primarily eastbound with an average train count of approximately 21 trains per day. BNSF also has trackage rights along this section of the Lafayette Subdivision. The Lafayette Subdivision’s right of way is generally within rural areas except through towns along the route.

Table 5.2.11 details the proposed improvements identified in this study on the UPRR Lafayette Subdivision.

Table 5.2.11 Proposed Improvements on UPRR Lafayette Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
762719C	Crossing Closure	Langham Rd	UP	Lafayette	Jefferson	Beaumont
	Railroad	Beaumont Yard Bypass	UP	Lafayette	Jefferson	Beaumont

Crossing Closures

Langham Rd at UPRR Lafayette Subdivision

Langham Rd (DOT #762719C) is a two-lane roadway with an estimated 1,510 vehicles per day at an at-grade crossing in the city of Beaumont in Jefferson County. Langham Rd is proposed to be closed at the intersection with the UPRR Lafayette Subdivision in order to

eliminate the potential for crossing incidents at this at-grade crossing in concert with an existing grade separation at Dowlen Rd and additional railroad improvements.

Access to adjacent properties along Langham Rd are anticipated to remain up to the grade crossing closure. The anticipated alternate route to this crossing location may use the existing grade separation at Dowlen Rd.

The crossing closure of Langham Rd at the Lafayette Subdivision is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the Beaumont Yard Bypass project.

Railroad Capacity Enhancements

Beaumont Yard Bypass

This project adds a 11,000 ft third mainline next to Beaumont Yard and includes the closure of the existing at-grade crossing at Langham Rd (DOT #76271C). This area is the junction of the UPRR Lafayette, UPRR Beaumont, UPRR Houston, UPRR Sabine Industrial Lead, BNSF Silsbee and KCS Beaumont Subdivisions. This will improve fluidity for train crews changing, working at UPRR Sunnyside Yard, and connecting between the railroads. The proposed improvement location is shown in Appendix A as part of Scenario 4.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

The Beaumont Yard bypass on the Lafayette Subdivision may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad – Lufkin Subdivision

The UPRR Lufkin Subdivision is a single-track railroad with limited sidings that runs between the HB&T West Belt Subdivision and Shreveport, Louisiana and through Harris, Liberty, and Montgomery counties within the study area. Rail traffic on this subdivision is primarily southbound with an average train count of approximately 9 trains per day. BNSF also has trackage rights along this section of the Lufkin Subdivision. The areas adjacent to the Lufkin Subdivision's right of way are typically urban/suburban within Harris County and suburban/rural north of the county line.

Table 5.2.12 details the proposed improvements identified in this study on the UPRR Lufkin Subdivision.

Table 5.2.12 Proposed Improvements on UPRR Lufkin Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
755863C	Grade Separation	Mt Houston Rd	UP	Lufkin	Harris	Houston
758750G	Grade Separation	Tidwell Rd	UP	Lufkin	Harris	Houston
758757E	Grade Separation	Little York Rd	UP	Lufkin	Harris	Houston
755876D	Grade Separation	Kingwood Dr	UP	Lufkin	Montgomery	Houston
	Railroad	Tower 76 Wye Connection	UP	Lufkin	Harris	Houston

Grade Separations

Mt Houston Rd at UPRR Lufkin Subdivision

Mt Houston Rd (DOT #427962W) is currently a two-lane roadway with approximately 17,920 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Lufkin Subdivision. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the Mt Houston Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead distribution lines and waterlines may be required for overpass construction. A place of worship within the grade separation limits was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the Mt Houston Rd/Hirsch Rd and Mt Houston Rd/Varnell St intersections and would require access roads to provide connectivity between those intersections. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to businesses and residences adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Mt Houston Rd at the Lufkin Subdivision is estimated to cost \$18 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Tidwell Rd at UPRR Lufkin Subdivision

Tidwell Rd (DOT #758750G) is currently a four-lane roadway with approximately 19,210 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Lufkin Subdivision. According to crash data collected over a five-year period, one crash occurred in the vicinity of the Tidwell Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead distribution lines, waterlines, and sanitary sewer lines may be required for overpass construction. A place of worship within the grade separation area was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the Tidwell Rd/Hirsch Rd and Tidwell Rd/Lundy Rd intersections and would require access roads to provide connectivity between those intersections. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to businesses and residences adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Tidwell Rd at the Lufkin Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Little York Rd at UPRR Lufkin Subdivision

Little York Rd (DOT #758757E) is currently a four-lane roadway with approximately 19,610 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Lufkin Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Little York Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead transmission/distribution lines and a gas pipeline may be required for overpass construction. No

environmental fatal flaws were identified during a preliminary environmental review that would require additional review during project design.

It is anticipated that the grade separation would impact the Little York Rd/Hirsch Rd intersection and would require additional access to provide connectivity between Hirsch Rd and Little York Rd. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to businesses adjacent to the proposed grade separation and the Little York Rd/Hirsch Rd connection may occur due to right-of-way and access requirements.

The grade separation of Little York Rd at the Lufkin Subdivision is estimated to cost \$30 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Kingwood Dr at UPRR Lufkin Subdivision

Kingwood Dr (DOT #755876D) is currently a four-lane roadway with approximately 40,180 vehicles per day that crosses the railroad at-grade in the city of Houston in Montgomery County. The identified grade separation location would separate vehicular traffic from the UPRR Lufkin Subdivision. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the Kingwood Dr at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead distribution lines may be required for overpass construction. No environmental fatal flaws were identified during a preliminary environmental review that would require additional review during project design.

It is anticipated that the grade separation would impact the Kingwood Dr/Loop 494 and Kingwood Dr/Royal Forest Dr intersections and would require access roads to provide connectivity between those intersections. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Kingwood Dr at the Lufkin Subdivision is estimated to cost \$33 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Railroad Capacity Enhancements

Tower 76 Wye Connection

The Tower 76 Wye project adds a northeast eye connection at Tower 76. This improvement allows for trains coming from the Lufkin Subdivision to enter Settegast Yard more directly without traveling through the congested terminal area and reduce the number of blocked crossings. This effort will require right-of-way acquisition in a residential area. The proposed improvement location is shown in Appendix A as part of Scenario 2.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad – Navasota Subdivision

The UPRR Navasota Subdivision is a predominately single-track railroad with sidings that runs between Spring Junction on the Palestine Subdivision and Valley Junction at the Austin Subdivision near Hearne, Texas and through Harris, Montgomery, and Waller counties within the study area. Rail traffic on this subdivision is bidirectional with an average train count of approximately 16 trains per day. Other railroads do not have trackage rights along this segment of the Navasota Subdivision. The Navasota Subdivision's right of way is generally suburban in Harris County and rural in other areas except through towns along the route.

Table 5.2.13 details the proposed improvements identified in this study on the UPRR Navasota Subdivision.

Table 5.2.13 Proposed Improvements on UPRR Navasota Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
430076S	Grade Separation	Kuykendahl Rd	UP	Navasota	Harris	Spring
	Railroad	Hufsmith Second Track	UP	Navasota	Harris	Spring

Grade Separations

Kuykendahl Rd at UPRR Navasota Subdivision

Kuykendahl Rd (DOT #430076S) is currently a four-lane roadway with approximately 13,290 vehicles per day that crosses the railroad at-grade in the city of Spring in Harris County. The

identified grade separation location would separate vehicular traffic from the UPRR Navasota Subdivision. According to crash data collected over a five-year period, seven crashes occurred in the vicinity of the Kuykendahl Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead transmission/distribution lines may be required for overpass construction. No environmental fatal flaws were identified during a preliminary environmental review that would require additional review during project design.

It is anticipated that the grade separation would impact the Kuykendahl Rd/Hufsmith Kuykendahl Rd intersection and would require access roads to provide connectivity to the intersection. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Kuykendahl Rd at the Navasota Subdivision is estimated to cost \$47 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Railroad Capacity Enhancements

Hufsmith Second Track

The Hufsmith Second Track project adds a 9-mile long second track and adds a grade separation at the existing at-grade crossing at Kuykendahl Rd (DOT #430076S) between Hufsmith Siding and Spring Junction on the UPRR Navasota Subdivision. This project allows for trains to meet and pass without any delays and a location to hold trains without blocking any vehicular crossings when there is congestion on the Palestine Subdivision. The proposed improvement location is shown in Appendix A as part of Scenario 8.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad – Palestine Subdivision

The UPRR Palestine Subdivision is a single-track railroad with limited sidings that runs between the North Junction at the HB&T West Belt Subdivision and Longview, Texas and through Harris and Montgomery counties within the study area. Rail traffic on this

subdivision is primarily northbound with an average train count that ranges between 9 and 30 trains per day depending on segment. BNSF also has trackage rights along this section of the Palestine Subdivision. The areas adjacent to the Palestine Subdivision's right of way are typically urban/suburban within Harris County and suburban/rural north of the county line.

Table 5.2.14 details the proposed improvements identified in this study on the UPRR Palestine Subdivision.

Table 5.2.14 Proposed Improvements on UPRR Palestine Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
448400J	Grade Separation	E Richey Rd	UP	Palestine	Harris	Spring
427257T	Grade Separation	Rankin Rd	UP	Palestine	Harris	Houston
435486H	Grade Separation	SH 105/Phillips St	UP	Palestine	Montgomery	Conroe
427259G	Crossing Closure	Westfield Loop Rd	UP	Palestine	Harris	Spring
435487P	Crossing Closure	Lewis St	UP	Palestine	Montgomery	Conroe
435484U	Crossing Closure	Avenue A	UP	Palestine	Montgomery	Conroe
	Railroad	Westfield Auto Facility Yard Tracks Extension	UP	Palestine	Harris	Spring
	Railroad	Hardy Third Main	UP	Palestine	Harris	Houston

Grade Separations

E Richey Rd at UPRR Palestine Subdivision

E Richey Rd (DOT #448400J) is currently a four-lane roadway with approximately 14,900 vehicles per day that crosses the railroad at-grade in the city of Spring in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Palestine Subdivision. According to crash data collected over a five-year period, three crashes occurred in the vicinity of the E Richey Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the E Richey Rd/Hardy Rd intersection and the elevated Hardy Toll Road west of the crossing. The grade separation would require traffic connectivity to the intersections, adjacent properties, and side streets through possible access roads. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of E Richey Rd at the Palestine Subdivision is estimated to cost \$35 million. Based on known constraints, this project may be considered a long-range implementation timeframe for planning purposes.

Rankin Rd at UPRR Palestine Subdivision

Rankin Rd (DOT #427257T) is currently a four-lane roadway with approximately 16,560 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the UPRR Palestine Subdivision. According to crash data collected over a five-year period, five crashes occurred in the vicinity of the Rankin Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead distribution lines and waterlines may be required for overpass construction. No environmental fatal flaws were identified during a preliminary environmental review that would require additional review during project design.

It is anticipated that the grade separation would impact the Rankin Rd/Hardy Rd intersection and would require additional access to provide connectivity between Hardy Rd and Rankin Rd. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Rankin Rd at the Palestine Subdivision is estimated to cost \$28 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

SH 105/Phillips St at UPRR Palestine Subdivision

SH 105/Phillips St (DOT #435486H) is currently a two-lane one-way roadway with approximately 22,000 vehicles per day that crosses the railroad at-grade in the city of

Conroe in Montgomery County. The identified grade separation location would separate vehicular traffic from the UPRR Palestine Subdivision. According to crash data collected over a five-year period, five crashes occurred in the vicinity of the SH 105/Phillips St at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the SH 105/Phillips St westbound grade separation would be in concert with an eastbound grade separation at SH 105/Davis St. It is also anticipated that the grade separation would impact the SH 105 intersections at 1st St, Pacific St, and Main St and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of SH 105/Phillips St (without including Davis St) at the Palestine Subdivision is estimated to cost \$15 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Crossing Closures

Westfield Loop Rd at UPRR Palestine Subdivision

Westfield Loop Rd (DOT #427259G) is a two-lane roadway with an estimated 6,190 vehicles per day at an at-grade crossing in the city of Spring in Harris County. Westfield Loop Rd is proposed to be closed at the intersection with the UPRR Palestine Subdivision in order to accommodate additional railroad improvements detailed in Appendix B.

Access to adjacent properties along Westfield Loop Rd are anticipated to remain up to the grade crossing closure. The anticipated alternate route to this crossing location may use the existing at-grade crossing at Humble Westfield Rd.

The crossing closure of Westfield Loop Rd at the Palestine Subdivision is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the Westfield Auto Facility Yard Tracks extension.

Lewis St at UPRR Palestine Subdivision

Currently a two-lane roadway with an estimated 3,180 vehicles per day, Lewis St (DOT #435487P) is an at-grade crossing in the city of Conroe in Montgomery County. Lewis St is proposed to be closed at the intersection with the UPRR Palestine Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separations at SH 105. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Lewis St are anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separations at SH 105, which are included as grade separation candidates in this study. The use of Lewis St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Lewis St at the Palestine Subdivision is estimated to cost \$60,000 (not including the SH 105 grade separations). Implementation of the crossing closure is anticipated to coincide with the SH 105 grade separation projects.

Avenue A at UPRR Palestine Subdivision

Avenue A (DOT #435484U) is a two-lane roadway with an estimated 270 vehicles per day at an at-grade crossing in the city of Conroe in Montgomery County. Avenue A is proposed to be closed at the intersection with the UPRR Palestine Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separations at SH 105. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Avenue A are anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separations at SH 105, which are included as grade separation candidates in this study. The use of Avenue A traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Avenue A at the Palestine Subdivision is estimated to cost \$60,000 (not including the SH 105 grade separations). Implementation of the crossing closure is anticipated to coincide with the SH 105 grade separation projects.

Railroad Capacity Enhancements

Westfield Auto Facility Yard Tracks Extension

The Westfield Auto Facility Yard Tracks Extension project extends the Westfield Yard lead 4,000 ft to the south, adds dispatcher controlled power switches at both ends, closing the existing at-grade crossing at Westfield Loop Road (DOT #427259G) and adding a grade separation at Richey Road (DOT #448400J). These improvements will decrease the time trains working at the Yard will block the mainline, preserving that capacity for through train movements and reduce the number of blocked vehicular crossings. The proposed improvement location is shown in Appendix A as part of Scenario 8.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Hardy Third Main

The Hardy Third Main project adds 16,000 ft of third main track on the UPRR Palestine Subdivision. The subdivision is often used to stage trains for long durations due to congestion in the terminal, crew changes, or customer constraints. The project provides locations for trains to dwell with hindering the through movement of trains. The proposed improvement location is shown in Appendix A as part of Scenario 8.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Union Pacific Railroad – Strang Subdivision

The UPRR Strang Subdivision is a predominately double-track railroad that runs between South Tower 68 off the Houston Subdivision and the Seaport Industrial Lead/Bayport Loop through Harris County. Rail traffic on this subdivision is bidirectional with an average train count of approximately 18 trains per day. The BNSF and PTRA have trackage rights on certain segments along the Strang Subdivision. The Strang Subdivision's right of way is generally urban and industrial along the route.

Table 5.2.15 details the proposed improvements identified in this study on the UPRR Strang Subdivision.

Table 5.2.15 Proposed Improvements on UPRR Strang Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
	Railroad	Booth Second Mainline Track	UP	Strang	Harris	Houston

Railroad Capacity Enhancements

Booth Second Mainline Track

The Booth Second Track project adds 14,000 ft double main track between the PTRA North Yard and Manchester Junction. The project includes a second track over Buffalo Bayou and

over Brays Bayou as well as adding a second track at Booth Yard and closing three existing at-grade crossings: Medina St (DOT #869706B) and two on Fennell St (DOT #859544Y and DOT #869705U). This project reduces the number of blocked crossings by reducing train delays and adding train capacity on the UPRR Strang Subdivision. The proposed improvement location is shown in Appendix A as part of Scenario 2.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes. A portion of this improvement is included in the Texas Freight Mobility Plan.

BNSF Railway – Galveston Subdivision

The BNSF Galveston Subdivision is a single-track railroad with limited sidings that runs between Galveston, Texas and Temple, Texas and through Brazoria, Fort Bend, and Galveston counties within the study area. Rail traffic on this subdivision is bidirectional with an average train count that ranges between 9 and 28 trains per day depending on location along the subdivision. UPRR also has trackage rights along a majority of the Galveston Subdivision within the study area. The areas adjacent to the Galveston Subdivision's right of way are typically rural with suburban areas through towns along the route.

Table 5.2.16 details the proposed improvements identified in this study on the BNSF Galveston Subdivision.

Table 5.2.16 Proposed Improvements on BNSF Galveston Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
022645V	Grade Separation	Gordon St	BNSF	Galveston	Brazoria	Alvin
022675M	Grade Separation	FM 762	BNSF	Galveston	Fort Bend	Richmond
022673Y	Grade Separation	Royal Lakes Blvd	BNSF	Galveston	Fort Bend	Richmond
	Railroad	Duke Second Track	BNSF	Galveston	Fort Bend	Richmond

Grade Separations

Gordon St at BNSF Galveston Subdivision

Gordon St (DOT #022645V) is currently a four-lane roadway with approximately 13,400 vehicles per day that crosses the railroad at-grade in the city of Alvin in Brazoria County. The identified grade separation location would separate vehicular traffic from the BNSF Galveston Subdivision. According to crash data collected over a five-year period, four crashes occurred in the vicinity of the Gordon St at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Gordon St intersections at Old Galveston Rd and Willis St/Disney St and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Gordon St at the Galveston Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

FM 762 at BNSF Galveston Subdivision

FM 762 (DOT #022675M) is currently a two-lane roadway at an intersection with approximately 2,680 vehicles per day that crosses the railroad at-grade in the city of Richmond in Fort Bend County. The identified grade separation location would separate vehicular traffic from the BNSF Galveston Subdivision. According to crash data collected over a five-year period, six crashes occurred in the vicinity of the FM 762 at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the FM 762/FM 2759 intersection and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of FM 762 at the Galveston Subdivision is estimated to cost \$35 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Royal Lakes Blvd at BNSF Galveston Subdivision

Royal Lakes Blvd (DOT #022673Y) is currently a two-lane roadway with an estimated 2,200 vehicles per day that crosses the railroad at-grade in the city of Richmond in Fort Bend County. The neighborhood's only access is at this roadway-rail crossing. The identified grade separation location would separate vehicular traffic from the BNSF Galveston Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Royal Lakes Blvd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for an overhead distribution line may be required for overpass construction. A place of worship within the grade separation limits was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the Royal Lakes Blvd/FM 762 intersection and is proposed as an elevated intersection with FM 762 through lanes to be at grade. Access to adjacent properties and side streets along the grade separation are provided through the FM 762 through lanes. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way requirements.

The grade separation of Royal Lakes Blvd at the Galveston Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes. This potential project is included within the Texas State Rail Plan.

Railroad Capacity Enhancements

Duke Second Track

The Duke Second Track project extends Duke Siding 16,000 ft to the west. The project creates another location for longer trains or multiple shorter trains to meet, reducing delays on the BNSF Galveston Subdivision. The proposed improvement location is shown in Appendix A as part of Scenario 5.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

BNSF Railway – Houston Subdivision

The BNSF Houston Subdivision is a predominately double-track railroad that runs between Belt Junction in Houston, Texas and the DFW Subdivision in Teague, Texas and through Harris and Montgomery counties within the study area. Rail traffic on this subdivision is bidirectional with an average train count of approximately 6 trains per day. Other railroads do not have trackage rights along this segment of the Houston Subdivision. The Houston Subdivision's right of way is generally rural with suburban/urban area closer to Houston.

Table 5.2.17 details the proposed improvements identified in this study on the BNSF Houston Subdivision.

Table 5.2.17 Proposed Improvements on BNSF Houston Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
597091H	Grade Separation	FM 1960	BNSF	Houston	Harris	Houston
597085E	Grade Separation	W Little York Rd	BNSF	Houston	Harris	Houston
089370C	Grade Separation	Tidwell Rd	BNSF	Houston	Harris	Houston
597084X	Grade Separation	Antoine Rd	BNSF	Houston	Harris	Houston
675158C	Grade Separation	Cypresswood Rd	BNSF	Houston	Harris	Tomball

Grade Separations

FM 1960 at BNSF Houston Subdivision

FM 1960 (DOT #597091H) is currently a six-lane roadway with approximately 63,000 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Houston Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the FM 1960 at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead transmission/distribution lines, a major AT&T duct bank, and a waterline may be required for overpass construction. No environmental fatal flaws were identified during a preliminary environmental review that would require additional review during project design.

It is anticipated that the grade separation would impact the FM 1960/Breton Ridge St intersection and would require additional access to provide connectivity between Breton Ridge St and FM 1960. Similarly, access to adjacent properties and side streets along the

grade separation are provided via access roads. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of FM 1960 at the Houston Subdivision is estimated to cost \$44 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

W Little York Rd at BNSF Houston Subdivision

W Little York Rd (DOT #597085E) is currently a six-lane roadway with approximately 27,470 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Houston Subdivision. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the W Little York Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the W Little York Rd/Victory Dr intersection and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of W Little York Rd at the Houston Subdivision is estimated to cost \$40 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Tidwell Rd at BNSF Houston Subdivision

Tidwell Rd (DOT #089370C) is currently a four-lane roadway with approximately 17,810 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Houston Subdivision. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the Tidwell Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Tidwell Rd/Antoine Rd intersection and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements. If the Tidwell Rd and Antoine Rd grade separations are to be constructed during the same timeframe there may be efficiencies and/or other challenges in constructing these two adjacent grade separations.

The grade separation of Tidwell Rd at the Houston Subdivision is estimated to cost \$28 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Antoine Rd at BNSF Houston Subdivision

Antoine Rd (DOT #597084X) is currently a four-lane roadway with approximately 29,500 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Houston Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Antoine Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead transmission and distribution lines may be required for overpass construction. No environmental fatal flaws were identified during a preliminary environmental review that would require additional review during project design.

It is anticipated that the grade separation would impact the Antoine Rd/N Houston Rosslyn intersection and would require additional access to provide connectivity between N Houston Rosslyn Rd, Antoine Rd, and Tidwell Rd. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements. If the Tidwell Rd and Antoine Rd grade separations are to be constructed during the same timeframe there may be efficiencies and/or other challenges in constructing these two adjacent grade separations.

The grade separation of Antoine Rd at the Houston Subdivision is estimated to cost \$30 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Cypresswood Rd at BNSF Houston Subdivision

Cypresswood Rd (DOT #675158C) is currently a two-lane roadway with approximately 28,700 vehicles per day that crosses the railroad at-grade in the city of Tomball in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Houston Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Cypresswood Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay.

Based on a high-level utility review, utility adjustments for overhead transmission and distribution lines may be required for overpass construction. A previously recorded archaeological site within the grade separation limits was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the Cypresswood Rd/Cutten Rd intersection and is proposed as an elevated intersection. Access to adjacent properties and side streets along the grade separation are provided through access roads. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Cypresswood Rd at the Houston Subdivision is estimated to cost \$51 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

BNSF Railway – Mykawa Subdivision

The BNSF Mykawa Subdivision is a single-track railroad with limited sidings that runs between New South Yard in Houston and Alvin, Texas through Brazoria and Harris counties. Rail traffic on this subdivision is bidirectional with an average train count of approximately 23 trains per day. UPRR also has trackage rights along the Mykawa Subdivision. The areas adjacent to the Mykawa Subdivision's right of way are typically suburban along the route.

Table 5.2.18 details the proposed improvements identified in this study on the BNSF Mykawa Subdivision.

Table 5.2.18 Proposed Improvements on BNSF Mykawa Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
023227H	Grade Separation	Walnut St	BNSF	Mykawa	Brazoria	Pearland
023228P	Grade Separation	Airport Blvd	BNSF	Mykawa	Harris	Houston
023214G	Grade Separation	Long Dr	BNSF	Mykawa	Harris	Houston
023215N	Grade Separation	Griggs Rd	BNSF	Mykawa	Harris	Houston
023211L	Grade Separation	W Belfort Ave	BNSF	Mykawa	Harris	Houston
023207W	Grade Separation	Almeda Genoa Rd	BNSF	Mykawa	Harris	Houston
	Railroad	Mykawa Yard Expansion	BNSF	Mykawa	Harris	Houston
	Railroad	Mykawa Subdivision Second Track	BNSF	Mykawa	Harris	Houston

Grade Separations

Walnut St at BNSF Mykawa Subdivision

Walnut St (DOT #023227H) is currently a four-lane roadway with approximately 9,630 vehicles per day that crosses the railroad at-grade in the city of Pearland in Brazoria County. The identified grade separation location would separate vehicular traffic from the BNSF Mykawa Subdivision. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the Walnut St at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the Walnut St/SH 35 intersection and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses and properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Walnut St at the Mykawa Subdivision is estimated to cost \$35 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Airport Blvd at BNSF Mykawa Subdivision

Airport Blvd (DOT #023228P) is currently a four-lane roadway with approximately 13,410 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Mykawa Subdivision. According to crash data collected over a five-year period, four crashes occurred in the vicinity of the Airport Blvd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead distribution lines, waterlines, sanitary sewer lines, and gas pipelines may be required for overpass construction. A place of worship within the grade separation limits was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the Airport Rd intersections with Mykawa Rd and Station Dr and would require traffic connectivity via access roads to these intersections as well as adjacent businesses and residences. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to businesses and residences adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Airport Blvd at the Mykawa Subdivision is estimated to cost \$34 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Long Dr at BNSF Mykawa Subdivision

Long Dr (DOT #023214G) is currently a four-lane roadway with approximately 14,800 vehicles per day that crosses the railroad at-grade as part of a three-legged intersection in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Mykawa Subdivision. According to crash data collected over a five-year period, five crashes occurred in the vicinity of the Long Dr at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact all four grade crossing locations within the intersection and the intersections at Mykawa Rd. It would also require traffic connectivity to adjacent

properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Long Dr at the Mykawa Subdivision is estimated to cost \$35 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Houston Southeast was awarded a CRISI grant to review preliminary engineering and NEPA for review of a potential grade separation at this location. This location is also included within the Texas Freight Mobility Plan.

Griggs Rd at BNSF Mykawa Subdivision

Griggs Rd (DOT #023215N) is currently a four-lane roadway with approximately 11,800 vehicles per day that crosses the railroad at-grade as part of a three-legged intersection in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Mykawa Subdivision. According to crash data collected over a five-year period, six crashes occurred in the vicinity of the Griggs Rd at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact all four grade crossing locations within the intersection and the intersections at Mykawa Rd. It would also require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Griggs Rd at the Mykawa Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Houston Southeast was awarded a CRISI grant to review preliminary engineering and NEPA for review of a potential grade separation at this location. This location is also included within the Texas Freight Mobility Plan.

W Bellfort Ave at BNSF Mykawa Subdivision

W Bellfort Ave (DOT #023211L) is currently a four-lane roadway with approximately 14,250 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Mykawa Subdivision. According to crash data collected over a five-year period, two crashes occurred in the vicinity of the W Bellfort Ave at-grade crossing.

While a conceptual exhibit has not been prepared for this location, it is anticipated that the grade separation would impact the W Bellfort Ave intersections with Mykawa Rd and Crosswell Rd and would require traffic connectivity to these intersections as well as adjacent businesses and residences. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of W Bellfort Ave at the Mykawa Subdivision is estimated to cost \$25 million. Based on known constraints, this project may be considered a mid-range implementation timeframe for planning purposes.

Almeda Genoa Rd at BNSF Mykawa Subdivision

Almeda Genoa Rd (DOT #023207W) is currently a two-lane roadway with approximately 7,850 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the BNSF Mykawa Subdivision. According to crash data collected over a five-year period, three crashes occurred in the vicinity of the Almeda Genoa Rd at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments a waterline may be required for overpass construction. A school within the grade separation area was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the Almeda Genoa Rd intersections with Mykawa Rd and Burk St and would require traffic connectivity via access roads to these intersections as well as adjacent businesses and residences. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to businesses and residences adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Almeda Genoa Rd at the Mykawa Subdivision is estimated to cost \$16 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes. This location is included in the Texas Freight Mobility Plan.

Railroad Capacity Enhancements

Mykawa Yard Expansion

The Mykawa Yard Expansion project expands the existing Mykawa Yard and adds a grade separation at the at-grade crossing at Almeda Genoa Rd (DOT #023207W). The expansion enables train traffic to shift from the New and Old South Yards. These yards, due to their location and short tracks that require trains to occupy the main line, congest the terminal area. To reach the expanded yard requires trains coming to and from the BNSF Galveston Subdivision, instead of arriving via the UPRR Glidden Subdivision, to continue on the BNSF Galveston Subdivision to Mykawa Subdivision. The new yard reduces congestion in the terminal and on the Glidden and Harrisburg Subdivisions but increase train miles and adds traffic on the BNSF Galveston Subdivision. ROW acquisition is anticipated at this location to accommodate the extra track capacity. The proposed improvement location is shown in Appendix A as part of Scenario 5.

During a preliminary environmental review, a superfund site was identified. As part of future project development fatal flaw environmental impacts would need to be determined prior to further design development.

This project may be considered a long-range implementation timeframe for planning purposes.

Mykawa Subdivision Second Track (T&NO Junction to Mykawa Yard)

The Mykawa Second Track is 20,000 ft of second main track between T&NO Junction and Mykawa Yard. The project provides more fluid movement of trains traveling between the two BNSF yards and allow for train movements to continue when trains are switching from the BNSF New South Yard. The proposed improvement location is shown in Appendix A as part of Scenario 6.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a long-range implementation timeframe for planning purposes.

KCS Railway – Beaumont Subdivision

The KCS Beaumont Subdivision is a predominately double-track railroad that runs from Port Arthur, Texas through Beaumont and to Shreveport, Louisiana and through Jefferson and Orange counties within the study area. Rail traffic on this subdivision is primarily westbound with an average train count of approximately 19 trains per day. UPRR, BNSF,

and Amtrak have trackage rights on different segments of the Beaumont Subdivision in the study limits. The Beaumont Subdivision's right of way is generally rural with some suburban areas.

Table 5.2.19 details the proposed improvements identified in this study on the KCS Beaumont Subdivision.

Table 5.2.19 Proposed Improvements on KCS Beaumont Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
329559B	Grade Separation	Dr Ransom Howard St	KCS	Beaumont	Jefferson	Port Arthur
762483M	Grade Separation	FM 105/S Main St	KCS	Beaumont	Orange	Vidor
329559B	Crossing Closure	9th St	KCS	Beaumont	Jefferson	Port Arthur
329473S	Crossing Closure	Mockingbird Dr	KCS	Beaumont	Orange	Rose City
329474Y	Crossing Closure	Canary St	KCS	Beaumont	Orange	Rose City
329472K	Crossing Closure	N Dewitt Rd	KCS	Beaumont	Orange	Vidor
	Railroad	Neches River Bridge Second Mainline Track	KCS	Beaumont	Jefferson	Beaumont
	Railroad	Vidor South Siding Extension	UP	Lafayette	Orange	Vidor

Grade Separations

Dr Ransom Howard St at KCS Beaumont Subdivision

Dr Ransom Howard St (DOT #329559B) is currently a two-lane roadway with approximately 3,130 vehicles per day that crosses the railroad at-grade in the city of Port Arthur in Jefferson County. The identified grade separation location would separate vehicular traffic from the KCS Beaumont Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Dr Ransom Howard St at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead transmission/distribution lines may be required for overpass construction. A place of worship within the grade separation area was identified during a preliminary environmental review that will require additional review during project design.

It is anticipated that the grade separation would impact the Dr Ransom Howard St/Houston Ave intersection and would require a change in access to provide connectivity between Houston Ave and Dr Ransom Howard St. Similarly, access to adjacent properties and side streets along the grade separation may be restricted due to the design constraints. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Dr Ransom Howard St at the Beaumont Subdivision is estimated to cost \$20 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes. This potential project is included within the Texas Freight Mobility Plan.

FM 105/S Main St at KCS Beaumont Subdivision

FM 105/S Main St (DOT #762483M) is currently a four-lane roadway with approximately 7,000 vehicles per day that crosses the railroad at-grade in the city of Vidor in Orange County. The identified grade separation location would separate vehicular traffic from the KCS Beaumont Subdivision. According to crash data collected over a five-year period, three crashes occurred in the vicinity of the FM 105/S Main St at-grade crossing.

A proposed conceptual grade separation design for this location is shown in Appendix B. The design provides a roadway overpass to eliminate vehicle/train incidents and delay. Based on a high-level utility review, utility adjustments for overhead lines may be required for overpass construction. No environmental fatal flaws were identified during a preliminary environmental review that would require additional review during project design.

It is anticipated that the grade separation would impact the FM 105 intersections at Greathouse Dr and Mission Dr and would require additional access to provide connectivity to these intersections. Similarly, access to adjacent properties and side streets along the grade separation are provided via access roads. Additional impacts to property adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of FM 105/S Main St at the Beaumont Subdivision is estimated to cost \$19 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes.

Crossing Closures

9th St at KCS Beaumont Subdivision

Currently a two-lane roadway with an estimated 3,130 vehicles per day, 9th St (DOT #329559B) is an at-grade crossing in the city of Port Arthur in Jefferson County. 9th St is proposed to be closed at the intersection with the KCS Beaumont Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separation at Dr Ransom Howard St. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along 9th St are anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separation at Dr Ransom Howard St, which is included as a grade separation candidate in this study. The use of 9th St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of 9th St at the Beaumont Subdivision (not including the Dr Ransom Howard St grade separation) is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the Dr Ransom Howard St grade separation project.

Mockingbird Dr at KCS Beaumont Subdivision

Mockingbird Dr (DOT #329473S) is a two-lane roadway with an estimated 340 vehicles per day at an at-grade crossing in the city of Rose City in Orange County. Mockingbird Dr is proposed to be closed at the intersection with the KCS Beaumont Subdivision in concert with additional railroad improvements.

Access to adjacent properties along Mockingbird Dr are anticipated to remain up to the grade crossing closure. The anticipated alternate route to this crossing location may use the existing grade separation at Rose City Dr.

The crossing closure of Mockingbird Dr at the Beaumont Subdivision is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the Vidor siding extension project.

Canary St at KCS Beaumont Subdivision

Currently a two-lane roadway with an estimated 100 vehicles per day, Canary St (DOT #329474Y) is an at-grade crossing in the city of Rose City in Orange County. Canary St is proposed to be closed at the intersection with the KCS Beaumont Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with additional railroad improvements.

Access to adjacent properties along Canary St are anticipated to remain up to the grade crossing closure. The anticipated alternate route to this crossing location may use the existing grade separation at Rose City Dr.

The crossing closure of Canary St at the Beaumont Subdivision is estimated to cost \$60,000. Implementation of the crossing closure is anticipated to coincide with the Vidor siding extension project.

N Dewitt Rd at KCS Beaumont Subdivision

N Dewitt Rd (DOT #329472K) is a two-lane roadway with an estimated 3,040 vehicles per day at an at-grade crossing in the city of Vidor in Orange County. N Dewitt Rd is proposed to be closed at the intersection with the KCS Beaumont Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the proposed grade separation at FM 105/S Main St.

Access to adjacent properties along N Dewitt Rd are anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the proposed grade separation at FM 105, which is included as a grade separation candidate in this study. The use of N Dewitt Rd traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of N Dewitt Rd at the Beaumont Subdivision is estimated to cost \$60,000 (not including the FM 105 grade separation). Implementation of the crossing closure is anticipated to coincide with the FM 105/S Main St grade separation project.

Railroad Capacity Enhancements

Neches River Bridge Second Mainline Track

The Neches River Bridge Second Main Track project involves the construction of a new two track moveable bridge. Trains from UPRR Lafayette and KCS Beaumont Subdivision combine and onto the existing single-track bridge. The new bridge will enable more fluid

movements through Beaumont for UPRR, KCS, and BNSF. The proposed improvement location is shown in Appendix A as part of Scenario 4.

A previous study, the *Neches River Bridge Feasibility Study*, reviewed multiple options to increase the capacity across the river. A preferred option was not identified within this study.

The second track across the Neches River on the Beaumont Subdivision has a varied range of potential costs depending on the implementation strategy chosen. This project may be considered a long-range implementation timeframe for planning purposes.

Vidor South Siding Extension

The Vidor South Siding Extension extends the existing 14,000 ft Vidor siding an additional 8,000 ft to the west, closes Canary St (DOT #329474Y), Mockingbird Dr (DOT #329473S), and N Dewitt St (DOT #329472K) and adds a grade separation at SH 105 (DOT #329471D). The project provides a location clear of the main line track for trains to meet and crew change. The proposed improvement location is shown in Appendix A as part of Scenario 4.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

HB&T – West Belt Subdivision

The HB&T West Belt Subdivision is a double-track railroad within the Houston complex that runs between T&NO Junction at the Harrisburg Subdivision and Belt Junction on the Houston East Belt Subdivision within Harris County. Rail traffic on this subdivision is bidirectional with an average train count of approximately 14 to 30 trains per day. Other railroads have trackage rights along the West Belt Subdivision. The areas adjacent to the West Belt Subdivision's right of way are typically urban residential and commercial within the complex.

Table 5.2.20 details the proposed improvements identified in this study on the HB&T West Belt Subdivision.

Table 5.2.20 Proposed Improvements on HB&T West Belt Subdivision

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
288228X	Grade Separation	York St	HB&T	West Belt	Harris	Houston
288129A	Grade Separation	Commerce St	HB&T	West Belt	Harris	Houston
288098D	Grade Separation	Nance St	HB&T	West Belt	Harris	Houston
288095H	Grade Separation	Lyons Ave	HB&T	West Belt	Harris	Houston
748688W	Crossing Closure	West St	HB&T	West Belt	Harris	Houston
	Railroad	Belt Jct SE Wye Connection	HB&T	West Belt	Harris	Houston
	Railroad	Texas Spur Third Main	HB&T	West Belt	Harris	Houston

Grade Separations

York St at HB&T West Belt Subdivision

York St (DOT #288228X) is currently a four-lane one-way roadway with approximately 1,680 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the HB&T West Belt Subdivision. According to crash data collected over a five-year period, one crash occurred in the vicinity of the York St at-grade crossing.

A conceptual design for this location was prepared as part of the Gulf Coast Rail District West Belt Improvements Study in 2012. Based on this design, York St and Sampson St combine for a single depressed roadway under the West Belt Subdivision. It is anticipated that the grade separation would impact multiple intersections and would require traffic connectivity to adjacent properties and side streets. Additional impacts to businesses adjacent to the proposed grade separation are likely to occur due to right-of-way and access requirements.

The grade separation of York St (with Sampson St) at the West Belt Subdivision is estimated to cost \$46 million. Based on known constraints, this project may be considered a near-

term implementation timeframe for planning purposes. This potential project is included within the Texas State Rail Plan.

Commerce St at HB&T West Belt Subdivision

Commerce St (DOT #288129A) is currently a two-lane roadway with approximately 300 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the HB&T West Belt Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Commerce St at-grade crossing.

A conceptual design for this location was prepared as part of the Gulf Coast Rail District West Belt Improvements Study in 2012. Based on this design, it is anticipated that the grade separation would require reconstruction of the existing Navigation Blvd underpass and would create a depressed intersection at the location with the need for a pump station. Additional impacts to businesses adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Commerce St at the West Belt Subdivision is estimated to cost \$36 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes. This potential project is included within the Texas State Rail Plan.

Nance St at HB&T West Belt Subdivision

Nance St (DOT #288098D) is currently a two-lane roadway with approximately 650 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the HB&T West Belt Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Nance St at-grade crossing.

A conceptual design for this location was prepared as part of the Gulf Coast Rail District West Belt Improvements Study in 2012. Based on the design, it is anticipated that the grade separation would realign the Nance St crossing with the railroad, requiring right-of-way acquisition, and would require additional traffic connectivity to adjacent properties and side streets. While most right-of-way acquisition appears to be in vacant properties, additional impacts to businesses adjacent to the proposed grade separation and associated closures may occur due to access requirements.

The grade separation of Nance St at the Houston West Belt Subdivision is estimated to cost \$15 million. Based on known constraints, this project may be considered a near-term

implementation timeframe for planning purposes. This is being contemplated as part of TxDOT's I-45 NHHIP. This potential project is included within the Texas State Rail Plan.

Lyons Ave at HB&T West Belt Subdivision

Lyons Ave (DOT #288095H) is currently a two-lane roadway with approximately 2,110 vehicles per day that crosses the railroad at-grade in the city of Houston in Harris County. The identified grade separation location would separate vehicular traffic from the HB&T West Belt Subdivision. According to crash data collected over a five-year period, no crashes occurred in the vicinity of the Lyons Ave at-grade crossing.

A conceptual design for this location was prepared as part of the Gulf Coast Rail District West Belt Improvements Study in 2012. Based on the design, it is anticipated that the grade separation would impact the Lyons Ave/West St intersection and may require traffic connectivity to adjacent properties and side streets via an Opelousas St extension to West St. The depressed design would require a pump station. Additional impacts to properties adjacent to the proposed grade separation may occur due to right-of-way and access requirements.

The grade separation of Lyons Ave at the Houston West Belt Subdivision is estimated to cost \$15 million. Based on known constraints, this project may be considered a near-term implementation timeframe for planning purposes. This potential project is included within the Texas State Rail Plan.

Crossing Closures

West St at HB&T West Belt Subdivision

West St (DOT #748688W) is a two-lane roadway with an estimated 310 vehicles per day at an at-grade crossing in the city of Houston in Harris County. West St is proposed to be closed at the intersection with the HB&T West Belt Subdivision and Houston Subdivision in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with a proposed grade separation at Lyons Ave and use of the existing grade separation at Jensen Dr. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along West St are anticipated to remain up to the grade crossing closure and through an extension of Opelousas St. The identified alternate route to this crossing location uses the proposed grade separation at Lyons Ave and the existing grade separation at Jensen Dr. The use of West St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of West St at the West Belt Subdivision and Houston Subdivision is estimated to cost \$60,000 (not including the Lyons Ave grade separation). Implementation of the crossing closure is anticipated to coincide with the Lyons Ave grade separation project and additional railroad improvements.

Railroad Capacity Enhancements

Belt Junction SE Wye Connection

The Belt Junction SE Wye adds a second track along the Belt Junction SE wye which connects the HB&T West Belt Subdivision with the Houston East Belt Subdivision. A large amount of traffic uses the existing single wye track, adding a second track allows for continue movement in each direction, reducing delays to trains in the terminal. The proposed improvement location is shown in Appendix A as part of Scenario 2.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a mid-range implementation timeframe for planning purposes.

Texas Spur Third Main

The Texas Spur Third Main project adds 14,000 ft of third main track. The project provides a location for trains to sit or pass by the congestion on the HB&T West Belt Subdivision by the BNSF New and Old South Yards. The proposed improvement location is shown in Appendix A as part of Scenario 6.

No fatal-flaw environmental impacts were found during a preliminary environmental review.

This project may be considered a long-range implementation timeframe for planning purposes.

PTRA

The PTRA is run by the Port of Houston Authority, BNSF, UPRR, and KCS and provides services to ports and the Houston Ship Channel area in Harris County. Rail traffic on the tracks is bidirectional with an average train count of approximately 6 trains per day depending on location. The areas adjacent to the PTRA's right of way are typically industrial along the route.

Table 5.2.21 details the proposed improvements identified in this study on the PTRA.

Table 5.2.21 Proposed Improvements on PTRA

DOT #	Type	Improvement	RR Owner	Subdivision	County	City
869706B	Crossing Closure	Medina St	PTRA	-	Harris	Houston
869705U	Crossing Closure	Fennell St	PTRA	-	Harris	Houston

Crossing Closures

Medina St at PTRA

Currently a two-lane roadway with an estimated 560 vehicles per day, Medina St (DOT #869706B) is an at-grade crossing in the city of Houston in Harris County. Medina St is proposed to be closed at the intersection with the PTRA in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the existing grade separation at Broadway St. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Medina St are anticipated to remain up to the grade crossing closure. The identified alternate route to this crossing location uses the existing grade separation at Broadway St. The use of Medina St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Medina St at the PTRA is estimated to cost \$60,000. This can be considered a near-term implementation timeframe since grade separation infrastructure is in place at Broadway St.

Fennell St at PTRA

Fennell St (DOT #869705U) is a two-lane roadway with an estimated 320 vehicles per day at an at-grade crossing in the city of Houston in Harris County. Fennell is proposed to be closed at the intersection with the PTRA in order to eliminate the potential for crossing incidents at this at-grade crossing in concert with the existing grade separation at Broadway St. The location of the potential crossing closure and its alternative route are identified in Appendix B.

Access to adjacent properties along Fennell St are anticipated to remain up to the grade crossing closure, and access to the area within the track areas may remain through gates into and out of the area to deter public traffic use. The identified alternate route to this crossing location uses the existing grade separation at Broadway St. The use of Fennell St traffic over a grade separation in lieu of an at-grade crossing eliminates potential vehicle and train conflicts and increases safety.

The crossing closure of Fennell St at the PTRC is estimated to cost \$60,000. This can be considered a near-term implementation timeframe since grade separation infrastructure is in place at Broadway St.

Section 6: Recommendation and Implementation Strategy

This report section identifies a process for moving the potential grade separation, crossing closure, and railroad capacity improvement projects forward through prioritizing improvements, determining an implementation schedule, and adding into local, regional, or state transportation plans. The section also discusses some opportunities for funding these projects through available grant programs and federal, state, and regional programs.

6.1 Implementation Strategies

The grade separation, crossing closure, and rail capacity improvements included in this study are the beginning of a discussion of the regional needs for infrastructure changes at railroad crossings and corridors. These proposed projects are anticipated to reduce vehicular and train delays, increase transportation system capacity, reduce the potential for incidents, and improve the quality of life for roadway users.

Stakeholders within the Houston-Beaumont region should review the initial findings of this report and further evaluate the projects to validate their benefits to the region. Projects, as deemed by the stakeholders, should be included as part of state, regional, and local transportation planning documents as well as planning documents of private stakeholders and identify potential funding for the projects based on anticipated implementation timeframes.

The process for the prioritization of projects for planning and implementation purposes should occur at the state, regional, and local level and include appropriate stakeholders associated with those improvements. At a minimum, those involved in the prioritization process should include:

- TxDOT districts
- H-GAC
- SETRPC
- Gulf Coast Rail District
- Municipalities within region
- Rail Stakeholders (BNSF, HB&T, KCS, PTRR, UPRR)

Potential implementation timeframes are included with each project and can assist in prioritization of near-term, mid-range, and long-term improvements. These timeframes are based on potential infrastructure and political challenges associated with each improvement. Considerations should also focus on additional infrastructure needs that may

be required to implement some of the proposed improvements, such as possible adjustment of US 90A overpasses for grade separations at Fondren Road, Gessner Road, and others.

6.2 Funding Opportunities

There are many programs through the USDOT that help fund eligible infrastructure projects through competitive discretionary grants. Some of the well-known programs, such as Rebuilding American Infrastructure with Sustainability and Equity (RAISE) and Infrastructure for Building America (INFRA) grants, have specific requirements related to eligibility, funding match, and project metrics.

The following programs provide opportunities for, at minimum, a portion of funding for the types of projects identified in this study.

Federal Highway Administration Rail-Highways Crossing Program (Section 130)

The Section 130 program, which appropriates funds to states, provides monies for improvements to eliminate hazards and decrease fatalities at roadway-rail crossings. Projects are funded at a 90% federal share. Fifty percent of the state's apportionment of the federal funds are to be used for installation of protective devices at crossings, while the remainder can be spent on any roadway-rail project meeting the program's requirements.

Eligible projects include all roadway-rail public crossing improvements, installation of protective devices (crossing gates/signals and associated railroad infrastructure), and crossing closures. Projects that remove hazards posed by blocked crossings are also considered eligible. Crossing closures can be implemented through the Section 130 program if matching funds are provided by the railroad.

Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grants

Previously known as Transportation Investment Generating Economic Recovery (TIGER), the BUILD Transportation Discretionary Grant program invests in roadway, railroad, transit, and port projects that achieve national objectives. Eligible projects include highway and bridge improvements, public transportation projects, passenger and freight rail improvements, port infrastructure investments, and intermodal projects.

Eligible applicants for BUILD grants include state and local governments, port authorities, metropolitan planning organizations (MPOs), and other political subdivisions of state or local governments. The federal funding percentage for projects under BUILD varies, and typically only up to a certain percentage of the matching funds from the applicant may be federal funds. Funds are split between rural and urban areas.

Infrastructure for Building America (INFRA) Grants

The goals of the INFRA Discretionary Grant program, previously called the Nationally Significant Freight and Highway Projects (NSFHP) program, are to provide Federal financial assistance to highway and freight projects of national or regional significance. Specifically, the program focuses on transportation infrastructure projects that support the key objectives of supporting economic vitality at the national and regional levels, leveraging federal funding to attract non-federal sources of investment, using innovative technology/project delivery/financing, and the accountability of the grant applicant.

Eligible grant applicants for INFRA grants include states, MPOs serving urban areas, local governments, public authorities with transportation functions, port authorities, and political subdivisions. The federal funding percentage for projects under INFRA varies, and typically only up to a certain percentage of the matching funds from the applicant may be federal funds. Funds are split between rural and urban areas.

Consolidated Rail Infrastructure and Safety Improvements (CRISI) Program

The CRISI grant program leverages private, state, and local investments to support safety enhancements and general improvements to infrastructure for both intercity passenger and freight railroads. Types of projects consist of railroad safety technology, capital projects related to intercity passenger rail service, capital projects that reduce congestion and facilitate ridership growth, grade crossing projects, rail line relocation and improvement projects, and shortline/regional railroad infrastructure.

Eligible grant applicants include states, public agencies, political subdivisions of states, Amtrak or other rail carriers providing intercity rail passenger service, and Class II or III railroads. The federal funding percentage for projects under CRISI varies, and typically only up to a certain percentage of the matching funds from the applicant may be federal funds.

Transportation Infrastructure Finance and Innovation Act (TIFIA) Loan Program

TIFIA's strategic goal is to provide credit assistance through direct loans and other methods to increase capital market investment in transportation infrastructure for nationally and regionally significant projects. TIFIA differs from grant programs in that it loans monies at low interest rates (equivalent to U.S. Treasury rates) with repayment up to a 35-year term from substantial completion. The loan program's key objectives are to facilitate projects with significant public benefits and encourage new revenue streams and private participation while limiting federal exposure and risk.

Eligible project sponsors include state governments, special authorities, local governments, and transportation improvement districts. Loans can be procured for highways and bridges,

freight transfer facilities, passenger rail facilities, and surface transportation elements of port projects. The TIFIA program's eligible cost threshold is typically at least \$50 million.

Railroad Rehabilitation and Improvement Financing (RRIF) Loan Program

The RRIF loan program provides direct loans and loan guarantees to finance the development of railroad infrastructure. Funding through the RRIF loan program may be used to improve or rehabilitate intermodal or rail facilities (track, bridges, yards, building, shops, PTC), to develop new intermodal or railroad facilities, or to reimburse planning and design activities related to those types of projects. Similar to TIFIA, the program offers a low interest rate with up to a 35-year repayment period.

Eligible applicants include state and local governments, government-sponsored authorities and corporations, railroads, and limited option freight shippers that own/operate facilities. The RRIF program does not have minimum project cost thresholds.

Federal Railroad Administration (FRA) and Federal Transit Administration (FTA) Funds

The FRA and FTA have other competitive discretionary grant programs beyond those described above that provide assistance in maintaining a state of good repair, improving intercity passenger rail service, and implementing safety and new technologies. While projects included within this study have not been chosen for inclusion of transit for FTA funding, future opportunities may arise which roadway-rail grade separation improvements may be along a future transit corridor and may qualify for certain grant programs.