



Accelerated Pavement Testing

Conferencia Internacional. **19-21 de Setiembre, 2016**

"El rol de los APT en pavimentos sostenibles: Ingeniería, ambiente, y economía"

Perspectives on trends in international APT research

Wynand Steyn and Fred Hugo

ORGANIZAN



UNIVERSIDAD DE
COSTA RICA



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Introduction

- Attendees of APT2016 in Costa Rica left with many cultural memories apart from the technical expose *and the exhibit of nature's force*
- The depth of the technical proceedings & excellent exhibit of the research equipment were good examples of the advancement of this aspect of pavement engineering

In this brief presentation, the authors will attempt to explain why!

- 3 APT Syntheses since 1996 (National Academies) – 1996, 2004, 2012 (NCHRP 433)
- This provided opportunity to review and evaluate
 - information identified
 - predicted trends
 - actual developments
- Take stock of trends now identified as
 - new & receiving attention in immediate future



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Costa Rica's Natural Forces



NCHRP 433 - General

- 2000 to 2011
- 38 US State DOTs, 29 f-sAPT programs
- Overall
 - Judicious use **contributing to & supporting** pavement engineering body of knowledge
 - Supportive actions ensuring sustainable, supply of **cost-effective pavement-related infrastructure**
 - **f-sAPT gained importance in pavement engineering**
 - **Now growing** as normal part of pavement research
 - Many programs **share** facilities & data

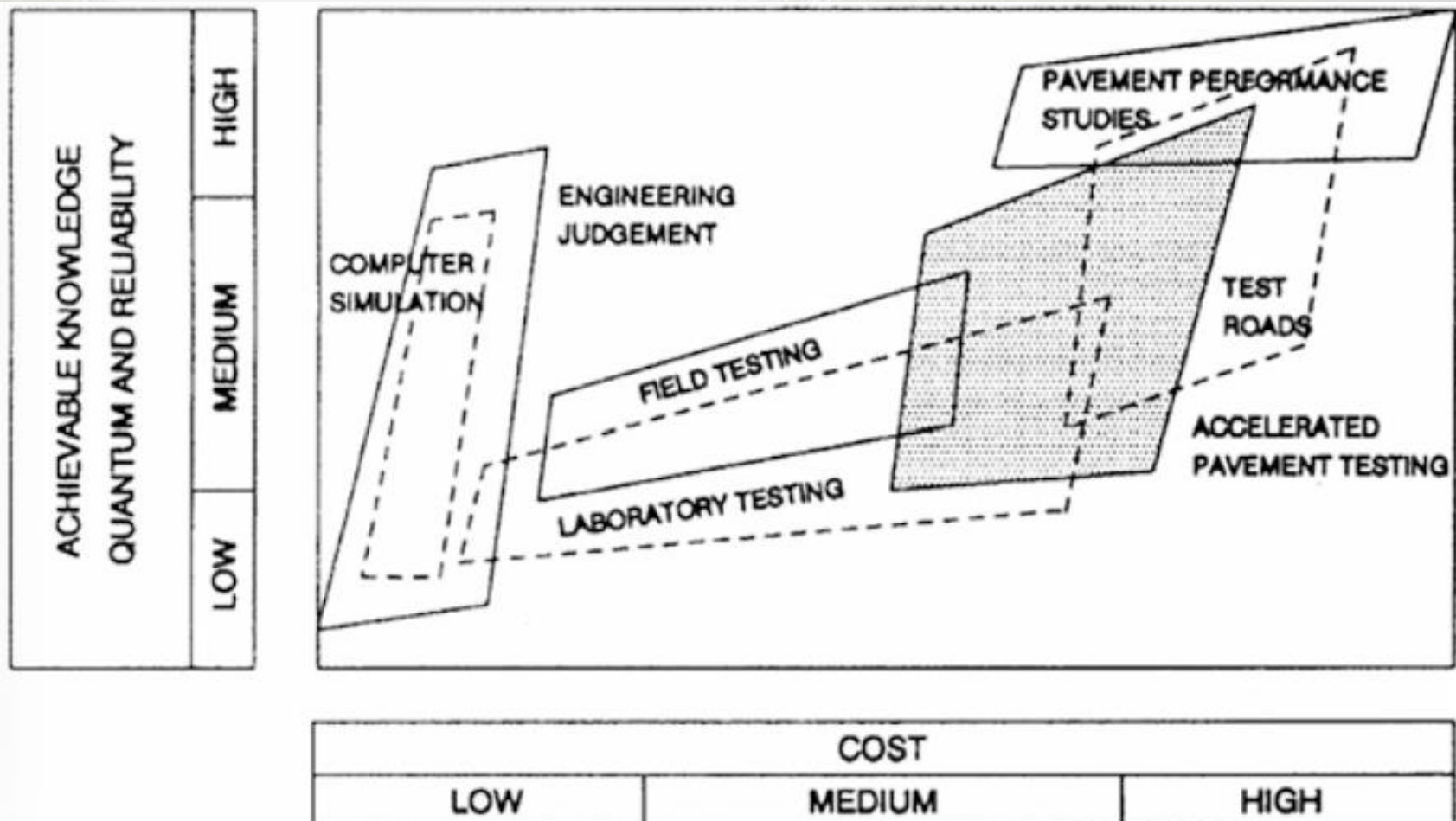
since NCHRP 433

- New f-sAPT facilities since 2011
 - ✧ US (mainly airfield), China, Indonesia, India, Mexico, Saudi Arabia
 - ✧ Various mobile & stationary loading devices
 - ✧ Most programs currently initiating research – currently limited outputs
 - ✧ Currently estimated 40 f-sAPT facilities
 - ✧ Africa 2, Asia 6, Australasia 3, Canada 1, Central America 1, Europe 11, Middle East 1, South America 1, USA 14
- Major co-operation development example
 - ✧ NCAT / MnROAD partnership
 - ✧ Collaborative research effort - sharing of resources & expertise
 - ✧ Big picture - national rather than state-focused research

NCHRP 433 – Topics Addressed

- Traditional focus areas
 - General response to applied loads
- Growing attention
 - Environmental issues
 - Loading issues - load history & contact stress patterns
- Extension of pavement life
- Materials models for newer pavement design methods
 - Non-linearity, viscosity and environmental sensitivity

Integration of Pavement Engineering Facets of primary importance for virtual processes



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- Extensive scope of recent (2012 to 2015) publications & conferences:
 - HMA & WMA (traditional)
 - Concrete Block Paving, Slab and block pavements, RCC, UTCRCP
 - “*alternative*” concrete pavements
 - Tire-Pavement interaction
 - noise / quieter pavements
 - texture and contact stress
 - wide-base tires

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- Extensive scope of recent (2012 to 2015) publications & conferences (cont):
 - Bridge decks and expansion joints
 - Unsurfaced road applications
 - Full-Depth Recycling
 - Long-term structural & pavement performance
 - Collaborative scaled and f-sAPT studies

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- TRB AFD40 APT committee remained active
- Formulation of Research Needs Statements
 - Effect of APT on **Rutting & Cracking** Performance of Flexible Pavements (since 2009)
 - Permanent Deformation Test Procedure for Evaluating **Rutting** Potential of Pavement Granular Base/Subbase Layers (since 2015)
- Development of final proposals in accordance with *current priorities*

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- **Cost Benefit** Determination for Pavement Research
 - Effect of speed, lateral wander & HMA temperature on **rutting & cracking** in HMA
 - **Relationship** between APT test results & performance of in-service pavements
- Accept variability & incorporate in analytical evaluation of pavements



NCHRP 433 - Economic analyses

- Evaluation of economic benefits of **f-sAPT** came to forefront
- More programs reporting BCR type evaluations
- Identify, analyze & quantify direct & indirect benefits from f-sAPT
- Majority of programs
 - Conducting BCR after research completed (43.5 %)
 - BCR as an input in research planning (17.4 %)
- BCR estimates ranged between 1.4 and 11.6
- Some perceive BCR over 30

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- Major current challenges
 - Access to funding / Continued institutional support of active programs
- International consensus - infrastructure & research funding under pressure
 - transportation investment dropped - population, traffic & maintenance backlogs increased
- Benefits of infrastructure investment research clear & well understood, *but....*
- More austere international financial environment
 - motivation of expenditures on issues not clear-cut & short-term is difficult

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- Important
 - Motivate continued need for APT given technical & economic benefits accrued
 - Consider improvements in modeling techniques & computer simulations - appear to enable APT virtually at a fraction of cost and time
 - Communicate need & requirement to develop accurate pavement materials & structural models, supporting computer simulations
 - Higher load application rates and increased traffic—quicker results
 - Highlight research benefit

Future focus areas

- Increased focus on **Vehicle-Environment-Pavement Interaction (V-E-PI)**
 - Improved load & contact stress models
 - New vehicle technologies (**Automated Vehicles-AV**)
 - Climate change-(**Performance Based Specifications-PBS**)
- Development of & improvements in performance related specifications
 - Improved MEPDG validation
- Sustainable pavement solutions
 - Energy efficient technologies & re-use of infrastructure
- Improved reliability in pavement design
 - Incorporation of LTPP sections / real traffic into programs

New Technologies

- All major device suppliers upgraded devices
- Improved **loading speed & loading level** control
 - Tire-pavement contact stress measurement systems
- Most new programs centralized around dedicated facility, incorporating laboratories, instrumentation development units & local universities
 - Almost a shift from traditional mobile field APT to improved controlled construction & environmental conditions
 - Still field studies on existing pavements by some programs

New Technologies

- Big data analysis
 - **Evaluate full data sets** from APT research, rather than average measurements at set intervals - variability
- Improved **field / laboratory linkages**
 - Extracting asphalt slabs for APT and laboratory testing
 - Multi-modal applications
- New sensors
 - Strain response with fibre Bragg grating sensors

Conclusions

- Significant progress over full range of topics forming basis of pavement engineering.....
- Stimulated by growth in extent of APT programs and...
- Pressure of economic constraints
 - Urgent need for reconstruction of highways
 - Increased traffic volumes & loads

Recommendations

- Further improved communication & collaboration required
- Ensure that short-term economic issues are not stifling innovative research but....
- Supporting required infrastructure investment to allow for renewed international economic growth

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Contact Information

- wynand.steyn@up.ac.za
 - Chair of Dept CE, University of Pretoria, South Africa
 - A member of AFD40 APT committee of TRB
- fhugo@sun.ac.za
 - Emeritus professor
 - Stellenbosch University



Questions or Comments



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