

# City of Calgary's Pavement Management System – Performance Indices Comparison

Venkat Lakkavalli P. Eng., Sukhwinder Dhanoa, Joe Chyc-Cies P. Eng.  
City of Calgary

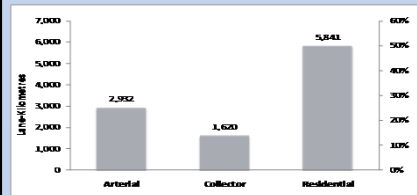
## Introduction

Pavement Management Systems (PMS) combine engineering and economics to develop cost-effective solutions for pavement maintenance and rehabilitation. To achieve fact based decision making in managing and maintaining the network efficiently, the City has been using PMS since mid 1980's. PMS measures the performance of the City's pavement network and predicts future needs, which is used in developing budget needs at targeted level of service.

Every year City invests in network level pavement data collection program to monitor functional and structural performance as mentioned below.:

- Visual Condition Index (VCI) – Automated and manual surface distresses;
- Riding Comfort Index (RCI) – Pavement roughness (IRI);
- Structural Adequacy Index (SAI) – FWD on Arterial network

## Network Distribution



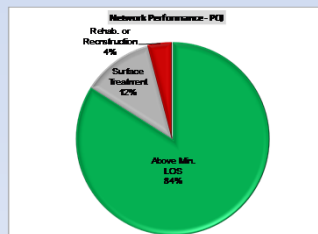
- 16,000 lane-km network length
- Classified as Arterial, Collector, Industrial and Residential roads
- Majority of roads (55%) are Residential
- Arterial – 28%; Collector/Industrial – 17%

- Automated surface distress data is collected every second year for Arterials and Collectors with high and heavier traffic. Manual data is collected every six years for Residential roads.
- While surface distresses are collected on all classifications, roughness and FWD is measured on Arterial and Collector roads only.

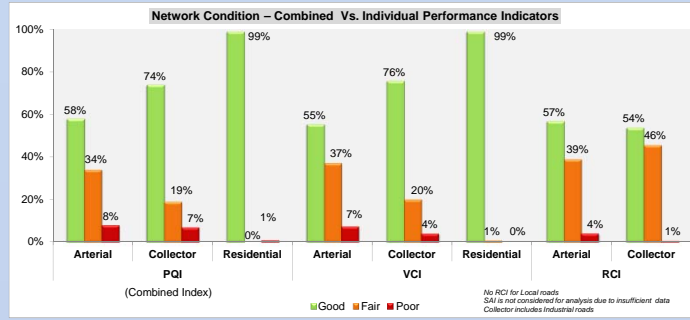
## Background

The City of Calgary adopts an overall combined index, Pavement Quality Index (PQI) as a performance measure in evaluating the network condition. While PQI gives us an overall picture of network level needs, this represents another level of aggregation and can involve loss of information. However, performance index is looked at independently at project level in prioritising the segments. Hence an attempt is made to compare the network level needs for overall pavement condition index with that of individual performance indicators to better understand the network condition as indicated by individual performance indicators.

- 84% of network is above minimum acceptable level of service (LOS) – Good & Fair
- 16% of the network is below targeted LOS – Poor
  - ❖ 4% needs rehabilitation or reconstruction
  - ❖ 12% needs surface treatment such as mill and inlay



## Combined Vs. Individual Performance Index

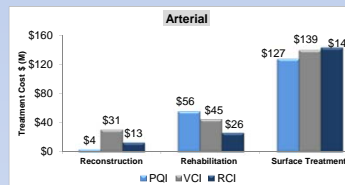


- VCI & PQI comparison shows similar performance for all road classifications
- RCI for Collectors show almost 50% of roads in fair condition, more than double that of PQI
- RCI compared with PQI for Arterials indicate poor condition roads are reduced by half
- Aggregation of parameters in PQI indicates the network is in better condition whereas roughness (RCI) independently shows different result

Backlog analysis below is based on the network condition graph shown above.

- Good roads – do nothing or preventative maintenance
- Fair roads – Above min. acceptable level of service. in future, needs Surface Treatment (mill and Inlay or similar treatment)
- Poor roads are divided in to roads that need Rehabilitation and Reconstruction

## Need Analysis



- Network level budget backlog assessment showed minor difference between combined index and individual indices
- Higher need for reconstruction based on VCI for Arterial roads
- Roughness triggered future needs for surface treatment on Collectors is significantly higher, congruent with roughness performance for collectors (46% - Fair)

## Conclusions and Future Directions

- PQI allows direct relation between level of funding and predicted network performance
- PQI tends to underestimate reconstruction need, can be attributed to the conglomeration of performance indices
- RCI shows greater future year needs for Collector roads, while reducing the present needs. Calibration of RCI model can be explored
- Continue and extend FWD testing program. to Collectors to verify the integrity of surface distress results (VCI).
- Sensitivity analysis on the weightage of roughness (RCI) and surface distress (VCI) indices in the PQI model may provide additional information for calibrating the existing model

