Smoothness of Roads Research Customer Summary

TERRA Pavement Conference
February 10, 2011

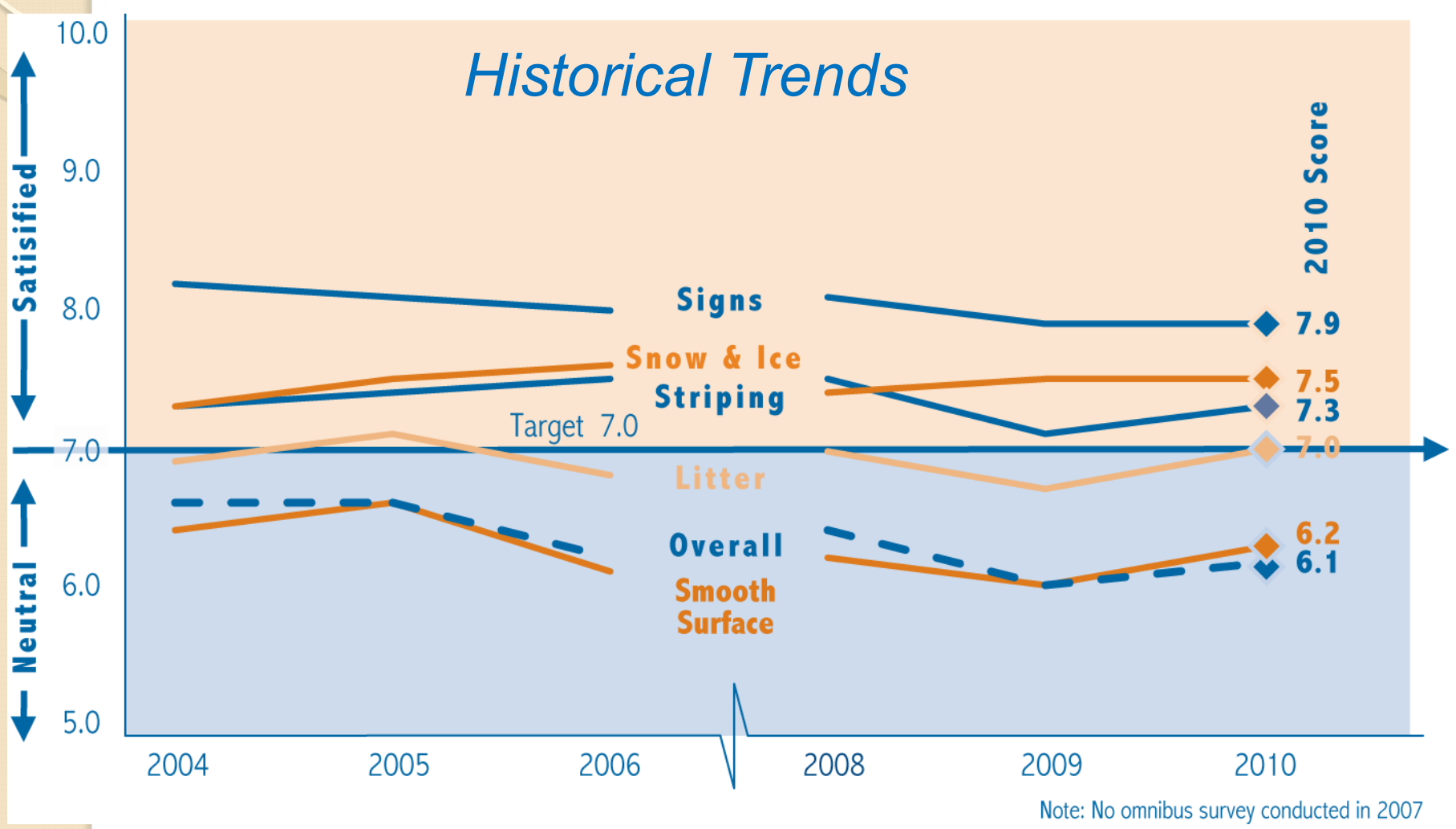
MnDOT Market Research & William & Kaye, Inc.

Recent Customer Studies Addressing Smoothness of Roads

- Omnibus Tracking: Longitudinal Customer Ratings Related to Roads:
  - Confidence -- *"MnDOT's ability to do a good job at maintaining roads and bridges"*
  - Performance -- *"Keeping road surfaces smooth and comfortable"*
  - Road Surface – *Poor rating: "Is it the general condition of pavement or potholes?"*
- Online Customer Surveys ~ In Depth Understanding of Road Perceptions and Surfaces:
  - Visual
  - Behavioral
  - Actual Road Smoothness Test -- "Ride Along Study"

OMNIBUS TRACKING ~ Maintenance Performance Measures

I want to know HOW WELL you think MnDOT is doing in each area. Use any number from 1 to 10; a '10' means they are doing an 'Extremely good' job in this area, and '1' means they are doing an 'Extremely poor' job in this area.



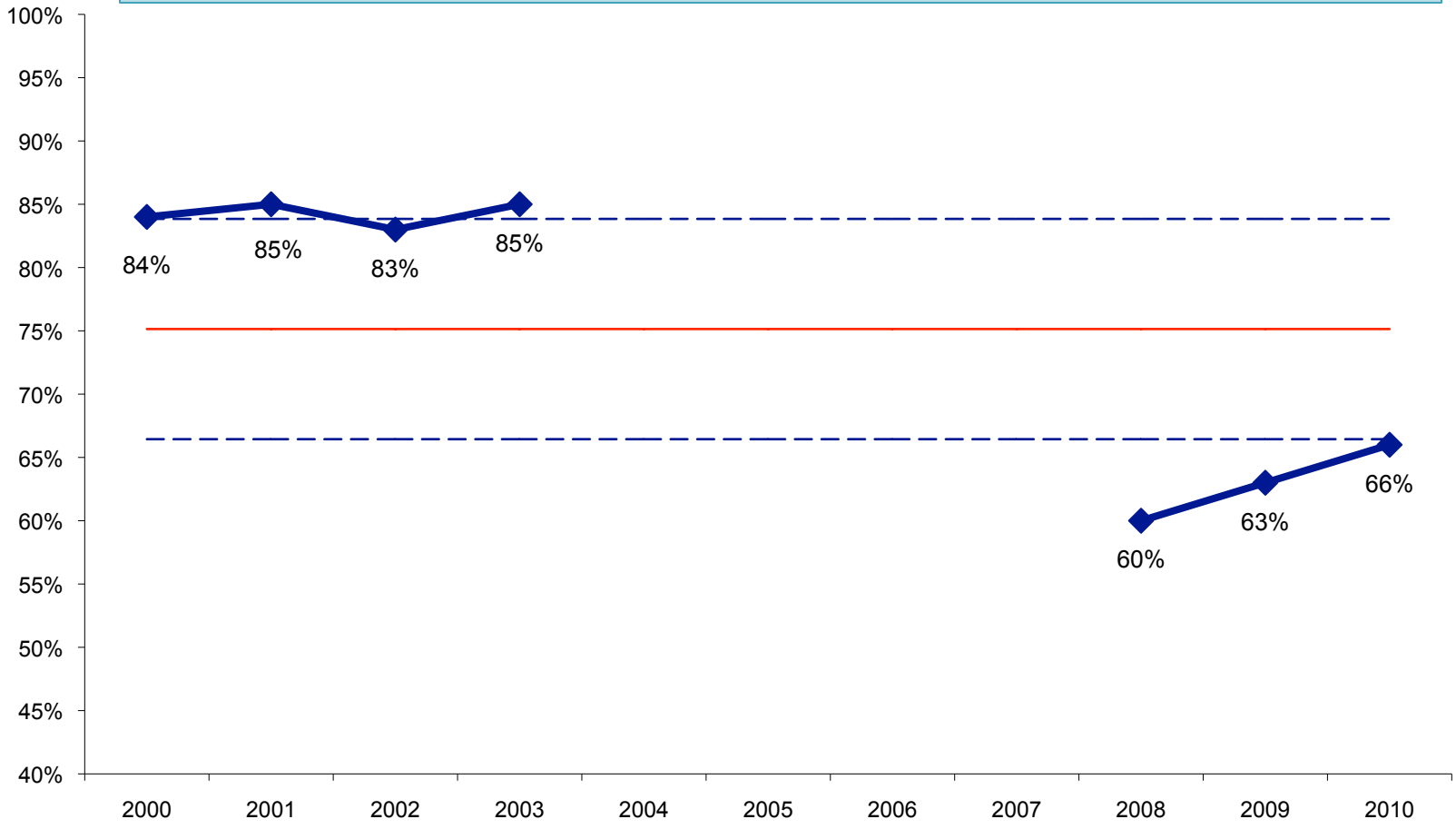
n=800

OMNIBUS TRACKING ~ Public Confidence

Q1. How CONFIDENT are you today in MnDOT's ability to do a good job at…?

"Maintaining Roads and Bridges"

Public confidence in MnDOT's "ability to do a good job at maintaining roads and bridges" declined sharply however perceptions are starting to recover.



Number of Respondents = 800

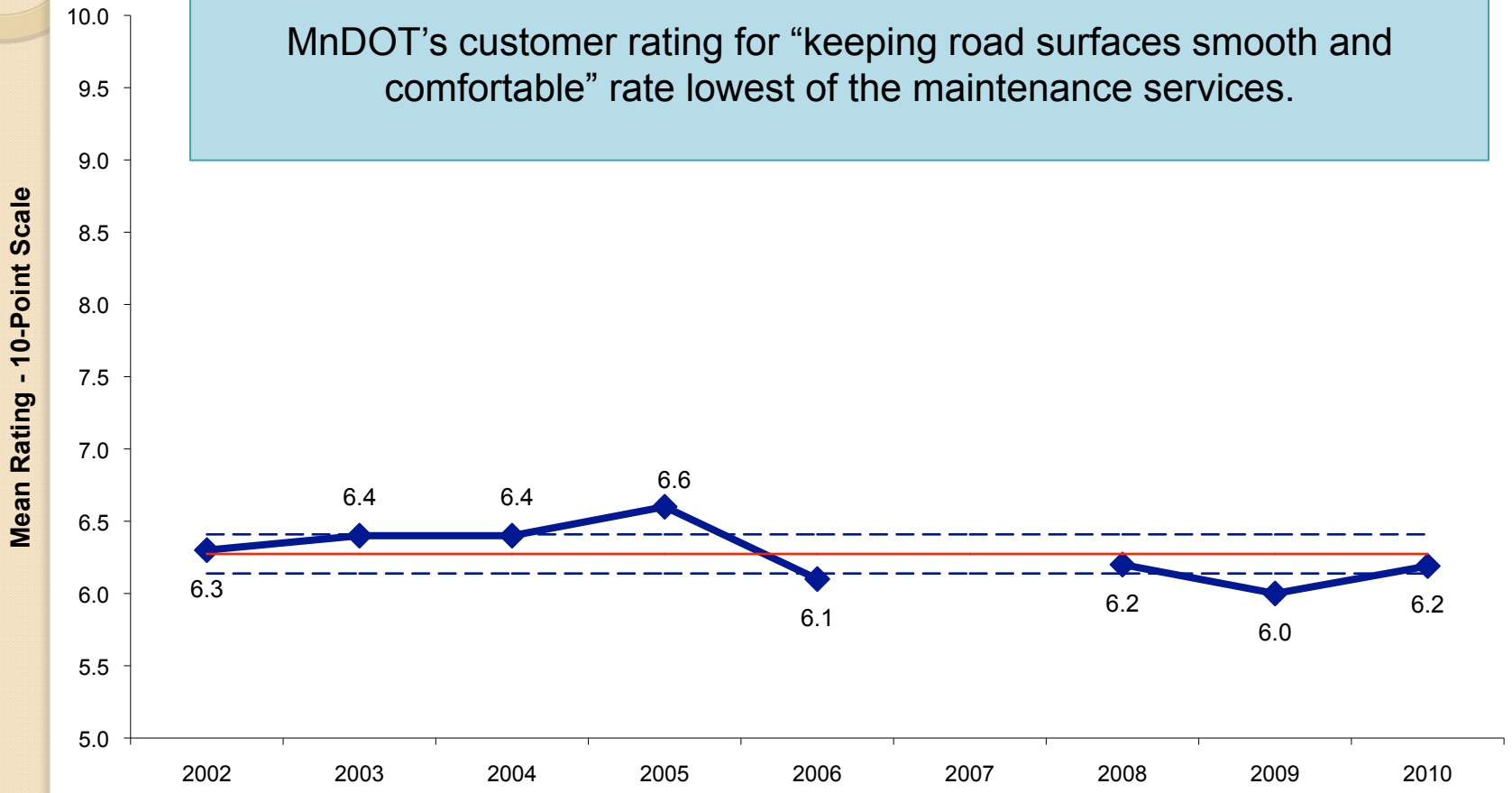
Scale: 1 = Not at all confident, 4 = Very confident

OMNIBUS TRACKING ~ Maintenance Performance

My next questions are about MnDOT's PERFORMANCE. For each service I read, I want to know HOW WELL you think MnDOT is doing in that area. Overall, how well has MnDOT been doing at…?

"Keeping Road Surfaces Smooth and Comfortable"

MnDOT's customer rating for "keeping road surfaces smooth and comfortable" rate lowest of the maintenance services.



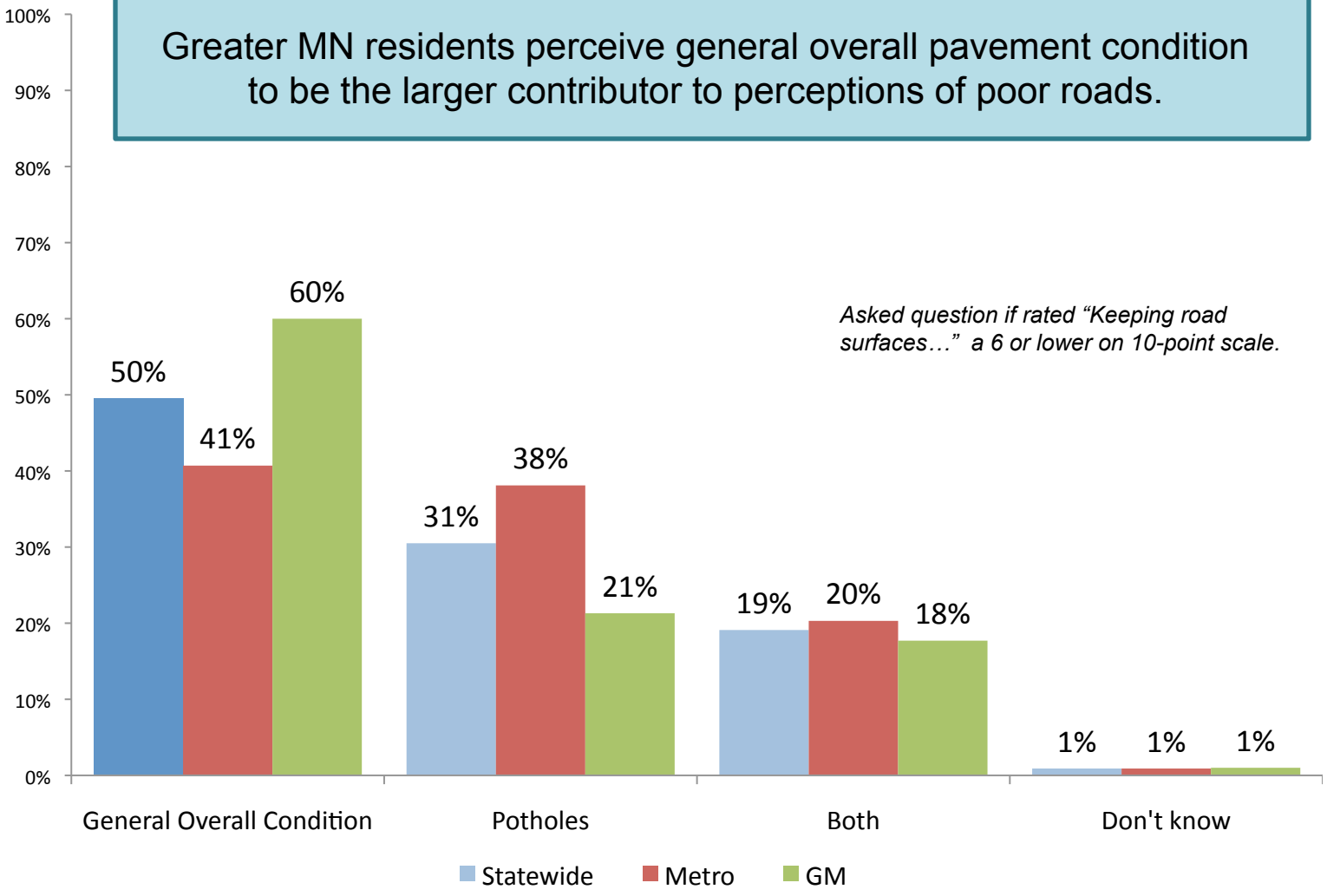
Number of respondents = 800

Rating Scale: 1 = Extremely poor job, 10 = Extremely good job
MnDOT Target = 7.0

Maintenance Performance – Smooth Road Surface Understanding

Q3c. Was your rating for "Keeping road surfaces smooth and comfortable" based on…? the general or "overall" condition of the highway pavement itself? Potholes?

Greater MN residents perceive general overall pavement condition to be the larger contributor to perceptions of poor roads.



Asked question if rated "Keeping road surfaces…" a 6 or lower on 10-point scale.

426 Statewide, 232 Metro, 194 GM

Road Smoothness: In-Depth Customer Understanding

Road Smoothness – three studies were conducted in 2010 among a customer community used to gain in-depth understanding of experiences and perceptions related to road surface issues.

•**Visual:** Tested 14 pictures of progressively, worsening road conditions for reactions and anticipated behaviors if these conditions were seen through their windshield

•**Behavioral:** Do customers drive differently from what they see and feel?

•**Ride/Smoothness:** How closely does MnDOT's scoring system for road smoothness/roughness match that of customer's smoothness/roughness scores? A "Ride Along" study recently tested the customer smoothness/roughness scores against MnDOT's technical Road Quality Index [van RQI] measures.

Road Smoothness
Online Customer Survey

Behavioral:

•Nine out of ten drivers say they drive *differently* when seeing/confronted with a poor road condition in front of them.

•Customers tell us that driving on roads in poor condition causes them to drive differently – which includes driving defensively, slowing down and swerving to avoid cracks that make for an uncomfortable ride or could appear to damage their vehicles.

More frequently used words are shown in larger font.

Powered by Wordle.net

Customer definition of poor road conditions encompasses three dimensions

How It Looks	How It Feels	How It Sounds
– *"Potholes, cracks."*	– *"A very bumpy ride, uneven."*	– *"Excessive road noise."*
– *"Asphalt patches that aren't even with the rest of the roadway."*	– *"If my soda is spilling all over, the road is in poor condition."*	– *"Tire noise is louder and grating on the nerves."*
– *"Cracked, lumpy, dingy, dirty, uneven, visibly over-repaired."*	– *"Like driving through a mine field to avoid the holes."*	– *"So noisy that you can't hear the person sitting next to you."*
– *"Many fixes on the seams … looks like a spider web from multiple repairs."*	– *"Feels like you are driving over a washer board. Just constant shaking or vibrating of the wheel."*	– *"Sounds like you should cringe while driving because the car will need servicing after getting off the road."*
– *"Paint lines are difficult to see/worn."*	– *"Like you're riding atop an unbalanced clothes dryer as opposed to in a luxury automobile."*	– *"It sounds like you are riding a horse."*

“Ride Along” Study
Background & Purpose

Annually, Minnesota highway road surface data is collected to generate the Ride Quality Index (RQI)

- RQI represents ratings customers would give road surface smoothness.
- Since 1997, rating scores of 2.0 or less have represented road surfaces in “Poor” condition – identifying repair or replacement.
- 2009 Omnibus Study – road smoothness measure received lowest customer rating.

Study Purpose:

- Request for pavement surface measures to be updated – by collecting ratings by from customers on current road conditions.
- Information will inform the alignment of customer smoothness measures with that of RQI/Van measures.

Methodology

Four "Ride-Along" sessions held November 2-3, 2010

- Both days with one morning and one afternoon session

46 Metro Area Residents (primarily)

- Gender and age quotas applied
- Customers were driven over pre-selected metro area roads, in state vehicles, driven by MnDOT employees

31 separate road sections selected

- Each approximately ½ mile in length
- Representing a variety of roads and road conditions
- Followed the same pre-selected route over the 31 road sections

Six state cars of same make, model and year driven

- Tire pressure identical for all cars; measured/calibrated before sessions
- All cars left the MnDOT Maplewood Office at same time; caravan
- Driven at the posted speed on each road

Six Mn/DOT employees rode shotgun serving as "navigators"

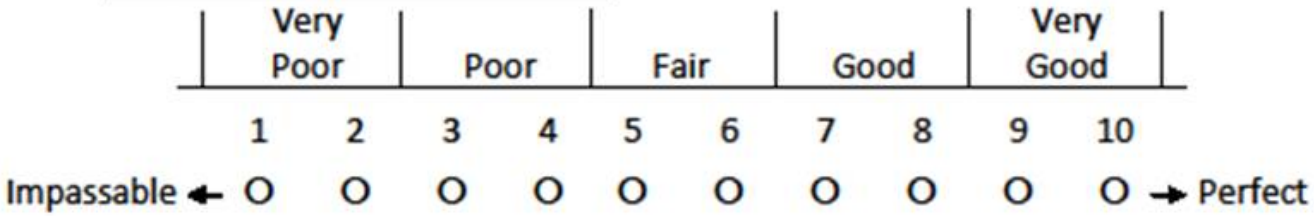
- Instructing customers when car was approaching and entering a road section, and when to complete each road section evaluation

"Ride-Along" Customer Survey Questions

Questions completed for all 31 pavement sections

1. Using the following scale, which measure best tells us how you evaluate the smoothness or roughness of this section of road?

   Completely fill in one circle below.



2. In your opinion, is this section of road (the one just scored) in need of repair?
   Completely fill in one circle below.

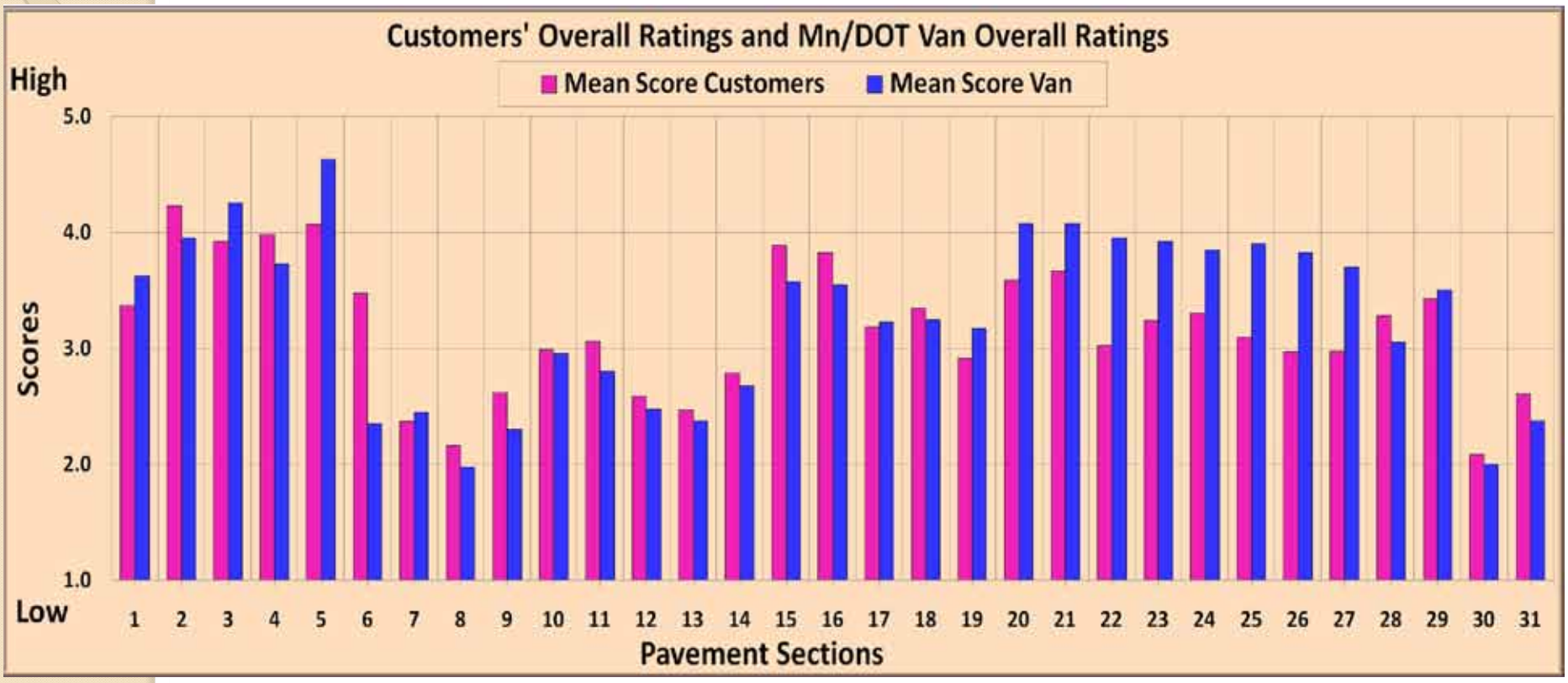
   O Yes
   O No

3. In your opinion, is this section of road (the one just scored) acceptable or unacceptable?
   Completely fill in one circle below.

   O Acceptable
   O Unacceptable

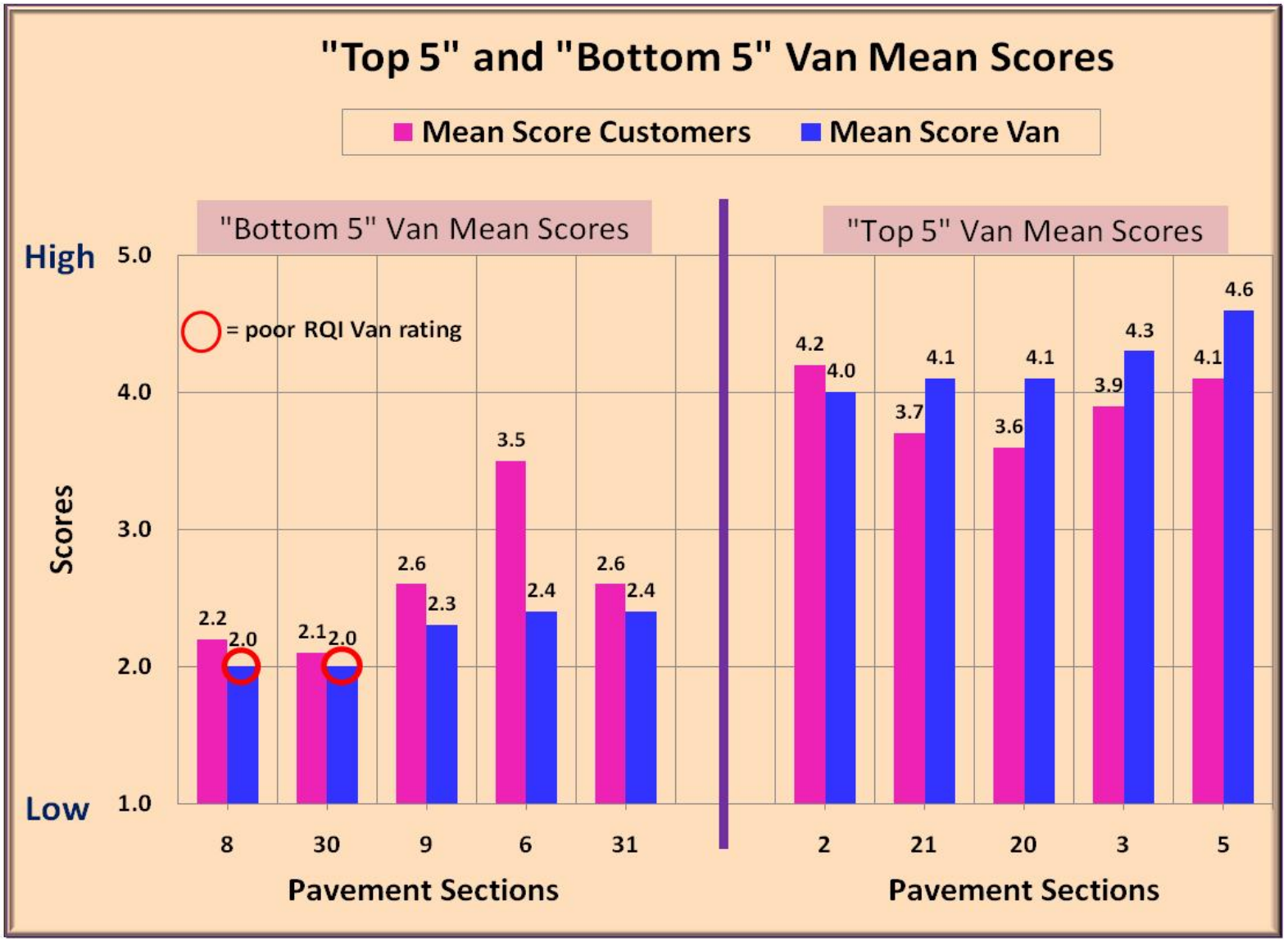
Customers' Smoothness Ratings Compared with MnDOT's RQI Ratings

Customers' road smoothness scores align closely with MnDOT's pavement surface smoothness scores [van calculated, RQI] -- for most of the 31 pavement sections evaluated.



Composite of All Pavement Sections	Mean Score Customers	Mean Score Van
Average	3.2	3.3

Customer ratings closely approximate the van's ratings. Among the 31 sections tested, 30 & 8 were the lowest scored pavement sections.



Customers' Overall Mean Scores for Pavement Sections Compared with MnDOT's Definition of "Good" [Van Mean Rating Scores]

(Ranked High to Low by Van Mean Scores)

MnDOT van mean scores above 3.0 ("Good") – shown primarily in shades of green and yellow – align closely with customers' perceptions of pavement smoothness.

Nearly all pavement sections rated above 3.0 by the van are rated above 3.0 by the customers. Similarly, the two pavements with the lowest ["poor"] van scores also garnered the lowest customer scores.

Van RQI Good

Pavement Sections	5	3	20	21	2	22	23	25	24	26	4	27	1	15	16	29	18	17	19	28	10	11	14	12	7	13	31	6	9	30	8
Mean Score Customers	4.1	3.9	3.6	3.7	H 4.2	3.0	3.2	3.1	3.3	3.0	4.0	3.0	3.4	3.9	3.8	3.4	3.3	3.2	2.9	3.3	3.0	3.1	2.8	2.6	2.4	2.5	2.6	3.5	2.6	L 2.1	2.2
Mean Score Van	H 4.6	4.3	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.3	3.2	3.2	3.1	3.0	2.8	2.7	2.5	2.5	2.4	2.4	2.4	2.3	L 2.0	L 2.0

Van RQI Good

Van RQI Poor

Converted 5-Point Mean Score Customers	Highest Rated Score	Midpoint Rated Score	Lowest Rated Score
	4.2	3.2	2.1

Customer Rating Scores for Pavement Smoothness
The higher rated scores are illustrated in the green color range
The average rated scores are illustrated in the yellow color range
The lower rated scores are illustrated in the red color range

* *L = Low H = High*

MnDOT's Definition of "Good" (RQI Greater than 3.0) Compared with Percent of Customers Who Consider Pavement Sections NOT "In Need of Repair"

(Ranked High to Low by Van Mean Scores)

Customers consistently rate "Good" pavement sections (MnDOT RQI score above 3.0) as pavement sections NOT "in need of repair."

Van RQI "Good"

Pavement Sections	5	3	21	20	2	22	23	25	24	26	4	27	1	15	16	29	18	17	19	28	10	11	14	12	7	13	31	6	9	30	8
Mean Score Van	**4.6**	**4.3**	**4.1**	**4.1**	**4.0**	**4.0**	**3.9**	**3.9**	**3.9**	**3.8**	**3.7**	**3.7**	**3.6**	**3.6**	**3.6**	**3.5**	**3.3**	**3.2**	**3.2**	**3.1**	3.0	2.8	2.7	2.5	2.5	2.4	2.4	2.4	2.3	2.0	2.0
% NOT In Need of Repair	98	100	98	93	100	78	85	76	85	74	100	76	87	100	98	89	93	87	72	87	72	74	57	54	46	48	59	98	57	35	30
Mean Score Customers	4.1	3.9	3.7	3.6	4.2	3.0	3.2	3.1	3.3	3.0	3.9	3.0	3.4	3.9	3.9	3.3	3.3	3.2	2.9	3.3	3.0	3.1	2.8	2.6	2.4	2.5	2.3	3.5	2.6	2.4	2.2

Highlighted cells are pavement surfaces identified as "Good" scores from Van [greater than 3.0]

Percent of Customers Who Consider Pavement Sections "In Need of Repair"

(Ranked From Low to High by Customer Mean Scores)

Clearly, customers who rate a pavement section close to a 2.0 or less ("Poor," as defined by MnDOT) also identify that pavement section as "in need of repair." They also perceive pavement sections receiving van ratings of 2.1 to 2.7 as likely in need of repair.

"Poor" RQI classification 2.0 or less

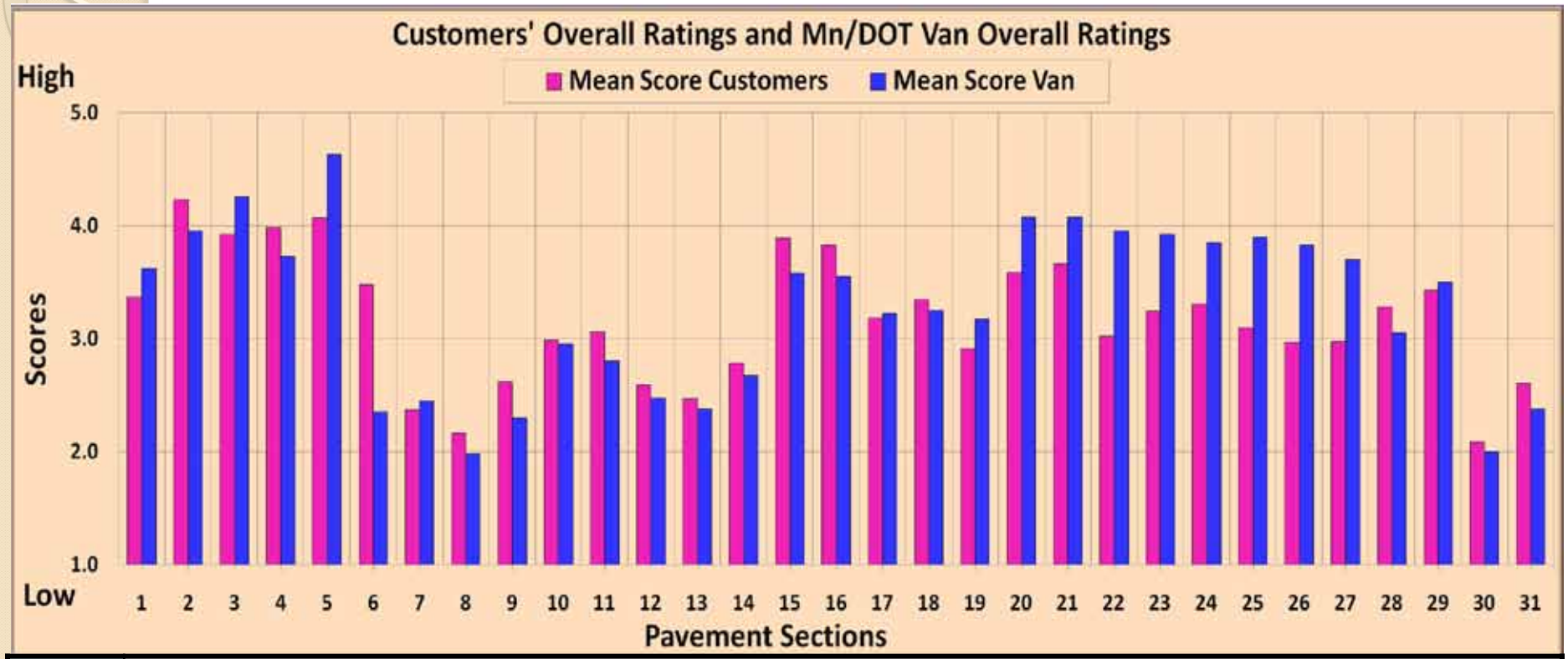
Pavement Sections	Pavement Type	In Need of Repair %	Mean Score Van	Mean Score Customers
30	CON	65	2.0	2.1
8	BIT	70	2.0	2.2
7	BIT	54	2.5	2.4
13	BIT	52	2.4	2.5
9	BIT	43	2.3	2.6
12	BIT	46	2.5	2.6
31	CON	41	2.4	2.6
14	BIT	43	2.7	2.8
19	BIT	28	3.2	2.9
10	BIT	28	3.0	3.0
22	CON	22	4.0	3.0
26	CON	26	3.8	3.0
27	CON	24	3.7	3.0
11	BIT	26	2.8	3.1
25	CON	24	3.9	3.1
17	BIT	13	3.2	3.2

Pavement Sections	Pavement Type	In Need of Repair %	Mean Score Van	Mean Score Customers
CONTINUED				
23	CON	15	3.9	3.2
18	BIT	7	3.3	3.3
24	CON	15	3.9	3.3
28	CON	13	3.1	3.3
1	BIT	13	3.6	3.4
29	BIT	11	3.5	3.4
6	BIT	2	2.4	3.5
20	CON	7	4.1	3.6
21	CON	2	4.1	3.7
16	BIT	2	3.6	3.8
3	CON	0	4.3	3.9
15	BIT	0	3.6	3.9
4	BIT	0	3.7	4.0
5	CON	2	4.6	4.1
2	BIT	0	4.0	4.2

Red = More than 40% of customers perceive pavement section as "in need of repair"

Customers' Smoothness Ratings Compared with MnDOT's RQI Ratings

An "in need of repair" rating of from customers does not *automatically* mean that a pavement section is also unacceptable to them.



Pavement Sections	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
% In Need of Repair	13	0	0	0	2	2	54	70	43	28	26	46	52	43	0	2	13	7	28	7	2	22	15	15	24	26	24	13	11	65	41
% Acceptable	96	100	100	100	100	98	76	59	83	87	93	80	74	83	100	100	98	98	87	96	100	98	91	98	91	93	89	93	98	57	80

Summary of Customer Feedback Related to Road Surface/Smoothness

qCustomer confidence in MnDOT's "*ability to do a good job at maintaining roads and bridges"* is beginning to recover.

qRoad smoothness customer ratings continue to be the lowest of all the maintenance services MnDOT provides.

qNine in ten Minnesotans express that they *drive differently* based upon what the road surface looks like through their windshield and feels like as they're driving over it. Customers make smoothness of road judgments based upon what it feels like, how it sounds *and* what they see ahead.

qCustomer road smoothness/roughness scores tightly align with that of MnDOT's existing [RQI] road surface scoring system.

“Ride Along” Key Findings

- For the 31 pavement sections evaluated customers’ pavement smoothness rating scores tightly align with MnDOT’s Ride Quality Index scores.
  - The composite of all customers’ mean scores is 3.2, all van scores is 3.3.
- The similarity of scores demonstrates that MnDOT’s definition of “Poor” (RQI rating of 2.0 or less) independently corresponds with the customers’ perceptions for “Poor” pavement.
- RQI’s ratings greater than 3.0, which MnDOT’s Defines as “Good” are also in line with pavement sections NOT perceived as needing repair
- Nearly all pavement sections rated above 3.0 by the van are also rated above 3.0 by the customers.
- Customers show some tolerance about the immediacy of repair when asked if roads are “acceptable” or “unacceptable”.

What's Next

- MnDOT will continue to track customer road-related perceptions and expectations.
- MnDOT Materials Office validates the RQI model.
- Study results shared with MnDOT Leaders.
- The results reported provide a reflection of road conditions in the Twin Cities and may not be a reflection of road conditions and perceptions in Greater Minnesota. It's recommended that this study be replicated in areas throughout Greater Minnesota.

Comparing Customers' Overall Pavement Smoothness Scores with MnDOT's RQI Rating System Scores

(Pavement Section Numbers Listed In Order Tested)

Customers' scores (using a 10-point scale) for evaluating perceptions of pavement smoothness were converted to a 5-point scale for comparability to the scale MnDOT uses to compute – RQI

RQI of "Poor" = a score of 2.0 or less; RQI of "Good" = a score higher than 3.0

Pavement Sections	Pavement Type	10-Point Mean Score Customers	*Converted* 5-Point Mean Score Customers	Mean Score Van
1	BIT	6.7	3.4	3.6
2	BIT	8.5	4.2 H	4.0
3	CON	7.8	3.9	4.3
4	BIT	8.0	4.0	3.7
5	CON	8.1	4.1	4.6 H
6	BIT	7.0	3.5	2.4
7	BIT	4.7	2.4	2.5
8	BIT	4.3	2.2	2.0 L
9	BIT	5.2	2.6	2.3
10	BIT	6.0	3.0	3.0
11	BIT	6.1	3.1	2.8
12	BIT	5.2	2.6	2.5
13	BIT	4.9	2.5	2.4
14	BIT	5.6	2.8	2.7
15	BIT	7.8	3.9	3.6
16	BIT	7.7	3.8	3.6

Pavement Sections	Pavement Type	10-Point Mean Score Customers	*Converted* 5-Point Mean Score Customers	Mean Score Van
		CONTINUED		
17	BIT	6.4	3.2	3.2
18	BIT	6.7	3.3	3.3
19	BIT	5.8	2.9	3.2
20	CON	7.2	3.6	4.1
21	CON	7.3	3.7	4.1
22	CON	6.0	3.0	4.0
23	CON	6.5	3.2	3.9
24	CON	6.6	3.3	3.9
25	CON	6.2	3.1	3.9
26	CON	5.9	3.0	3.8
27	CON	6.0	3.0	3.7
28	CON	6.6	3.3	3.1
29	BIT	6.8	3.4	3.5
30	CON	4.2	2.1 L	2.0 L
31	CON	5.2	2.6	2.4

* *L = Low H = High*

** *BIT = Bituminous CON = Concrete*

Converted 5-Point Mean Score Customers	Highest Rated Score	Midpoint Rated Score	Lowest Rated Score
	4.2	3.2	2.1

Customer Rating Scores for Pavement Smoothness

The higher rated scores are illustrated in the green color range

The average rated scores are illustrated in the yellow color range

The lower rated scores are illustrated in the red color range