

## How Pavement Management Works for the Layman

Colorado Department of Transportation's (CDOT) Pavement Management Program (PMP) exists to provide the Regions with tools that optimize the use of funding allocated to the Surface Treatment Program (STP).

CDOT collects annual condition data for every highway on the network. Condition data collection begins in January and finishes in June. Condition data includes an inventory of every pavement crack, the rutting depth for every highway, the International Roughness Index (IRI) for every highway, pavement types, and various forms of shoulder observations.

Each Region's Pavement Manager maintains a database that includes all projects performed on all of their highways for as far back historically as records allow. Each year during data collection season (April through June) the Regions send their updated maintenance databases to the HQ-PMP. The HQ-PMP imports records into the modeling software.

On an annual basis the PMP reduces the raw condition data into a series of reports and maps classifying CDOT highways into one of four condition categories, Good, Fair, Poor or Poor-0. To arrive at the Good/Fair/Poor classifications, the current raw condition data (IRI, rut, fatigue cracking, transverse cracking, longitudinal cracking, and corner breaks) is first manipulated through equations and normalized into an index value on a scale of 0 to 100, where 100 indicates a pavement free of distress.

These index values are then loaded into the Pavement Management Software, which compiles all of the data and generates performance curves for all CDOT highways. From these regression curves the software models the life and deterioration of the pavement. A performance curve is required for each distress type. The performance curve models the deterioration of the index value for a specific distress versus time.

Once a pavement segment has been assigned a performance curve, a threshold age can be determined for each distress type and the RSL can then be calculated. The threshold age is the age at which the only cost-effective pavement treatment is reconstruction. Knowing that pavements require reconstruction at an index value of 50, the threshold age can be determined from the regression curves. The RSL is the difference between the threshold age and the current age of the pavement. If the pavement is 9 years old then the threshold age minus the current age yields an RSL of 7 years.

Threshold age RSL is adjusted based on maintenance activity that was performed in the past year. If the depth of the treatment is less than 1-inch, the RSL will be increased by one year. If the depth of treatment is equal to or greater than 1-inch the RSL will be increased by two years. The final RSL for the particular segment is reported as the lowest of the individual distress RSLs which rounded (up or down) to the nearest whole number. Next, the RSLs are grouped into categories:

- >10 years RSL is Good
- 6-10 years RSL is Fair
- < 6 years RSL is Poor

The Good/Fair/Poor results are displayed graphically in map form and sorted by system type (i.e. Network, National Highway System [NHS], Interstates, and Other). These reports are presented to the Transportation Commission (TC) to illustrate the current conditions of the CDOT highway system.

After the data has been loaded into the pavement management software and the Good/Fair/Poor percentages calculated, the Region Pavement Manager uses the Deighton dTIMS software to generate a list of resurfacing recommendations or strategies for their respective region. To generate these lists, the PMTC annually reviews

and updates the PM Model variables used in the PM software. The PMP software then uses an optimization technique called Incremental Benefit Cost (IBC). "...the ratio between the increase in benefit to the increase in cost between successive strategies." The IBC's goal is to select the strategies that maximize the benefit to the entire statewide network while not exceeding the budget available.

The Transportation Commission has a goal for CDOT to have 60% of the state's roads in either Good or Fair condition. The HQ-PMP reports the current roadway condition and projects future conditions based on available budget annually.

The budget used to predict 20-year conditions given CDOT's current funding levels comes from the current version of *Colorado Department of Transportation Revenue Forecast and Resource Allocations* (maintained by the CDOT Office of Financial Management and Budget , currently the 2035 resource allocation plan(OFMB)). The "funding gap" identified is the difference between anticipated budget, and that budget required to meet the TC's vision, objective, goal, or to maintain the current condition.