

Least-Cost Analysis



Pavement Management

Impetus for Investigation

For very low volume roads, what is the lowest life cycle cost to consistently maintain acceptable drivability without reconstruction, while maintaining safe conditions?

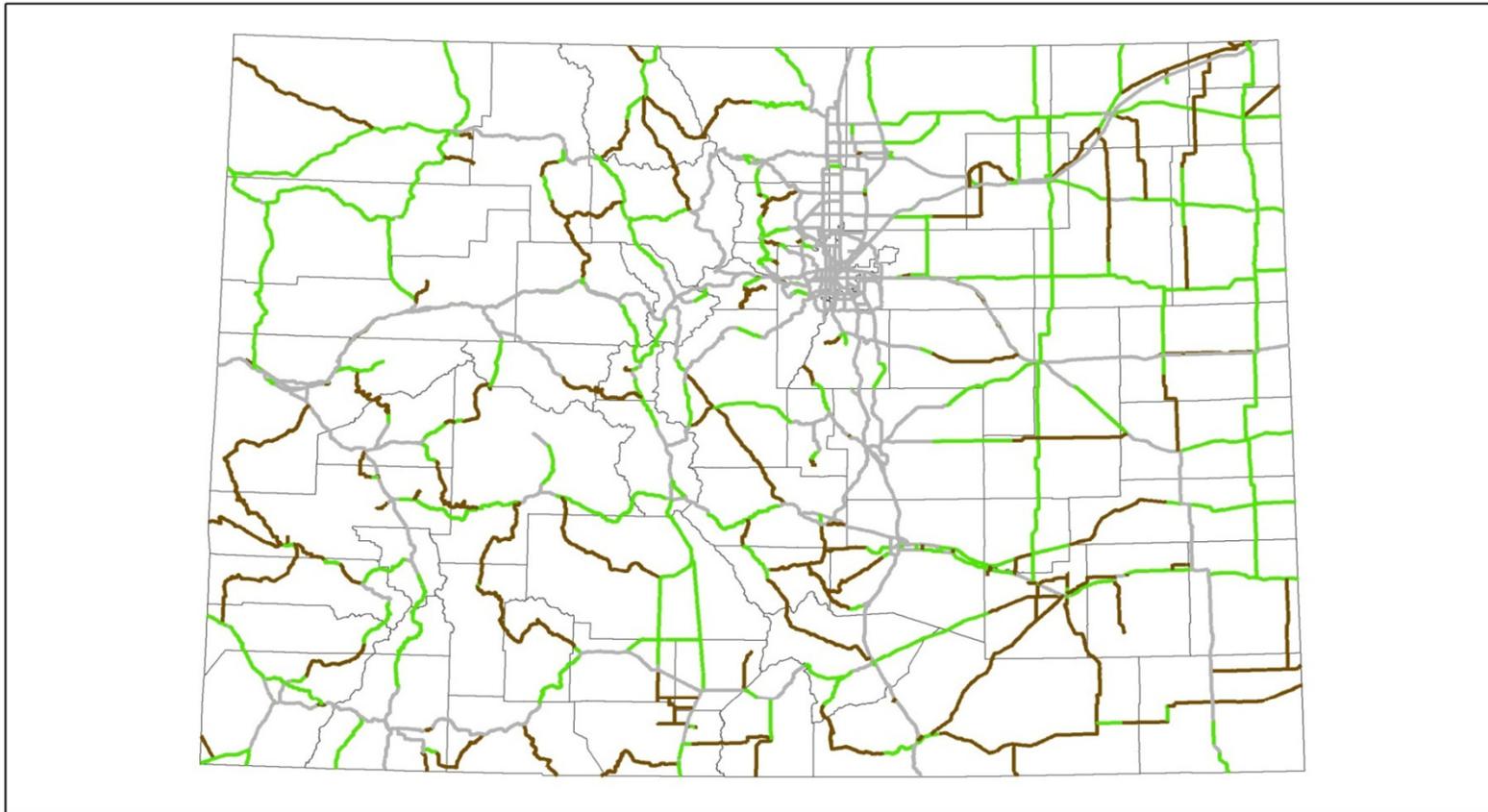
- Requires different type of analysis than Pavement Management's traditional benefit-cost method.
- Partnered with our software vendor, Deighton Associates, to perform a least-cost analysis on low volume roads.



Very Low Volume Roads Defined

Very Low Volume Roads: AADT less than 2,000 or trucks less than 100

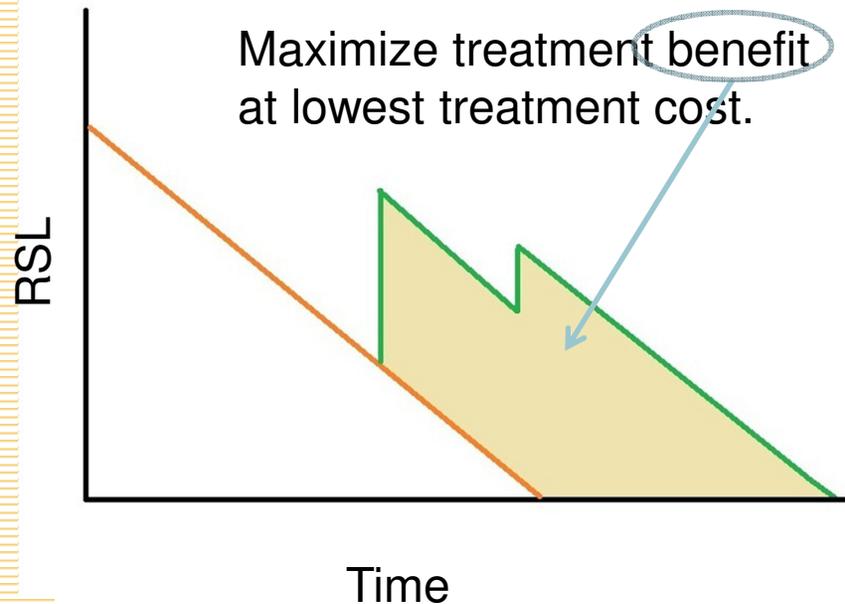
AADT and Truck AADT



Linetype	Description	Centerline Miles	% Centerline miles	Lane Miles	% Lane Miles	%VMT
	AADT >4000 or Trucks >1000	3,448	37.93%	11,487	50.02%	90.17%
	2000- 4000 AADT or Truck is 100-1000	3,074	33.82%	6,337	27.59%	7.64%
	AADT less than 2000 and Truck less than 100	2,569	28.25%	5,140	22.38%	2.19%
	Total	9,091	100.00%	22,964	100.00%	100.00%

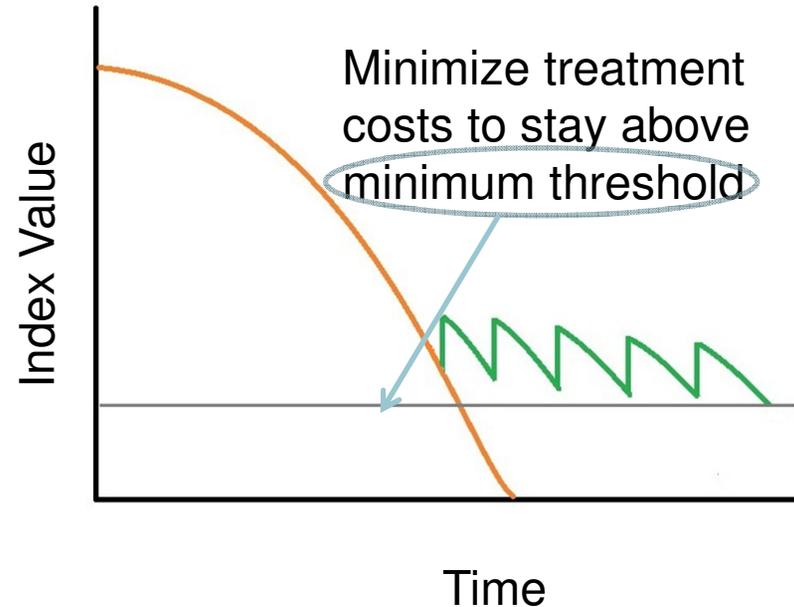
PAVEMENT MANAGEMENT ALTERNATIVES

Benefit-Cost Optimization



Given a budget, determines the most cost-effective investments, and identifies the future condition of the highway network.

Least-Cost Analysis



Given a set condition threshold, determines the minimum investment required to stay above the threshold.



RSL=0 AND DRIVABILITY

RSL=0 Acceptable Drivability



- Highway 36D
- Milepoint 189.5
- Fatigue Index 45

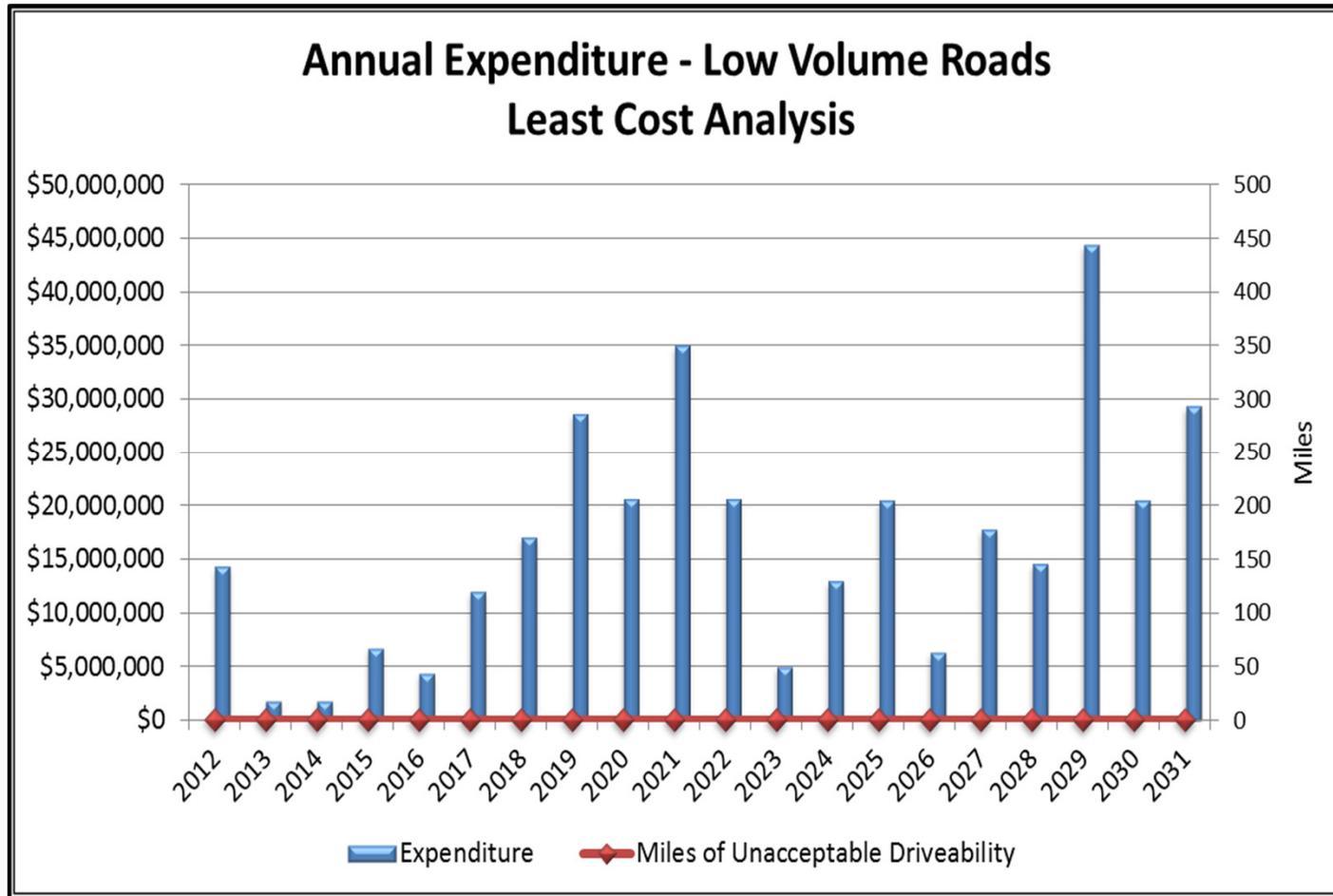
RSL=0 Unacceptable Drivability



- Highway 257B
- Milepoint 0.4
- Fatigue Index 9

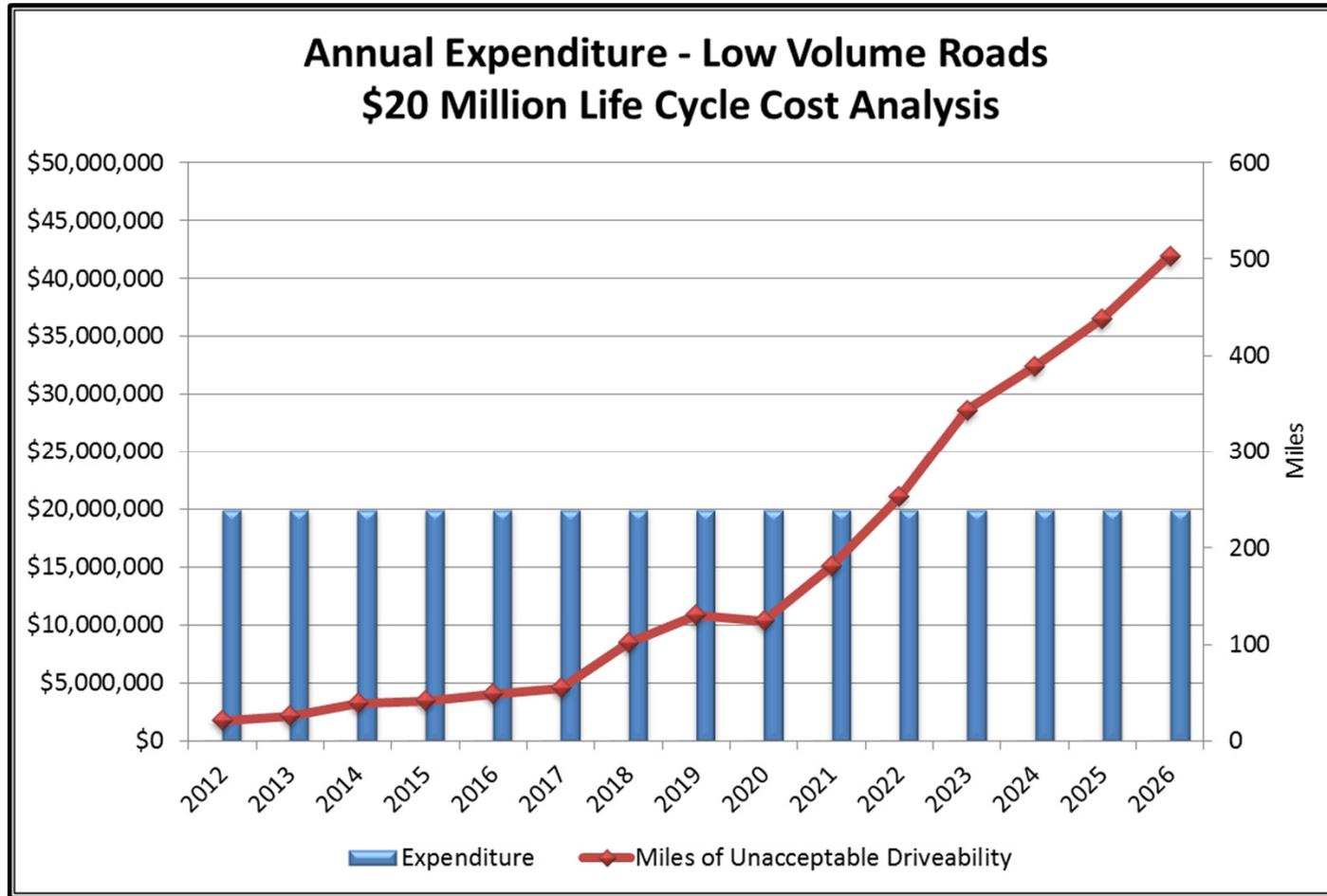


Lowest Cost Analysis Results



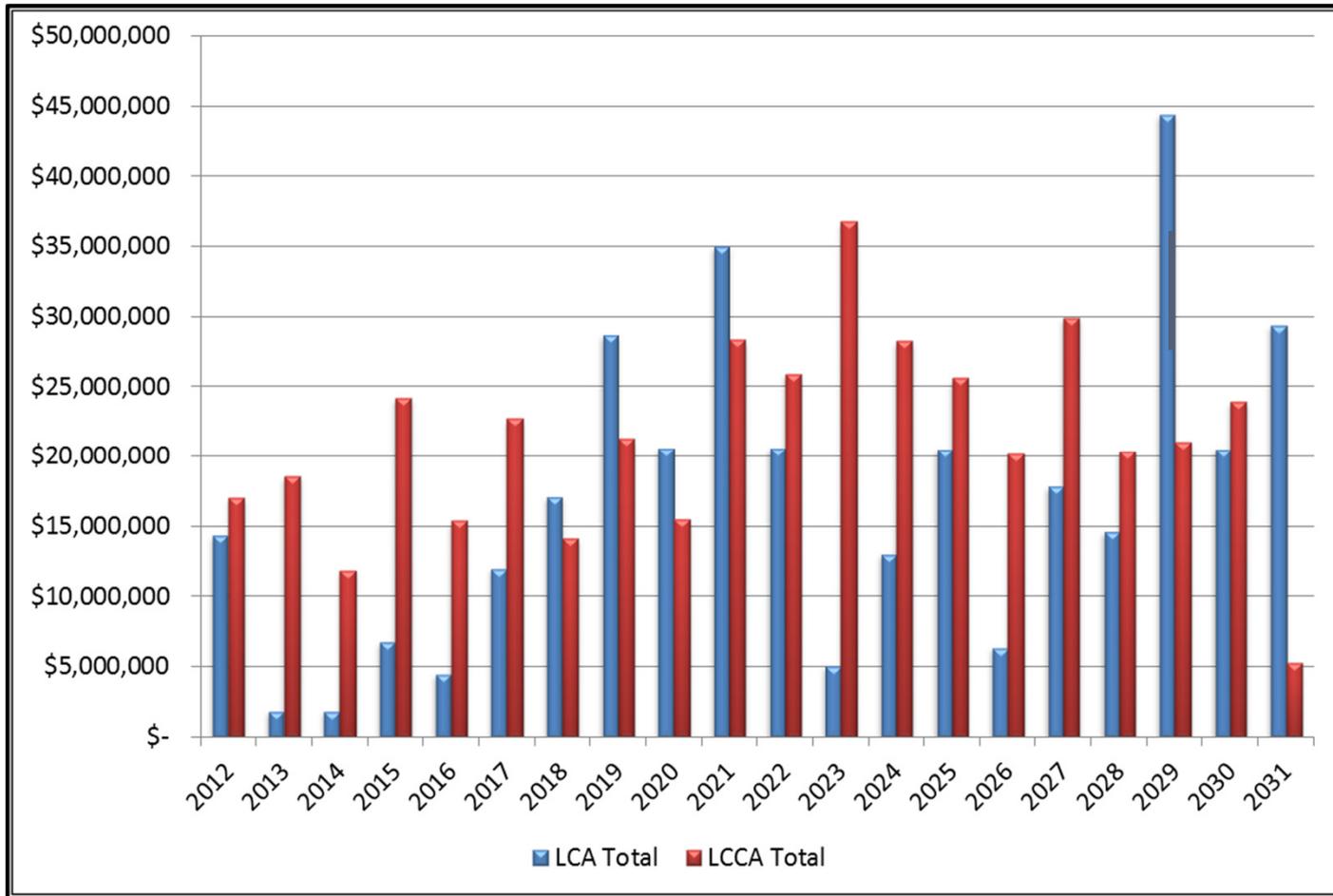


LCCA Analysis Results



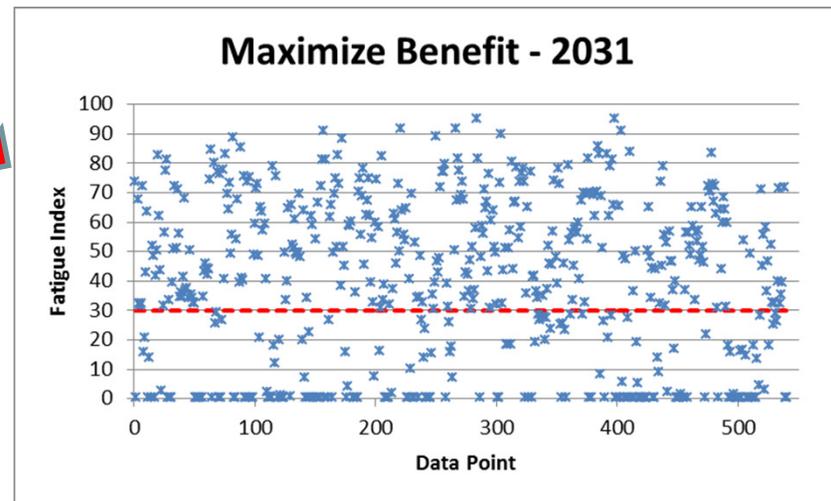
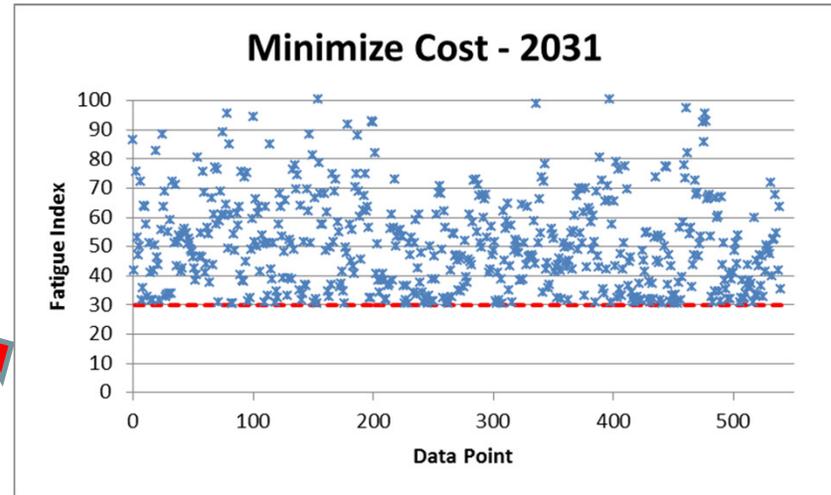
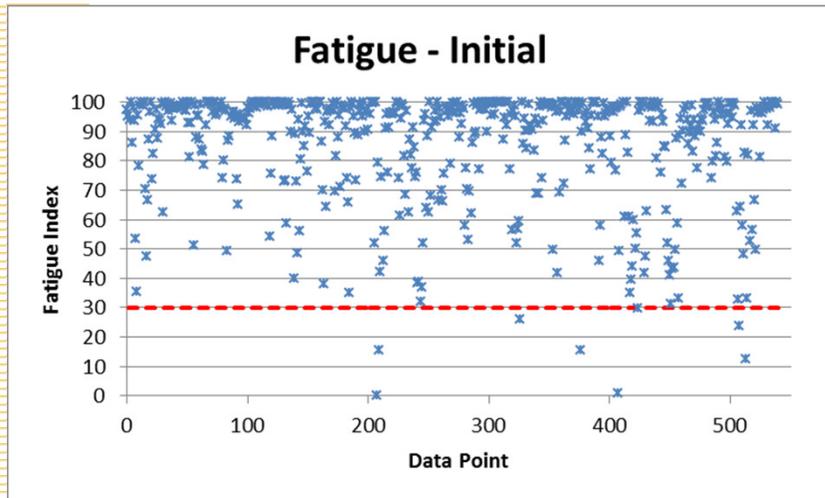


Lowest Cost / Life Cycle Cost Comparison



Lowest Cost / Life Cycle Cost Comparison

Distribution of Fatigue Index Data – Individual Sections



Low-Volume Roads Comparison

Benefit-Cost

- Total 20-year investment: \$426,074,732
- Average Annual Investment: \$21,303,737 per year
- Percent of STP investment: 10.6%

Least-Cost

- Total 20-year investment: \$334,979,660
- Average Annual Investment: \$16,748,983 per year
- Percent of STP investment: 8.3%

Note: CDOT currently invests 8% of the total construction budget in low-volume roads.





Least-Cost Recommendations

Issues Needing Resolution:

1. The threshold for “acceptable” drivability is the most important parameter in the lowest costs analysis, and further investigation should be completed to ensure the most appropriate threshold is used. If the threshold is set too low, the engineering integrity of the pavement structure will be lost before it has been fully utilized. Will require analysis to be regenerated
2. More detailed analysis of proposed treatments needs to be done to verify the ensure the suitability of these treatments at the proposed pavement condition levels.
3. Roads need to be classified into categories and parameters established for each category; consideration should be given to continuing the use of LCCA for higher classes of roads and LCA for lower classes.
4. The analysis period needs to be extended out to 40 or 50 years to fully understand the behavior of the network using these two analysis approaches, since many roads do not meet the threshold for treatment in the 15 and 20 year periods that were used for the “proof of concept”.
5. Implementing a least-cost analysis from a project delivery standpoint will take approximately 2-years.





Least-Cost Recommendations

Staff Recommendations:

1. Nail down distress thresholds for “Unacceptable Drivability.”
2. Modify Pavement Management variables and inputs to match the recommended investment levels of the least-cost analysis for low-volume roads
3. Remove reconstruction as a viable treatment type on low-volume roads
4. Incorporate CDOT’s *Practical Design Guide* philosophies into the Pavement Management Model
5. Explore alternate distress regression techniques that put more emphasis on surface distress when calculating pavement condition
6. Modify Pavement Management and Asset Management software that least-cost analysis can be performed
 - Perform a 50 year least-cost analysis to see if investment requirements continue to increase

