



Transverse Macro-texture of Pavement Wheel Paths Relative to Other Surface Areas

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Presentation Outline

- ❑ Macro-Texture
- ❑ Longitudinal Macro-Texture Measurement
- ❑ Transverse Macro-Texture Measurement
- ❑ Longitudinal Texture Repeatability
- ❑ Longitudinal vs Transverse Macro-Texture
- ❑ Transverse Macro-Texture Index
- ❑ Conclusions and Recommendations



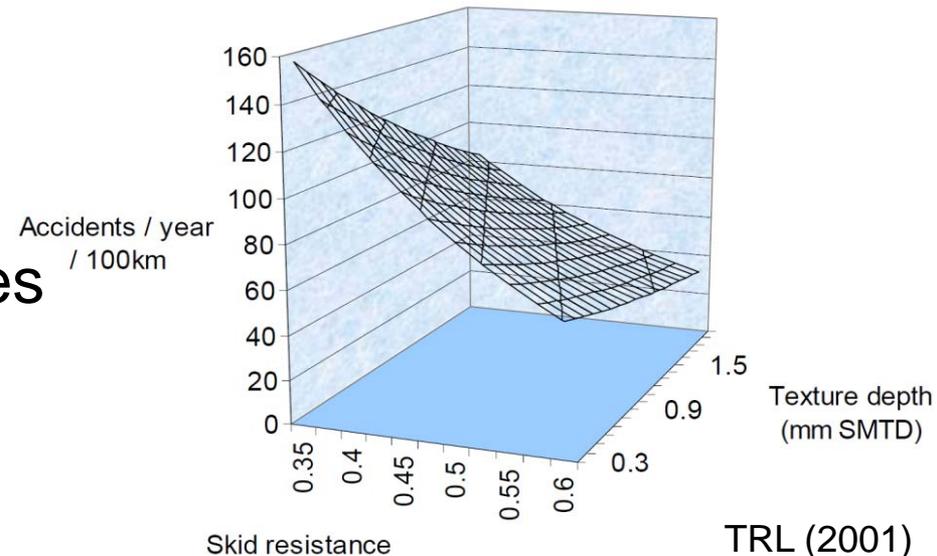
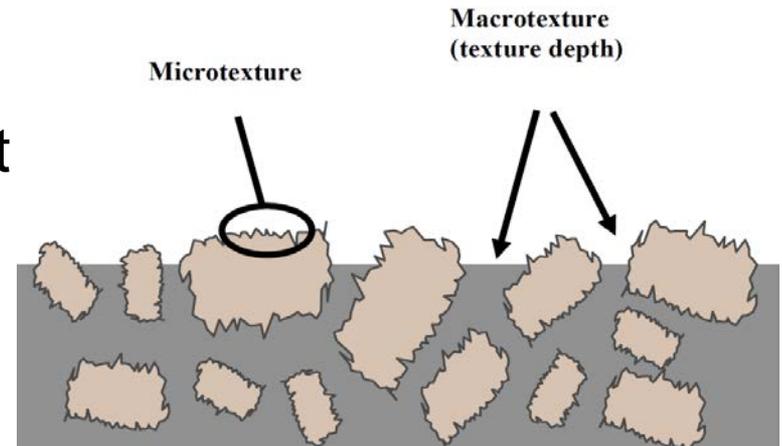
Macro-Texture

□ Macro-Texture

- a surface friction component
- splash and spray
- friction at higher speeds

□ Value in Texture Testing

- safety evaluation
- guide friction testing
- evaluation of noise
- surface types and patches



TRL (2001)

Longitudinal Macro-Texture

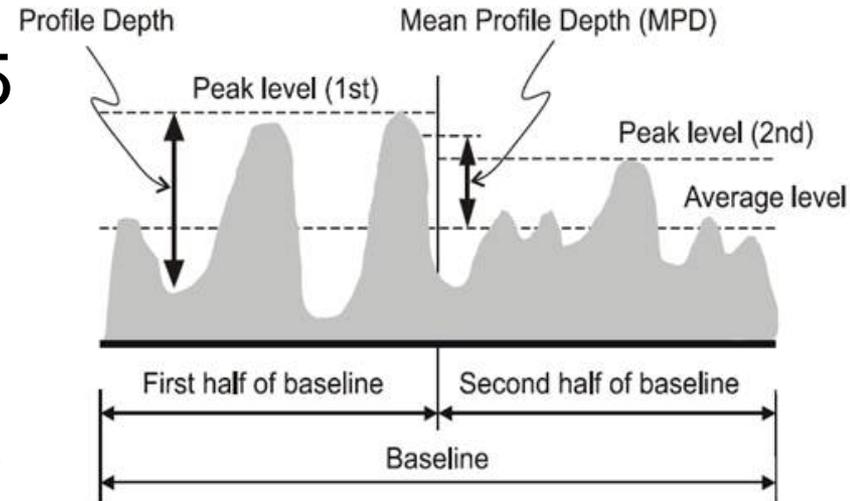


❑ Test Method: ASTM E1845

- ❑ laser profiler
- ❑ highway speeds
- ❑ mean profile depth (MPD)

❑ Texture changes over time

- ❑ traffic abrasion
- ❑ oxidation of asphalt surfaces
- ❑ particles clogging surface
- ❑ surface mix
- ❑ surface distresses
- ❑ surface treatment



Longitudinal vs Transverse

Transverse



area

longitudinal



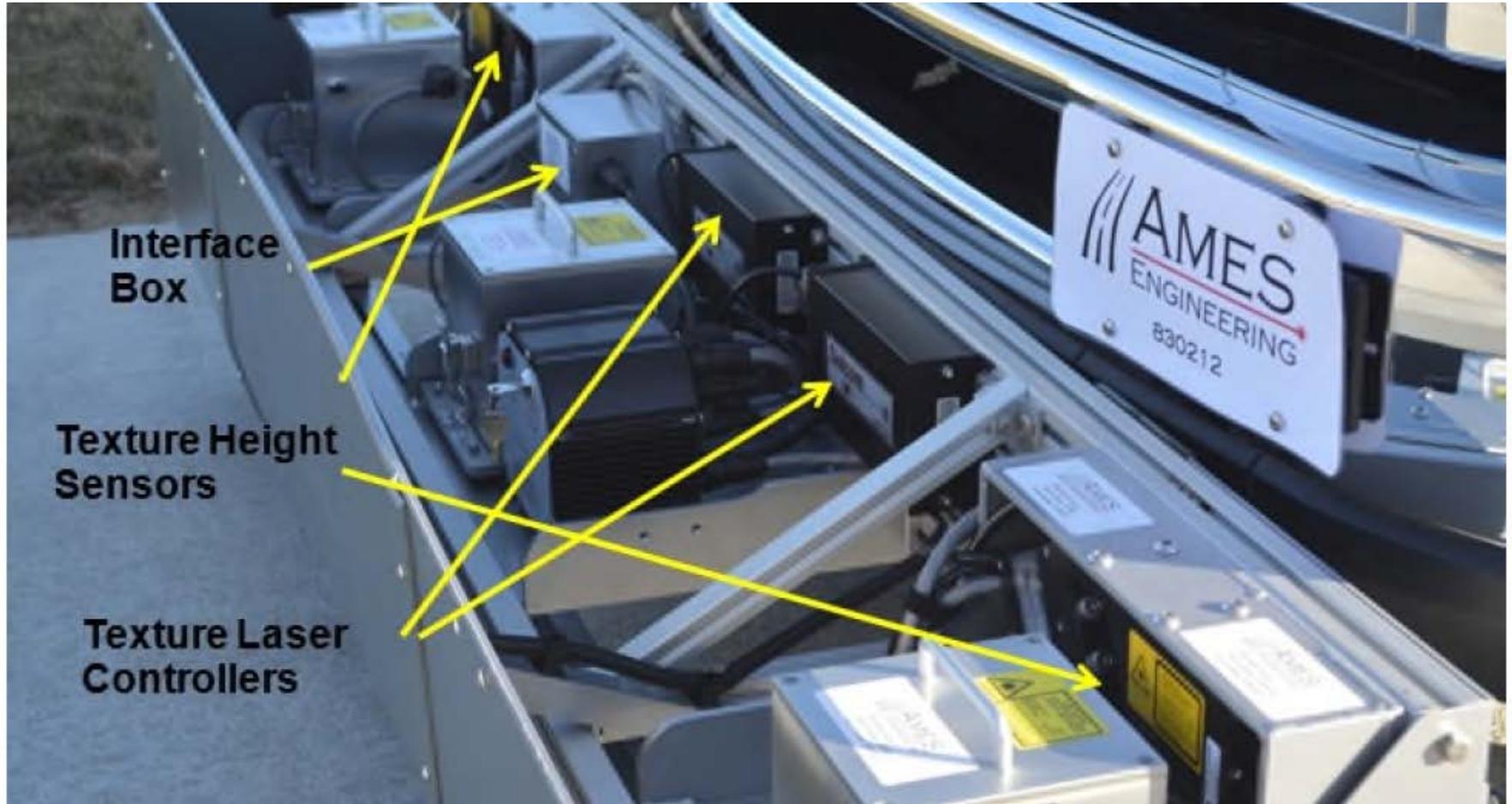
line

- ❑ Longitudinal texture depends on vehicle wander
- ❑ Transverse texture: an area as opposed to a line

Laurent et al. 2008



LTPP Data



Long-Term Pavement Performance (LTPP) Program



Longitudinal vs Transverse

- ❑ LTPP Section 48-0802 in Texas
- ❑ open-graded aggregate seal coat in 2011
- ❑ Longitudinal Macro-Texture: LTPP 5 runs @0.1m
- ❑ Transverse Macro-Texture: ARAN LCMS 1 run @1m

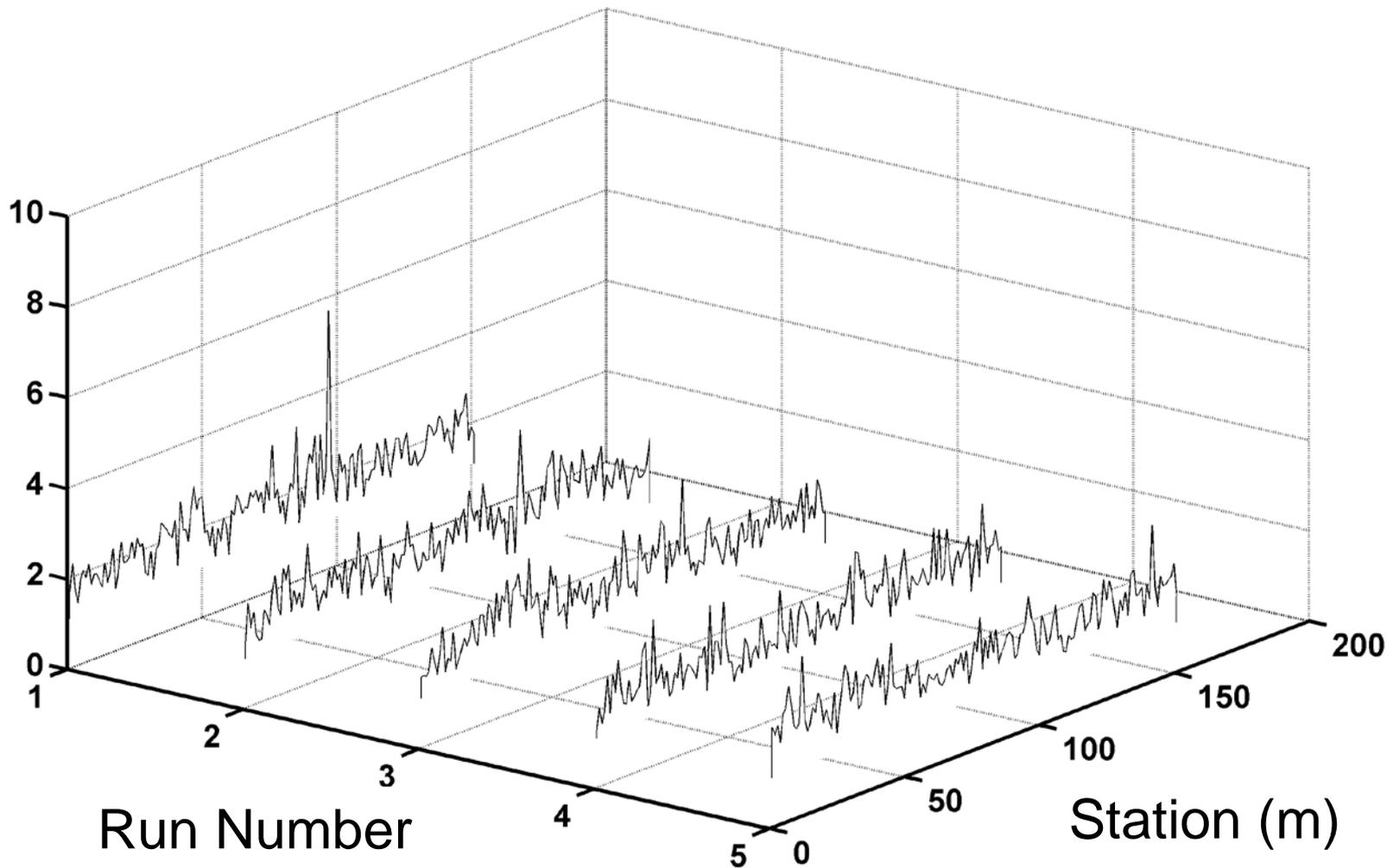




Longitudinal MPD – Multiple Runs

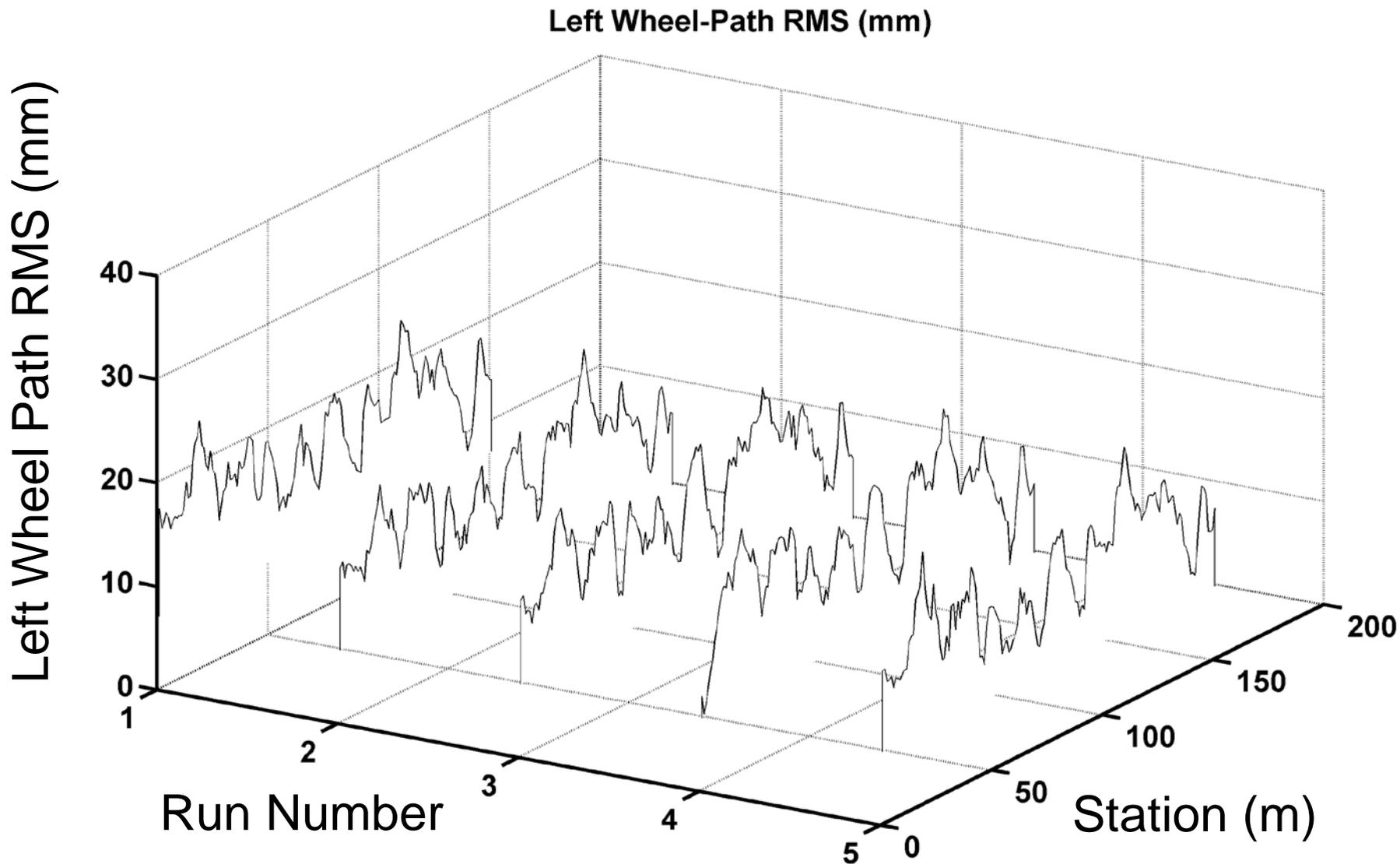
Left Wheel Path MPD (mm)

Left Wheel-Path MPD (mm)



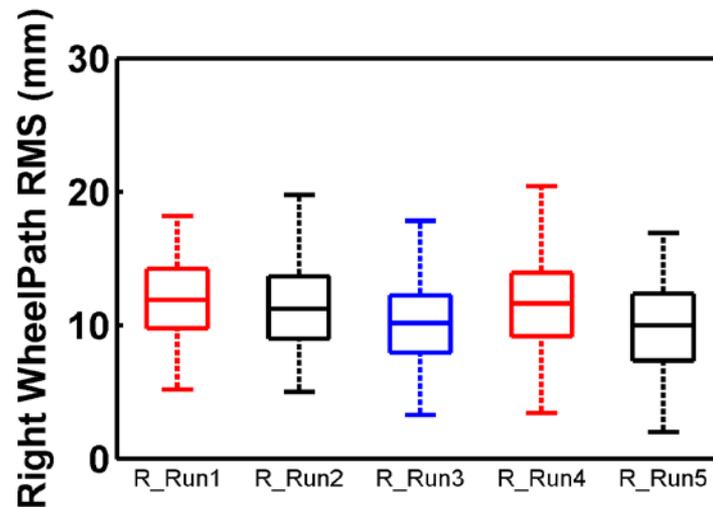
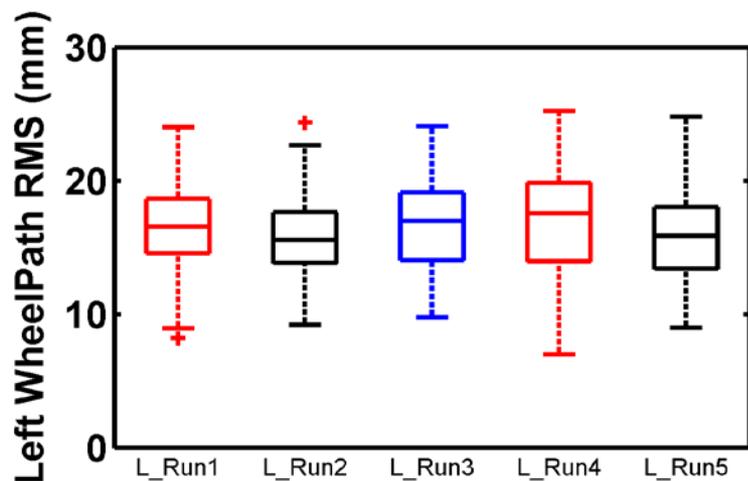
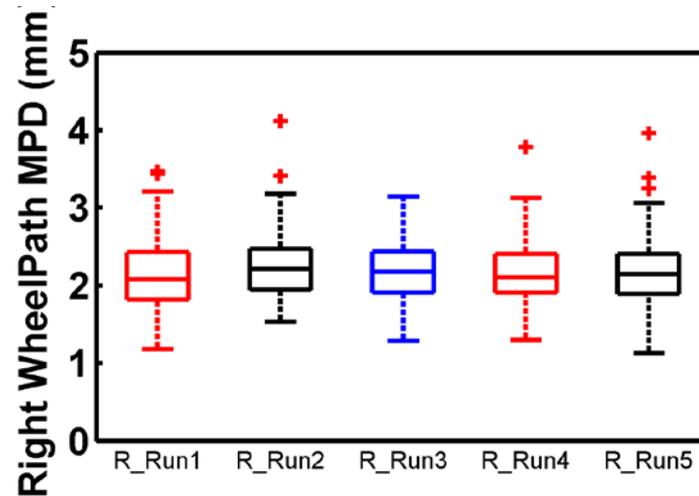
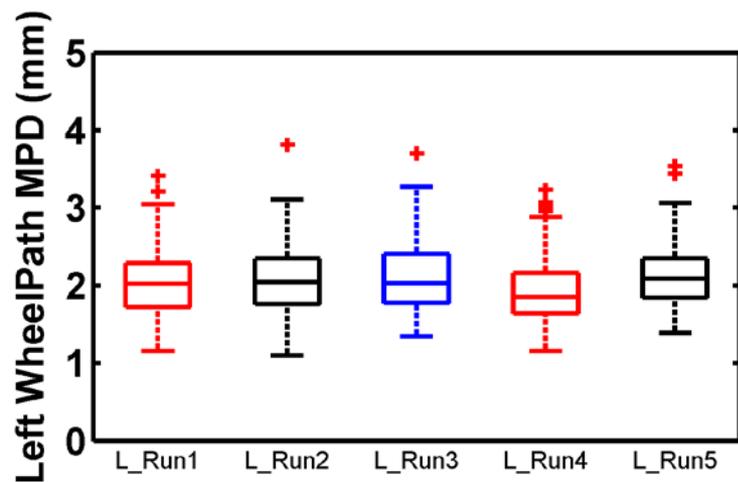


Longitudinal RMS – Multiple Runs

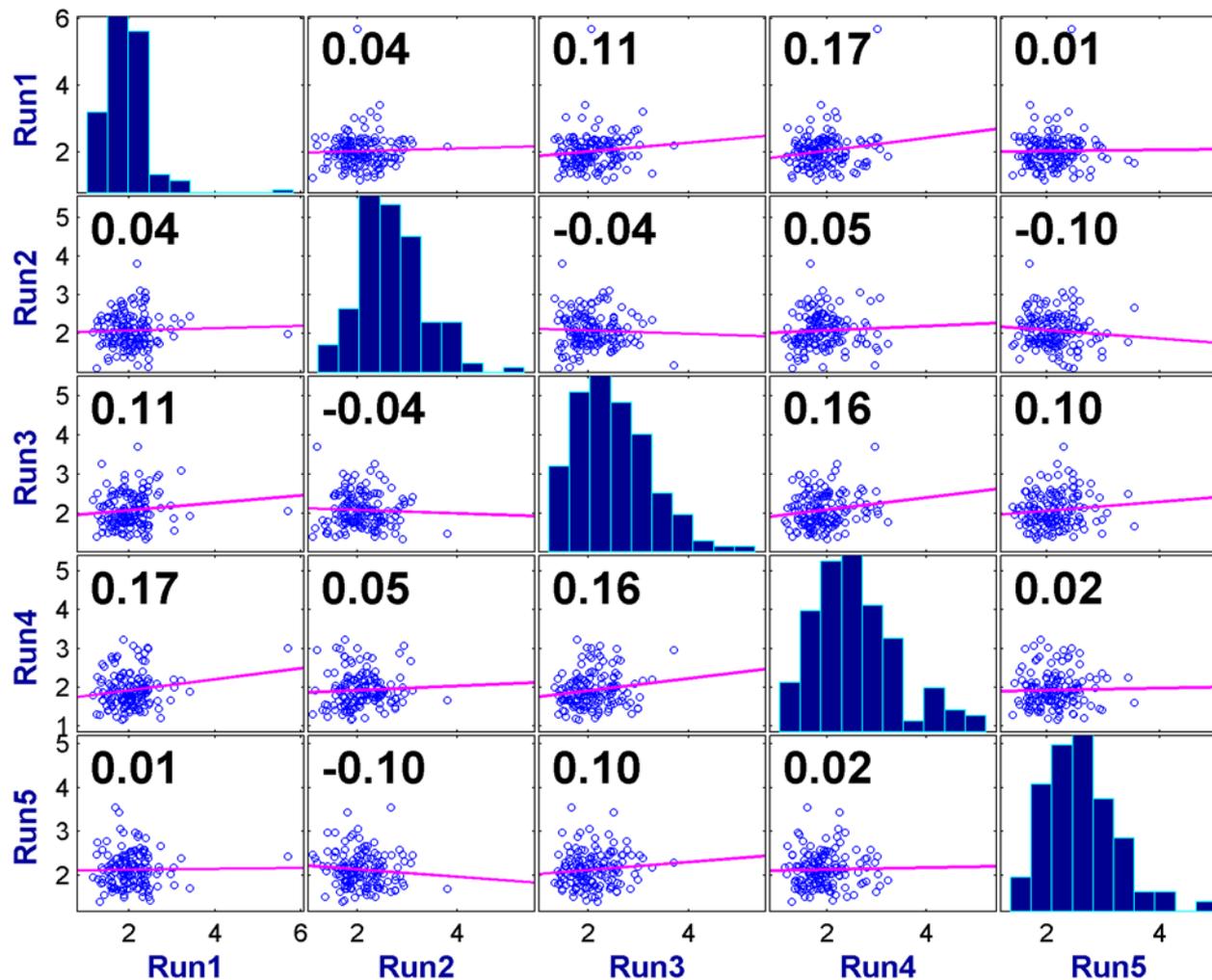




Multiple Longitudinal Runs



Longitudinal MPD – Multiple Runs



MPD (mm)

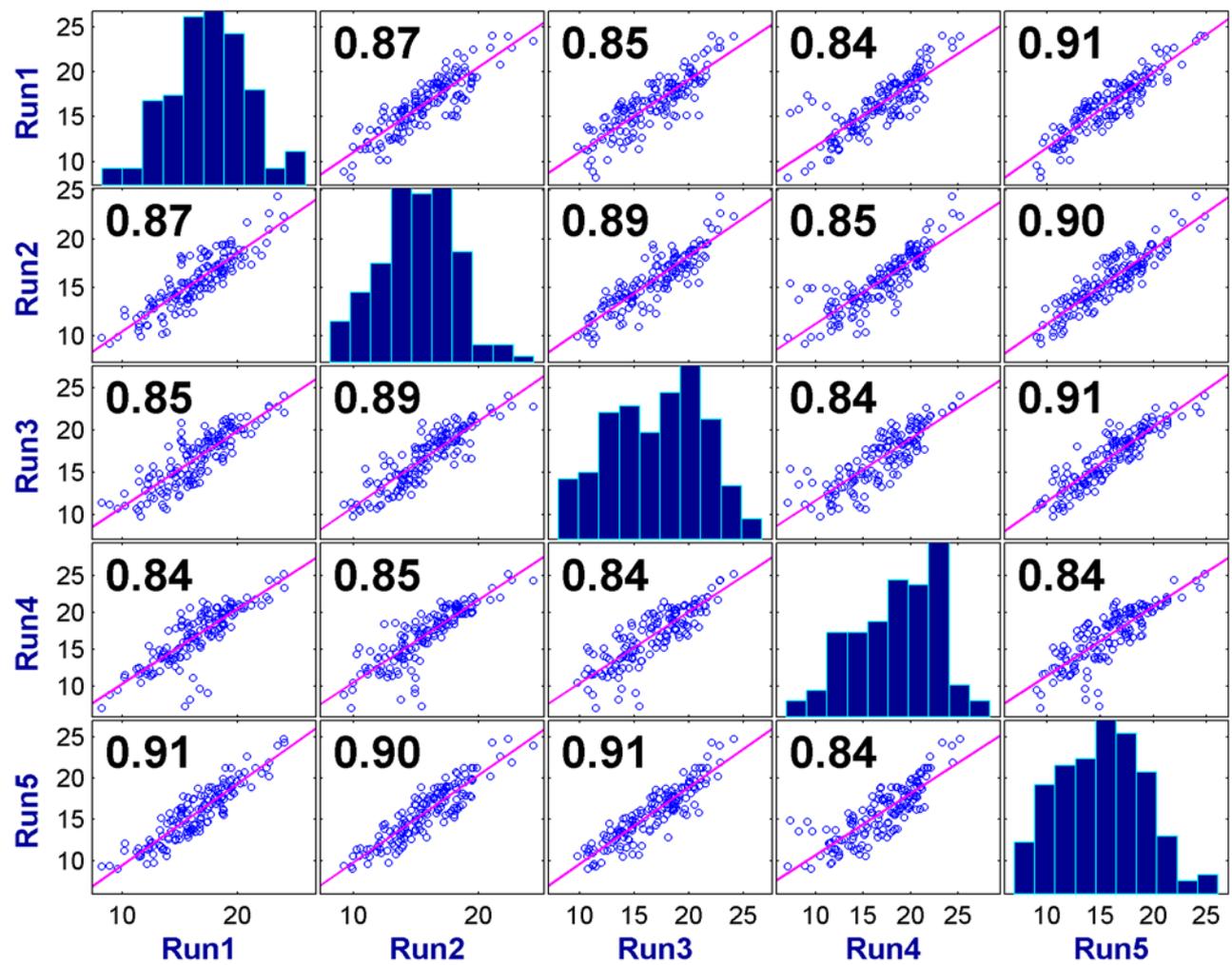
MPD (mm)



Longitudinal RMS – Multiple Runs



RMS (mm)

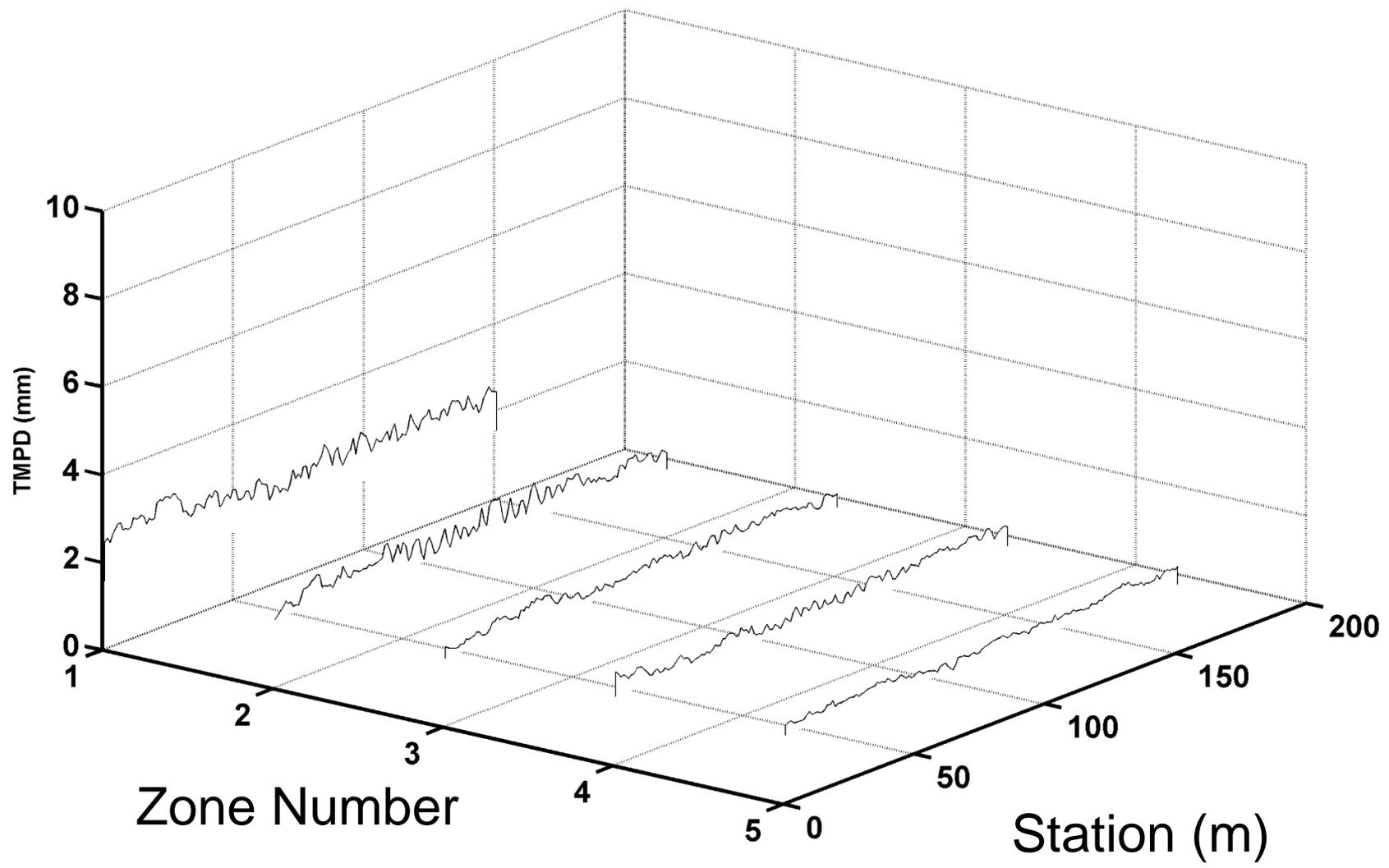


RMS (mm)



Transverse MPD

Variation of TMPD (mm) along the Section

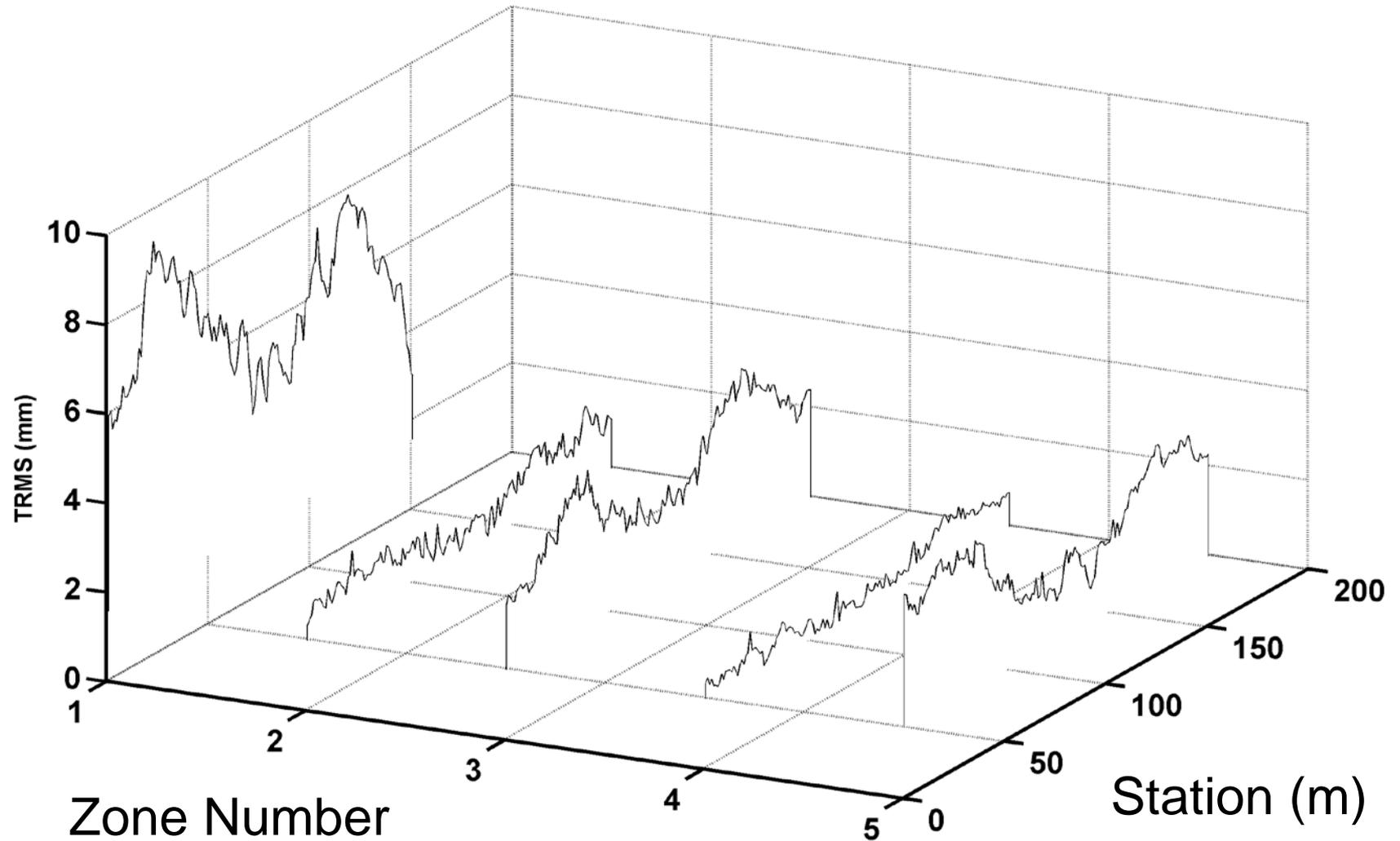




Transverse RMS

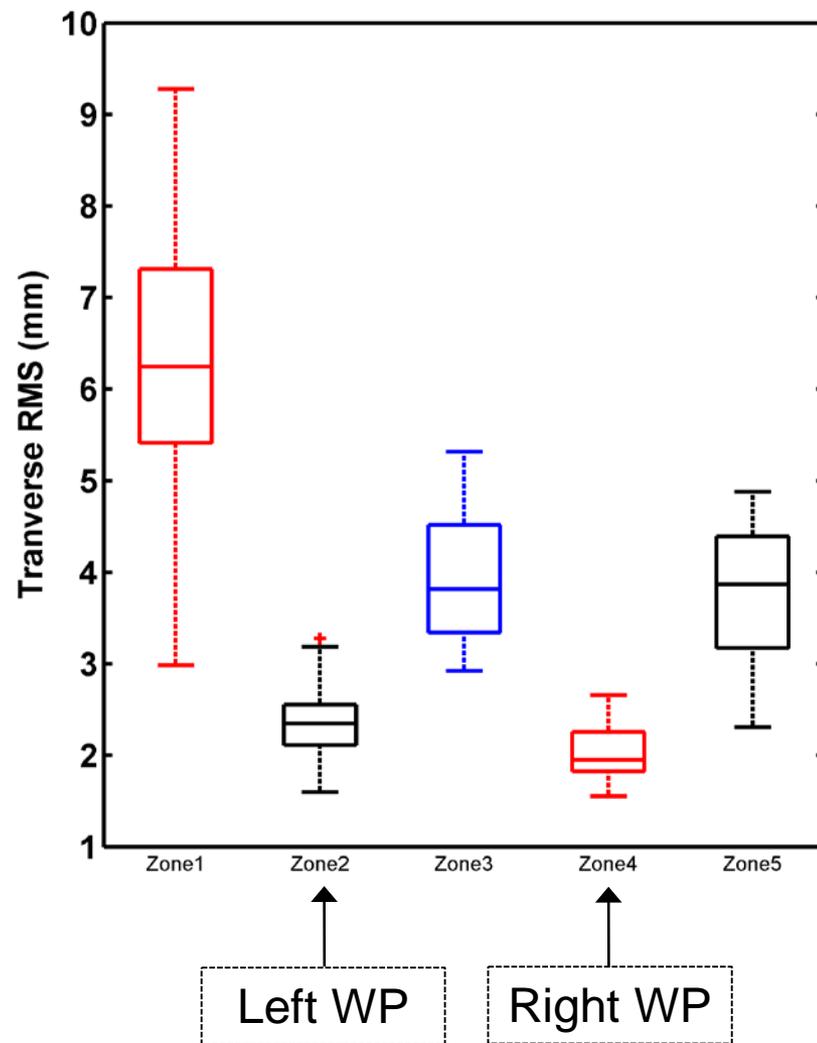
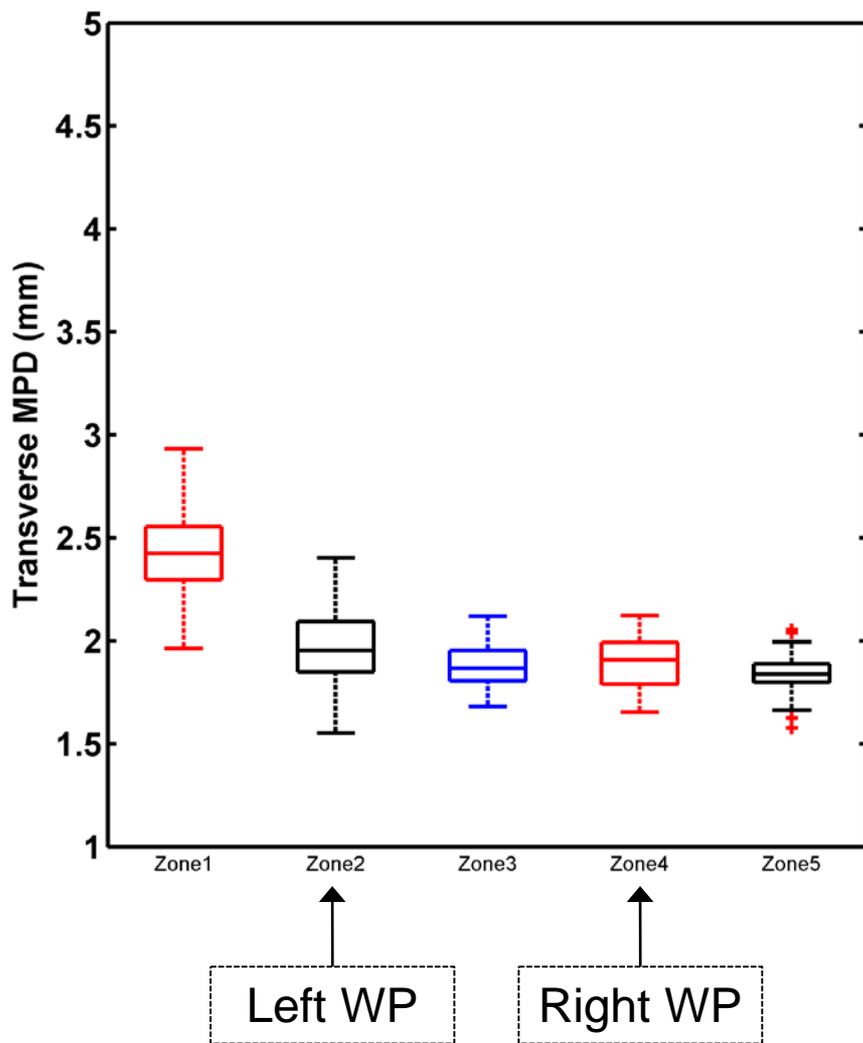


Variation of TRMS (mm) along the Section





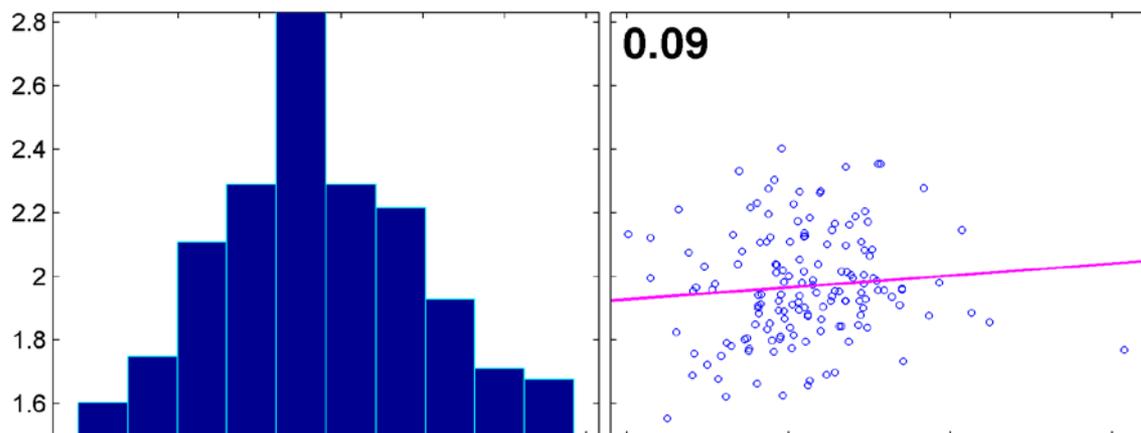
Transverse Macro-Texture



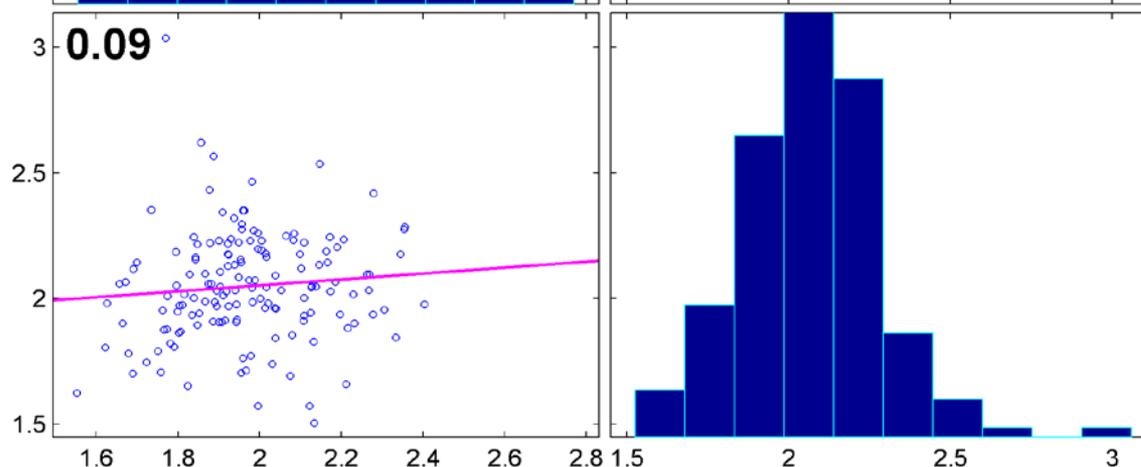


Longitudinal vs Transverse MPD

Transverse
MPD (mm)



Longitudinal
MPD (mm)



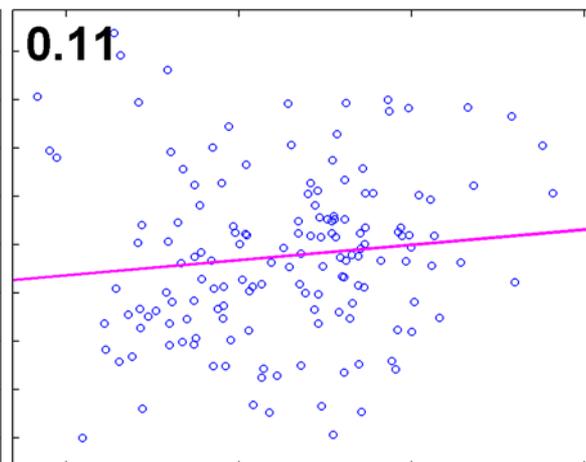
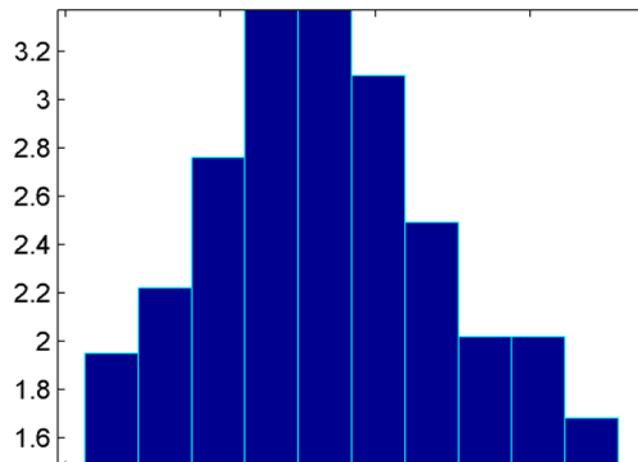
Transverse
MPD (mm)

Longitudinal
MPD (mm)

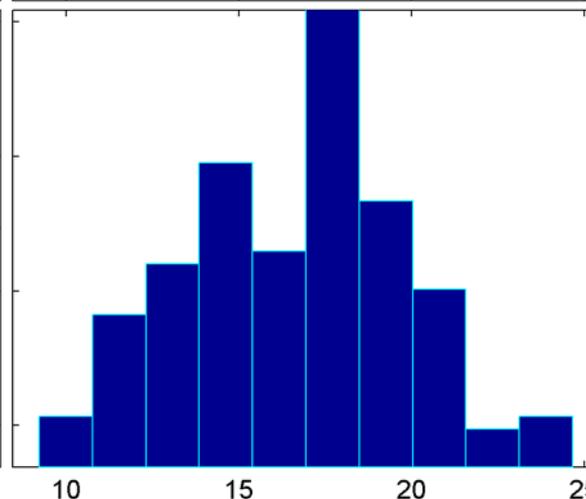
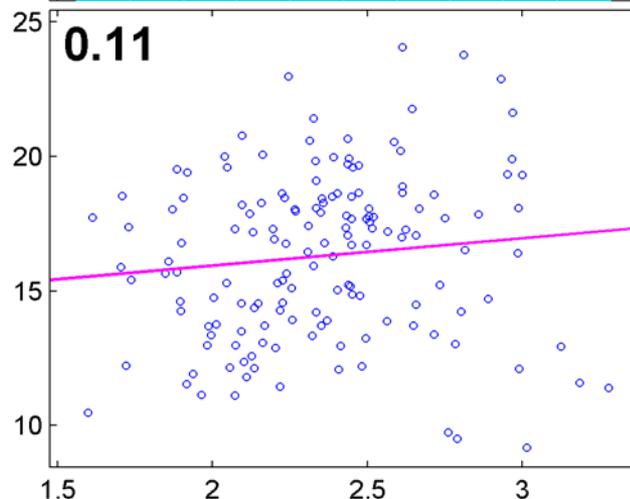


Longitudinal vs Transverse RMS

Transverse
RMS (mm)



Longitudinal
RMS (mm)



Transverse
RMS (mm)

Longitudinal
RMS (mm)



MPD and RMS

- ❑ MPD represents μ of texture distribution
- ❑ RMS represents σ in texture distribution
- ❑ Both are needed to explain the distribution



Lower RMS



Higher RMS



Transverse Macro-Texture Index

- Combine MPD and RMS information:

$$CoV = \frac{RMS}{MPD}$$

- Relative transverse CoV of left wheel path:

$$RCoV_{LWP}(\%) = 100 \times \frac{CoV_{LWP}}{CoV_C}$$

- Relative transverse CoV of right wheel path:

$$RCoV_{RWP}(\%) = 100 \times \frac{CoV_{RWP}}{CoV_C}$$

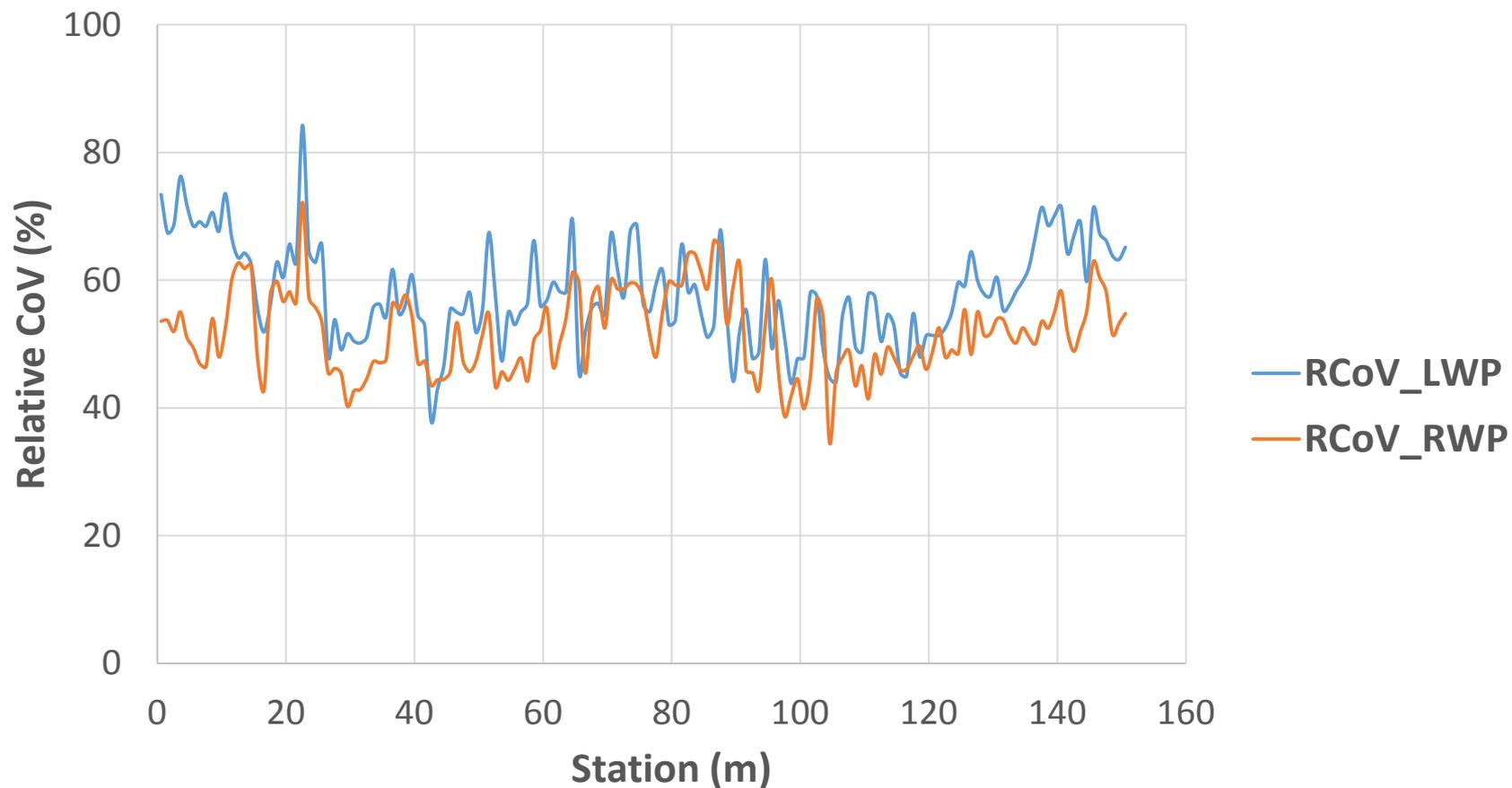
- Wheel path macro-texture benchmarked to the center
- Potentially indicating traffic abrasion



Transverse Macro-Texture Index



Relative Transverse CoV of Wheel Paths to the Center Zone



Conclusions and Recommendations

- ❑ Longitudinal RMS is more robust compared to MPD
- ❑ *Study of noise, spikes, filters, speed, outliers is needed*
- ❑ Transverse RMS highlights the difference between wheel paths and other surface areas better than MPD
- ❑ Longitudinal texture data cannot capture all of the transverse macro-texture information
- ❑ Transverse macro-texture index combines MPD and RMS and benchmarks the texture of the wheel paths to the center, indicating traffic abrasion
- ❑ *Further investigation of relative texture index, friction, and micro-texture is needed*



Statistical Parameters of Longitudinal Runs

LMPD2	AVG	STD	MAX	MIN	MED	LRMS2	AVG	STD	MAX	MIN	MED
Run1	2.03	0.50	5.70	1.16	2.02	Run1	16.44	3.06	24.01	8.22	16.58
Run2	2.08	0.43	3.81	1.10	2.04	Run2	15.69	2.83	24.36	9.21	15.58
Run3	2.08	0.43	3.70	1.34	2.03	Run3	16.68	3.24	24.08	9.77	16.98
Run4	1.92	0.43	3.23	1.16	1.85	Run4	16.87	3.73	25.21	7.00	17.55
Run5	2.12	0.38	3.54	1.39	2.09	Run5	15.81	3.32	24.79	9.00	15.87
AVG	2.05	0.44	4.00	1.23	2.01	AVG	16.30	3.23	24.49	8.64	16.51
LMPD4	AVG	STD	MAX	MIN	MED	LRMS4	AVG	STD	MAX	MIN	MED
Run1	2.17	0.69	8.84	1.18	2.08	Run1	11.97	3.12	18.17	5.16	11.87
Run2	2.24	0.43	4.12	1.53	2.21	Run2	11.44	3.21	19.75	5.02	11.23
Run3	2.20	0.39	3.14	1.28	2.18	Run3	10.01	3.03	17.83	3.28	10.17
Run4	2.17	0.41	3.78	1.30	2.10	Run4	11.54	3.61	20.40	3.40	11.64
Run5	2.16	0.42	3.96	1.13	2.15	Run5	9.84	3.49	16.89	1.96	9.99
AVG	2.19	0.47	4.77	1.28	2.14	AVG	10.96	3.29	18.61	3.76	10.98

Statistical Parameters of Transverse Run

TMPD	AVG	STD	MAX	MIN	MED
Zone1	2.44	0.20	2.93	1.96	2.42
Zone2	1.97	0.17	2.40	1.55	1.95
Zone3	1.87	0.10	2.12	1.68	1.87
Zone4	1.89	0.12	2.12	1.65	1.91
Zone5	1.84	0.08	2.06	1.58	1.84
AVG	2.00	0.13	2.33	1.69	2.00
TRMS	AVG	STD	MAX	MIN	MED
Zone1	6.35	1.29	9.28	2.98	6.24
Zone2	2.35	0.34	3.28	1.60	2.35
Zone3	3.91	0.64	5.32	2.92	3.81
Zone4	2.02	0.27	2.66	1.55	1.95
Zone5	3.78	0.70	4.88	2.31	3.87
AVG	3.68	0.65	5.08	2.27	3.64