Ontario

Performance Measures for Pavement Assets under Performance Based Contracts

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OUTLINE

- Introduction
- Scope and Objective
- Performance Measures and Goals
- Performance Measures Review
- Performance Monitoring
- Recommended Performance Measures – MTO
- Advantages and Challenges
- Conclusions

INTRODUCTION

- Movement towards Performance Based Contracts (PBCs), a long term warranty contract
- PBC provides contractor with performance measures and required LOS that must be met over contract period
- Contractor determines how to achieve the specified LOS
- PBC tenure typically ranges from 3-10 years (up to 30 years)

INTRODUCTION

- Performance measures continuously measured against LOS as a basis for payment

- Therefore, performance measures are fundamental to the successful use of PBC

SCOPE AND OBJECTIVE

- Conduct a review of the following:
  - PBC focusing on performance measures
  - Performance measures employed by various agencies in PBCs
  - Agencies performance inputs to evaluate the overall condition and asset management of road assets
  - Performance specifications implemented by Ontario Ministry of Transportation (MTO)

SCOPE AND OBJECTIVE

- Framework for performance measures monitoring
- Recommended performance measures for use in MTO's PBC.

PERFORMANCE MEASURES AND GOALS

PERFORMANCE MEASURES

- Performance measures grouped into:
  - Non-Pavement Performance Measures
    - Non-pavement highway attributes such as signs, vegetation, lights, barriers etc
  - Pavement Performance Measures
    - Pavement attributes that indicates the condition or performance of the pavement, such as rutting, cracking and skid resistance, etc

PERFORMANCE MEASURES

- Pavement Performance Measures grouped into:
  - Functional Performance Measures
    - represent the demand on the road by the users
    - Ex. roughness, cracking, pothols, etc.
  - Safety Performance Measures
    - Contribute to a safe environment for road users
    - Ex. skid resistance, texture, rutting, etc.
  - Structural Performance Measures
    - Represent the service and remaining life of the road as a function of traffic, environment, and material properties

PERFORMANCE MEASURES

- Effective Performance measure should consider the following questions: [SAIC 2007]
  - **Specific**?
  - **Measurable**?
  - **Achievable**?
  - **Results oriented**?
  - **Timely**?
  - **Meet** the **agency's objectives and desires**?
  - Been **measured before**?
  - **Conflict** with the **agency's standard specifications**?
  - **Aim to improve performance**?

PERFORMANCE GOALS

- Also referred to as LOS, the targeted level or value to be achieved for the performance measure
- Must take care when establishing performance goals
  - Not too high, resulting in high cost, nor too low, resulting in poor quality

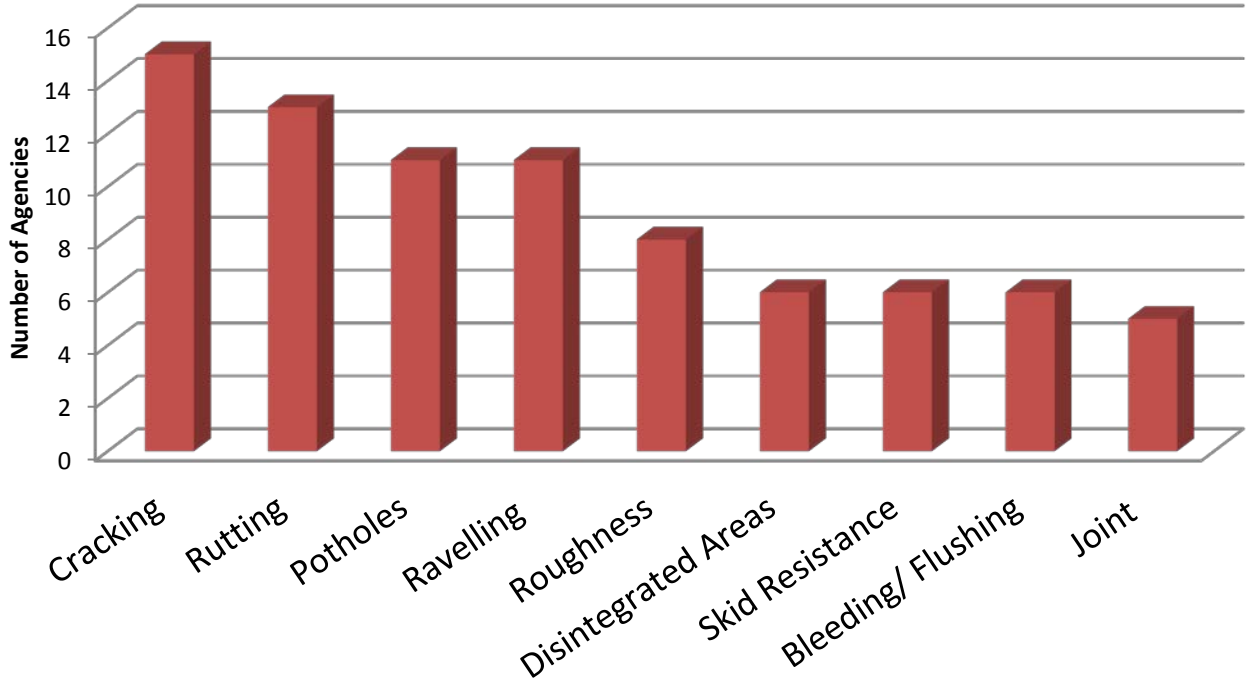
PERFORMANCE GOALS

- Performance Goals: [NCHRP Synthesis 389]
  - Base performance goal to that achieved by the In-house staff
  - Examine literature, procurement document and contracting information of other agencies; compare to other provinces, states, and countries
  - Conduct benchmarking studies
  - Set a scale from 0-100 for each performance measure and set the goal at 80

PERFORMANCE MEASURES REVIEW

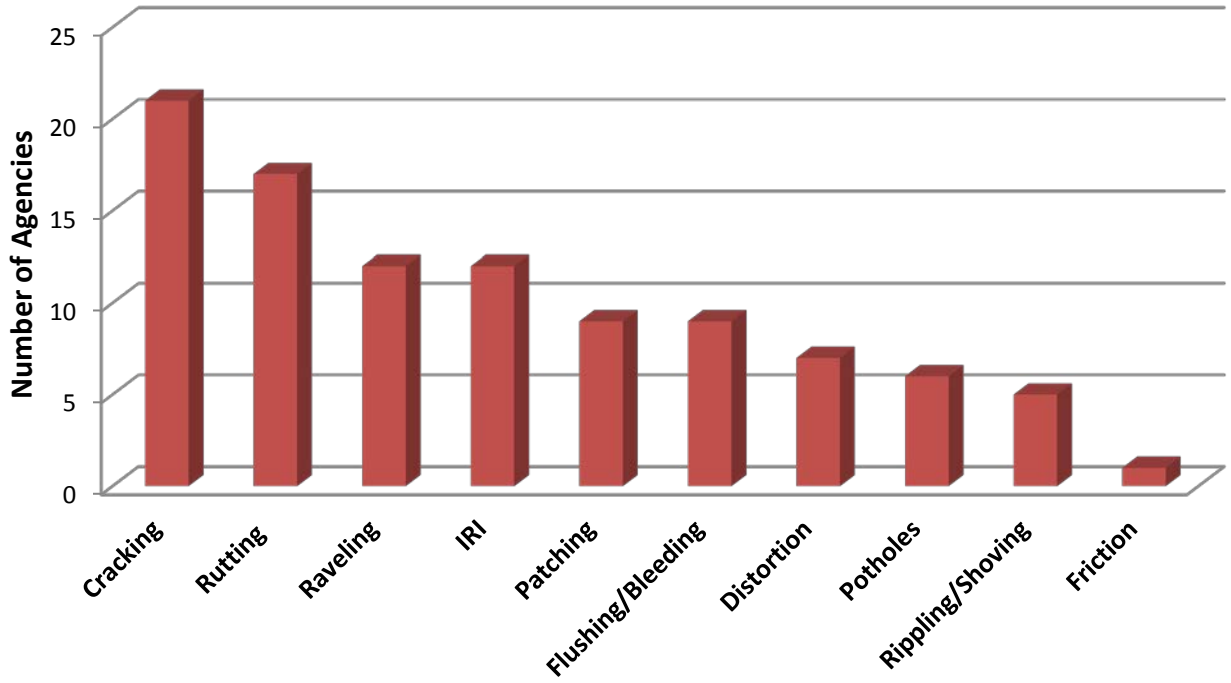
Performance Measure Review

- Performance measures employed by other agencies in PBC



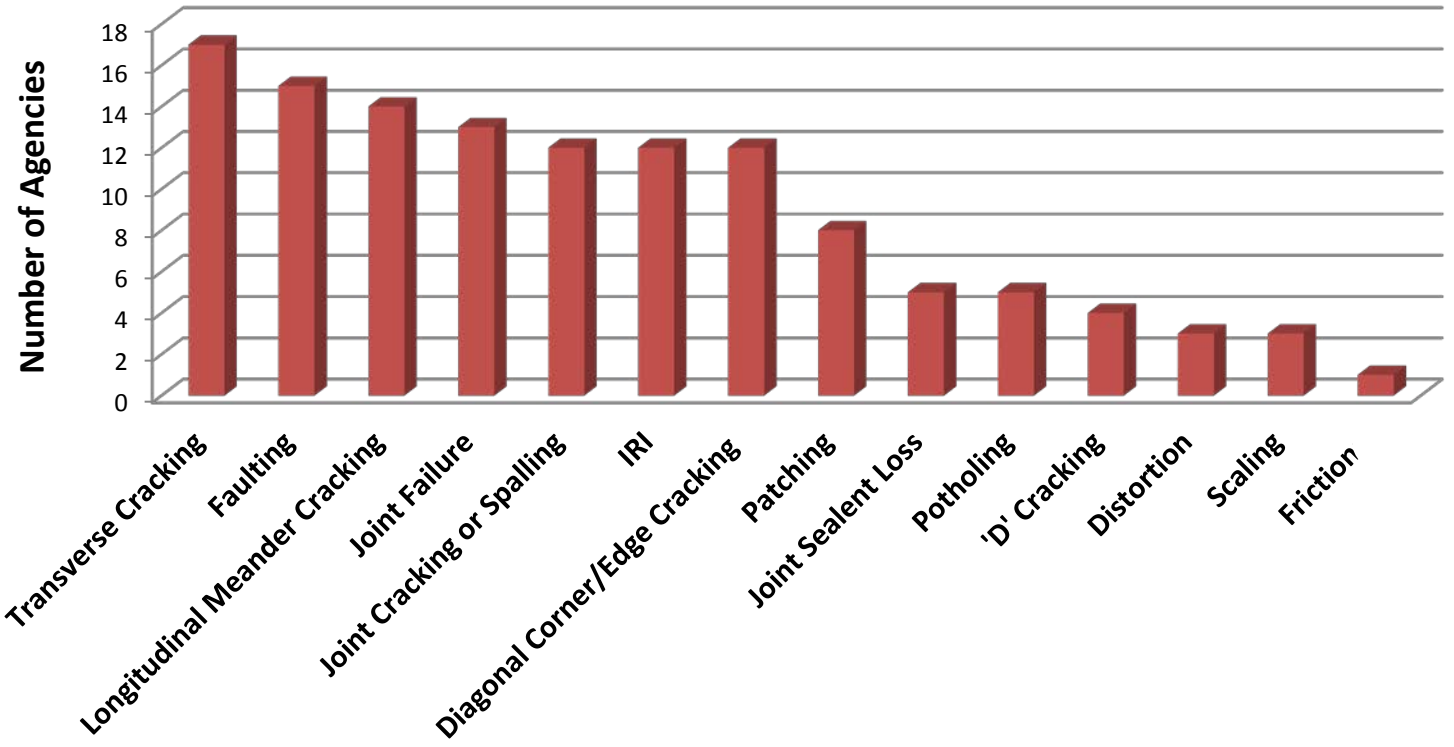
Performance Measure Review

- Agencies' pavement evaluation indices
- Flexible Pavement



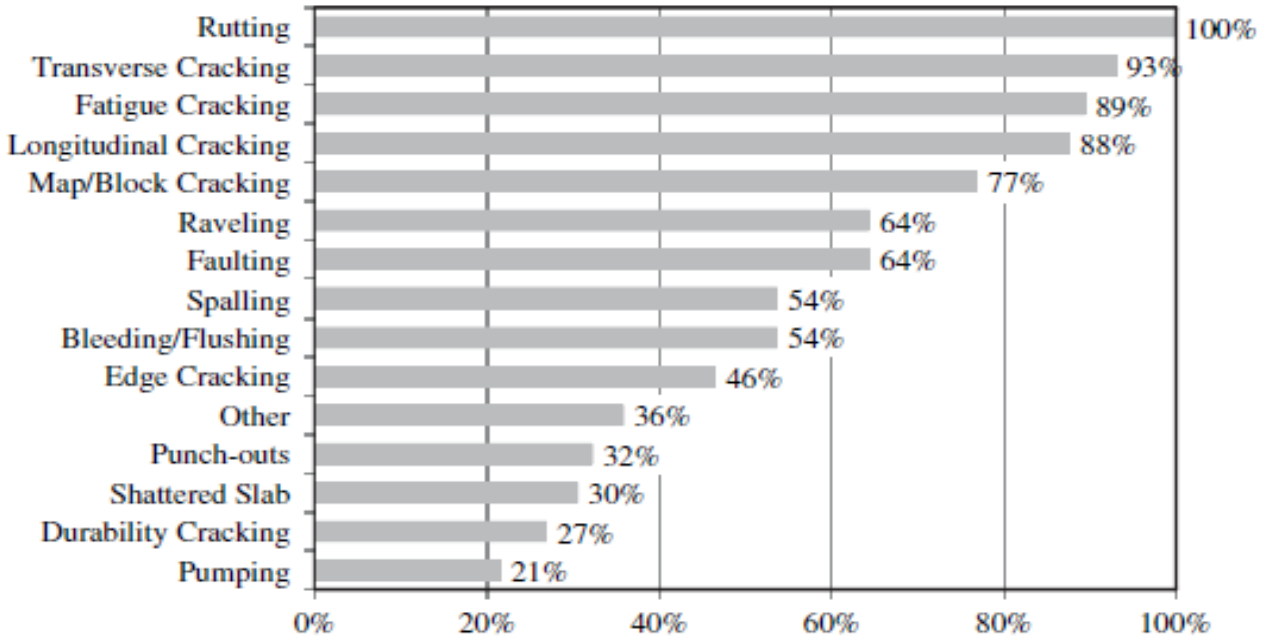
Performance Measure Review

- Rigid Pavement



Performance Measure Review

- Survey of 55 agencies (46 states and 9 Canadian Provinces) [NCHRP Synthesis 401]



MTO PERFORMANCE SPECIFICATION

- Pavement with Warranty (PWW)
  - Contractors bid on the pavement portion of the project without the conventional specifications
  - MTO does not prove the design; however, it depends on the performance requirements during the warranty period
  - 7-year warranty period

MTO PERFORMANCE SPECIFICATION

- PWW performance requirements

Performance Measure	New Construction	Rehabilitation/ Reconstruction
Roughness	X	X
Rutting	X	X
Friction	X	X
Coarse Aggregate Loss	X	X
Rippling	X	X
Shoving	X	X
Flushing	X	X
Cracking	X	X
Potholing	X	X
Warranty Period (Years)	7	7

MTO PERFORMANCE SPECIFICATION

- Minimum Oversight (MinO) contracts
  - Used for relatively small, low risk capital projects such as shave and pave, microsurfacing, and surface treatment
  - MTO is responsible for assessing the roads' performance over the warranty period
  - MTO has reported that the quality of the projects are comparable or at the same level of traditional contracts.

MTO PERFORMANCE SPECIFICATION

- Performance Measures in (MinO) contracts

	Contract Type					
Performance Measure	Asphalt Mix Type A	Asphalt Mix Type B1	Asphalt Mix Type B2	Micro-surfacing Single and Double	Surface Treatment Single	Surface Treatment Double
Rutting	X	X	X			
Friction	X	X	X	X	X	X
Coarse Aggregate Loss	X	X	X	X	X	X
Rippling				X	X	X
Shoving				X		
Flushing			X	X	X	X
Cracking						
Potholing	X	X	X			X
Joint Separation	X	X	X			
Delamination				X		
Streaking					X	X
Warranty Period (Years)	3	3	3	2	2	2

RECOMMENDED PERFORMANCE MEASURE FOR MTO

RECOMMENDED PERFORMANCE MEASURES

Flexible Pavements	Rigid Pavements	Granular Shoulders
• Coarse Aggregate Loss • Cracking • Cross-Fall • Flushing • Ponding • Potholing • Ravelling • Roughness • Rutting • Skid Resistance • Structural Adequacy • Texture	• Cracking • Cross-Fall • Disintegrated Areas • Faulting • Joint Failure • Joint Sealant • Load Transfer Efficiency • Ponding • Roughness • Scaling • Skid resistance • Spalling • Structural adequacy • Texture	• Cross-Fall • Edge Drop-off • Ponding • Rutting • Shoulder Elevation • Stability • Wash Outs

RECOMMENDED PERFORMANCE MEASURES

Performance Measure	Flexible	Rigid	Granular Shoulder	✓ : Automated/ semi-automated monitoring Available	✓ : Manual Monitoring Available	Comments
Coarse Aggregate Loss	✓			✓	✓	Can be identified by imaging systems or using MTO Manual for Condition Rating
Cracking	✓	✓		✓	✓	
Cross-Fall	✓	✓	✓	✓	✓	Can be identified by profiler systems
Disintegrated Areas		✓		✓	✓	Can be identified by imaging systems Or using MTO Manual for Condition Rating
Edge Drop-off			✓	✓	✓	
Faulting		✓		✓	✓	
Flushing	✓				✓	MTO Manual for Condition Rating
Joint Failure		✓		✓	✓	
Joint Sealant		✓		✓	✓	Can be picked up by imaging systems
Load Transfer Efficiency		✓		✓	✓	

Performance Measure	Flexible	Rigid	Granular Shoulder	✓ : Automated/ semi-automated monitoring Available	✓ : Manual Monitoring Available	Comments
Ponding	✓	✓	✓	✓	✓	Can be picked up by imaging systems
Potholing	✓			✓	✓	
Ravelling	✓			✓	✓	
Roughness	✓	✓		✓	✓	
Rutting	✓		✓	✓	✓	
Scaling		✓		✓	✓	identified by imaging systems Or using MTO Manual for Condition Rating
Shoulder Elevation			✓	✓	✓	Can be identified by profiler systems
Skid Resistance	✓	✓		✓	✓	
Spalling		✓		✓	✓	Can be identified by imaging systems Or using MTO Manual for Condition Rating
Stability			✓	✓	✓	
Structural adequacy	✓	✓		✓	✓	
Texture	✓	✓		✓	✓	
Wash Outs			✓		✓	using MTO Manual for Condition Rating

PERFORMANCE MONITORING

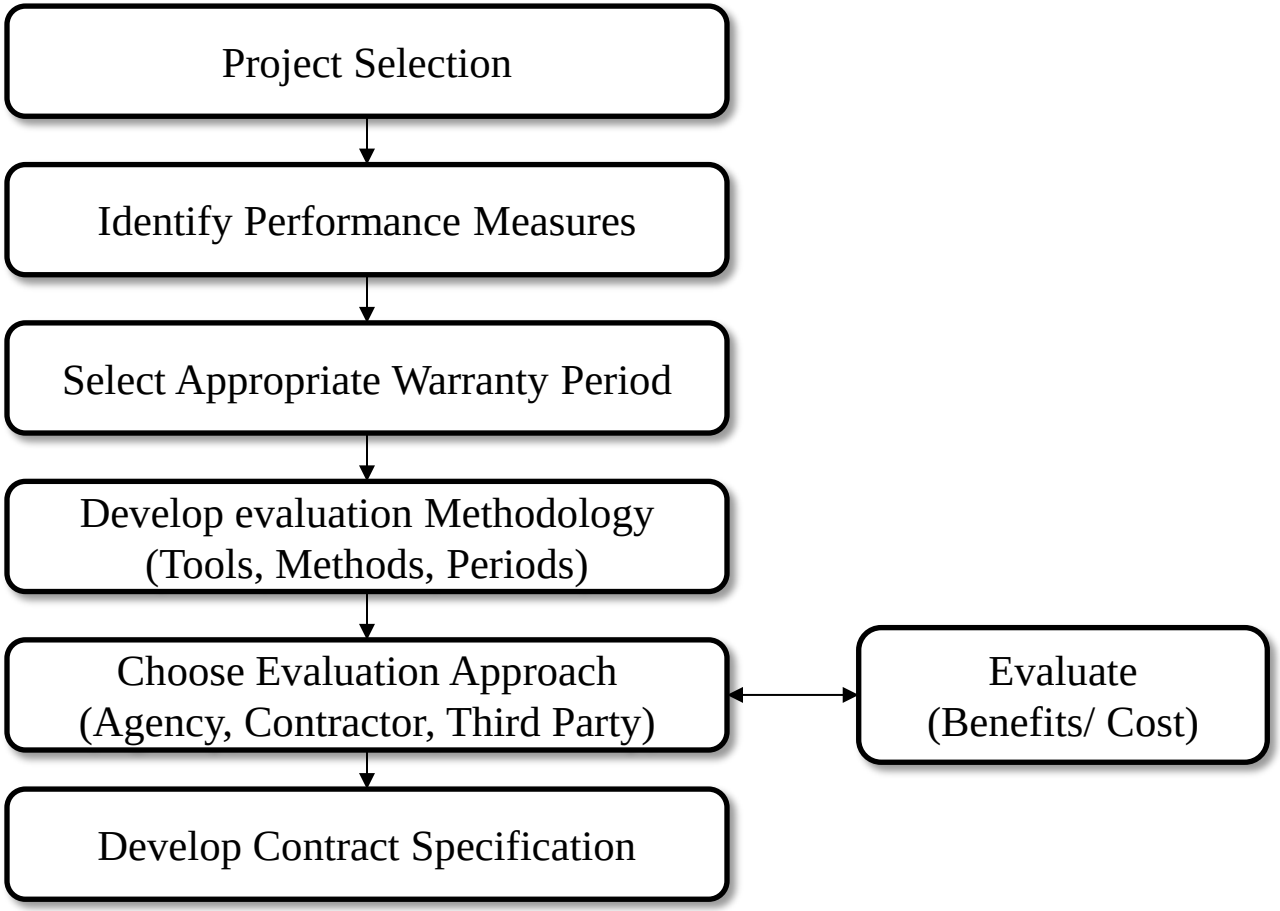
PERFORMANCE MONITORING

- Major factor in the success of performance contracting
- Data collection requires time, effort, money to collect, store, retrieve, and use
- A monitoring system should be carefully developed and implemented

MONITORING APPROACH

- Monitoring and evaluation of performance measures can be done by
  - **Agency monitoring**:
    - Responsible for monitoring periodically
    - Agency may use a random, unannounced inspection
  - **Contractor Monitoring**
    - Agency requires the contractor to present periodic reports (monthly, annually etc.) of performance
    - Agency assure performance monitoring by joining the contractor during data collection or scheduling random quality assurance evaluations
  - **Independent Third Party**
    - Added cost

MONITORING FRAMEWORK



ADVANTAGES TO PBCs

- Potential reduction in costs
- Improved level of service (could cost more)
- The transfer of risk to the contractor
- More innovation
- More integrated services
- Enhanced asset management
- Building a new industry
- Achieving economies of scale

CHALLENGES

- Lack of government support (legislative or executive branch)
- A significant change in culture (contracting agency and contractors)
- Adjustments to go from method to performance specifications
- Inadequate experience with PBC or a negative experience on the first try
- Lack of training
- Lack of legal authority

CHALLENGES

- Challenges in estimating in-house and contractor costs
- Insufficient contractor capacity
- Concern over loss of control over methods, equipment, and material used
- The need to secure substantial funds through the budgetary process for large, multiyear contracts

SUMMARY AND CONCLUSIONS

- Performance measures are fundamental to the successful usage of PBCs
- Agencies employ unique sets of performance measures;
  - Different project scale, warranty or contract period, and overall strategic goal of the agency
- There are common performance measures used by agencies;
  - Basis for developing recommended performance measures

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- Centre of Pavement and Transportation Technology CPATT

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