# 2.0 Alternatives Analysis

As part of the Project planning process, on-site and offsite alternatives were considered. Based on the factors considered below, TxDOT has demonstrated that there are no practicable alternatives that achieve the Project's stated purpose and need.

## 2.1 Screening Criteria

The following Screening Criteria have been created to help determine the practicability of Project alternatives in light of the Overall Project Purpose and the feasibility of these alternatives when considering cost, logistics, and existing technology.

1. **Traffic Capacity:** Roadway infrastructure must be able to support existing and forecasted traffic.
    a. Traffic capacity is measured by the current (2024) and anticipated future (2050) traffic volumes along the Project corridor.
    b. The SH 4 existing traffic volume is 6,743 vehicles per day (based on Oct 3, 2024 count). Based on a Year 2024-2044 Growth Rate of 9% and a Year 2044-2060 Growth Rate of 2%, the SH 4 traffic volume is expected to be 19,700 vehicles per day in 2050.
    c. Based on guidance from the Highway Capacity Manual (HCM), this volume, in combination with a Direction Distribution Factor of 70% and a Truck Percentage of 12%, indicates the need for a 4-lane facility.
2. **Roadway Safety:** Roadway improvements must reduce crash frequency along the SH 4 corridor.
    a. Safety levels are measured by reviewing the history of crashes along the Project corridor. A safety analysis has been conducted in accordance with procedures per AASHTO Highway Safety Manual and TxDOT Traffic and Safety Analysis Procedures Manual.
    b. TxDOT's Crash Records Information System (CRIS) for the period between January 1, 2019 and December 31, 2023 indicates that there was one fatal crash and three serious injury crashes along the Project corridor.
    c. The observed average crash frequency was compared to a predicted average crash frequency for the Project segment based on safety performance functions calibrated to Texas and published by Texas

Transportation Institute. Observed crashes were higher than predicted values for similar type roadways, indicating a potential for reducing crashes.

3. **Address Roadway Deficiencies:** Any improvements to SH 4 must address the following facility deficiencies along the Project corridor:

    a. Sight Distance – the horizontal and vertical sight distance does not meet current design guidelines in several places along the corridor.

    b. Failing Pavement – the existing pavement is failing, resulting in potholes, cracks, and undulations along the road. Use by trucks and other heavy vehicles exacerbates this problem. These issues help contribute to crashes along SH 4.

    c. Limited Clear Zone – the existing narrow paved shoulder does not provide a space for vehicles to pull off if they hit a pothole, animal, or other object. This results in increased potential for a secondary incident and delays along the roadway.

    d. Flooding – SH 4 experiences flooding in several locations due to the vertical curvature and hydraulic design. When flooding occurs, this increases the odds of crashes and delays along the roadway, as well as restricts emergency access to the easternmost reach of SH 4.

4. **Cost:** Alternatives and improvements to SH 4 must have reasonable right-of-way and construction costs in light of the Overall Project Purpose.

5. **Location:** Alternatives and improvements to SH 4 must avoid impacts to adjacent US Fish and Wildlife Service (USFWS) National Wildlife Refuge to the extent practicable.

    a. The existing SH 4 abuts approximately 7.5 miles of the USFWS Lower Rio Grande Valley National Wildlife Refuge.

    b. Natural resources, including federally protected species habitat and aquatic resources, within the USFWS Lower Rio Grande Valley National Wildlife Refuge are contiguous and high in quality.

    c. Any easements or right-of-way within the Refuge would require extensive coordination to obtain a Right-of-Way Permit from the USFWS, and would likely be in conflict with the goals or objectives of the Refuge Management Plan and therefore deemed an incompatible use.

6. **Environmental Impacts:** Alternatives and improvements to SH 4 must avoid and minimize impacts to high quality wetlands and federally protected species habitat.

    a. The existing SH 4 abuts wetlands and federally protected species habitat throughout much of the corridor. Most of the wetlands and protected species habitat within the SH 4 right-of-way have been historically disturbed, and higher quality aquatic resources and habitat exists outside the right-of-way

    b. Widening the existing facility without impacts to aquatic resources features and effect to protected species habitat is infeasible. To the extent practicable, the proposed improvements should minimize impacts to wetlands and species habitat and avoid impacts to higher quality natural resources, such as those present within the adjacent National Wildlife Refuge.

## 2.2 Description of Alternatives

### 2.2.1 No Action Alternatives

TxDOT has considered two No Action Alternatives, including siting the proposed Project in a manner that avoids a discharge of dredged or fill material into any waters of the United States (WOTUS) (No DA Permit/Uplands Only) or permit denial from the USACE (No Build Alternative). A summary of both No Action Alternatives is provided below.

*No DA Permit/Uplands Only*

The No DA Permit/Uplands Only alternative evaluates the potential for siting the proposed Project in a manner that avoids any discharge of dredged or fill material into any WOTUS. TxDOT has considered no action alternatives that would not result in impacts to WOTUS by attempting to locate the proposed infrastructure in upland areas within the existing SH 4 right-of-way.

As part of this analysis, TxDOT conducted aquatic resources delineations within the approximately 249-acre Project corridor in September 2022, December 2024, and March 2025. Approximately 74.40 acres of aquatic resources were identified within the 249-acre project corridor. An Approved Jurisdictional Determination for the project corridor was received from the Galveston District of the US Army Corps of Engineers (USACE) on November 5, 2025 (SWG-2025-00370). Of the approximately 74.40 acres of aquatic resources within the project corridor, approximately 61.255 acres have been determined to be WOTUS subject to Section 404 jurisdiction. The remaining 13.145 acres of aquatic resources within the project corridor have been determined to be non-jurisdictional wetlands.

The majority of the SH 4 roadway is constrained to the north and south by WOTUS. Due to the extensive WOTUS surrounding the existing SH 4 facility, there are no upland only areas within the Project right-of-way of sufficient size to support the proposed widening. The South Bay estuarine system is located immediately north of SH 4 and a majority of the land north of SH 4 is owned by the USFWS and contains substantial aquatic resources. As a result, there is no opportunity to utilize upland only lands to widen the existing SH 4 facility.

Based on the limited availability of upland areas in and around SH 4 and the WOTUS immediately adjacent to the existing SH 4 facility, there are no alternatives available that would avoid impacts to WOTUS and allow the Project to achieve its stated purpose and need without triggering the need for a DA permit.

*No Build Alternative*

The No Build Alternative would result from denial of this Section 404 Individual Permit application and provides consideration and disclosure of the consequences of permit denial. Should the USACE deny this application, TxDOT would not construct the proposed SH 4 Widening, and the Project Purpose and Need would not be fulfilled. SH 4 is currently operating under the No Build Alternative and as a result, is projected to be under capacity for the existing and forecasted traffic volumes, exceeds predicted crash frequency for similar type roadways, and contains multiple roadway deficiencies that do not meet current design standards. Without the proposed SH 4 widening, the road would continue to lack the proper safety measures, typical section, and facilities necessary for the growing daily traffic volume. As a result, TxDOT would have no ability to meet the Public's Need for the Project, which includes improved safety, traffic capacity, adequate facilities, and multimodal connectivity.

### 2.2.2 Offsite Alternatives

Due to the location of the existing SH 4 and the limited options available to construct an east to west highway in the region, only one offsite alternative to the proposed Project was carried forward for evaluation. The Offsite Alternative would reroute approximately 9 miles of SH 4 onto an 11.4-mile new location route north along the Brownsville Port Channel connecting to Del Mar/Boca Chica Beach (**Alt Figure 1** in **Attachment D**).

The Offsite Alternative corridor is heavily constrained by federally protected wildlife refuges, hydrologic features, the Brownsville Port Channel and dredge/spoil ponds, and known wetlands. The Offsite Alternative alignment would generally follow an existing, unimproved service road where feasible to limit the magnitude of impacts to adjacent wetlands and other federally protected lands.

Based on a review of aerial imagery and observations in the field, it is assumed that the existing, unimproved service road where SH 4 would be rerouted does not meet TxDOT highway design standards and that the Offsite Alternative would require complete reconstruction of this segment to meet TxDOT standards. The Offsite Alternative would require

an approximately 5.3-mile bridge originating above the dredge ponds and increasing in height to span the South Bay inlet and allow boat traffic to pass under. This alternative would require the TxDOT to acquire additional right-of-way north of the existing SH 4.

Based on an overlay of the Offsite Alternative conceptual plan onto USFWS National Wetlands Inventory (NWI) data, the Offsite Alternative would result in approximately 18.5 acres of impact to WOTUS. In addition, the Offsite Alternative would result in approximately 14.5 acres of impacts to the USFWS Lower Rio Grande Valley National Wildlife Refuge.

An Opinion of Probable Construction Cost (OPCC) for the Offsite Alternative new location route was rendered and resulted in an estimated design and construction cost in excess of $99M. This OPCC excludes the cost of right-of-way acquisition as well as the roadway improvements along the existing SH 4 alignment.

### 2.2.3 On-Site Alternatives

TxDOT has evaluated three on-site alternatives to the proposed Project. Each of the three on-site alternatives proposes widening and improving the existing SH 4 roadway within the existing SH 4 right-of-way. Details regarding each on-site alternative are provided below.

*Alternative 1 – Super 2 Alternative*

Alternative 1, the Super 2 Alternative, was previously evaluated by TxDOT to address pavement deficiencies and travel time reliability along SH 4 from FM 1419 to Remedios Avenue (**Alt Figure 2** in **Attachment D**). The Super 2 Alternative would widen approximately 10 miles of the 13-mile SH 4 corridor to allow for a passing lane at variable locations. The passing lane would alternate from one direction of travel to the other within a section of roadway, which allows periodic passing opportunities in both directions. The Super Alternative would also reconstruct, widen, and raise the vertical profile approximately 18 inches to 3 feet for approximately 3 miles in the eastern portion of the project area and construct an approximately 3-mile passing lane.

The Super 2 Alternative would result in approximately 1.101 acres of impacts to emergent wetlands and 0.044 acres of impacts to wind-tidal flats. In addition, the Super 2 Alternative would result in approximately 0.720 acres of impacts to Coastal Wetlands and 0.044 acres of impacts to Tidal Sand Flats, as regulated by the Coastal Zone Management Act (CZMA). Note, the Super 2 Alternative design was preliminary and included only proposed edge of pavement. A 4-foot buffer was applied to the edge of pavement to accommodate a 4:1 slope to calculate impacts that would result from fill slopes/grading for the Super 2 Alternative.

The Super 2 Alternative began planning in 2022. As a result of the rapid growth in the region, the traffic counts and safety data used to develop the Super 2 Alternative are now dated and no longer provide an appropriate baseline to be used in forecasting roadway improvements. The Super 2 Alternative would resolve the SH 4 facility deficiencies; however, the proposed

typical section would not address future traffic growth and would not provide adequate crash safety for the forecasted traffic volume.

*Alternative 2 – Bridge Alternative*

Alternative 2, the Bridge Alternative, was evaluated as part of a value engineering study conducted by TxDOT (**Alt Figure 3** in **Attachment D**). The Bridge Alternative would widen the existing SH 4 to a four-lane typical section between 2,700 feet east of Oklahoma Avenue and LBJ Boulevard and construct an approximately 1.2-mile bridge along SH 4 from Station (STA) 935+00 to STA 1000+00, approximately 500 feet east of Richardson Avenue to around 400 feet west of the eastern Project limit. The Bridge Alternative would also include variable retaining walls ranging in height from 0 to 10 feet and spanning approximately 300 feet long at each end of the bridge. The Bridge Alternative would remain within the existing right-of-way. The SH 4 bridge would not include a separate bike path; bicyclists would use the outer travel lane along that 1.2-mile section.

The Bridge Alternative was evaluated to determine the feasibility of reducing a portion of the proposed impacts to WOTUS. The Bridge Alternative would result in approximately 19.781 acres of impacts to emergent wetlands, 0.017 acres of impacts to scrub-shrub wetlands, 1.242 acres of impacts to wind-tidal flats, and 0.004 acres of impacts to open waters. In addition, the Bridge Alternative would result in approximately 0.020 acres of impacts to Coastal Wetlands and 1.242 acres of impacts to Tidal Sand Flats, as regulated by the CZMA.

The Bridge Alternative would address the traffic capacity and roadway facility deficiencies as it would be a proposed 4-lane section designed to current standards. The Bridge Alternative would partially address safety concerns; however, due to the lack of recovery area and shoulders along the bridge and the lack of multimodal bike path, some safety concerns would remain. An OPCC for the Bridge Alternative conceptual design was rendered and resulted in an estimated construction cost increase of $55M when compared to the Preferred Alternative. This OPCC excludes the cost of structural design.

*Alternative 3 – Preferred Alternative*

Alternative 3, the Preferred Alternative, was designed to accommodate a 4-lane widening of SH 4 (**Attachment B & C**). The Preferred Alternative proposes widening approximately 13 miles of SH 4 from the existing 2-lane roadway to a 4-lane divided roadway with two, 12-foot travel lanes and an 8-foot paved shoulder in each direction, with a 12-foot flush paved median separating opposing traffic. At the western end of the project, the 2-lane roadway would transition into a 3-lane roadway for a length of approximately 1,500 feet, with two, 12-foot lanes in the westbound direction and one, 12-24-foot lane in the eastbound direction, separated by a 12-14-foot median, before transitioning into the 4-lane roadway. Existing culverts would be extended to accommodate the widened typical section and turn lanes would be added at some intersections. The proposed design speed for the Preferred Alternative is

60 mph, which would allow the roadway to retain a posted speed limit of 55 mph. The Preferred Alternative would be fully within the existing SH 4 right-of-way as to avoid impacts to the adjacent USFWS Lower Rio Grande Valley National Wildlife Refuge.

Additionally, the Preferred Alternative would construct an 8-foot bike path with a 4- to 6-foot grass separation from the outside travel lane on the south side of SH 4 for approximately 3.75 miles from Quicksilver Avenue (the southern end of the Rio West development) to LBJ Boulevard (the northern end of Boca Chica Village).

The Preferred Alternative would result in approximately 24.090 acres of permanent impacts to emergent wetlands, 0.789 acres of permanent impacts to scrub-shrub wetlands, 3.216 acres of permanent impacts to wind-tidal flats, and 0.004 acres of permanent impacts to open waters. To accommodate construction access, the Preferred Alternative would also require 22.728 acres of temporary impacts to emergent wetlands, 0.272 acres of temporary impacts to scrub-shrub wetlands, 10.055 acres of temporary impacts to wind tidal flats, and 0.217 acres of temporary impacts to open waters. All temporarily impacted aquatic resources would be returned to pre-existing conditions upon completion of construction. In addition, the Preferred Alternative would result in approximately 1.846 acres of permanent impacts to Coastal Wetlands and 3.216 acres of permanent impacts to Tidal Sand Flats, as regulated by the CZMA.

An OPCC for the Preferred Alternative was rendered and resulted in an estimated cost of $187M. The Preferred Alternative presents a cost-effective roadway design that would accommodate the forecasted traffic capacity, improve safety and mobility, and address roadway deficiencies.

Table 1. On-Site Alternatives Considered

| Alternative | Emergent Wetland Impacts (ac.) | | Scrub-Shrub Wetland Impacts (ac.) | | Wind-Tidal Flat Impacts (ac.) | | Open Water Impacts (ac.) | |
|---|---|---|---|---|---|---|---|---|
| | Temp. | Perm. | Temp. | Perm. | Temp. | Perm. | Temp. | Perm. |
| **Alternative 1 - Super 2 Alternative** (Alt Figure 2, Attachment D) | * | 1.101 | * | 0.000 | * | 0.044 | * | 0.000 |
| **Alternative 2 - Bridge Alternative** (Alt Figure 3, Attachment D) | * | 19.781 | * | 0.017 | * | 1.242 | * | 0.004 |
| **Alternative 3 - Preferred Alternative** (Attachment B & C) | 22.728 | 24.090 | 0.272 | 0.789 | 10.055 | 3.216 | 0.217 | 0.004 |

*****Temporary impacts for Alternatives 1 and 2 are not quantifiable due to lack of detailed of design, but are assumed commensurate with the temporary impacts from Alternative 3*

### 2.2.4 On-Site Minimization of Unavoidable Impacts

In addition to reviewing on-site design alternatives, TxDOT has also implemented the following measures to avoid and minimize unavoidable impacts to aquatic resources:

- The proposed roadway improvements have been sized and sited to make the best use of the limited area available within the existing right-of-way.
- The Project design has tightened and steepened fill slopes to the extent allowable in order to reduce additional wetland impacts.
- The Project design has incorporated approximately 2.2 miles of retaining walls to accommodate the proposed 4-lane typical section and further reduce impacts to wetlands and adjacent properties that would result from extended fill slope.
- Where feasible, the Project has proposed asymmetrical widening, giving preference to the side of road containing uplands and non-jurisdictional wetlands.
- Rather than flattening curves to accommodate the proposed speed limit, the Project has incorporated some non-standard features, such as retaining walls and guard rails, to minimize impacts to adjacent WOTUS and the USFWS Lower Rio Grande Valley National Wildlife Refuge.
- The project is designed to minimize vegetation removal and impacts to the adjacent National Wildlife Refuge by limiting construction to the existing previously disturbed ROW.
- After evaluating offsite alternatives, TxDOT has intentionally located the proposed SH 4 widening along the existing roadway corridor to make use of previously disturbed areas to the extent practicable and to completely avoid impacts to the adjacent USFWS Lower Rio Grande Valley National Wildlife Refuge.

## 2.3 Alternatives Evaluation Under Section 404(b)(1) Guidelines and NEPA

TxDOT has evaluated the aforementioned alternatives for practicability utilizing the screening criteria outlined in Section 2.1 above. The following paragraphs briefly describe the results of the site practicability screening and are accompanied by an alternatives screening matrix in Table 2.

*No Action Alternative*

The No Action Alternative, which includes both the No Build and No DA Permit/Uplands Only Alternatives, would satisfy the Cost, Location, and Environmental Impacts screening criteria. However, the No Action Alternative would fail to satisfy the Traffic Capacity, Roadway Safety, and Address Facility Deficiencies screening criteria due to the limited availability of upland areas in and around the existing SH 4 facility (i.e., No DA Permit/Uplands Only) and, without the proposed SH 4 improvements (i.e., No Build), TxDOT would have no ability to meet the traffic capacity needs, improve safety and mobility, or address the roadway deficiencies. Based on this information, the No Action Alternative is not practicable and would not meet the Project's Overall Purpose.

*Offsite Alternatives*

The Offsite Alternative would reroute a portion of SH 4 on new location north along the Brownsville Port Channel. The Offsite Alternative would satisfy the Traffic Capacity and Roadway Safety screening criteria and partially satisfy the Address Facility Deficiencies screening criteria. The Offsite Alternative would improve the western portion of existing SH 4, but not the eastern portion after the offsite route. However, the Offsite Alternative would fail to satisfy the Cost, Location, and Environmental Impact screening criteria due to the anticipated construction and right-of-way acquisition costs, and the location of the new alignment within the USFWS National Wildlife Refuge. The Offsite Alternative would nearly double the anticipated Project construction cost when compared to the Preferred Alternative. The cost to design, permit, acquire right-of-way, and construct the Offsite Alternative would not be practicable in light of the Overall Project Purpose.

*On-Site Alternative 1 (Super 2 Alternative)*

Alternative 1 would widen approximately 10 miles of the 13-mile SH 4 corridor to allow for a passing lane at variable locations. Alternative 1 would satisfy the Cost, Location, and Environmental Impact screening criteria and partially satisfy the Address Facility Deficiencies screening criteria. The Super 2 Alternative would not elevate the road profile, which would be necessary to address the road flooding concerns. However, Alternative 1 would fail to satisfy the Traffic Capacity and Roadway Safety screening criteria. Alternative 1 was previously evaluated by TxDOT to address pavement deficiencies and travel time reliability along SH 4 from FM 1419 to Remedios Avenue. As a result of the rapid growth in the region, the traffic counts and safety data used to develop Alternative 1 are now dated and no longer provide an appropriate baseline to be used in forecasting the SH 4 roadway improvements. Therefore, the typical section proposed in Alternative 1 would not address the forecasted traffic capacity and would not provide adequate crash safety for the forecasted traffic volume. For these reasons, Alternative 1 is not practicable and would not meet the Project's Overall Purpose.

*On-Site Alternative 2 (Bridge Alternative)*

Alternative 2 would widen the existing SH 4 to a four-lane typical section between Oklahoma Avenue and LBJ Boulevard and construct an approximately 1.2-mile bridge along SH 4 from STA 935+00 to STA 1000+00, approximately 500 feet east of Richardson Ave to around 400 feet west of the eastern Project limit. Alternative 2 would satisfy the Traffic Capacity, Address Roadway Deficiencies, Location, and Environmental Impact screening criteria and partially satisfy the Roadway Safety criteria. Alternative 2 would not provide a multimodal bike path along the eastern portion of SH 4, which increases safety concerns for multimodal commuters. However, Alternative 2 would fail to satisfy the Cost screening criteria due to the anticipated construction cost of the bridge. Alternative 2 would increase the anticipated $187M (Preferred Alternative) cost of construction by nearly $55M. For this reason, Alternative 2 would not be practicable in light of the Overall Project Purpose.

*On-Site Alternative 3 (Preferred Alternative)*

Alternative 3 would widen approximately 13 miles of SH 4 from the existing 2-lane roadway to a 4-lane divided roadway with two, 12-foot travel lanes and an 8-foot paved shoulder in each direction, with a varying 4-12-foot flush paved median separating opposing traffic. Alternative 3 would satisfy all six screening criteria. Alternative 3 would therefore be considered practicable given the Overall Project Purpose and has been carried forward for further analysis under the Section 404(b)(1) Least Environmentally Damaging Practicable Alternative Guidelines.

Table 2. Alternatives Screening Matrix

| | | | On-Site Alternatives | | |
|---|---|---|---|---|---|
| Site Selection / Screening Criteria | No Action Alternative | Offsite Alternative | Alternative 1 (Super 2 Alternative) | Alternative 2 (Bridge Alternative) | Alternative 3 (Preferred Alternative) |
| 1. Traffic Capacity | | X | | X | X |
| 2. Roadway Safety | | X | | X - Partially | X |
| 3. Address Facility Deficiencies | | X - Partially | X - Partially | X | X |
| 4. Cost | X | | X | | X |
| 5. Location | X | | X | X | X |
| 6. Environmental Impacts | X | | X | X | X |
| Practicable (Yes / No) | No | No | No | No | Yes |

## 2.4 Least Environmentally Damaging Practicable Alternative Under the Section 404(b)(1) Guidelines

Of the aforementioned alternatives, solely Alternative 3 has been determined to be practicable in light of the Overall Project Purpose and established Site Selection/Screening Criteria. As discussed above, due to the limited availability and size of upland areas in and around the existing SH 4 facility, there are no practicable alternatives that would not involve discharges into special aquatic sites.

Alternative 3, the Preferred Alternative, presents a cost-effective roadway design that would accommodate the forecasted traffic capacity, improve safety and mobility, address roadway deficiencies, and avoid impacts to high quality wetlands, species habitat, and National Wildlife Refuges. Permit drawings for Alternative 3 are included in **Attachment B**.

Based on the practicability and environmental factors considered, Alternative 3, the Preferred Alternative, is the practicable alternative with the least adverse impact on the aquatic ecosystem, and it does not have other significant environmental consequences. As such, Alternative 3 is proposed as the least environmentally damaging practicable alternative.