# FM 2090 Expansion

(HGAC Project ID #1310)

# Benefit-Cost Analysis

Montgomery County

August 2024

## Table of Contents



## Figures



## Tables

## 1.0 Executive Summary

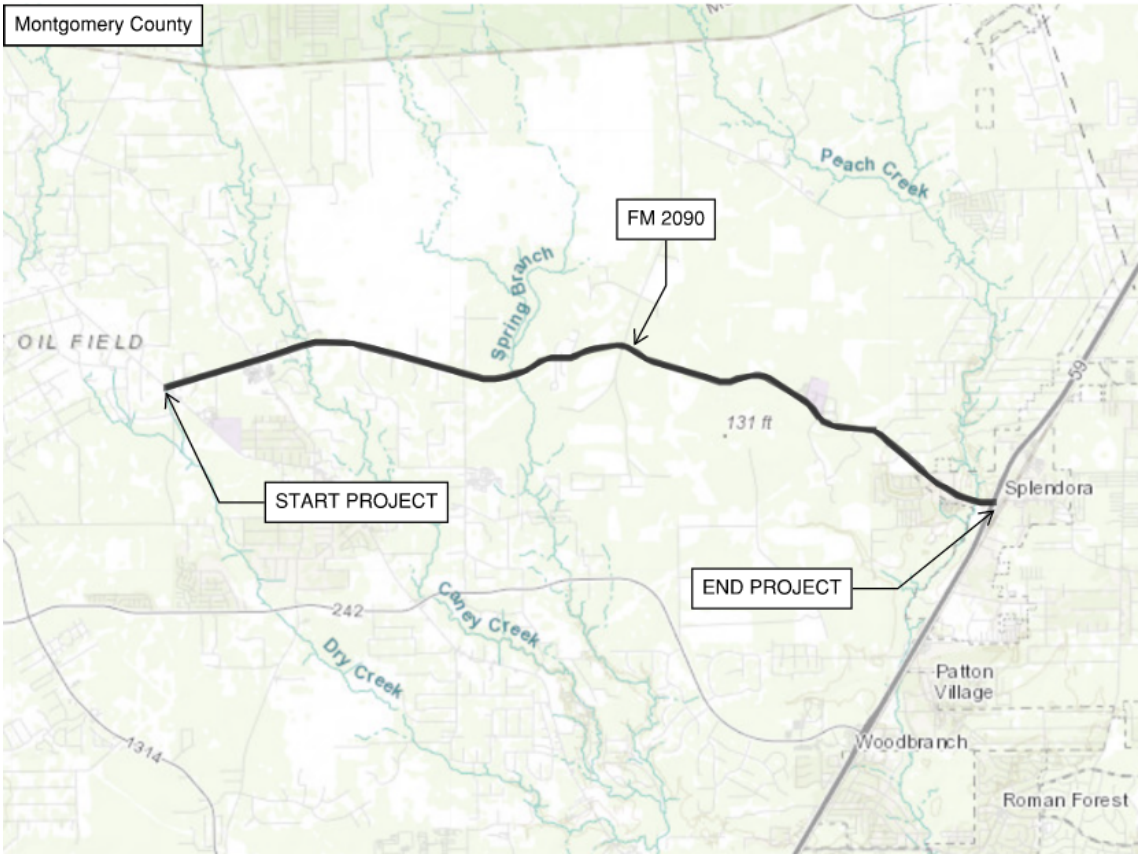
FM 2090, between FM 3083 and I-69, is a 2-lane roadway, classified as a major collector. This section of FM 2090 is approximately 10.7 miles and is included in the Montgomery County Major Thoroughfare Plan. This facility serves as an east/west connection between Grangerland/Conroe & Splendora, serving IH 69 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 vertical and horizontal curves.

The project proposes to widen and realign FM 2090 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.

FM 2090 reconstruction would greatly increase safety and efficiency throughout the project limits. FM 2090 has 8 schools adjacent to the roadway and by adding an extra lane, a SUP, adding turn lanes, signalization and fixing sight lines will create a community improvement.

Figure 1: FM 2090 Project Map



| | |
|---|---|
| Project Title: | FM 2090 Expansion |
| County: | Montgomery |
| Facility Type: | Non-Freeway |
| Federal Functional Class: | Major Collector |
| Street Name: | FM 2090 |
| Limits (From): | FM 3083 |
| Limits (To): | IH 69 |
| Length (in Miles): | 10.7 |
| Application ID Number: | 1310 |

*Table 1: Project Information*

The 2090 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 vertical alignment and dividing the 2 laned road into 4 lanes. This will improve the current congestion of FM 2090, allowing traffic to flow more freely, decrease daily interruptions, increase 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 2090 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 2090 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 2090 is anticipated to reduce crashes by 45% over the service life of 20 years. Additional safety benefits include bringing the roadway to current design standards including horizontal and vertical curves. Our proposed improvements go beyond just improving the vertical alignment, 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)
- Install Traffic Signal(s) (35% Crash Reduction Factor)
- Install Warning/Guide Signs (20% Crash Reduction Factor)
- Improve School Zone (5% 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)

2. Achieve and Maintain a State of Good Repair: The proposed project would completely reconstruct this section of FM 2090, requiring minimal maintenance for at least 20 years after completion.

3. Move People and Goods Efficiently: As a proposed multimodal facility, FM 2090 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. The section of I-69 that connects to FM 2090 is part of the Texas Highway Freight Network, Strategic Highway Network, National Highway System. I-69 is also a designated Hurricane Evacuation Route.

4. Strengthen Regional Economic Competitiveness: The widening of FM 2090 will provide congestion relief for automobile users. The proposed widening of FM 2090 is needed to support future residential development. H-GAC land use estimates an increase in nearly 100 % for housing units within a ¼ mile of the project corridor. Activity centers, including Conroe and The Woodlands, are served by the roadway network in this region of Montgomery County.

Households:

2018: 5,708

2045: 13,279

Population:

2018: 17,180

2045: 36,975

Jobs:

2018: 2,744

2045: 3,201

5. Conserve and Protect Natural and Cultural Resources: Montgomery County will be conducting an Environmental Assessment (EA) for the proposed improvements along FM 2090. 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 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 2090.

# 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.

| | |
|---|---|
| **Year Open to Traffic?** | 2030 |
| **Safety Improvement Type 1** | Improve Vertical Alignment |
| Work Type Code | 505 |
| Preventable Crash Type | Non-Intersection related (Roadway Related) |
| Appropriate Crash Reduction Factor (%): | 50% |
| Service Life (years): | 10 |
| **Safety Improvement Type 2** | 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 |
| **Safety Improvement Type 3** | Install Traffic Signal |
| Work Type Code | 107 |
| Preventable Crash Type | Intersection Related |
| Appropriate Crash Reduction Factor (%): | 35% |
| Service Life (years): | 10 |
| **Bike/Ped Improvement Type** | 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 | 10,582 |
| Estimated traffic volume in year Open to Traffic | 13,325 |
| 2022 Potential Daily Walk/Bike Commuters | 228 |
| Potential Daily Walk/Bike Commuters in Year Open to Traffic | 280 |

*Table 3: Daily Travel Demand (Crash Benefits)*

| | |
|---|---|
| Discounted Safety Benefits @ 7% ($) | **$44,330,000** |

*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.

| | |
|---|---|
| **Year Open to Traffic?** | 2030 |
| **Type of Improvement** | Roadway improvements (Added Capacity, Grade Separations) including HOV |
| Type of Facility | Non-Freeway |
| Total Length of Corridors Affected by Project (miles) | 10.7 |
| Average Roadway Speed Before Improvement (mph) | 48 |
| Average Roadway Speed After Improvement (mph) | 54 |
| Service Life of Project (from MoSERS) | 20 |

*Table 5: Proposed Improvements (Roadway Emissions Benefits)*

| | |
|---|---|
| 2022 Average Daily Traffic Volume of Corridors Affected by project | 10,582 |

*Table 6: Daily Travel Demand (Roadway Emissions Benefits)*

| | |
|---|---|
| Discounted NOx Benefits @ 7% ($) | **-$9,834** |
| Discounted VOC Benefits @ 7% ($) | **$957,895** |

*Table 7: Benefit Results (Roadway Emissions Benefits)*

| | |
|---|---|
| Discounted Emissions Benefits @ 7% ($) | **$948,061** |

*Table 8: Total Emissions Benefit Results (Roadway Emissions Benefits)*

| | |
|---|---|
| NOx Emission Reductions (tons) | -0.74 |
| VOC Emission Reductions (tons) | 1.48 |

*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.

| | |
|---|---|
| **Year Open to Traffic?** | 2030 |
| **Type of Improvement 1** | Adding New Lanes or Roads |
| Estimated Delay Reductions (in %) | 30% |
| Service Life (years): | 20 |
| **Type of Improvement 2** | Active Traffic Management |
| Estimated Delay Reductions (in %) | 15% |
| Service Life (years): | 10 |
| **Type of Improvement 3** | 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 | 0.223 | 13.38 |
| Estimated Average Peak Period Travel Time without project | 0.446 | 26.75 |
| Estimate Average Delay without project | 0.223 | 13.38 |
| Estimated Delay with project 1 | 0.156 | 9.36 |
| Estimated Average Peak Travel Time with project 1 | 0.379 | 22.74 |
| Estimated Delay with project 1 & 2 | 0.133 | 7.96 |
| Estimated Average Peak Travel Time with project 2 | 0.356 | 21.33 |
| Estimated Delay with projects 1, 2 & 3 | 0.131 | 7.88 |
| Estimated Average Peak Travel Time with projects 1, 2 & 3 | 0.354 | 21.25 |

*Table 11: Interim Calculations for the Delay Reductions*

| VHT Improvements | *Without Project* | *With Project* |
|---|---|---|
| Peak period VHT In year open to traffic in hours | 2,976 | 2,365 |

*Table 12: VHT Improvements*

| | |
|---|---|
| 2022 Traffic Volume (AADT) | 10,582 |
| 2022 Peak Period Traffic Volume | 5,441 |
| Peak Period Traffic Volume in Year Open to Traffic | 6,676 |
| | |
| Estimated Free Flow Speed before improvement (mph) | 48 |
| Average Peak Period Corridor Speed before improvement (mph) | 24 |

*Table 13: Daily Travel Demand (Transit Delay Benefits)*

| | |
|---|---|
| Discounted Delay Benefits @ 7% ($) | **$174,858,000** |

*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 | 10.7 |
| Applicable Project Service Life (years) | 20 |

*Table 15: Proposed Improvements (Transportation Emissions Benefits)*

| | |
|---|---|
| Total Daily VMT Reductions (H-GAC ACE) | 20.57 |
| Estimated Total Walking/Bicycling Commuter Daily VMT Reduction with potential mode shift in Year Open to Traffic | 23 |

*Table 16: Daily VMT Reductions*

| | |
|---|---|
| Discounted NOx Benefits @ 7% ($) | **$78** |
| Discounted VOC Benefits @ 7% ($) | **$3,767** |

*Table 17: Benefit Results (Transportation Emissions Benefits)*

| | |
|---|---|
| Discounted Emissions Benefits @ 7% ($) | **$3,845** |

*Table 18: Total Emissions Benefit Results (Transportation Emissions Benefits)*

| | |
|---|---|
| NOx Emission Reductions (tons) | **0.01** |
| VOC Emission Reductions (tons) | **0.01** |

*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 $220,139,906.

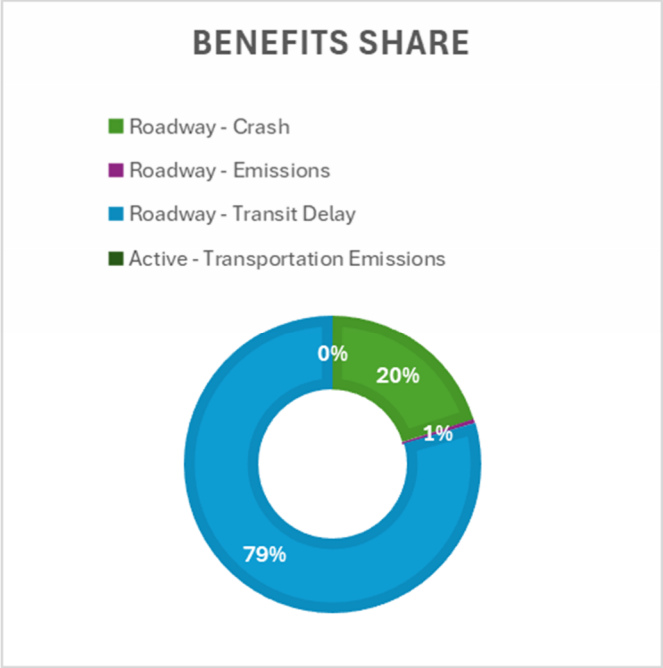



*Figure 2: Benefits Share*

| Roadway - Crash | Roadway - Emissions | Roadway - Transit Delay | Active - Transportation Emissions | SUM |
|---|---|---|---|---|
| $44,330,000 | $948,061 | $174,858,000 | $3,845 | **$220,139,906** |

*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 0.79 in 2022 real dollars.

| Scenario | $2022 Real Dollars |
|---|---|
| Benefits | $220,139,906 |
| Construction Costs (Scoping estimate provided by Montgomery County) | $280,000,000 |
| BCA Ratio | 0.79 |
| Net Present Value | -$59,860,094 |

*Table 21: BCR Analysis*