

## Attachment D

### Benefit-Cost Ratio Calculations<sup>1</sup>

A detailed explanation of the benefit-cost ratios calculations follows:

The Benefit from saved **time** is:

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

- ⇒ **D<sub>b</sub>** - difference in the Peak Hour travel time through the corridor using 20 yr traffic with and without the proposed improvement
- ⇒ **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<sup>2</sup> 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:

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

- ⇒ **% 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 Benefit from **fuel saved** is:

$$\text{Fuel Benefit (F}_b\text{)} = D_b\{\text{hrs/veh}\} * (.5 * \text{ADT}\{\text{veh/day}\}) * 250\{\text{days/yr}\} * 20\{\text{yrs}\} * 38.25\{\text{miles/hour}\} * 2.3\{\text{\$/gallon}\} / 18.36\{\text{miles/gallon}\}$$

- ⇒ **38.25 miles/hour** – the average running speed in the region
- ⇒ **\$2.3 gallon** – the average cost of fuel in the region
- ⇒ **18.36 miles/gallon** – the average fuel economy in the region

<sup>1</sup> Calculations based on the GDOT Benefit/Cost Analysis Worksheet dated November 13, 2007.

<sup>2</sup> Texas Transportation Institute (TTI). 2002. The Urban Mobility Report. Prepared by David Schrank and Tim Lomax. June 2002.



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CONCEPT A

General Purpose Lanes

Benefit Cost Analysis Work Sheet CONGESTION Projects	
PENHS-0008-00(256) 0008256 Cobb and Cherokee Counties I-75 Northwest Corridor Project - General Purpose Lanes	
Congestion Benefit = Tb + CMb + Fb	
Person Time Savings Benefit (Tb)	
*Db (hrs)	0.17
ADT	322,000.00
Tb (\$s)	\$1,881,687,500.00
Commercial or Truck Time Savings Benefit (CMb)	
Db (hrs)	0.17
% Truck Traffic	0.0958
ADT	322,000.00
CMb	\$952,458,209.50
Fuel Savings Benefit (Fb)	
ADT	322,000.00
Fb (\$s)	\$655,739,583.33
Total Congestion Benefit	\$3,489,885,292.83
Total Project Cost	\$0.00
B/C Ratio	N/A

Managed Lanes

Benefit Cost Analysis Work Sheet CONGESTION Projects	
PENHS-0008-00(256) 0008256 Cobb and Cherokee Counties I-75 Northwest Corridor Project - Managed Lanes	
Congestion Benefit = Tb + CMb + Fb	
Person Time Savings Benefit (Tb)	
*Db (hrs)	0.666666667
ADT	60,000.00
Tb (\$s)	\$1,375,000,000.00
Commercial or Truck Time Savings Benefit (CMb)	
Db (hrs)	0.666666667
% Truck Traffic	0
ADT	60,000.00
CMb	\$0.00
Fuel Savings Benefit (Fb)	
ADT	60,000.00
Fb (\$s)	\$479,166,666.67
Total Congestion Benefit	\$1,854,166,666.67
Total Project Cost	\$2,000,000,000.00
B/C Ratio	0.93
Total Congestion Benefit	\$5,344,051,959.50
Total Project Cost	\$2,000,000,000.00
B/C Ratio	2.67

\*Reduction in delay or **Delay Benefit (D<sub>b</sub>)** 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.

NORTHWEST CORRIDOR PROJECT

CONCEPT B1

General Purpose Lanes

Benefit Cost Analysis Work Sheet CONGESTION Projects	
PENHS-0008-00(256) 0008256 Cobb and Cherokee Counties I-75 Northwest Corridor Project - General Purpose Lanes	
Congestion Benefit = Tb + CMb + Fb	
Person Time Savings Benefit (Tb)	
*Db (hrs)	0.268333333
ADT	326,000.00
Tb (\$s)	\$3,007,010,416.67
Commercial or Truck Time Savings Benefit (CMb)	
Db (hrs)	0.268333333
% Truck Traffic	0.094
ADT	326,000.00
CMb	\$1,493,467,260.83
Fuel Savings Benefit (Fb)	
ADT	326,000.00
Fb (\$s)	\$1,047,897,569.44
Total Congestion Benefit	\$5,548,375,246.94
Total Project Cost	\$0.00
B/C Ratio	N/A

Managed Lanes

Benefit Cost Analysis Work Sheet CONGESTION Projects	
PENHS-0008-00(256) 0008256 Cobb and Cherokee Counties I-75 Northwest Corridor Project - Managed Lanes	
Congestion Benefit = Tb + CMb + Fb	
Person Time Savings Benefit (Tb)	
*Db (hrs)	0.733333333
ADT	36,000.00
Tb (\$s)	\$907,500,000.00
Commercial or Truck Time Savings Benefit (CMb)	
Db (hrs)	0.733333333
% Truck Traffic	0
ADT	36,000.00
CMb	\$0.00
Fuel Savings Benefit (Fb)	
ADT	36,000.00
Fb (\$s)	\$316,250,000.00
Total Congestion Benefit	\$1,223,750,000.00
Total Project Cost	\$1,200,000,000.00
B/C Ratio	1.02
Total Congestion Benefit	\$6,772,125,246.94
Total Project Cost	\$1,200,000,000.00
B/C Ratio	5.64

\*Reduction in delay or **Delay Benefit (D<sub>e</sub>)** 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.

CONCEPT B2

General Purpose Lanes

Benefit Cost Analysis Work Sheet CONGESTION Projects	
PENHS-0008-00(256) 0008256 Cobb and Cherokee Counties I-75 Northwest Corridor Project - General Purpose Lanes	
Congestion Benefit = Tb + CMb + Fb	
Person Time Savings Benefit (Tb)	
*Db (hrs)	0.28
ADT	325,000.00
Tb (\$s)	\$3,128,125,000.00
Commercial or Truck Time Savings Benefit (CMb)	
Db (hrs)	0.28
% Truck Traffic	0.0939
ADT	325,000.00
CMb	\$1,551,967,462.50
Fuel Savings Benefit (Fb)	
ADT	325,000.00
Fb (\$s)	\$1,090,104,166.67
Total Congestion Benefit	\$5,770,196,629.17
Total Project Cost	\$0.00
B/C Ratio	N/A

Managed Lanes

Benefit Cost Analysis Work Sheet CONGESTION Projects	
PENHS-0008-00(256) 0008256 Cobb and Cherokee Counties I-75 Northwest Corridor Project - Managed Lanes	
Congestion Benefit = Tb + CMb + Fb	
Person Time Savings Benefit (Tb)	
*Db (hrs)	0.74
ADT	36,000.00
Tb (\$s)	\$915,750,000.00
Commercial or Truck Time Savings Benefit (CMb)	
Db (hrs)	0.74
% Truck Traffic	0
ADT	36,000.00
CMb	\$0.00
Fuel Savings Benefit (Fb)	
ADT	36,000.00
Fb (\$s)	\$319,125,000.00
Total Congestion Benefit	\$1,234,875,000.00
Total Project Cost	\$1,045,000,000.00
B/C Ratio	1.18
Total Congestion Benefit	\$7,005,071,629.17
Total Project Cost	\$1,045,000,000.00
B/C Ratio	6.70

\*Reduction in delay or **Delay Benefit (Db)** 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.

NORTHWEST CORRIDOR PROJECT

CONCEPT C			
General Purpose Lanes		Managed Lanes	
<b>Benefit Cost Analysis Work Sheet</b> <b>CONGESTION Projects</b>  <i>PENHS-0008-00(256)</i> <i>0008256</i> <i>Cobb and Cherokee Counties</i>  I-75 Northwest Corridor Project - General Purpose Lanes		<b>Benefit Cost Analysis Work Sheet</b> <b>CONGESTION Projects</b>  <i>PENHS-0008-00(256)</i> <i>0008256</i> <i>Cobb and Cherokee Counties</i>  I-75 Northwest Corridor Project - Managed Lanes	
<b>Congestion Benefit = Tb + CMb + Fb</b>		<b>Congestion Benefit = Tb + CMb + Fb</b>	
<b>Person Time Savings Benefit (Tb)</b>		<b>Person Time Savings Benefit (Tb)</b>	
*Db (hrs)	0.233333333	*Db (hrs)	0.731666667
ADT	331,000.00	ADT	50,000.00
Tb (\$s)	\$2,654,895,833.33	Tb (\$s)	\$1,257,552,083.33
<b>Commercial or Truck Time Savings Benefit (CMb)</b>		<b>Commercial or Truck Time Savings Benefit (CMb)</b>	
Db (hrs)	0.233333333	Db (hrs)	0.731666667
% Truck Traffic	0.0909	% Truck Traffic	0
ADT	331,000.00	ADT	50,000.00
CMb	\$1,275,100,128.75	CMb	\$0.00
<b>Fuel Savings Benefit (Fb)</b>		<b>Fuel Savings Benefit (Fb)</b>	
ADT	331,000.00	ADT	50,000.00
Fb (\$s)	\$925,190,972.22	Fb (\$s)	\$438,237,847.22
<b>Total Congestion Benefit</b>	<b>\$4,855,186,934.31</b>	<b>Total Congestion Benefit</b>	<b>\$1,695,789,930.56</b>
<b>Total Project Cost</b>	<b>\$0.00</b>	<b>Total Project Cost</b>	<b>\$1,410,000,000.00</b>
<b>B/C Ratio</b>	<b>N/A</b>	<b>B/C Ratio</b>	<b>1.20</b>
		<b>Total Congestion Benefit</b>	<b>\$6,550,976,864.86</b>
		<b>Total Project Cost</b>	<b>\$1,410,000,000.00</b>
		<b>B/C Ratio</b>	<b>4.65</b>
*Reduction in delay or <b>Delay Benefit (D<sub>b</sub>)</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.			

**NORTHWEST CORRIDOR PROJECT**