FM 1097 Realignment

(HGAC Project ID #1311)

Benefit-Cost Analysis

Montgomery County

August 2024

Table of Contents

Figures

Tables

1.0 Executive Summary

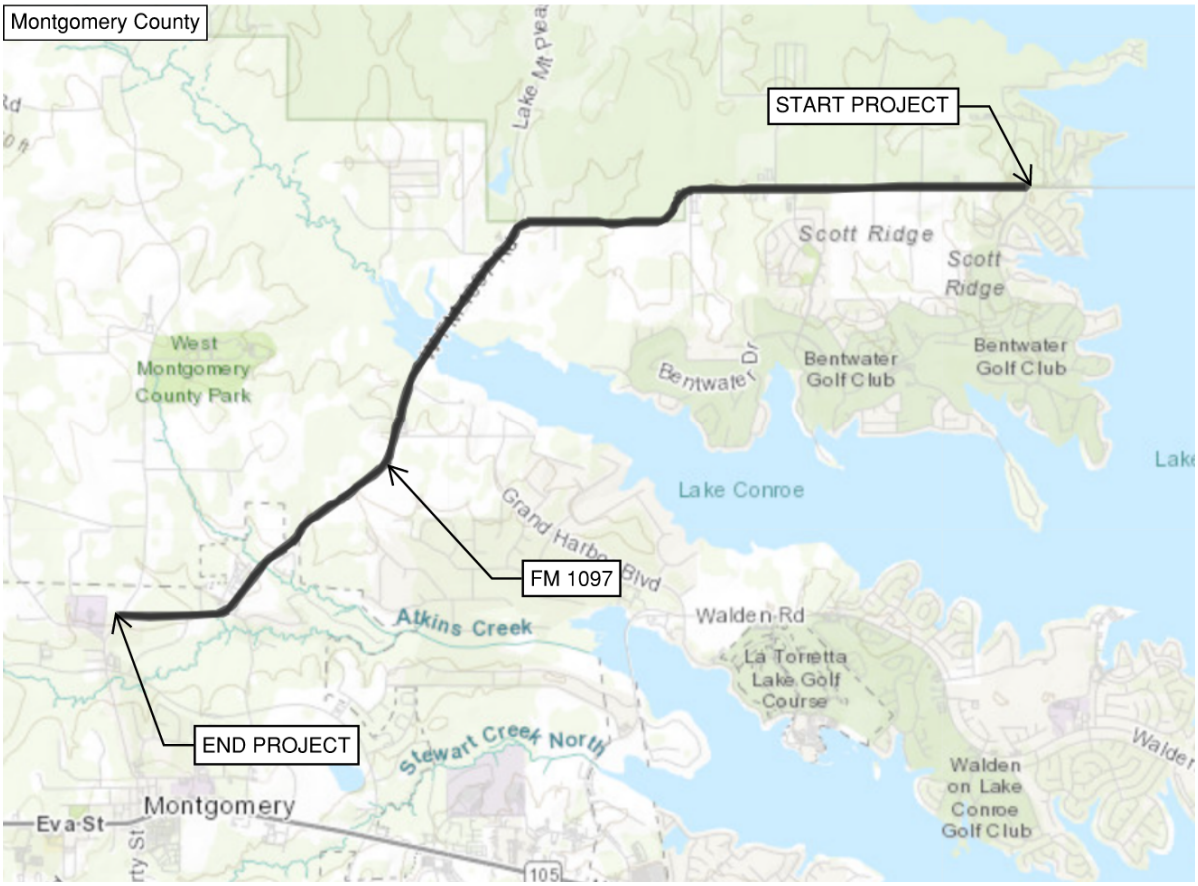
FM 1097, between Bentwater Drive and FM 149, is a 2-lane roadway, classified as a major collector. This section of FM 1097 is approximately 6.0 miles and is included in the Montgomery County Major Thoroughfare Plan. This facility serves as an east/west connection between Willis/Conroe and Montogomery.

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

The proposed project will widen from 2- to 4-lanes, add a raised median to control left turns from adjacent properties/developments, and bring 10' wide shoulders to increase safety, while providing a consistent shoulder for cyclists. Project also plans to add SUP throughout corridor to increase pedestrian and bicycle safety.

This project also will realign FM 1097 to meet existing FM 1097 west of FM 149. Improvements to the intersection will increase safety, provide greater capacity, simplify travel patterns and connect east/west roadway corridor.

Figure 1: FM 1097 Project Map



Project Title:	FM 1097 Realignment
County:	Montgomery
Facility Type:	Non-Freeway
Federal Functional Class:	Major Collector
Street Name:	FM 1097
Limits (From):	Bentwater Drive
Limits (To):	FM 149
Length (in Miles):	5.98
Application ID Number:	1311

Table 1: Project Information

The 1097 corridor expects substantial household growth along the corridor, which in turn will create new jobs, activity centers and increase population.

The greatest benefit of the project would be the construction of the new intersection of FM 1097 and FM 149. This will improve the current traffic congestion for both FM 1097 and FM 149, increase safety, allow traffic to flow more freely, decrease delays, 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 1097 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 1097 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 1097 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 realignment, and include the following:

- Safety Treat Fixed Objects (50% Crash Reduction Factor)
- Widen Bridge (55% 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)
- Improve School Zone (5% 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 1097, requiring minimal maintenance for at least 20 years after completion.

3. Move People and Goods Efficiently: As a proposed multimodal facility, FM 1097 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 1097 will provide congestion relief for automobile users. The proposed widening of FM 1097 is needed to support future residential development. H-GAC land use estimates an increase in nearly 242% for housing units within a ¼ mile of the project corridor. FM 1097'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. Activity centers, including Montgomery, Lincoln Elementary School and Lake Conroe are served by the roadway network in this region of Montgomery County.

Households:

2018: 3,880

2045: 7,494

Population:

2018: 8,602

2045: 15,906

Jobs:

2018: 903

2045: 1,080

5. Conserve and Protect Natural and Cultural Resources: Montgomery County will be conducting an Environmental Assessment (EA) for the proposed improvements along FM 1097. After assessing environmental resources and constraints, the alignment and footprint of the roadway will be designed to avoid, minimize, and mitigate sensitive environmental resources (natural and cultural). Project improvements will also include drainage and detention updates. By adding additional travel lanes in each direction, congestion along the facility would be reduced, therefore improving overall air quality. There has been an increase in congestion due to recent residential development, and because this facility serves as a major collector between Montgomery and Willis/Conroe. Sight distance is poor due to inadequate vertical and horizontal curves.

3.0 Benefits

We have selected the following safety improvements as they are the most critical and beneficial to FM 1097.

Roadway - Crash Benefits

After inputting our traffic volumes from 2022 and projected values for 2032, 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?	2032
Safety Improvement Type 1	Construct Interchange
Work Type Code	515
Preventable Crash Type	Intersection Related
Appropriate Crash Reduction Factor (%):	65%
Service Life (years):	30

Table 2: Proposed Improvements (Crash Benefits)

Safety Improvement Type 2	Widen Bridge
Work Type Code	218
Preventable Crash Type	Non-Intersection related (Roadway Related)
Appropriate Crash Reduction Factor (%):	55%
Service Life (years):	20
Safety Improvement Type 3	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
Bike/Ped Improvement Type	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	10,875
Estimated traffic volume in year Open to Traffic	14,147
2022 Potential Daily Walk/Bike Commuters	174
Potential Daily Walk/Bike Commuters in Year Open to Traffic	221

Table 3: Daily Travel Demand (Crash Benefits)

Discounted Safety Benefits @ 7% ($)	**$180,520,000**

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?	2032
Type of Improvement	Roadway improvements (Added Capacity, Grade Separations) including HOV
Type of Facility	Non-Freeway
Total Length of Corridors Affected by Project (miles)	6.0
Average Roadway Speed Before Improvement (mph)	47
Average Roadway Speed After Improvement (mph)	52
Service Life of Project (from MoSERS)	20

Table 5: Proposed Improvements (Roadway Emissions Benefits)

2022 Average Daily Traffic Volume of Corridors Affected by project	10,875

Table 6: Daily Travel Demand (Roadway Emissions Benefits)

Discounted NOx Benefits @ 7% ($)	**-$3,228**
Discounted VOC Benefits @ 7% ($)	**$663,069**

Table 7: Benefit Results (Roadway Emissions Benefits)

Discounted Emissions Benefits @ 7% ($)	**$659,841**

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

NOx Emission Reductions (tons)	**-0.26**
VOC Emission Reductions (tons)	**1.09**

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?	2032
Type of Improvement 1	Adding New Lanes or Roads
Estimated Delay Reductions (in %)	30%
Service Life (years):	20
Type of Improvement 2	Intersection Turn Lanes
Estimated Delay Reductions (in %)	30%
Service Life (years):	10
Type of Improvement 3	Bottleneck Removal
Estimated Delay Reductions (in %)	25%
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	0.128	7.67
Estimated Average Peak Period Travel Time without project	0.150	9.03
Estimate Average Delay without project	0.023	1.35
Estimated Delay with project 1	0.016	0.95
Estimated Average Peak Travel Time with project 1	0.144	8.62

Table 11: Interim Calculations for the Delay Reductions

Interim Calculations	Per Veh In hours	Per Veh In minutes
Estimated Delay with project 1 & 2	0.011	0.66
Estimated Average Peak Travel Time with project 2	0.139	8.34
Estimated Delay with projects 1, 2 & 3	0.008	0.50
Estimated Average Peak Travel Time with projects 1, 2 & 3	0.136	8.17

Table 11: Interim Calculations for the Delay Reductions (Continued)

VHT Improvements	*Without Project*	*With Project*
Peak period VHT In year open to traffic in hours	1,180	1,068

Table 12: VHT Improvements

2022 Traffic Volume (AADT)	10,875
2022 Peak Period Traffic Volume	5,683
Peak Period Traffic Volume in Year Open to Traffic	7,841
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% ($)	**$35,275,000**

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?	2032
Type of Improvement Project	Paved Shoulder/Shared Use Path
Length	5.98
Applicable Project Service Life (years)	20

Table 15: Proposed Improvements (Transportation Emissions Benefits)

Total Daily VMT Reductions (H-GAC ACE)	62
Estimated Total Walking/Bicycling Commuter Daily VMT Reduction with potential mode shift in Year Open to Traffic	70

Table 16: Daily VMT Reductions

Discounted NOx Benefits @ 7% ($)	**$216**
Discounted VOC Benefits @ 7% ($)	**$10,475**

Table 17: Benefit Results (Transportation Emissions Benefits)

Discounted Emissions Benefits @ 7% ($)	**$10,691**

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

NOx Emission Reductions (tons)	**0.02**
VOC Emission Reductions (tons)	**0.02**

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 $216,465,532.

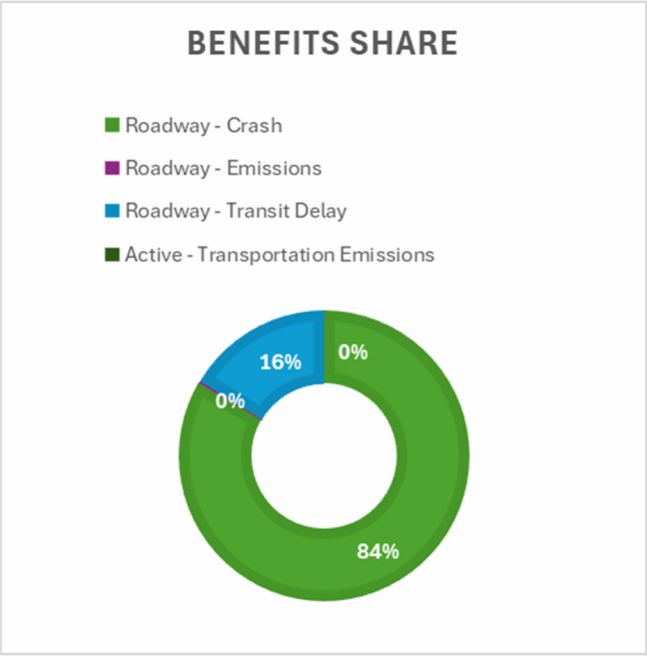


Figure 2: Benefits Share

Roadway - Crash	Roadway - Emissions	Roadway - Transit Delay	Active - Transportation Emissions	SUM
$180,520,000	$659,841	$35,275,000	$10,691	**$216,465,532**

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 1.27 in 2022 real dollars, which exceeds our costs.

Scenario	$2022 Real Dollars
Benefits	$216,465,532
Construction Costs (Scoping estimate provided by Montgomery County)	$170,000,000
BCA Ratio	1.27
Net Present Value	$46,465,532

Table 21: BCR Analysis