



9th International Conference on
MANAGING PAVEMENT ASSETS (ICMPA9)

Accelerated Testing and Instrumentation: A Canadian Case Study

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Outline of Presentation

- **Introduction**
- **Research Methodology**
- **Experimental Analysis**
- **Analysis of Results**
- **Findings and Impact**
- **Closing Thoughts**

Pavement Monitoring Site – Sippy Downs - East



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Introduction

- **1,000,000+ km ; \$200 Billion Investment**
- **Roads and Airfield Pavements**
- **Massive Investment: Requires Repair**
- **Dramatic Gap in Funding and Needs**
- **Vital to Economy, Quality of Life**
- **Many Factors Impact Performance**
- **Flexible, Rigid, Composite, Surface Treatments, Gravel** [TAC 2013]

Introduction

- **Climate Change Impacts on Infrastructure**
- **Sustainability Incorporated into Design, Construction, Maintenance, Management**
- **Multi Criteria Decision Making: Technical, Economic, Environmental, Social, Political**
- **Negative impacts to the population**
- **Balance Needs**

<https://www.youtube.com/channel/UCLbomPwqCgvwr3hPm4oeyfw>**Introduction**

Research Methodology

- **Experimental Design**
- **Demonstrating differences between materials**
- **Using innovative tools to measure Key Performance Indicators**
- **Calibrating design models**
- **Technical/economic/sustainable designs**
- **Moving laboratory to field**

Research Methodology

- **Several Partnerships Across Canada**
- **Factor Analysis:**
 - **Pavement Thickness**
 - **Traffic**
 - **Climatic Zone**
 - **Materials***
 - **Maintenance and Management Techniques**

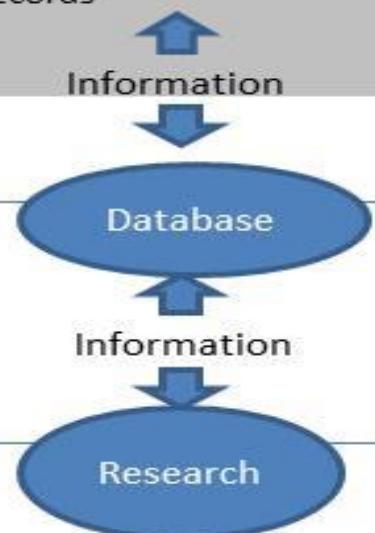
*** Emphasis on sustainable materials**

Research Methodology

Planning and Programming	Design	Construction	Maintenance, Preservation and Rehabilitation	In-Service Evaluation	End of Service Life
<ul style="list-style-type: none"> •Traffic and Environmental data •Assess network deficiencies •Budgets •Establish priorities •Schedule projects •Priorities 	<ul style="list-style-type: none"> •Information on materials, traffic, costs, environment, etc. •Design alternatives •Analysis •Optimization •Sustainability •User costs 	<ul style="list-style-type: none"> •Environment during construction •Specifications •Contracts •Schedules •Construction operations •Quality control/quality assurance •Records 	<ul style="list-style-type: none"> •Standards •Treatments •Schedules •Operations •Budget control •Records •Impact on performance •User costs 	<ul style="list-style-type: none"> •Periodic monitoring of structural adequacy, roughness, surface distress, and surface friction •Assess performance •Prioritize 	<ul style="list-style-type: none"> •Recycling and reuse of materials for reconstruction •Salvage Value •Records •Restoration •Zero Waste Management

“Working” Management

Loop



Research

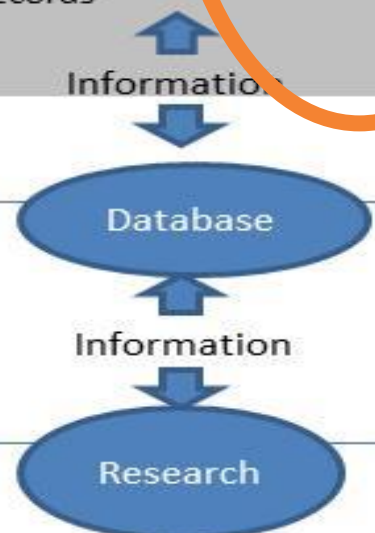
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Research

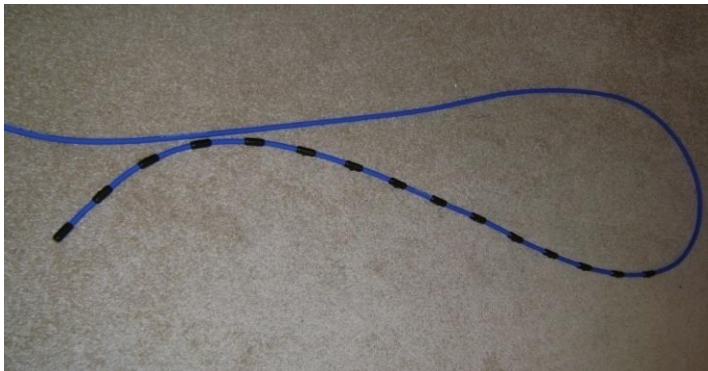
Loop

Experimental Analysis

- **Asphalt Mix Designs**
- **Asphalt Pavement Thickness**
- **Jointed Plain Concrete Pavement**
- **Pervious Concrete Pavement**
- **Concrete Overlay**
- **Structural Dome Pavements**

Experimental Analysis

- **Technical**
- **Economic**
- **Sustainable**
- **Costs/Benefits**



Analysis of Results : Asphalt

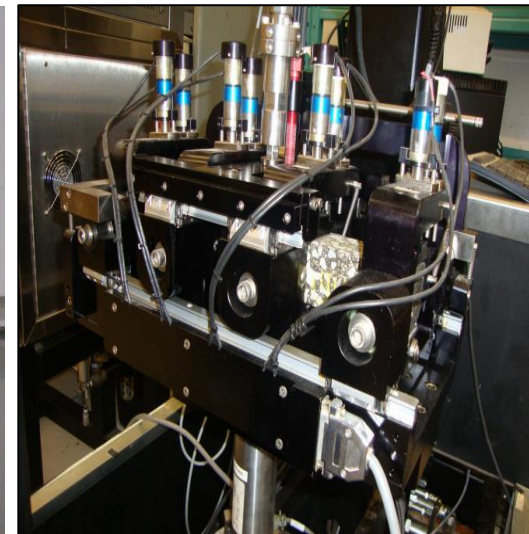
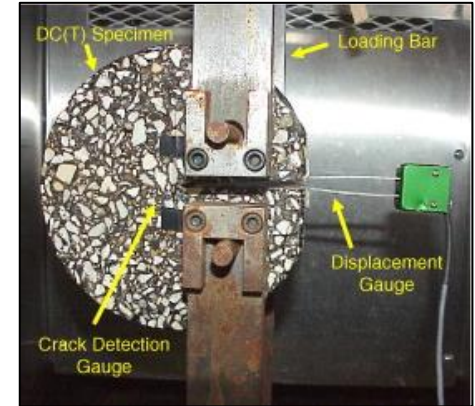
- **Asphalt Mix Designs**
- **Asphalt Pavement Thickness**
- **Warm Mix**
- **Recycled Asphalt Pavement Performance**
- **Recycled Crumb Rubber**



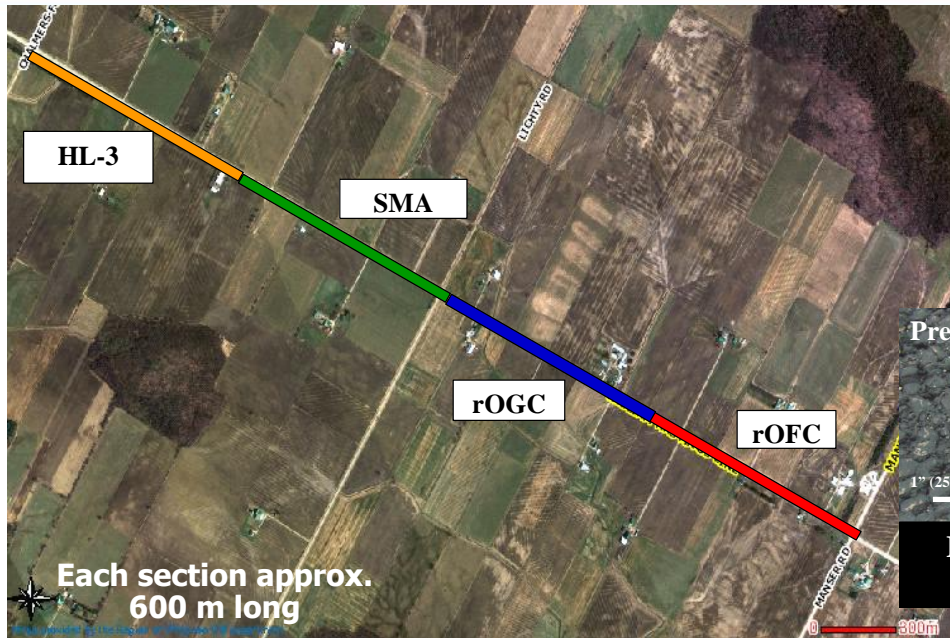
- 
- A close-up photograph showing a person's hand, wearing a blue jacket and a metal watch, holding a yellow vertical rod. The hand is positioned between two cylindrical samples of asphalt concrete, which are resting on a sandy surface. The asphalt samples are dark and contain numerous light-colored aggregate particles. The background is a blurred outdoor setting with green grass and a fence.
- Quality Control
 - Geogrid Design
 - Structural Analyses
 - Laboratory Tests
 - Field Tests
 - Quality Assurance

Engineering Analysis

Analysis of Results : Asphalt



Analysis of Results : Asphalt



**First truly controlled study
Integrated CPX and PBM**

Leung et al

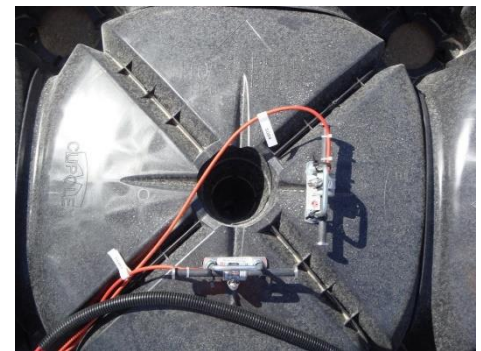
Analysis of Results : Asphalt

- **Cost-Effective Usage of Innovative Materials**
- **Recycled Asphalt Shingles,
Recycled Asphalt Pavement
Recycled Crumb Rubber**
- **Pavement Thickness**
- **Strategic Design**



Analysis of Results : Concrete

- **Jointed Plain Concrete Pavement**
- **Pervious Concrete Pavement**
- **Fast Track Concrete Repairs**
- **Concrete Overlay**
- **Structural Dome Pavements**



Analysis of Results : Concrete



Analysis of Results : Concrete



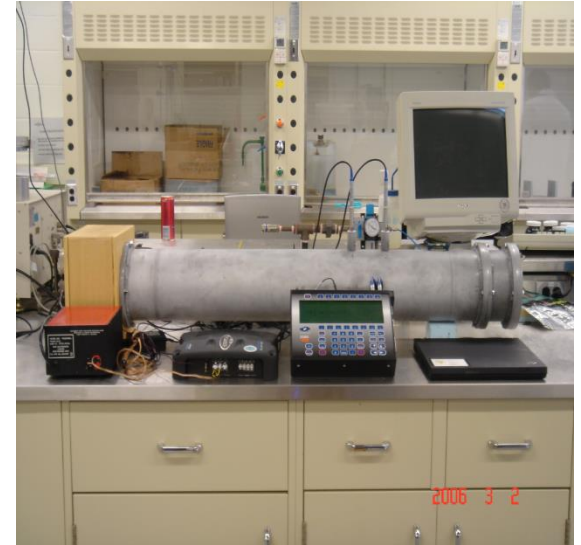
Analysis of Results : Concrete

- **Cost-Effective Usage of Innovative Materials**
- **Fast Track Repairs**
- **Concrete Overlays**
- **Structural Dome Designs**
- **Pervious Concrete**

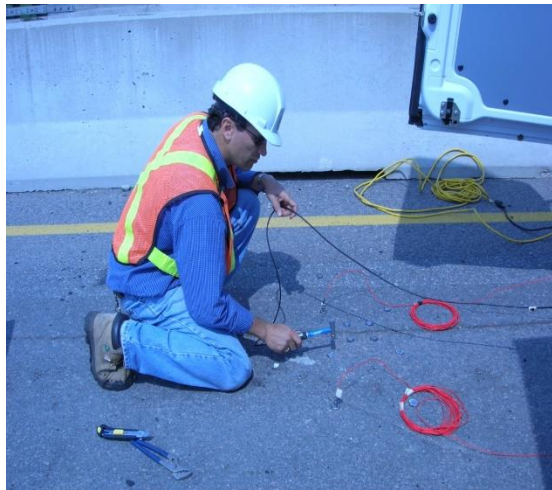


Analysis of Results : Performance

- **Impact of Maintenance Treatments**
- **Noise Measurements**
- **Evaluation of Distress**
- **Safety Analysis**
- **Development of New Measures**



Analysis of Results : Performance



Analysis of Results : Performance



Analysis of Results : Performance

- Climate



→ Dry

→ Mediterranean

→ Humid

- Hierarchy

Hierarchy	Functional Classification	Traffic	Structure
1	Express	Different traffic volume and equivalent axles ranges defined	Different structural strengths (MPa) to be defined (Structure and subgrade)
2	Troncal		
3	Colector		
4	Service		
5	Local		

Available data and field evaluation



Analysis of Results : Performance



PONTIFICIA
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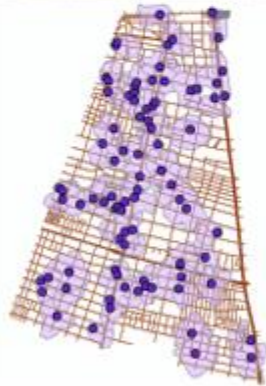
Pavimentos Urbanos
Pontificia Universidad Católica de Chile
Escuela de Ingeniería

Encuétranos también en:



ANTECEDENTES

INFORMAR DAÑOS



FONDEF
Fondo de Fomento al Desarrollo
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PROYECTO FONDEF
D0911018

INVESTIGACIÓN Y DESARROLLO DE
SOLUCIONES PARA LA GESTIÓN DE
PAVIMENTOS URBANOS EN CHILE

Sistema de Gestión de Pavimentos Urbanos que integra metodologías técnico-económicas y un sistema de información geográfica que incorpora variables espaciales en toma de decisiones de conservación de redes viales urbanas.

Ingreso al Sistema SGPU

Usuario

Clave

ENTRAR

Findings and Impact

- **Use Lab or Software Tools to examine mix designs and pavement designs**
- **Tools for Long Term Management**
- **Provide a design and management guides, specifications**
- **Technology Transfer**



Findings and Impact



- **Making information available in a variety of formats**
- **Working with stakeholders**
- **Promoting Best Practices**

Closing Thoughts

- **Strategic Partnering**
- **Opportunity to Highlight Canadian Expertise**
- **Provides National and International Business Opportunities**
- **Impact on Research and Education of Future Leaders**

Acknowledgements

- **Norman McLeod Chair**
- **CPATT Partners, Faculty, Students, Staff**
- **Transportation Association of Canada:
Pavement Asset Design and Management
Guide**
- **Queensland Pavement Centre**



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