Benefit/Cost Analysis Team
Final Report

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The Benefit/Cost Analysis team has researched the cost and impacts of the following benefit cost indicators:

- Cost/annual Person-Hour of delay saved – Genetha Rice-Singleton
- Total Vehicle Operating Cost Savings – Darrell Richardson
- Cost per Accident Avoided – Angela T. Alexander
- Cost per Injury Avoided – Angela T. Alexander
- Cost per Life Saved – David Millen
- Cost per Gram-mile of pollutant reduced – Mathew Fowler
- Socio-Economic Impacts Daniel Fodera
- Secondary / Cumulative Impacts – Daniel Fodera

As a result of the committee's research and discussion the following conclusions were reached:

While there are several secondary advantages to implementing a **Congestion** project, the primary benefit is **a reduction in delay**. Reduction in delay or Delay Benefit (D_b) can be defined as the difference between the peak hour travel time through the corridor without the proposed improvement and the peak hour travel time through the corridor with the proposed improvement. The 20 year projected volume should be used to determine the travel time through the corridor.

Planning

It is difficult to determine a meaningful accurate measurement of delay in minutes along a specific corridor during the Planning phase. To do this using our existing tools the regions model would need to be run numerous times with the proposed improvement for each corridor modified individually. Planning uses a macro-type analysis and would have a difficult time identifying a change in minutes of delay for each project. The team recognizes that in order to prioritize our congestion projects, the analysis should begin at the planning stage; however this may not be feasible at this time. The Cost analysis team is continuing to explore software that would be better suited to perform a B/C analysis during the planning phase. In addition, the team recommends implementing a two-phase Preliminary Engineering process to address this issue. This means that Phase I PE will be authorized in order to get through the concept phase. At that point a meaningful B/C analysis can be done and a decision based on the B/C analysis and other factors can be made as to whether Phase II PE should be authorized and the projects proceed. **NOTE**: The team acknowledges that this was not part of their task; however, it is a recommendation that came forward as a process of researching and creating a B/C equation. This process is used in other States and is acceptable to FHWA.

Delay Benefit (D_b)

Delay is best determined from base year traffic counts and projected traffic volumes based on an accepted growth rate along the corridor. This information is currently provided to the preconstruction project manager during the concept development phase of a project and is used to determine the lane configuration and the anticipated LOS in the corridor. Therefore, this is a tool that is available and could readily be used to calculate the reduction of delay in the corridor.

The dollar cost for delay is dependant of three factors: Value of Time; Commercial Cost and Fuel Cost. Per **THE 2002 URBAN MOBILITY REPORT** prepared by the **Texas Transportation Institute** those cost for the Atlanta area are defined as follows:

Value of Time - $13.45/hour
Commercial Cost - $71.05/hour
Fuel Cost - $1.24/gallon or

The study also reports the annual congestion cost per Peak Traveler as $1,065.

The following is proposed to determine the congestion benefit from reduced delay:

Known Values:

- ⇒ AM and PM Peak Hour Travel time through the corridor with and without improvement
- ⇒ Delay Benefit (difference in the Peak Hour travel time through the corridor using 20 yr traffic with and without the proposed improvement)
- ⇒ ADT (Project Specific)
- ⇒ Corridor length (Project Specific)
- ⇒ Value of Time (given from Mobility Study)
- ⇒ Commercial Cost (given from Mobility Study)
- ⇒ Fuel Cost (given from Mobility Study)

The Benefit from saved **time** is as follows:

Time Benefit (T_b) = D_b{hrs/veh)} * (.5*ADT {veh/day}) * 250 {days/yr}* 20 {yrs} * 13.45 {$/hr}

- ⇒ **D_b** is defined above
- ⇒ **0.5*ADT** – in order to compensate for the fact that various corridors have peak hours ranging from 2 to 6 hours in both the AM and PM peak periods, the TTI study recommends ½ of the ADT as an appropriate amount of traffic volume to use as opposed to the peak DHV.
- ⇒ **250 days** – a measure of high volume days
- ⇒ **20 yrs** – the life of the project
- ⇒ **$13.45 /hr** – the value of time

The Benefit from saved **Commercial Cost** is as follows:

Commercial Benefit ($CM_{b)}$ = D_b {hrs/veh)} * (% truck traffic) * (.5*ADT {veh/day}) * 250 {days/yr}* 20 {yrs} * 71.05 {$/hr}

- ⇒ **% truck traffic** – an assumption is made that the majority of the commercial traffic is in trucks; therefore this benefit is limited to the trucks through the corridor
- ⇒ **$71.05/hr** – the cost of delay to Commercial vehicles

The team recognizes that costs for Time and Commercial Delay will vary outside of Atlanta. However, the majority of the Congestion projects should be in urbanized areas and these differences should be minimal. Also the TTI study examined the Atlanta Region where Time and Commercial cost can vary, further justifying the reasonableness of using the same factors for all congestion projects throughout the state.

The benefit from **fuel saved** is difficult to quantify for individual projects because of the following:

- ⇒ Frequent changes in fuel cost over time
- ⇒ Wide variations in fuel cost based on location
- ⇒ Variation in vehicle mileage rate (the vehicles miles/gallon rate)

For this reason, it is recommended that the benefit from fuel cost not be included in the equation.

Accidents:
The team agreed that all projects, regardless of their transportation strategy, should have some accident reduction affect or benefit. However, the accident benefit resulting from decreased Congestion and the resulting increased speed has been debated. Some reports state that reduced Congestion and increased speed, while reducing the number of accidents could actually increase the severity of the accident. Others report that reducing congestion allows quicker emergency response to accidents, and therefore have a benefit of clearing them quicker. Different reports have varying opinions.

Two separate reports from TRB and NCHRP were reviewed. One report attributed higher crash numbers to higher congestion. Even though this report concedes that higher speeds result in more fatalities, this researcher still believes relieving bottlenecks will save lives and reduce injuries. The second report completely disputes the theory that roadway widening reduces injuries and fatalities. This report says it actually increases them.

This issue has also been discussed with the Office of Traffic Safety and Design (Keith Golden). As a result, we have considered the possibility that the fatality rate for a widened roadway could actually go up, thus being a "cost" to the project. Without the rates, we can't know what the chance of this occurrence will be. Also, the Urban Mobility Report, which was used as a guide for determining the Congestion formulas, did not include Accidents in their Analysis.

At this time, a method for quantifying the benefit of reduced accidents is not included in the Congestion B/C analysis. If further analysis yields a quantifiable method for defining an accident reduction benefit resulting from a congestion project, the equations will be revised.

Conclusion:
Congestion Benefit = $\mathbf{T_b + CM_b}$

Congestion Cost = the total project cost (PE + R/W + Construction Cost)

B/C= Congestion Benefit/Congestion Cost.

A Congestion B/C ratio greater than 1.0 indicates that the calculated dollar value of congestion benefits exceeds the estimated dollar cost of the project. The B/C ratio is one piece of information that can be used to help determine whether a project should or should not proceed. Projects with a B/C ratio less than 1.0 should not automatically be deleted. However, when advancing projects with a Congestion B/C ratio less than 1.0, they should be rigorously evaluated regarding congestion relief and other transportation benefits to assure that they should proceed.