DESIGN BULLETIN #13
(Revised June 2012. Supersedes March 2007)

Revisions to Pavement Design Manual for Selection of ACP Mix Types and Asphalt Binder Grades

Updates to Design Bulletin #13

- June 2012 update to include full use of AASHTO Performance Grade specifications for asphalt cements.

Summary

This design bulletin is being issued as an addendum to Alberta Transportation's Pavement Design Manual (June 1997). Design ESAL criteria, mix types and mix type selection process replace those listed in the Pavement Design Manual.

June 2012 Revisions

The main revisions include:

- All asphalt cements to be specified as AASHTO Performance Grade (PG) asphalts.
- The mix type in Zone 1 for 3 to 6 million ESAL has been revised to H2 from H1.
- Asphalt grades are now listed for very high traffic loading (> 20 million ESAL).
- References to including a life cycle cost adjustment factor in the tender package have been removed.
- Guidance is provided on testing asphalt-aggregate mixtures for moisture susceptibility.

Implementation

This Design Bulletin is effective immediately.

1. Mix Types

Asphalt Concrete Pavement (ACP) mix types are listed in Table 3.50.3.2 Asphalt Concrete Mix Types and Characteristics of Specification 3.50 ACP – EPS contained in the Standard Specifications for Highway Construction.

The H, M and L designations refers to High, Medium and Low service applications. The selection of these mixes is governed by expected traffic loads, geographic location and type of application (new construction versus overlay rehabilitation). Asphalt binder grades are selected based on the expected traffic loads, geographic location and type of application. The "S" series of mixes are for specialty applications as discussed in section 5 of this bulletin. For community airports a L1 mix type is to be used with PG 46-37 asphalt. Airports with higher aircraft loadings (water bombers) should use a H2 mix with PG 58-28 asphalt.

All references to design ESAL are for a 20-year period regardless of that used in the pavement design.

2. Mix Type Selection

The high temperature zone is determined from the map shown in Figure 1 (attached). Zone 1 is the area of the province south and east of the boundaries created by the Red Deer River, Highway 36 (excluding Highway 36), and Highway 4 south of Warner (excluding Highway 4). Zone 2 is the area of the province south of the North Saskatchewan River, not including that area defined as Zone 1. Zone 3 is the area of the province north of Zone 2.

Mix type selection is based upon geographic location and traffic loading as outlined in Table 1.

Table 1- ESAL Criteria for Selection of Mix Types

High Temperature Zone	Design ESAL (millions)				
	< 1.0	1.0 to < 3.0	3.0 to < 6.0	6.0 to <10.0	10.0
1	L11	H2	H2	H1	H1
2	L1	M1	H2	H1	H1
3	L11	M1	M1	H2	H1

1 - An adjustment in the asphalt grade and mix type selection for projects involving new construction or overlays of pavements with a very low incidence of existing transverse cracks is described in Section 4.

3. Asphalt Grade Selection

Asphalt grade selection is based upon geographic location, traffic loading, location in the pavement structure and whether consideration is required for enhanced resistance to low temperature cracking and/or wheel path rutting.

Material specifications for Performance Grade asphalts are contained in Specification 5.7 Supply of Asphalt and AASHTO M320 Standard Specification for Performance Graded Asphalt Binder.

3.1 Asphalt Selection

Asphalt grades are selected based upon the type of construction, design ESAL loading and geographic location. Construction type is broadly sorted into two categories:

i. Overlay construction with all levels of design ESAL; or new construction with design ESAL less than 6 million. The majority of paving would fit into this category.

ii. New construction with design ESAL greater than 6 million.

3.1.1 Overlay or New Construction with Design ESAL ess Than 6 Million

Asphalt selection is based upon geographic location (Figure 1) and design ESAL loading as outlined in Table 2. For these projects less emphasis is placed on controlling low temperature transverse cracking which then allows the use of "straight run" or non-

modified asphalts (with the exception of the PG 64-28 grade which may need some form of modification).

Table 2 Selection of Conventional Asphalt Grades

High Temperature Zone	Design ESAL {millions}					
	< 1.0	1.0 to < 3.0	3.0 to < 6.0	6.0 to <10.0	10 to < 20	> 20.0
1	PG 58-28[1]	PG 58-28	PG 58-28	PG 58-28	PG 64-28	PG 64-28
2	PG 52-34	PG 52-34	PG 58-28	PG 58-28	PG 58-28	PG 64-28
3	PG 52-34[1]	PG 52-34	PG 58-28	PG 58-28	PG 58-28	PG 64-28

Note 1- An adjustment in the asphalt grade selection for these projects involving new construction or overlays of pavements with a very low incidence of existing transverse cracks is described in Section 4.

3.1.2 New Construction with Design ESAL Greater Than 6 Million ESAL

Asphalt selection for highways with traffic loading greater than 6 million ESAL involving new construction (either: first stage, final stage or non-staged construction) is outlined in Table 3. For these highways the asphalt selection is meant to provide increased resistance to the formation of low temperature transverse cracks. These are premium grade asphalts which have been engineered through chemical modification or polymer additives.

Although not commonly encountered, overlays of existing pavements with little or no transverse cracking and design ESAL greater than 6 million would also fit into this category.

Table 3 Selection of Modified Asphalt Grades for New Construction (Design ESAL Greater Than 6 million)

	Traffic Loading (ESAL)			
	> 6 and S 20 million		> 20 million[4]	
	First Stage	Final	First Stage	Final
South[1]	PG 58-34		PG 64-34	
North	PG 58-34	PG 58-37[2]	PG 64-34	PG 64-37P[2,3]

Notes:

1 - All highways south of and including Highway 11 west of Nevis and Highway 12 east of Nevis.

2 - For non-staged new construction or thick pavement structures use a PG xx-37 in the upper 100 mm and a PG xx-34 for material greater than 100 mm in depth from pavement surface.

3 – "P" indicates binder to be modified using polymer additives.

4 – In certain special applications where resistance to wheel path rutting is paramount use a PG 70-28 in all lifts as per Section 3.1.3 Special Applications.

3.1.3 Special Applications

For locations with very high ESAL loadings and slow moving traffic, consideration should be given to grade bump to PG 70-28. This would include such applications as urban roadways with intersections or Vehicle Inspection Stations.

4. Adjustment to Mix Type and Conventional Asphalt Grade Selection

For projects involving new construction {1st stage, final stage or non-staged), or overlays of pavements with very little transverse cracking, the mix type selected from Table 1 and asphalt grade selected from Table 2 are adjusted as follows in order to build crack resistant pavements:

- In High Temperature Zone 1 for design ESAL < 1 million use a M1 mix type and PG 52-34.
- In High Temperature Zone 3 for design ESAL < 1 million use a M1 mix type and PG 46-34 asphalt cement.

5. Specialty Mixes

The selection of mix types S1, S2 and S3 is based upon specific pavement design and construction requirements as outlined in Table 4.

Table 4 - Selection of Specialty Mixes

Specialty Mix	Application	Asphalt Grade
51	i.) Paver laid first lift of 20 mm or less. Used to improve pavement cross-section and mitigate roughness problems. ii.) Single lift of 30 mm where traffic loading and geographic location call for a L1 type.	i.) Same as upper pavement lift ii.) Select according to Section 3.
52	Single lift of 30 mm where traffic loading and geographic location call for an "H" or "M" mix type.	Select according to Section 3.
53	A single lower lift mix used where the design pavement thickness is 140 mm or greater. Minimum lift thickness is 80 mm and maximum lift thickness is 100 mm. To be used as a lower lift only; not intended for use as a surface lift. The minimum thickness of the subsequent surface lift is to be 60 mm.	Same as upper pavement lift.

6. Preparation of Tender Documents

Contracts using mixtures under the following circumstances shall include provisions for testing of asphalt-aggregate mixtures using the AASHTO T283 test procedure. The current special provision is titled Moisture Susceptibility Testing and Design Criteria. Those mixes include:

- Pavements with an urban cross section (curb and gutter).
- Mixes using asphalts with a PG temperature differential greater than 90°C (e.g. PG 58-34 has a .dT of 92°C).

References to mix types in tender documents are to include both the mix type and PG asphalt grade in both the unit price schedule (UPS) and on the typical section drawings (e.g. Mix Type M1, PG 52-34). For updating existing surfacing strategies where penetration grade asphalts are indicated the following PG asphalt grades are to be used.

Table 5 Conversion of AT Penetration Grades to Performance Grades

AT Penetration Grade	Corresponding AT Performance Grade
80-100A	PG 64-28
120-150A & 150-200A	PG 58-28
200-300A	PG 52-34
300-400A	PG 46-34

Questions on the use of this design bulletin may be directed to the Surface Engineering and Aggregates section of Technical Standards Branch.

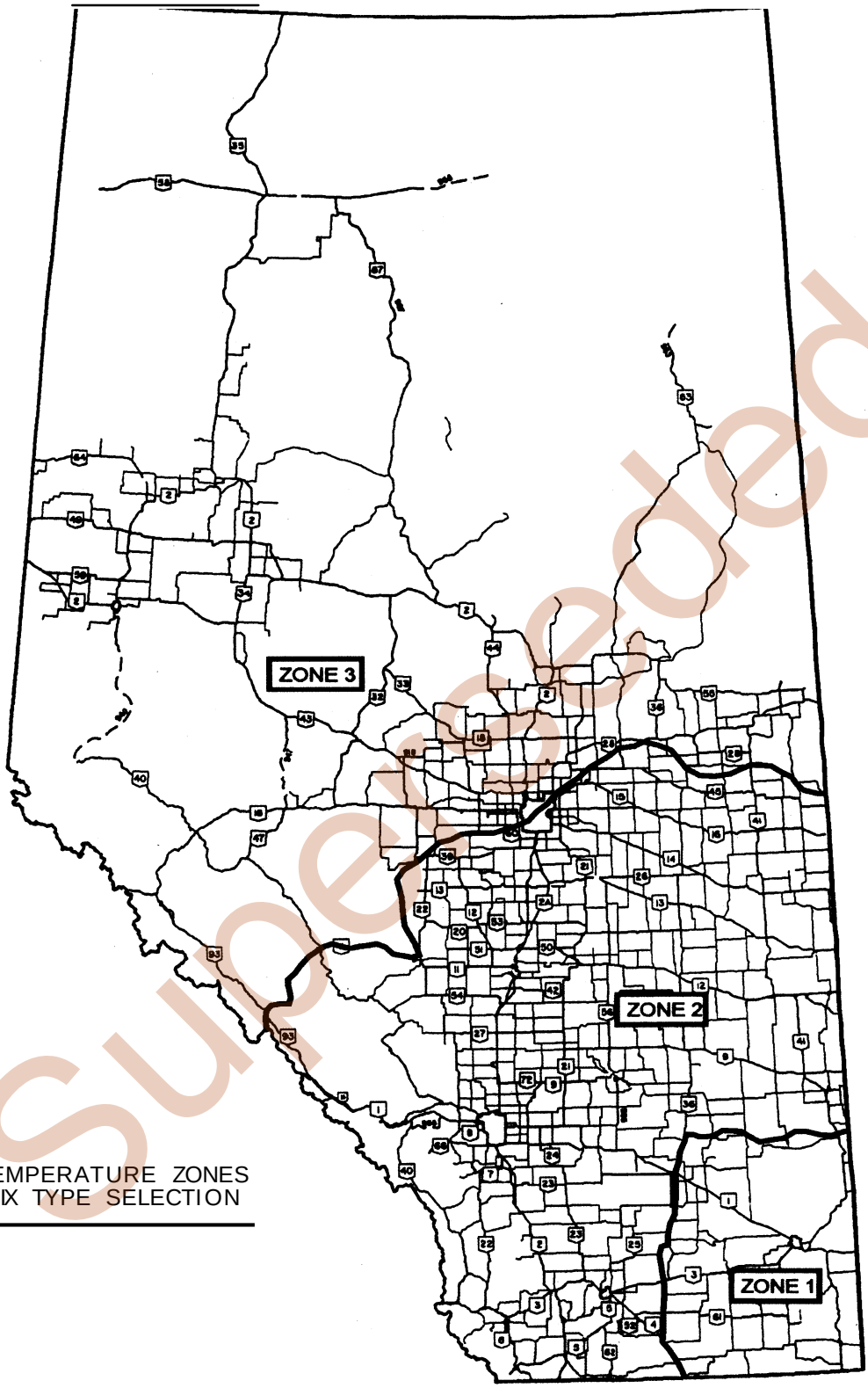
Recommended:

Chuck McMillan, P.Eng.
Director
Surface Engineering & Aggregates Section

Approved:

Moh Lali, P.Eng.
Executive Director
Technical Standards Branch

Figure 1- High Temperature Zones for Mix Type Selection



HIGH TEMPERATURE ZONES
FOR MIX TYPE SELECTION