SH-99 Ramp Improvements

(HGAC Project ID #1315)

Benefit-Cost Analysis

Montgomery County

August 2024

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1.0 Executive Summary

SH 99 between Valley Ranch Road and IH 59 is a 3-lane roadway, classified as an interstate highway. Traversing east/west, this section of highway serves the North Houston region, “carrying” regional goods and services.

The proposed project includes the addition of the westbound off-ramp and eastbound on ramp along SH 99 at Valley Ranch Parkway.

New ramps will provide direct access to and from the surrounding community and SH 99. Ramps attract a significant portion of traffic from the surrounding network, reducing the utilization of alternative ramps, frontage road access, and connectors.

Figure 1: SH-99 Ramp Project Map

Project Title:	SH 99 Ramp Improvements
County:	Montgomery
Facility Type:	Freeway
Federal Functional Class:	Major Collector
Street Name:	SH 99
Limits (From):	Valley Ranch Pkwy
Limits (To):	I-69
Length (in Miles):	0.84
Application ID Number:	1315

Table 1: Project Information

The SH-99/IH 69 region expects substantial jobs, population and household growth along the corridor, which will create new jobs and activity centers.

Within this TAZ, population is expected to increase by nearly 150%, from 2018 to 2045, and jobs are expected to increase by 71%. Within a quarter mile of the Valley Ranch Parkway at SH 99 interchange, there are currently 81 housing units; 2045 projections estimate 2,625 housing units which is a 3,100% increase from existing. Non-residential building square footage is expected to increase by 205% in 2045 and lane use dedicated to residential is expected to increase by 36%.

The greatest benefit of the project will be providing access. This will improve traffic flow and safety.

2.0 Purpose

This benefit-cost analysis (BCA) quantifies the net benefits and cost of building and maintaining SH-99 in Montgomery County. The BCA illustrates that the benefits of widening the bridge and improving the horizontal alignment of the ramps justify 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

**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 SH-99 meet four of the five goals of the 2045 RTP:

1. Improve Safety: Our proposed improvements go beyond just adding additional pavement, and include the following:

- Improve Horizontal Alignment (55% Crash Reduction Factor)
- Improve Vertical Alignments (50% Crash Reduction Factor)
- Install Warning/Guide Signs (20% Crash Reduction Factor)
- Safety Treat Fixed Objects (50% Crash Reduction Factor)
- Install Overhead Signs (20% Crash Reduction Factor)
- Safety Lighting (49% Crash Reduction Factor)

2. Achieve and Maintain a State of Good Repair: The proposed project would add new ramps, requiring minimal maintenance for at least 20 years after completion.

3. Move People and Goods Efficiently: As a proposed multimodal facility, SH99 EB ML and EB FR would be able to efficiently move vehicles, goods, and pedestrians/cyclists in a safe manner. Additional access will also improve mobility by reducing travel time delays and improving incident response time.

4. Strengthen Regional Economic Competitiveness: Within this TAZ, population is expected to increase by nearly 150%, from 2018 to 2045, and jobs are expected to increase by 71%. Within a quarter mile of the Valley Ranch Parkway at SH 99 interchange, there are currently 81 housing units; 2045 projections estimate 2,625 housing units which is a 3,100% increase from existing. Non-residential building square footage is expected to increase by 205% in 2045 and lane use dedicated to residential is expected to increase by 36%.

Households:

2018: 4,987

2045: 11,867

Population:

2018: 14,342

2045: 35,558

Jobs:

2018: 6,236

2045: 9,091

3.0 Benefits

We have selected the following safety improvements as they are the most critical and beneficial to SH-99.

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
Safety Improvement Type 1	Safety Lighting
Work Type Code	304
Preventable Crash Type	Non-Intersection related (Roadway Related)
Appropriate Crash Reduction Factor (%):	49%
Service Life (years):	15
Safety Improvement Type 2	Install Overhead Signs
Work Type Code	119
Preventable Crash Type	Non-Intersection related (Roadway Related)
Appropriate Crash Reduction Factor (%):	20%
Service Life (years):	6
Safety Improvement Type 3	Install Pavement Markings
Work Type Code	401
Preventable Crash Type	Non-Intersection related (Roadway Related)
Appropriate Crash Reduction Factor (%):	20%
Service Life (years):	2
Bike/Ped Improvement Type	Blank
Work Type Code	0
Preventable Crash Type	Blank
Appropriate Crash Reduction Factor (%):	0%
Service Life (years):	0

Table 2: Proposed Improvements (Crash Benefits)

2022 Traffic Volume	7,543
Estimated traffic volume in year Open to Traffic	10,372
2022 Potential Daily Walk/Bike Commuters	48
Potential Daily Walk/Bike Commuters in Year Open to Traffic	64

Table 3: Daily Travel Demand (Crash Benefits)

Discounted Safety Benefits @ 7% ($)	**$28,642,000**

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?	2031
Type of Improvement	Roadway improvements (Added Capacity, Grade Separations) including HOV
Type of Facility	Non-Freeway
Total Length of Corridors Affected by Project (miles)	0.8
Average Roadway Speed Before Improvement (mph)	38
Average Roadway Speed After Improvement (mph)	45
Service Life of Project (from MoSERS)	20

Table 5: Proposed Improvements (Roadway Emissions Benefits)

2022 Average Daily Traffic Volume of Corridors Affected by project	7,543

Table 6: Daily Travel Demand (Roadway Emissions Benefits)

Discounted NOx Benefits @ 7% ($)	**$196**
Discounted VOC Benefits @ 7% ($)	**$95,330**

Table 7: Benefit Results (Roadway Emissions Benefits)

Discounted Emissions Benefits @ 7% ($)	**$95,526**

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

NOx Emission Reductions (tons)	**0.02**
VOC Emission Reductions (tons)	**0.15**

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?	2031
Type of Improvement 1	Access Management
Estimated Delay Reductions (in %)	20%

Table 10: Proposed Improvements (Transit Delay Benefits)

Service Life (years):	20
Type of Improvement 2	Acceleration/Deceleration Lanes (Speed Change Lane)
Estimated Delay Reductions (in %)	15%
Service Life (years):	20
Type of Improvement 3	Ramp Configuration
Estimated Delay Reductions (in %)	10%
Service Life (years):	20

Table 10: Proposed Improvements (Transit Delay Benefits) (Continued)

Interim Calculations	Per Veh In hours	Per Veh In minutes
Estimated Free Flow Travel Time	0.020	1.18
Estimated Average Peak Period Travel Time without project	0.028	1.68
Estimate Average Delay without project	0.008	0.51
Estimated Delay with project 1	0.007	0.40
Estimated Average Peak Travel Time with project 1	0.026	1.58
Estimated Delay with project 1 & 2	0.006	0.34
Estimated Average Peak Travel Time with project 2	0.025	1.52
Estimated Delay with projects 1, 2 & 3	0.005	0.31
Estimated Average Peak Travel Time with projects 1, 2 & 3	0.025	1.49

Table 11: Interim Calculations for the Delay Reductions

VHT Improvements	*Without Project*	*With Project*
Peak period VHT In year open to traffic in hours	202	178

Table 12: VHT Improvements

2022 Traffic Volume (AADT)	7,543
2022 Peak Period Traffic Volume	5,224
Peak Period Traffic Volume in Year Open to Traffic	7,191
Estimated Free Flow Speed before improvement (mph)	43
Average Peak Period Corridor Speed before improvement (mph)	30

Table 13: Daily Travel Demand (Transit Delay Benefits)

Discounted Delay Benefits @ 7% ($)	**$7,385,000**

Table 14: Benefit Results (Transit Delay 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 3 sheets totaled out to be $36,122,526.

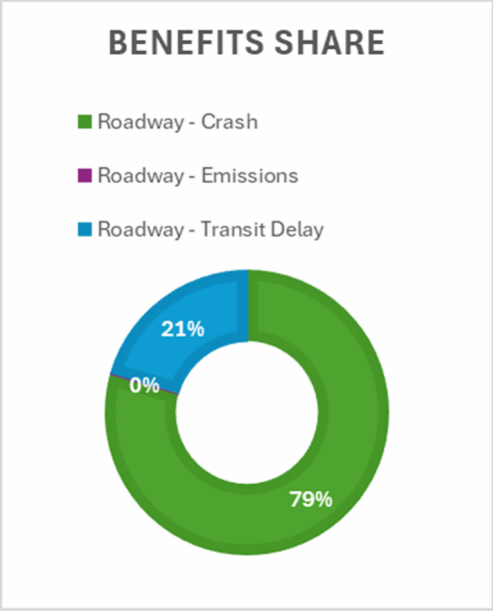

Figure 2: Benefits Share

Roadway - Crash	Roadway - Emissions	Roadway - Transit Delay	Active - Transportation Emissions	SUM
$28,642,000	$95,526	$7,385,000	$ -	**$36,122,526**

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 3.01 in 2022 real dollars.

Scenario	$2022 Real Dollars
Benefits	$36,122,526
Construction Costs (Scoping estimate provided by Montgomery County)	$12,000,000
BCA Ratio	3.01
Net Present Value	$24,122,526

Table 21: BCR Analysis