

# **FM 2432 Expansion**

(HGAC Project ID #1313)

## **Benefit-Cost Analysis**



Montgomery County

August 2024

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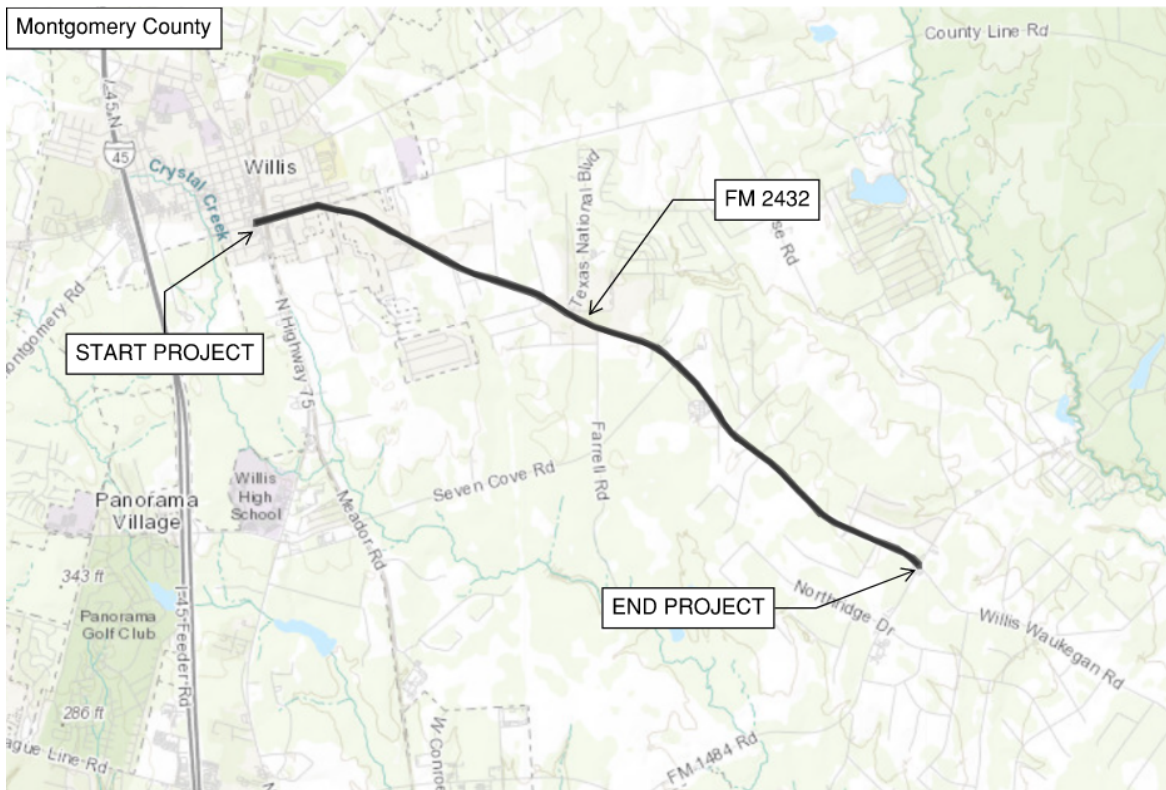
## 1.0 Executive Summary

FM 2432, between SH 75 and FM 1484, is a 2-lane roadway, classified as a major collector. This section of FM 2432 is approximately 5.1 miles and is included in the Montgomery County Major Thoroughfare Plan. This facility serves as a north/south connection between Willis & Conroe/Cleveland serving Conroe-North Houston Regional Airport, Conroe, Lake Conroe and the IH 45 Corridor.

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

The project proposes to widen FM 2432 from 2 to 4-lanes with a 16-foot-wide raised median; 10-foot-wide shoulders and a 10-foot-wide shared use path would be in both directions. Pedestrian improvements will play a key role in the success of this project, as 2432 is heavily travelled by both pedestrian and bicycles.

Figure 1: FM 2432 Project Map



Project Title:	FM 2432 Expansion
County:	Montgomery
Facility Type:	Non-Freeway
Federal Functional Class:	Major Collector
Street Name:	FM 2432
Limits (From):	SH 75
Limits (To):	FM 1484
Length (in Miles):	5.1
Application ID Number:	1313

*Table 1: Project Information*

The 2432 corridor expects steady population and household growth along the corridor, which in turn will create new jobs and activity centers.

The greatest benefits of the project would be the upgraded intersection with SH 75 and the inclusion of sidewalks or SUP along corridor. These improvements will increase vehicular and pedestrian safety and upgrade an important and busy intersection, allowing traffic to flow more freely, decrease daily interruptions, increase safety, and increase the traffic turn movements.

## **2.0 Purpose**

This benefit-cost analysis (BCA) quantifies the net benefits and cost of building and maintaining FM 2432 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 2432 meet the five goals of the 2045 RTP:

1. **Improve Safety:** Widening from two to four lanes and installing a raised median along the entire length of FM 2432 is anticipated to reduce crashes by 45% over the service life of 20 years. Upgrading the US75/FM2432 intersection, with UPRR safety implementations will increase safety and efficiency benefits. Our proposed improvements go beyond just roadway and intersection upgrades, and include the following:

- 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)
- Update Traffic Signal(s) (35% Crash Reduction Factor)
- Install Warning/Guide Signs (20% Crash Reduction Factor)
- Install Raised Median (25% Crash Reduction Factor)
- Safety Treat Fixed Objects (50% Crash Reduction Factor)
- Install Sidewalks/SUP (65% Crash Reduction Factor)
- Widen Paved Shoulders (25% Crash Reduction Factor)
- Construct Interchange (65% Crash Reduction Factor)
- Safety Lighting (49% Crash Reduction Factor)

2. **Achieve and Maintain a State of Good Repair:** The proposed project would completely reconstruct this section of FM 2432, requiring minimal maintenance for at least 20 years after completion.

3. **Move People and Goods Efficiently:** As a proposed multimodal facility, FM 2432 would be able to efficiently move vehicles, goods, and pedestrians/cyclists in a safe manner.

4. **Strengthen Regional Economic Competitiveness:** Proposed improvements to FM 2432 would provide enhanced connectivity for passenger vehicles and freight to SH 75, a relief route to I-45, and I-45 for this growing community. FM 2432 provides direct connectivity to the City of Willis from the surrounding residential areas. FM 2432's growth and development, along with the proposed improvements, will create an area that is more desirable to live in by ensuring fair mobility for all community members, will expand access and economic opportunities in and within Lake Conroe, increase tax base through new residential and commercial properties, and improving residents' quality of life by reducing road congestion and providing greater travel pattern options. H-GAC 2045 population estimates a 210% growth from 2018 along with 27% growth in employment within the TAZ. The number of housing units is anticipated to increase by 32.5%.

Households:

2018: 3,883

2045: 13,257

Population:

2018: 11,803

2045: 36,489

Jobs:

2018: 2,226

2045: 2,817

5. Conserve and Protect Natural and Cultural Resources: Montgomery County will be conducting an Environmental Assessment (EA) for the proposed improvements along FM 2432. 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). Drainage, Detention and SW3P implementation will be in place to safely protect adjacent environmental resources and water ways (East Fork Crystal Creek, Camp Creek and Caney Creek). By adding one additional travel lane 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 2432.

## Roadway - Crash Benefits

After inputting our traffic volumes from 2022 and projected values for 2031, 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.

Year Open to Traffic?	2031
<b>Safety Improvement Type 1</b>	Improve Vertical Alignment
Work Type Code	505
Preventable Crash Type	Non-Intersection related (Roadway Related)
Appropriate Crash Reduction Factor (%):	50%
Service Life (years):	10
<b>Safety Improvement Type 2</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>Safety Improvement Type 3</b>	Install Traffic Signal

Table 2: Proposed Improvements (Crash Benefits)

Work Type Code	107
Preventable Crash Type	Intersection Related
Appropriate Crash Reduction Factor (%):	35%
Service Life (years):	10
<b>Bike/Ped Improvement Type</b>	Install Sidewalks
Work Type Code	407
Preventable Crash Type	Pedestrian, Cyclist
Appropriate Crash Reduction Factor (%):	65%
Service Life (years):	10

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

2022 Traffic Volume	9,737
Estimated traffic volume in year Open to Traffic	14,268
2022 Potential Daily Walk/Bike Commuters	356
Potential Daily Walk/Bike Commuters in Year Open to Traffic	502

Table 3: Daily Travel Demand (Crash Benefits)

Discounted Safety Benefits @ 7% (\$)	<b>\$205,272,000</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>	2031
<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)	5.1
Average Roadway Speed Before Improvement (mph)	47
Average Roadway Speed After Improvement (mph)	50
Service Life of Project (from MoSERS)	20

Table 5: Proposed Improvements (Roadway Emissions Benefits)

2022 Average Daily Traffic Volume of Corridors Affected by project	9,737
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Table 6: Daily Travel Demand (Roadway Emissions Benefits)

Discounted NOx Benefits @ 7% (\$)	<b>-\$2,564</b>
Discounted VOC Benefits @ 7% (\$)	<b>\$526,630</b>

Table 7: Benefit Results (Roadway Emissions Benefits)

Discounted Emissions Benefits @ 7% (\$)	<b>\$524,067</b>
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Table 8: Total Emissions Benefit Results (Roadway Emissions Benefits)

NOx Emission Reductions (tons)	<b>-0.20</b>
VOC Emission Reductions (tons)	<b>0.84</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>	2031
<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>	Active Traffic Management
Estimated Delay Reductions (in %)	15%
Service Life (years):	10
<b>Type of Improvement 3</b>	Intersection Turn Lanes
Estimated Delay Reductions (in %)	30%
Service Life (years):	20

Table 10: Proposed Improvements (Transit Delay Benefits)

Interim Calculations	Per Veh In hours	Per Veh In minutes
Estimated Free Flow Travel Time	0.109	6.55
Estimated Average Peak Period Travel Time without project	0.128	7.70
Estimate Average Delay without project	0.019	1.16
Estimated Delay with project 1	0.013	0.81
Estimated Average Peak Travel Time with project 1	0.123	7.35
Estimated Delay with project 1 & 2	0.011	0.69
Estimated Average Peak Travel Time with project 2	0.121	7.23
Estimated Delay with projects 1, 2 & 3	0.008	0.48
Estimated Average Peak Travel Time with projects 1, 2 & 3	0.117	7.03

Table 11: Interim Calculations for the Delay Reductions



VHT Improvements	Without Project	With Project
Peak period VHT In year open to traffic in hours	996	909

Table 12: VHT Improvements

2022 Traffic Volume (AADT)	9,737
2022 Peak Period Traffic Volume	5,294
Peak Period Traffic Volume in Year Open to Traffic	7,760
Estimated Free Flow Speed before improvement (mph)	47
Average Peak Period Corridor Speed before improvement (mph)	40

Table 13: Daily Travel Demand (Transit Delay Benefits)

Discounted Delay Benefits @ 7% (\$)	<b>\$29,292,000</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?	2031
Type of Improvement Project	Paved Shoulder/Shared Use Path
Length	5.1
Applicable Project Service Life (years)	20

Table 15: Proposed Improvements (Transportation Emissions Benefits)

Total Daily VMT Reductions (H-GAC ACE)	137.12
Estimated Total Walking/Bicycling Commuter Daily VMT Reduction with potential mode shift in Year Open to Traffic	153

Table 16: Daily VMT Reductions

Discounted NOx Benefits @ 7% (\$)	<b>\$496</b>
Discounted VOC Benefits @ 7% (\$)	<b>\$24,096</b>

Table 17: Benefit Results (Transportation Emissions Benefits)

Discounted Emissions Benefits @ 7% (\$)	<b>\$24,592</b>
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Table 18: Total Emissions Benefit Results (Transportation Emissions Benefits)

NOx Emission Reductions (tons)	<b>0.04</b>
VOC Emission Reductions (tons)	<b>0.04</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 \$235,112,659.

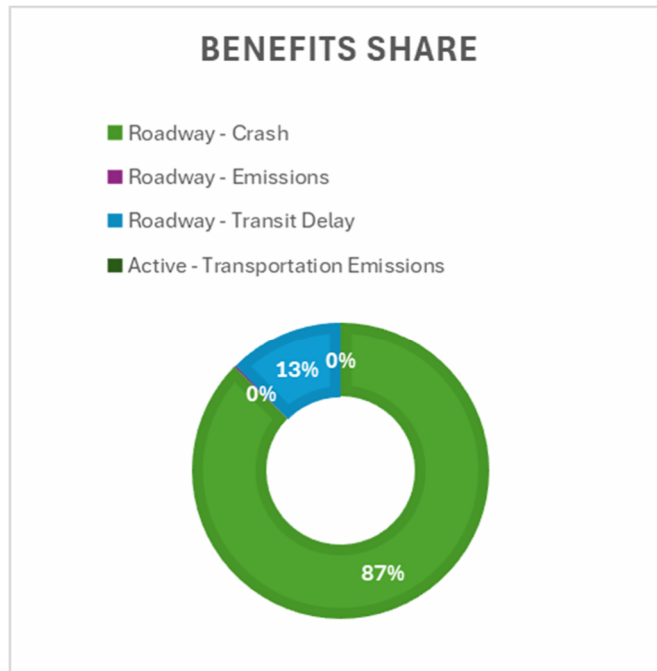


Figure 2: Benefits Share

Roadway - Crash	Roadway - Emissions	Roadway - Transit Delay	Active - Transportation Emissions	SUM
\$205,272,000	\$524,067	\$29,292,000	\$24,592	<b>\$235,112,659</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 1.57 in 2022 real dollars.

Scenario	\$2022 Real Dollars
Benefits	\$235,112,659
Construction Costs (Scoping estimate provided by Montgomery County)	\$150,000,000
BCA Ratio	1.57
Net Present Value	\$85,112,659

Table 21: BCR Analysis