

BENEFIT/COST ANALYSIS

Based on the analysis summarized in this document, it is expected that the Benefit To Cost Ratio (B/C Ratio) for the project will be significant. This section will quantify the benefits and the costs and present a calculation of the B/C Ratio.

The expected benefits fall into two categories: one related to the improved operations and the second associated with reduced vehicular crashes. An estimation of the value of these benefits was derived for use in calculating the B/C Ratio.

Benefits of Reduced Delay

Table 3 demonstrated reduced travel time in terms of hours for the AM and PM Peak Hours. This represents time saved by all users of the facility during these peak hours.

Each of the two peak hours generally represents a three (3) hour period, therefore covering 6 hours of the day. The peak periods occur each weekday for a total of 260 days each year. This approach is a conservative representation of the benefits of reduced delay, since benefits will also occur during the off peak periods of the day.

The Hall County average hourly rate of pay is \$18.225 per hour. Table 4 summarizes the estimated value of the total time that would be saved by motorists each year as a result of the improvements.

Table 4: ESTIMATED VALUE OF ANNUAL TIME SAVINGS RESULTING FROM THE PROPOSED PROJECT

PERIOD	Reduced Amount of Delay per Hour (hrs)	Number of Hours during Period	Total Time Savings During Period			
AM Peak Hour	1062.1	3	3186.3			
PM Peak Hour	924	3	2772			
Estimated Daily Time Savings (hrs)				5958.3		
Work Days per Year				260		
Estimated Annual Time Savings (hrs)					1,549,158	
Hall County Average Hourly Rate					\$18.225	
Estimated Annual Savings from Reduced Travel Time						\$28,233,404

Benefits of Reduced Fuel Consumption

The simulation analyses summarized in Table 3 indicated that the amount of fuel consumed would decrease as a result of the project.

Using the same approach described in the Benefits of Reduced Delay section and an average price per gallon of fuel of \$2.50 benefits of reduced fuel consumption was calculated. Table 5 summarizes the estimated value of reduced fuel consumption resulting from the proposed project.

Table 5: ESTIMATED VALUE OF ANNUAL FUEL SAVINGS RESULTING FROM THE PROPOSED PROJECT

PERIOD	Reduced Fuel Consumption (gals)	Number of Hours during Period	Total Fuel Savings During Period			
AM Peak Hour	215.1	3	645.3			
PM Peak Hour	184.5	3	553.5			
Estimated Daily Fuel Savings (gals)				1198.8		
Work Days per Year				260		
Estimated Annual Fuel Savings (gals)					311,688	
Average Price per gallon of gasoline (assumed)					\$2.50	
Estimated Annual Fuel Savings						\$779,220

Benefits of Safety Improvements

The installation of a median and adding turn lanes is expected to reduce crashes by ten (10) per year. This accident reduction represents an average condition of the life of the project and was previously derived on page 21.

The National Highway Traffic safety Administration (NHTSA) published a relevant document in May 2002 entitled: *The Economic Impact of Motor Vehicle Crashes 2000*. That document provided average costs for both property damage only crashes and for injury crashes.

Since, Guidelines for evaluating statistical life and time savings have been updated and provided by the Federal Highway Administration (FHWA). A memorandum, dated March 18, 2009, Treatment of the Economic Value of a Statistical Life (VSL) in Departmental Analyses was set at \$5.8 million. Corresponding MAIS levels (0-5) were set as a percentage of VSL. MAIS 2 was set at 0.0155 (\$89,900).

Using percentages established in the 2002 report, approximately 92.5% of the \$89,900 or (\$83,157) would be the injury related component and 7.5% or (\$6743) would be the property damage component.

From the accident analysis presented earlier, it is expected that about 2 of the accidents preventable with the improvements will be injury crashes and 8 will be property damage only.

For the purposes of this analysis, it is assumed that the severity of these preventable injury crashes is MAIS 2, which is an average injury level.

The estimated cost the eight (8) property damage only crashes per year (80% of the 10 total accidents to be reduced) is as follows:

$$8 \times \$6,743 = \$53,944$$

The estimated cost of the two (2) injury crashes to be reduced by the project are as follows:

$$2 \times (\$89,900) = \$179,800$$

The total safety benefit of the reduction of ten (10) crashes is \$233,744 per year.

Total Benefits of Proposed Project

Table 6 summarizes the total annual benefits anticipated by the proposed project.

Table 6: TOTAL ESTIMATED ANNUAL BENEFITS

BENEFIT	ESTIMATED ANNUAL BENEFIT
Saved Time	\$28,233,404
Saved Fuel	\$779,220
Reduced Crashes	\$233,744
TOTAL	\$29,246,368

Construction Cost of Project

The estimated cost of constructing the project including design, right-of-way acquisition, and utility relocation is shown in Table 7.

Table 7: TOTAL ESTIMATED CONSTRUCTION COST

COMPONENT	ESTIMATED COST
Engineering	\$2,500,000
Right of Way	\$50,000,000
Utility Relocation	\$500,000
Construction	\$27,000,000
TOTAL	\$80,000,000

Annual Cost of Project

The project is estimated to have a useful life of twenty (20) years. The equivalent annual cost of constructing the project is estimated by converting the total cost to an annual cost by applying an equal payment series capital recovery factor. Compound interest factors for three (3), five (5) and seven (7) percent have been calculated.

Annual Cost = (Construction Cost) x (Equal Payment Series Capital Recovery Factor)

Equal Payment Series Capital Recovery Factor:

$$@ 3\% = \left[\frac{0.03 (1+0.03)^{20}}{(1+0.03)^{20}-1} \right] = .0672$$

$$@ 5\% = \left[\frac{0.05 (1+0.05)^{20}}{(1+0.05)^{20}-1} \right] = .0802$$

$$@ 7\% = \left[\frac{0.07 (1+0.07)^{20}}{(1+0.07)^{20}-1} \right] = .0944$$

Annual Cost = (\$80,000,000) x (Factor)

@ 3%: Annual Cost = \$5,376,000

@ 5%: Annual Cost = \$6,416,000

@ 7%: Annual Cost = \$7,552,000

Maintaining the corridor after construction of the project is estimated at approximately \$50,000 per year.

Total Annual Cost:

@3% = \$5,426,000

@5% = \$6,466,000

@7% = \$7,602,000

Benefit Cost Ratio

The resulting benefit/cost ratio is derived by dividing the annual benefits by the annual cost:

B/C Ratio:

$$@3\% = \frac{\$29,246,368}{\$5,426,000} = 5.39$$

$$@5\% = \frac{\$29,246,368}{\$6,466,000} = 4.52$$

$$@7\% = \frac{\$29,246,368}{\$7,602,000} = 3.85$$

SUMMARY OF FINDINGS

Improving Spout Springs Road to a four lane divided corridor mitigates impacts to the critical measures of effectiveness, improves travel times and safety. The project results in a **B/C Ratio of 5.39 at 3%, 4.52 at 5% and 3.85 at 7%**. The following statements summarize the MOE evaluation:

1. Comparison of 2030 No-Build Condition to Existing Condition:

- The MOE Evaluation Matrix provided in Table 3 shows significant degradation in each of the critical measures for the next 20 years if no improvements are made.
- Average travel speeds, fuel efficiency and emissions are heavily degraded due to the congestion and immobility.
 - AM Peak Hour Conditions
 - Total delay increases from 22 hours to 1411 hours.
 - Average travel speeds are reduced from 33 mph to 18 mph.
 - Fuel used increases from 127 to 586 gallons.
 - Fuel efficiency is reduced from 31 mpg to 14.4 mpg.
 - CO₂ emissions increase from 1750 to 4737 grams.
 - PM Peak Hour Conditions
 - Total delay increases from 47 hours to 1360 hours.
 - Average travel speeds are reduced from 31 mph to 15 mph.
 - Fuel used increases from 179 to 572 gallons.
 - Fuel efficiency is reduced from 31 mpg to 14.5 mpg.
 - CO₂ emissions increase from 2360 to 4167 grams.

2. Comparison of 2030 Build Condition to 2030 No-Build Condition:

- The MOE Evaluation Matrix in Table 3 shows substantial improvement to each of the critical measures for the next 20 years with the proposed project.
- Average travel speeds, fuel efficiency and emissions are vastly improved with the proposed project.
 - AM Peak Hour Conditions
 - Total delay is reduced from 1411 hours to 324 hours.
 - Average travel speeds improve from 18 mph to 25 mph.
 - Fuel used is reduced from 586 to 371 gallons.
 - Fuel efficiency is improved from 14.4 mpg to 25.2 mpg.
 - CO₂ emissions are reduced from 4737 to 4660 grams.
 - PM Peak Hour Conditions
 - Total delay is reduced from 1360 hours to 413 hours.
 - Average travel speeds improve from 15 mph to 24 mph.
 - Fuel used is reduced from 572 to 388 gallons.
 - Fuel efficiency is improved from 14.5 mpg to 23.4 mpg.
 - CO₂ emissions are reduced from 4167 to 4140 grams.