

## Lecture #8 & #9:

### Data Requirements

(Haas, Chapter 6-14)

Inventory of Pavement Management  
Data Needs, Pavement Performance,  
Pavement Evaluation (Structural  
Capacity, Condition Surveys, Safety),  
Feedback Database Management

### Pavement Management Data Needs

#### 1. Classes of Data Needed & Uses

Section Description, Performance,  
Historic, Policy, Geometry, Environment,  
and Cost Related Data (Fig. 6.1, 6.2)

Typical Uses: Network & Project  
Levels (Table 6.1)

#### 2. Importance of Construction & Maintenance History Data

#### 3. Importance of Performance Related Pavement Evaluation

- (a) Roughness: Serviceability & Riding  
Comfort;
- (b) Surface Distress;
- (c) Deflection: for Structural Adequacy;
- (d) Surface Friction: for Safety

#### 4. Objectivity & Consistency in Pavement Evaluation

“Repeatable”

“Consistent” across Time & Space

Well-documented Set of Practices & Procedures + Good Training

#### 5. Combining Pavement Evaluation Measures

Overall Pavement Quality Index

“Detailed Pavement Condition

Information is NOT Necessary at All Levels of Pavement Management.”

e.g., Senior Administrators may Only be Interested in Summary Descriptions of ...

#### Inventory Data Needs

##### 1. Types of Inventory Data

Section Reference & Description, Geometry, Pavement Structure, Costs, Environment (Weather) & Drainage, Traffic

Referencing Method (Haas, page 71)

Route-Milepost / Node-Link / Branch-Section / GIS (==> Effective Database)

Branch-Section Method used in PAVER

Uniform Section: Homogeneous  
Characteristics

Workable, Consistent, & Amendable to  
Updating

## 2. Collecting & Processing Inventory Data

Pavement Performance

### 1. Serviceability-Performance Concept AASHO Road Test

Functional Pavement Rating: User's  
Perception, Vertical Acceleration,  
Experienced Driving ==> Roughness  
Characteristics, Vehical Mass,  
Suspension Parameters, Travel Speed

Pavement Serviceability Index (PSI)  
“Subjective” PSR => Measured  
Objectively

### 2. Characteristics of Pavement Roughness

AASHO Road Test: About 95% of  
Pavement Serviceability Information is  
Contributed by “Roughness of Surface  
Profile”

Roughness=Distortion of Pavement  
Surface

==> Undesirable or Uncomfortable Ride

Three Profile Components:

Longitudinal, Transverse, & Horizontal Distortions

(Longitudinal => Vertical Acceleration)

(Vehicle Roll & Yaw => Lateral Acceleration)

### 3. Equipment for Evaluating Roughness

1920's Recognized the Need

Late 1950's AASHO Slope Profilometer

CHOLE Profilometer (剖面儀): record

angle of 1 foot intervals, 5 mph (slow speed)

#### (1) Profile measurement devices:

(a) Face dipstick

(b) TRRL profilometer (high-speed road monitor)

(c) Inertial profilometers: General Motors Research (GMR) or Surface Dynamics Profilometer (SDP), FHWA profilometer, APL profilometer, Low cost profile based devices (Law Model 8300 Roughness Surveyor, South Dakota Profiler)

#### (2) Profilographs:

Rolling straight edge devices or profilographs

(3) Response type measurements:

Response type road roughness measuring systems (RTRRMS) or devices

(a) Mechanical RTRRMS: Bureau of Public Roads (BPR) roughometer, Mays Ride Meter (MRM) or Maysmeter

(b) Accelerometer-Based RTRRMS: Automatic Road Analyzer (ARAN), etc.

#### 4. 高公局之糙度量測儀器

K. J. Law SDP M8300 表面動力剖面儀 (Surface Dynamics Profilometer)

=> SDP可計算均方加速指標(Root-Mean Square Acceleration Index, RMSA) 與梅斯指標(MaysMeter Index)

=>梅氏儀糙度值(MaysMeter Roughness, cm/km), 超過某平坦度以上高低值之總和

台灣區高速公路路面養護管理系統建議：

路面類型	新路面驗收值	養護臨界值
剛性	86-103 (96)	134-150 (142)

柔性	32-55 (47)	86-103 (94)
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(期終報告 : pp. 139-140)

## 5. A Universal Roughness Standard

(a) Quarter-Car Simulation ==>

Quarter-Car Statistics (QCS) ==>

International Roughness Index (IRI)

Highway Safety Research Institute

(HSRI)

Recommended by the World Bank

(b) Root Mean Square Vertical

Acceleration (RMSVA)

$$MO = -20 + 23 * RMSVA4 + 58$$

RMSVA16

$$PSI = 5 * e^{(- 9.387 * \ln (32 * MO)) / 8.493}$$

MO=Maysmeter Output (MO, in/mile)

RMSVA=RMSVA (ft/sec<sup>2</sup>)

(c) Slope variance

$$SV = \frac{\sum (y - \bar{y})^2}{n - 1}$$

(d) Profile index

## 6. Relating Roughness to Serviceability

$$PSI = 5.41 - 1.80 \log(0.40R - 30) - 0.09$$

$$(C+P)^{0.5}$$

Recommendations:

“Distress Terms should be Excluded from the Serviceability Equations”

(Hass’s Textbook P.103)

Development of Serviceability-Roughness Relationships

$$PSR = 5 * e^{(\alpha * IRI)}$$

$$\alpha = -0.0041 \text{ for IRI in (in/mile)}$$

$$\alpha = -0.26 \text{ for IRI in (mm/m)}$$

$$\alpha = -0.0026 \text{ for IRI in (cm/km)}$$

(Note: 1 in/mile = 1.578 cm/km,

$$1 \text{ in/mile} = 0.01578 \text{ mm/m})$$

## 7. Application of Roughness Data

Network Level & Project Level

## Pavement Evaluation: Structural Capacity, Condition Surveys, Safety

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- Feedback Database Management

## Describing the Present Status of Taiwan's Pavement Networks

