

NJDOT's Adoption of an IRI Based Ride Quality Specification



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RESEARCH & DEVELOPMENT

Multi year NJDOT/Rutgers/Stantec study

Pooled Fund Study TPF 5(063)

“Improving the Quality of Pavement Profiler Measurement”

AID, Inc. retained in 2003 to expedite development of an “Interim” ride quality specification



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OBJECTIVE

- **Replace the NJDOT's Traditional smoothness specification that is based on the 10 foot Rolling Straight Edge (RSE)**
- **Develop a trial ride quality acceptance specification based on profilers and IRI statistic**



ROLLING STRAIGHTEDGE (RSE)

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- Used for many years
- Measures **PDL**
($>1/8$ inch in 10 feet)
- Simple, **inexpensive**
- Several drawbacks
 1. **Slow**, labor intensive
 2. Safety issues
 3. **Reliability issues**
 4. Sensitivity issues





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International Roughness Index (IRI)

- Worldwide standard
- Many states using it
- Advocated by FHWA
- Designed to be sensitive to vehicle dynamics
- Data collection by AASHTO Class 1 inertial profiling systems

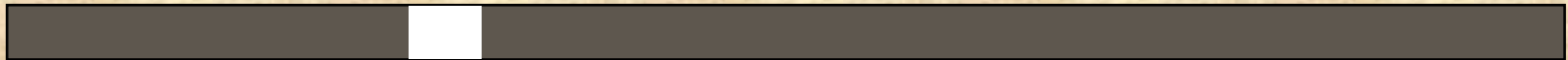
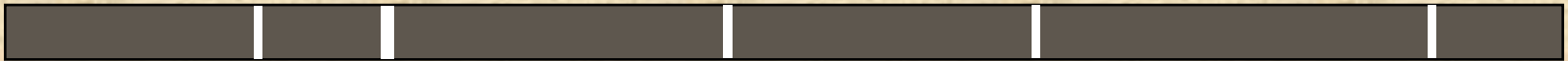




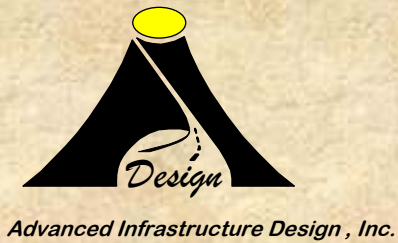
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ADDITIONAL MEASURES

LOCALIZED ROUGHNESS



BONUS PAYMENT CONCEPT



Formation of Advisory Group

An Advisory Group was formed

Consisted of representatives from:

1. NJDOT (6)
2. FHWA (2)
3. Construction industry (6)
4. AID (6)



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First Specification - Section 406.13 Surface Course Rideability

1. General Requirements

- Measured in terms of the International Roughness Index **(IRI)**
- Ride quality acceptability judged in terms of percent defective **(PD)**
- The measured PD used to compute the appropriate **pay adjustment**



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First Specification - Section 406.13 Surface Course Rideability

Specific Requirements

- PD for interstate and limited access roadways calculated using an upper IRI limit:

U = 70 inches/mile

- All others, upper limit:

U = 90 inches/mile



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First Specification - Section 406.13 Surface Course Rideability

Specific Requirements

- 0.1-mile length single lane **lots**
- PD = 10 percent, eligible for **full** payment
- PD < 10 , eligible for **bonus** payment
- PD > 10 percent, pay **reductions** assessed
- PD ≥ 90, corrective action or **removal** and replacement at the Contractor's expense
- IRI reported for each 0.01-mile segment
 - Average of 3 runs, of right and left wheel paths



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First Specification - Section 406.13 Surface Course Rideability

Method of Measurement

- Localized Roughness: 0.01-mile segments
 - IRI > 100 in/mi for interstates, Etc.
 - IRI > 120 in/mi for all other types
 - Will require corrective action by Contractor
 - If the corrective action not successful or deemed unattainable
 - ✓ The Engineer will assess a \$500 pay reduction per incident



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First Specification - Section 406.13 Acceptance of Surface Course Rideability

Lot Acceptance and Payment

- (a) Compute the sample **mean** (\bar{X}) and standard deviation (**S**) of the N test results

$$\bar{X} = \frac{(X_1 + X_2 + \dots + X_N)}{N}$$

$$S = \sqrt{\frac{(X_1 - \bar{X})^2 + (X_2 - \bar{X})^2 + \dots + (X_N - \bar{X})^2}{N - 1}}$$



First Specification - Section 406.13 Acceptance of Surface Course Rideability

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Lot Acceptance and Payment

(b) Compute the **quality index** (Q):

$$Q = (\mathbf{U} - \text{mean}) / S \quad (\text{Eq. 3})$$

U is the upper limit of 70 or 90



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First Specification - Section 406.13 Acceptance of Surface Course Rideability

Lot Acceptance and Payment

- c) Determine percent defective (PD)
 1. Using **Table 914-5** for sample size (N)
 2. Determine PD of the lot **outside** the upper specification limit (U)



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First Specification - Section 406.13 Acceptance of Surface Course Rideability

Lot Acceptance and Payment

(f) Compute pay adjustment (Pay equations express the pay adjustment in dollars per lane per 0.1 mile)

$$\mathbf{PD \leq 10:} \quad \mathbf{PA = \$1000 - \$100 \times PD \quad (Eq. 4)}$$

$$\mathbf{10 < PD < 90:} \quad \mathbf{PA = \$250 - \$25 \times PD \quad (Eq. 5)}$$

$$\mathbf{PD \geq 90:} \quad \mathbf{PA = \$70,000 - \$800 \times PD \quad (Eq. 6)}$$



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PILOT PROJECT PROFILE

**Route 195 Westbound Resurfacing
Contract No. 00503327**

2 Lanes Mile Post 9.8 to Mile Post 5.3

Approximately 7 lane miles of mainline



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PILOT PROJECT PROFILE

**Contract was awarded early spring
of 2005 for \$2.9 million to
Trap Rock Industries, Inc.**

**Work began in late May and was
completed September 2005.**



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INITIAL IRI VALUES

Network data (L2) tested May 3, 2005
Average IRI for the section - 135





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INTERMEDIATE COURSE IRI VALUES

Lane 1 & 2 tested June 11 & 18, 2005
Average IRI - 78





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SURFACE COURSE IRI VALUES

Lane 1 & 2 tested July 25 & 27, 2005
Average IRI - 57





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LOT PAYMENTS

70 Lots were measured:

51 received positive pay adjustment

37 received full bonus \$1000.00

(+5 more within \$30 of max)

19 received negative pay adjustment

**5 pay reductions were based on localized
roughness**



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FINAL IRI \$VALUES\$

**\$ 2.9 million ~ 7 lane miles of mainline
(potential + / - : \$70,000 to - \$700,000)**

**Actual Bonus = \$18,000+* (\$36,000+)
0.6% of entire contract* (1.2%)**

***50% reduction due to Pilot Project Status**



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ADDITIONAL PILOT PROJECTS

Route I-78 EB and WB

Resurfacing Contract No. 018054020

\$ 8.6 million ~ 35 lane miles of mainline

(Avg. IRI ~ 48, Anticipated Pay Adj. ~ \$148,000)

Route I-287 NB & SB

Resurfacing Contract No. 042054010

\$ 7.8 million ~ 37 lane miles of mainline

(Avg. IRI ~ 68, Anticipated Pay Adj. ~ -\$185,000)



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ADDITIONAL PILOT PROJECTS

Route I-287 NB

Resurfacing Contract No. 215054030

**\$ 5.8 million ~ 25 lane miles of mainline
(Avg. IRI ~ 39, Anticipated Pay Adj. ~ \$207,000)**

Route 295 NB and SB

Resurfacing Contract No. 060033250

\$14.2 million ~ 40 lane miles of mainline

**(Still under construction with 50% reduction in pay
adjustment due to Pilot Project Status)**



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The END
Thank you!