

PARTIALLY POPULATED CATALOGUE OF MEASURED PROPERTIES OF FIELD SECTIONS

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DISCLAIMER

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INTRODUCTION

This catalogue documents the construction, monitoring, and mixture information of 11 test sections: four in SH 15 in the north Amarillo, three in US 62 in Childress, and four in Loop 820 in Fort Worth. Below is the information included in this catalogue.

1. Field Test Section Information, such as:

The locations such as Global Positioning System (GPS) coordinates of each test section.

The existing pavement structure and pavement conditions.

The asphalt mix type of each test section.

The construction information such as laying temperature and compaction pattern, etc.

2. Lab Testing Results of Mixtures from Each Test Section, such as:

The dynamic modulus results.

The overlay test (OT) results.

The repeated load test results.

This partially populated catalogue is aimed to help with tracking, understanding, and analyzing the field performance of these test sections.

FIELD TEST SECTION INFORMATION

SH 15 TEST SECTION LOCATIONS

The four SH 15 test sections belong to an overlay project constructed on October 7, 2013, and the overlay is composed of 1.5 inches type D mix and 1 inch type F mix. The differences among the four test sections are different binder type and/or binder content used in the type D mix. The location of sections, existing pavement conditions, and construction information are described below.

The four test sections are located end-to-end in the eastbound of SH 15, north of Amarillo. Table 1 lists the GPS coordinates for each test section.

Table 1. GPS Coordinates of SH 15 Test Sections.

Section ID	Begin		End		Length (ft)
	Latitude	Longitude	Latitude	Longitude	
S1	36°25.887'	-100°44.277'	36°26.006'	-100°44.033'	1390
S2	36°26.040'	-100°43.966'	36°26.154'	-100°43.705'	1450
S3	36°26.201'	-100°43.560'	36°26.293'	-100°43.268'	1530
S4	36°26.328'	-100°43.155'	36°26.395'	-100°42.956'	1050

SH 15 Existing Pavement Conditions

The existing pavement was asphalt concrete pavement with some transverse and longitudinal cracking. The GPR data were collected before the milling work and showed that the existing AC pavement thickness was about 2.5 inches. After that about 1 inch of the existing pavement was milled and was replaced with 1 inch type F mix. No obvious transverse cracks were observed in the shoulder or the milled surface during construction. Figure 1 shows the pavement structure of the SH 15 test sections.



Figure 1. Pavement Structure of SH 15 Test Sections.

Asphalt Mix Types of SH 15 Test Sections

The type D mixes of four test sections are all warm mixes. The binder types and asphalt contents of SH 15 test sections are:

Section 1: PG 58-28, 5.5 percent.

Section 2: PG 58-28, 5.8 percent.

Section 3: PG 64-34, 5.8 percent.

Section 4: PG 64-34, 5.5 percent.

Construction Information of SH 15

The average paving temperature was 245°F, measured from the material in the paver. The rollers used in SH 15 test sections and the compaction pattern is four vibrating compactions (CB64) + six static compactions (Dynapac CP274 or CP271) + one static compaction (CB64). The same compaction pattern was employed for all the test sections. Generally, the test sections were completed in an orderly way. For each test section, seven buckets of mixes were sampled and taken back to TTI to conduct lab tests.

US 62 TEST SECTION LOCATIONS

The three US 62 test sections were constructed on October 3, 2013, and the overlay is composed of 2 inches type D mix and 3 inches type B mix. The three test sections are located in the eastbound of US 62, close to Childress. Table 2 lists the GPS coordinates for each test section.

Table 2. GPS Coordinates of US 62 Test Sections.

Section ID	Begin		End		Length (ft)
	Latitude	Longitude	Latitude	Longitude	
S1	36°25.887'	-100°44.277'	36°26.006'	-100°44.033'	1390
S2	36°26.040'	-100°43.966'	36°26.154'	-100°43.705'	1450
S3	36°26.201'	-100°43.560'	36°26.293'	-100°43.268'	1530

US 62 Existing Pavement Conditions

The previous pavement structure was 8 inches asphalt pavement plus 11 inches flexible base. These 8 inches pavement was fully milled down and replaced with 2 inches type D mix and 3 inches type B mix. The paving of the 2 inches type D mix of these test sections was conducted on October 3, 2013. Figure 2 shows the pavement structure of the US 62 test sections.

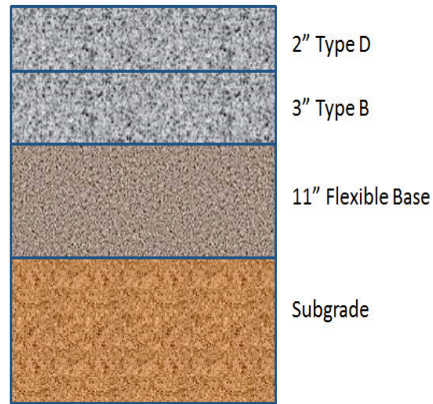


Figure 2. Pavement Structure of US 62 Test Sections.

Asphalt Mix Types of US 62 Test Sections

The differences among the three test sections are different binder type and with/without Reclaimed Asphalt Pavement (RAP) or Reclaimed Asphalt Shingles (RAS) in the type D mix. The type D mixes of each test section of US 62 are:

- Section 1: PG 64-34, with RAP/RAS.
- Section 2: PG 70-28, virgin mix.
- Section 3: PG 70-28, with RAP/RAS.

Construction Information of US 62

The average paving temperature was 320°F, measured from the material in the paver. The rollers used in US 62 test sections and the compaction pattern is two vibrating compactions (Dynapac CC722) + four static compactions (Dynapac RR602) + one static compaction (Dynapac RS607). The same compaction pattern was employed for all the test sections.

No abnormality was observed during the construction of US 62 test sections. For each test section, seven buckets of mixes were sampled and taken back to TTI to conduct lab tests.

LOOP 820 TEST SECTION LOCATIONS

Four test sections on Loop 820 were constructed on July 20, 2012. The four test sections are located side by side on four lanes at Westbound Loop 820. The start and end points of GPS coordinates are (32°48.239', -97°25.887') and (32°48.162', -97°25.761'), respectively. The length of the test sections is 992 ft.

Loop 820 Existing Pavement Conditions

The existing pavement of Loop 820 is continuously reinforced concrete pavement with lots of fine cracks; the estimated cracking gap is around 5–6 feet. Figure 3 shows the pavement structure of the Loop 820 test sections.



Figure 3. Pavement Structure of Loop 820 Test Sections.

Asphalt Mix Types of Loop 820 Test Sections

The overlay mix for each test section is illustrated in Figure 3, from inside lane to outside lane. The thickness of all test sections is 2 inches.

→ Traffic Direction	Section 0: control-PG 64-22 13%RAP/5%RAS+ Advera
	Section 1: APAC-PG 64-22 13%RAP/5%RAS blended with
	Section 2: PG 64-28 13%RAP/5%RAS+ Advera additive
	Section 3: PG 64-22+0.4% more+13%RAP/5%RAS+Advera

Figure 3. Overlay Mix Type for Each Test Section of Loop 820.

Construction Information of Loop 820

The construction of test sections 1, 2, and 3 happened at the night of July 19, 2012. The average paving temperatures measure with TTI temperature gun were 262°F, 268°F, and 272°F for test sections 1, 2, and 3, respectively. Note that TTI temperature gun is on average 6°F higher than that of the construction company’s gun. The overall feeling is that test section 3 had the highest paving temperature. The rollers used in Loop 820 test sections and the compaction pattern is three vibrating compactions (Dynapac CC624 steel roller, high frequency) + eight static compactions (Dynapac CP271 pneumatic roller) + one or two static compaction (Ingersoll-rand DD70). The same compaction pattern was employed for all test sections.

Ten buckets of plant mix for each test section (Sections 1, 2, and 3) were taken, and 13 barrels of raw material (5 barrels of type D rock, 3 barrels of screenings, 2 barrels of RAP, 1 barrel of pure RAS, 1 barrel of RAS blended with Advera, and 1 barrel of sand) and two buckets of PG 64-22 binder were sampled. For each test section, 10 cores were taken one day after the construction.

LAB TESTING RESULTS OF MIXTURES FROM EACH TEST SECTION

SH 15 SECTION RESULTS

Dynamic Modulus of SH 15 Test Sections

Table 3 listed the dynamic modulus values for each test section of SH 15. The tests were conducted using the asphalt mixture performance tester machine.

Table 3. Dynamic Modulus of SH 15 Test Sections.

Test Temp. (°C)	Test Frequency (Hz)	Modulus (ksi)			
		Section 1 PG 58-28 @ 5.5 AC	Section 2 PG 58-28 @ 5.8 AC	Section 3 PG 64-34 @ 5.8 AC	Section 4 PG 64-34 @ 5.5 AC
4	25	1799.6	1903.0	1728.4	1894.3
4	10	1567.7	1668.2	1480.7	1638.6
4	5	1394.9	1495.4	1301.5	1453.9
4	1	1023.8	1116.9	925.8	1059.4
4	0.5	882.9	970.7	786.4	910.1
4	0.1	602.2	673.2	511.4	611.0
20	25	806.3	845.4	685.6	784.7
20	10	631.3	665.3	520.6	605.5
20	5	521.2	551.0	418.5	494.0
20	1	309.8	333.4	230.1	282.1
20	0.5	246.5	267.1	177.9	221.1
20	0.1	132.3	147.3	90.7	116.3
40	25	176.3	184.3	142.3	165.7
40	10	117.1	124.2	91.7	109.5
40	5	83.1	89.5	65.6	78.8
40	1	35.0	38.8	29.6	34.9
40	0.5	25.4	28.5	23.5	27.1
40	0.1	12.7	14.5	14.0	15.3
40	0.01	6.3	7.2	8.5	7.5

Repeated Load Test Results of SH 15 Test Sections

A repeated load test is required to determine the rutting properties α and μ . The test equipment and the specimen can be the same as in the dynamic modulus test. Two replicates are recommended. The maximum load repetition number is 10,000. Each load repetition time is 0.1 second of loading plus 0.9 second of rest. The rutting properties are determined based on the permanent strain curve. Table 4 listed the rutting properties for each test section.

Table 4. Rutting Properties of SH 15 Test Sections.

Rutting Properties	Section 1 PG 58-28 @ 5.5 AC	Section 2 PG 58-28 @ 5.8 AC	Section 3 PG 64-34 @ 5.8 AC	Section 4 PG 64-34 @ 5.5 AC
α	0.6437	0.6697	0.7685	0.7694
μ	0.634	0.7035	0.539	0.44

Overlay Tester Results of SH 15 Test Sections

The fracture properties A and n are determined by an Overlay tester (OT) related approach. Table 5 listed the OT cycles and corresponding cracking properties for each test section.

Table 5. Cracking Properties of SH 15 Test Sections.

Cracking Properties	Section 1 PG 58-28 @ 5.5 AC	Section 2 PG 58-28 @ 5.8 AC	Section 3 PG 64-34 @ 5.8 AC	Section 4 PG 64-34 @ 5.5 AC
OT cycles	912	1590	9001	6549
A	9.7044E-9	3.3559E-9	1.2234E-10	2.2459E-10
n	5.6184	5.9097	6.8181	6.6514

US 62 SECTION RESULTS

Table 6, Table 7, and Table 8 show the dynamic modulus, rutting properties, and cracking properties, respectively, of the US 62 test sections.

Dynamic Modulus of US 62 Test Sections

Table 6. Dynamic Modulus of US 62 Test Sections.

Test Temp. (°C)	Test Frequency (Hz)	Modulus (ksi)		
		Section 1 PG 64-34, RAP/RAS	Section 2 PG 70-28, Virgin Mix	Section 3 PG 70-28, RAP/RAS
4	25	1479.8	1488.6	1826.0
4	10	1265.2	1283.2	1608.1
4	5	1108.0	1135.1	1453.8
4	1	782.5	821.7	1120.8
4	0.5	665.0	702.8	989.5
4	0.1	432.9	470.8	718.9
20	25	631.4	599.0	850.3
20	10	481.5	459.7	685.0
20	5	390.2	377.2	578.7
20	1	220.2	219.7	375.0
20	0.5	174.2	175.6	309.4
20	0.1	93.4	96.9	189.0
40	25	128.5	130.7	215.7
40	10	86.1	88.3	156.2
40	5	63.4	65.4	122.0
40	1	29.6	31.0	64.7
40	0.5	24.0	24.8	52.4
40	0.1	14.1	14.4	30.1
40	0.01	8.5	8.4	15.8

Repeated Load Test Results of US 62 Test Sections

Table 7. Rutting Properties of US 62 Test Sections.

Rutting Properties	Section 1 PG 64-34, RAP/RAS	Section 2 PG 70-28, Virgin Mix	Section 3 PG 70-28, RAP/RAS
α	0.7285	0.7581	0.7424
μ	0.5345	0.629	0.4905

OT Test Results of US 62 Test Sections

Table 8. Cracking Properties of US 62 Test Sections.

Cracking Properties	Section 1 PG 64-34, RAP/RAS	Section 2 PG 70-28, Virgin Mix	Section 3 PG 70-28, RAP/RAS
OT cycles	5426	33192	417
A	3.2171E-10	1.0113E-11	4.3272E-8
n	6.5529	7.5019	5.2083

LOOP 820 TEST SECTION RESULTS

Table 9, Table 10, and Table 11 show the dynamic modulus, rutting properties, and cracking properties, respectively, of the Loop 820 test sections.

Dynamic Modulus of Loop 820 Test Sections

Table 9. Dynamic Modulus of Loop 820 Test Sections.

Test Temp. (°C)	Test Frequency (Hz)	Modulus (ksi)			
		Section 0 PG 64-22, Control Mix	Section 1 PG 6422, Blended with Advera	Section 2 PG 64-28	Section 3 PG 64-22 with 0.4% More Binder
4	25	2393.7	2033.0	2011.2	2309.5
4	10	2220.5	1845.6	1826.3	2117.5
4	5	2088.4	1700.5	1685.5	1971.6
4	1	1781.6	1381.1	1362.6	1639.8
4	0.5	1647.0	1243.6	1226.0	1494.0
4	0.1	1341.7	935.6	928.7	1178.2
20	25	1458.7	1119.8	1046.6	1242.6
20	10	1264.9	940.9	866.0	1052.0
20	5	1120.6	820.1	747.5	922.5
20	1	825.7	570.5	511.5	658.3
20	0.5	713.8	485.4	432.8	566.8
20	0.1	489.6	314.8	280.3	381.5
40	25	468.2	384.5	333.8	398.8
40	10	358.9	288.2	249.6	305.9
40	5	292.2	230.4	200.1	246.0
40	1	162.7	127.2	110.1	134.7
40	0.5	129.9	100.8	88.4	109.1
40	0.1	72.8	56.0	49.6	65.1
40	0.01	34.2	27	24.5	37.6

Repeated Load Test Results of Loop 820 Test Sections

Table 10. Rutting Properties of Loop 820 Test Sections.

Rutting Properties	Section 0 PG 64-22, Control Mix	Section 1 PG 6422, Advera Blended with RAP/RAS	Section 2 PG 64-28	Section 3 PG 64-22 with 0.4% More Binder
α	0.6921	0.7311	0.6674	0.7102
μ	0.312	0.671	0.4915	0.548

OT Test Results of US 62 Test Sections

Table 11. Cracking Properties of Loop 820 Test Sections.

Cracking Properties	Section 0 PG 64-22, Control Mix	Section 1 PG 6422, Advera Blended with RAP/RAS	Section 2 PG 64-28	Section 3 PG 64-22 with 0.4% More Binder
OT cycles	8	12	22	24
A	8.2469E-5	3.8011E-5	1.1941E-5	1.0112E-5
n	3.1366	3.3491	3.6667	3.7123

SUMMARY

Eleven test sections were constructed, monitored, and analyzed: four in SH 15 north of Amarillo, three in US 62 at Childress, and four in Loop 820 at Fort Worth. The field test section and the lab mix test information provide a partially populated catalogue to track the field performance of test sections. These test sections will be monitored, and comparisons will be made between prediction and surveying results for further model refining/calibration.

