International Transport Forum | Joint Transport Research Centre | OECD

Long Life Surfaces for Busy Roads

TRA2008 WORKSHOP

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The generalised business case for very long-life surface pavements on roads with heavy traffic

by

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Context and background

- National road networks are amongst largest community assets
  - predominately government-owned in most countries
- Road administrations are increasingly adopting life cycle / asset management approaches
- Long service life of road pavements on high traffic roads has long been a key goal for road professionals
- Surface layer or wearing course is the Achilles' heel of the long life pavement concept
- Trends in traffic growth leading to increasing proportions of highly trafficked roads - which become candidates for more durable pavements at higher construction costs

Long Life Pavements – Phase I : Economic Evaluation Findings

- LLP Phase 1 Report was published by OECD in 2005
- Economic analysis in Phase I study explored potential economic benefits of long life wearing courses able to meet performance requirements over 30-40 years
- Findings: long-life surfacing costing around three times that of traditional wearing courses would be economically feasible for a range of high-traffic roads
- Emphasises importance of taking user costs into account

Structure of the analysis

- Surveying traditional pavements for high-traffic roads
  - Initial costs
  - Expected life
  - Maintenance strategies
  - Maintenance costs
  - Closure duration for maintenance activities
- Exploring potential advanced materials in international workshop with industry participation
- Establishing suitable evaluation framework and demands on the cost model
- Evaluating candidate costing model
- Selecting basis scenario for evaluation
- Conducting the analysis

Basis of the evaluation

- Model used: TRL's PASI model (by Highways Agency)
- Scenario: 4 km motorway with dual 3-lane carriageways
  - preconstructed, with long-life subgrade
  - 45 years maintenance with traditional or advanced pavement
- Traditional treatment
  - initial surfacing with 30 mm SMA
  - replaced every 10/8 yrs for heavy/very heavy traffic with 30 mm
  - replaced every 20/16 yrs for heavy/very heavy traffic with 100 mm
  - Costs: USD 8/sq m for 30 mm resurfacing (removal and replacing)
- Advanced treatment
  - Surfacing life to replacement: 30 or 40 yrs
  - Treatment for skidding resistance at intermediate periods
  - Costs: 3 or 5 times the cost of traditional treatment

Standard test case results (1)

Surface treatment costs	Net present value (1000 USD)	
Contributing factors	*Traditional*	
Initial works (treatment in yr 0)	480	
Maintenance works	1.084	
User delay	1.279	
Traffic mgmt.	259	
Residual value	-44	
Total Net Present Value (NPV)	**3.058**	

Standard test case results, night work (2)

Surface treatment costs	Net present value (1000 USD)	
Contributing factors	*Traditional*	*Advanced*
Initial works (treatment in yr 0)	480	1.441
Maintenance works	1.084	282
User delay	1.279	516
Traffic mgmt.	259	169
Residual value	-44	-92
Total Net Present Value (NPV)	**3.058**	**2.317**
Difference		**741**
Percentage difference		**24 %**

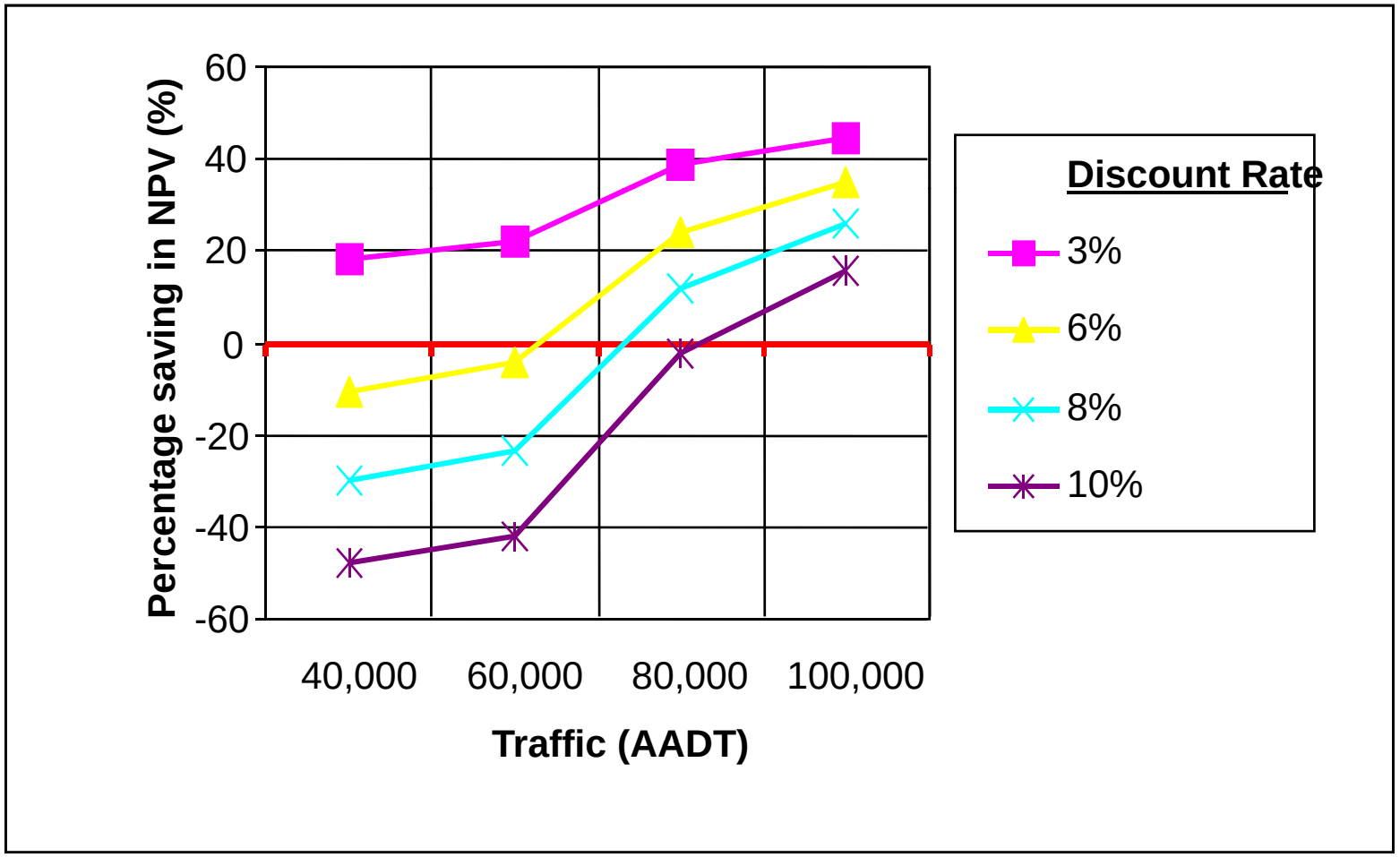
More to the standard case

- AADT = 80 000
- Heavy Vehicles = 15 %
- Advanced : Traditional cost ratio 3 : 1
- Life of advanced material, years 40
- Traffic growth per annum 1 %
- Rate of discount per annum 6 %

Standard test case results, day work (2)

Surface treatment costs	Net present value (1000 USD)	
Contributing factors	*Traditional*	*Advanced*
Initial works (treatment in yr 0)	480	1.441
Maintenance works	1.084	282
User delay	4.216	1.720
Traffic mgmt.	254	166
Residual value	-44	-92
Total Net Present Value (NPV)	**5.990**	**2.317**
Difference		**2.473**
Percentage difference		**41%**

Standard Case Sensitivity to AADT and Discount Rate



Long Life Pavements – Phase I : Findings

- Maintaining safe, comfortable and durable surfaces on heavily trafficked motorways is a major challenge to road owners
- Long-life surfacing costing around three times that of traditional wearing courses could be economically feasible
- Findings on Materials: Two long life surfacing materials warrant further investigation:
  - Epoxy Asphalt
  - High Performance Cementitious Materials (HPCM)

Long Life Pavements – Phase II Objectives

- Gain necessary knowledge about the potential strengths and limitations of *Epoxy Asphalt* and *High Performance Cementitious Materials (HPCM*), by:
  - *Establishing* properties and behaviour of the two material
  - *Optimising* material mixes
  - *Testing* their performance / suitability for long-life wearing courses
  - *Proposing* Phase III full scale tests, if performance results are positive and indicative costs generally consistent with Phase I

Long Life Pavements – Phase II Process

- Adoption by Joint Transport Research Committee in 2004
- Nomination of participants in Working Group by JTRC member countries in 2004
- Coordination of the testing programme in national laboratories beginning late 2004
- Completion of testing in early 2007
- Publication of final report summary in late 2007

Long Life Pavements – Phase II Mandate

- Scope of the Phase II study as approved by Transport Ministers of OECD and ECMT countries in May 2004 was:

- *"This next phase of the project will coordinate sufficient initial testing by national testing laboratories to assess the durability of the wearing courses. This will involve small-scale testing (laboratory testing and accelerated load testing) of the most promising pavement materials".*

Long Life Pavements – Phase II Members

- **Laboratory testing***: 9 active laboratories from 8 countries*

  - Australia, Denmark, France, Germany, New Zealand, Ukraine, United Kingdom (x2), United States

- **Working Group members***: 37 members from 18 supporting countries and JTRC Secretariat*

  Australia, Austria, Belgium, Denmark, France, Germany, Greece, Italy, Japan, New Zealand, Poland, Portugal, Russian Federation, Sweden, Switzerland, Ukraine, United Kingdom, United States.

- **External Reviewers of Final report***: from 2 other countries:*

  Canada and Finland

International Transport Forum

Joint Transport Research Centre

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Long Life Pavements Working Group

Secretariat
OECD/ECMT
Joint Transport Research Centre

Active Research Laboratories Epoxy Asphalt

- Denmark
  Danish Road Institute
- France
  Laboratoire Central des Ponts et Chaussées (LCPC)
- New Zealand
  Transit New Zealand
  Opus Central Laboratories
- Germany
  Bundesanstalt für Straßenwesen (BASt)
- Ukraine
  State Road Scientific Research Institute (DerzhdorNDI)
- United Kingdom
  Highways Agency
  Scott Wilson
- United States
  Federal Highways Administration
  Turner Fairbank Highway Research Centre

Active Research Laboratories HPCM

- Australia
  NSW Roads and Traffic Authority (RTA)
- Denmark
  Danish Concrete Company
  Danish Road Institute
- France
  Laboratoire Central des Ponts et Chaussées
- Germany
  Bundesanstalt für Straßenwesen (BASt)
- United Kingdom
  Highways Agency
  Transport Research Laboratory
- United States
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Other Participating Countries

Austria

Belgium

Canada

Finland

Greece

Italy

Japan

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Portugal

Russian Federation

Sweden

Switzerland