



The Value of Smoothness

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VDOT Research

- Genesis ~ 1996
- Applies high-speed profilers & the IRI
- IRI “targets” for Interstate and Non-Interstate pavements
- Incentives for superior smoothness
- Disincentives for excessive roughness
- Applied to 0.01-mile pay lots (2001/2 – present)

Questions to Explore

- What (if any) impact does our ride spec have on achieved smoothness?
- Do we pay more for work that's subject to the ride spec?
- What do we gain by using the ride spec? That is, what is the Value of Smoothness?

**Historically, what impact has
VDOT's Ride Spec had on
achieved ride quality?**

Historical Smoothness Data

- In 1998, Data collected on 405 project-lanes across state
 - 315 not subject to ride spec (“non-spec”)
 - 90 subject to ride spec (“spec”)
- In 2005, forty-seven of original 405 records retested
 - 21 among “non-spec” projects
 - 26 among the “spec” projects
- “Spec” projects 8.8 in/mi smoother...over entire 7-year period

Historical Smoothness (Cont.)

- McGhee (1999) ... “identified a consistent **6 to 8 in/mi** decrease in IRI for projects constructed under the Special Provision...”
- Clark (2005) ... “documented an IRI on the (VDOT) spec work of **8 in/mi** smoother (lower IRI) than for non-spec activity.”

Does the Ride Spec have an impact on the unit price in the winning bids?

Resurfacing Schedules ('01 – '05)

VDOT District	Contracts
Bristol	55
Salem	63
Lynchburg	31
Richmond	74
Hampton Roads	24
Fredericksburg	26
Culpeper	25
Staunton	56
Northern Virginia	49
Total	403

Quantities & Costs

Mix	No. Contract “Appear- ances”	Total Quantity (tons)	Avg. Price (Wtd. \$)
SM9.5 (3)	395	7,024,957	38.39
SM12.5 (2)	304	4,027,265	39.01
SMA9.5 (2)	9	99,173	59.81
SMA12.5(2)	41	559,098	63.91
SMA19 (2)	12	95,449	54.30
All Surfaces	761	11,805,942	40.12

...subject to Ride Spec?

Mix	Contracts w/Spec		Quantity w/Spec	
	Number	Percent	Tons	Percent
SM-9.5 (3)	131	33.3	1,526,243	21.7
SM-12.5 (2)	111	36.5	1,009,879	25.1
SMA-9.5 (2)	5	55.6	48,733	49.1
SMA-12.5 (2)	29	90.6	404,202	72.3
SMA-19.0 (2)	7	58.3	70,220	73.6
All Surfaces	283	37.2	3,059,277	25.9

- 761 Observations, 5-Superpave, 6-SMA
- Variables of the analysis:
 - Winning bid price (\$/ton)
 - Mix type (using 11-dummy variables)
 - Total quantity in award (by mix)
 - Price of “regular unleaded gasoline”
 - Fraction of job subject to each: ride spec, MTV, time-of-day restrictions, additional structural layer, and planing/milling

Analysis Results

- Ride spec impact not *statistically significant*
 - *point estimate* was \$1.03 per ton with 90% confidence band from -1.56 to \$3.09/ton
- Estimated quantity and gasoline prices only statistically significant influences
 - “...price per ton...drops by some \$0.10 for every thousand tons in bid...”
 - increases by \$1.46 per ton for every 10-cent increase in price per gallon of gasoline

**What do we gain through use of
the Ride Spec?**

- “Turns back the clock” on IRI by about 7 years
- Deferring resurfacing by just 2-years:
 - Reduces present value of next overlay from 74.4% to 70.1% of current costs
 - Habitual use can reduce annual maintenance outlay to about 10/12 of what it otherwise would be (15% for applicable projects)

- For continued 10-year resurfacing cycle, ride spec pavements are 12% smoother over lifetime
- Deferring additional 2-years (12-year cycle), ride spec pavements are 10% smoother
- WesTrack, FLDOT, and NCAT findings suggest 10% reduced IRI = 1.3 to 10% reduction in fuel consumption
 - Each 1% = > \$5,617/million truck-miles

Cost/Benefit Example

- Consider 4-lane road (1-mile in length), ADT=10,000, 10% trucks
- Cost added by ride spec = \$598 (based on \$1.03/ton point estimate)
- Case 1 - Continue 10-Year Resurfacing Cycle
 - No maintenance cost savings
 - \$425,076 lifetime fuel savings
- Case 2 - Extend Cycle to 12-years
 - \$4,015 maintenance cost savings
 - \$354,228 lifetime fuel savings
 - \$149 travel time cost savings

- Ride Spec - No significant impact on HMA bid price
- Pavements accumulate ~1.23 in/mi of IRI roughness per year (Ride Spec or Not)
- Use of Ride Spec “turns back the clock” by as much as 7 years
- Two-year life increase ~ 15% reduced annual maintenance outlay
- 1% lower IRI = \$5,617/million truck-miles

- Continue to promote, apply, and develop ride spec
- Pursue empirical link between measures of roughness and other pavement distresses (i.e., actual service life)
- Update the pay adjustment schedules for ride quality (using more scientific basis)
- Continue to monitor roughness progression on 1998 dataset

Promoting smoothness - doing
our part to reduce fuel
consumption and dependence on
foreign oil!

- www.vtrc.net
 - Go to “reports”
 - Search on “smoothness”
 - “Impact of a Smoothness Incentive/Disincentive on Hot-Mix Asphalt Maintenance-Resurfacing Costs” – McGhee & Gillespie

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Or visit our web site at

<http://www.cpe.vt.edu/pavementmanagement07/>



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