Performance Indicators

Joint Nordic/Baltic Symposium on Pavement Design and Performance Indicators

Ragnar Evensen
ViaNova Plan og Trafikk AS

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Performance indicators,

a high level of activity throughout the World

- **Performance index roads**
  - **1 960 000 hits on the internet**
- **Performance index pavements**
  - **557 000 hits on the internet**
- **Performance index PMS**
  - **260 000 hits on the internet**

Performance indicators / key performance indicators
The driving force behind performance indicators:

- **The vision for the road transport system and the mission of the road administration in fulfilling that vision**
- **OECD definition: a tool enabling**
  - **i) the effectiveness of an operation or of an organisation to be measured; or**
  - **ii) an achieved result to be gauged or evaluated in relation to a set of objectives**
- **Performance indicators**
  - **for the road authority as an organisation**
    - **with focus on the authority as a customer oriented organisation**
  - **for the road network, operations included**
    - **with a focus on the clients expectations and demands**
  - **for the road pavement**
    - **as an integral part of asset management**

Properties of Performance Indicators

- **The variable in question should be relevant to the purpose for which the indicator is required.**
- **The variable should be clearly defined.**
- **The measurements should be reliable, i.e. the same measurement taken by two different people should give the same value for the indicator.**
- **The measurements should be as precisely defined as required.**
- **The measurements should be readily available, i.e. the cost of collecting the measurements as regularly as required should not outweigh the usefulness of the indicator.**
- **The measurements should be available within a reasonable time frame, i.e. the measurements should still be useful for the purpose of the indicator at the time when they become available.**

PIARC Strategic Plan 2004 - 2007

- **Strategic Theme 1: Governance and Management of the Road System**
- Technical Committee
  - 1.3 Performance of Road Administrations

Issue 1.3.3 - Application of performance indicators of the road system	
Strategies	*Outputs*
➢ **Investigate** the performance indicators which are actually implemented by road administrations and how these indicators are obtained and used ➢ **Investigate** policy evaluation based on performance indicators in accordance with a country's socioeconomic development level: - how indicators match daily needs - means for data management - assess the level of achievement	➢ **Best practices** to improve the transparency and efficiency of administration through the application of performance indicators ➢ **Best practices** for policy evaluation and the application of the results for integration into new projects

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Performance Indicators for the road authority

Applicable to road programme evaluation, planning and organisation management:

- **In process management: to measure success of processes, or groups of processes.**
- **In management by results: to set targets and evaluate achievement of goals and objectives.**
- **Benchmarking**
  - **In topography surveys : A distinguishable mark placed on a wall, building or rock that is used as a reference point to determine elevation and position.**
- **To aid the development or improvement of the functions or specific engineering tasks.**
- **Help build a learning organisation**

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Performance Indicators for the Road Sector

13 participating countries including Finland, Sweden, Denmark, USA, Australia and New Zealand.

- **15 performance indicators were tested**
  - **Average road user cost**
  - **Level of satisfaction (travel time, reliability, information)**
  - **Protected road user risk**
  - **Unprotected road user risk**
  - **Environmental policy/programmes**
  - **Process in place for market research and customer feedback**
  - **Long term programmes**
  - **Foercast vs. actual road costs (including road construction)**
  - **Overhead percentage**
  - **Value of assets**
  - **Roughness**
  - **State of road bridges**
  - **Satisfaction with road system**

Austroads NPI: 50 Indexes in 10 groups

- **Group 2 Road safety**
  - **8 Indexes**
- **Group 3 Registration and Licensing**
  - **5 Indexes [New indexes to be developed]**
- **Group 4 Asset Management**
  - **12 Indexes (all based on IRI)**
- **Group 5 Environmental**
  - **3 Indexes (New indexes to be developed)**
- **Group 6 Program / Project Assessment**
  - **5 Indexes (3 new indexes to be developed)**
- **Group 7 Travel Speed**
  - **6 Indexes (2 new indexes to be developed)**
- **Group 8 Lane Occupancy Rate**
  - **3 Indexes (1 data no longer collected)**
- **Group 9 User Cost Distance**
  - **4 Indexes (Data no longer collected)**
- **Group 10 User Satisfaction Index**
  - **1 Index**
- **Group 11 Consumption of Road, Transport, Freight and Fuel**
  - **3 Indexes (Data no longer collected)**

NPI: National Performance Indicator

http://algin.net/austroads/site/Index.asp?id=5

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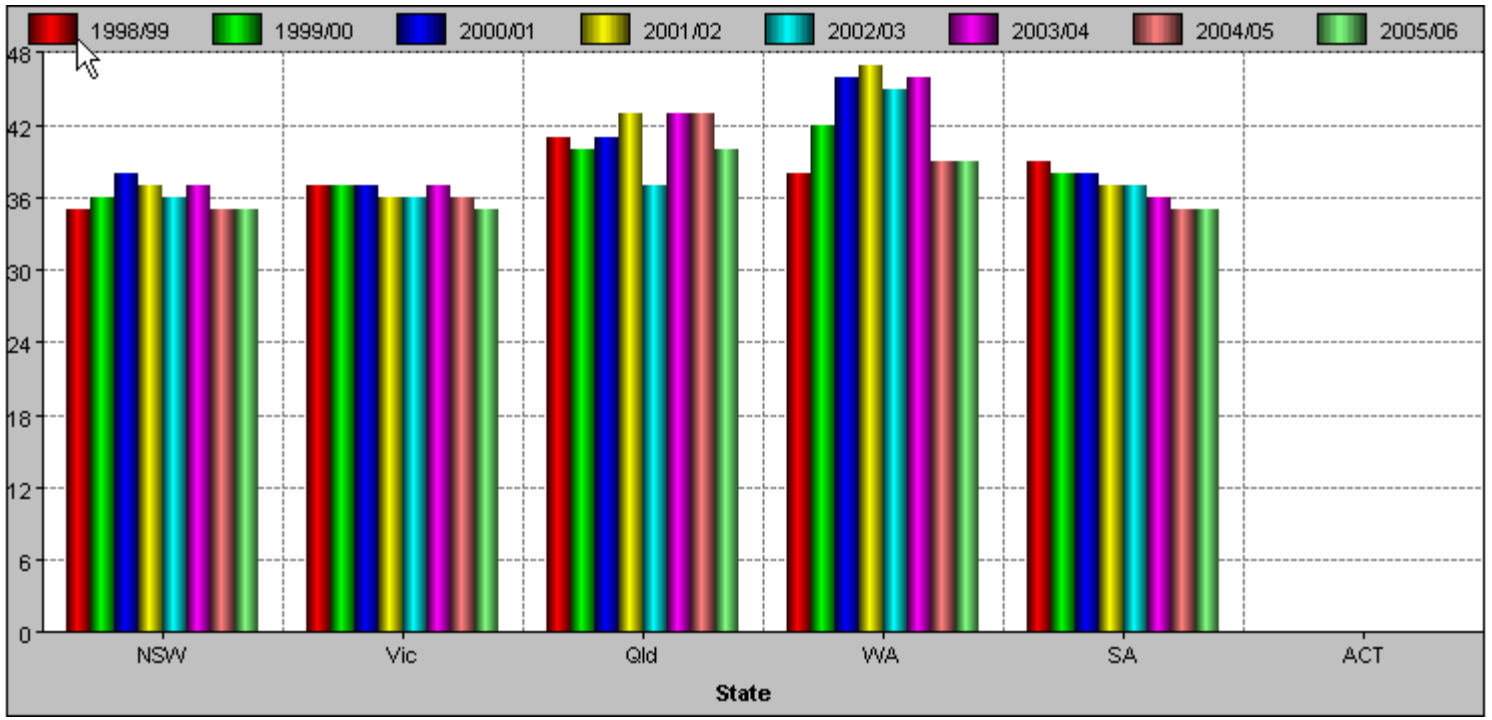
AM Peak Actual Urban Travel Speed, km/h



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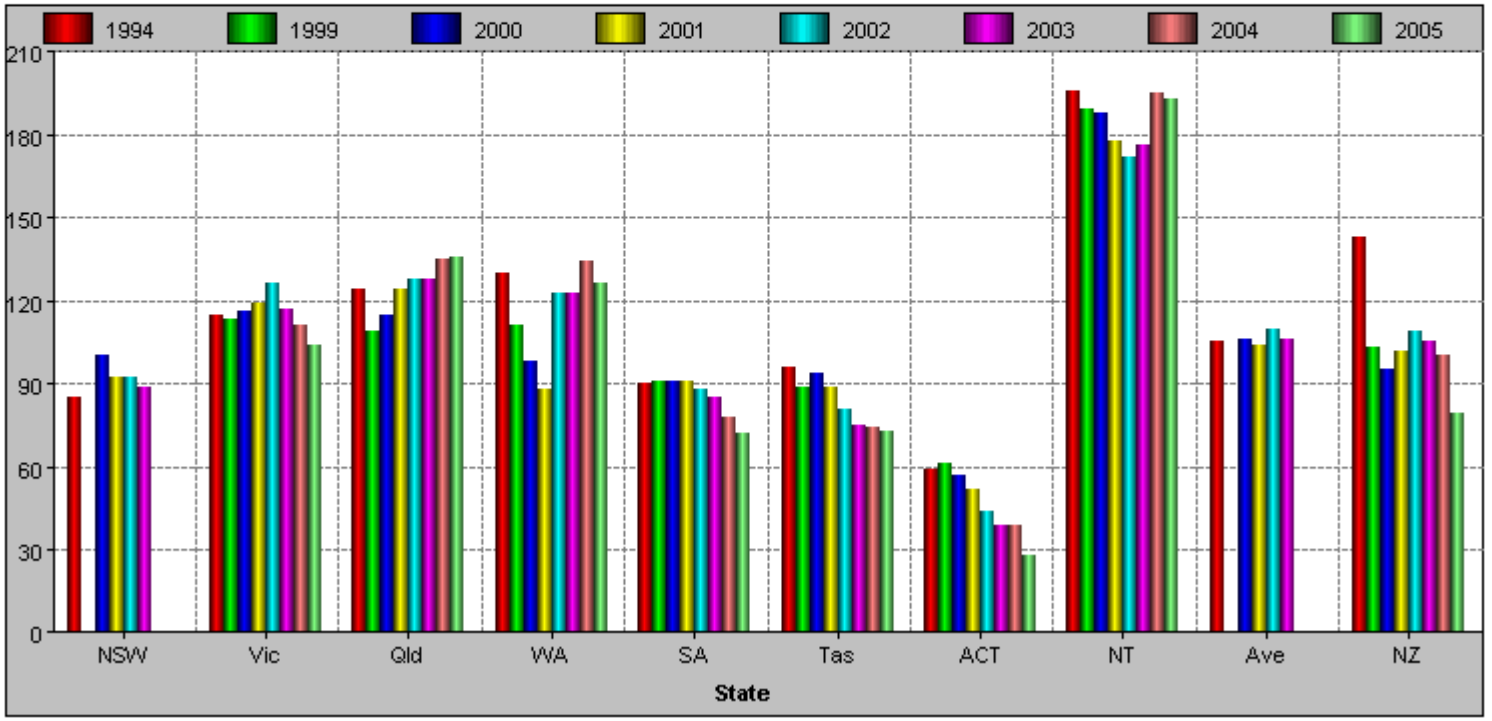
One out of 8 indexes on safety

Graph 2.1 Serious Casualty Crashes (Population)

Serious Casualty Crashes per 100,000 population

Qualifications Considerations Methodology



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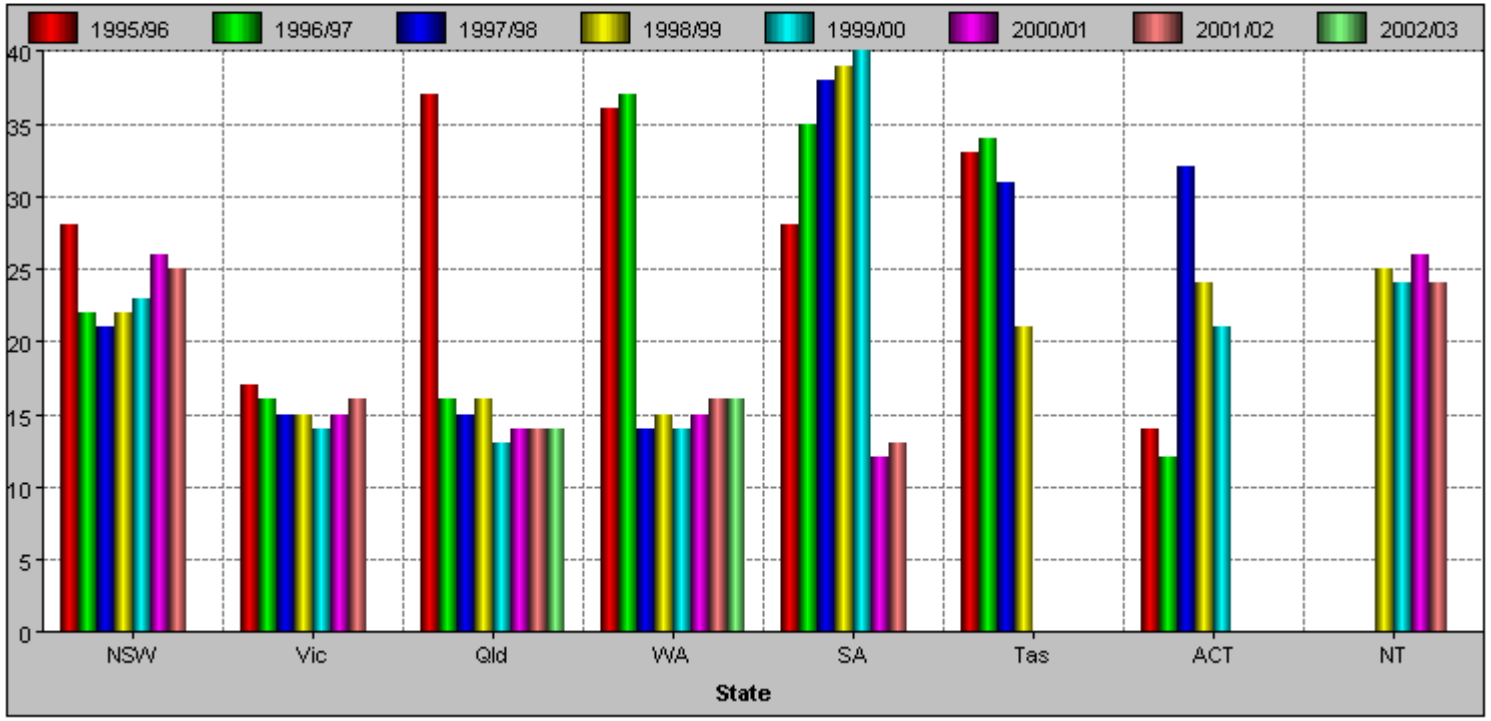
GRAPH 3.5 USER TRANSACTION ADDITIONAL COST FOR VEHICLE REGISTRATION (UTAC/V)

$ per record

Qualifications Considerations Methodology



New Indicator to be developed

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COST 354 Performance Indicators for the Road Pavement

Initiated by FEHRL, started 15th of April 2004, duration 4 years

- **The main objective of the Action is the definition of uniform European performance indicators and indexes for road pavements taking the needs of road users and road operators into account.**

- **Uniform indexes which will allow the specification of minimum European standards for road pavements.**

- **Filter out those areas of the European road network where more investment is needed to attain such minimum standards (depending on the road category).**

- **Inputs to pavement management systems (PMS), for calculating maintenance needs and thus to provide objective arguments for the need of reinvestment in road pavements.**

The objectives of COST 354

A quantitative assessment of individual performance indicators provides guidance regarding present and future needs in road pavement design and maintenance at both the national and the European levels.

By specifying limits and acceptance values (e.g. target values, alert values, threshold values, etc.) for individual performance indicators, minimum standards can be laid down for both projected and existing road pavements.

Performance indicators should be defined for different types of pavement structures and road categories.

A further objective is the grouping of these individual performance indicators or indexes into representative combined performance indexes as:

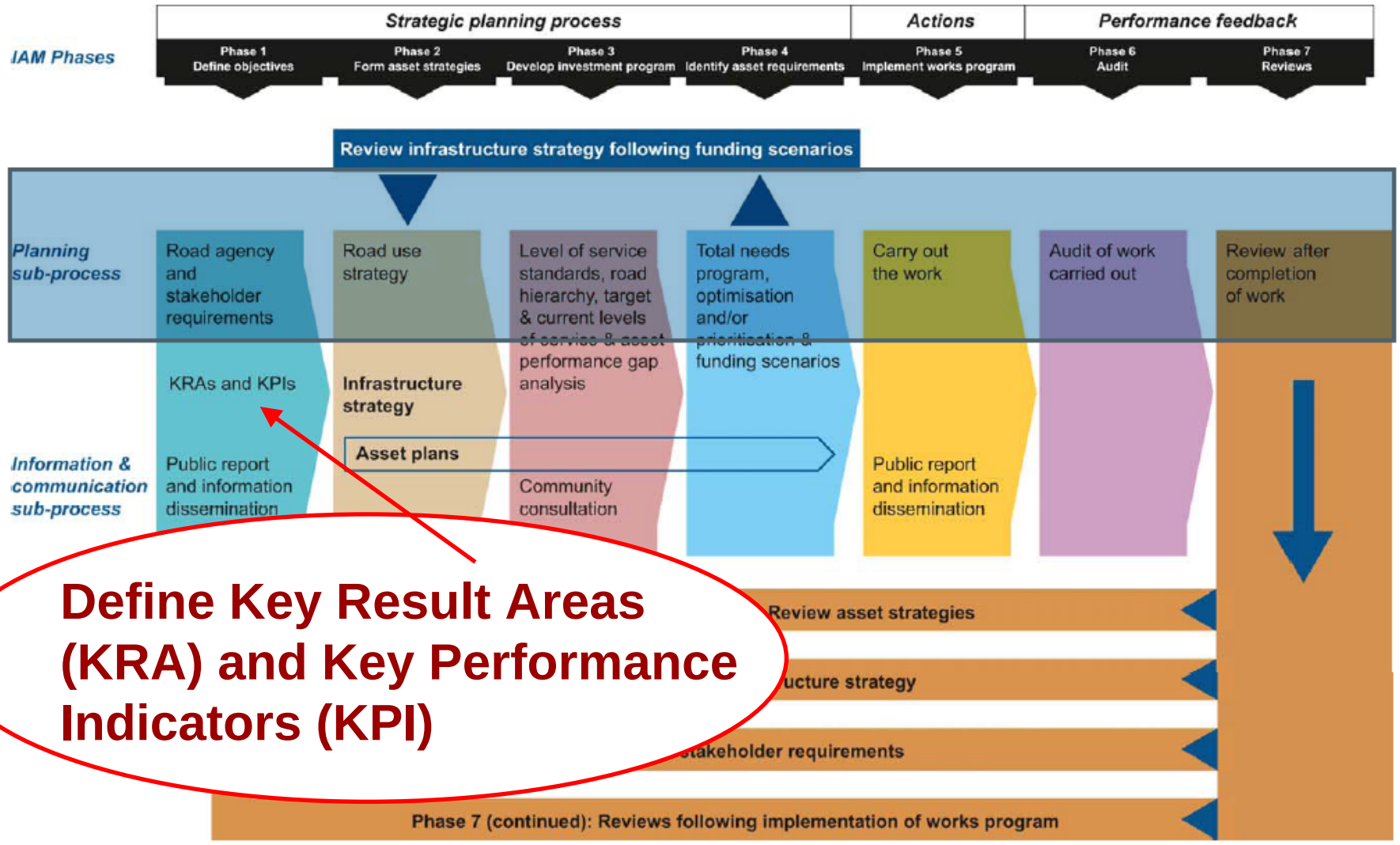
- **Functional performance indexes related to road safety and riding comfort (demands made on road pavements by road users)**
- **Structural performance indexes (structural demands to be met by the road pavement)**
- **Environmental performance indexes (demands made on road pavements from an environmental perspective)**

The World Bank: The characteristics of pavement KPI

- **Be directly relevant to current asset condition, to facilitate asset management and predict future asset performance.**
- **The choice of the performance indicators should take two concerns into consideration:**
  - **provide an adequate level of service to users**
  - **preserve the road heritage.**

Unit indices	Surface/ quality of use	Asset preservation
Evenness	•	
Skid resistance	•	
Macrotexture	•	
Rutting	•	
Raveling	•	
Potholes	•	•
Cracking	•	•
Deflection		•

Austroads: Guide to Asset Management



Define Key Result Areas (KRA) and Key Performance Indicators (KPI)

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New Brunswick Government, NJ, USA

- **OMM Contract (Operate, Maintain, Manage & Rehabilitate)**
  4 lane, 195 km, 1998 – 2028 (opened to traffic October 2001)

- **Four parameters in the evaluation of pavement performance**
  - **Surface Distress (Surface Distress Index)**
    - **based on photographic detection of crack and surface defects**
  - **Roughness**
    - **trigger value: 2,5 m/km**
  - **Rutting**
    - **trigger value: 20 mm**
  - **Structural Adequacy**
    - **Residual life, calculated fram FWD**

AASHTO 2002 Design Guide (ME-PDG)

Default values, flexible pavements, 90-percentile

- **Roughness, IRI** **2,72 m/km**
- **Permanent deformation, total** **19 mm**
- **(Permanent deformation, asphalt** **6,4 mm)**
- **Surface down cracking** **380 m/km**
- **Bottom up (alligator) cracking** **25%**
- **Low temperature cracking** **190 m/km**

The World Bank: Roughness classification

Figure 4.2. **IRI threshold matrix**

TRAFFIC Average daily traffic (ADT)	***IRI – International Roughness Index*** (m/km)						
	0-2	*2-4*	*4-6*	*6-8*	*8-10*	*10-12*	*>12*
0 - 4 999	**Very good**	**Good**	**Average**		**Bad**	**Very bad**	
5 000 - 9 999							
10 000 - 19 999							
> 20 000							

Source: World Bank.

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Vägverket: Publication 2000:31E Roughness

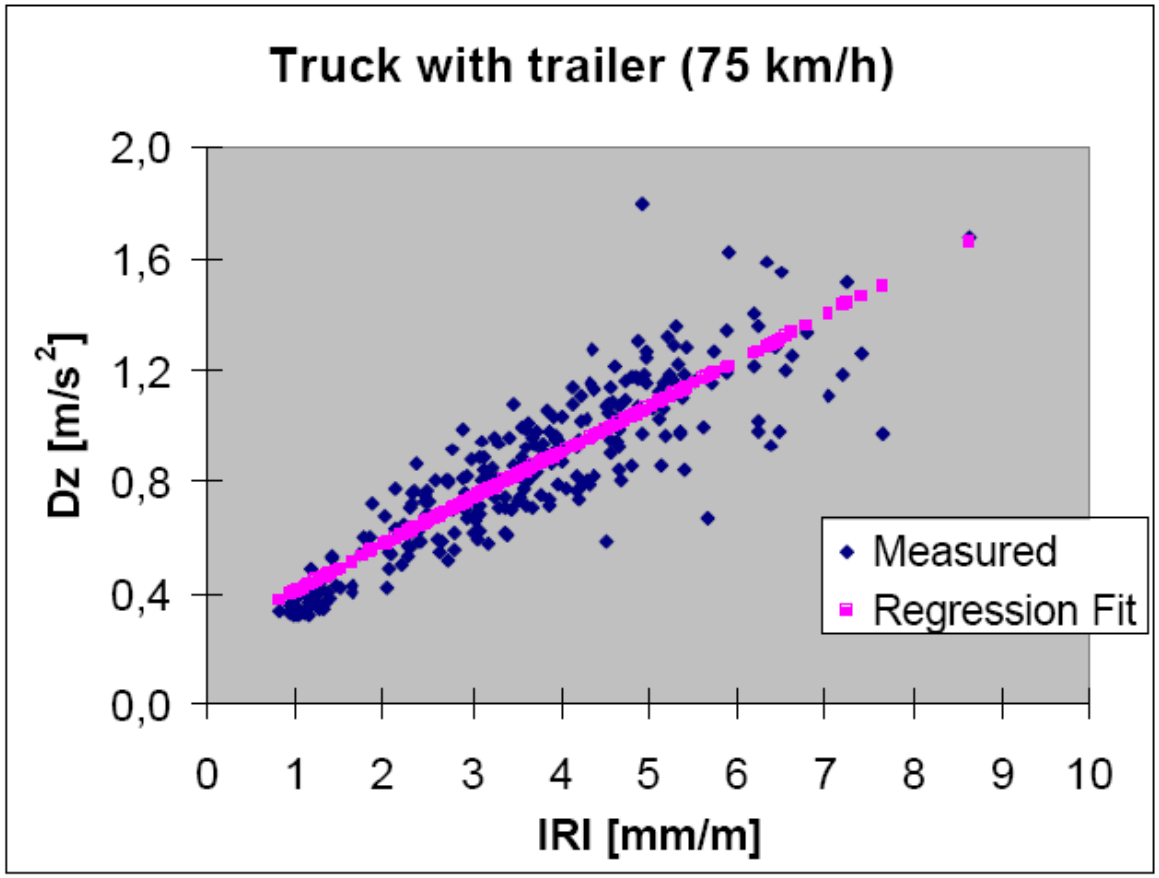

Figure 35 Regression analysis (prior to the division into IRI classes) for vertical translational vibrations at the seat in the truck

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Vägverket: Publication 2000:31E

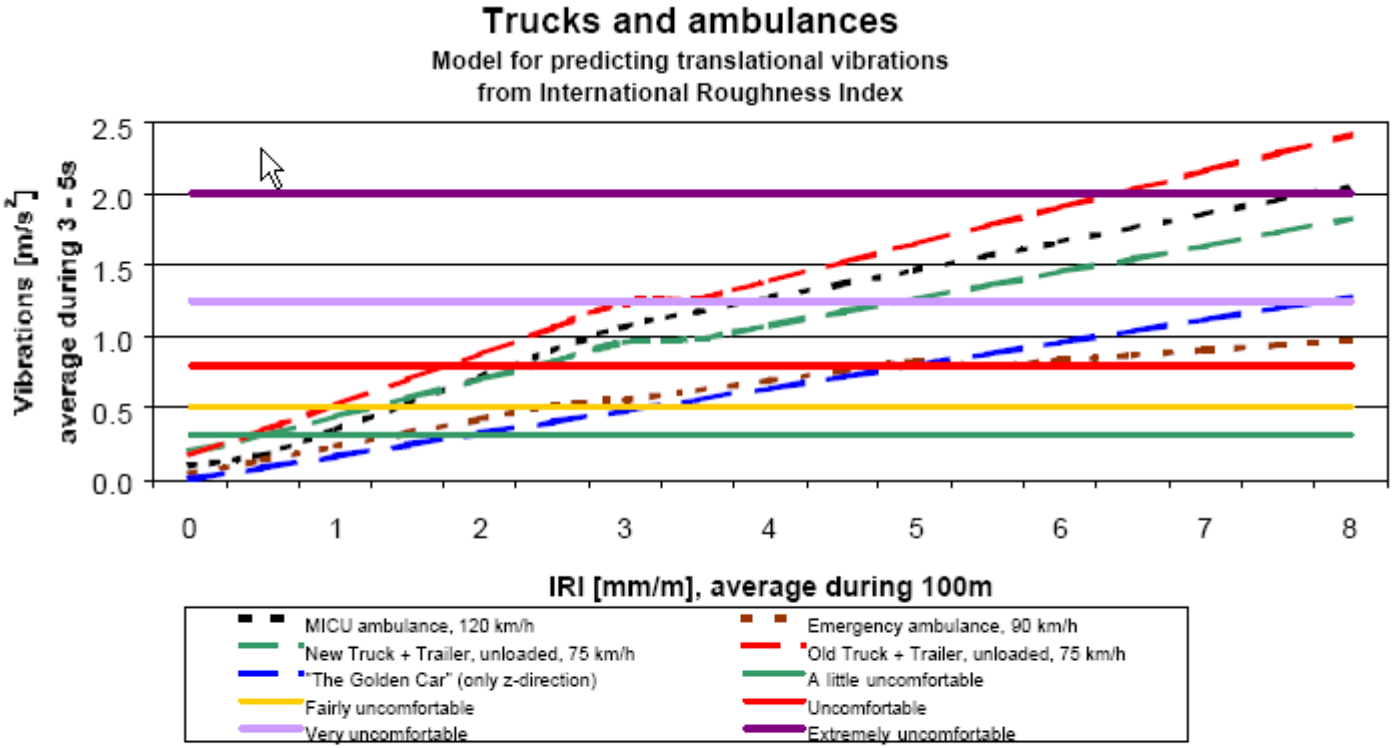

Figure 36 Model for (x, y, z)-vector translational vibrations as a function of road roughness

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Candidate Pavement Performance Indexes

- **Roughness** (IRI, possible alternatives in the future)
- **Rut depth** (rut depth)
- **Friction** (winter friction excluded)
- **Macrotexture** (friction, light reflection, noise)
- **Potholes**
- **Ravelling and other surface defects**
- **Patching**
- **Longitudinal, transverse and alligator cracking**
- **Pavement strength** (FWD deflection, residual life)

Average values, xx-percentiles, std.deviations (homogeniety)

Some indexes are important for the present functional performance of the pavement, others are important for the future performance prediction