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Road Roughness versus Ride Comfort which Considers Road Users

RPUG 2015 Annual Meeting

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Outline

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Introduction

- Performance is of interest to everyone
 - Measured in schools
 - Measured at work
 - Increasing emphasis on performance in governing
 - Pavement performance is the foundation of pavement design since the 1960's
- We contend that pavement performance must encompass the road user's perception of serviceability

History

- Early road tests and design methods did not have consistent definitions for condition or failure of pavements
- Mr. Bill Carey and Dr. Paul Irick developed the means to measure pavement condition and performance
- The Serviceability-Performance concept
 - Supported the AASHO Road Test definition of failure
 - Key component of design used since 1962
 - Supported pavement load equivalency concepts
 - Defines pavement performance

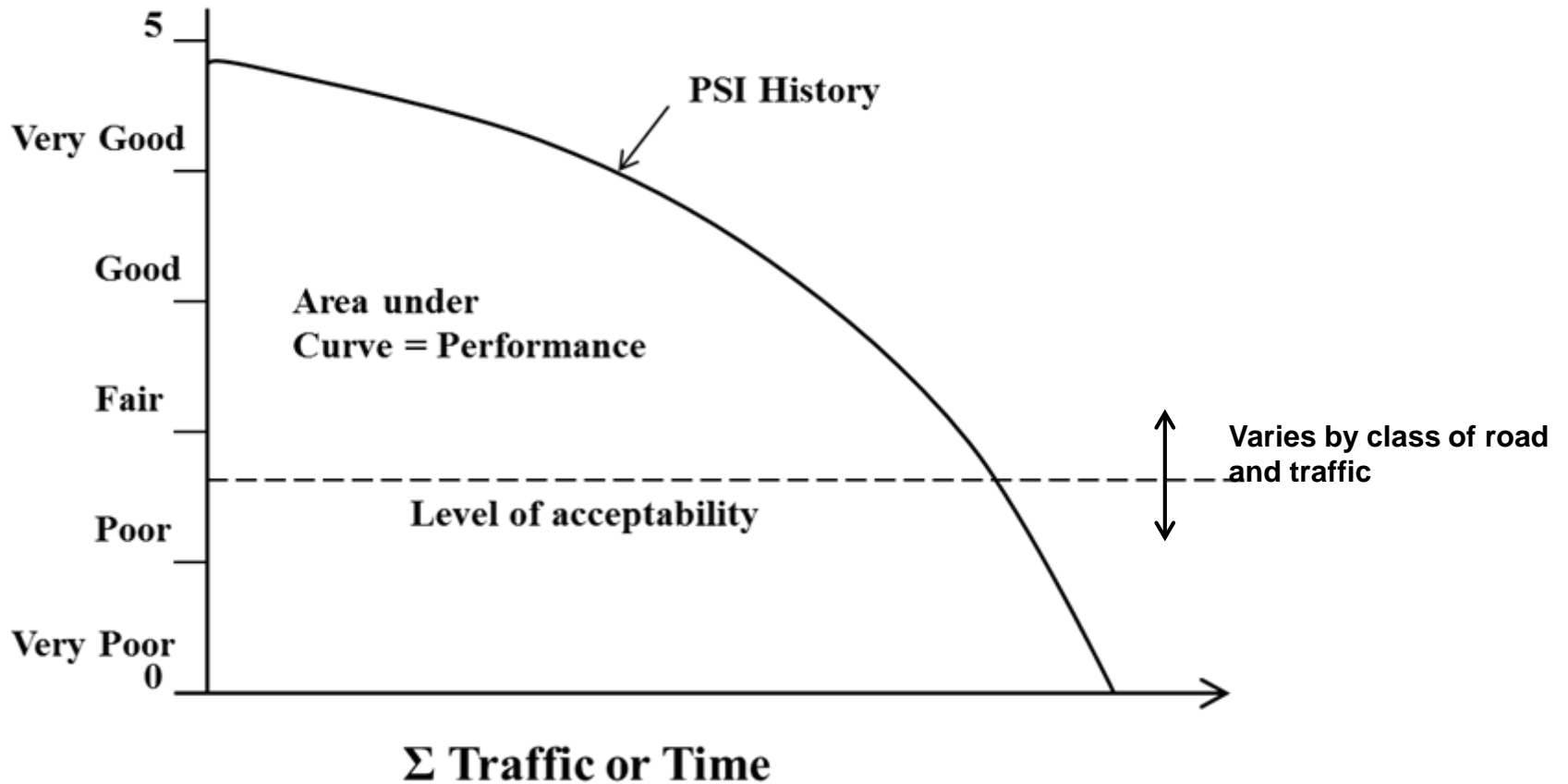
Serviceability

- Five Assumptions by Carey and Irick
 - Highways are built for the comfort, convenience and safety of the travelling public
 - User's opinions highway service are subjective
 - Objective measurements are directly related to the users subjective opinions
 - The “serviceability” may be expressed as the mean rating (evaluation) given by all highway users.
 - Performance is then defined as the serviceability history of a pavement.

Serviceability Ratings and Index

- The Present Serviceability Rating (PSR) is an estimate of the mean rating obtained by a user survey
- The Present Serviceability Index (PSI) is an estimate of the PSR obtained by measuring critical characteristics of the road and correlating those measurements to the PSR
- AASHO Road test initial equations found that PSR could be estimated by measurements of
 - Roughness
 - Cracking and Patching
- Since that time PSI is generally computed only from measures of roughness

Serviceability-Performance



PSR, HPMS and IRI

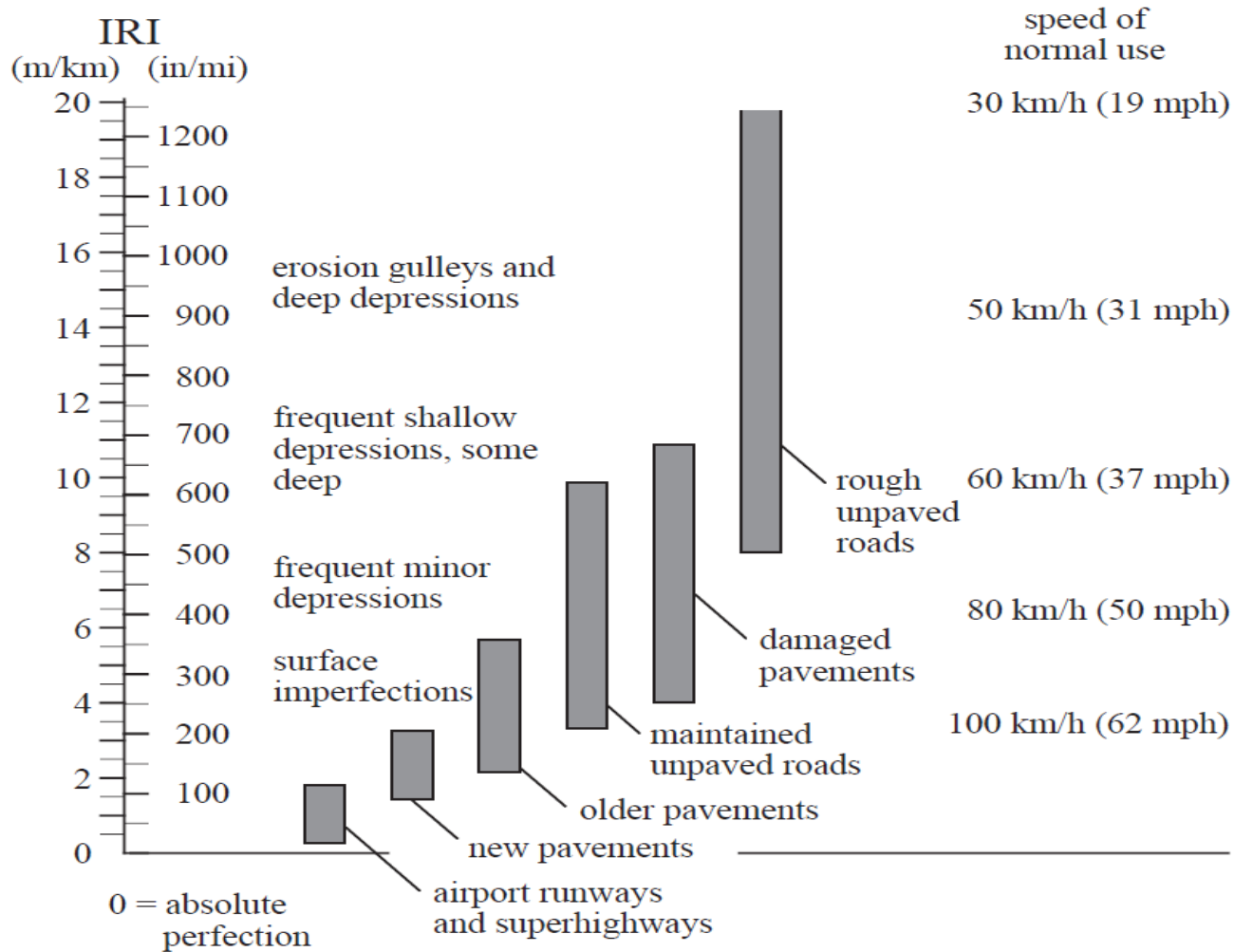
- Original HPMS reporting required estimates of PSR for pavements
 - PSR estimates widely acknowledged to be poor
 - No original requirement for an objective PSI measure
- The International Roughness Index (IRI) was adopted as the HPMS reporting standard
- PSR/PSI has since faded as network condition rating and performance monitoring tool
- Relating roughness, however measured, to mean panel rating is no longer a common practice

IRI as a Condition Indicator

- IRI is derived from a simulated quarter car passing over a measured profile
- IRI is an open ended scale with condition categories that vary across agencies
- 5 categories often used to describe IRI

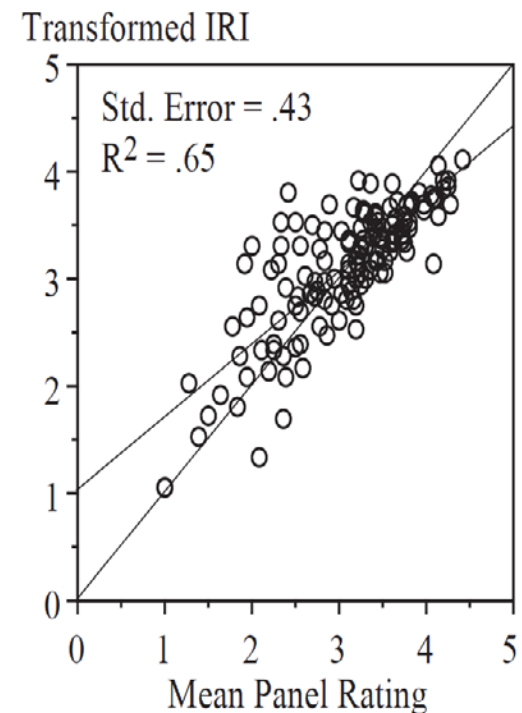
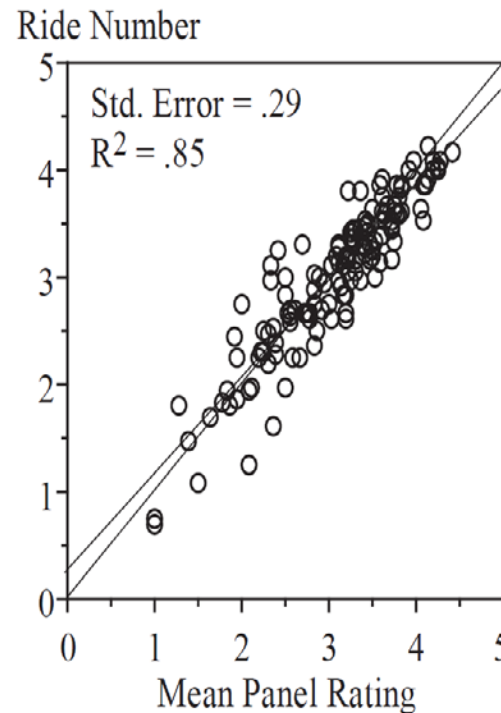
IRI Category	WSDOT	FHWA
Very Good	≤ 95	≤ 60
Good	96 - 170	61 - 95
Fair	171 - 220	96 - 120
Poor	221 - 320	121 - 170
Very Poor	> 320	> 170
	Shaded areas deemed unacceptable	

RANGES OF IRI



Mean Panel Ratings Related to Roughness Statistics

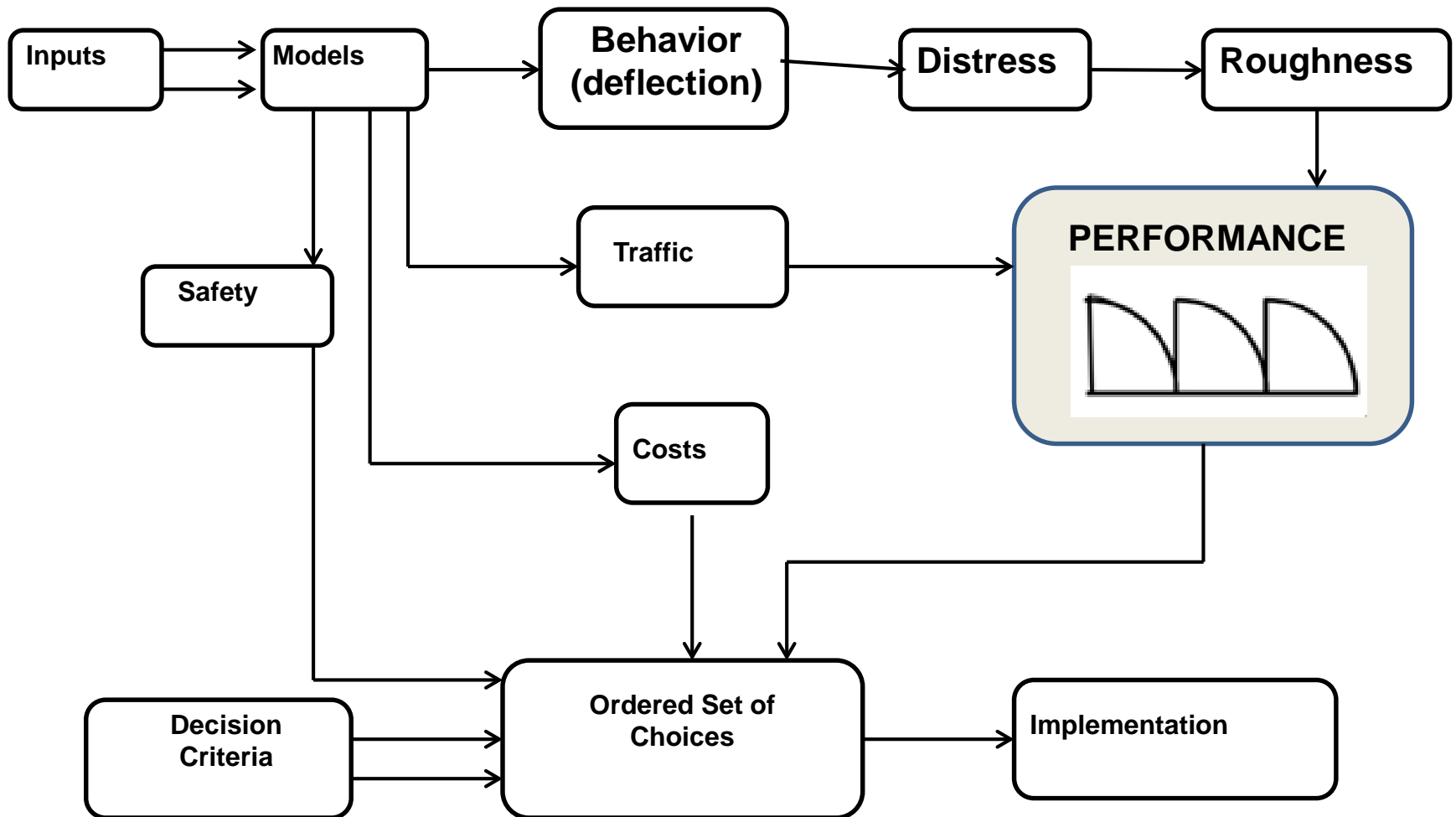
- Other efforts to relate roughness to MPR have occurred
- Janoff et.al. performed basic research into a Ride Number (RN)
 - Computed from measured profiles
 - Purpose was to estimate Mean Panel Ratings
 - Provided better estimates than IRI for MPR
 - Difficulty in computing RN for different lengths



Modern Network Level PMS Systems

- At a network level pavement management systems frequently separate “performance” from distress
- Distress deterioration controls engineering decision making
- Distresses impact the pavement leading to changes in performance over time
- Many practitioners have foregone utilizing PSI or Roughness to drive network level decision making
 - lack of connection between distress deterioration models and PSI for network level use
 - Roughness/PSI is seen as a lagging indicator and not suitable to be an analysis objective

PMS Concept



Considering the Road User in PMS Systems

- Key Concepts must be considered
 - The purpose of the road as stated by Carey/Irick
 - Estimated user perceptions provide key to understanding highway performance
 - Analysis should utilize projections of performance as captured by the area or trend in PSI
 - Models needed, especially at the network level, that relate distress deterioration to projected pavement performance through roughness
 - Then ‘performance’ becomes a suitable analysis driver
 - Distress remains primary decision criteria

Conclusions

- The 'serviceability' and thus over time the 'performance' of pavements are a subjective quantity
- Objective measures relate to the user estimated serviceability and performance
- Further develop relationships between panel ratings and roughness measures
- Need to develop usable network level frameworks that relate deterioration/distress to pavement performance
- Meaningful ratings on a 5 point scale are a good communications tool to all, including legislators and the public
- PSI is a simple scale understood by all stake holders and over time a good measure of performance

Questions