EFLHD SUPPLEMENT 11.2.3-1

11.2.3 ENGINEERING ECONOMIC EVALUATION

Add the following at the end of the first paragraph:

Refer to Exhibit 11.2-D for guidance on standard inputs, analysis, and methodologies. Guidance for inputs on service life, maintenance intervals, and maintenance costs are provided in Exhibit 11.2-E. It is recommended that an LCCA be considered for projects with total estimated constructions costs exceeding $1 Million.

Exhibit 11.2-C Table of Standard Inputs and Methodologies

Input / Parameter	Source / Methodology	Comments
Economic Variables		
Discount Rate	Default to 4.0% (sensitivity analysis can be completed on a project-by-project basis, but only if warranted)	4.0% is most common value used by highway agencies (2007 national LCCA survey had an average discount rate of 4.1% and a range of 3 to 5%) Some agencies use 10-year moving average of OMB Real Interest Rate (3.3% in 2008) Link: http://www.whitehouse.gov/omb/circulars/a094/dischist.pdf Note: Higher discount rates favor short service life and lower initial cost alternatives. Lower discount rates favor long service life and higher initial cost alternatives.
User Costs 1. Value of User Time for Passenger Cars, Single Unit Trucks, & Combination Trucks ($/hour) 2. Added time and vehicle stopping costs (idling costs) for passenger cars, single unit trucks, and combination trucks ($/Veh-hour) 3. Crash Costs – NOT CONSIDERED, currently	FHWA Technical Bulletin (FHWA-SA-98-079) NCHRP Report 133 (Procedures for Estimating Highway User Costs…) USDOT wage rates and value of travel time MicroBENCOST program FHWA HERS Model	Unless more appropriate data is available, use default values from reports listed to the left. The FHWA Technical Bulletin (FHWA-SA-98-079) is an especially good source Website link for additional LCCA info: http://www.fhwa.dot.gov/infrastructure/asstmgmt/lcca.cfm

Consumer Price Index (CPI)	www.bls.gov (Bureau of Labor Statistics)	2008: CPI All Urban Consumers: 219.1 2008: CPI Transportation: 206.7
Construction Costs – initial & future costs	Initial Costs: EE Future Costs: (rehabilitation, reconstruction, or preservation) Calculate pavement costs and apply multiplier as per guidelines in comments block	Based on HPMA database year ending 2008. ▪Preservation (PM): Refer to maintenance cost table ▪Light 3R (overlays, mill & overlay): Pavement Costs x 1.7 ▪Heavy 3R (recycle & overlay, thick overlays 3"+): Pavement Costs x 2.0 ▪Reconstruction: Pavement Costs x 2.4
Analysis Options		
When to include User Costs and/or User Cost RSL Value	Sensitivity analysis* showed that user costs on a 2-lane road are significant -greater than 50% of agency cost- and begin to increase rapidly at 7000 AADT. * Inputs: 2-lane road, 4% trucks, 1-mile WZ, 500 vphpl in WZ, 240 day WZ duration, 8-hr daily WZ closures, misc defaults.	The following is recommended: ▪**AADT less than 5000** – No user costs ▪**5000 < AADT < 7000** – Consider inclusion of user costs depending upon project conditions ▪**AADT greater than 7000 and on all multi-lane facilities** – Include user costs Always include RSL in analysis.
Calculate costs for inbound, outbound, or both traffic directions	Directional costs will only be used on divided highways and only when one direction has significantly different disruptions/costs	
Analysis Period	35 years or 10 years more than expected service life whichever is greater	-2007 national LCCA survey- Average analysis period: 38 years (range was 20 to 50 years)
Deterministic or Probabilistic analysis	Use deterministic analysis	Longer term goal may be to move towards probabilistic approach. Probabilistic approach is more data intensive and requires inputs we currently don't track.

<table>
<tr><td>Project Scope</td><td>Complete LCCA (VA) only on projects that significantly improve structural capacity (i.e. pavement rehab/ reconstruction projects)</td><td>Do not compare pavement preservation treatments with pavement rehab/reconstruction. The scope is determined during programming and may be adjusted during the project scoping trip.</td></tr>
<tr><td colspan="3">Traffic Data (only needed when user costs considered)</td></tr>
<tr><td>AADT and breakdown of % Cars, SU Trucks, and C Trucks</td><td>Project data</td><td></td></tr>
<tr><td>Annual Growth Rate of Traffic (%)</td><td>Project data</td><td></td></tr>
<tr><td>Speed limit – normal conditions (mph)</td><td>Project data</td><td></td></tr>
<tr><td>Number of lanes in each direction – normal conditions</td><td>Project data</td><td></td></tr>
<tr><td>Free Flow Capacity (vphpl)</td><td>Use calculation tool in RealCost, the chart to the right, or calculate using equation manual below.

Highway Capacity Manual (calculated by RealCost)

FHWA Technical Bulletin (FHWA-SA-98-079)</td><td>Free Flow Capacity (vphpl)<table><tr><th></th><th colspan="3">Terrain</th></tr><tr><th>% Trucks</th><th>Level</th><th>Rolling</th><th>Mountainous</th></tr><tr><td>3</td><td>1,666</td><td>1,532</td><td>1,290</td></tr><tr><td>5</td><td>1,634</td><td>1,430</td><td>1,107</td></tr><tr><td>7</td><td>1,604</td><td>1,341</td><td>969</td></tr><tr><td>10</td><td>1,560</td><td>1,226</td><td>817</td></tr></table></td></tr>
<tr><td>Rural or Urban Hourly Traffic Distribution</td><td>Use default data in RealCost (from MicroBENCOST)
Or
Use actual data from agency, if available</td><td></td></tr>
</table>

Queue Dissipation Capacity (vphpl)	Use 15% deduct from free flow capacity Highway Capacity Manual FHWA Technical Bulletin (FHWA-SA-98-079)	The 15% deduct is based on several studies referenced in the Highway Capacity Manual and the Technical Bulletin
Maximum AADT (caps traffic growth based on capacity of facility)	Highway Capacity Manual FHWA Technical Bulletin (FHWA-SA-98-079)	Prevents traffic growth beyond the capacity of the facility
Maximum Queue Length (miles)	Project by project decision of estimating the maximum queue length that will be tolerated before alternative routes are sought FHWA Technical Bulletin (FHWA-SA-98-079)	
Construction Alternative Inputs		
Agency Construction Cost	From database developed above	
Work Zone Duration	Project data	Only use if user costs are being considered.

Service life (years) Definition: The period of time during which the product of a construction or rehabilitation activity is able to meet the performance requirements of a roadway. This period defines the time of normal operations between agency activities. And Structural Life (years)	Need to develop performance data for various activity scopes (i.e 4R, 3R, other). In the interim suggestions provided to the right in the comment box and in the Table on LCCA on Service Life, Maintenance Intervals, and Maintenance Costs can be used.	Use estimated service life for alternatives in analysis. Suggest using a generic H3R follow up rehabilitation (or repeating the original) for each HACP alternative. However, there may be cases when using different follow up rehabilitations (e.g. different long term strategies) for alternatives may be appropriate. For PCCP, suggest assuming a full reconstruct at year 35. The standard PDDM service life requirements: •20 years for all rehabilitation (3R) alternatives •25 years for HACP reconstruction (4R) •35 years for PCCP reconstruction (4R)
Maintenance costs ($)	Table on LCCA on Service Life, Maintenance Intervals and Maintenance costs	Table will need to be reviewed annually and updated as necessary for cost and performance information.
Maintenance frequency (years)	Table on LCCA on Service Life, Maintenance Intervals and Maintenance costs	Note: RealCost constrains users to selecting a maintenance interval that will repeat over and over for the life of the pavement. Table will need to be reviewed annually and updated as necessary for cost and performance information.
Work Zone Traffic Data -Lanes open (each direction) -Speed limit (mph) -Capacity (vphpl) -Length (miles) -Hourly Distribution -Work Zone hours	Project Data Highway Capacity Manual FHWA Technical Bulletin (FHWA-SA-98-079) Hourly Distribution – Default values in RealCost	Refer to above traffic input section. Again this data is needed only when user costs are considered.

Exhibit 11.2-E LCCA Inputs for Service Life, Maintenance Intervals, and Maintenace

3R (Rehab) 20 year service life*	Transverse Cracking - ~20 to 30 foot spacing and typical crack 1/2 in. or less in width	Transverse Cracking - less than 20 foot spacing and most cracks greater than 1/2 in.	>5% Fatigue Cracking	> 0.75 in Rutting	> 220 in/mi average IRI	Prevalent Block Cracking (~25% of the area or more, 1/2 in. cracks)	Maintenance Interval and Costs (5+ mile project)	Maintenance Interval and Costs (5- mile project)
Overlay (with pre-overlay repairs)	[2]		(not all repaired)	[2]	[2]		[2] 8 yrs $70,000/mi - 4 yrs $90,000/mi	[2] 8 yrs $125,000/mi - 4 yrs $175,000/mi
Mill & overlay (+ pre-overlay repairs)	[2]		(not all repaired)	[2]	[2]		[2] 8 yrs $70,000/mi - 4 yrs $90,000/mi	[2] 8 yrs $125,000/mi - 4 yrs $175,000/mi
CIR & overlay	[2]	[2]	[2]	[2]	[2]	[2]	8 yrs $70,000/mi	8 yrs $125,000/mi
FDR pulverize & overlay	[2]	[2]	[2]	[2]	[2]	[2]	8 yrs $70,000/mi	8 yrs $125,000/mi
FDR emulsion, foam, or cement & overlay	[2]	[2]	[2]	[2]	[2]	[2]	8 yrs $70,000/mi	8 yrs $125,000/mi

FDR/CIR and surface treatment (100 AADT or less)	[2]	[2]	[2]	[2]	[2]	[2]	5 yrs $70,000/mi	5 yrs $125,000/mi
4R (HACP) Reconstruction 25 year service life	Maintenance Interval and Costs		**4R (PCCP) Reconstruction 35 year service life**	Maintenance Interval and Costs (re-sealing joints)		***Note for : , reduce service life by 25-35%.**		
All HACP project scopes	8 yrs $70,000/mi		All PCCP project scopes	10 yrs $25,000/mi				