

# **FM 149 North Widening**

(HGAC Project ID #1306)

## **Benefit-Cost Analysis**



Montgomery County

August 2024

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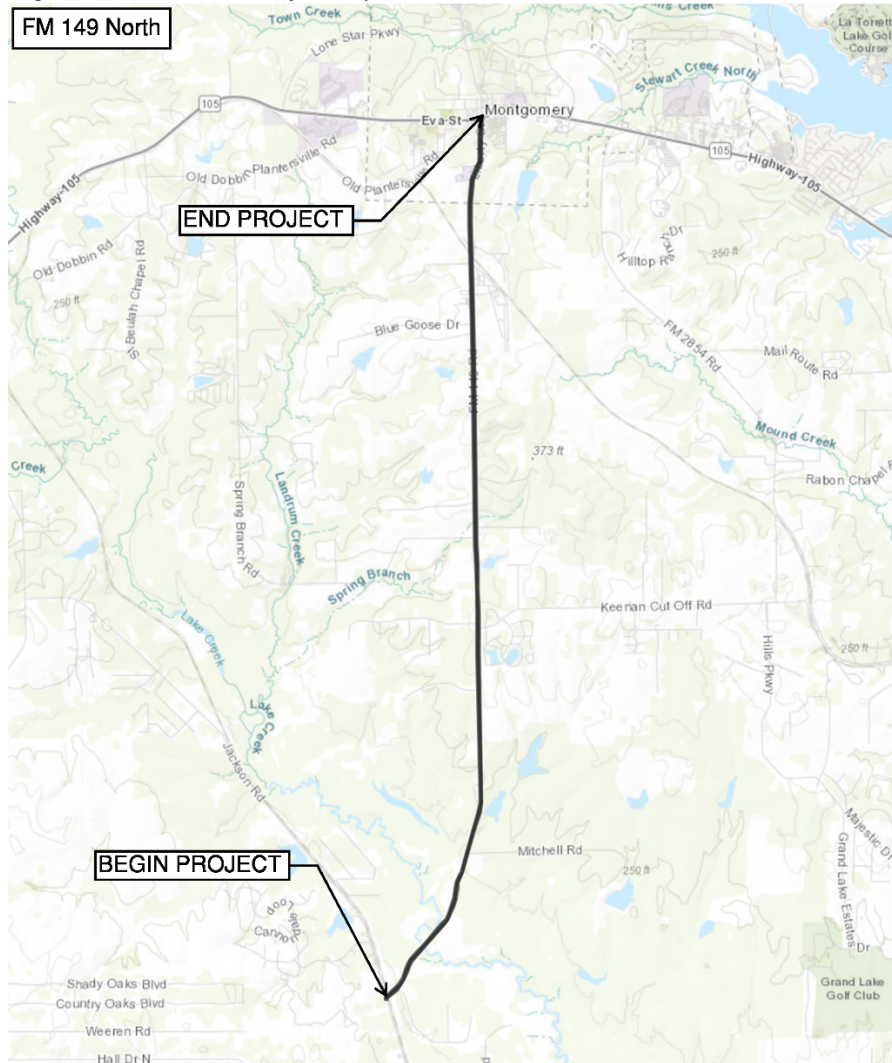
## 1.0 Executive Summary

FM 149 Widening Northbound, between Jackson Road/FM 149/UPRR and SH 105 is classified as a 2-lane major collector roadway. This section of FM 149 is approximately 8.2 miles and is included in the Montgomery County Major Thoroughfare Plan. This facility serves as a major north/south connection, west of Lake Conroe and IH 45, between Magnolia/Montgomery. FM 149 corridor serves SH 105, SH 249 Tollroad, FM 1488 corridors that serves Conroe to Navasota.

Developed originally as a rural collector, the roadway does not meet current design standards. The roadway has narrow shoulders and has poor sight distance issues due to inadequate vertical and horizontal curves.

The proposed project will initially widen from 2 to 4-lanes with a raised 12'-16' median, 10' wide shoulders to increase safety, and separate traffic from two at grade railroad crossings (BNSF and UPRR), accommodate a grade separated interchange at the Kennan Cut-off Road, while planning for future expansion to 6-lanes.

Figure 1: FM 149 North Project Map



Project Title:	FM 149 North
County:	Montgomery
Facility Type:	Non-Freeway
Federal Functional Class:	Major Collector
Street Name:	FM 149 North
Limits (From):	Jackson Road
Limits (To):	SH 105
Length (in Miles):	8.16
Application ID Number:	1306

*Table 1: Project Information*

The FM 149 North corridor expects substantial population and household growth along the corridor, which in turn will create new jobs and activity centers.

The greatest benefit of the project would be the multiple grade separations. This will improve the current bottlenecking of FM 149, allowing traffic to flow more freely, decrease daily interruptions, increase corridor pedestrian and vehicular safety and increase the overall speed of traffic.

## **2.0 Purpose**

This benefit-cost analysis (BCA) quantifies the net benefits and cost of building and maintaining FM 149 North in Montgomery County. The BCA illustrates that the benefits of replacing and upgrading the existing 2-lane open ditch roadway to a 4-lane boulevard section justifies the costs.

This BCA analysis details the benefits and costs identified, benefit methodologies, project costs, and the overall benefit-cost ratio for the proposed project. Furthermore, this BCA outlines additional quantitative benefits of the project that have not been assigned a monetary value.

### **2.1 Methodology**

Montgomery County has elected to use HGAC’s BCA methodology and spreadsheets to calculate the safety and mobility benefits of the proposed improvements. The HGAC methodology utilized the crash, emissions, and delay benefits template spreadsheets to calculate the project benefits. The spreadsheets contain all standardized assumptions to determine present value benefits.

- Roadway - Crash Benefits
- Roadway - Emissions Benefits
- Roadway - Transit Delay Benefits
- Active Transportation - Emissions Benefits

*\*All the template calculators used to find the benefit results are in the link below.*

[\*Transportation Project Selection Process | Houston-Galveston Area Council \(H-GAC\)\*](#)

## 2.2 2045 RTP Goals

The proposed improvements to FM 149 North meet the five goals of the 2045 RTP:

1. **Improve Safety:** Widening from two to four lanes (initially, before ultimate 6-lane typical sections) and installing a raised median along the entire length of FM 149 is anticipated to reduce crashes by 25% over the service life of 20 years. Additional safety benefits include bringing the roadway to current design standards including horizontal and vertical curves. Grade separating FM 149 over the railroads will also yield safety benefits. Our proposed improvements go beyond just grade separation, and include the following:

- Grade Separation (80% Crash Reduction Factor)
- Improve Horizontal Alignment (55% Crash Reduction Factor)
- Improve Vertical Alignments (50% Crash Reduction Factor)
- Convert from 2 Lane Facility to 4-Lane Divided (45% Crash Reduction Factor)
- Install Traffic Signal(s) (35% Crash Reduction Factor)
- Install Warning/Guide Signs (20% Crash Reduction Factor)
- Install Raised Median (25% Crash Reduction Factor)
- Install Sidewalks/SUP (65% Crash Reduction Factor)
- Widen Paved Shoulders (25% Crash Reduction Factor)
- Construct Interchange (65% Crash Reduction Factor)

2. **Achieve and Maintain a State of Good Repair:** The proposed project would completely reconstruct this section of FM 149, requiring minimal maintenance for at least 20 years after completion.

3. **Move People and Goods Efficiently:** As a proposed multimodal facility, FM 149 would be able to efficiently move vehicles, goods, and pedestrians/cyclists in a safe manner. The additional capacity will also improve mobility by reducing travel time delays and improving incident response time. Furthermore, adding a sidewalk will dramatically decrease vehicle and pedestrian accidents by a Crash Reduction Factor of 65%.

4. **Strengthen Regional Economic Competitiveness:** The widening of FM 149 will provide congestion relief for automobile users. The proposed widening of FM 149 is needed to support future residential development. H-GAC land use estimates an increase in nearly 150% for housing units within a ¼ mile of the project corridor. Activity centers, including Montgomery, Lake Conroe, SH 249 Toll Road and Magnolia are served by the roadway network in this region of Montgomery County.

Housing:

2018: 2,481

2045: 6,343

Population:

2018: 6,682

2045: 17,630

Jobs:

2018: 2,902

2045: 4,712

5. Conserve and Protect Natural and Cultural Resources: Montgomery County will be conducting an Environmental Assessment (EA) for the proposed improvements along FM 149. After assessing environmental resources and constraints, the alignment and footprint of the roadway will be designed to avoid, minimize and mitigation sensitive environmental resources (natural and cultural). By adding additional travel lanes in each direction, congestion along the facility would be reduced, therefore improving overall air quality.

### 3.0 Benefits

We have selected the following safety improvements as they are the most critical and beneficial to FM 149 North.

## Roadway - Crash Benefits

After inputting our traffic volumes from 2022 and projected values for 2030, we were able to see how the Safety Benefits were being calculated. Using the HGAC Methodology, the following results have been outputted from the Roadway - Crash Template.

<b>Year Open to Traffic?</b>	2030
<b>Safety Improvement Type 1</b>	Grade Separation
Work Type Code	514
Preventable Crash Type	Intersection Related
Appropriate Crash Reduction Factor (%):	80%
Service Life (years):	30
<b>Safety Improvement Type 2</b>	Improve Horizontal Alignment
Work Type Code	506
Preventable Crash Type	Non-Intersection related (Roadway Related)
Appropriate Crash Reduction Factor (%):	55%
Service Life (years):	10
<b>Safety Improvement Type 3</b>	Convert 2-Lane Facility to 4-Lane Divided
Work Type Code	538
Preventable Crash Type	Non-Intersection related (Roadway Related)
Appropriate Crash Reduction Factor (%):	45%
Service Life (years):	20
<b>Bike/Ped Improvement Type</b>	Install Sidewalks
Work Type Code	407
Preventable Crash Type	Pedestrian, Cyclist

Table 2: Proposed Improvements (Crash Benefits)

Appropriate Crash Reduction Factor (%):	65%
Service Life (years):	10

Table 2: Proposed Improvements (Crash Benefits) (Continued)

2022 Traffic Volume	8,361
Estimated traffic volume in year Open to Traffic	12,420
2022 Potential Daily Walk/Bike Commuters	168
Potential Daily Walk/Bike Commuters in Year Open to Traffic	239

Table 3: Daily Travel Demand (Crash Benefits)

Discounted Safety Benefits @ 7% (\$)	<b>\$232,876,000</b>
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Table 4: Crash Benefit Results

## Roadway - Emissions Benefits

Inputting our type of improvements and average speeds of before and after, we can see the output NOx and VOC Benefits. Using the HGAC Methodology, the following results were calculated from the Roadway - Emissions Template.

<b>Year Open to Traffic?</b>	2030
<b>Type of Improvement</b>	Roadway improvements (Added Capacity, Grade Separations) including HOV
Type of Facility	Non-Freeway
Total Length of Corridors Affected by Project (miles)	8.2
Average Roadway Speed Before Improvement (mph)	51
Average Roadway Speed After Improvement (mph)	59
Service Life of Project (from MoSERS)	20

Table 5: Proposed Improvements (Roadway Emissions Benefits)

2022 Average Daily Traffic Volume of Corridors Affected by project	8,361
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Table 6: Daily Travel Demand (Roadway Emissions Benefits)

Discounted NOx Benefits @ 7% (\$)	<b>-\$12,726</b>
Discounted VOC Benefits @ 7% (\$)	<b>\$1,033,729</b>

Table 7: Benefit Results (Roadway Emissions Benefits)

Discounted Emissions Benefits @ 7% (\$)	<b>\$1,021,003</b>
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Table 8: Total Emissions Benefit Results (Roadway Emissions Benefits)

NOx Emission Reductions (tons)	<b>-0.96</b>
VOC Emission Reductions (tons)	<b>1.60</b>

Table 9: Total Emissions Reductions (Roadway Emissions Benefits)

## Roadway - Transit Delay Benefits

After incorporating the Interim calculations, inputting our improvements, speeds, and traffic volumes we were given our calculated benefits. Using the HGAC Methodology, the following results have been given to us from the Roadway - Transit Delay Template.

<b>Year Open to Traffic?</b>	2030
<b>Type of Improvement 1</b>	Adding New Lanes or Roads
Estimated Delay Reductions (in %)	30%
Service Life (years):	20
<b>Type of Improvement 2</b>	Grade Separation
Estimated Delay Reductions (in %)	15%
Service Life (years):	30
<b>Type of Improvement 3</b>	Pedestrian Connections
Estimated Delay Reductions (in %)	1%
Service Life (years):	10

Table 10: Proposed Improvements (Transit Delay Benefits)

Interim Calculations	Per Veh In hours	Per Veh In minutes
Estimated Free Flow Travel Time	0.160	9.60
Estimated Average Peak Period Travel Time without project	0.188	11.29
Estimate Average Delay without project	0.028	1.69
Estimated Delay with project 1	0.020	1.19
Estimated Average Peak Travel Time with project 1	0.180	10.79
Estimated Delay with project 1 & 2	0.017	1.01
Estimated Average Peak Travel Time with project 2	0.177	10.61
Estimated Delay with projects 1, 2 & 3	0.017	1.00
Estimated Average Peak Travel Time with projects 1, 2 & 3	0.177	10.60

Table 11: Interim Calculations for the Delay Reductions

VHT Improvements	Without Project	With Project
Peak period VHT In year open to traffic in hours	1,458	1,368

Table 12: VHT Improvements



2022 Traffic Volume (AADT)	8,361
2022 Peak Period Traffic Volume	6,148
Peak Period Traffic Volume in Year Open to Traffic	7,743
Estimated Free Flow Speed before improvement (mph)	51
Average Peak Period Corridor Speed before improvement (mph)	43

Table 13: Daily Travel Demand (Transit Delay Benefits)

Discounted Delay Benefits @ 7% (\$)	<b>\$26,465,000</b>
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Table 14: Benefit Results (Transit Delay Benefits)

## Active Transportation - Emissions Benefits

After finding our daily VMT reductions from the HGAC Activity-Connectivity Explorer (ACE), we saw our NOx and VOC benefits and reductions. Using the HGAC Methodology, the following results have been calculated from the Active Transportation - Emissions Benefits Template.

Year Open to Traffic?	2030
Type of Improvement Project	Paved Shoulder/Shared Use Path
Length	8.16
Applicable Project Service Life (years)	20

Table 15: Proposed Improvements (Transportation Emissions Benefits)

Total Daily VMT Reductions (H-GAC ACE)	24.96
Estimated Total Walking/Bicycling Commuter Daily VMT Reduction with potential mode shift in Year Open to Traffic	28

Table 16: Daily VMT Reductions

Discounted NOx Benefits @ 7% (\$)	<b>\$94</b>
Discounted VOC Benefits @ 7% (\$)	<b>\$4,572</b>

Table 17: Benefit Results (Transportation Emissions Benefits)

Discounted Emissions Benefits @ 7% (\$)	<b>\$4,666</b>
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Table 18: Total Emissions Benefit Results (Transportation Emissions Benefits)

NOx Emission Reductions (tons)	<b>0.01</b>
VOC Emission Reductions (tons)	<b>0.01</b>

Table 19: Total Emissions Reductions (Transportation Emissions Benefits)

## 4.0 BCA Results

After using the Roadway – Crash, Roadway – Emissions, Roadway – Transit Delay, and Active Transportation – Emissions template sheets, we were able to sum up all sheets to get a final benefits summary. Our final value including each of the 4 sheets totaled out to be \$260,366,669.

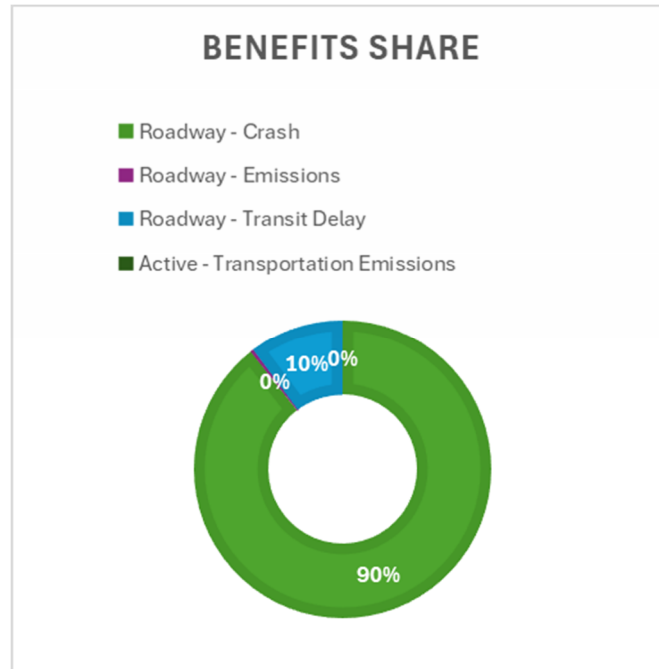


Figure 2: Benefits Share

Roadway - Crash	Roadway - Emissions	Roadway - Transit Delay	Active - Transportation Emissions	SUM
\$232,876,000	\$1,021,003	\$26,465,000	\$4,666	<b>\$260,366,669</b>

Table 20: Total Discounted Benefits

### Benefit-Cost Ratio Analysis

Using the benefits we have calculated from HGAC’s Benefit templates, we calculated a Benefit-Cost Ratio where our cost considers all construction, design, and labor encompassed over the duration of the project. Anything over a 1.0 ratio means the 20-year life-cycle benefits of a project exceed the estimated project-related costs over the same period.

This cost was provided to us by Montgomery County. Benefits and Costs in real dollars are shown in the table below. The benefit-cost ratio is 1.63 in 2022 real dollars.

Scenario	\$2022 Real Dollars
Benefits	\$260,366,669
Construction Costs (Scoping estimate provided by Montgomery County)	\$160,000,000
BCA Ratio	1.63
Net Present Value	\$100,366,669

*Table 21: BCR Analysis*