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# Revised Statewide Asphalt Binder Selection Catalog

Technical Report 0-6674-01-P1

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Cooperative Research Program

TEXAS A&M TRANSPORTATION INSTITUTE  
COLLEGE STATION, TEXAS

in cooperation with the  
Federal Highway Administration and the  
Texas Department of Transportation  
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# **REVISED STATEWIDE ASPHALT BINDER SELECTION CATALOG**

Pravat Karki  
Assistant Transportation Researcher  
Texas A&M Transportation Institute

and

Fujie Zhou  
Research Engineer  
Texas A&M Transportation Institute

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This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation and it is not intended for construction, bidding, or permit purposes. The engineer in charge was Dr. Fujie Zhou, P.E. (Texas, # 95969).

There is no invention or discovery conceived or first actually reduced to practice in the course of or under this contract, including any art, method, process, machine, manufacture, design or composition of matter, or any new useful improvement thereof, or any variety of plant, which is or may be patentable under the patent laws of the United States of America or any foreign country.

The United States Government and the State of Texas do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

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# **REVISED STATEWIDE ASPHALT BINDER SELECTION CATALOG**

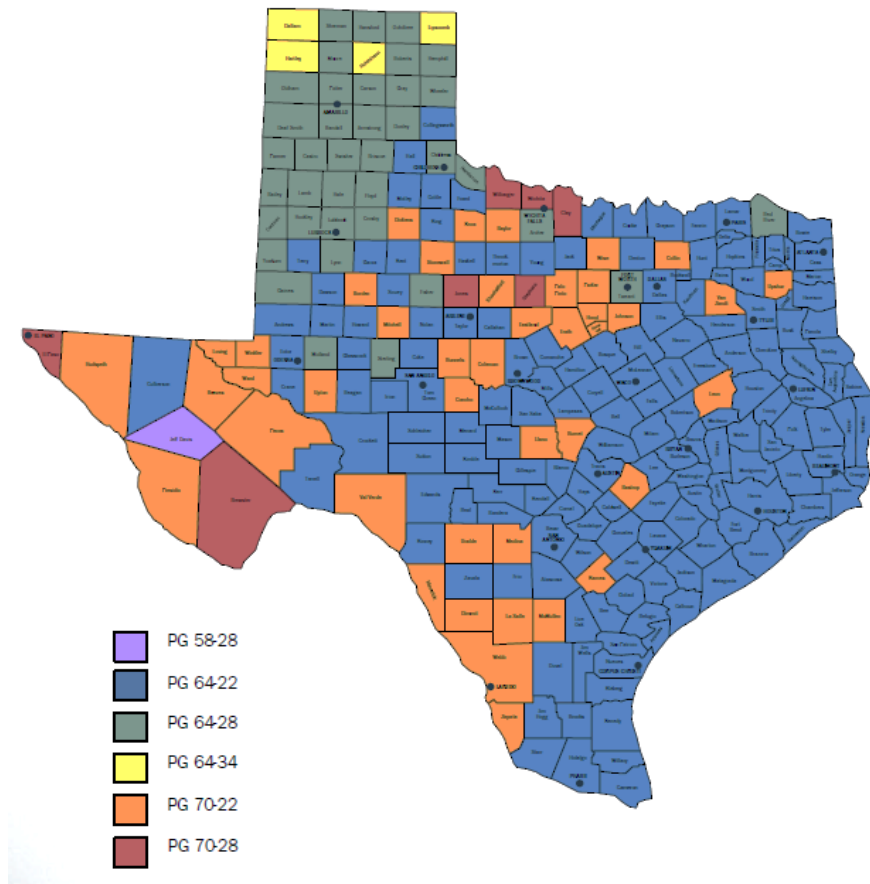
## **INTRODUCTION**

This product describes the revised statewide asphalt binder catalog. To accomplish this objective, researchers first identified the difference between the catalog currently used in Texas and the catalog developed under project 0-6674 and then revised the existing catalog based on the latest research findings from project 0-6674-01, as described below.

## **STATEWIDE PG BINDER SELECTION CATALOG CURRENTLY USED IN TEXAS**

The Texas Department of Transportation (TxDOT) currently selects asphalt binder PG grade for any pavement in Texas involves two major phases.

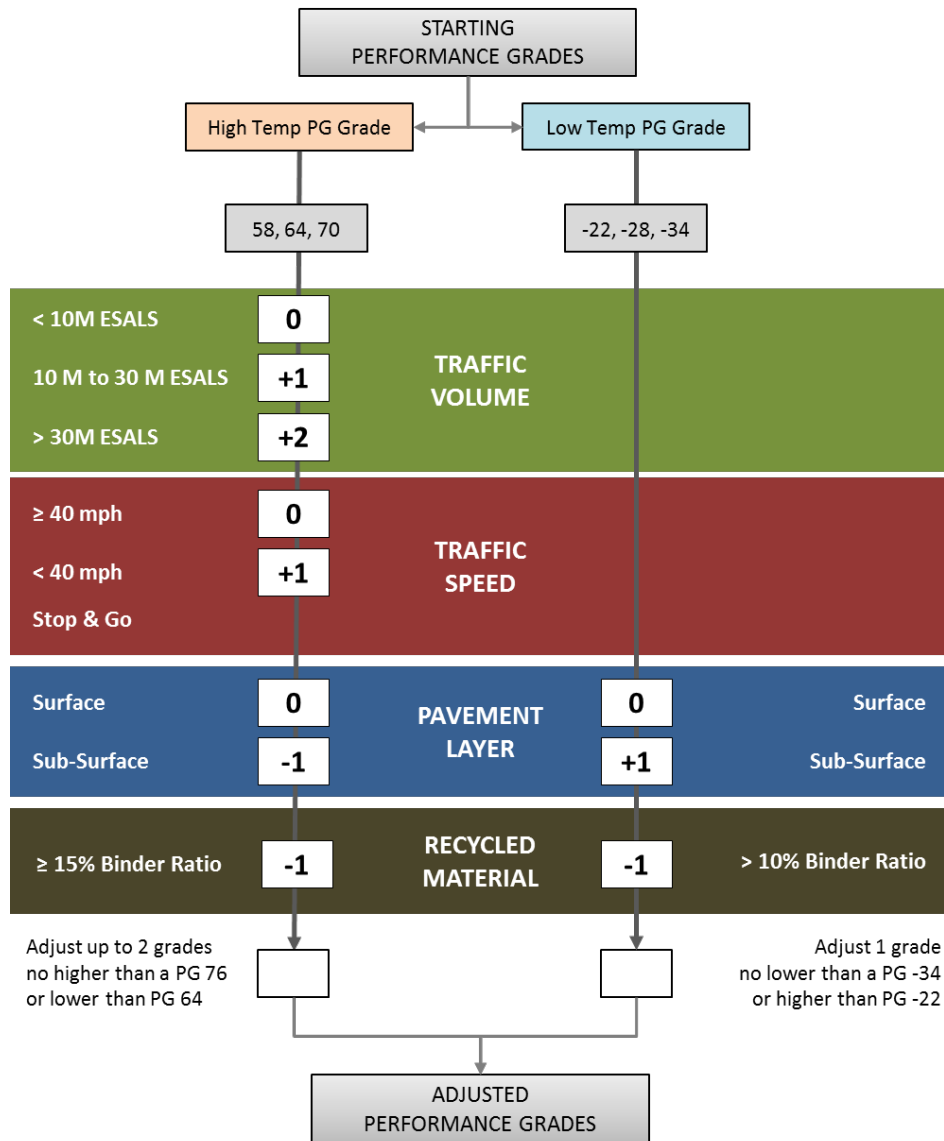
The *first phase* of this method involves selecting the high and low temperature PGs of asphalt binder based on the location of the project and the desired level of confidence (i.e., 95 or 98 percent confidence). Confidence level refers to the chances that the normal variations in temperature 20 mm below the surface of the pavement will never exceed the range of the selected binder grade. TxDOT provides color-coded location maps for a given confidence level to aid in this step. Figure 1 presents the color-coded location map with recommended starting binder PG.



**Figure 1. Asphalt Binder Grade Recommendation: TxDOT Method.**

The *second phase* of TxDOT’s current method for asphalt binder PG selection involves four different steps for adjusting the starting binder PG. Each step deals with a different factor (traffic volume, traffic speed, pavement layer, and the use of recycled material) that influences the overall performance of asphalt pavement. Figure 2 presents these steps with corresponding impact each factor would have on the starting binder PG. In some cases, these factors change the starting binder PG up to two grades.

TxDOT’s current method recommends that the high temperature PG be 64 at the minimum and 76 at the maximum, and that the low temperature PG be –34 at the minimum and –22 at the maximum. However, in some special locations, the recommendations are a little bit different. The method recommends high temperature PG of 58 in select hot climates such as Jeff Davis County in the El Paso District, and low temperature PG of –34 in select cold climates such as counties north of the IH40, namely in Dallam, Hartley, Hutchinson, and Lipscomb Counties in the Amarillo District.



**Figure 2. Asphalt Binder Grade Adjustment: TxDOT Method.**

Despite these safeguards, the TxDOT’s current method does not consider whether the proposed project involves the construction of a new pavement or an asphalt overlay over an existing pavement when recommending binder PG.

**STATEWIDE ASPHALT BINDER SELECTION CATALOG DEVELOPED UNDER 0-6674**

To make TxDOT’s current binder grade selection method more robust, researchers first established that the existing pavement layer, overlay thickness, traffic level, environmental zones (or climate), aggregate type, and asphalt binder PG influence the cracking performance of the overlays. For this purpose, researchers simulated cracking performance of 2700 different cases of overlays involving five different zones for climates, four different levels of traffic volume, three

different overlay thicknesses, three different types of existing pavement structures, three different types of aggregate types, and five different grades of asphalt binder (see Table 1). Researchers used the Texas Asphalt Concrete Overlay Design and Analysis System for these simulations. From the simulation results, researchers also determined the binder PG that would provide the best possible outcome in terms of cracking performance in each district in Texas.

Table 2 presents the recommended binder grades for each district in Texas based on these simulations. The table shows that each county in a given district is recommended the same binder PG. When recommended binders in Table 2 and Figure 1 are compared, one can notice that binder recommended by this new approach is usually softer than the binder recommended by the TxDOT's current method. This difference highlights the fact that binder recommendations for each county need to be updated when an overlay construction is considered.

## **NEW STATEWIDE ASPHALT BINDER SELECTION CATALOG**

Using TxDOT's current catalog, TTI researchers identified the counties in each district that have different recommended PGs and then updated them with newly recommended PGs. Table 3 presents the recommended high and low temperature PG for a brand new pavement construction and new overlay construction over existing pavement layers. Researchers second TxDOT's current protocol that the starting binder PG needs to be adjusted for traffic volume, traffic speed, pavement layer, and the use of recycled material whichever applicable. As such, researchers modified the two phases of TxDOT's current binder PG selection method as follows.

The *first phase* of the new approach involves selecting the high and low temperature PGs of asphalt binder based on the location of the project, the desired level of confidence, and the type of construction. The type of construction (new versus overlay) specifically plays a critical role in recommending low temperature PG for the project. Researchers developed color-coded location maps for a 98 percent confidence level to aid in selecting the recommended PG for any given project in Texas:

- Figure 3 → PG for new pavement construction.
- Figure 4 → PG for asphalt overlay over existing asphalt concrete (AC).
- Figure 5 → PG for asphalt overlay over existing jointed concrete pavements (JPCP).

The *second phase* of the new approach involves adjusting the starting binder PG using four different steps. As in Texas's current approach, each of these steps deals with a different factor (traffic volume, traffic speed, pavement layer, and the use of recycled material) that might influence the overall performance of asphalt pavement. The adjustment for pavement layer might not be applicable for overlay design. Figure 6 illustrates each step included in Phase I and Phase II of the new approach.

**Table 1. Overlay Performance Simulation Factorial: 0-6674.**

<i>Factor</i>	<i>Details</i>		
Environmental Zones	Zone	Representative District	Case
	Dry-Cold	Amarillo	1
	Dry-Warm	Odessa	2
	Moderate	Austin	3
	Wet-Cold	Paris	4
	Wet-Warm	Beaumont	5
Existing Pavement Structure	Type		Case
	Conventional AC over granular base (GB)		1
	Existing JPCP over GB		2
	Thinner Existing AC over cement treated base (CTB)		3
Traffic Level	Equivalent single axle loads		Case
	3 million		1
	5 million		2
	10 million		3
	30 million		4
Overlay Thickness	Thickness		Case
	2 in.		1
	3 in.		2
	4 in.		3
Overlay Mixture	Aggregate	Binder	Case
	Limestone	PG 64-34	1
		PG 64-28	2
		PG 64-22	3
		PG 70-22	4
		PG 76-22	5
	Gravel	PG 64-34	1
		PG 64-28	2
		PG 64-22	3
		PG 70-22	4
		PG 76-22	5
	Granite	PG 64-34	1
		PG 64-28	2
		PG 64-22	3
		PG 70-22	4
PG 76-22		5	

**Table 2. Asphalt Binder Grade Recommendation: 0-6674.**

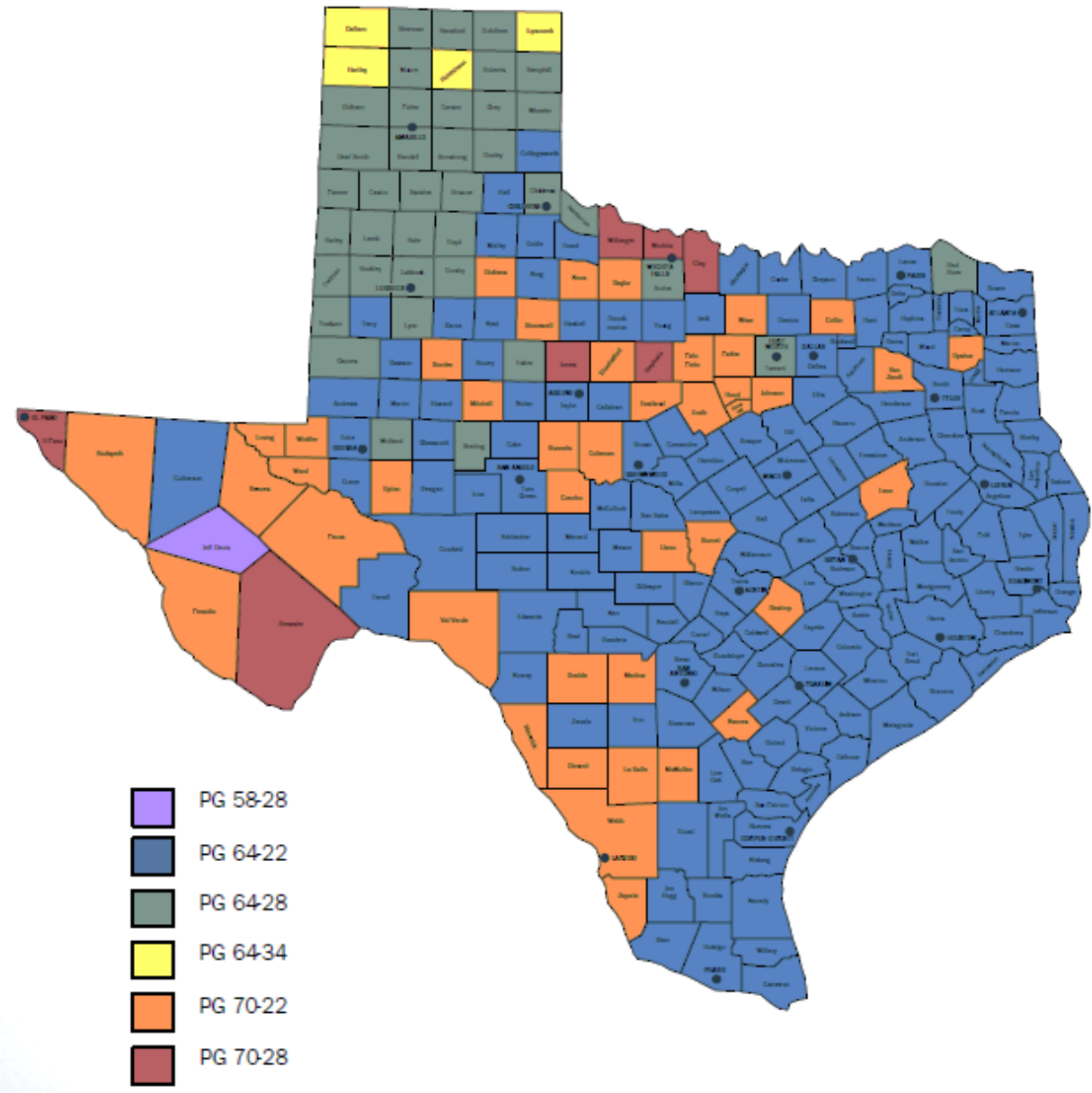
<i>No.</i>	<i>District</i>	<i>Aggregate</i>	<i>Conventional Existing AC Pavement</i>	<i>Existing JPCP</i>
1	Paris	Gravel	PG64-28	PG64-34
2	Fort Worth	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-34
3	Wichita Falls	Gravel	PG64-28	PG64-34
4	Amarillo	Gravel	PG64-28	PG64-34 (Higher %AC)
5	Lubbock	Gravel	PG64-28	PG64-34 (Higher %AC)
6	Odessa	Gravel	PG64-28	PG64-28
7	San Angelo	Gravel	PG64-28	PG64-28
8	Abilene	Gravel	PG64-28	PG64-34 (Higher %AC)
9	Waco	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-28
10	Tyler	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-34
11	Lufkin	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-28
12	Houston	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-28
13	Yoakum	Gravel	PG64-28	PG64-28
14	Austin	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-28
15	San Antonio	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-28
16	Corpus Christi	Gravel	PG64-22	PG64-22
17	Bryan	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-28
18	Dallas	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-28
19	Atlanta	Granite	PG70-22	PG64-28
20	Beaumont	Granite	PG70-22	PG64-28
21	Pharr	Gravel	PG64-22	PG64-22
22	Laredo	Gravel	PG64-22	PG64-22
23	Brownwood	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-28
24	El Paso	Limestone	PG64-22 (Higher %AC) or PG64-28	PG64-28
25	Childress	Gravel	PG64-28	PG64-34 (Higher %AC)

**Table 3. Asphalt Binder Grade Recommendation: New Catalog.**

No.	District	Counties	PGH:		PGL:		PGL: Overlay	
			New & Overlay	New	Existing AC	Existing JPCP		
1	Paris	Red River	64	-28	-28	-34	-34	
		Delta, Fannin, Franklin, Grayson, Hunt, Hopkins, Lamar, Rains	64	-22	-28	-34	-34	
		Tarrant	64	-28	-28	-34	-34	
2	Fort Worth	Jack	64	-22	-28	-34	-34	
		Erath, Hood, Johnson, Palo Pinto, Parker, Somervell, Wise	70	-22	-28	-34	-34	
		Archer	64	-28	-28	-34	-34	
3	Wichita Falls	Cooke, Montague, Throckmorton, Young	64	-22	-28	-34	-34	
		Baylor	70	-22	-28	-34	-34	
		Clay, Wichita, Wilbarger	70	-28	-28	-34	-34	
4	Amarillo	Armstrong, Carson, Deaf Smith, Gray, Hansford, Hemphill, Moore, Ochiltree, Oldham, Potter, Randall, Roberts, Sherman	64	-34	-34	-34	-34	
		Dallam, Hartley, Hutchinson, Lipscomb	64	-28	-28	-34	-34	
5	Lubbock	Bailey, Castro, Cochran, Crosby, Floyd, Garza, Hale, Hockley, Lamb, Lubbock, Lynn, Parmer, Swisher, Yoakum	64	-28	-28	-34	-34	
		Dawson, Gaines, Terry	64	-22	-28	-34	-34	
		Midland	64	-28	-28	-28	-28	
6	Odessa	Andrews, Crane, Ector, Martin, Terrell	64	-22	-28	-28	-28	
		Loving, Pecos, Reeves, Upton, Ward, Winkler	70	-22	-28	-28	-28	
		Sterling	64	-28	-28	-28	-28	
7	San Angelo	Coke, Crockett, Edwards, Glasscock, Irion, Kimble, Menard, Reagan, Real, Schleicher, Sutton, Tom Green	64	-22	-28	-28	-28	
		Concho, Runnels	70	-22	-28	-28	-28	
		Fisher	64	-28	-28	-34	-34	
8	Abitene	Callahan, Haskell, Howard, Kent, Nolan, Scurry, Taylor	64	-22	-28	-34	-34	
		Borden, Mitchell, Shackelford, Stonewall	70	-22	-28	-34	-34	
		Jones	70	-28	-28	-34	-34	
9	Waco	Bell, Bosque, Coryell, Falls, Hamilton, Hill, Limestone, McLennan	64	-22	-28	-28	-28	
10	Tyler	Anderson, Cherokee, Gregg, Henderson, Rusk, Smith, Wood	64	-22	-28	-34	-34	
		Van Zandt	70	-22	-28	-34	-34	
11	Lufkin	Angelina, Houston, Nacogdoches, Polk, Sabine, San Augustine, San Jacinto, Shelby, Trinity	64	-22	-28	-28	-28	
12	Houston	Brazoria, Fort Bend, Galveston, Harris, Montgomery, Waller	64	-22	-28	-28	-28	
13	Yoakum	Austin, Calhoun, Colorado, DeWitt, Fayette, Gonzales, Jackson, Lavaca, Matagorda, Victoria, Wharton	64	-22	-28	-28	-28	
14	Austin	Blanco, Caldwell, Gillespie, Hays, Lee, Mason, Travis, Williamson	64	-22	-28	-28	-28	
		Bastrop, Burnet, Llano	70	-22	-28	-28	-28	
15	San Antonio	Atascosa, Bandera, Bexar, Comal, Frio, Guadalupe, Kendall, Kerr, Wilson	64	-22	-28	-28	-28	
		McMullen, Medina, Uvalde	70	-22	-28	-28	-28	

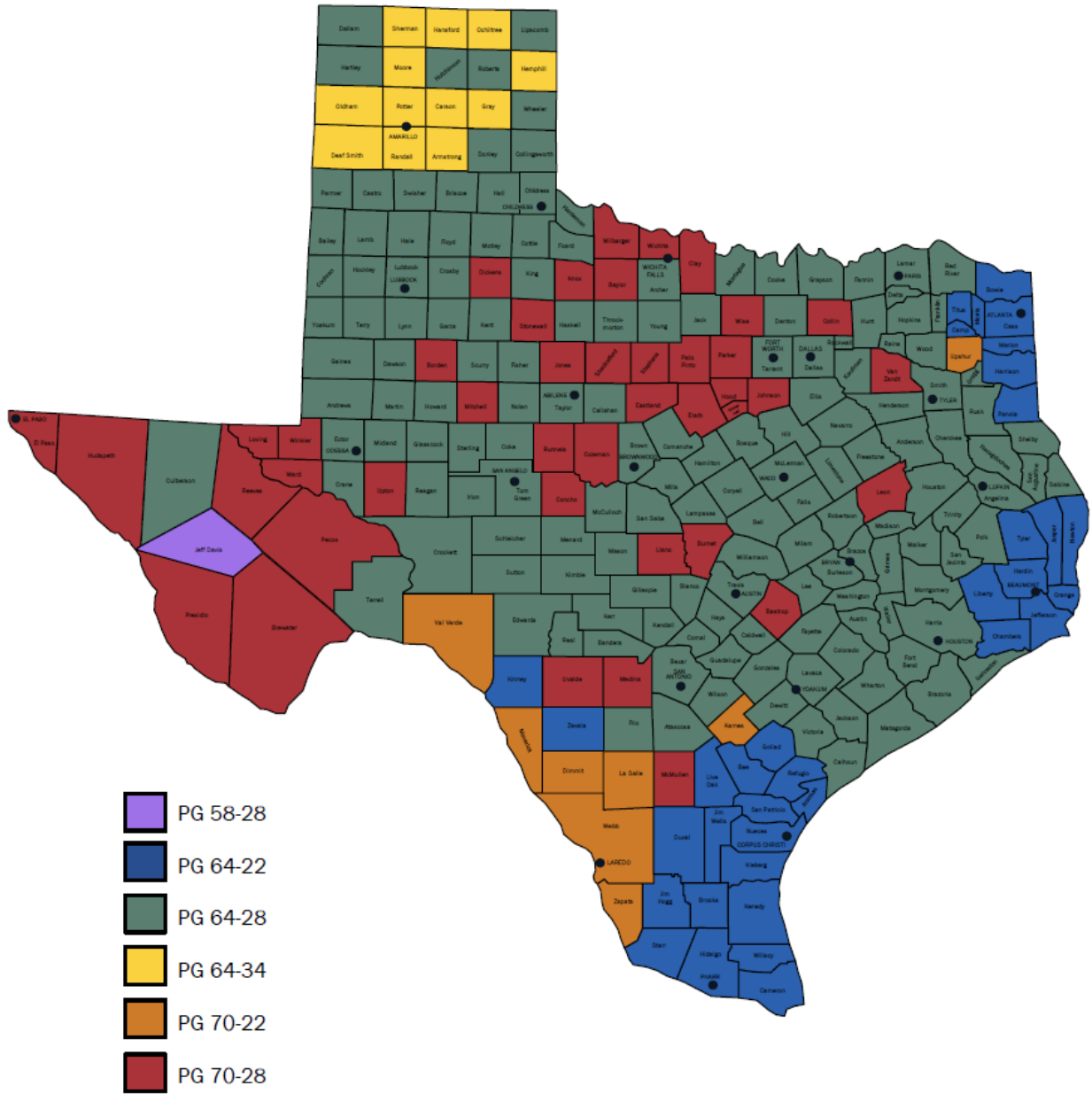
No.	District	Counties	PGH: New & Overlay	PGL: New	PGI: Existing AC	PGI: Overlay JPCP
16	Corpus Christi	Aransas, Bee, Goliad, Jim Wells, Kleberg, Live Oak, Nueces, Refugio, San Patricio	64	-22	-22	-22
17	Bryan	Brazos, Burleson, Freestone, Grimes, Madison, Milam, Robertson, Walker, Washington	70	-22	-22	-22
18	Dallas	Leon Dallas, Denton, Ellis, Kaufman, Navarro, Rockwall	70	-22	-22	-22
19	Atlanta	Bowie, Camp, Cass, Harrison, Marion, Morris, Panola, Titus Upshur	64	-22	-22	-22
20	Beaumont	Chambers, Hardin, Jasper, Jefferson, Liberty, Newton, Orange, Tyler	64	-22	-22	-22
21	Pharr	Brooks, Cameron, Hidalgo, Jim Hogg, Kenedy, Starr, Willacy Zapata	70	-22	-22	-22
22	Laredo	Duval, Kinney, Zavala Dimmit, La Salle, Maverick, Val Verde, Webb	64	-22	-22	-22
23	Brownwood	Brown, Comanche, Lampasas, McCulloch, Mills, San Saba Coleman, Eastland	64	-22	-22	-22
24	El Paso	Stephens Jeff Davis Culberson Hudspeth, Presidio Brewster, El Paso	70	-28	-28	-28
25	Childress	Briscoe, Childress, Donley, Hardeman, Wheeler Collingsworth, Cottle, Foard, Hall, Motley, King Dickens, Knox	64	-28	-28	-34
			70	-22	-28	-34





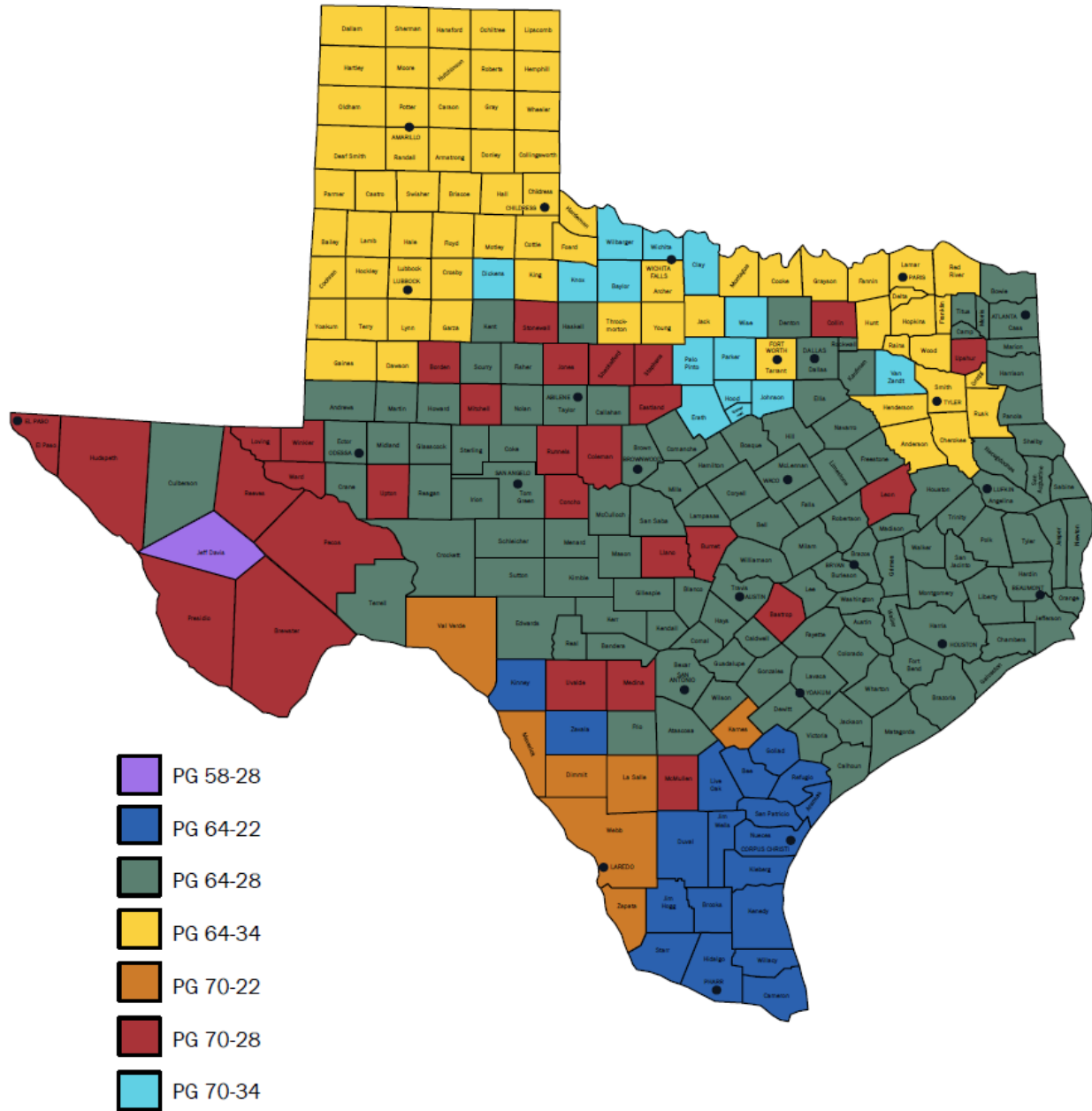
**Figure 3. PG Recommendation for New Construction.**

# PG GRADE RECOMMENDATION BASED ON CLIMATE - 98% CONFIDENCE

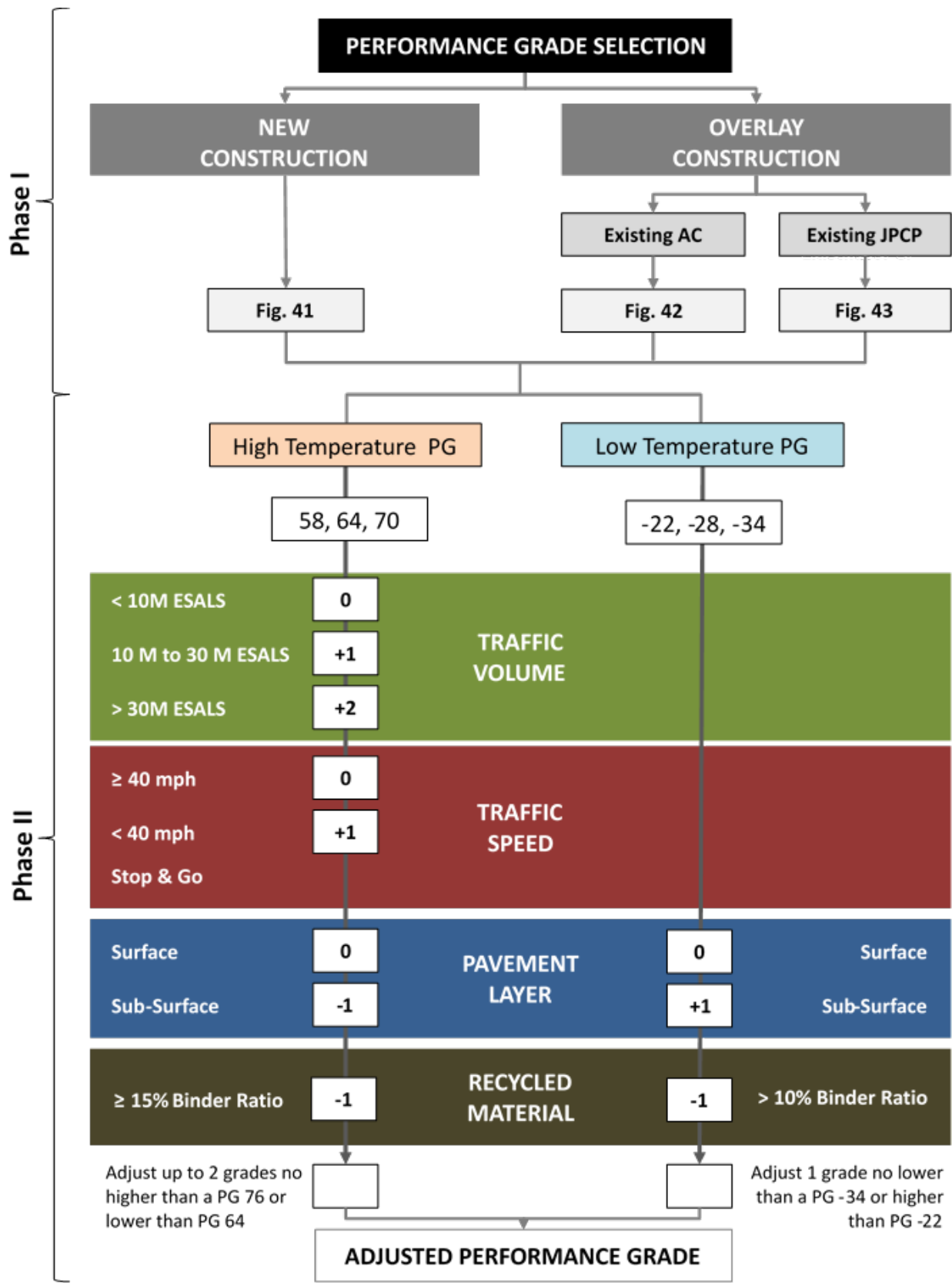


**Figure 4. PG Recommendation for Asphalt Overlay over Existing AC.**

# PG GRADE RECOMMENDATION BASED ON CLIMATE - 98% CONFIDENCE



**Figure 5. PG Recommendation for Asphalt Overlay over JPCP.**



**Figure 6. Asphalt Binder PG Recommendation and Adjustment: New Method.**