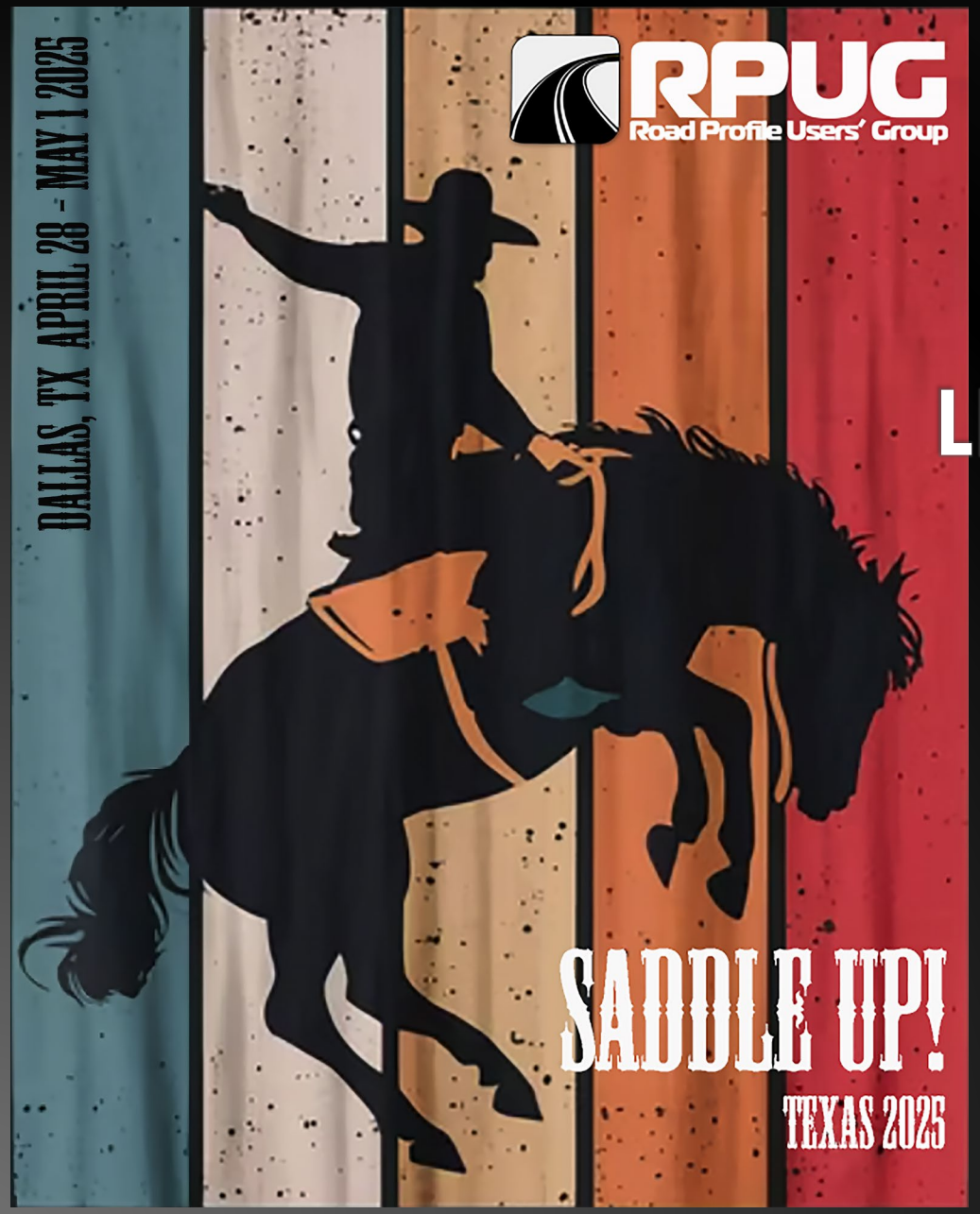

STATISTICAL ANALYSIS OF DIFFERENT SPATIAL SAMPLING ALTERNATIVES IN NETWORK-LEVEL PAVEMENT TEXTURE DATA

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RUOHAN LI, JORGE PROZZI, UNIVERSITY OF TEXAS AT AUSTIN

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Road Profile Users' Group

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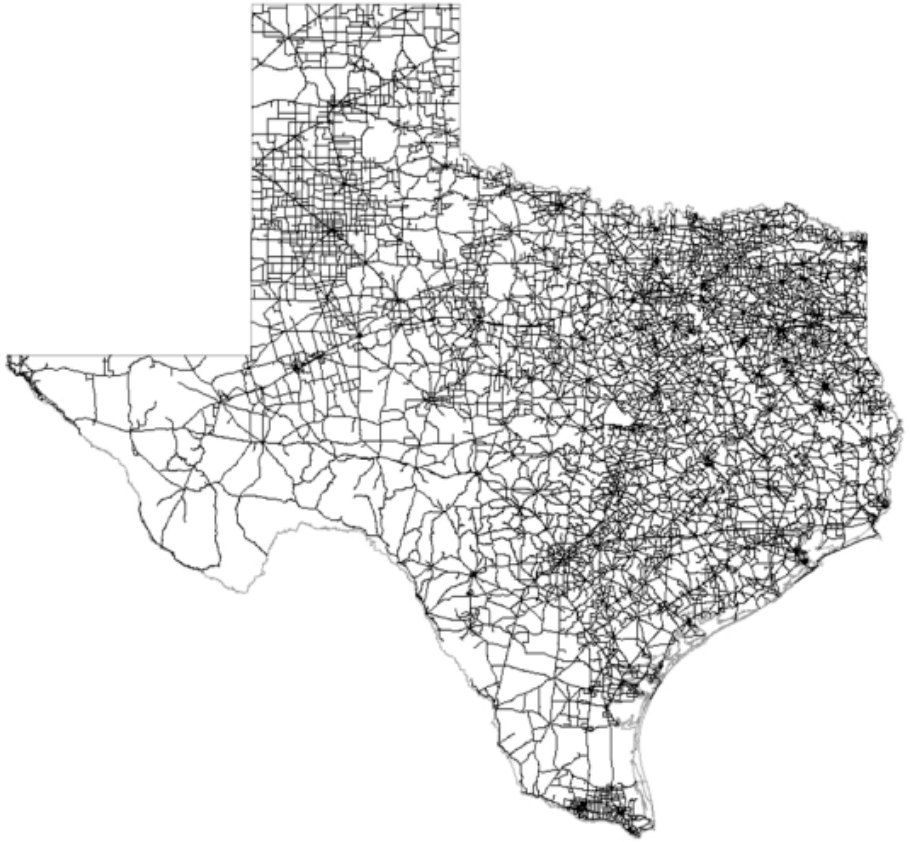
NETWORK-LEVEL TEXTURE DATA COLLECTION

- Timeframe
  - Started from FY2019, on an annual basis
- Coverage
  - FY2019: 2 districts involved, 4,840 miles
  - FY2020: 7 districts involved, 12,327 miles
  - FY2021~: All 25 districts full coverage, around 100,000 miles
  - Same lane to the distress data
- Data type
  - Macrotexture
- Data collector
  - Contracted vendor
- Data collection method
  - Highway speed
  - Line laser
  - Right wheelpath



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DATA FORMAT

- Two spatial sampling alternatives
  - Every 0.1 mile
  - Every 10 meters
- Texture index
  - Mean Profile Depth (MPD)
  - ASTM1845
- Statistics
  - Mean, Max, Min, Stdev, Histogram distribution

DATA SET

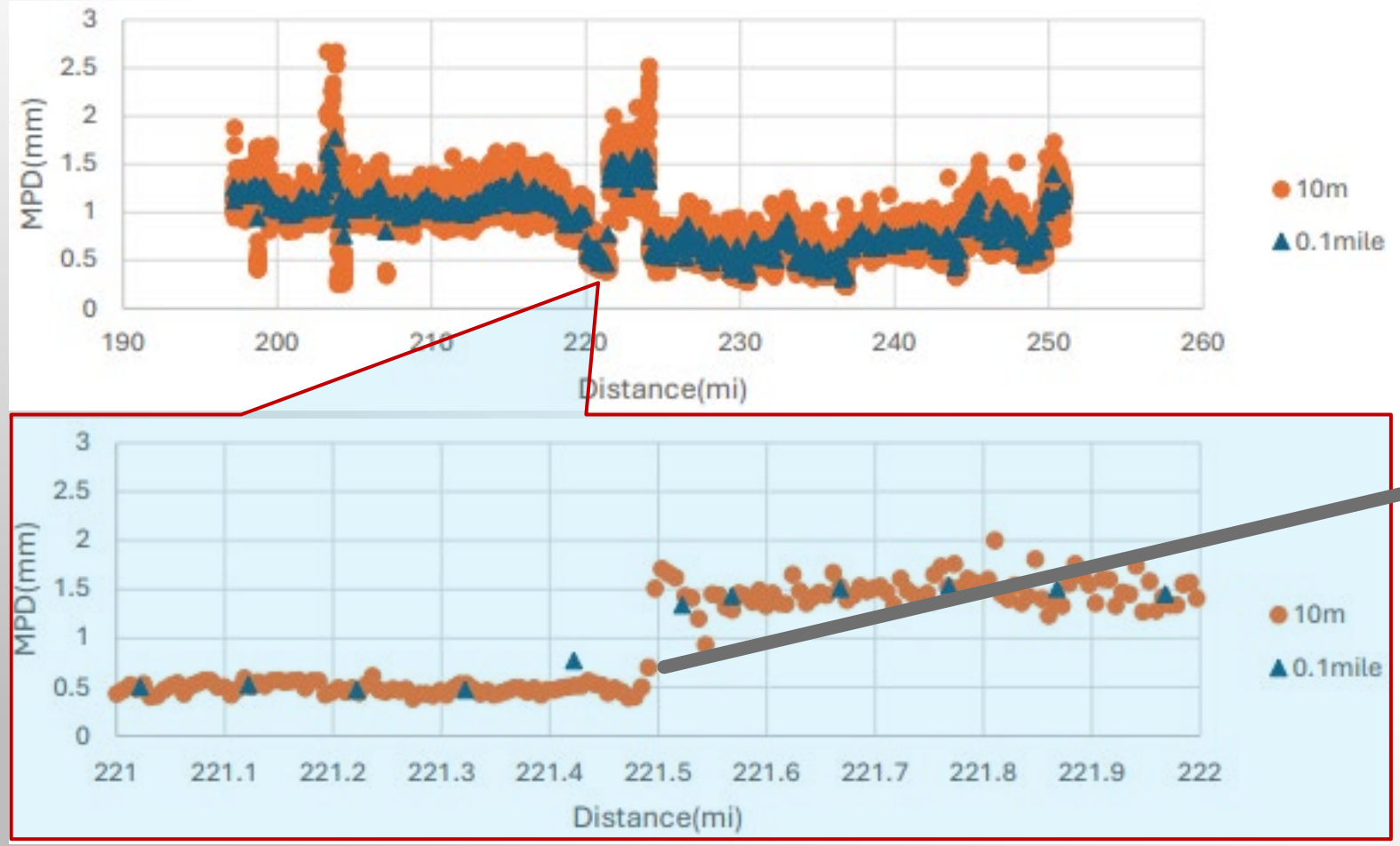
- FY2023 NETWORK-LEVEL DATA
  - SELECTED TWO DISTRICTS
    - AUSTIN
    - ATLANTA
- DIFFERENT HIGHWAY CLASSES
  - INTERSTATE HIGHWAY
  - US HIGHWAY
  - STATE HIGHWAY
  - FARM-TO-MARKET HIGHWAY

STATISTICAL ANALYSIS APPROACHES

- Compare MPD between 0.1-mile and 10-meter sampling
  - Visual comparison along a road
  - Summary statistical comparison
    - Max, Min, Mean, Median, Standard Deviation, Upper quartile(Q3)/75th percentile, Lower quartile (Q1)/25th percentile
  - Cumulative distribution
  - Histogram/relative frequency distribution
  - Box plot
  - Percent within limit (PWL)

AUSTIN DISTRICT: IH35L

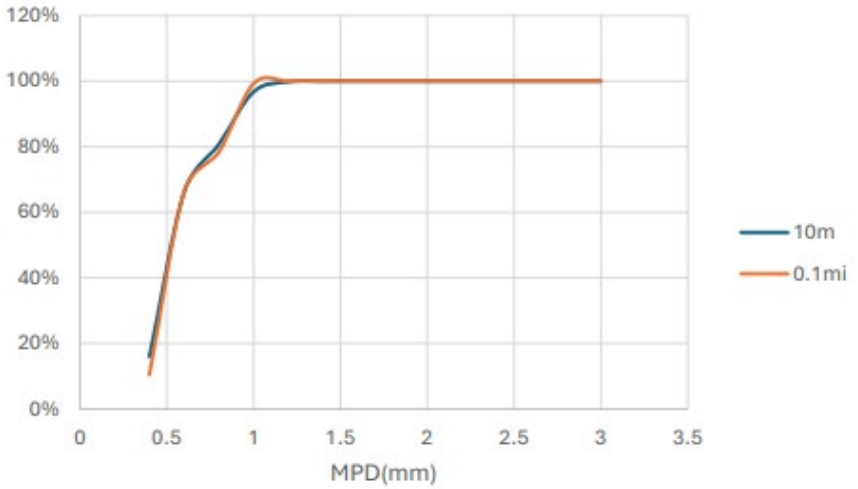
- MPD ALONG DISTANCE

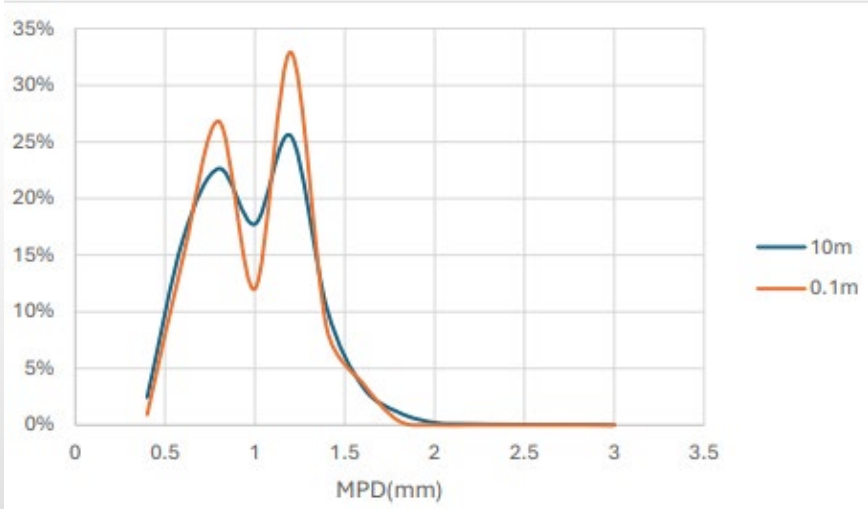


AUSTIN DISTRICT: IH35L

- SUMMARY STATISTICS/DISTRIBUTIONS

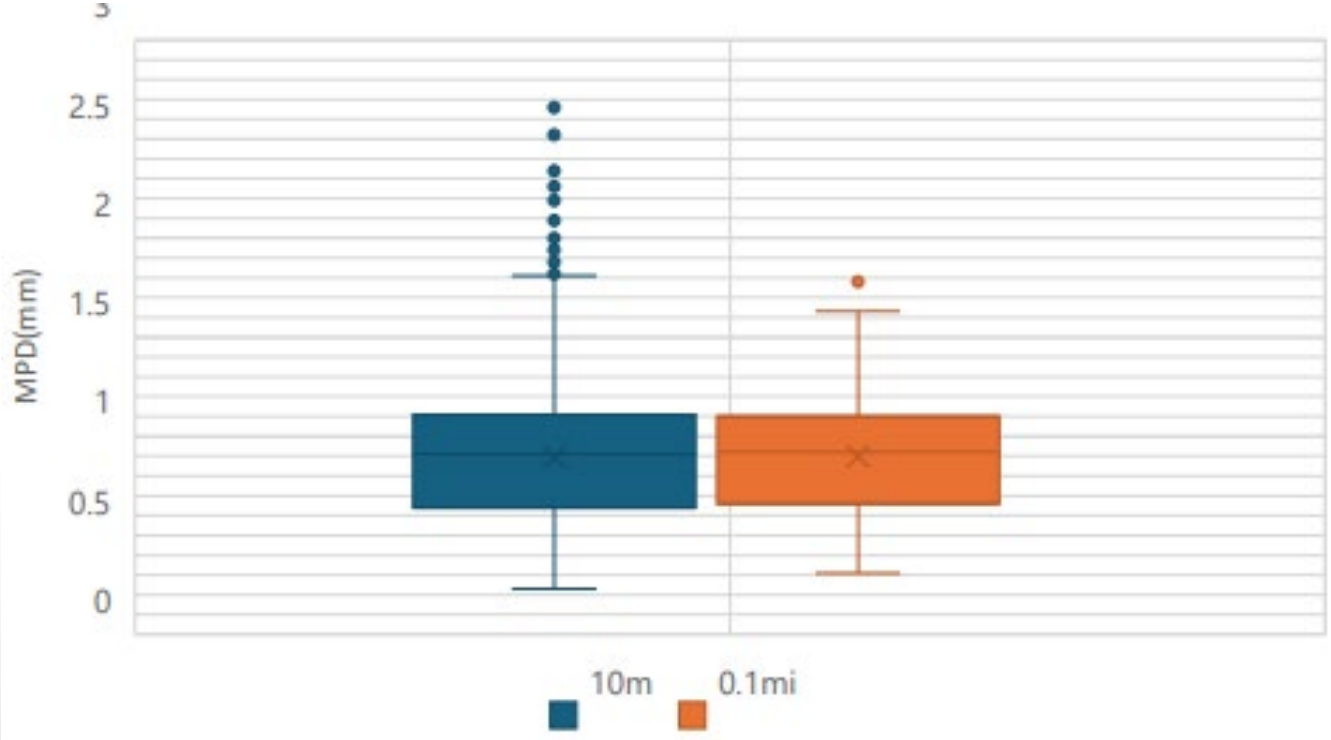
Statistics	10m	0.1mi	Difference
Max	2.67	1.78	0.89
Min	0.23	0.31	0.08
Mean	0.90	0.90	0.00
Median	0.91	0.92	0.01
Stdev	0.31	0.28	0.03
Q3	1.11	1.10	0.01
Q1	0.64	0.66	0.02





AUSTIN DISTRICT: IH35L

- Box-plot
  - Box: middle 50% of the data points
  - Line in the box: median
  - Cross in the box: mean
  - Dots outside whiskers: statistical outliers.



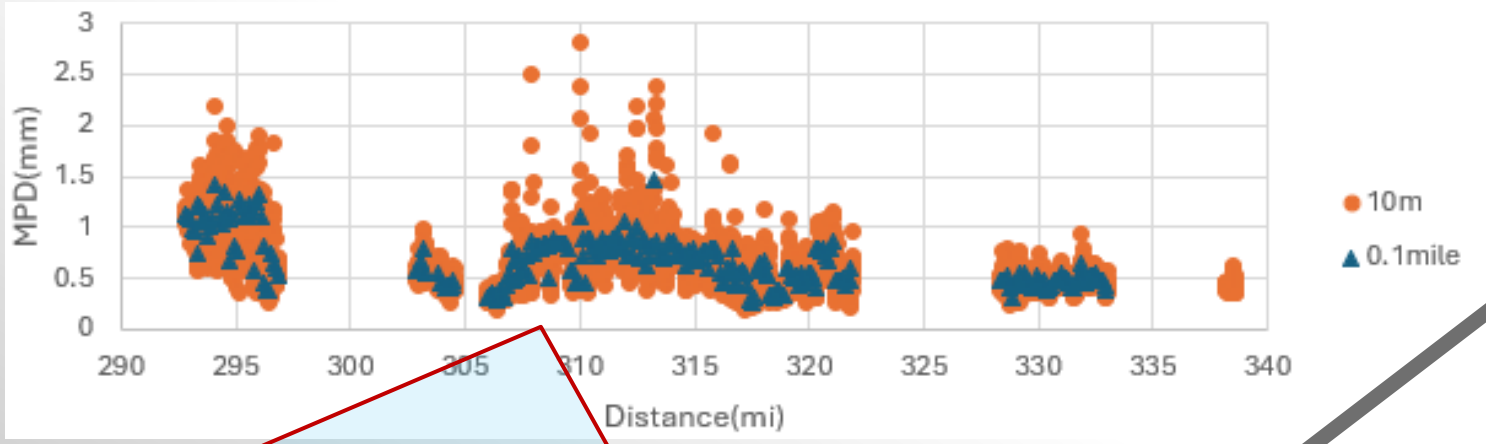
AUSTIN DISTRICT: IH35L

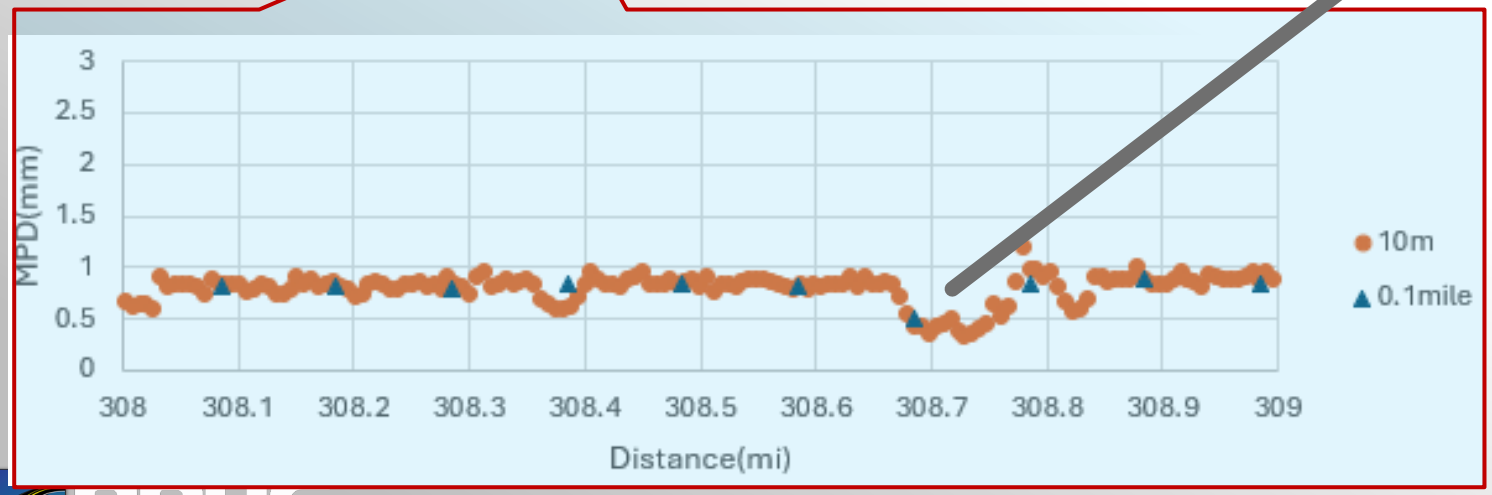
- PWL
  - Self check: for a relatively large number, if the data follows a normal distribution, there should be 95% of the data falling in the ± 2 x standard deviation of its mean.
  - Cross check: it is used to check how much percent of the data from a different sample fall in the ± 2 x standard deviation of the mean of the reference sample.

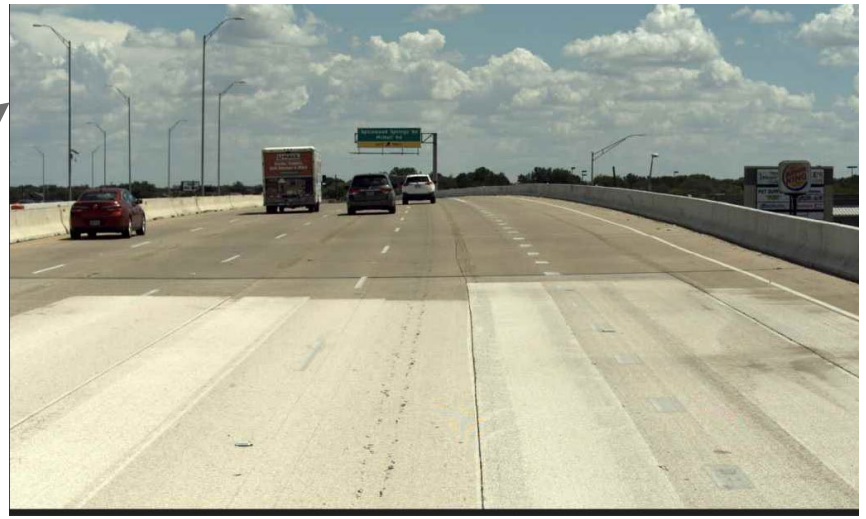
Statistics	10m	0.1mi
Mean	0.90	0.90
Stdev	0.31	0.28
M-2Stdev	0.29	0.34
M+2Stdev	1.51	1.46
PWL_self	97%	97%
PWL_cross	98%	96%

AUSTIN DISTRICT: US183R

- MPD ALONG DISTANCE



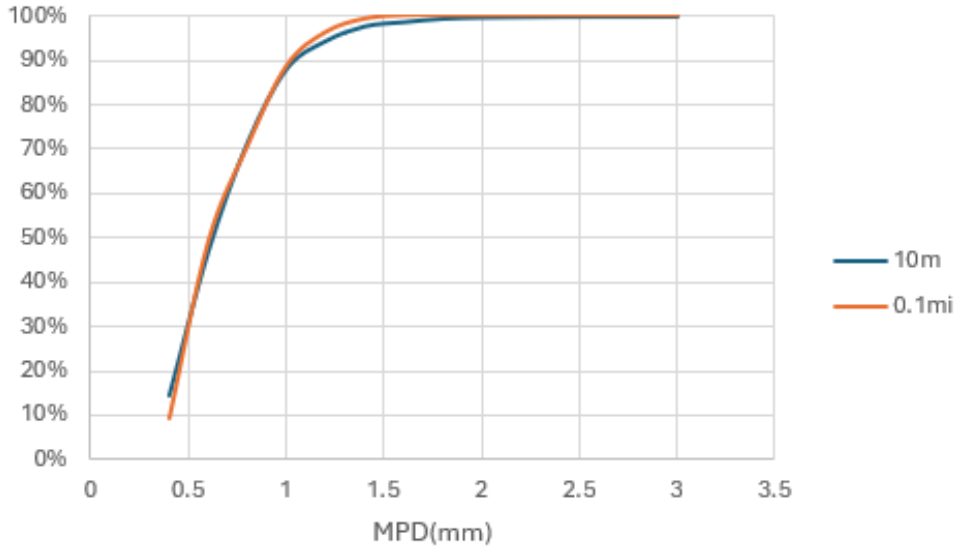


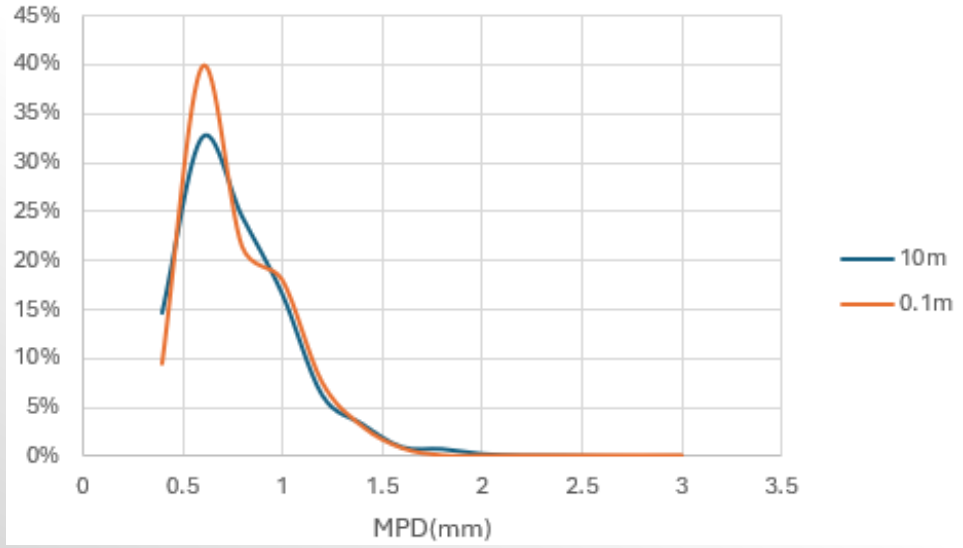


AUSTIN DISTRICT: US183R

- SUMMARY STATISTICS/DISTRIBUTIONS

Statistics	10m	0.1mi	Difference
Max	2.80	1.46	1.34
Min	0.19	0.27	0.08
Mean	0.67	0.67	0.01
Median	0.62	0.60	0.02
Stdev	0.29	0.25	0.05
Q3	0.82	0.82	0.00
Q1	0.45	0.47	0.02





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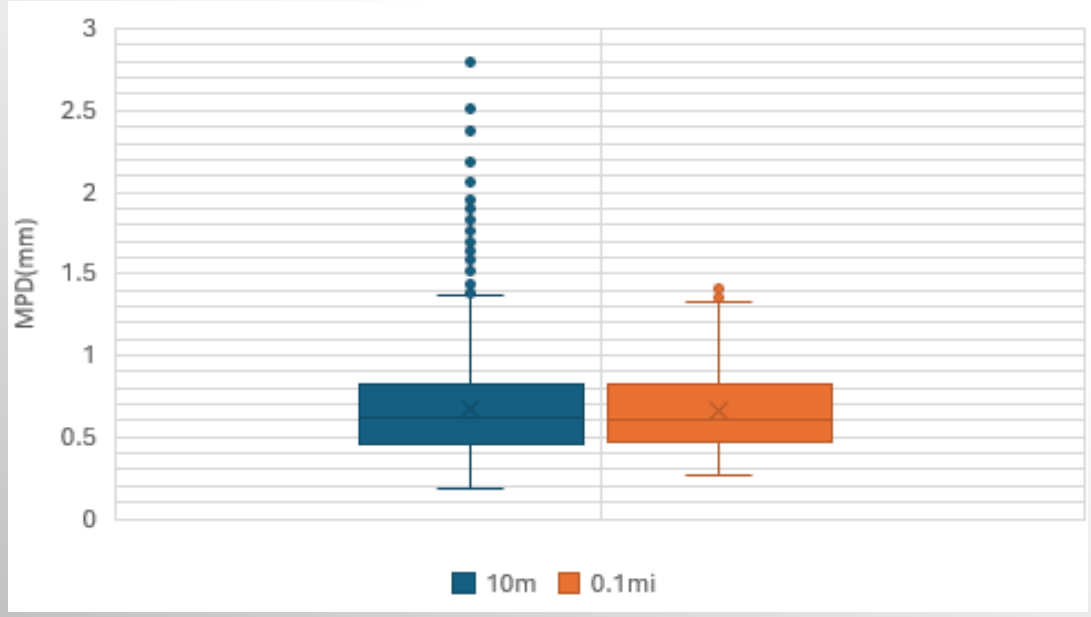
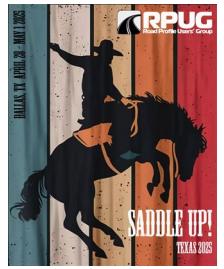
AUSTIN DISTRICT: US183R

- BOX-PLOT AND PWL

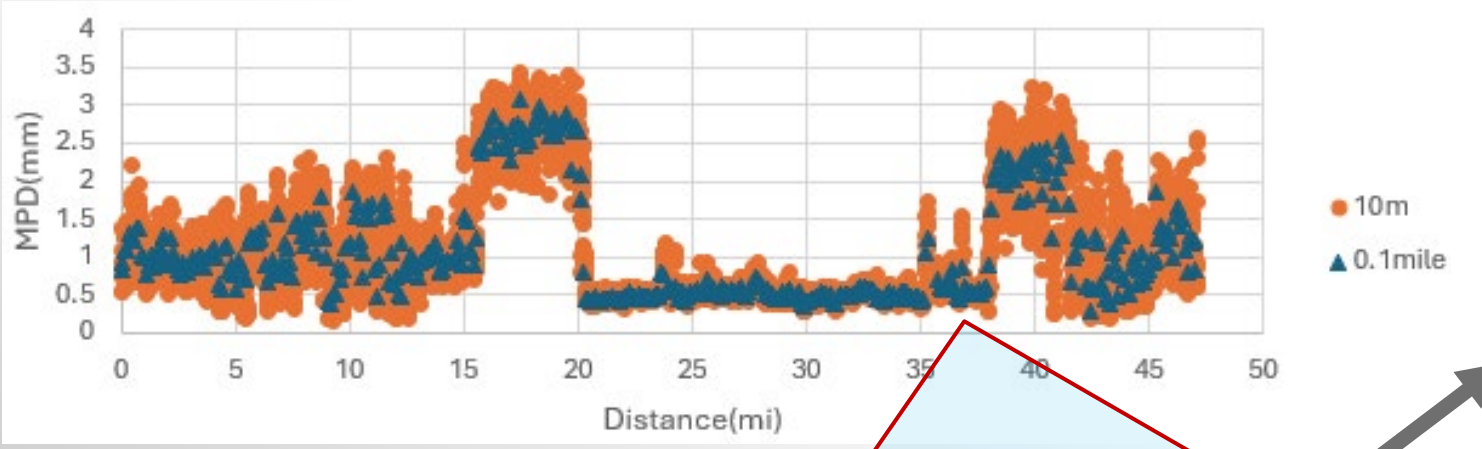


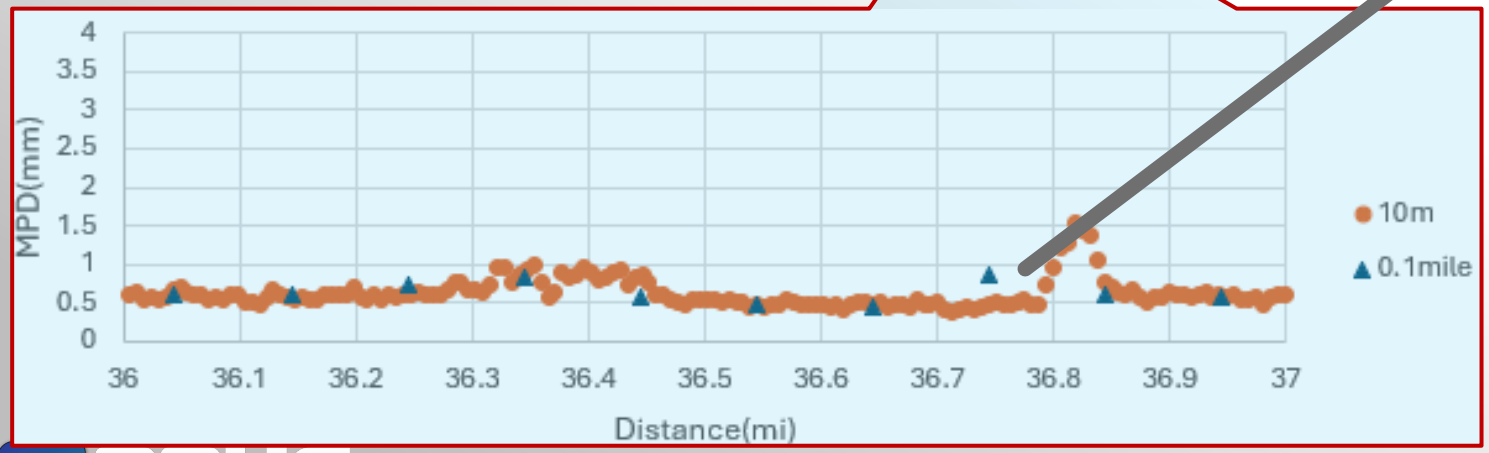
Statistics	10m	0.1mi
Mean	0.67	0.67
Stdev	0.29	0.25
M-2Stdev	0.09	0.17
M+2Stdev	1.25	1.16
PWL_self	96%	96%
PWL_cross	98%	93%

ATLANTA DISTRICT: SH77K



- MPD ALONG DISTANCE

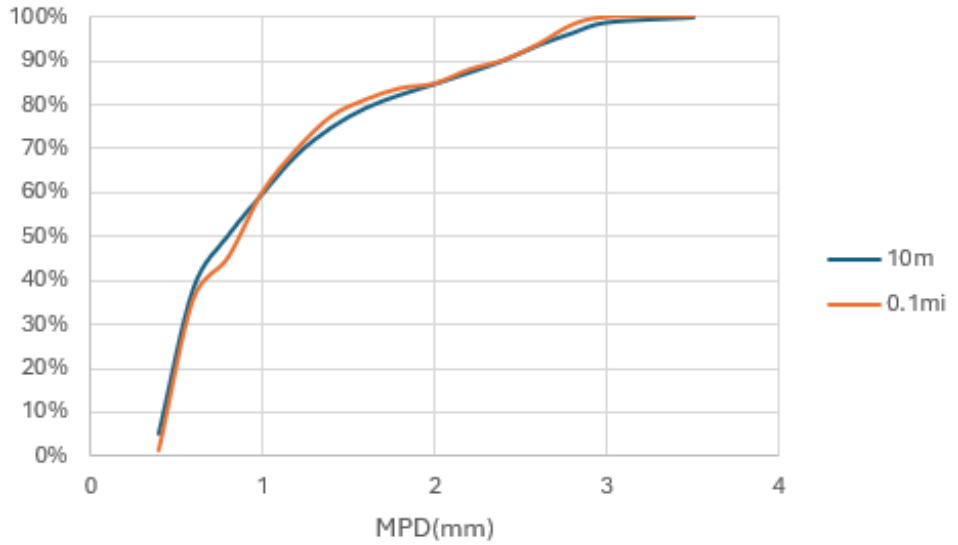


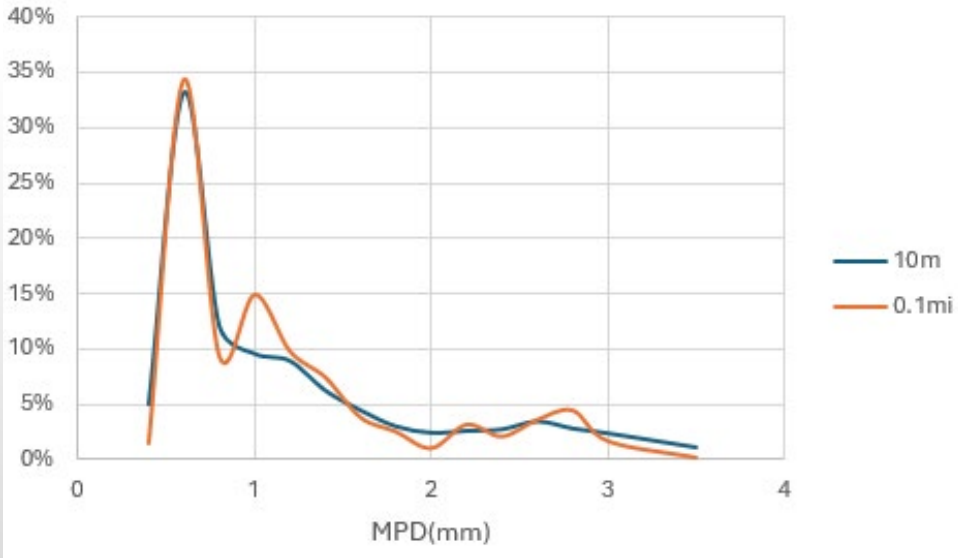


ATLANTA DISTRICT: SH77K

- SUMMARY STATISTICS/DISTRIBUTIONS

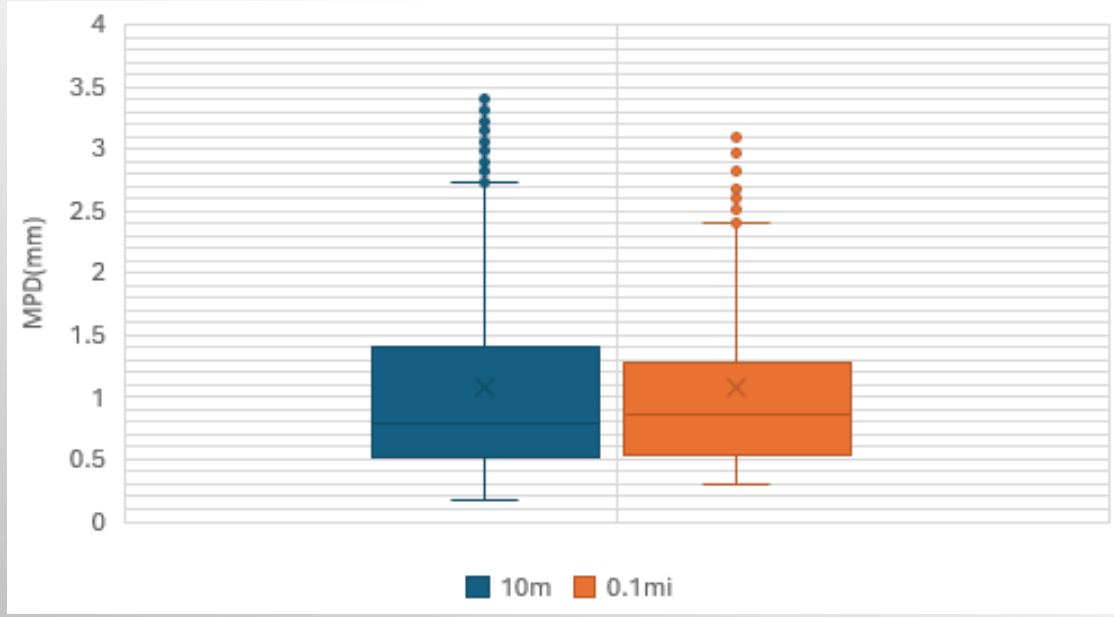
Statistics	10m	0.1mi	Difference
Max	3.43	3.09	0.34
Min	0.17	0.30	0.13
Mean	1.08	1.08	0.00
Median	0.79	0.86	0.07
Stdev	0.73	0.70	0.04
Q3	1.40	1.28	0.12
Q1	0.51	0.53	0.02





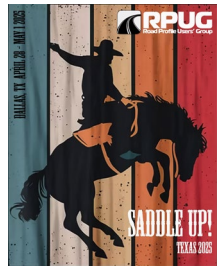
ATLANTA DISTRICT: SH77K

- BOX-PLOT AND PWL

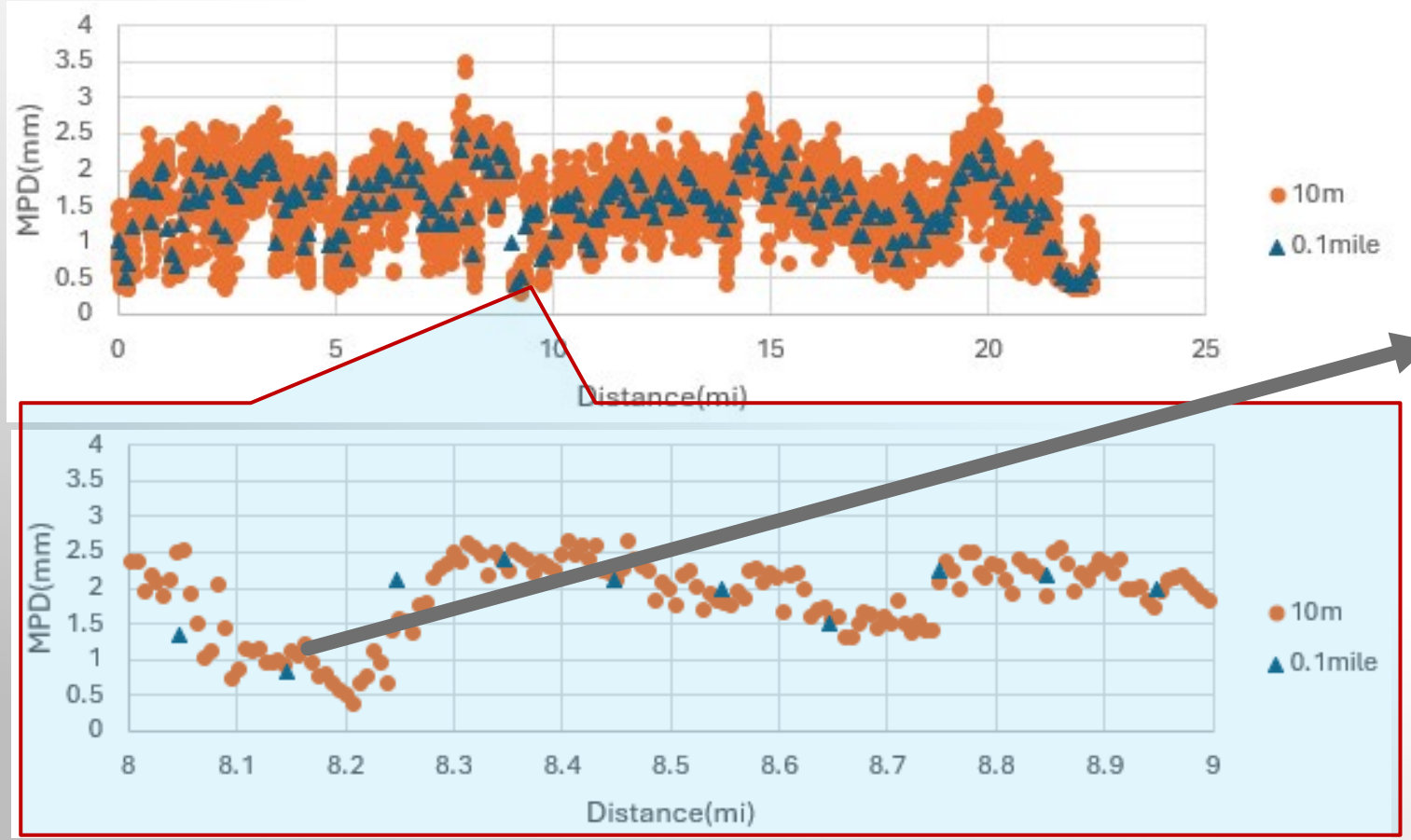


Statistics	10m	0.1mi
Mean	1.08	1.08
Stdev	0.73	0.70
M-2Stdev	-0.39	-0.32
M+2Stdev	2.54	2.47
PWL_self	93%	92%
PWL_cross	93%	92%

ATLANTA DISTRICT: FM1841K



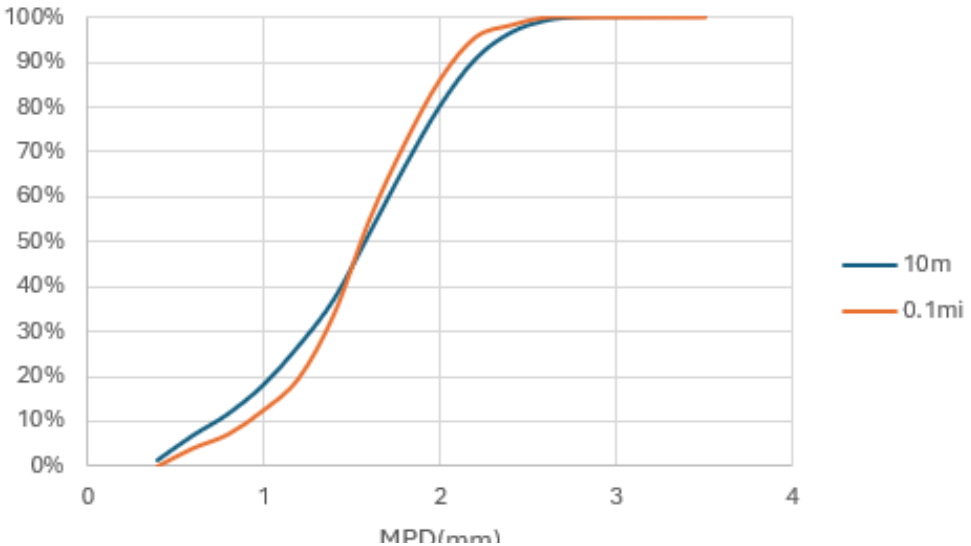
- MPD ALONG DISTANCE

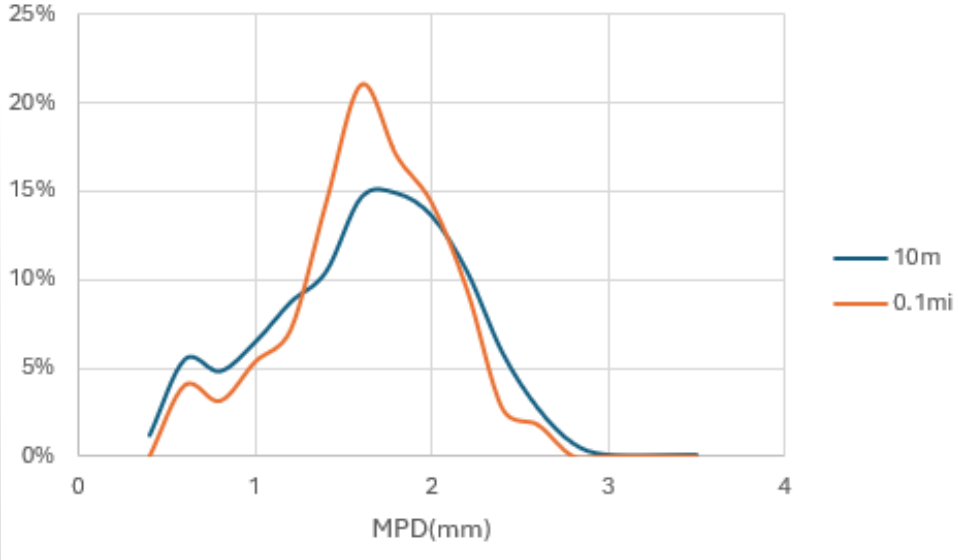


ATLANTA DISTRICT: FM1841K

- SUMMARY STATISTICS/DISTRIBUTIONS

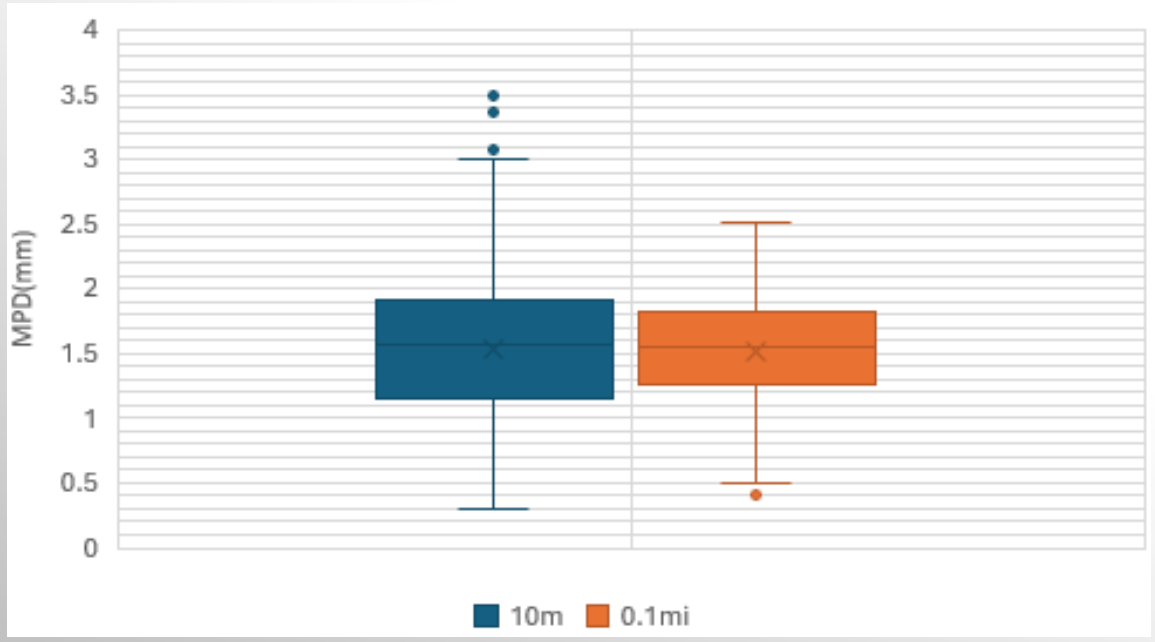
Statistics	10m	0.1mi	Difference
Max	3.49	2.52	0.97
Min	0.30	0.40	0.10
Mean	1.53	1.52	0.00
Median	1.57	1.55	0.02
Stdev	0.54	0.44	0.09
Q3	1.92	1.82	0.10
Q1	1.16	1.27	0.11





ATLANTA DISTRICT: FM1841K

- BOX-PLOT AND PWL

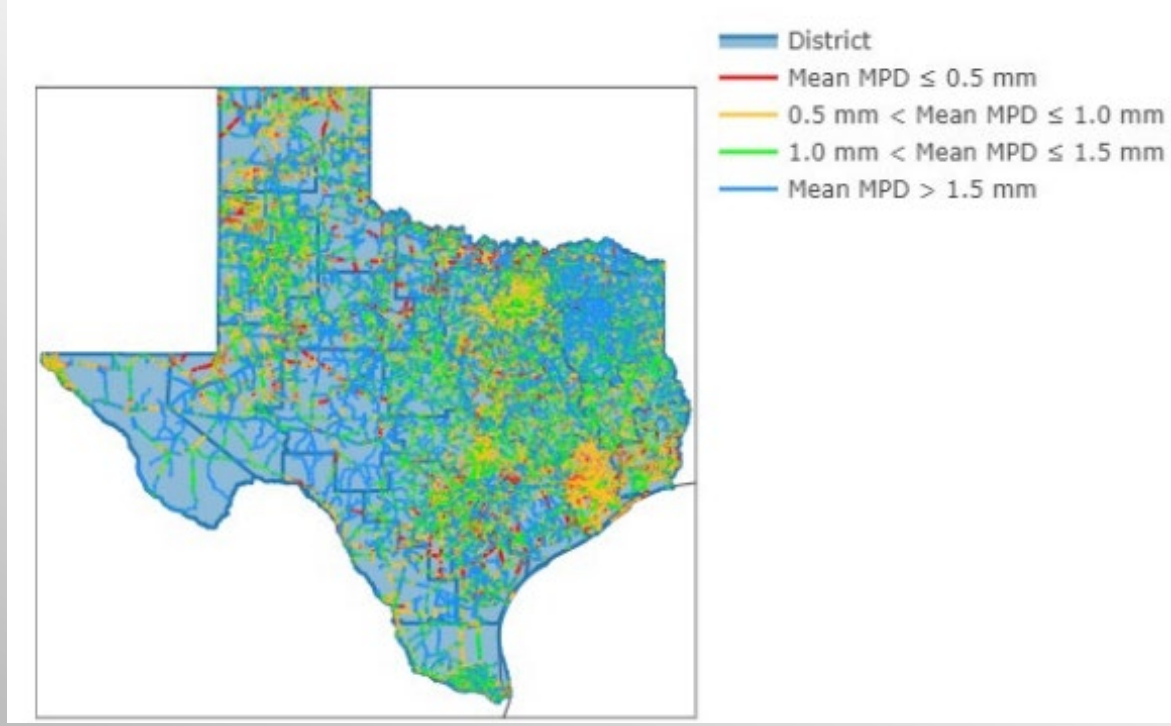


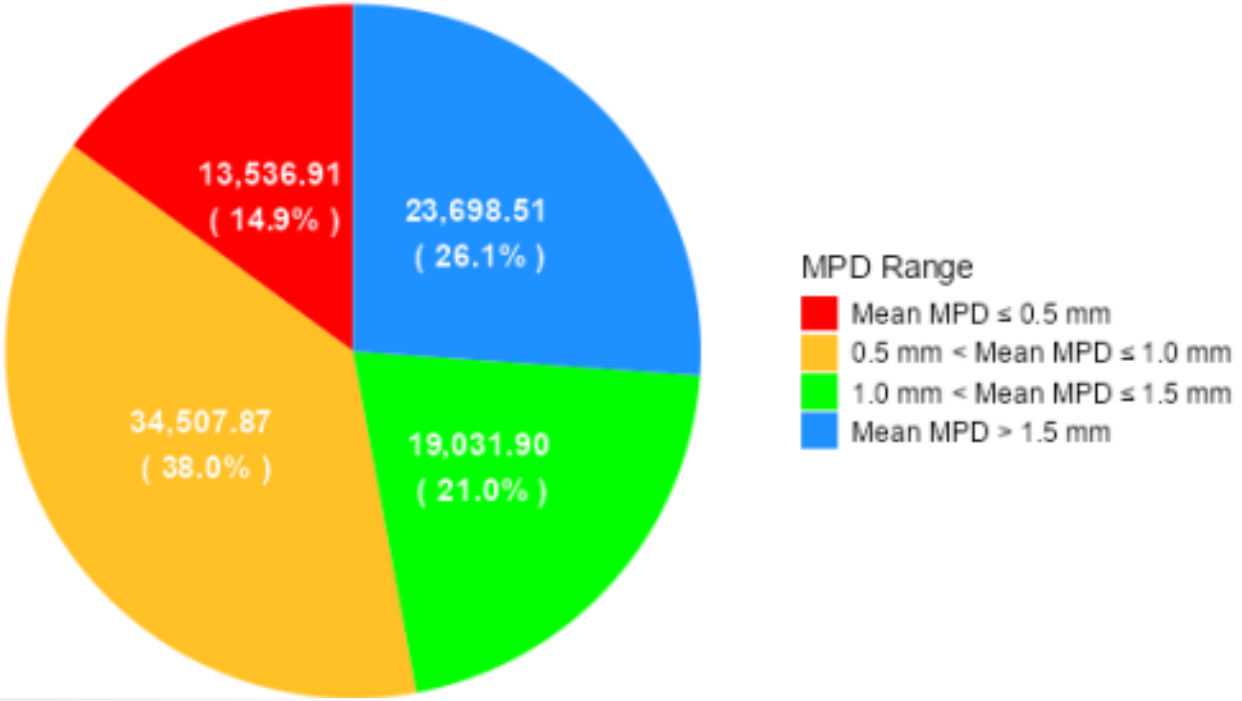
Statistics	10m	0.1mi
Mean	1.53	1.52
Stdev	0.54	0.44
M-2Stdev	0.45	0.64
M+2Stdev	2.60	2.41
PWL_self	96%	94%
PWL_cross	98%	89%

SUMMARY

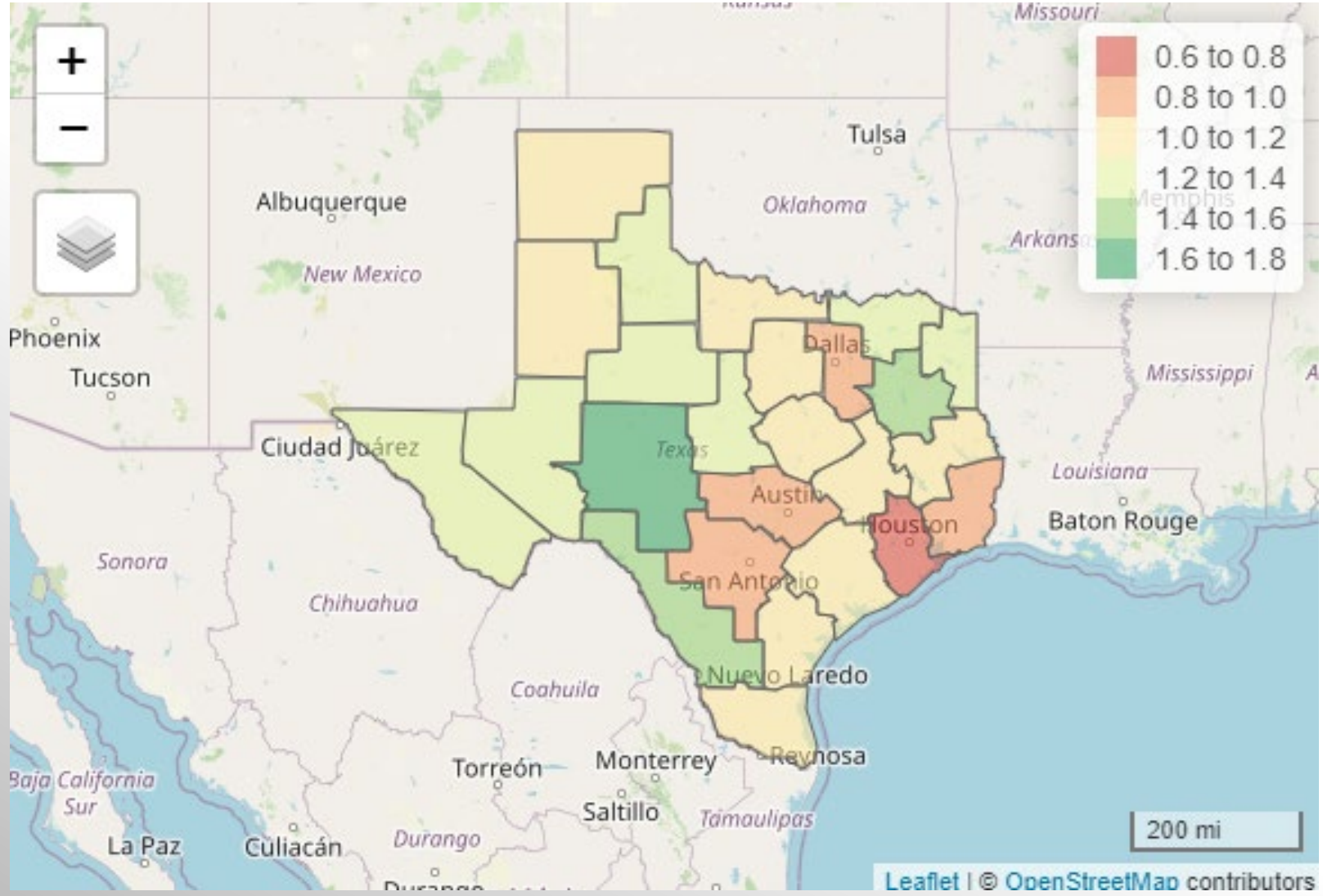
- MPD's in both sampling alternatives (10-m and 0.1-mile) follow the same trend along the distance.
- Both sampling alternatives could capture pavement surface type change.
- There is no significant evidence showing a difference in MPD between the 10-m and 0.1-mile scenarios. The difference is very small, except the extreme values such as max and min.
- Because the 10-m sampling contains more details, the MPD shows more variation than 0.1-mile sample. This means the 10-m sampling provides more details of the pavement surface texture.
- Around 90% or more of the MPD in 10-m sampling is within the limit of ± 2 x standard deviation of the mean of the 0.1-mile sampling and vice versa.

STATEWIDE MPD DISTRIBUTIONS





STATEWIDE MPD DISTRIBUTIONS



RPUG Road Profile Users' Group

ACKNOWLEDGEMENT

- TxDOT research project 0-7178 "Use Network Level Texture to Enhance Pavement Management"
- Project technical panel: Dr. Jenny Li, PE, Dr. Hui Wu, PE, Dr. Andre Smit, PE, Dr. Taehoon Lim, PE, Elizabeth Paul, PE, Lacy Peters, PE, Ryan Philips, PE
- Project manager: Jarrin Jensen

THANK YOU & BE SAFE!

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