Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

0-6986: Determine Proper Selection of Ride Quality Pay Adjustment Schedule and Re-evaluation of Current Bonus/Penalty Structure

Background

Each year, the Texas Department of Transportation (TxDOT) constructs a diverse portfolio of paving projects. The annual letting includes between 300 and 400 projects eligible for ride quality evaluation and bonus/penalty payment. Item 585 of TxDOT's Standard Specification, Ride Quality for Pavement Surfaces, provides ride quality requirements using three pay schedules. Each pay schedule includes a bonus/penalty structure depending upon the final surface smoothness. Since 2004, paving has improved to construct smoother surfaces; however, TxDOT's guidance for pay schedule selection and the specification structure have remained unchanged.

What the Researchers Did

Initially, this research focused on the use of the existing guidance document within TxDOT. Following this analysis, researchers evaluated post-construction ride quality data gathered from 70 projects, totaling 8,448 sections. This data set allowed researchers to develop new guidance based on a probabilistic method. Researchers evaluated typical sections and grouped paving construction scopes into eight work types. Furthermore, researchers reviewed pre-construction and post-construction International Roughness Index (IRI) values to develop a probabilistic distribution for change in ride quality for each work type.

The pre-construction and post-construction analysis included matching pavement sections and ensuring adequate data were available. The pre- and post-construction data set included 2,230 sections used to develop regression equations for each paving type. These equations predict the change in IRI based on the pre-construction IRI and the paving scope.

Using the knowledge gained about post-construction ride quality and given a paving scope, the research team developed a new guidance table. A pay schedule selection was provided for all seven flexible paving scopes and two concrete work types. To consider the influence of traffic volume, 10,000 vehicles per day was considered as a dividing factor. The new guidance provides the 25th, 50th, and 75th percentiles of each work type to inform the expectations of TxDOT engineers for projects without pre-construction data. For projects with available pre-construction data, it predicts the percentiles with regression equations and helps choose the pay schedule based on predicted post-construction percentiles.

The research indicated that the new guidance document would serve a better role if each paving scope had its own pay schedule. This is like the work-type-specific pay schedule currently used for next-generation concrete surfaces (NGSS) governed by Special Specification 3012. Therefore, researchers developed a new pay structure (bonus/penalty) using 25th, 50th, and 97th percentiles as the crucial alteration points in the probability of IRI improvement for each work type. This new bonus/penalty structure was built around the expectations of the final surfaces and rewards high-performing projects, penalizes low-performing projects, and provides no incentive for average projects. These new pay structures shift the philosophy toward incentive and disincentive as opposed to the current structure where TxDOT pays a bonus on over 80 percent of flexible sections. Researchers built these proposed pay structures to minimize the change in the amount of bonus TxDOT pays annually. Currently, this amount is approximately $8 million per year.

What They Found

Table 1 is the new guidance table and offers recommendations for each paving scope using TxDOT's existing three schedule pay structures.

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Project Completed:
8-31-2020

Because of improvements in paving construction over the past 15 years, using Table 1 will result in TxDOT selecting Pay Schedule 1 or 2 more frequently. This will result in TxDOT annually paying more bonuses with little to no improvement in statewide ride quality. This research study found that when comparing Pay Schedule 2 and Pay Schedule 3 projects with nearly identical scopes, there was no difference in post-construction ride quality. Therefore, to improve statewide ride quality, this research developed pay structures for each work type shown.

What This Means

Without simultaneously changing the pay structure, the research team recommends implementing the guidance table for informational purposes only. This implementation project would work with districts to educate district personnel on the post-construction expectations for different construction types. To move beyond informational implementation, the research team recommends a change to the Item 585 specification. The specification change would require building construction-specific pay structures using data-driven smoothness expectations.

Table 1. Guidance Table.

Select Pay Schedule based on predominant work type and no existing condition data

Work Type	Statewide Data Distribution			Pay Schedule when AADT < 10,000 vpd	Pay Schedule when AADT ≥ 10,000 vpd
	25th Percentile	50th Percentile	75th Percentile		
Mill & fill in outside lane of C&G	67	70	90	3	3
Mill & fill not constrained by gutter	48	55	67	3	2
Scarify & reshape base with overlay ≥ 1.5 in.	53	62	71	3	3
Overlay ≥ 1.5 in.	37	45	52	1	1
Mill & overlay with HMA ≥ 1.5 in.	43	52	60	2	1
Overlay < 1.5 in.	48	55	63	2	1
Multiple lifts of HMA ≥ 1.5 in.	30	36	42	1	1
CRCP	75	93	105	Test Type A	3
JCP	NA	NA	NA	Test Type A	3

Calculate Pay Schedule using network-level data and the predicted 75th percentile post-construction IRI value

Work Type	Regression Equation	Pay Schedule 1	Pay Schedule 2	Pay Schedule 3	Test Type A
Mill & fill in outside lane of C&G	Predicted Change IRI = -0.84*Preconstruction + 65.90	75th Percentile < 60	60 ≤ 75th Percentile < 75	75 ≤ 75th Percentile < 95	75th Percentile ≥ 95
Mill & fill not constrained by gutter	Predicted Change IRI = -1.08*Preconstruction + 68.64				
Scarify & reshape base with overlay ≥ 1.5 in.	Predicted Change IRI = -1.15*Preconstruction + 86.66				
Overlay ≥ 1.5 in.	Predicted Change IRI = -0.89*Preconstruction + 34.42				
Mill & overlay with HMA ≥ 1.5 in.	Predicted Change IRI = -0.87*Preconstruction + 38.03				
Overlay < 1.5 in.	Predicted Change IRI = -0.95*Preconstruction + 51.50				
Multiple lifts of HMA ≥ 1.5 in.	Predicted Change IRI = -1.05*Preconstruction + 39.77				
CRCP		Schedule 3 or Test Type A on roadways with less than 10,000 vpd			
JCP					

Note: For more conservative values, add 3 in./mi. to the 75th percentile value. For very conservative selection, add 6 in./mi. to the 75th percentile value.

For More Information

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Keyword: Research