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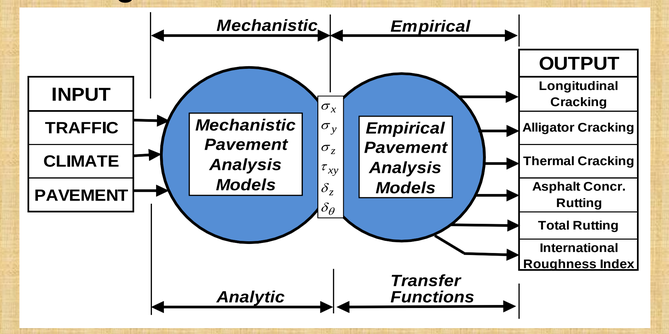
Investigation of AASHTOWare Pavement ME Design Performance Prediction Models for Iowa Pavement Analysis and Design

Background

Mechanical Empirical Pavement Design Guide (MEPDG) and AASHTOWare Pavement ME Design

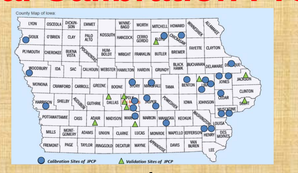


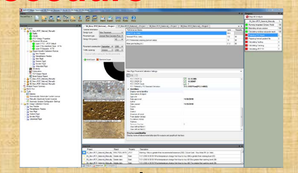
- MEPDG: developed under National Cooperative Highway Research Program (NCHRP) Project 1-37A
- AASHTOWare Pavement ME: evolved from MEPDG and is now official AASHTO pavement design methodology (currently version 2.1)

Objectives

- Examine the AASHTOWare Pavement ME Design performance predictions using the previously identified MEPDG calibration coefficients
- Refine local calibration of AASHTOWare Pavement ME performance predictions for Iowa pavement systems if needed

Local Calibration Procedure



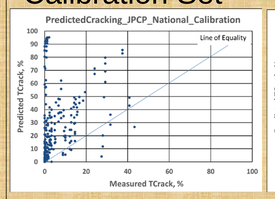


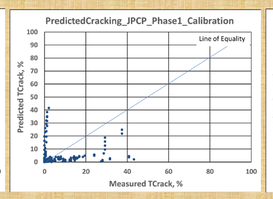
Calibrate the pavement performance prediction models using actual field data

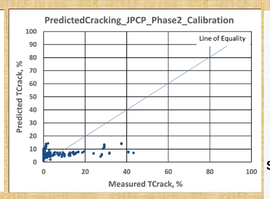
Local Calibration of Jointed Plain Concrete Pavement (JPCP) Systems

Transverse Cracking Distress

Calibration Set

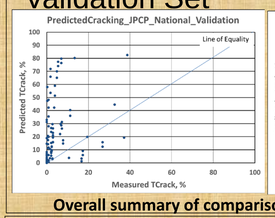


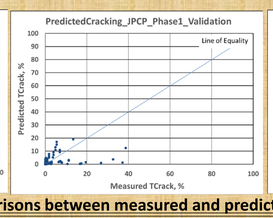


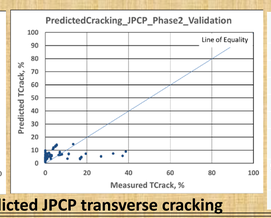


Coefficients	National	Local (MEPDG)	Local (Pavement ME)
C1	2	2.17	2.25
C2	1.22	1.32	1.4
C4	1	1.08	4.06
C5	-1.98	-1.81	-0.44
N	240	240	240
Average Bias, %	-5.44	-1.90	0.36
Standard Error, %	10.40	10.86	8.18
R^2	-0.38	-0.51	0.14

Validation Set





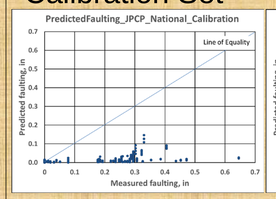


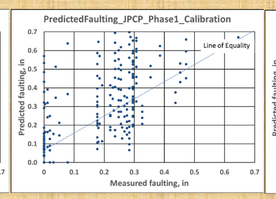
Coefficients	National	Local (MEPDG)	Local (Pavement ME)
C1	2	2.17	2.25
C2	1.22	1.32	1.4
C4	1	1.08	4.06
C5	-1.98	-1.81	-0.44
N	101	101	101
Average Bias, %	16.59	-2.29	0.99
Standard Error, %	28.02	8.23	7.75
R^2	-11.70	-0.10	0.03

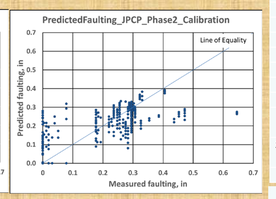
Overall summary of comparisons between measured and predicted JPCP transverse cracking

Faulting Distress

Calibration Set

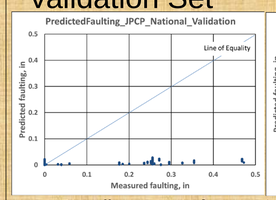


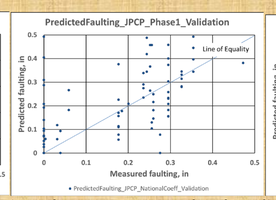


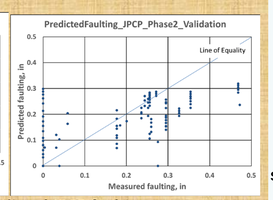


Coefficients	National	Local (MEPDG)	Local (Pavement ME)
C1	1.02	2.04	0.85
C2	0.92	1.84	1.39
C3	0.002	0.004	0.002
C4	0.001	0.002	0.274
C5	250.0	250.0	250.8
C6	0.4	0.8	0.4
C7	1.83	1.83	1.45
C8	400	400	400
N	248	248	248
Average Bias, inch	0.189	-0.204	0.001
Standard Error, inch	0.23	0.34	0.11
R^2	-1.64	-4.66	0.47

Validation Set





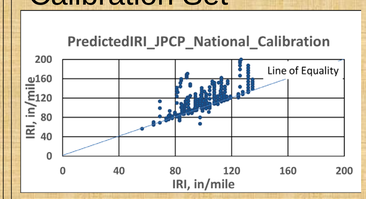


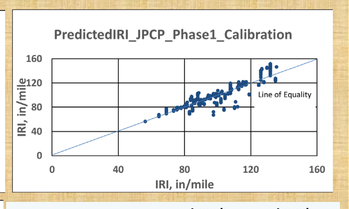
Coefficients	National	Local (MEPDG)	Local (Pavement ME)
C1	1.02	2.04	0.85
C2	0.92	1.84	1.39
C3	0.002	0.004	0.002
C4	0.001	0.002	0.274
C5	250	250	251
C6	0.4	0.8	0.4
C7	1.833	1.833	1.452
C8	400	400	400
N	101	101	101
Average Bias, inch	0.19	0.10	-0.02
Standard Error, inch	0.24	0.22	0.12
R^2	-1.71	-1.26	0.36

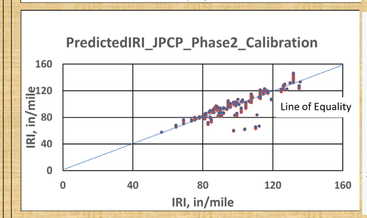
Overall summary of comparisons between measured and predicted JPCP faulting

International Roughness Index (IRI)

Calibration Set

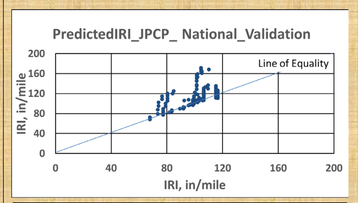


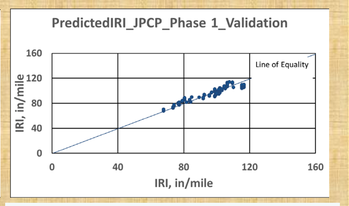


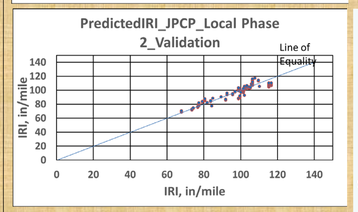


Coefficients	National	Local (MEPDG)	Local (Pavement ME)
C1	0.82	0.04	0.46
C2	0.44	0.02	0.44
C3	1.49	0.07	1.49
C4	25.24	1.17	17.00
N	248	248	248
Average Bias, in/mi	-27.29	7.38	-1.79
Standard Error, in/mi	38.7	13.0	10.4
R^2	-4.39	0.39	0.61

Validation Set







Coefficients	National	Local (MEPDG)	Local (Pavement ME)
C1	0.82	0.04	0.46
C2	0.44	0.02	0.44
C3	1.49	0.07	1.49
C4	25.24	1.17	17.00
N	101	101	101
Average Bias, in/mi	22.80	5.70	-0.29
Standard Error, in/mi	31.90	8.40	5.10
R^2	-5.40	0.56	0.84

Overall summary of comparisons between measured and predicted IRI values

Summary: Key Findings and Significance of study

- For all performance measure types, lower average bias and standard error as well as higher R^2 values were attained
- The newly identified local calibration coefficients are recommended to Iowa DOT to be used in JPCP Pavement ME Design
- This study would be more comprehensive than previous MEPDG local calibration studies in literatures because of its methodologies including the detailed review of JPCP pavement responses and performance transfer function models and the employment of nonlinear optimization algorithm

Acknowledgements: The authors gratefully acknowledge Iowa Department of Transportation (Iowa DOT) and Iowa State University for supporting this study.