

# **Performance-Based Contracts for Management and Maintenance of Roads (PMMR)**

## **Module 4 Long-term asset monitoring**

# Quotes

***“Roads in all countries represent an important national asset”***

***“Management of road network asset of such value requires adoption of the most careful management practices commensurate with those adopted by the most successful businesses.”***

**Richard Robinson 2004**

# Large Sums Are Invested in Road Networks

Examples of values administered by road agencies:

- UK Highways  $\approx$  Value of IBM
- Japan Road Public Corporation  $\approx$  Value of GM (General Motors)
- Central and Eastern Europe  $\approx$  550 billion \$ US

Source: Robinson and Thagesen 2004

# **Purpose of Road Asset Management:**

**Aim:**

**Maintain and improve existing road network**

**Means: Attempting to optimize the overall performance of road networks over time.**

**Robinson et al. 1998**

# How

**Ensure that you have sufficient knowledge, proper tools and information, and**

- **Get thr best out of the funds available**
- **Ensure that you have sufficient funds**

# Proper Tools

**Models exists that simulates the interaction between**

- **pavement construction standards,**
- **maintenance standards,**
- **the effects of the environment and traffic loading**

**in order to predict the annual trend in road condition.**

**Henry Kerali**

# **HDM-4 (Highway Development & Management)**

**HDM-4 is the best-known example of road investment models.**

**It is capable of simulating the deterioration of pavements based on the present condition and a defined maintenance plan**

# Analysis

**Using HDM-4 a selection of different maintenance plans can be analyzed to determine the long-term costs. Based on the results the most suitable maintenance plan can be identified.**



# Optimization

**The program can be used to find the best suited maintenance approach for each road under the required performance standards**

# Requirements for HDM-4

**The program needs information to work on.**

**The most important are road inventory data, pavement condition data and traffic data.**

# Typical Inventory Data

- **Sections** – the length of each section
- **Cross-section** – the width of the carriageway and shoulders (and ditches)
- **Pavement** – type, thickness, (age)
- **Alignment** – chainage of crossroads, culverts, bridges, curves, gradients
- **Structures** – types and dimensions
- **Furniture** – road signs, guard rails, lightning etc.

# Typical Condition Data (Paved Roads)

- Roughness
- Rutting
- Cracking
- Pot-holes
- Pavement texture and friction

# Traffic

**Traffic is quantified as equivalent standard axles and is based on:**

- **Present traffic level**
- **Traffic growth**

**In addition future traffic depends on:**

- **Increase in legal axle limits**
- **Increase in violation of legal axle limits**

# Calibration of HDM-4

**The HDM-4 model can be calibrated to improve the prediction accuracy of the development of the pavement condition.**

**This is done to improve the match of the modeling with the conditions prevailing for the region in question**

# Data for Calibration

**Historical data (pavement condition data) and carried traffic are required to calibrate the model.**

**In the absence of such data HDM-4 provides suggestions for calibration, but calibration based on data is recommended to reduce risks.**

# Risks

**When introducing new methods the involved parties has to acknowledge, understand and live with risks involved, constantly striving to minimize the risks.**



# Transfer of Risks

**In a PMMR contract a significant part of the risk is transferred from the Client to the Contractor.**

**It is in the Clients interest that the Contractors are aware of the risks and knows how to handle them.**

# Risk Mitigation

**It is in nobody's interest that the Contractor goes broke by underestimating the works involved. The Client has an interest (and a responsibility) to assist the Contractor in making a sensible bid proposal.**

# Estimation of Works Required

**2 basic scenarios exist:**

- **Maintaining status quo in the pavement condition**
- **Improving/reducing the present pavement condition**

**It is much easier to estimate required works for a “status quo” scenario.**

# **Risk Analysis**

**There is no substitution for practical engineering judgement and understanding of pavement behavior.**

**... but HDM-4 or other suitable deterioration models helps !!!!**

# Basis for Modeling

**There is no substitute for good reliable data and good sound statistical experience is required to analyze available data correctly.**

# **Establishing Deterioration Model**

- 1. Data validation**
- 2. Data analysis**
- 3. Building of deterioration model**
- 4. Calibration of deterioration model**
- 5. Validation of model in field**

# Costing of Bid Proposal

1. **Prepare draft work program**
2. **Optimise work program**
3. **Costing of final work program**
4. **Sensitivity analysis of works program**
5. **Final costing and bid submission**

# Acknowledgement

Any resemblance with

*“Pavement deterioration modelling in long term performance based contracts: How far does it mitigate the risk for client and contractor”* by Chris Parkman, John Hallet, Theuns Henning and Mike Trapper

has been unavoidable as this paper has been a great inspiration for parts of the above presentation.



# PMS

**Pavement Management Systems are tools to guide the Road Administration to optimize the maintenance plans under given budgetary constraints and/or to calculate the required budget to maintain the road at a defined standard.**