



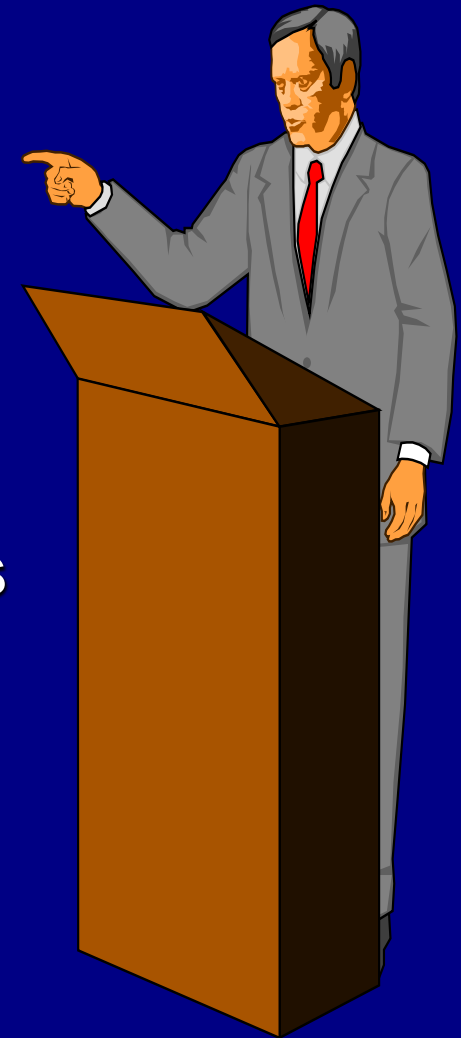
**2017 NWPMA Conference
Vancouver, Washington
October 16 – 19th, 2017**

*The Old, the New and the Missing in
Pavement Asset Management*

Ralph Haas,
University of Waterloo

PRESENTATION

- ◆ **Update on ICMPA's**
- ◆ **Example milestones up to current PMS practice**
- ◆ **New technologies and advancements that should be on our radar**
- ◆ **Moving forward**



EVOLUTION & LEGACY OF TEN ICMPA'S

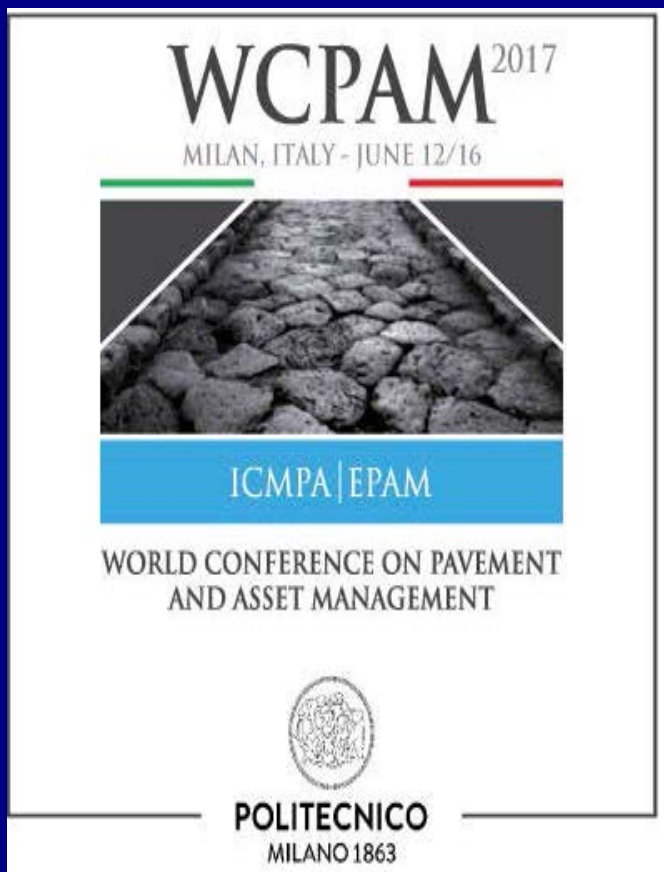
Conference chair
Maurizio Crispino
Politecnico di Milano
(Italy)



Vice Chair
Luis de Picado Santos



Vice Chair
Gerardo Flintsch



- 1985 Toronto
- 1987 Toronto
- 1994 San Antonio
- 1998 Durban
- 2001 Seattle
- 2004 Brisbane
- 2008 Calgary
- 2009 Santiago
- 2015 Washington
- 2017 Milan

ACCOMPLISHMENTS and LEGACY

1985	Toronto
1987	Toronto
1994	San Antonio
1998	Durban
2001	Seattle
2004	Brisbane
2008	Calgary
2011	Santiago
2015	Washington
2017	Milan

- ◆ Unparalleled, record of achievements, advances and implementation of PMS's
- ◆ Clear verification of PMS return on investment
- ◆ Education and training of many, many people
- ◆ Buy in of PMS world wide
- ◆ A legacy for the future of Pavement Asset Management

THANKS TO WCPAM 2017 AND THE INTERNATIONAL PAVEMENT COMMUNITY



Farewell
AU REVOIR
BUONO SERA
Auf Wiedersehn
Adios

EXAMPLE MILESTONES

- ◆ **1960'S First concepts and framework of PMS (project level)**
 - ◆ **1970's Extension to network level; enhanced framework; first two books and national workshops (States and Feds)**
- * TRB forms Pavement Management Committee in 1978**

PIONEER BASIS FOR PMS

ANNOUNCING



Price: \$2.50
(\$1.50 to members)

*the publication of a new reference book
by the Canadian Good Roads Association*

(1965)

A GUIDE TO THE STRUCTURAL DESIGN OF FLEXIBLE AND RIGID PAVEMENTS IN CANADA

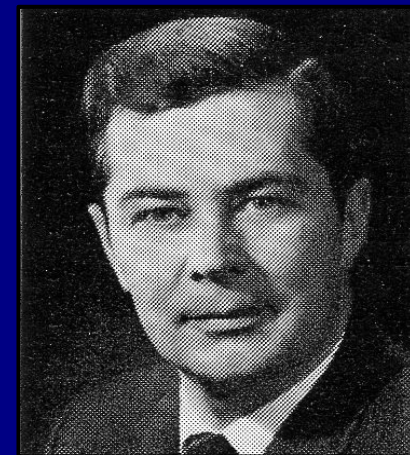
The Guide outlines the numerous variables involved in the complex problem of the structural design of flexible and rigid pavements in Canada. The methods suggested are based on field evidence, construction practices and practical considerations rather than on theoretical hypothesis and laboratory tests.

The Guide was prepared by the Pavement Design and Evaluation Committee of the Canadian Good Roads Association based on a study of highway pavements in Canada. This study was unique in that it was based on the evaluation of the design, construction and performance of thousands of miles of primary highway.

Designed to assist road engineers, the Guide presents interim recommendations based on results currently available from its investigations and on supplementary data. It is hoped that it will be of particular value as a practical introduction to pavement design for junior engineers in highway departments and engineers in counties, rural municipalities and consultants' offices.

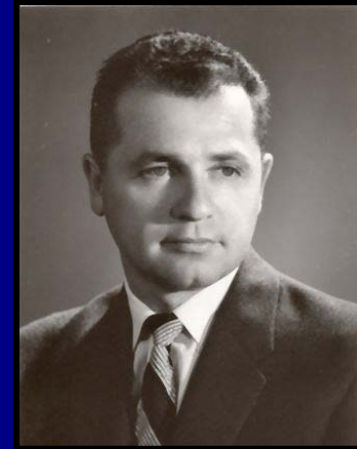
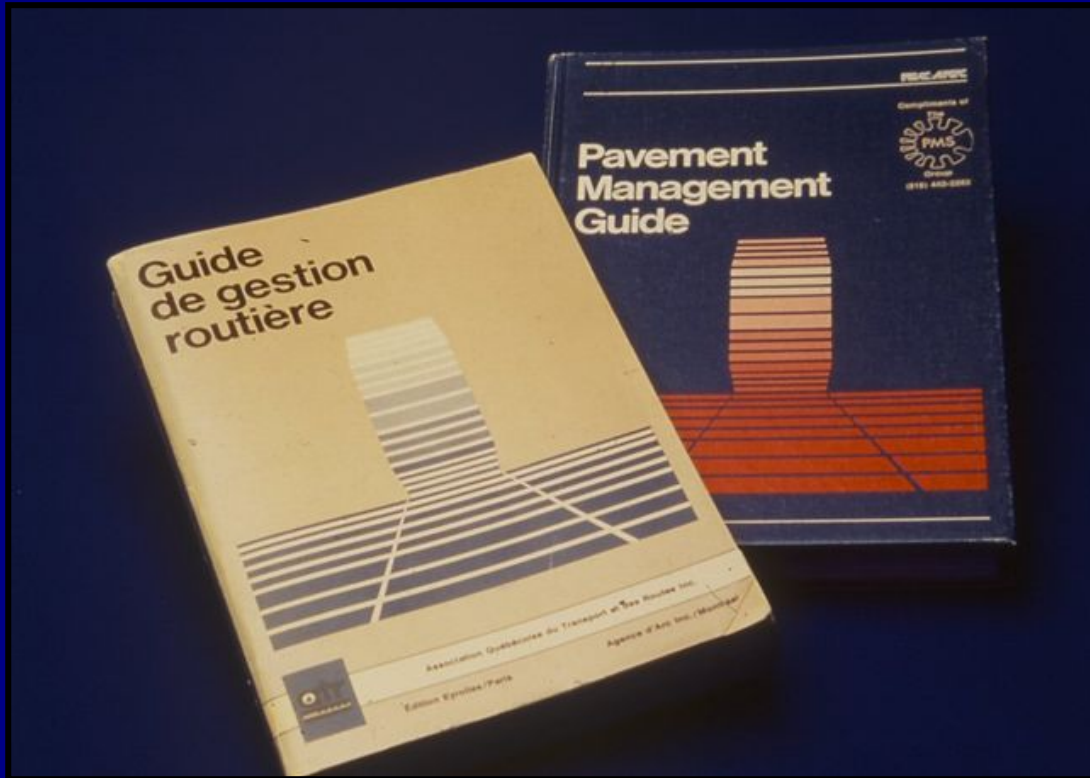


**Bert Wilkins (Chair)
B.C. Highways**

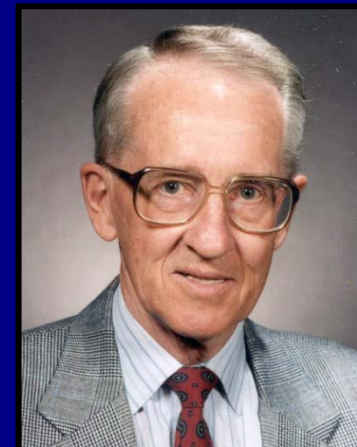


**Gordon Campbell
(Secretary) CGRA**

1977 FIRST GUIDE



**G. Robert Tessier (Chair)
Ministère des Transports
Du Québec**



**Ralph Haas, Secretary
And Editor**

1978 FIRST TEXTBOOK



1978 Textbook
(Haas and Hudson)



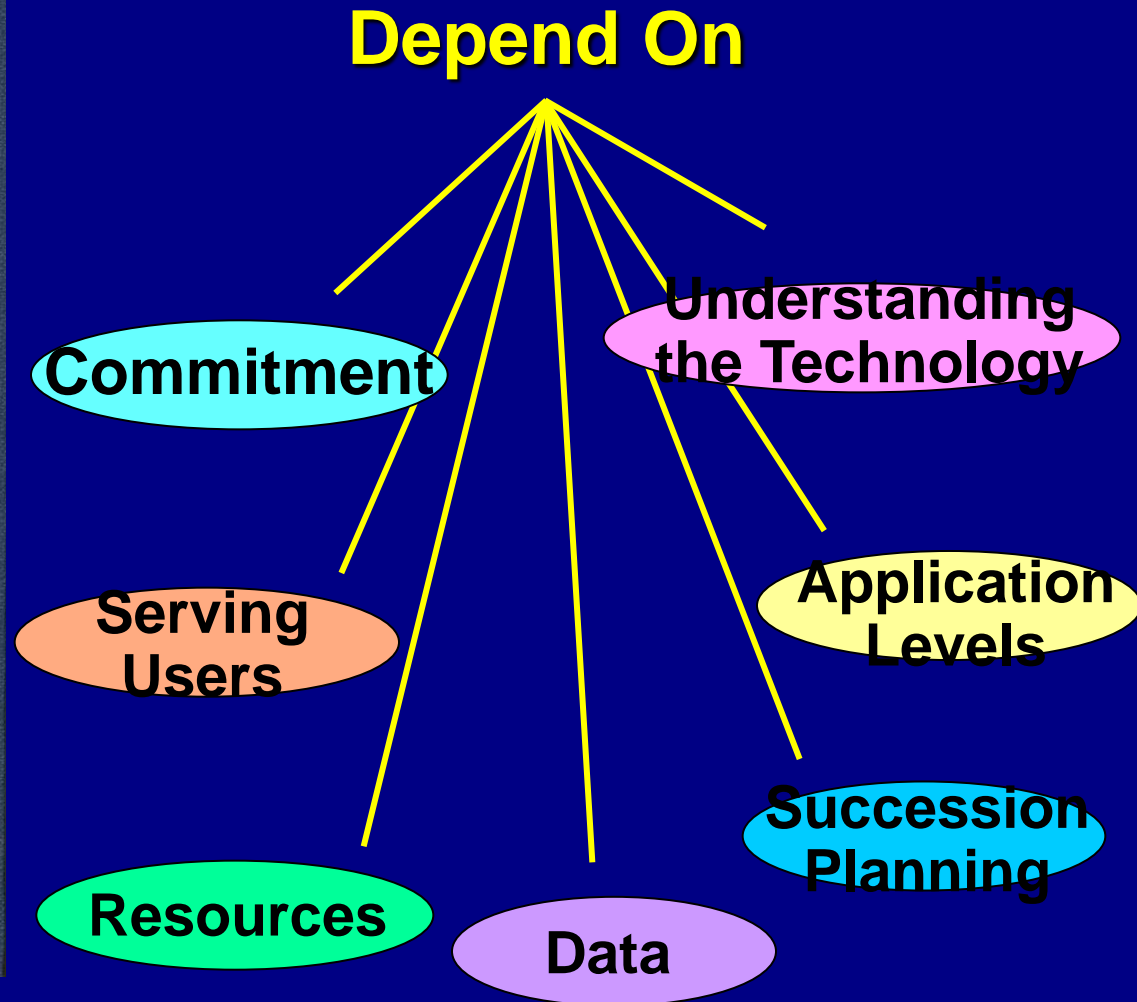
EXAMPLE MILESTONES (cont.)

- ◆ **1980's update of PMS concept, framework and practices nationally and internationally. First Int. Conference**
- ◆ **1990's continued advancement in technologies and practices. Two more Int. Conf. (San Antonio and Durban)**
- ◆ **Two more major books (1994 & 1997)**

1994

PAVEMENT MANAGEMENT SUCCESSES ?

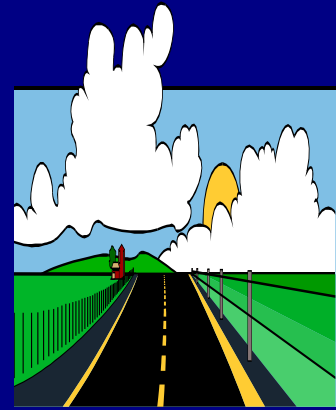
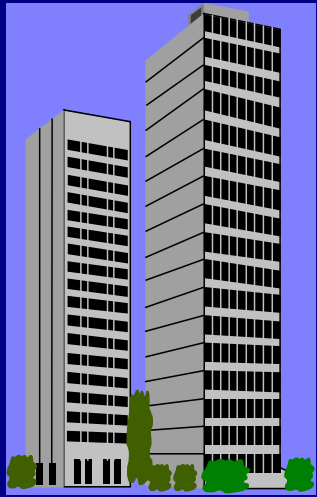
**Modern
Pavement
Management**



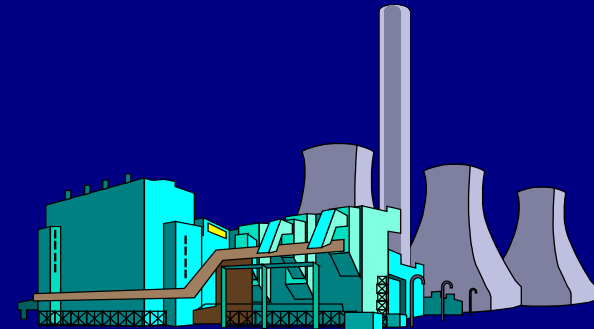
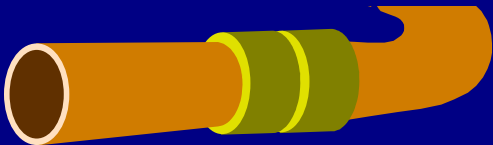
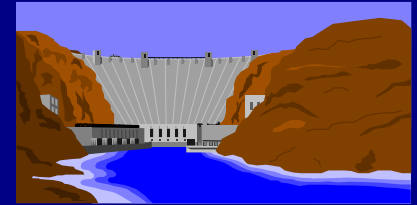
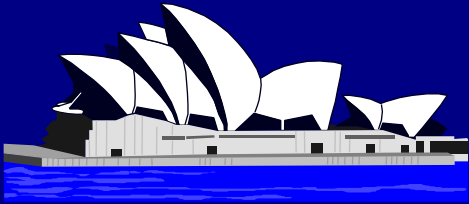
EXAMPLE MILESTONES (cont.)

- ◆ **2000's Numerous advancements and innovations:**
 - **Life cycle levels asset management**
 - **Users and Agency Costs in Life Cycle Analysis**
 - **Driving forces for Innovations**
 - **Sustainability in life cycle management**
 - **Pavement Management Roadmap (2010)**

LIFE CYCLE LEVELS OF ASSET MANAGEMENT

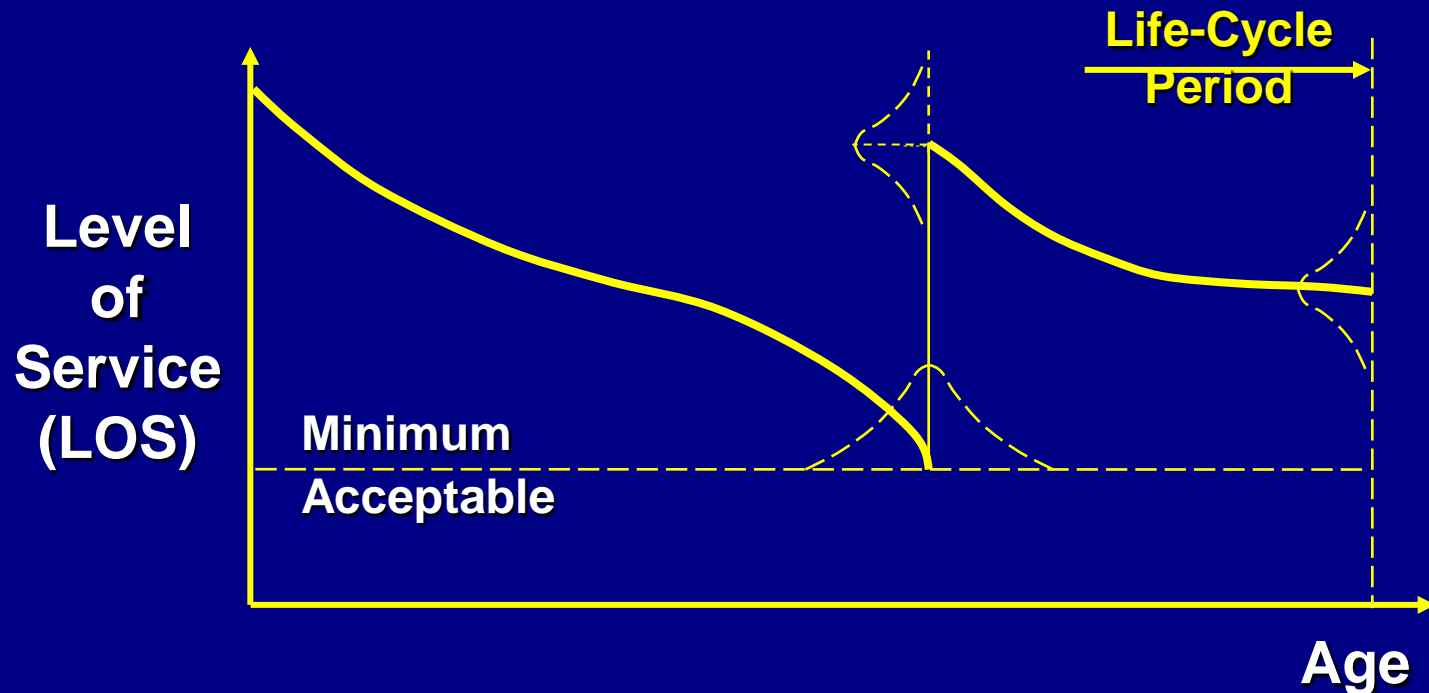


- ◆ Strategic level
- ◆ Network / system wide level
- ◆ Project / site specific level

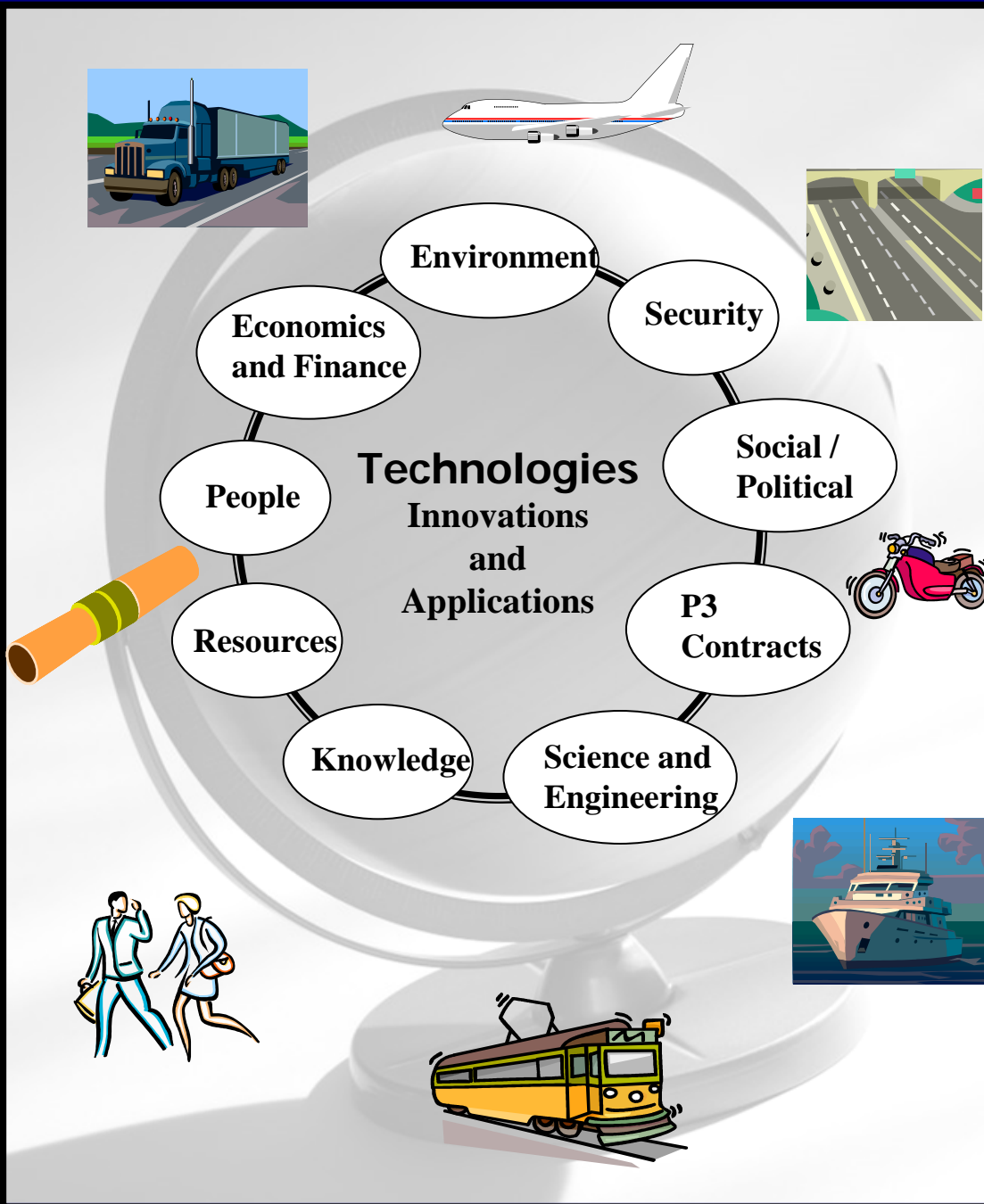


LIFE CYCLE ANALYSIS

Require: LOS vs Age (Performance) Model
Cost / Cash Flow Calculation (eg. PW)
Asset Value vs Age Calculation
Risk Analysis



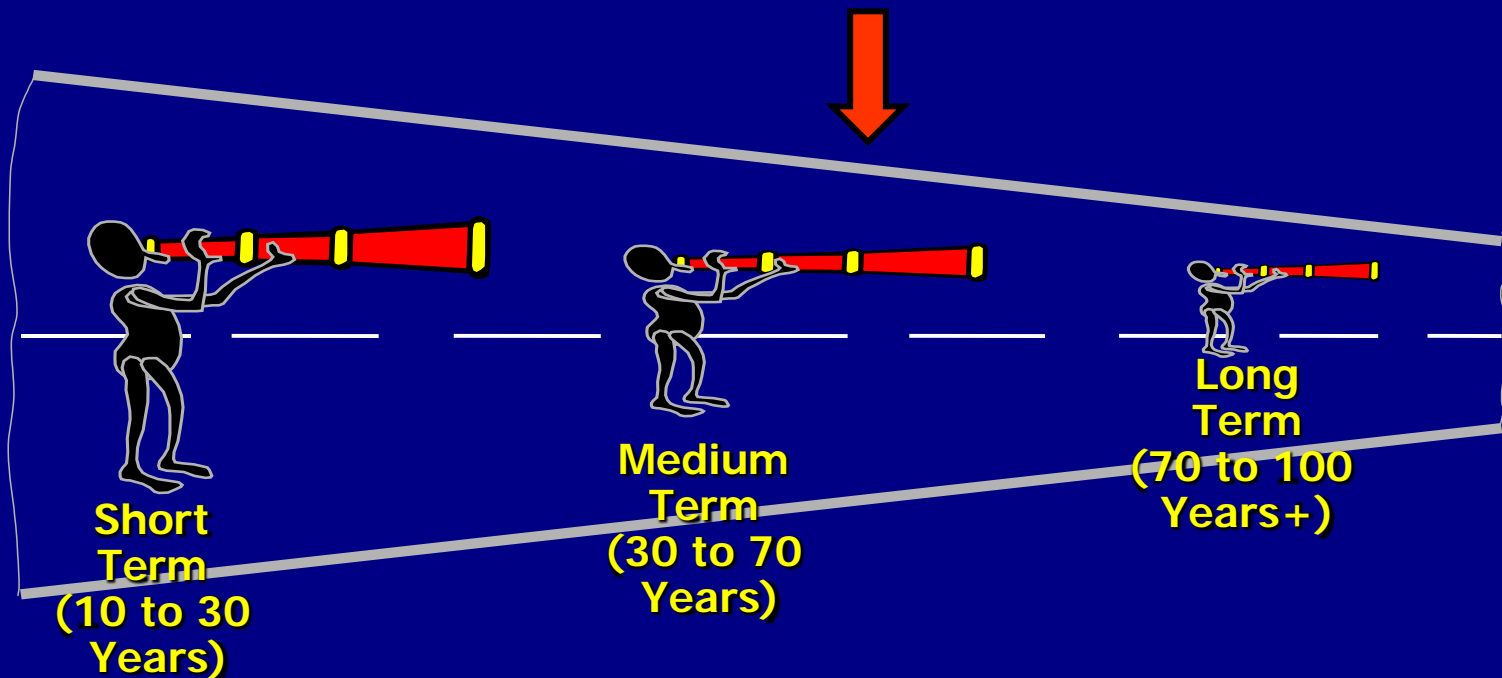
DRIVING FORCES FOR INNOVATION IN TRANSPORTATION INFRASTRUCTURE TECHNOLOGIES

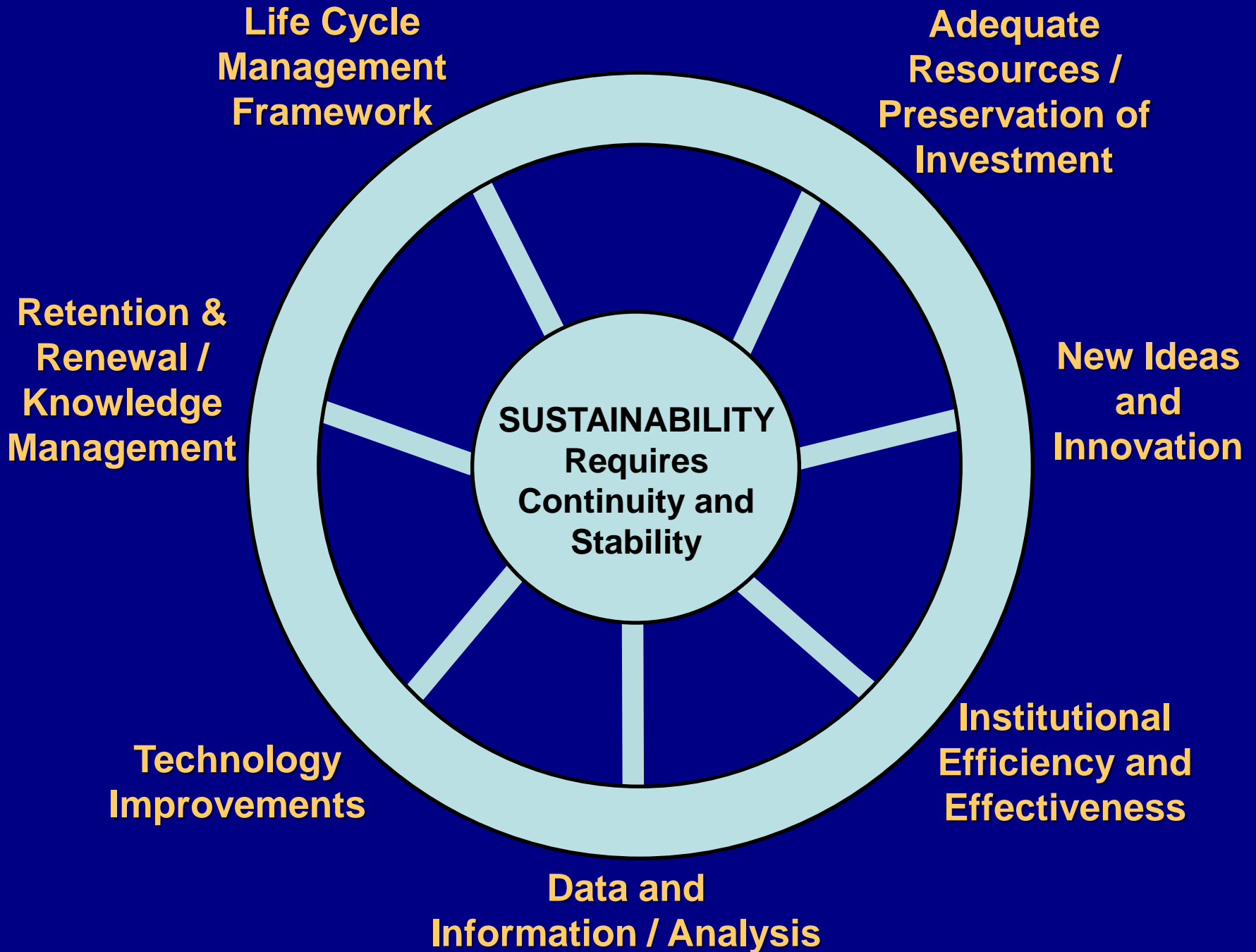


What is Sustainable Transportation

..... A balance between transportation's economic and social benefits vs. the need to protect the environment

Simply put - **Do things today that ensure the Future**





Development of a Pavement Management Roadmap



Sponsored by the Federal Highway Administration
US Department of Transportation

Prepared By [Applied Pavement Technology, Inc.](#)

115 W. Main St., Suite 400

Urbana, IL 61801

In Cooperation With [Science Applications International Corporation](#)

1710 SAIC Drive, MS T1-12-3

McLean, Virginia 22102

March 5, 2010

Contract: DTFH61-07-D-00028

LOOKING FORWARD

◆ 2010

- **Some big issues**
- **Future of PMS**
- **Impact of new technologies**
- **Challenges to adapt and improve**

**Meeting the Needs of Today
and the Challenges of Tomorrow**

07

**NATIONAL PAVEMENT
MANAGEMENT CONFERENCE**

MAY 6-9, 2007

SHERATON NORFOLK WATERSIDE HOTEL, NORFOLK, VA

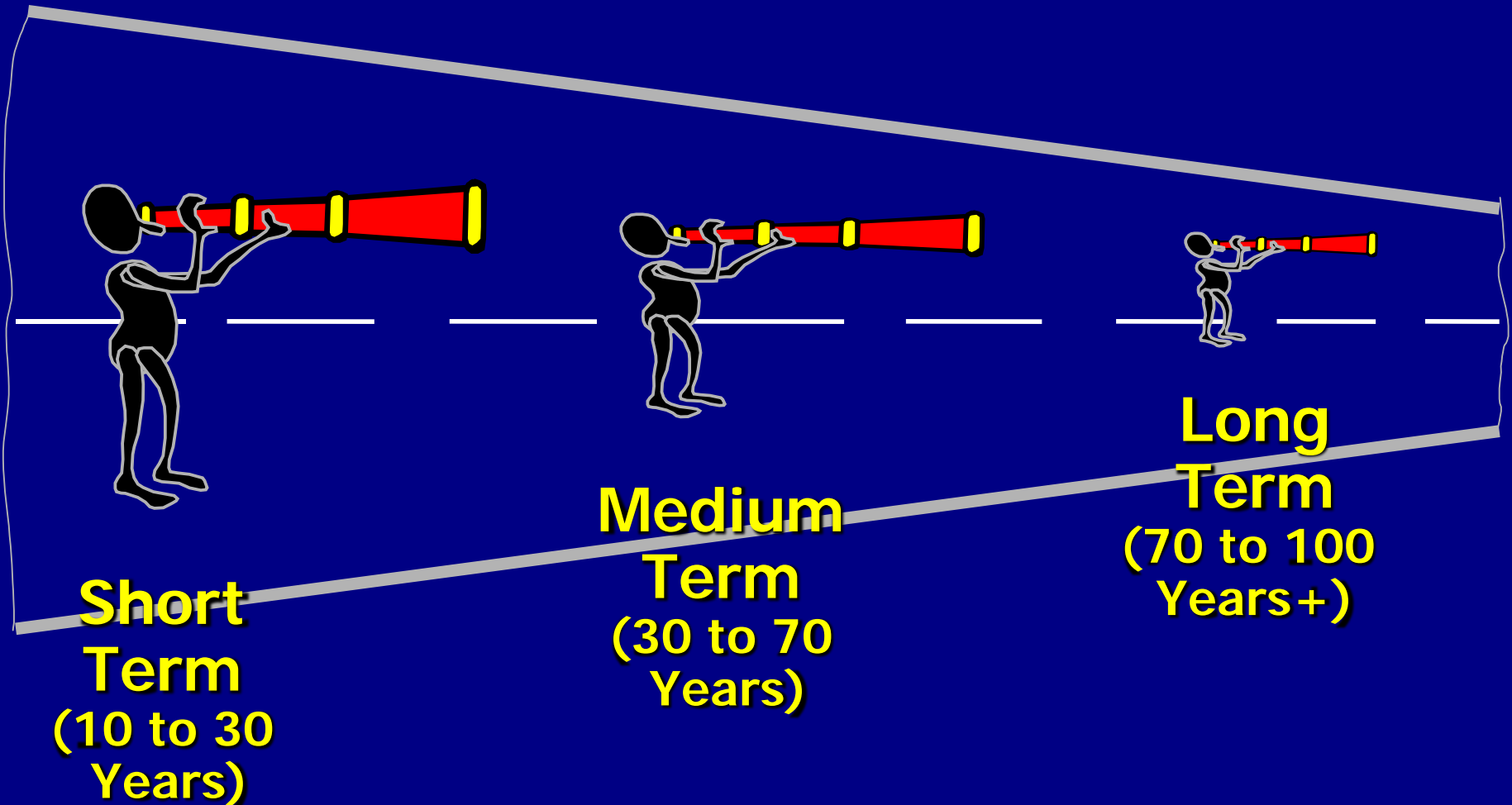
Join fellow pavement management professionals, administrators, agencies, engineers, and educators in this conference designed to encourage proactive and coordinated efforts in effective pavement management. For information and to register, visit www.cpe.vt.edu/pavementmanagement07/

If you have questions, please call 540-231-5182

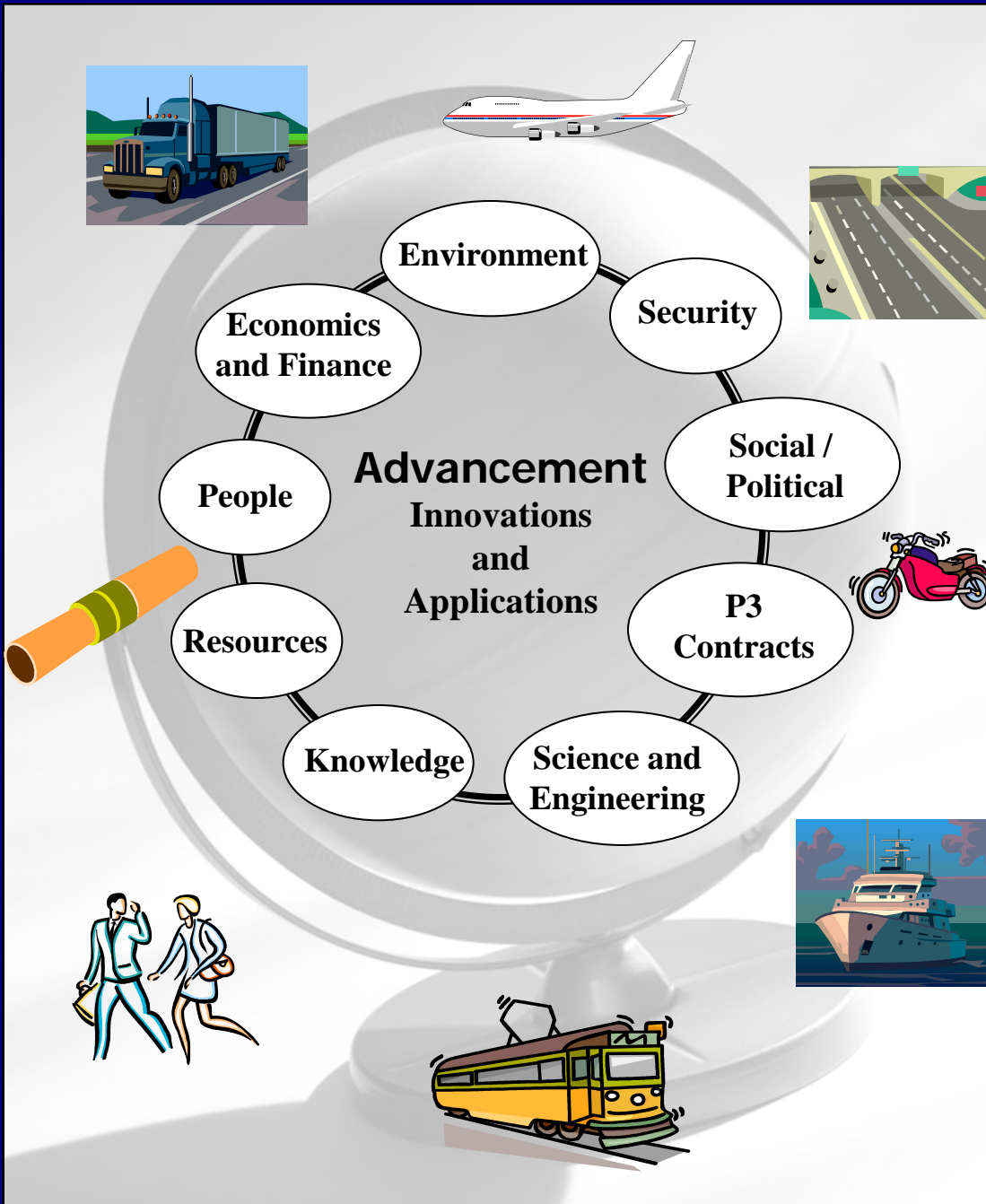
**REGISTER
ON-LINE!**

THAT WAS 10 YEARS AGO!! TODAY??

TIME HORIZON FOR THE FUTURE



DRIVING FORCES BEHIND THE FUTURE OF PAVEMENT MANAGEMENT SYSTEMS





WHAT'S MISSING

FUTURE OF PAVEMENT MANAGEMENT

- Include intangible assets in life cycle analysis
- Adapting to autonomous vehicles (maint., design, constr., pvt. perf., geometrics, etc.)



WHAT'S MISSING

FUTURE OF PAVEMENT MANAGEMENT

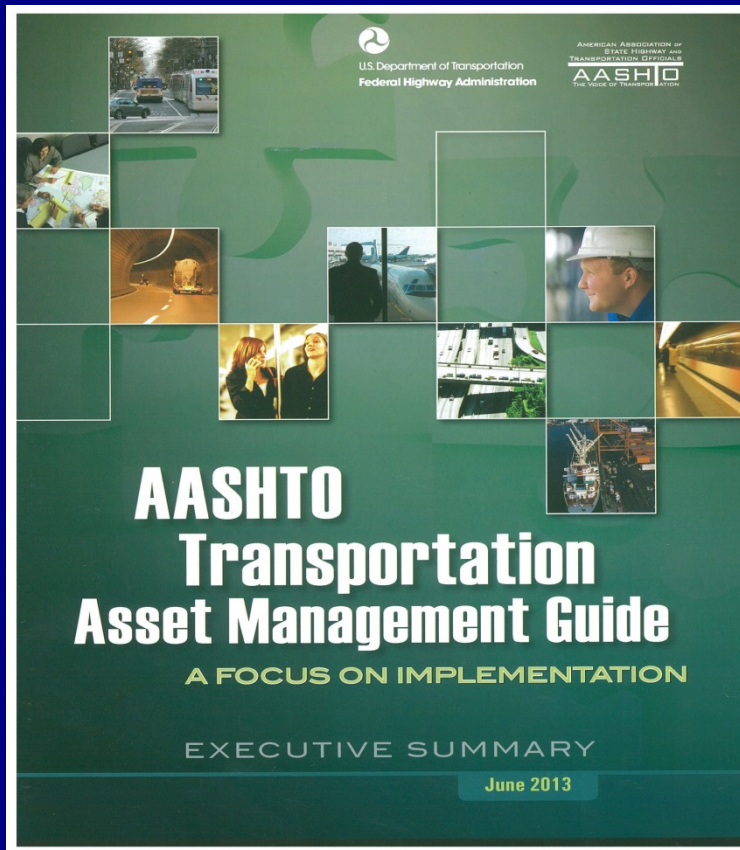
- Comprehensive succession planning commitment
- Adapting to “smart” pavements (sensors, maint. needs, self healing, power generation, etc.)



WHAT'S MISSING

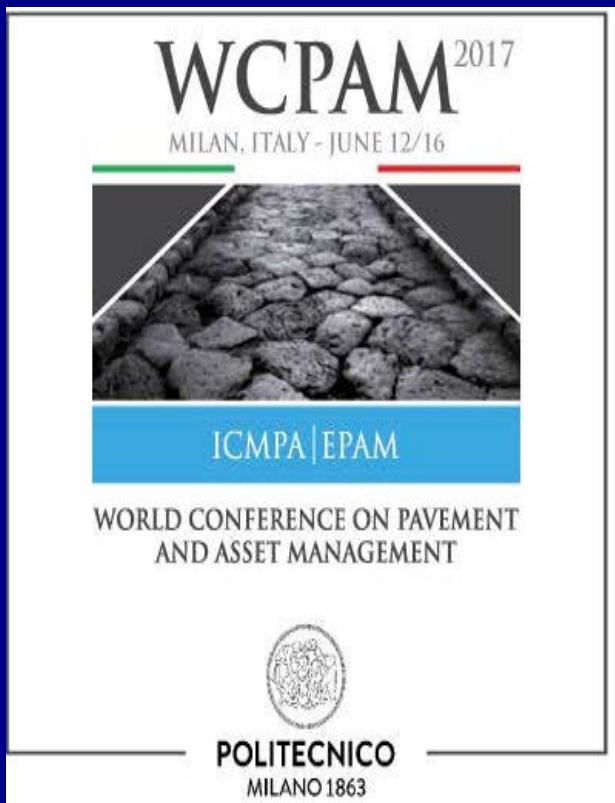
FUTURE OF PAVEMENT MANAGEMENT

- Adapting maint. constr., condition surveys, etc. to drones and UAV's
- Adapting fully automated/robotic maint. and constr.

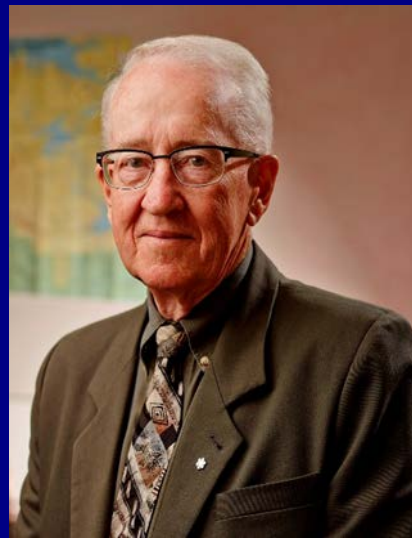


**TAM considers
“physical
facilities” (eg.,
tangible assets)
BUT
There are also
Intangible
Assets, with
Value**

- Knowledge (People, Intellectual Property, Data and Information, Specifications, Manuals, Software.....)
- Level of Safety?? Knowledge?? Environmental Stewardship?? Innovations?? Etc.



Incorporating Safety, Knowledge, Innovations, Resource Conservation, and Environmental Stewardship as Quantifiable Assets in Pavement Management



Ralph Haas



Ronald Hudson



Lynne Cowe Falls



Safety:

A

**Monetary
Value**

Asset?



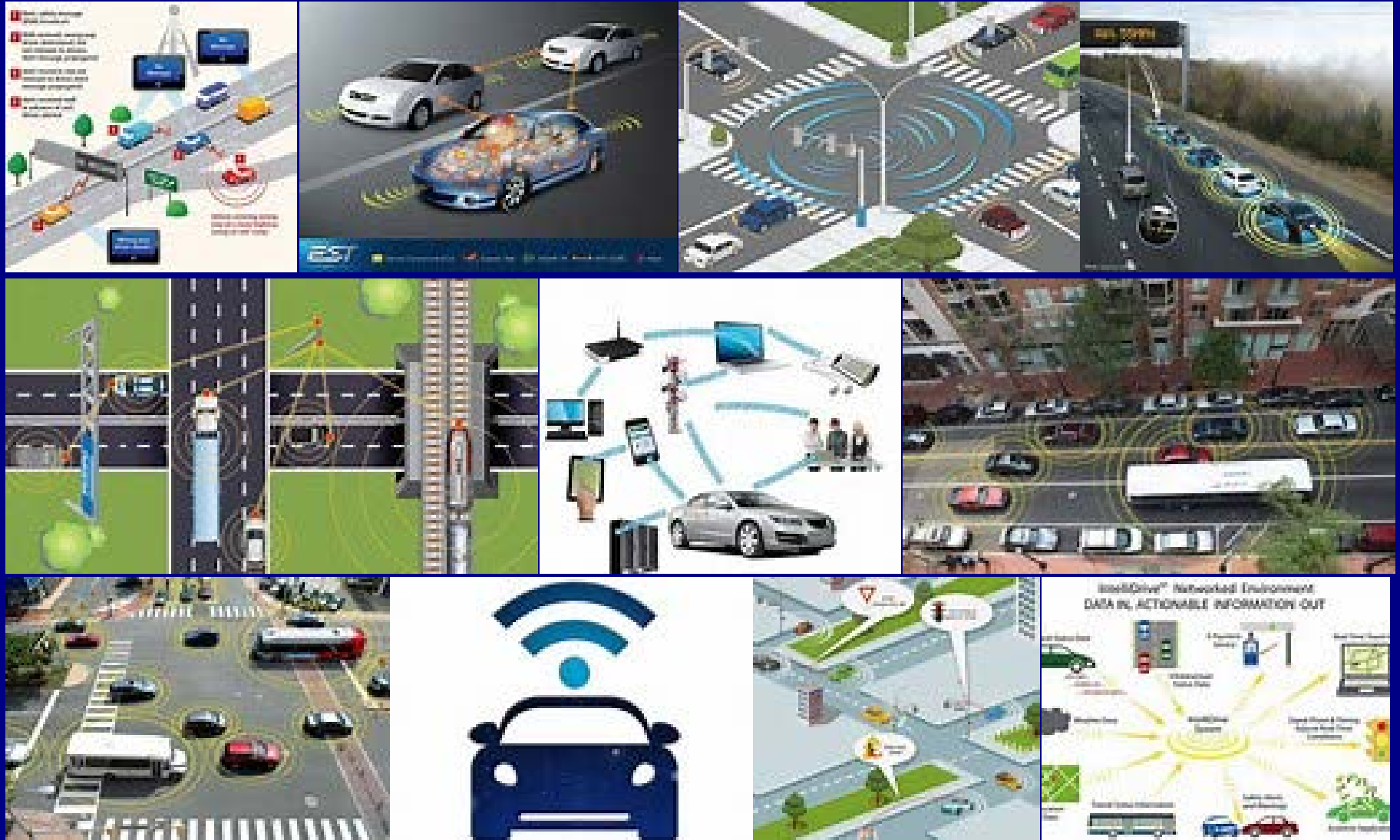
VALUE OF KNOWLEDGE ASSETS

(Tomblin and Maheshwari; Delhi

Business Review, 2004

“If knowledge..... as an asset.....The need to assign a definite value.....important implications for financial reporting and managerial decision making”

THE WORLD OF CONNECTED VEHICLES



Tomorrow ?

Autonomous/Connected
Vehicles Inc.



FOCUS of the CONNECTED/AUTONOMOUS WORLD

- Almost overwhelmingly, the focus has been on technologies and associated wireless, communications, control systems and sensors infrastructure.
- Environmental, safety, economic, legal and operations considerations also comprise much of the focus.
- Still another focus area is actual full-scale testing and implementation, and much of this has been reported. In fact these are major full-scale working implementations already in place on the mining and resource extraction areas.

So What is the Issue re Adapting Pavement Asset Management?

- Accessing web sites and other information sources you can find the U.S. DOT's "Connected Vehicles 101", the SAE's "Connected Vehicle Professional (CVP) Credentialing Program" and much more from ITS, AASHTO, FHWA, Provincial and State Transportation Departments, PIARC and others.
- *But going through this vast sea of information, technologies, etc. you can find very little for the highway engineers and technologists who actually have to plan, design, build, maintain and operate facilities on behalf of their agencies and the public. So the issue is how and where do we adapt, and for the Colleges and Universities what changes in the curricula might be needed.*

ADAPTING??



- Maintenance and rehabilitation
- Vehicles (mixed?)
- Accidents
- Dodging the potholes?

CHAOS??



IMPACTING FACTORS:

- ◆ Delays and value(s) of time
- ◆ Traffic volume
- ◆ Types and percent of vehicles
- ◆ Speeds
- ◆ Road capacity
- ◆ Traffic control plan
- ◆ Length of work zone
- ◆ Geometric characteristics

ROAD CONSTRUCTION AND MAINTENANCE



USE OF
DRONES
AND UAV'S?

ROAD CONSTRUCTION AND MAINTENANCE

ARE THE DRONES AND UAV'S TAKING OVER?



December
2016

The State of the Practice of UAS Systems in Transportation



Charles D. Baker, Governor
Karyn E. Polito, Lieutenant Governor
Stephanie Pollack, MassDOT Secretary & CEO



Applications in Transportation

- Asset management
- Construction monitoring
- Infrastructure inspection
- Disaster response
- Safety
- Surveillance
- Traffic operations



WHAT'S MISSING

FUTURE OF PAVEMENT MANAGEMENT

The possibilities are endless with smarter pavements



By James Careless

Smart pavement is an exciting concept that could revolutionize the building, usage and funding of asphalt roads everywhere.

To be specific, smart pavement refers to roadways that have been specifically engineered and built to support a wide range of 21st century IT-enabled features; making them "smart" in the process.



WHAT'S MISSING

FUTURE OF PAVEMENT MANAGEMENT ADAPTING TO SMART PAVEMENTS

- Embedded sensors for constant monitoring of condition
- WiFi transmitters in roadbed for commercial broadband
- Power source for charging electric vehicles
- Supporting informed decisions for maint. and rehab.
- Evidence based information on materials performance

.....and the list goes on.....



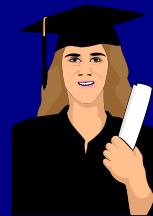
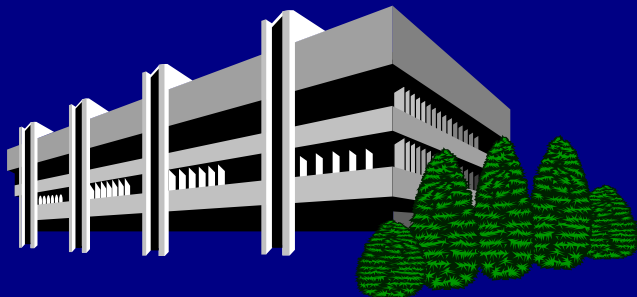
WHAT'S MISSING

FUTURE OF PAVEMENT MANAGEMENT

CHALLENGE OF SUCCESSION PLANNING

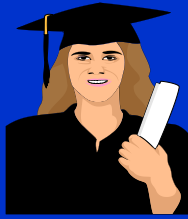
**(What Is It ? Why Do It ? Guidelines ?
Obstacles ? Opportunities ?
Future Prospects ?)**

EDUCATION



WORKING WORLD





"SURPLUSSED" / RETIRED / DOWNSIZED

WHAT'S THE COST ?

◆ training investment loss	\$ \$ \$
	\$ \$
◆ original recruitment cost	\$ \$ \$ \$
◆ experience loss	\$ \$
◆ cost of inefficiencies	\$ \$ \$
◆ cost of re-recruitment and	
Total	\$ \$ \$ \$ \$

REASONS FOR SUCCESSION PLANNING

1. It is cost-effective
2. It contributes to organizational stability
3. It is good public relations
4. It reassures the “marketplace”
5. It preserves a big investment
6. IT IS JUST GOOD BUSINESS !!

FUTURE PROSPECTS FOR SUCCESSION PLANNING AS A PART OF PAVEMENT ASSET MANAGEMENT

Business as usual ?

or

**Meeting the challenge
of creating a "culture"
of succession planning
in the public and private
Sectors.**

CONCLUSIONS

Many old and new advancements characterize current practice in pavement management

BUT

Adaptions will be needed for continued automation, intangible assets in life cycle analysis, world of autonomous vehicles, smart pavements, new technologies and innovations.....and more.



**2017 NWPMA Conference
Vancouver, Washington
October 16 – 19th, 2017**

*A Closing Congratulation on 25 Years of
Great Conferences*

KEEP UP THE GOOD WORK!!

Ralph Haas,
University of Waterloo



Dr. Ralph Haas is the Norman W. McLeod Engineering Professor and Distinguished Professor Emeritus at the University of Waterloo. The author or co-author of 15 books and 500 technical papers in pavement and infrastructure management. He is past Chair of the Pavement Management Committees of both TAC and TRB, a Founder and Board Member of the TAC Foundation, a Fellow of the Royal Society of Canada, the Canadian Academy of Engineering, the Engineering Institute of Canada, ASCE and CSCE. He is a Member of the Order of Canada, recipient of TRB's Roy W. Crum Award in 2014 for Outstanding Achievement in Transportation Research, named a Distinguished Alumnus of the University of Alberta and in 2014 the University of Waterloo officially named "The Ralph Haas Infrastructure and Sensing Analysis Laboratory" in his honour.