PAVEMENT SUBGRADE PERFORMANCE STUDY

Test Section 706

Subgrade soil type A-6 at wet of optimum (22%)

By

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Subgrade Moisture Content	AASHTO Soil Type			
	A-2-4	A-4	A-6	A-7-6
M1	Optimum 10 % TS 701	Optimum 17 % TS 702	Optimum 16 %	Optimum TBD*
M2	12 % TS 707	19 % TS 704	19 % TS 708	TBD
M3	15 % TS 703	23 % TS 705	**22 % TS 706**	TBD

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EXECUTIVE SUMMARY

This is one of a series of reports on the subgrade performance research study. The hypothesis for this study is that the failure criterion depends on the subgrade type and the in-situ moisture content. Many of the current mechanistic design procedures incorporate the results from AASHO Road Tests conducted in the late fifties. However, the AASHO Road Tests were all conducted on only one soil type (AASHTO type A-6). The tests results reflect the combined effect of traffic loads and seasonal variations. Applying failure criteria based on the AASHO Road Tests to other soil types, at different moisture contents and different climate creates much uncertainty.

In recent decades much progress has been achieved in computer technology and new sensors allow reliable in-situ stress and strain measurements. The authors recognize the technological opportunities to develop more reliable pavement failure criteria that consider the effects of subgrade soil type and moisture condition.

Transportations agencies from several US states are contributing to a research initiative that will develop the bases for new pavement failure criteria that is adequate for the most common subgrade soil types found in the United State at various soil moisture contents. As part of the research program, four subgrade soils were selected for testing in the Frost Effects Research Facility (FERF). Each subgrade soil was to be constructed at three moisture contents, with one at or near optimum density and moisture content. The test sections consisted of 75 mm of asphalt concrete, 229 mm of crushed base and 3 m of the test subgrade soil type at pre-determined moisture content. The current test section was code numbered as Test Section 706. It represents the case of a subgrade soil AASHTO type A-6 at 22 percent gravimetric water content. For this soil type, 22 percent gravimetric water content renders the soil very soft and difficult to build with. According to the Unified Soil Classification System, the subgrade soil was type CL (low liquid limit, clay).

Accelerated traffic was applied by means of a Heavy Vehicle Simulator (HVS). Each test window was subjected to one of various load levels. The traffic load was varied for each test window, ranging from 22.2 (5,000 lb) to 40 kN (9,000 lb). The load was applied through dual truck tires, with the tire pressures averaging 689 kPa (100 psi).

The test section was built inside the FERF testing facility, therefore the moisture and temperature conditions were controlled. The test section contained six test windows. Each test window was approximately 6.0 m long and 1 m wide. Loading was applied unidirectionally at an average speed of 12 km/hr. The test windows were subjected to about 600 load repetitions in an hour. Testing was conducted for 22 hours per day. The remaining 2 hours were used for maintenance.

Stress, strain, and surface rut measurements were taken periodically. Dynatest® stress sensors were embedded in a tri-axial arrangement in the subgrade at a depth of 0.076 m (3 in) from the top of the subgrade in all the test windows. Test window 2 contained an additional tri-axial set of Dynatest stress cells at a depth of 0.23 m (9 in) from the top of the subgrade.

Dynamic and permanent strains in the base and subgrade were measured in all of the six test windows.

This report contains a description of the test section, construction, instrumentation, and pavement response to accelerated traffic testing.

It was found that, for this AASHTO A-6 soil at 22 percent moisture content, the subgrade bearing capacity was low. Test Window 5 failed by 250 passes with a traffic load of to 40 kN (9,000 lb). Much care was applied to reduce the deformations caused by construction traffic. Cores taken near each corner of each test window indicated that the asphalt concrete thickness was uniform.

INTRODUCTION

As part of an international study on pavement subgrade performance, several full-scale test sections were constructed in the Frost Effects Research Facility (FERF) at the U.S. Army Cold Regions Research & Engineering Laboratory (CRREL) in Hanover, New Hampshire. CRREL is a component of the US Army Corps of Engineers Research and Engineering Center. The test sections were constructed using four subgrade soil types at three moisture contents. They were instrumented with stress cells, strain gages, moisture, and temperature sensors. The test sections were subjected to accelerated loading using the Heavy Vehicle Simulator (HVS). Pavement failure was defined at 12.5-mm (0.5 in.) surface rut depth. Surface rut depth measurements were taken periodically during the accelerated load tests. At the same time, subsurface stress and strain measurements were also taken. A detailed overview of the project can be found in Janoo et al (2001). The test sections consisted of a 76-mm (3 in.) asphalt concrete (AC) layer, a 229-mm (9 in.) crushed gravel base and 3 m (10 ft) of subgrade soil. The testing was conducted at around 20 °C.

This reports deals with the construction, accelerated traffic testing, and pavement response of Test Section 706. Test Section 706 corresponds to a subgrade soil AASHTO type A-6 conditioned at 22 percent moisture content. At this moisture content, the subgrade soil was soft. Much care had to be applied to build this test section and to avoid excessive deformation under construction traffic.

Table 1. Subgrade soil types and moisture contents included in this project.

Subgrade Moisture Content	AASHTO Soil Type			
	A-2-4	A-4	A-6	A-7-6
M1	Optimum 10 % TS 701	Optimum 17 % TS 702	Optimum 16 %	Optimum TBD*
M2	12 % TS 707	19 % TS 704	19 % TS 708	TBD
M3	15 % TS 703	23 % TS 705	**22 % TS 706**	TBD

* TBD = To be devised.

DESCRIPTION OF THE TEST SECTION

The test section consists of a 76-mm (3 in) asphalt concrete (AC) layer, a 229-mm (9 in) crushed gravel base course, and 3 m of AASHTO A-6 subgrade soil conditioned to a gravimetric moisture content of 22 percent.

The test section was divided into six test windows. A test window is the area where traffic is applied. An effective test window was 0.91 m (3 ft) wide by 6.08 m (20 ft.) long, excluding acceleration and deceleration areas. The thickness and material properties for all test windows were intended to be constant, but the traffic load was designed to vary for different test windows.

Each test window was instrumented with embedded sensors to measure in-situ stress, strain, moisture and temperature at various locations within the pavement structure. Dynatest® stress cells were used to measure stress in the subgrade soil. Geokon® stress cells were embedded in the unbound base course. Strain was deducted from displacement measurements obtained by means of emu coil pairs. Vitel Hydra® sensors were used to record volumetric soil moisture content and temperature. Additionally, strings of thermocouples were used to record subgrade temperatures.

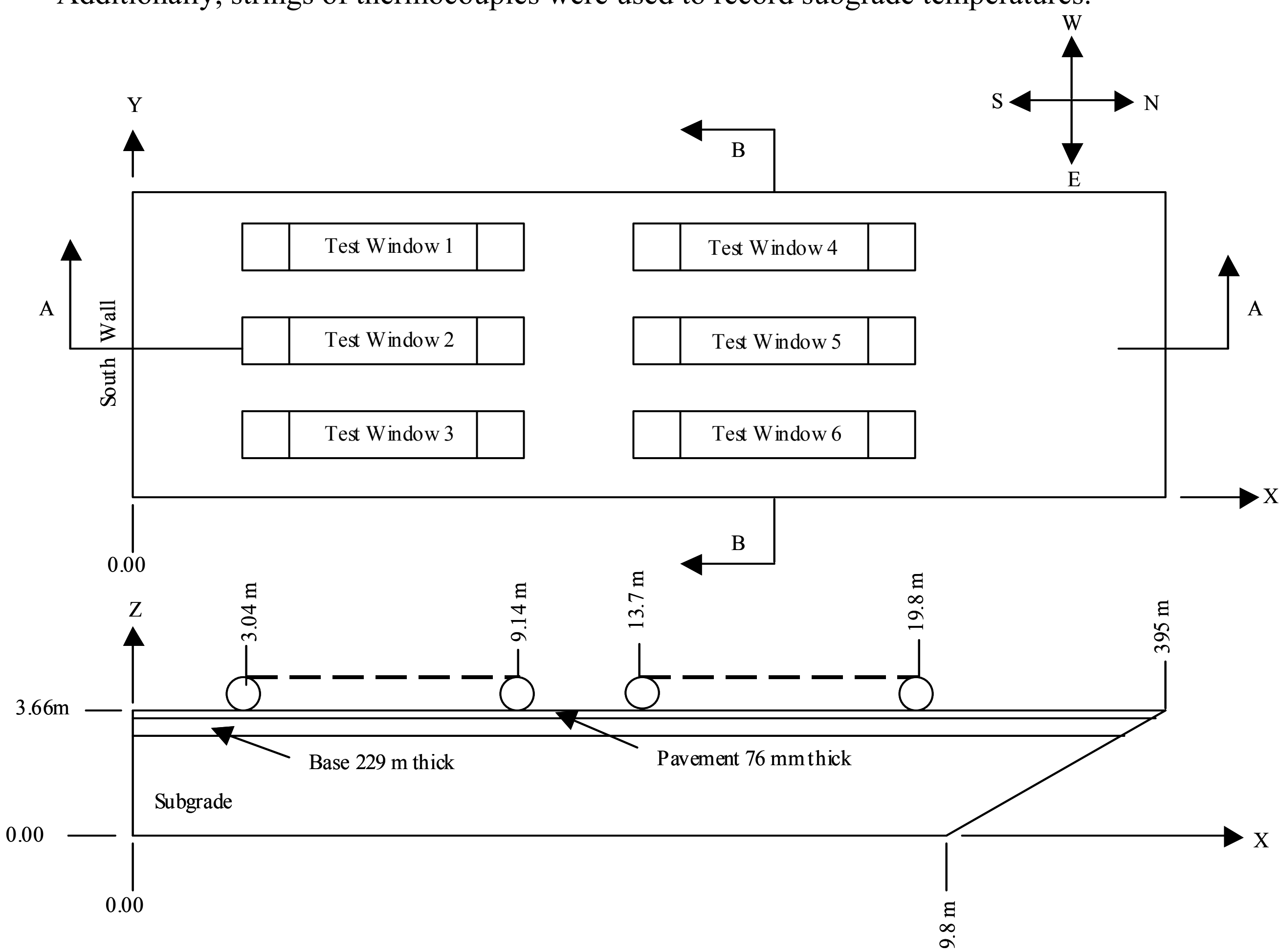


Figure 1 a. Plan view and longitudinal cross section of test section.

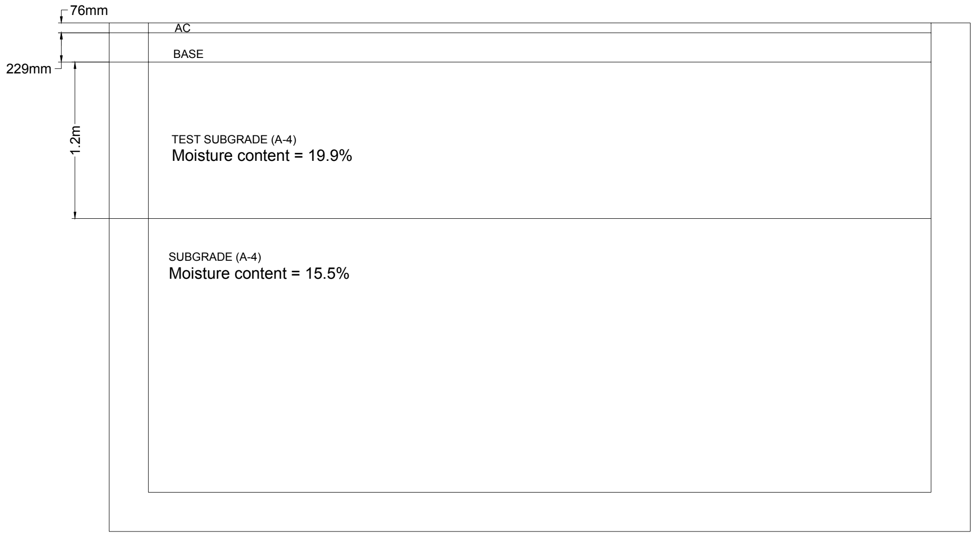


Figure 1 b. Transversal cross section.

MATERIAL PROPERTIES

Laboratory tests were conducted on representative samples of the subgrade soil and the base course soil. The battery of tests included moisture and density, grain size distribution, specific gravity, liquid and plastic limits, and hydrometer tests.

Figure 2 shows grain size distributions for the subgrade soil and for the base course soil. The subgrade soil has approximately 92 % passing the 0.074-mm sieve. The average liquid limit (LL) and plasticity index (PI) of the soil was 29 % and 13 % respectively. The average specific gravity of the subgrade soil was 2.70. According to the American Association of Highway & Transportation Officials (AASHTO) soil classification system, the subgrade soil was type A-6. According to the Unified Soil Classification System, the subgrade soil was type CL (low liquid limit, clay).

The base course material was made of unbound crushed stone. It was classified as an AASHTO type A-1 soil. According to the Unified Soil Classification System, the base course soil was type GP-GM (mix of poorly graded gravel and silty gravel). About 11 percent by weight of the base course soil particles passed through the sieve 0.074-mm (#200) sieve. The fines were classified as non-plastic.

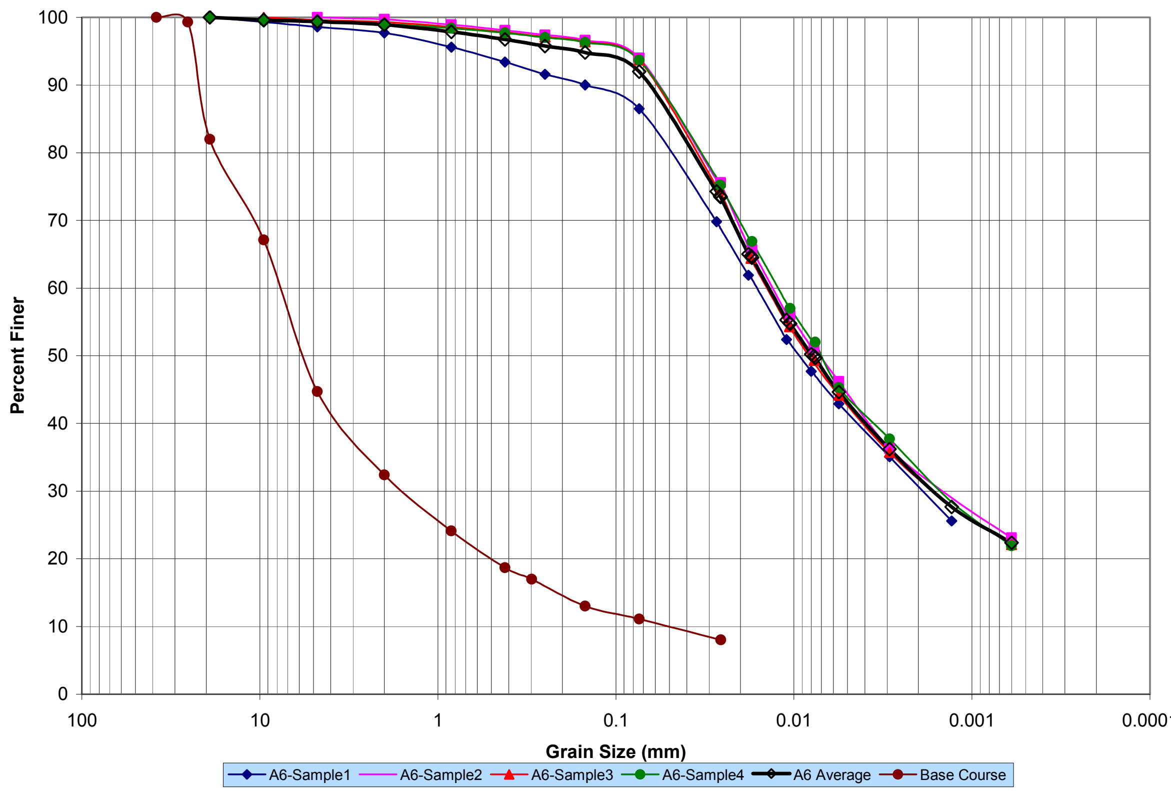


Figure 2. Grain size distribution for A-6 subgrade soil and base course

Optimum moisture content and maximum density tests were conducted on the subgrade material in the test section using the AASHTO test procedure, "*The Moisture-Density Relations of Soils Using a 5.5 lb (2.5 kg) Rammer and a 12 in. (305 mm) Drop* (T 99-90)". Samples were collected from various parts of the stockpile for the test and the results from these tests are shown in Figure 3. The optimum density and moisture content was 1791 kg/m^3 (111.8 pcf) and 16.1% respectively.

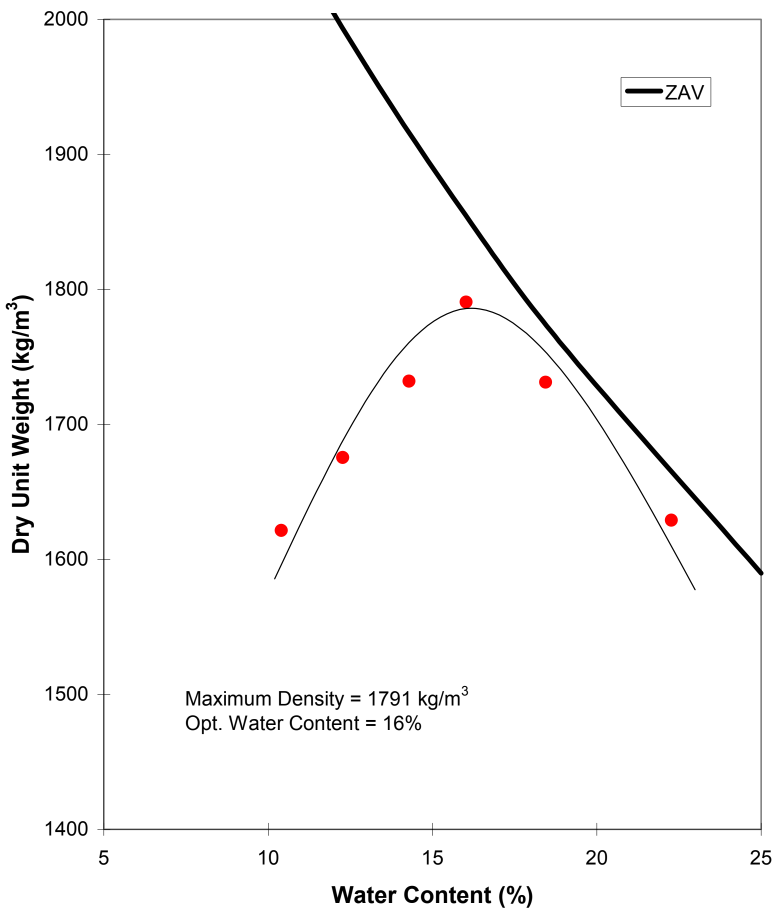


Figure 3. Moisture-Density relationship for A-6 subgrade soil

Table 2. Summary of classification test on the subgrade soil used in Test Section 706.

AASHTO	A-6
USCS	CL
Spec. Gravity	2.70
LL (%)	29
PI	13
Optimum moisture content (%)	16
Maximum Density (kg/m^3)	1791
% passing #10	99
% passing #200	92

The standard moisture density relationships for the base material using the AASHTO T-99 are presented in Figure 4.

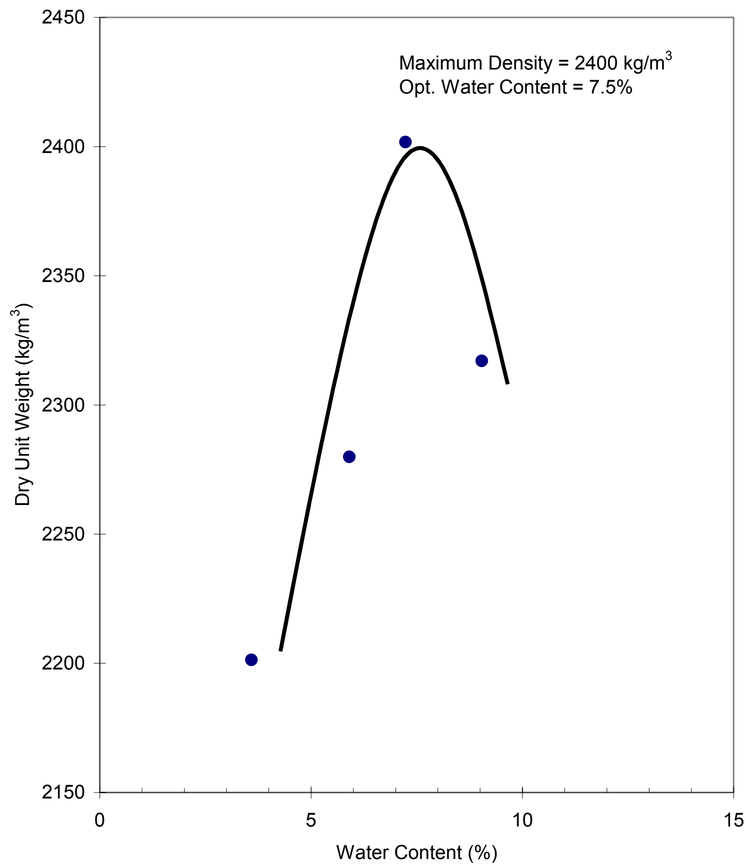


Figure 4. Moisture-density relationships for base course

The optimum densities and gravimetric moisture contents from the Standard Proctor test are 2403 kg/m^3 (150 pcf) and 7.5 percent respectively.

The asphalt mix was produced according to New Hampshire Department of Transportation (NHDOT) Type C specification. The Type C specification requires 95-100% passing the 12.52-mm (1/2-in.) sieve size. The asphalt binder used conformed to specification PG64-22 with an asphalt content of 6.1% by weight. . Nebraska Department of Roads Materials and Research Testing Laboratories conducted additional tests on the asphalt concrete. The letter report is presented in Appendix I/

The asphalt concrete was placed and compacted in a single layer. Because of the soft subgrade soil, large pavement deformations were anticipated. Experience from other experiments indicated that, under these conditions, delamination of asphalt layers is likely. The single layer construction was designed to prevent delamination.

CONSTRUCTION OF THE TEST SECTION

The subgrade material was preprocessed to remove stones and to mix it well in a relatively dry condition. The soil was brought into the test basin by means of a front loader. It was spread with a bulldozer in separate layers each about 0.15 m (6 inches) thick. Water was sprinkled onto the soil and sampled periodically. If the moisture content of the subgrade soil was found to be too dry, the soil was roto-tilled, and more water was added. When the target moisture content was achieved, the exiting subgrade surface was roller compacted with two passes of a 10-Ton (9,072-kg) steel roller in static mode.

Figure 5. Empty test basin and start of subgrade building.

Moisture and density quality control measurements were taken at every other subgrade soil layer, i.e., every 0.30 m (1 ft).

The subgrade soil was conditioned to gravimetric moisture content of about 22 percent. For this AASHTO A-6 subgrade soil, this moisture content rendered the subgrade soft. Much care was needed to build the subgrade to avoid damage from construction traffic.

Figure 6. Roller compacting a subgrade A-6 soil layer at 22 percent gravimetric water content.

Figure 7. Nuclear gauge moisture and density testing on a subgrade layer.

At various depths, sensors were embedded into the soil and wires routed through recorded paths to reach the inlets leading to the instrumentation tunnel.

Figure 8. Emu coil sensors installed in the subgrade.

Figure 9. Dynatest® stress cells installed in the subgrade.

Figure 10. Sensor wires were routed toward the instrumentation tunnel.

Figure 11. Sensor wire connections in the instrumentation tunnel.

A single layer of asphalt concrete was placed on top of the base course material. The hot mix asphalt (HMA) was produced at a local asphalt plant about 7 miles from the test sections site. The asphalt concrete mix was transported in dump trucks. A Black Knox® paver model PF-400A was used to place the asphalt in a single layer over 2 lanes. A single layer was chosen instead of the traditional 2-layer system to reduce the possibility of interlayer delamination. Recent experience with pavement test sections built with similarly soft soils indicated that a 2-layer asphalt system is prone to delamination and premature asphalt shear failure due to large pavement deflections.

Figure 12. Paving of the test section.

The air temperature during the asphalt paving operation was about 13°C (55°F). The average temperature of the asphalt mix when deposited on the paver hopper was 150°C (302°F). Immediately after placing, the asphalt mixture was at an average temperature of 134°C (273°F). Roller compacting took place as soon as the asphalt paver had completed each lane.

Compaction of the asphalt concrete was done using a Bomag® steel roller model BW 120 AD-3. The steel roller applied 4 passes in static mode plus 4 passes in vibratory mode.

A series of cores of 5 cm (2 inch) in diameter were taken to verify the asphalt concrete thickness. The thickness variations were minimal.

The test windows were paint marked on the finished asphalt pavement in preparation for testing with the heavy vehicle simulator.

Figure 13. Constructed Test Section 706 with marked test windows.

Construction Quality Control

Once the compaction was completed for each soil layer, a series of tests were conducted. These measurements were made on every 300-mm lift. The tests included determination of moisture, density, Vane shear, and layer thickness. The primary properties used for construction quality control was the moisture content.

Moisture Content

Moisture and density measurements were taken at each soil layer using a Troxler nuclear gauge. The test locations are shown in Figure 14 b.

Figure 14 a. Locations of quality control tests on the soil layers.

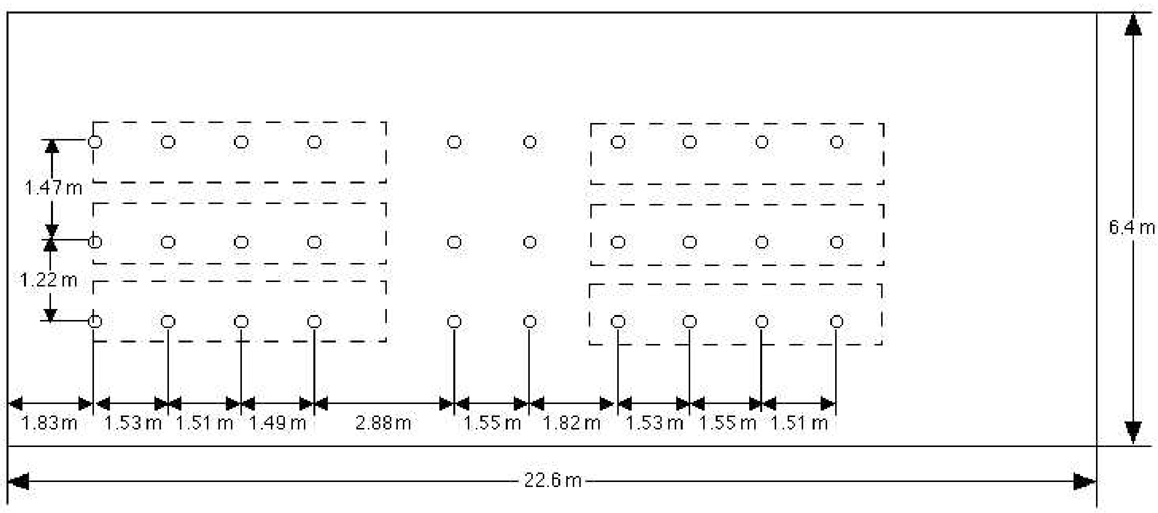


Figure 14 b. Location of moisture and density measurements on Test Section 706.

. Moisture and density determinations on the subgrade layers were made in a volume of soil using the direct approach. The probe from the nuclear gage penetrated into 150 mm of soil. On most lifts, 30 measurements of moisture and densities were made. A total of 304 moisture and density measurements were made during the construction of the subgrade. Moisture and density measurements were also conducted on top of the finished base course using the backscattered method. The results are presented in Appendix B.

In addition to the nuclear moisture and density tests, oven dry verifications were conducted at selected locations. Figure 15 shows a histogram of 304 moisture content measurements conducted at various locations within the subgrade. Figure 16 shows a histogram of 51 oven dry verifications.

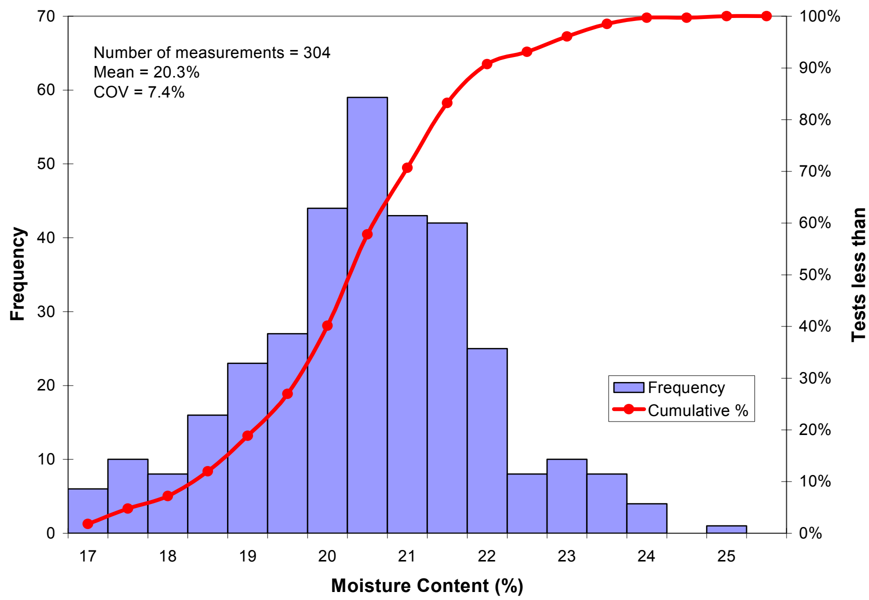


Figure 15. Histogram of gravimetric subgrade soil moisture measurements by means of a nuclear gage.

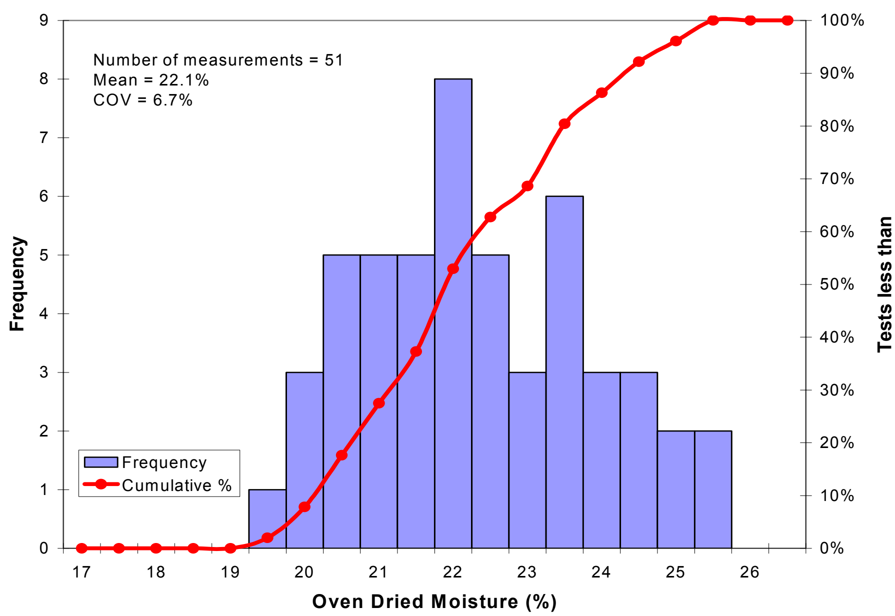


Figure 16. Histogram of gravimetric subgrade soil moisture measurements by the oven dry method.

Nuclear gage moisture and density measurements were taken at 12 locations on the base course. The mean moisture content was 2.8% ©V = 9%). The mean average density was 2093 kg/m^3 (COV = 1.2%).

Subgrade Soil Dry Density

Density tests were conducted in the subgrade soil and on the base course using a nuclear gage. For the subgrade layers, the direct method was used, i.e, the radioactive source inserted into the soil about 0.15 m. For the base course, the backscattered method was followed. The mean dry density of the subgrade was 1659 kg/m ^{3} (104 lb/ft ^{3}), with a coefficient of variation (COV) of 7 %. A histogram and cumulative frequency plot of the subgrade soil dry density during construction is presented in Figure 17.

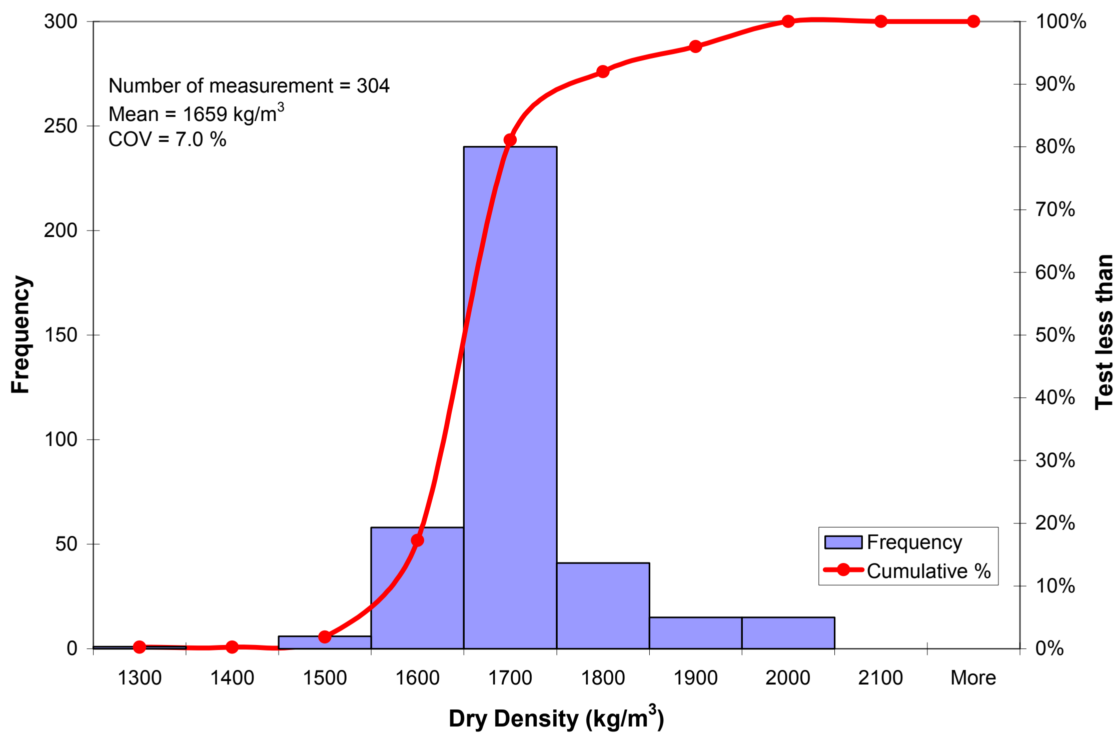


Figure 17. Dry density measurements in the subgrade.

The CBR of the subgrade ranged from 1 to 5 with an average of 2.4, suggesting a fairly weak subgrade, see Appendix B, Table B 3.

INSTRUMENTATION

Sensors:

Instrumentation for measuring stress, strain, temperature, and moisture content were installed in the pavement structure during construction of the test section. Details of the instrumentation can be found in Janoo et al., 2002. The locations of the strain, stress, moisture and temperature sensors are presented in Appendix C. The locations of the gages in the test section were similar to that in Test Section 705.

Displacement measurements were made in the base and subgrade by means of εmu coils. Strain can be deducted from displacement between a pair coils. The sensors were placed 150 mm center to center. Displacements were measured in the longitudinal (x), transverse (y), and vertical (z) direction of loading. Displacements in the vertical direction were measured to a depth of 1.52 m. Locations of the sensors are presented in Table C 1, Appendix C.

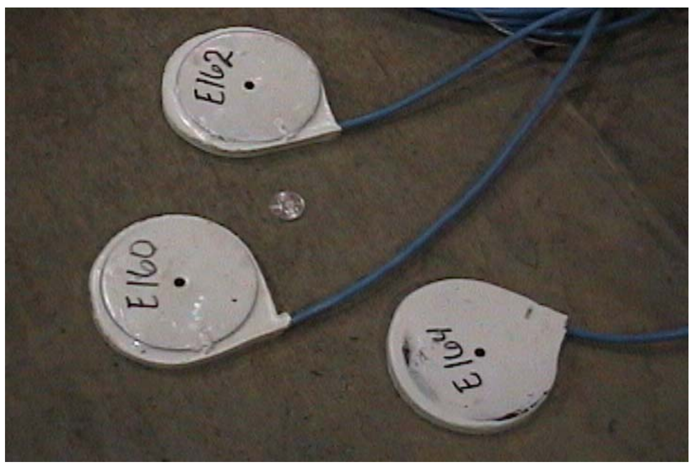


Figure 18. Emu coils. A US 25-cent coin is included for scale reference.

A triaxial Dynatest® stress cell set was installed at a depth of 76 mm (3 in.) below the top of the subgrade in all test windows. In Test Window 2 an additional triaxial stress cell set was installed at a depth of 229 mm (9 in.) below the top of the subgrade. The diameter of the Dynatest® stress cells was 76 mm (3 in.). The locations of the various pressure cells are presented in Table C 2, Appendix C.

A triaxial Geokon® stress cell set was installed in the middle thickness of the base course in each of Test Windows 2 and 5. The diameter of the Geokon® stress cells was 229 mm (9 in.).

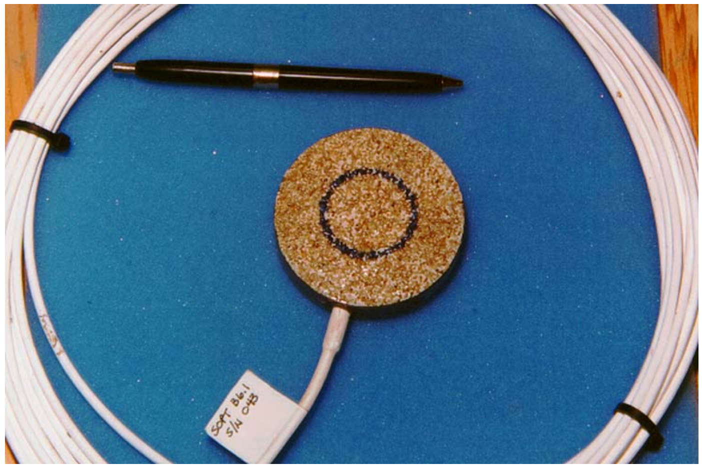


Figure 19. Dynatest® stress cell used in the subgrade.

Figure 20. Geokon® stress cell used in the base course.

Soil moisture was measured with Vitel Hydra® soil moisture probes. One set of two Vitel Hydra® soil moisture probes was installed in the subgrade at depths of 0.46 m (1.5 ft) and 0.76 m (2.5) from the top of the asphalt concrete at each of three representative locations in the test section. Details on the locations of each probes are presented in Table C 3, Appendix C. Through the use of appropriate calibration curves, the dielectric constant measurement was related to soil moisture. The Vitel Hydra® soil moisture probes were calibrated for the AASHTO A-6 subgrade soil. Details on the calibration of the probes can be found in Janoo et al. (2002).

Figure 21. Vitel Hydra moisture sensor.

Subsurface temperatures were taken using thermocouple sensors. The thermocouples have an accuracy of ± 0.5°C. The subsurface temperature sensors were installed at three locations shown in Figure 22 and in Table C 4, Appendix C.

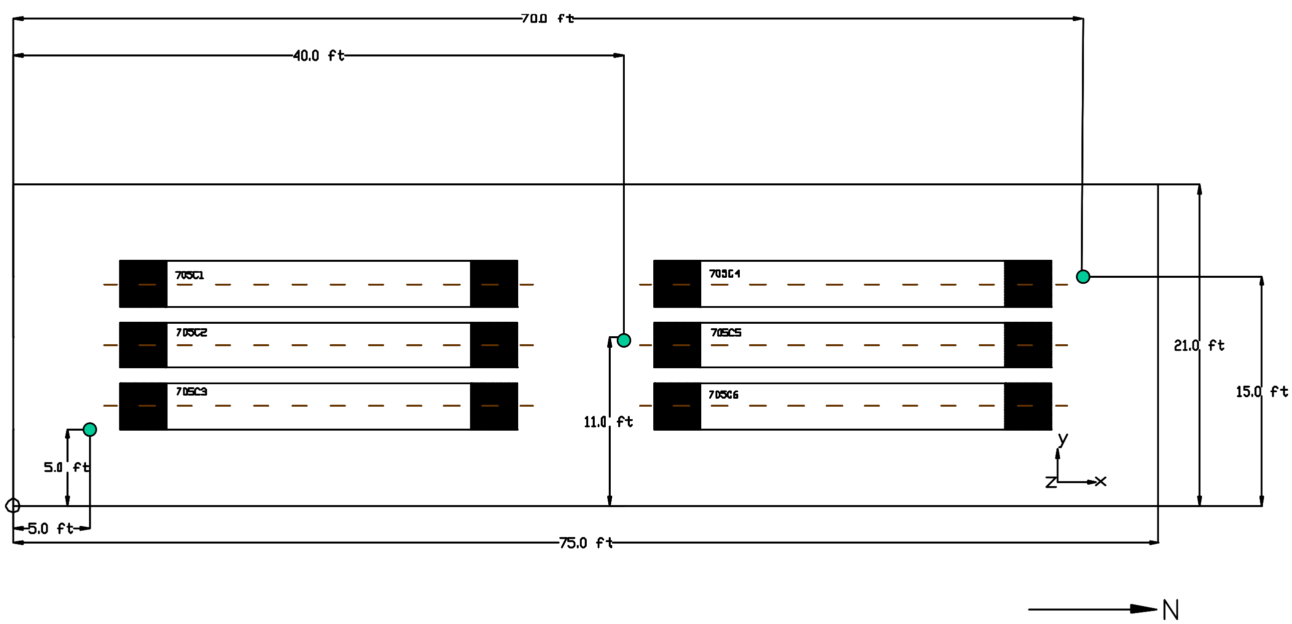


Figure 22. Location of the thermocouple strings in Test Section 706.

Data Acquisition System

The primary data acquisition system for this experiment was in-house engineered because no suitable system was commercially available. This system was used to measure the response of stress and strain sensors. In order to avoid interference, the εmu coil pairs had to be read at different times than their neighboring sensors. The data acquisition system includes a set of relays to time the various measurements.

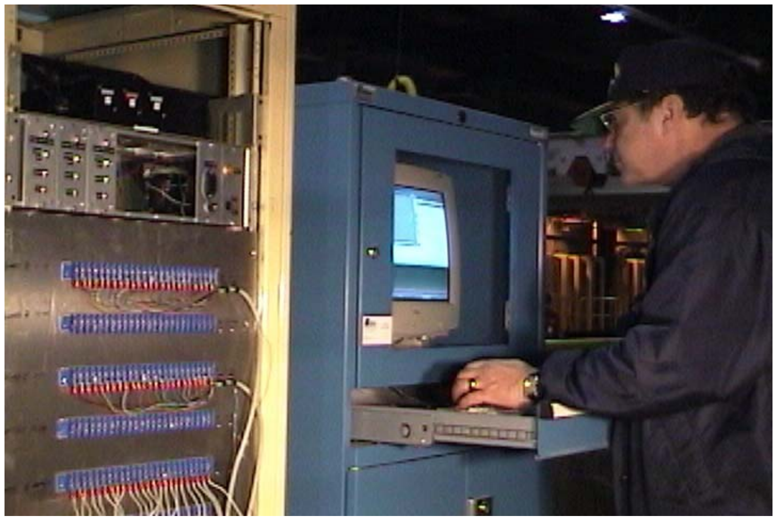


Figure 23. In-house engineered hardware data acquisition system.

The primary data acquisition system was controlled by a dedicated personal computer that also stored the data. A computer program written in LabView® language was developed specially for the current instrumentation.

Figure 24. In-house engineered software data acquisition system.

In addition, Campbell Scientific® CR10X data loggers equipped with multiplexers were programmed to collect data from moisture and temperature sensors embedded in the test sections.

Figure 25. Data loggers used to measure and record moisture and temperature data.

TESTING PROGRAM

The test windows were subjected to accelerated traffic loads using CRREL's Heavy Vehicle Simulator (HVS). A description of the HVS can be found in Appendix D.

The following tests were conducted:

1. Prior to the accelerated load tests, FWD measurements on the surface of the AC layer using the same locations as during the construction phase.
2. Initial transverse profiles of each test window were measured using the 3-m-long laser Profilometer (Fig. 10). The laser located 45 cm from the ground surface measured the surface profile at approximately 9-mm intervals.
3. In addition to the Profilometer measurements, level surveys were made during every test to determine whether the reference points (i.e. where the feet of the Profilometer were located during the surface profile measurements) moved. The results from the level surveys indicated that the points were stationary throughout the test. Twenty transverse cross-section measurements spaced 0.3 m apart were made in each window (Fig. 27). Surface profile measurements were made at each traffic stop. The maximum rut depth was calculated as the difference of the surface profile after N passes to a baseline. The baseline was the measurement taken prior to loading of the test section. A typical surface rut measurement and the definition of maximum rut depth are shown in Figure 28.

Testing was terminated when the average maximum surface rut depth of 12.5 mm was reached or exceeded.

Figure 26. Laser profilometer.

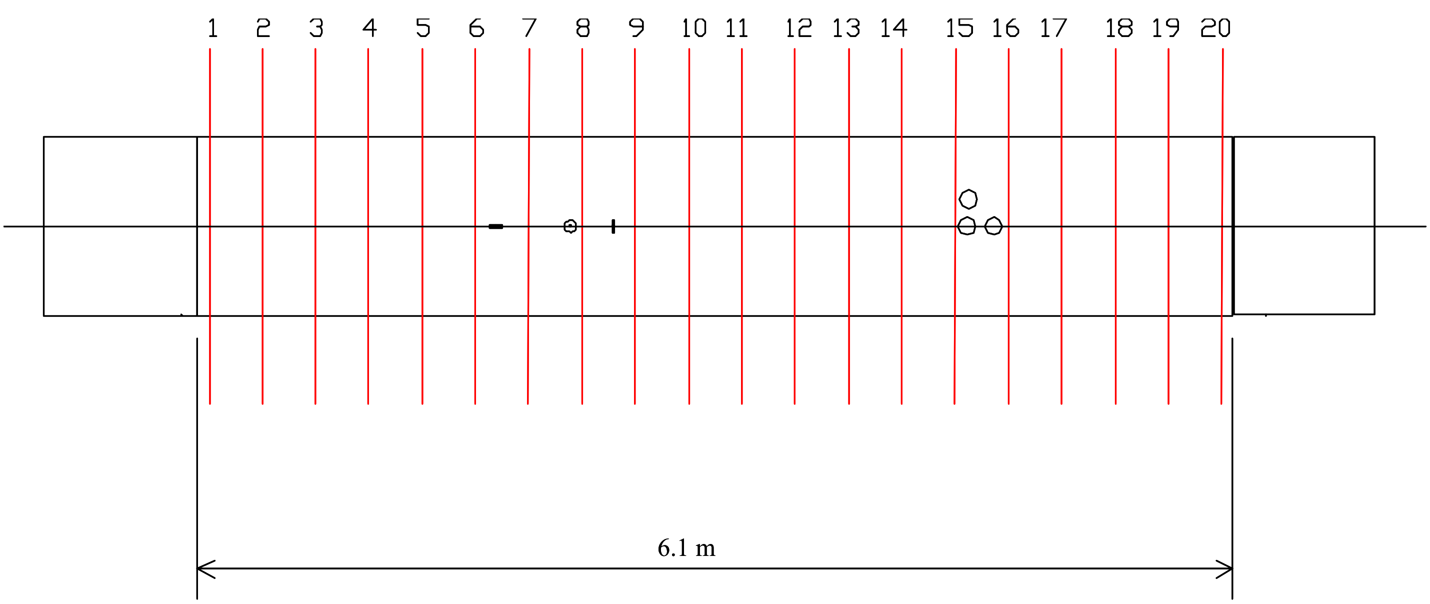


Figure 27. Locations for profile measurements in test section 706

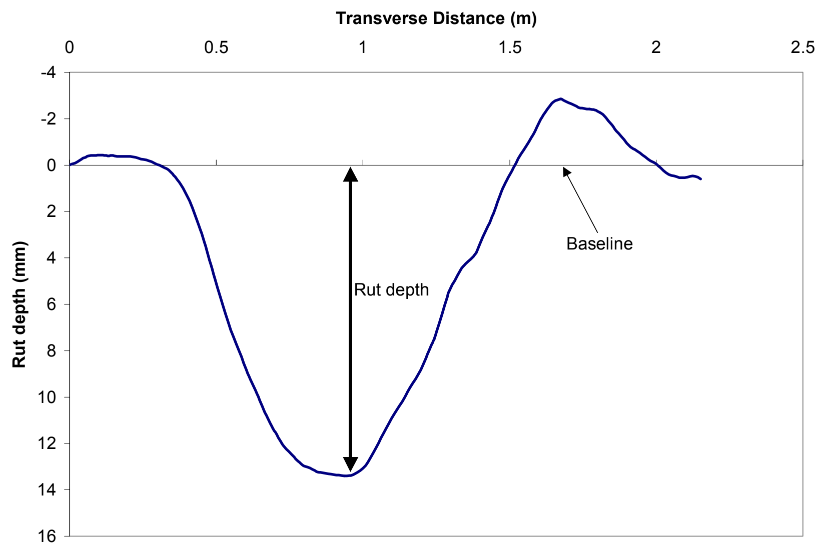


Figure 28. Definition of rut depth

4. Subsurface stresses, strains, and permanent displacements were also measured in the vertical and in two perpendicular horizontal directions at several traffic-pass levels.
5. At the end of the dynamic stress-strain measurements, permanent deformation measurements were taken using the εmu coils. A loose coil gage on the surface was used to measure the permanent deformation between the AC surface and the first coil in the base course.

Figure 29. Measuring displacement between the AC surface and the top of the base course.

SUMMARY OF RESULTS

ACCELERATED TRAFFIC LOADING

Traffic loading was applied by means of CRREL's Heavy Vehicle Simulator (HVS). The tire assembly was a dual-tire standard truck half axle. The traffic speed was 12 km/hr. The traffic was allowed to wander across the 1-m width. The mean applied loads are summarized in Table 3. The tire pressure was set to 690-kPa (100 psi).

Table 3. Mean load and tire pressures on test windows

Test Window	Applied Load (kN)
706C1	27
706C2	40
706C3	22
706C4	22
706C5	27
706C6	40

Figure 30. Tire assembly used to apply accelerated traffic

Table 4. Sequence of HVS tests on test windows

Window	Start	End	No. of test days
706C1	02/21/2002	02/27/2002	7
706C2	03/07/2002	03/11/2002	5
706C3	03/18/2002	03/26/2002	9
706C4	02/14/2002	02/21/2002	8
706C5	02/28/2002	03/06/2002	7
706C6	03/14/2002	03/15/2002	2

MOISTURE & TEMPERATURE

The mean air temperatures in the test sections during the time of HVS testing are presented in Table 5. The subsurface temperatures at various locations in the pavement structure are presented in Figure 31. The subsurface temperatures fluctuated little around 18°C. The locations of the thermocouple strings are shown in Table C 4, Appendix C.

Table 5. Mean air temperatures during traffic testing of the test windows.

	(C)
706c1	17.2
706c2	17.7
706c3	17.3
706c4	17.3
706c5	16.9
706c6	18.7

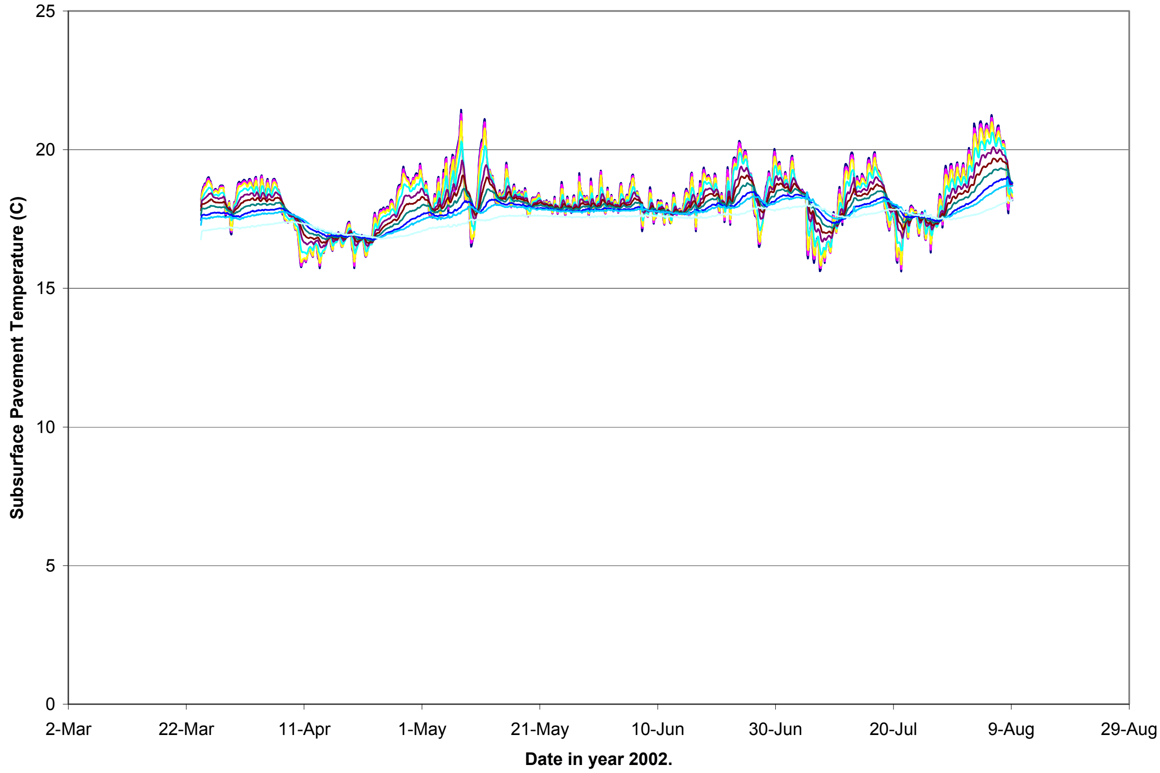
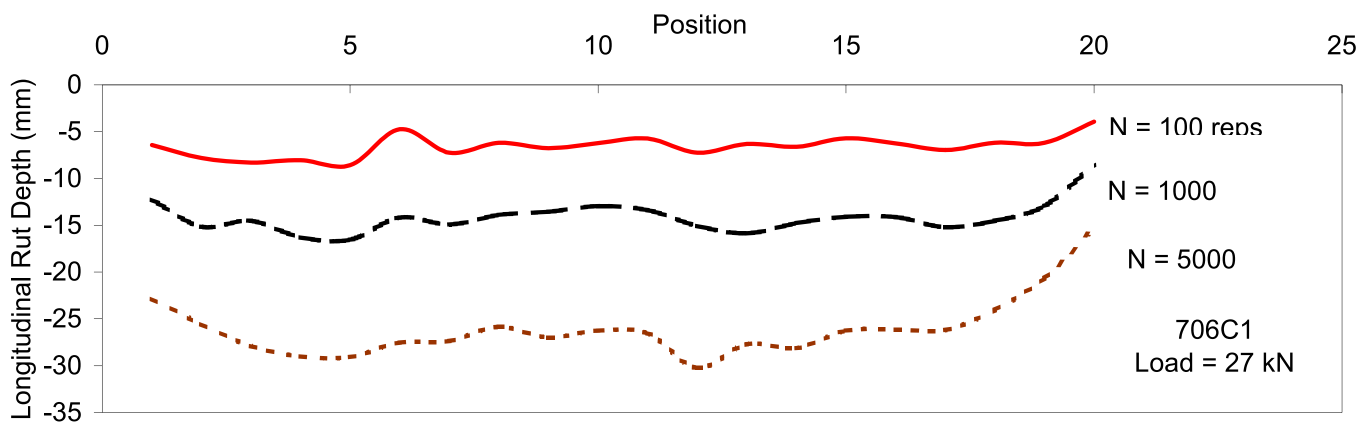


Figure 31. Subsurface pavement temperatures during traffic testing.

SURFACE RUT MEASUREMENTS

Transverse surface profile measurements were taken periodically during testing. The maximum rut depths at each of these locations are presented in Appendix E. The rut depth was calculated as the difference between the profile measurements taken at the pass level and the profile measurements taken prior to testing. Profile measurements were taken every 305-mm starting from one end of the test window for a total of 24 locations. The measurements in the acceleration and deceleration zones (Positions 1,2, 23 and 24) are not reported.

The maximum rut depths from transverse profile measurements were used to develop the longitudinal profile. The longitudinal rut depth in various test windows as a function of load repetitions are presented in Figure 32 to Figure 34. As seen in the figures, rutting as fairly uniform throughout the windows, with the exception of 706C6. In 706C6, failure was fairly rapid (N = 500 passes).



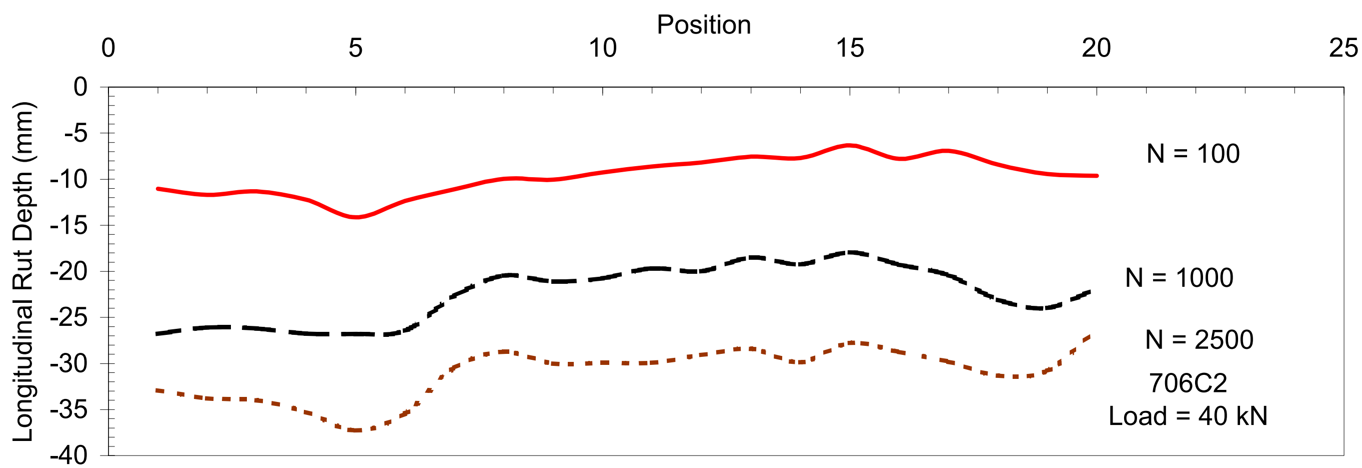
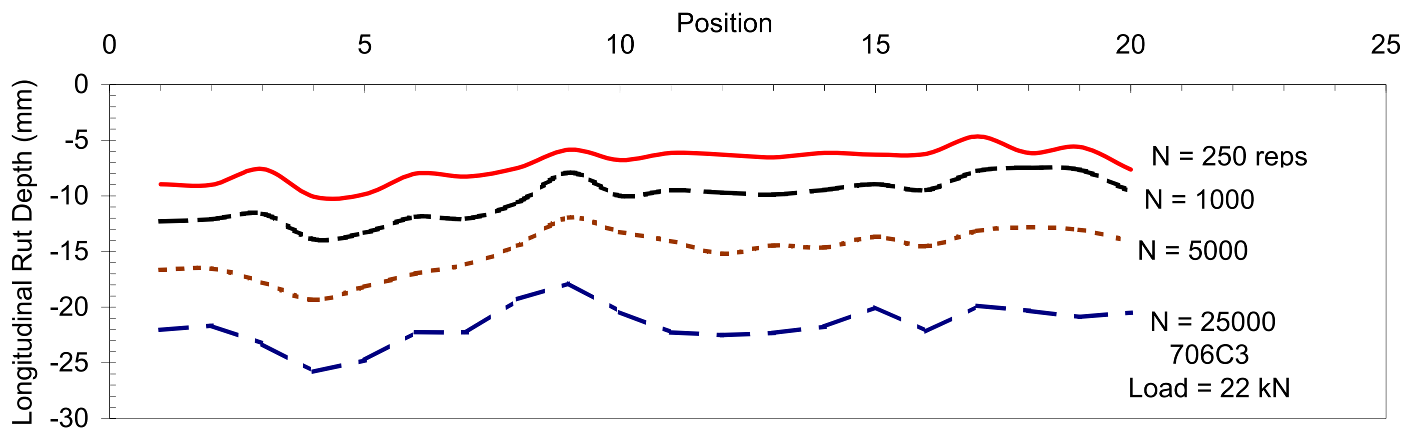


Figure 32. Longitudinal rut formation in TS706C1 and TS706C2

Test Section 706
AASHTO A-6 subgrade soil at 22 % gravimetric moisture content



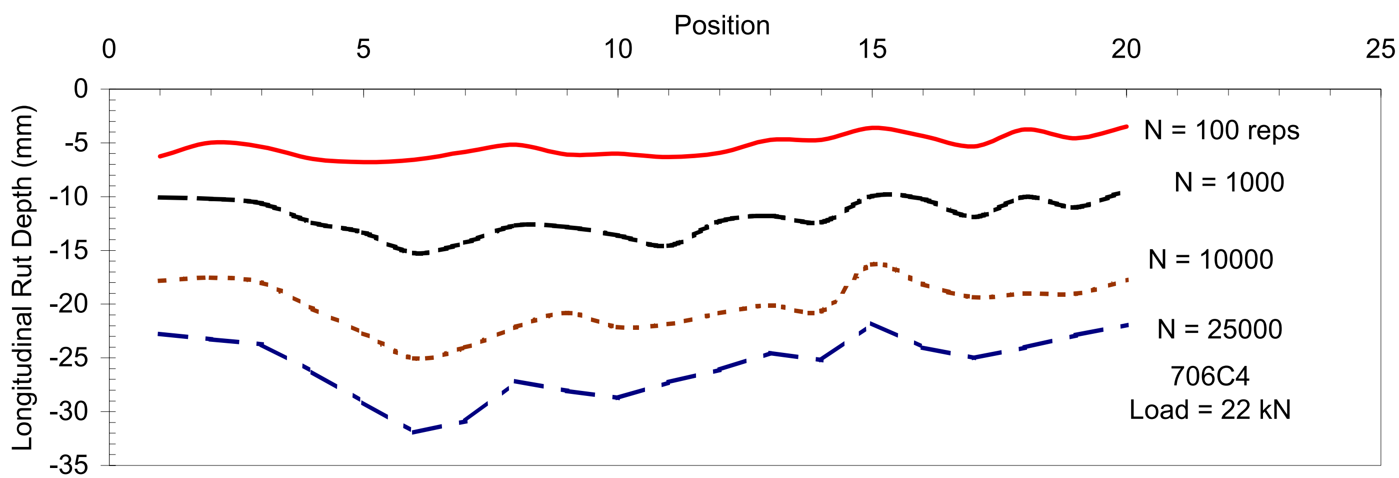
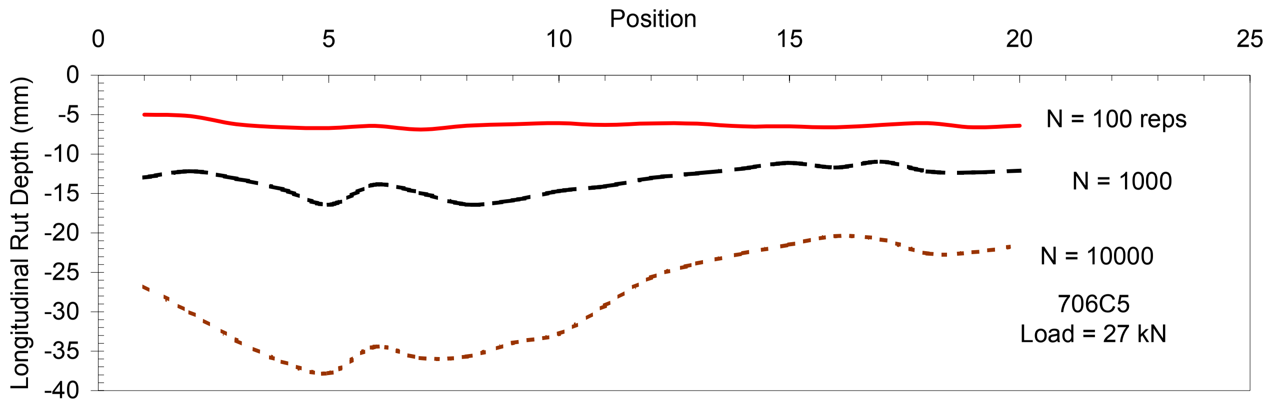


Figure 33. Longitudinal rut formation in TS706C3 and TS706C4



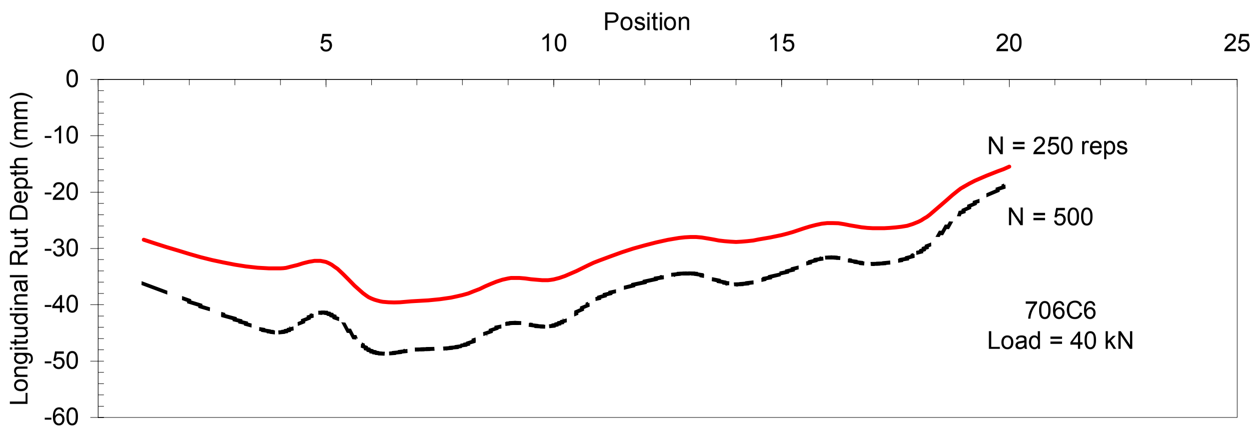


Figure 34. Longitudinal rut formation in TS706C5 and TS706C6

The progressions of rut depths as a function of load repetitions in the various windows are presented in Figure 35. In general, as the applied load increased so did the rate of rut depth.

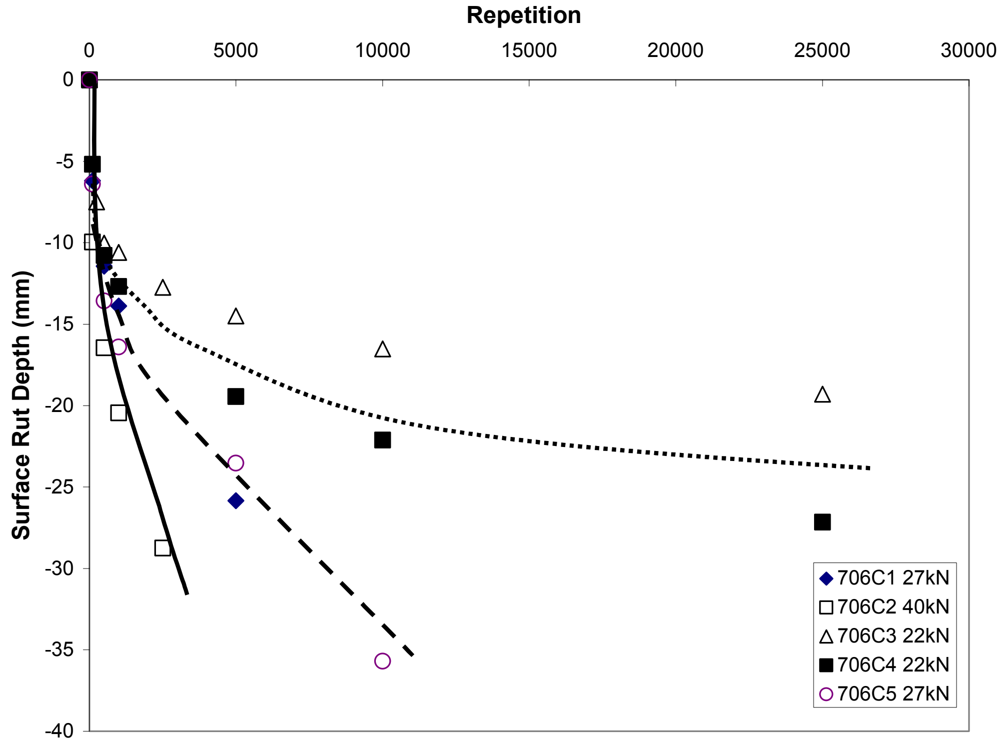


Figure 35. Rut depth progression as function of load repetitions.

The data from the surface profile measurements were also used to estimate the number of load repetitions required to reach failure. Failure was defined when the average rut depth reached a 12.5-mm. The estimated load repetitions were then used with the appropriate power equations to estimate the failure stresses and strains, Table 6.

Table 6. Load Repetitions to reach failure of 12.5-mm

Test Window	Passes to failure
706C1	688
706C2	208
706C3	2285
706C4	1291
706C5	556

Strain Measurements

Permanent deformations & strains

Permanent deformation and strain measurements were collected in the base and subgrade. The permanent deformations and strains at various depths in the base and subgrade are presented in Tables F-1 to F-12, Appendix F.

During the test, a surface coil and the coil under the AC layer are used to determine the deformation of the asphalt layer with increasing load application. These deformations are presented in Appendix F under the heading of surface.

The vertical permanent deformations on the top of the subgrade as a function of load repetitions is shown in Figure 36. The deformations were compressive and there appears to be correlation between applied load and permanent deformation.

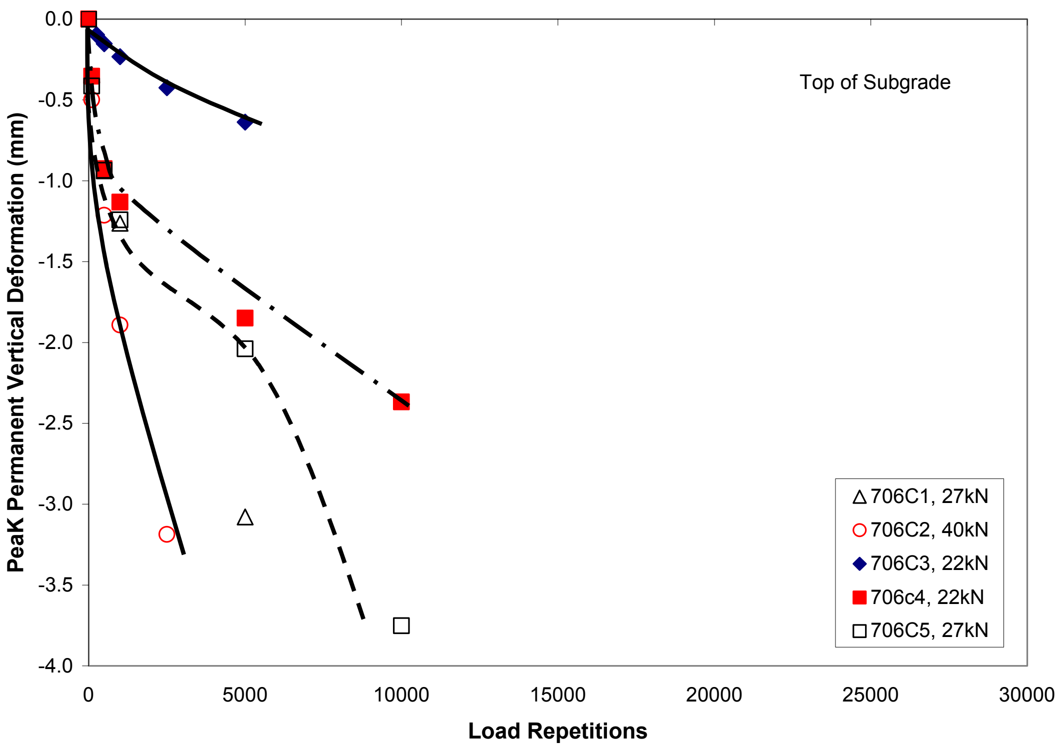


Figure 36. Permanent deformations of top of subgrade layer

The permanent deformations in the longitudinal and transverse directions are presented in Tables F-1 to F-6, Appendix F. The permanent deformations were converted into permanent strains and are presented in Tables F-7 to F-12. The permanent vertical strains in the top of the subgrade as a function of load repetition is presented in Figure 37. Power curves were fitted to the data and the coefficients are presented in Table 7.

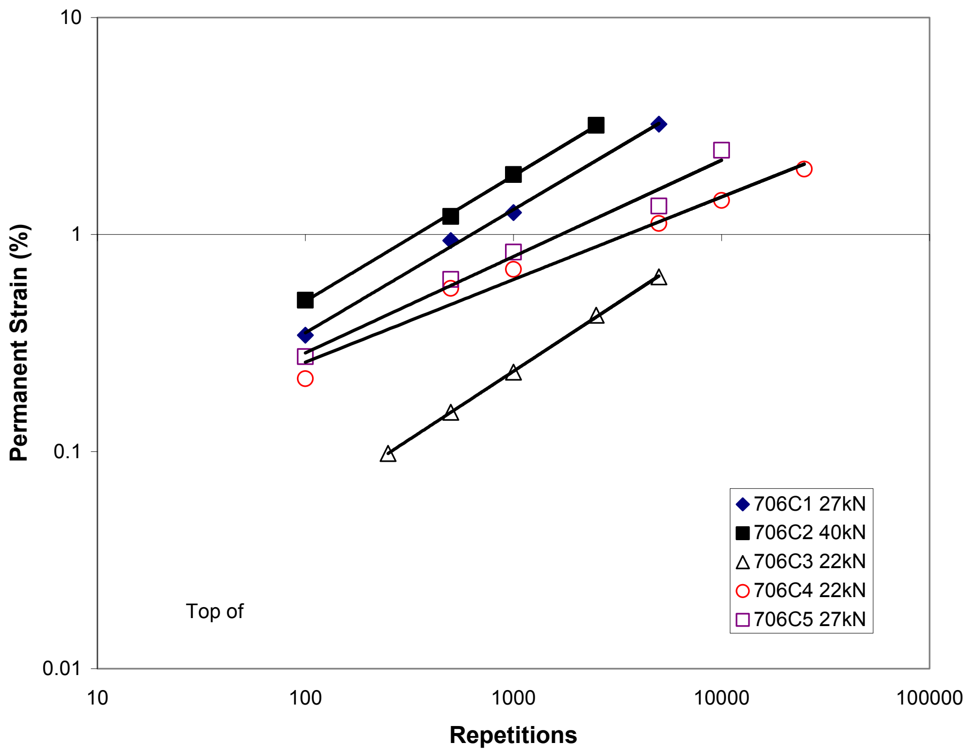


Figure 37. Development of permanent strains on top of subgrade as function of load repetitions

Table 7. Power curve coefficients for the vertical permanent strains

Test Window	Load (kN)	A	n	R^2
706C1	27	0.0258	0.5679	1.00
706C2	40	0.0344	0.5781	0.99
706C3	22	0.0031	0.6283	1.00
706C4	22	0.0447	0.3807	0.98
706C5	27	0.0369	0.4439	0.98

Dynamic displacements & Strains

As with previous test sections, triaxial dynamic displacements were measured with the εmu coil gages in the base and subgrade. The vertical displacements were compressive, whereas the peak longitudinal and transverse displacements were tensile. The peak vertical displacements are presented in Appendix G. The peak displacements were used to calculate the peak strains and are presented in Appendix G. For the longitudinal measurements, 3 displacement (strain) measurements are reported, see Figure 38. For the vertical and transverse displacements (strains) only the peak values are reported.

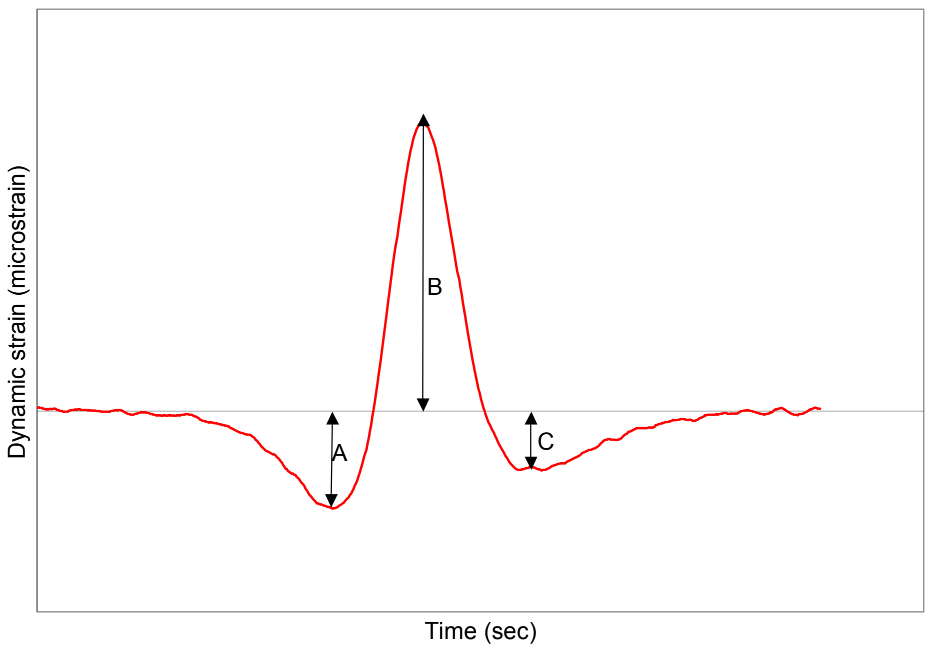


Figure 38. Location of peak longitudinal displacement (strain) measurements

The peak vertical displacements (strains) were compressive. The change in the vertical displacement as a function of load repetitions at the top of the subgrade is shown in Figure 39. There was some correlation between the peak dynamic vertical displacements and applied load. In general, the greater the load, the greater was the displacement..

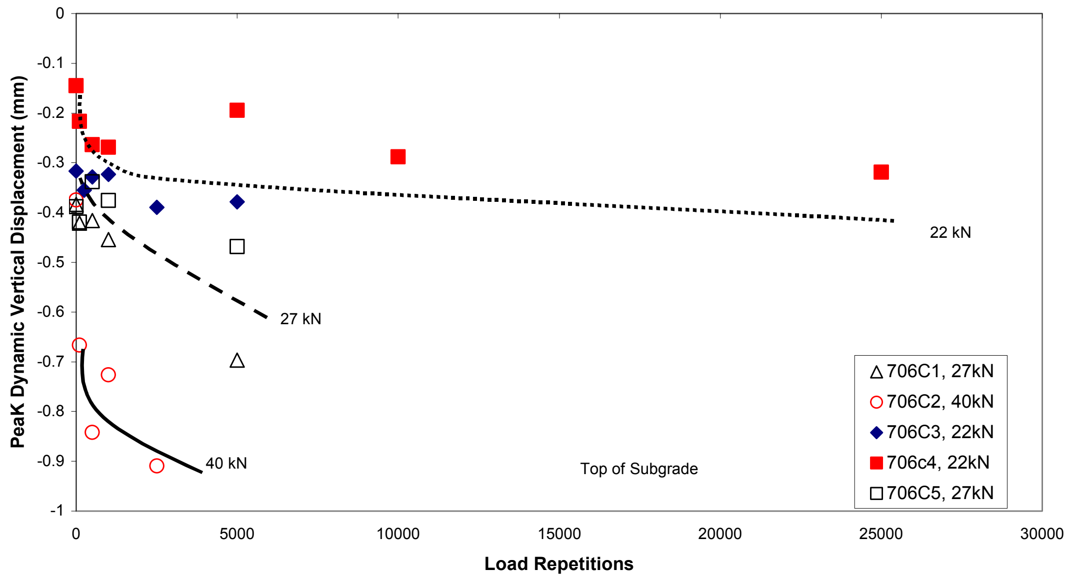


Figure 39. Peak dynamic vertical displacements at top of subgrade as function of load repetitions

The change in the vertical displacement of the total subgrade as a function of load repetition is presented in Figure 40. Again, there appears to be a correlation between the peak displacements of the subgrade layer and applied load similar to the top of the subgrade.

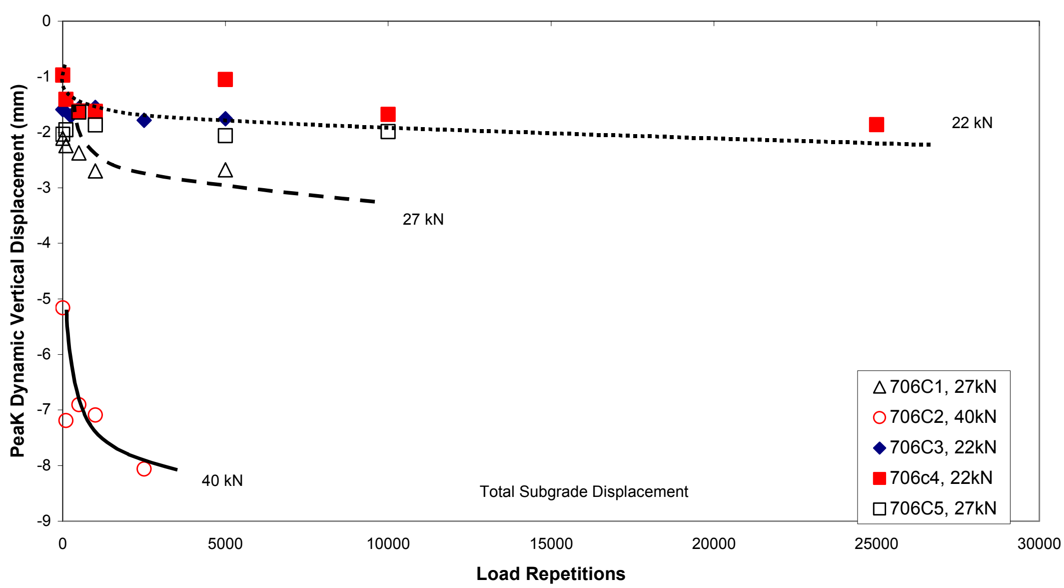


Figure 40. Peak dynamic vertical displacements of total subgrade as function of load repetitions

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The change in vertical strain as a function of load repetition is presented in Figure 41. Power curves were fitted to the data. Examples of the power curves are also shown in Figure 41. The power curve coefficients are presented in Table 8.

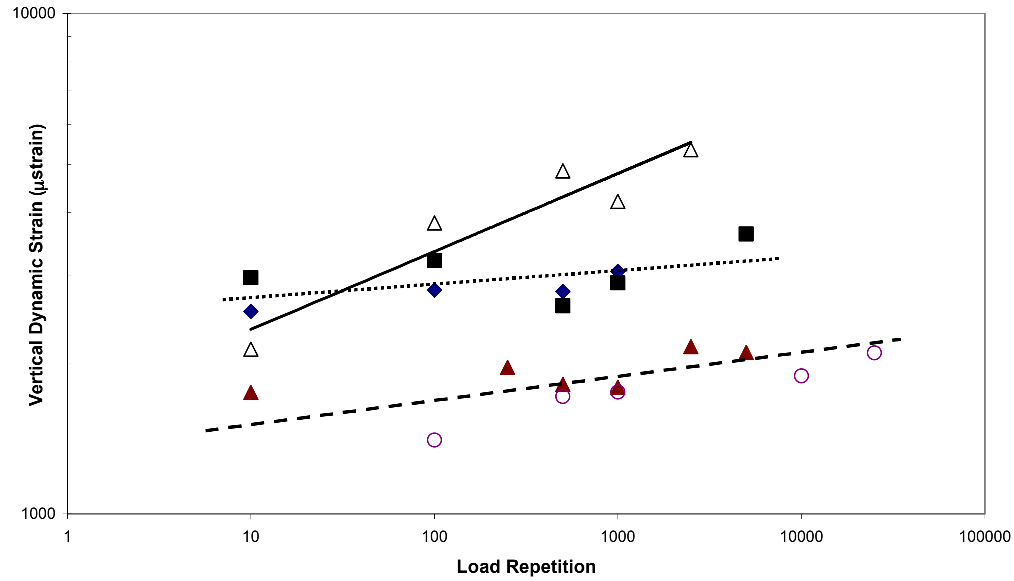

Figure 41. Peak dynamic vertical strains of subgrade as function of load repetitions

Table 8. Power curve coefficients for the vertical strains

Test Windows	Load (kN)	A	n	R^2
C3, C4	22	1460	0.0346	0.39
C1,C5	27	2543	0.0260	0.26
C2	40	1631	0.1559	0.89

The progression of the peak longitudinal displacements as a function of load repetitions is presented in Figure 42. The strains were in extension. The maximum displacements were about 4-mm. Power curves were fitted to the longitudinal displacements, Figure 42. The following power coefficients were found to best fit the data, Table 9.

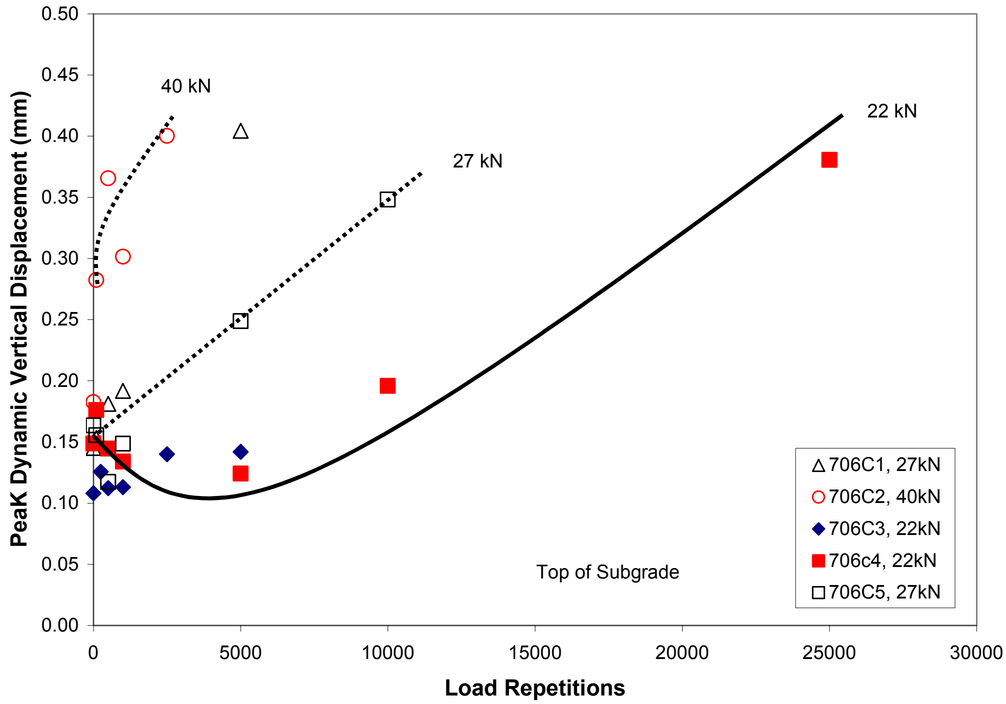

Figure 42. Peak dynamic longitudinal displacements of subgrade as function of load repetitions

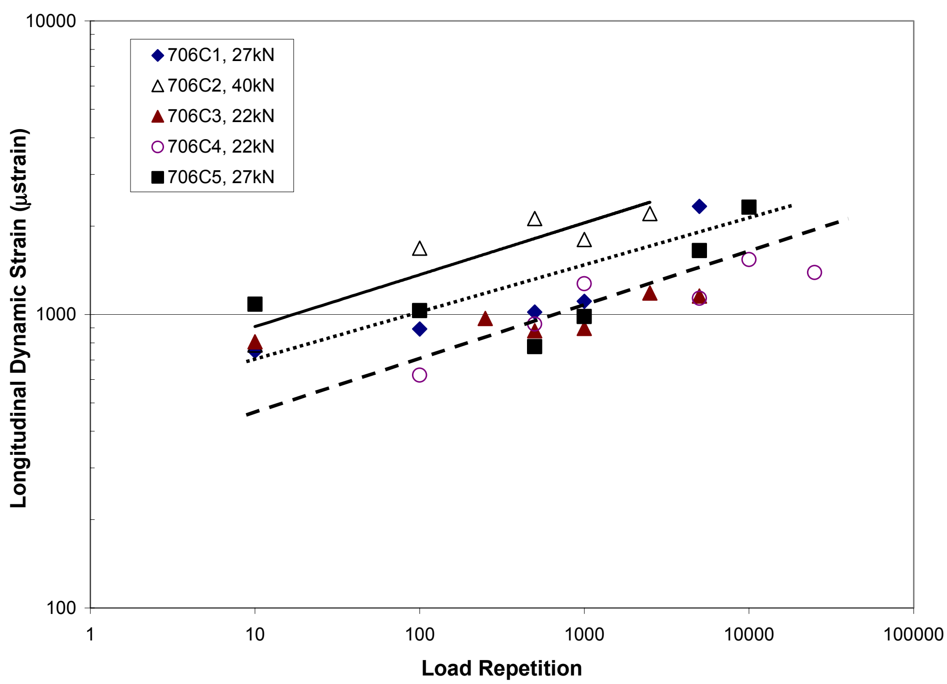

Figure 43. Peak dynamic longitudinal strains of subgrade as function of load repetitions (log-log).

Table 9. Power curve coefficients for the longitudinal strains

Test Windows	Load (kN)	A	n	R^2
C3, C4	22	471	0.1333	0.68
C1,C5	27	554	0.1245	0.55
C2	40	605	0.11767	0.84

The transverse displacements were also in extension. The maximum displacements were around 0.2-mm.

STRESS MEASUREMENTS

Triaxial stress measurements were made in the subgrade in all test windows at an approximate depth of 380-mm from the pavement surface. TS706C2, an additional set of triaxial stress measurements was made at 533-mm from the AC surface. The actual locations of the stress gages are shown in Table C 2. Location of DYNATEST pressure cells, Appendix C. The peak stresses as a function of load repetitions are presented in Appendix H. All stress measurements were compressive.

SUMMARY & CONCLUSIONS

Accelerated Pavement Testing was conducted on an test section with an A-4 subgrade soil placed at wet of optimum density and moisture content of 1700 kg/m^3 and 19.9% respectively. The subgrade layer was instrumented with stress, strain, temperature and moisture sensors.

The test section was divided into 6 test windows and accelerated pavement testing was conducted over a period of 11 months. During the accelerated pavement testing, dynamic stresses, dynamic and permanent strains, and surface rut depth measurements were collected at given loading intervals. Stress measurements were collected in all of the six test windows. Strain measurements were collected in all six windows to a depth of 1.2-m into the subgrade. Stress and strain measurements were made in the vertical, longitudinal and transverse directions of loading. Temperature and moisture measurements were made every 4 hours during the tests. The test loads varied between 22 to 40-kN. The average tire pressure was 690-kPa.

The dynamic strains at failure are compared with the current Asphalt Institute and Shell subgrade failure criterions, Figure 44. In additions the strains at failure from the other subgrades are shown in Figure 44. Note that these results were measured at 12 km/hr. To be able to compare with the results from the AASHO Road tests, where the test speed was 48 km/hr, a correction factor was applied to the strain data. The correction factors were developed based on results from MnRoad (Dai and Van Deusen, 1998, Janoo, et al, 2002). The test results were multiplied by factors of 0.63 and 0.48 for speeds of 48 km/hour (AASHO Road Test) and 88 km/hour (highway) respectively.

In terms of the allowable number of load repetitions N_d to limit rutting on top of the subgrade, where

$$N_d = f_4 \left(\varepsilon_v \right)^{-f5} \qquad \text{(Equation 1)}$$

the coefficients f_4, f_5 are 12.134 and -0.3748 for highway speeds.

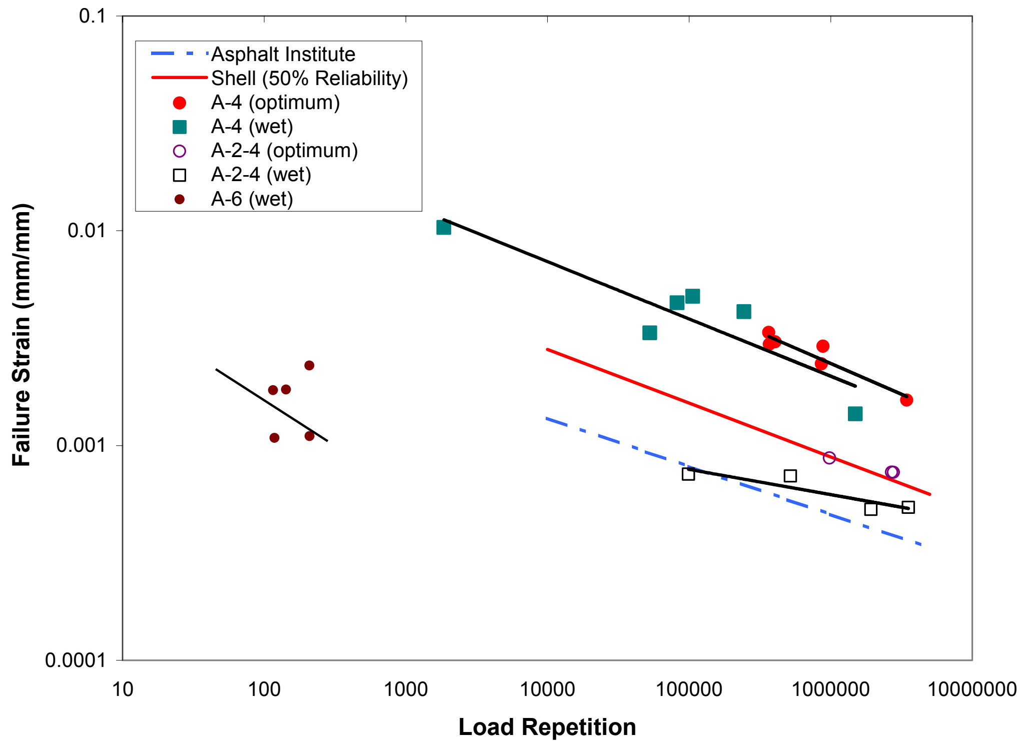

Figure 44. Effect of soil type on the subgrade failure criterion

REFERENCE

Dai, S.T., D.Van Deusen, D.Rettner and G.Cochran. "Investigation of Flexible Pavement Response to Truck Speed and FWD Load Through Instrumented Pavements", Proceedings of the 8th International Conference on Flexible Pavements. Seattle, Washington, pp.141-160. 1997.

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Janoo, V., L. Irwin, R. Eaton, and R. Haehnel, "Pavement Subgrade Performance Study: Project Overview, ERDC Report TR15, 2002.

Janoo, V., E. Cortez, R.Eaton, "Pavement Subgrade Performance Study, A-2-4 Test Soil at Near Optimum Conditions", ERDC Report, TR53, 2002. (in final preparation).

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APPENDIX A: FROST EFFECTS RESEARCH FACILITY (FERF)

DESCRIPTION OF FROST EFFECTS RESEARCH FACILITY

The FERF is a 2,700 m^2 environmentally controlled building. The overall facility is 56 m long by 31 m wide (Figure A 1).

Figure A 1. Frost Effects Research Facility (FERF)

Within the facility are 12 test cells, which are 6.4 m wide. Eight of the cells (TC-1 to TC-8) are 7.6 m long and 2.4 m deep. The remaining 4 cells (TB-9 to TB-12) are of the same width but are 11.3 m long and 3.7 m deep, A- 2. They can be used individually for smaller experiments or combined in a variety of ways to accommodate larger projects. In addition, the cells can be made impermeable to simulate the raising and lowering of the water table.

The ambient air temperature within the facility can be controlled from -4 °C to 24 °C with a ± 2 °C tolerance. The temperatures in the test cell can be further reduced or increased using surface panels (- 32 °C to 49 °C).

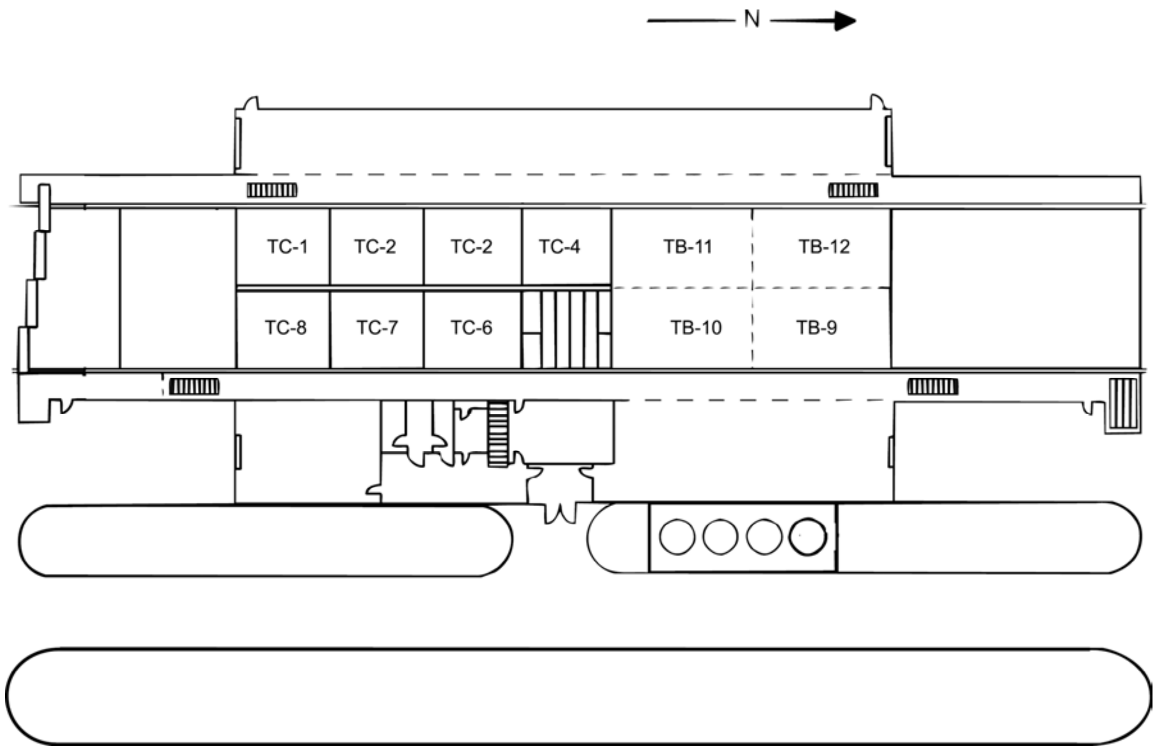

Figure A 2. Plan view of test basins in the Frost Effects Research Facility (FERF)

Test Section 706
AASHTO A-6 subgrade soil at 22 % gravimetric moisture content

APPENDIX B: CONSTRUCTION DATA

Table B 1. As constructed densities of the various layers

Depth from AC surface (mm)	3.10	*2.85*	2.59	2.33	2.03	1.73	1.53	1.36	1.19	0.70	0.43	0.14	
Station	Subgrade Dry Density (kg/m^3)											Base	AC
1	1581	1696	1637	1552	1603	1660	1668	1639	1652	1595	1563	1844	2199
2	1560	1642	1711			1637	1632	1637					
3	1592	1643	1756	1674	1501	1560	1693		1643	1712	1741	1836	2244
4	1595	1695	1692			1570	1664						
5	1603	1684	1682	1736	1676	1602	1672	1570	1624	1653	1687	1908	2206
6	1602	1700	1720			1584	1527						
7	1495	1696	1741	1704	1698	1517	1685	1602	1611	1618	1648	1808	2187
8	1693	1682	1749			1579	1669	1631					
9		1676	1724	1696	1676	1482	1583		1599	1674	1685	1855	2177
10		1626	1687	1605	1722	1568	1627	1656					
11	1631	1690	1693	1549	1451	1608	1701	1647	1627	1687	1584	1922	2179
12	1648	1639	1672			1602	1544	1647					
13	1656	1589	1679	1668	1560	1627	1650	1624	1640	1640	1615	1905	2110
14	1623	1655	1676			1571	1658	1693					
15	1652	1688	1680			1562	1664	1672	1653	1616	1650	1884	2299
16	1528	1688	1711			1616	1621	1652					
17	1599	1669	1717			1645	1764		1599	1627	1684	1930	2364
18	1605	1668	1740	1632	1647	1615	1656	1656					
19		1708	1740			1600	1728	1581	1648	1671	1650	1916	2412
20		1664	1738	1714	1543	1527	1743	1576					
21	1626	1688	1709	1626	1682	1687	1706	1599	1619	1635	1696	1849	2408
22	1613	1643	1706	1547	1716	1672	1623	1623					
23	1589	1616	1712			1690	1634	1615	1592	1632	1666	1887	2449

Table B 1. As constructed densities of the various layers (cont)

Depth from AC surface (mm)	3.10	*2.85*	2.59	2.33	2.03	1.73	1.53	1.36	1.19	0.70	0.43	0.14	
Station					Subgrade Dry Density (kg/m^3)							Base	AC
24	1645	1688	1696	1749	1538	1661	1626						
25	1671	1519	1693			1671	1658		1640	1679	1716	1841	2438
26	1671	1587	1701			1684	1631	1643					
27	1595	1626	1716	1736	1658	1685	1616	1647	1652	1632	1616	1932	2422
28	1669	1602	1698			1639	1616	1608					
29		1535	1728	1778	1637	1629	1728	1655	1615	1610	1479	1945	2425
30		1708	1748	1587	1538	1679	1688	1603					
31							1709	1642	1611	1704	1639	1919	2132
32							1623						
33							1709		1599	1687	1666	1877	2228
34							1680	1536					
35							1732		1640	1658	1791	1850	2294
36							1698						
37							1698	1637	1679	1639	1682	1905	2243
38							1704	1565					
39							1725		1661	1616	1677	1882	2263
40							1674						
41							1631		1616	1592	1712	1927	2243
42							1626	1557					
43							1709		1623	1639	1546	1994	2263
44							1764	1605					
45							1743	1664	1621	1631	1443	1937	2204
46							1660						

Table B 1. As constructed densities of the various layers (cont)

Depth from AC surface (mm)	3.10	*2.85*	2.59	2.33	2.03	1.73	1.53	1.36	1.19	0.70	0.43	0.14	
Station					Subgrade Dry Density (kg/m^3)							Base	AC
47							1698	1676	1607	1680	1565	1879	2257
48							1680						
49							1685		1668	1709	1571	1857	2287
50							1674						
51							1621		1653	1658	1656	1868	2263
52							1680						
53							1674	1643	1663	1576	1660	1919	2073
54							1660						
55							1627		1635	1615	1626	1937	2116
56							1642						
57							1679	1660	1631	1648	1716	1887	2267
58							1637						
59							1661		1619	1679	1597	1951	2294
60							1650	1631					

Table B 2. As constructed moisture contents of the various layers

Depth from AC surface (mm)	3.10	*2.85*	2.59	2.33	2.03	1.73	1.53	1.36	1.19	0.70	0.43	0.14
	Subgrade											Base
Station	Moisture Content (%)											
1	22.6	19.9	21.0	17.8	17.5	19.2	20.5	20.4	19.1	21.9	19.6	2.5
2	23.4	20.9	20.2			20.8	20.0	20.9				
3	22.3	20.5	22.8	19.0	18.2	20.2	19.7		19.8	20.4	18.3	2.8
4	23.6	20.3	20.7			20.4	19.1					
5	22.7	20.3	21.5	17.5	17.1	20.0	19.1	21.2	20.3	19.8	18.5	3.2
6	23.8	21.1	20.6			20.2	21.2					
7	24.9	21.0	20.6	17.6	18.0	20.2	19.2	21.4	19.7	19.6	19.0	2.8
8	20.4	20.4	21.1			19.1	18.9	21.8				
9		19.3	20.3	16.1	17.2	21.6	21.6		19.0	20.4	18.7	2.6
10		20.5	23.0	15.8	18.3	20.3	21.0	21.6				
11	23.5	20.8	24.0	19.3	18.7	20.1	19.7	21.3	20.3	19.8	20.6	2.9
12	21.6	21.2	21.1			20.5	20.4	20.7				
13	20.1	20.3	20.4	17.9	18.3	20.4	19.7	21.2	21.0	19.9	18.1	3.0
14	23.3	20.9	23.1			20.8	19.1	20.4				
15	21.6	20.1	21.5			21.5	19.9	20.6	22.1	18.9	18.6	2.9
16	23.3	19.6	20.1			19.5	21.4	20.8				
17	23.6	19.7	21.2			19.0	17.2		19.9	20.0	19.1	2.8
18	22.8	20.7	21.4	17.2	17.3	20.5	19.9	22.0				
19		19.5	21.4			20.5	18.8	20.9	20.8	20.9	19.1	2.7
20		20.4	23.5	16.6	17.3	22.1	18.3	22.2				
21	23.3	20.1	18.6	18.7	17.2	20.4	19.2	22.5	20.7	19.6	19.4	3.0
22	22.7	20.8	22.0	19.7	19.4	19.7	19.6	21.1				
23	23.0	21.0	21.4			20.4	19.8	21.6	21.4	20.0	18.6	2.9

Table B 2. As constructed moisture contents of the various layers (cont)

Depth from AC surface (mm)	3.10	*2.85*	2.59	2.33	2.03	1.73	1.53	1.36	1.19	0.70	0.43	0.14
					Subgrade							Base
Station						Moisture Content (%)						
24	22.3	19.6	22.0	18.2	18.0	20.7	21.1					
25	22.0	21.3	21.4			19.4	20.4		21.3	20.2	18.3	2.6
26	20.9	21.2	21.9			18.5	19.5	20.4				
27	21.7	20.5	20.4	17.7	18.8	19.9	20.3	21.1	21.6	18.9	18.8	3.2
28	21.1	20.4	21.0			21.3	20.2	23.0				
29		20.9	22.3	17.4	18.3	19.9	18.1	20.6	21.4	19.8	20.0	3.0
30		19.0	21.5	16.4	17.9	20.2	19.6	21.5				
31							19.1	20.6	20.3	19.6	20.2	2.7
32							21.2					
33							19.6		20.9	20.2	19.4	2.5
34							19.8	22.2				
35							19.7		19.8	20.6	16.8	3.1
36							19.9					
37							19.4	19.6	19.3	19.4	17.9	2.8
38							19.1	21.6				
39							19.8		19.0	19.6	18.1	3.4
40							20.3					
41							21.2		21.9	21.5	18.1	3.1
42							19.9	22.0				
43							19.0		20.6	20.6	21.1	2.7
44							16.2	22.0				
45							19.0	21.5	20.5	19.3	20.9	3.0
46							21.2					

Table B 2. As constructed moisture contents of the various layers (cont)

Depth from AC surface (mm)	3.10	*2.85*	2.59	2.33	2.03	1.73	1.53	1.36	1.19	0.70	0.43	0.14
	Subgrade											Base
Station	Moisture Content (%)											
47							20.3	20.2	22.0	20.2	20.9	2.6
48							20.8					
49							20.8		21.2	20.5	21.9	2.9
50							19.7					
51							21.3		20.7	19.0	18.6	3.1
52							20.6					
53							21.1	21.3	21.5	23.2	18.2	3.4
54							20.4					
55							22.6		21.8	21.9	19.5	3.2
56							21.7					
57							20.3	19.7	21.6	20.0	18.1	2.9
58							20.8					
59							20.3		20.9	19.1	18.6	2.8
60							20.4	20.9				

Table B 3. As constructed CLEGG hammer CBR of the various layers

Depth from AC surface (mm)	3.10	*2.85*	2.59	2.33	2.03	1.73	1.53	1.36	1.19	0.70	0.43	0.14
						Subgrade						Base
Station						Clegg CBR (%)						
1	2	1	1			2	2	2	3	3	4	
2	3	1	1			2	3	2	2	3	3	
3	4	1	1			2	3	3	2	4	3	
4	3	1	1			2	3	2	2	3	3	
5	3	1	1			2	3	2	3	3	3	
6	2	1	1			2	3	2	3	3	3	
7	3	1	2			2	3	2	3	3	3	
8	2	1	1			2	3	2	3	2	4	
9		1	1			3	3	2	2	2	4	
10		1	1			2	3	2	2	3	4	
11		1	2			2	3	2	2	3	3	
12		1	3			2	2	2	3	3	4	
13	2	1	1			3	3	2	2	3	3	
14	2	1	1			2	2	3	2	4	4	
15	2	1	1			3	4	3	3	3	3	
16	2	1	1			2	3	1	2	3	3	
17	2	1	1			2	3	2	2	4	3	
18	3	1	2			2	3	2	2	3	3	
19	3	1	1			2	3	2	4	3	3	
20	2	1	1			2	3	2	2	4	3	
21	2	1	1			2	3	2	3	5	3	
22		1	1			2	3	1	3	4	3	
23		1	2			2	3	2	3	4	3	

Table B 3. As constructed CLEGG hammer CBR of the various layers (cont)

Depth from AC surface (mm)	3.10	*2.85*	2.59	2.33	2.03	1.73	1.53	1.36	1.19	0.70	0.43	0.14
					Subgrade							Base
Station						Clegg CBR (%)						
24		1	4			2	3	2	4	3	4	
25	2	1	1			3	3	2	3	3	3	
26	2	1	1			3	3	2	3	3	4	
27	2	2	1			2	3	2	2	3	5	
28	2	1	1			3	3	2	3	2	4	
29	2	1	1			2	3	2	3	3	4	
30	2	1	1			2	3	2	3	3	5	
31	2	1	1			2	3	2	2	3	2	
32	2	1	1			2	3	2	2	4	2	
33	2	1	1			2	3	1	2	3	2	
34		1	1			2	3	1	3	3	3	
35		1	2			3	3	3	2	4	3	
36		1	4			2	3	1	4	3	3	
37	2	1	2			2	3	2	3	3	4	
38	2	1	2			3	3	2	3	3	3	
39	1	1	2			2	3	2	3	3	3	
40	2	1	1			3	3	2	2	2	3	
41	2	1	2			2	3	2	2	3	3	
42	2	2	1			2	3	2	2	3	4	
43	1	1	2			3	3	2	3	3	4	
44	2	1	2			3	3	2	2	3	4	
45	2	1	1			2	3	2	2	4	5	
46		1	1			2	3	2	3	3	3	

Table B 3. As constructed CLEGG hammer CBR of the various layers (cont)

Depth from AC surface (mm)	3.10	*2.85*	2.59	2.33	2.03	1.73	1.53	1.36	1.19	0.70	0.43	0.14
					Subgrade							Base
Station					Clegg CBR (%)							
47		1	2			3	3	2	3	3	3	
48		1	3			2	3	2	3	4	2	
49							3	2	2	3	3	
50							3	2	4	3	3	
51							3	2	2	3	3	
52							3	2	3	3	3	
53							3	2	3	3	3	
54							3	2	3	2	3	
55							3	2	2	3	3	
56							3	2	2	3	3	
57							3	3	3	4	3	
58							3	2	3	4	4	
59							3	2	2	3	4	
60							3	2	3	3	4	

APPENDIX C: INSTRUMENTATION DATA

Table C 1. Location of εmu (strain) measurement gages

ID	X (m)	Y (m)	Z (mm)
C1-1	4.57	4.42	76
C1-4	4.57	4.42	191
C1-7	4.57	4.42	305
C1-10	4.57	4.42	457
C1-13	4.57	4.42	610
C1-16	4.57	4.42	762
C1-19	4.57	4.42	914
C1-22	4.57	4.42	1067
C1-23	4.57	4.42	1219
C1-24	4.57	4.42	1372
C1-25	4.57	4.42	1524
C1-26	7.62	4.42	76
C1-29	7.62	4.42	191
C1-32	7.62	4.42	305
C1-35	7.62	4.42	457
C1-38	7.62	4.42	610
C1-2	4.72	4.42	76
C1-5	4.72	4.42	191
C1-8	4.72	4.42	305
C1-11	4.72	4.42	457
C1-14	4.72	4.42	610
C1-17	4.72	4.42	762
C1-20	4.72	4.42	914
C1-27	7.47	4.42	76
C1-30	7.47	4.42	191
C1-33	7.47	4.42	305
C1-36	7.47	4.42	457
C1-39	7.47	4.42	610
C1-3	4.57	4.27	76
C1-6	4.57	4.27	191
C1-9	4.57	4.27	305
C1-12	4.57	4.27	457
C1-15	4.57	4.27	610
C1-18	4.57	4.27	762
C1-21	4.57	4.27	914
C1-28	7.62	4.27	76
C1-31	7.62	4.27	191
C1-34	7.62	4.27	305
C1-37	7.62	4.27	457

ID	X (m)	Y (m)	Z (mm)
C1-40	7.62	4.27	610
C2-1	4.57	3.20	76
C2-4	4.57	3.20	191
C2-7	4.57	3.20	305
C2-10	4.57	3.20	457
C2-13	4.57	3.20	610
C2-16	4.57	3.20	762
C2-19	4.57	3.20	914
C2-22	4.57	3.20	1067
C2-23	4.57	3.20	1219
C2-24	4.57	3.20	1372
C2-25	4.57	3.20	1524
C2-26	7.62	3.20	76
C2-29	7.62	3.20	191
C2-32	7.62	3.20	305
C2-35	7.62	3.20	457
C2-38	7.62	3.20	610
C2-2	4.72	3.20	76
C2-5	4.72	3.20	191
C2-8	4.72	3.20	305
C2-11	4.72	3.20	457
C2-10	4.72	3.20	610
C2-17	4.72	3.20	762
C2-20	4.72	3.20	914
C2-27	7.47	3.20	76
C2-30	7.47	3.20	191
C2-33	7.47	3.20	305
C2-36	7.47	3.20	457
C2-39	7.47	3.20	610
C2-3	4.57	3.05	76
C2-6	4.57	3.05	191
C2-9	4.57	3.05	305
C2-12	4.57	3.05	457
C2-15	4.57	3.05	610
C2-18	4.57	3.05	762
C2-21	4.57	3.05	914
C2-28	7.62	3.05	76
C2-31	7.62	3.05	191
C2-34	7.62	3.05	305
C2-37	7.62	3.05	457
C2-40	7.62	3.05	610

Table C 1. Location of εmu (strain) measurement gages (cont)

ID	X (m)	Y (m)	Z (mm)	ID	X (m)	Y (m)	Z (mm)
C3-1	4.57	1.98	76	C4-1	15.24	4.42	76
C3-4	4.57	1.98	191	C4-4	15.24	4.42	191
C3-7	4.57	1.98	305	C4-7	15.24	4.42	305
C3-10	4.57	1.98	457	C4-10	15.24	4.42	457
C3-13	4.57	1.98	610	C4-13	15.24	4.42	610
C3-16	4.57	1.98	762	C4-16	15.24	4.42	762
C3-19	4.57	1.98	914	C4-19	15.24	4.42	914
C3-22	4.57	1.98	1067	C4-22	15.24	4.42	1067
C3-23	4.57	1.98	1219	C4-23	15.24	4.42	1219
C3-24	4.57	1.98	1372	C4-24	15.24	4.42	1372
C3-25	4.57	1.98	1524	C4-25	15.24	4.42	1524
C3-26	7.62	1.98	76	C4-26	18.29	4.42	76
C3-29	7.62	1.98	191	C4-29	18.29	4.42	191
C3-32	7.62	1.98	305	C4-32	18.29	4.42	305
C3-35	7.62	1.98	457	C4-35	18.29	4.42	457
C3-38	7.62	1.98	610	C4-38	18.29	4.42	610
C3-2	4.72	1.98	76	C4-2	15.39	4.42	76
C3-5	4.72	1.98	191	C4-5	15.39	4.42	191
C3-8	4.72	1.98	305	C4-8	15.39	4.42	305
C3-11	4.72	1.98	457	C4-11	15.39	4.42	457
C3-6	4.72	1.98	610	C4-14	15.39	4.42	610
C3-17	4.72	1.98	762	C4-17	15.39	4.42	762
C3-20	4.72	1.98	914	C4-20	15.39	4.42	914
C3-27	7.47	1.98	76	C4-27	18.14	4.42	76
C3-30	7.47	1.98	191	C4-30	18.14	4.42	191
C3-33	7.47	1.98	305	C4-33	18.14	4.42	305
C3-36	7.47	1.98	457	C4-36	18.14	4.42	457
C3-39	7.47	1.98	610	C4-39	18.14	4.42	610
C3-3	4.57	1.83	76	C4-3	15.24	4.27	76
C3-6	4.57	1.83	191	C4-6	15.24	4.27	191
C3-9	4.57	1.83	305	C4-9	15.24	4.27	305
C3-12	4.57	1.83	457	C4-12	15.24	4.27	457
C3-15	4.57	1.83	610	C4-15	15.24	4.27	610
C3-18	4.57	1.83	762	C4-18	15.24	4.27	762
C3-21	4.57	1.83	914	C4-21	15.24	4.27	914
C3-28	7.62	1.83	76	C4-28	18.29	4.27	76
C3-31	7.62	1.83	191	C4-31	18.29	4.27	191
C3-34	7.62	1.83	305	C4-34	18.29	4.27	305
C3-37	7.62	1.83	457	C4-37	18.29	4.27	457
C3-40	7.62	1.83	610	C4-40	18.29	4.27	610

Table C 1. Location of εmu (strain) measurement gages (cont)

ID	X (m)	Y (m)	Z (mm)	ID	X (m)	Y (m)	Z (mm)
C5-1	15.24	3.20	76	C6-1	15.24	1.98	76
C5-4	15.24	3.20	191	C6-4	15.24	1.98	191
C5-7	15.24	3.20	305	C6-7	15.24	1.98	305
C5-10	15.24	3.20	457	C6-10	15.24	1.98	457
C5-13	15.24	3.20	610	C6-13	15.24	1.98	610
C5-16	15.24	3.20	762	C6-16	15.24	1.98	762
C5-19	15.24	3.20	914	C6-19	15.24	1.98	914
C5-22	15.24	3.20	1067	C6-22	15.24	1.98	1067
C5-23	15.24	3.20	1219	C6-23	15.24	1.98	1219
C5-24	15.24	3.20	1372	C6-24	15.24	1.98	1372
C5-25	15.24	3.20	1524	C6-25	15.24	1.98	1524
C5-26	18.29	3.20	76	C6-26	18.29	1.98	76
C5-29	18.29	3.20	191	C6-29	18.29	1.98	191
C5-32	18.29	3.20	305	C6-32	18.29	1.98	305
C5-35	18.29	3.20	457	C6-35	18.29	1.98	457
C5-38	18.29	3.20	610	C6-38	18.29	1.98	610
C5-2	15.39	3.20	76	C6-2	15.39	1.98	76
C5-5	15.39	3.20	191	C6-5	15.39	1.98	191
C5-8	15.39	3.20	305	C6-8	15.39	1.98	305
C5-11	15.39	3.20	457	C6-11	15.39	1.98	457
C5-14	15.39	3.20	610	C6-6	15.39	1.98	610
C5-17	15.39	3.20	762	C6-17	15.39	1.98	762
C5-20	15.39	3.20	914	C6-20	15.39	1.98	914
C5-27	18.14	3.20	76	C6-27	18.14	1.98	76
C5-30	18.14	3.20	191	C6-30	18.14	1.98	191
C5-33	18.14	3.20	305	C6-33	18.14	1.98	305
C5-36	18.14	3.20	457	C6-36	18.14	1.98	457
C5-39	18.14	3.20	610	C6-39	18.14	1.98	610
C5-3	15.24	3.05	76	C6-3	15.24	1.83	76
C5-6	15.24	3.05	191	C6-6	15.24	1.83	191
C5-9	15.24	3.05	305	C6-9	15.24	1.83	305
C5-12	15.24	3.05	457	C6-12	15.24	1.83	457
C5-15	15.24	3.05	610	C6-15	15.24	1.83	610
C5-18	15.24	3.05	762	C6-18	15.24	1.83	762
C5-21	15.24	3.05	914	C6-21	15.24	1.83	914
C5-28	18.29	3.05	76	C6-28	18.29	1.83	76
C5-31	18.29	3.05	191	C6-31	18.29	1.83	191
C5-34	18.29	3.05	305	C6-34	18.29	1.83	305
C5-37	18.29	3.05	457	C6-37	18.29	1.83	457
C5-40	18.29	3.05	610	C6-40	18.29	1.83	610

Table C 2. Location of DYNATEST pressure cells

ID	F.S. Range (kPa)	Test Window	Measurement Orientation	Location X (m)	Location Y (m)	Location Z (mm)
B36	800	706C1	Z	6.1	4.4	381
A63	200	706C1	X	5.8	4.4	381
A622	200	706C1	Y	6.1	4.1	381
B61	800	706C2	Z	6.1	3.2	381
A77	200	706C2	X	5.8	3.2	381
A711	200	706C2	Y	6.1	2.9	381
A624	200	706C2	Z	6.1	3.2	533
A62	200	706C2	X	5.8	3.2	533
A630	200	706C2	Y	6.1	2.9	533
B33	800	706C3	Z	6.1	2.0	381
A713	200	706C3	X	6.1	1.7	381
A712	200	706C3	Y	5.8	2.0	381
B38	800	706C4	Z	16.8	4.4	381
A633	200	706C4	X	16.5	4.4	381
A611	200	706C4	Y	16.8	4.1	381
B37	800	706C5	Z	16.8	3.2	381
A37	200	706C5	X	16.5	3.2	381
A38	200	706C5	Y	16.8	2.9	381
B31	800	706C6	Z	16.8	2.0	381
A619	200	706C6	X	16.5	2.0	381
A61	200	706C6	Y	16.8	1.7	381

Table C 3. Location of GEOKON pressure cells

ID	F.S. Range (kPa)	Test Window	Measurement Orientation	Location X (m)	Location Y (m)	Location Z (mm)
851	700	706C2	Z	6.9	3.2	190.5
838	700	706C2	X	5.3	3.2	190.5
849	700	706C2	Y	6.9	2.8	190.5
848	700	706C5	Z	17.5	3.2	190.5
846	700	706C5	X	16.0	3.2	190.5
847	700	706C5	Y	17.5	2.8	190.5

Table C 4. Location of moisture sensors

ID	Location		
	X (m)	Y (m)	Z (mm)
P1	1.8	4.9	38
P2	1.8	4.9	64
P3	10.7	1.5	38
P4	10.7	1.5	64
P5	19.8	5.2	38
P6	19.8	5.2	64

APPENDIX D: HEAVY VEHICLE SIMULATOR

The test sections were loaded using the DYNATEST™ Mark IV Heavy Vehicle Simulator (HVS), an accelerated loading system used by the South African Commonwealth of Scientific & Industrial Research (CSIR) for over twenty years, Figure D-1. The HVS delivered to CRREL was a modification of the existing MK III. The modifications included increased speed capability, automatic and manual controls, and an electric motor to drive the test carriage. The HVS is monitored continuously and is set to automatically shutdown out if a major problem is detected.

The HVS is approximately 23-m long, 4-m wide and 4-m high and weighs about 46 metric tons. It can accommodate dual truck tires, a super single truck tire, or a C-141 aircraft tire. The load on the dual and super single can range between 20 to 100-kN. The C-141 tire can be loaded to 200-kN. The loads on the dual or super single can be applied in either one or both directions. The length of the test section where the load is applied at constant velocity is 6-m. The load on the dual tires or super single can be applied at a creep rate up to 13 km/hr. An additional feature to the Mark IV HVS, is the ability to program the load distribution on the pavement section. The maximum lateral wander of the test wheel will be set at 0.9-m. Table B-1 provides a summary of the features of the HVS Mark IV.

For this project, the speed will be set at 13 km/hr per hour, the number of load repetitions on the dual tire in one direction is approximately 700 per hour. In addition, the HVS was operated 22 hours per day, 7 days a week. Trafficking of the test section is uni-directional. Uni-directional was selected since highways pavements are subjected to uni-directional loads. The test windows were subjected to wheel wander and the length of the wander will set over the width of the test windows in increments of 5 cm to a maximum of 0.9-m, which ever is the smaller.

A dual truck tire used for the study. The dimensions of the tires are shown in Figure D-2. The tires were manufactured by Bridgestone.

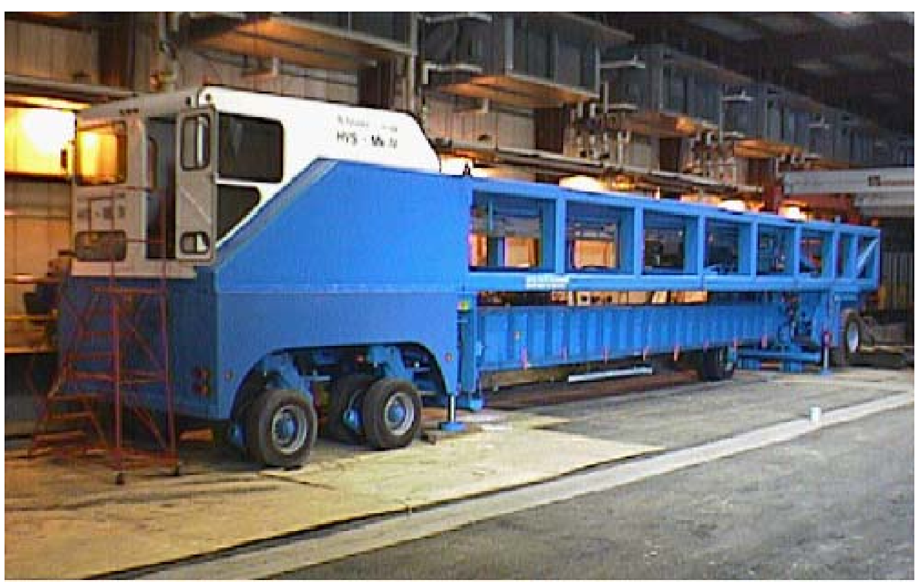

Figure D 1. Heavy Vehicle Simulator (HVS)

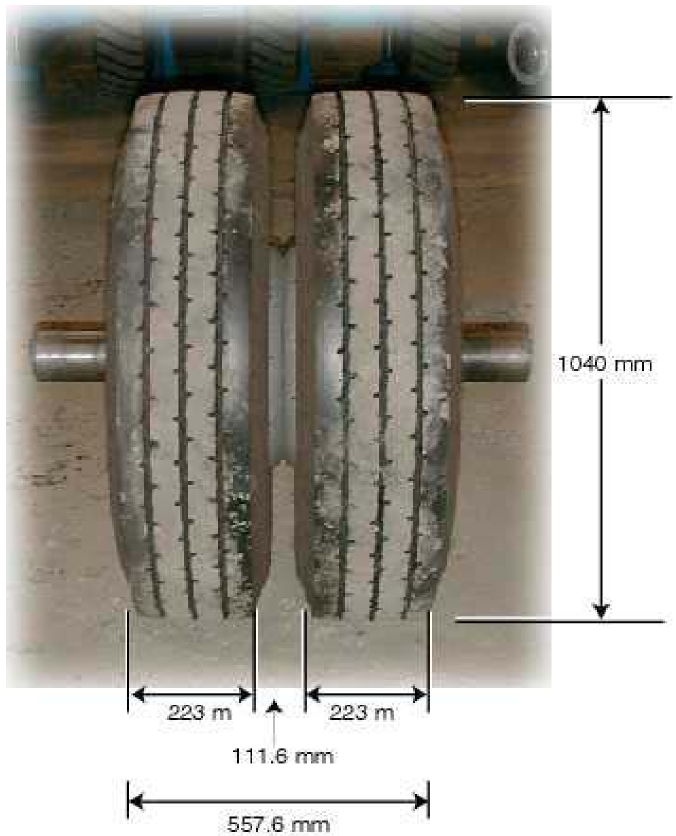

Figure D 2. Dimensions of the test tire

APPENDIX E: SURFACE PROFILE TEST RESULTS

Table E 1. Surface rut measurements in 706C1

Pos\Pass	0	100	500	1000	5000
	Maximum Rut (mm)				
1	0	-6.43	-10.06	-12.26	-22.84
2	0	-7.81	-11.63	-15.16	-25.57
3	0	-8.29	-12.61	-14.53	-27.88
4	0	-8.04	-12.92	-16.28	-29.00
5	0	-8.59	-14.14	-16.55	-29.06
6	0	-4.73	-11.12	-14.18	-27.51
7	0	-7.26	-11.96	-14.92	-27.36
8	0	-6.20	-11.43	-13.88	-25.85
9	0	-6.77	-11.02	-13.55	-26.98
10	0	-6.22	-10.53	-12.96	-26.26
11	0	-5.75	-11.88	-13.37	-26.53
12	0	-7.26	-11.94	-15.06	-30.24
13	0	-6.31	-12.04	-15.86	-27.69
14	0	-6.61	-12.26	-14.79	-28.12
15	0	-5.71	-10.77	-14.08	-26.24
16	0	-6.24	-11.10	-14.12	-26.12
17	0	-6.96	-11.79	-15.20	-26.20
18	0	-6.20	-11.20	-14.51	-24.04
19	0	-6.20	-10.47	-12.96	-20.65
20	0	-3.92	-7.02	-8.53	-15.26

Table E 2. Surface rut measurements in 706C2

Pos\Pass	0	100	500	1000	2500
	Maximum Rut (mm)				
1	0	-11.04	-20.08	-26.79	-32.90
2	0	-11.71	-19.88	-26.10	-33.79
3	0	-11.31	-20.98	-26.20	-34.00
4	0	-12.22	-22.00	-26.77	-35.26
5	0	-14.14	-22.63	-26.81	-37.28
6	0	-12.35	-21.45	-26.45	-35.45
7	0	-11.10	-18.71	-22.67	-30.49
8	0	-9.96	-16.45	-20.45	-28.75
9	0	-10.04	-16.73	-21.10	-30.00
10	0	-9.26	-16.24	-20.75	-29.92
11	0	-8.61	-15.79	-19.67	-29.92
12	0	-8.18	-14.75	-20.00	-29.08
13	0	-7.55	-14.06	-18.49	-28.41
14	0	-7.71	-15.12	-19.24	-29.87
15	0	-6.33	-13.71	-17.94	-27.79
16	0	-7.77	-14.39	-19.28	-28.75
17	0	-6.92	-14.94	-20.41	-29.81
18	0	-8.41	-17.92	-23.08	-31.32
19	0	-9.43	-18.84	-23.96	-30.81
20	0	-9.65	-17.77	-21.84	-26.34

Table E 3. Surface rut measurements in 706C3

Pos\Pass	0	250	500	1000	2500	5000	10000	25000
	Maximum Rut (mm)							
1	0	-8.94	-10.39	-12.30	-13.57	-16.65	-18.67	-22.06
2	0	-9.00	-9.79	-12.10	-14.51	-16.53	-17.88	-21.65
3	0	-7.59	-9.57	-11.61	-14.41	-17.79	-20.14	-23.30
4	0	-10.08	-11.53	-13.90	-17.39	-19.34	-21.94	-25.81
5	0	-9.86	-12.12	-13.31	-17.39	-18.18	-21.26	-24.75
6	0	-8.00	-9.18	-11.88	-14.16	-16.98	-19.82	-22.24
7	0	-8.28	-10.65	-12.06	-14.82	-16.14	-18.96	-22.28
8	0	-7.49	-10.02	-10.59	-12.75	-14.49	-16.51	-19.30
9	0	-5.86	-7.16	-7.90	-10.57	-11.94	-14.57	-17.86
10	0	-6.79	-9.33	-10.00	-11.49	-13.24	-16.26	-20.43
11	0	-6.14	-7.84	-9.49	-12.00	-14.04	-16.61	-22.26
12	0	-6.29	-7.94	-9.71	-13.57	-15.20	-18.28	-22.51
13	0	-6.53	-7.94	-9.88	-12.26	-14.47	-17.33	-22.32
14	0	-6.14	-7.77	-9.45	-12.49	-14.63	-17.98	-21.75
15	0	-6.29	-7.71	-8.96	-11.82	-13.69	-16.86	-20.00
16	0	-6.22	-7.84	-9.49	-11.67	-14.51	-17.10	-22.20
17	0	-4.65	-6.51	-7.75	-10.88	-13.14	-15.88	-19.88
18	0	-6.14	-6.82	-7.49	-11.31	-12.83	-16.73	-20.32
19	0	-5.61	-6.67	-7.67	-11.00	-13.04	-15.96	-20.88
20	0	-7.63	-7.67	-9.59	-11.41	-14.08	-16.71	-20.49

Table E 4. Surface rut measurements in 706C4

Pos\Pass	0	100	500	1000	5000	10000	25000
	Maximum Rut (mm)						
1	0	-6.27	-8.42	-10.07	-14.54	-17.84	-22.78
2	0	-4.98	-7.90	-10.20	-15.82	-17.55	-23.28
3	0	-5.39	-9.10	-10.65	-15.26	-18.02	-23.77
4	0	-6.51	-10.66	-12.43	-17.90	-20.45	-26.31
5	0	-6.80	-11.92	-13.35	-19.41	-22.71	-29.14
6	0	-6.57	-13.00	-15.28	-21.73	-25.04	-31.94
7	0	-5.84	-12.47	-14.28	-20.61	-24.04	-30.88
8	0	-5.18	-10.79	-12.69	-19.45	-22.12	-27.16
9	0	-6.10	-10.67	-12.84	-18.08	-20.83	-28.08
10	0	-6.02	-11.41	-13.61	-19.92	-22.14	-28.73
11	0	-6.31	-12.53	-14.59	-20.32	-21.86	-27.28
12	0	-5.94	-11.63	-12.31	-18.77	-20.84	-26.10
13	0	-4.73	-10.14	-11.81	-17.37	-20.12	-24.53
14	0	-4.73	-10.12	-12.37	-16.92	-20.65	-25.22
15	0	-3.61	-8.24	-9.96	-14.96	-16.31	-21.79
16	0	-4.37	-8.94	-10.24	-15.53	-18.14	-24.04
17	0	-5.33	-9.82	-11.90	-17.29	-19.35	-25.02
18	0	-3.77	-9.90	-10.02	-16.88	-19.00	-24.02
19	0	-4.57	-9.88	-11.00	-16.39	-19.02	-22.88
20	0	-3.49	-8.06	-9.41	-15.55	-17.75	-21.92

Table E 5. Surface rut measurements in 706C5

Pos\Pass	0	100	500	1000	5000	10000
	Maximum Rut (mm)					
1	0	-5.00	-11.91	-12.97	-16.19	-26.81
2	0	-5.20	-11.62	-12.18	-17.09	-30.05
3	0	-6.20	-12.24	-13.13	-17.91	-33.64
4	0	-6.60	-12.66	-14.46	-19.93	-36.34
5	0	-6.70	-13.26	-16.42	-22.93	-37.79
6	0	-6.44	-12.93	-13.87	-21.54	-34.44
7	0	-6.90	-14.64	-14.95	-22.74	-35.87
8	0	-6.40	-13.58	-16.40	-23.54	-35.70
9	0	-6.20	-14.69	-15.87	-21.95	-33.93
10	0	-6.10	-14.87	-14.69	-23.79	-32.79
11	0	-6.30	-13.69	-14.11	-21.52	-29.23
12	0	-6.12	-12.24	-13.03	-17.81	-25.66
13	0	-6.14	-11.93	-12.46	-17.01	-23.87
14	0	-6.50	-10.48	-11.83	-15.89	-22.58
15	0	-6.50	-11.81	-11.11	-15.09	-21.48
16	0	-6.60	-9.87	-11.69	-14.14	-20.40
17	0	-6.30	-10.73	-10.97	-14.50	-20.83
18	0	-6.10	-11.32	-12.20	-15.52	-22.62
19	0	-6.60	-11.24	-12.34	-15.70	-22.44
20	0	-6.40	-11.32	-12.13	-15.70	-21.56

Table E 6. Surface rut measurements in 704C6

Pos\Pass	0	250	500
	Maximum Rut (mm)		
1	0	-28.45	-36.14
2	0	-30.96	-39.36
3	0	-32.89	-42.55
4	0	-33.55	-44.91
5	0	-32.43	-41.43
6	0	-38.90	-48.24
7	0	-39.34	-47.96
8	0	-38.28	-47.26
9	0	-35.32	-43.32
10	0	-35.51	-43.67
11	0	-32.16	-38.77
12	0	-29.47	-35.92
13	0	-27.98	-34.43
14	0	-28.87	-36.38
15	0	-27.61	-34.45
16	0	-25.51	-31.63
17	0	-26.41	-32.77
18	0	-25.30	-30.79
19	0	-19.06	-23.37
20	0	-15.47	-18.39

APPENDIX F: PERMANENT DEFORMATION & STRAIN TEST RESULTS

Table F 1. Permanent deformation (mm) in 706C1

Vertical Deformation (mm)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
Surface	0.0	-0.2188	-0.6662	-1.0980	-2.1015
135	0.0	-0.7832	-1.6506	-2.1027	-3.8453
250	0.0	-0.4493	-1.1300	-1.5557	-3.1741
380	0.0	-0.5485	-1.4928	-2.0118	-4.8998
535	0.0	-0.3941	-0.8809	-1.1227	-2.1675
685	0.0	-0.3581	-0.7962	-1.0329	-1.6696
840	0.0	-0.1647	-0.3836	-0.5332	-0.9248
990	0.0	-0.2422	-0.5728	-0.7782	-1.3447
1145	0.0	-0.1228	-0.3207	-0.4386	-0.5845
1295	0.0	-0.1314	-0.3470	-0.4894	-0.5715
1450	0.0	-0.0659	-0.1676	-0.2546	-0.2485
	Load Repetition				
Depth (mm)	0	500	1000	2500	5000
75	0.0	-0.0858	-0.2416	-0.3593	-0.5440
190	0.0	-0.0875	-0.2083	-0.2951	-0.4594
305	0.0	-0.0666	-0.1322	-0.1778	-0.0918
455	0.0	-0.0135	0.0056	-0.0084	0.4966
610	0.0	-0.0274	-0.0769	-0.1262	0.0714
760	0.0	-0.0158	-0.0406	-0.1043	-0.0915
915	0.0	-0.0524	-0.1443	-0.2117	-0.2088
	Load Repetition				
Depth (mm)	0	500	1000	2500	5000
75	0.0	0.4813	0.9378	1.1601	2.3305
190	0.0	0.1310	0.2620	0.3151	1.0352
305	0.0	0.0451	0.0579	0.0395	0.4067
455	0.0	0.2520	0.4318	0.5400	1.7076
610	0.0	0.1528	0.3265	0.4201	1.2692
760	0.0	0.0874	0.1975	0.1930	0.4823
915	0.0	0.1106	0.2654	0.3220	0.9398

Table F 2. Permanent deformation (mm) in 706C2

Vertical Deformation (mm)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
Surface	0.0	-0.1787	-1.0840	-1.6993	-2.5668
135	0.0	-0.9544	-2.0031	-2.7114	-3.8211
250	0.0	-0.7089	-1.5679	-2.1377	-3.0881
380	0.0	-0.0162	-0.0606	-0.4955	-0.6345
535	0.0	-0.2280	-0.4932	-0.6857	-0.8949
685	0.0	-1.0920	-2.2292	-2.8567	-3.7710
840	0.0	-0.3890	-0.8407	-1.2079	-1.6850
990	0.0	-0.2867	-0.6153	-1.0114	-1.4236
Longitudinal Deformation (mm)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
75	0.0	-0.1552	-0.3391	-0.5325	-0.7414
190	0.0	-0.0949	-0.2769	-0.4323	-0.6635
305	0.0	0.0417	0.1020	0.0214	0.0467
455	0.0	0.0631	0.2129	0.2569	0.6146
610	0.0	0.0367	0.0854	0.0377	0.1119
760	0.0	-0.1115	-0.2220	-0.3637	-0.4578
915	0.0	-0.0886	-0.1548	-0.2532	-0.2481
Transverse Deformation (mm)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
75	0.0	0.4716	1.0153	1.3020	2.0229
190	0.0	0.1595	0.4492	0.5724	1.0412
305	0.0	0.1248	0.2941	0.3205	0.6017
455	0.0	0.5687	1.2780	1.6917	3.1227
610	0.0	0.5192	1.1131	1.4212	2.1516
760	0.0	0.4172	0.9159	1.1268	1.7213
915	0.0	0.2379	0.5348	0.8030	1.5002

Table F 3. Permanent deformation (mm) in 706C3

Vertical Deformation (mm)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
Surface	0.0	-1.1985	-1.5722	-1.7767	-2.3331	-2.7075
135	0.0	-0.4327	-0.6419	-0.8564	-1.2574	-1.5887
250	0.0	-0.1626	-0.2429	-0.3548	-0.6119	-0.8532
380	0.0	-0.1697	-0.2627	-0.4022	-0.7361	-1.1069
535	0.0	-0.1091	-0.1530	-0.2264	-0.3679	-0.5934
685	0.0	-0.0089	0.0223	0.0182	-0.0475	-0.2123
840	0.0	0.0271	0.0765	0.0794	0.0463	-0.0809
990	0.0	0.0485	0.0865	0.0975	0.0959	-0.0239
1145	0.0	0.0775	0.1358	0.1475	0.1548	0.0707
1295	0.0	0.1562	0.2412	0.2647	0.2767	0.1599
1450	0.0	0.0949	0.1447	0.1590	0.1763	0.1057
Longitudinal Deformation (mm)						
	Load Repetition					
Depth (mm)	0.0	250	500	1000	2500	5000
75	0.0	0.0011	0.0097	-0.0030	-0.0812	-0.1710
190	0.0	-0.0233	-0.0190	-0.0503	-0.1491	-0.2927
305	0.0	0.0558	0.0860	0.0861	0.0576	-0.0308
455	0.0	0.1044	0.1688	0.1925	0.2057	0.1468
610	0.0	0.1042	0.1622	0.1903	0.2112	0.1605
760	0.0	0.0917	0.1496	0.1738	0.1992	0.1586
915	0.0	0.1074	0.1757	0.2031	0.2206	0.1647
Transverse Deformation (mm)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
75	0.0	0.2516	0.3782	0.4675	0.6211	0.7154
190	0.0	0.1176	0.1851	0.2165	0.2640	0.2579
305	0.0	0.0810	0.1177	0.1316	0.1517	0.1230
455	0.0	0.1465	0.2138	0.2487	0.3067	0.3124
610	0.0	0.1822	0.2681	0.3130	0.3909	0.4093
760	0.0	0.1606	0.2355	0.2756	0.3383	0.3499
915	0.0	0.0075	0.0116	0.0133	0.0158	0.0141

Table F 4. Permanent deformation (mm) in 706C4

Vertical Deformation (mm)							
	Load Repetition						
Depth (mm)	0	100	500	1000	5000	10000	25000
Surface	0.0	-1.7219	-2.7198	-3.0126	-4.2948	-5.2938	-6.7214
135	0.0	-0.8226	-1.9934	-2.3941	-3.4358	-3.9699	-4.9219
250	0.0	-0.7571	-1.8837	-2.2261	-3.0527	-3.5154	-4.2464
380	0.0	-0.3542	-0.9248	-1.1318	-1.8493	-2.3664	-3.2982
535	0.0	-0.1892	-0.5395	-0.6059	-0.7114	-0.9384	-1.1556
685	0.0	-0.2833	-0.7334	-0.8637	-1.1562	-1.3959	-1.4497
840	0.0	-0.1222	-0.3186	-0.3701	-0.4097	-0.5460	-0.5085
990	0.0	-0.3224	-0.7690	-0.8604	-1.1177	-1.3951	-1.4747
1145	0.0	-0.0941	-0.2283	-0.2510	-0.2725	-0.3972	-0.3679
1295	0.0	-0.0519	-0.1186	-0.1389	-0.1545	-0.2630	-0.2127
1450	0.0	-0.0666	-0.1508	-0.1714	-0.1831	-0.3027	-0.3124
Longitudinal Deformation (mm)							
	Load Repetition						
Depth (mm)	0	100	500	1000	5000	10000	25000
75	0.0	-0.1141	-0.3076	-0.4079	-0.5521	-0.7655	-0.9680
190	0.0	-0.0926	-0.2604	-0.3249	-0.4353	-0.6058	-0.8054
305	0.0	-0.0535	-0.1498	-0.1935	-0.2327	-0.3626	-0.5115
455	0.0	-0.0139	-0.0644	-0.0686	0.0924	0.0714	0.3502
610	0.0	-0.0412	-0.1111	-0.1381	-0.0749	-0.1633	-0.1520
760	0.0	-0.0109	-0.0742	-0.0916	-0.0128	-0.1049	-0.1975
915	0.0	-0.0186	-0.0934	-0.1197	-0.0351	-0.1413	-0.1072
Transverse Deformation (mm)							
	Load Repetition						
Depth (mm)	0	100	500	1000	5000	10000	25000
75	0.0	-0.0148	-0.0970	-0.0726	0.1558	0.1811	0.4665
190	0.0	-0.2080	-0.4884	-0.5686	-0.6542	-0.8048	-0.8557
305	0.0	0.0132	-0.2151	-0.9404	-0.0658	-0.1704	0.5719
455	0.0	0.0458	0.0332	0.0467	0.2603	0.2347	0.3925
610	0.0	0.0289	-0.0016	0.0170	0.1942	0.1864	0.3505
760	0.0	0.0096	0.0126	0.0068	0.1274	0.0879	0.1728
915	0.0	-0.0377	-0.1131	-0.1365	-0.0204	-0.1152	0.0163

Table F 5. Permanent deformation (mm) in 706C5

Vertical Deformation (mm)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
Surface	0.0	-0.1954	-0.3415	-0.9697	-4.0014	-4.7209
135	0.0	-1.1079	-1.9240	-2.2781	-3.3133	-4.5300
250	0.0	-0.3675	-0.6479	-0.8555	-1.4688	-2.2223
380	0.0	-0.4133	-0.9353	-1.2414	-2.0393	-3.7518
535	0.0	-0.3987	-0.8108	-1.0528	-2.0270	-3.6229
685	0.0	-0.2465	-0.3633	-0.5719	-1.2095	-1.9896
840	0.0	-0.0700	-0.0702	-0.1962	-0.4918	-0.7676
990	0.0	-0.0434	-0.0066	-0.2263	-0.7397	-1.5159
1145	0.0	-0.0959	-0.0152	-0.1917	-0.5997	-0.9895
1295	0.0	0.0832	0.1689	0.0220	-0.3113	-0.5452
1450	0.0	0.0958	0.1643	0.0049	-0.3185	-0.5122
Longitudinal Deformation (mm)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
75	0.0	0.1000	0.1937	0.0528	-0.3001	-0.5986
190	0.0	0.7746	1.5777	0.6354	-0.8324	-1.6797
305	0.0	0.0686	0.1136	0.0028	-0.2628	-0.6086
455	0.0	0.1042	0.2506	0.1708	0.0549	0.1319
610	0.0	0.1557	0.2947	0.1750	-0.0314	-0.1328
760	0.0	0.1319	0.2653	0.1495	-0.0927	-0.1827
915	0.0	0.0926	0.2026	0.1041	-0.0891	-0.1573
Transverse Deformation (mm)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
75	0.0	-0.4071	-0.5270	-0.7210	-1.0241	-1.3117
190	0.0	-0.1484	-0.1718	-0.3284	-0.6379	-0.8958
305	0.0	0.1508	0.3120	0.2116	0.0467	0.2415
455	0.0	0.2674	0.5167	0.4495	0.3457	0.9344
610	0.0	0.2821	0.5673	0.5001	0.5473	1.1348
760	0.0	0.2767	0.5347	0.4506	0.3184	0.5557
915	0.0	0.2766	0.5363	0.4604	0.3974	0.5907

Table F 6. Permanent deformation (mm) in 706C6

Vertical Deformation (mm)			
	Load Repetition		
Depth (mm)	0	250	500
Surface	0.0	-2.3840	-3.0718
132	0.0	-1.4072	-2.0334
246	0.0	-1.0325	-1.5512
381	0.0	-1.9871	-3.0592
537	0.0	-1.7151	-2.5718
686	0.0	-1.1835	-1.8324
835	0.0	-0.7763	-1.1839
991	0.0	-1.6517	-2.5179
Longitudinal Deformation (mm)			
	Load Repetition		
Depth (mm)	0	500	1000
75	0.0	-0.1089	-0.2433
190	0.0	-0.1915	-0.4199
305	0.0	-0.0212	-0.1689
455	0.0	0.4641	0.6612
610	0.0	0.3147	0.3600
760	0.0	0.2260	0.2172
915	0.0	0.1190	0.0490
Transverse Deformation (mm)			
	Load Repetition		
Depth (mm)	0	500	1000
75	0.0	0.4195	0.6365
190	0.0	0.1730	0.1120
305	0.0	0.2853	0.3454
455	0.0	1.1285	1.5553
610	0.0	1.5506	2.2126
760	0.0	0.9905	1.3146
915	0.0	0.8835	1.1037

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Table F 7. Permanent strains in 706C1

Vertical Strain (%)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
Surface*					
135	0.00	-0.7886	-1.6700	-2.1294	-3.9113
250	0.00	-0.3727	-0.9366	-1.2896	-2.6322
380	0.00	-0.3437	-0.9379	-1.2632	-3.0787
535	0.00	-0.2578	-0.5785	-0.7372	-1.4320
685	0.00	-0.1979	-0.4400	-0.5708	-0.9226
840	0.00	-0.1111	-0.2588	-0.3598	-0.6240
990	0.00	-0.1451	-0.3431	-0.4661	-0.8055
1145	0.00	-0.0791	-0.2065	-0.2824	-0.3763
1295	0.00	-0.0694	-0.1831	-0.2583	-0.3016
1450	0.00	-0.0448	-0.1140	-0.1731	-0.1690
Longitudinal Strain (%)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
75	0.00	-0.0540	-0.1524	-0.2266	-0.3448
190	0.00	-0.0553	-0.1316	-0.1862	-0.2919
305	0.00	-0.0420	-0.0854	-0.1157	-0.0725
455	0.00	-0.0086	0.0034	-0.0053	0.3131
610	0.00	-0.0171	-0.0481	-0.0794	0.0444
760	0.00	-0.0100	-0.0257	-0.0660	-0.0579
915	0.00	-0.0331	-0.0911	-0.1336	-0.1318
Transverse Strain (%)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
75	0.00	0.3120	0.6085	0.7534	1.5175
190	0.00	0.1038	0.2055	0.2479	0.7478
305	0.00	0.0315	0.0425	0.0310	0.2791
455	0.00	0.1671	0.2864	0.3581	1.1320
610	0.00	0.1011	0.2171	0.2801	0.8505
760	0.00	0.0535	0.1210	0.1183	0.2955
915	0.00	0.0748	0.1796	0.2179	0.6360

* Surface measurements missing.

Table F 8. Permanent strains in 706C2

Vertical Strain (%)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
Surface					
135	-0.8214	-1.7264	-2.3374	-3.2895	-0.8214
250	-0.5723	-1.2659	-1.7261	-2.4941	-0.5723
380	-0.1173	-0.2920	-0.5809	-0.9159	-0.1173
535	-0.1559	-0.3293	-0.4616	-0.6216	-0.1559
685	-0.7341	-1.4986	-1.9204	-2.5351	-0.7341
840	-0.2537	-0.5482	-0.7877	-1.0988	-0.2537
990	-0.1695	-0.3639	-0.5982	-0.8419	-0.1695
Longitudinal Strain (%)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
75	0.00	-0.1053	-0.2305	-0.3617	-0.5032
190	0.00	-0.0642	-0.1868	-0.2895	-0.4494
305	0.00	0.0250	0.0610	0.0080	0.0220
455	0.00	0.0419	0.1397	0.1680	0.3982
610	0.00	0.0242	0.0565	0.0251	0.0738
760	0.00	-0.0685	-0.1365	-0.2235	-0.2813
915	0.00	-0.0571	-0.0998	-0.1632	-0.1599
Transverse Strain (%)					
	Load Repetition				
Depth (mm)	0	100	500	1000	5000
75					
190	0.00	0.3293	0.7045	0.9032	1.3988
305	0.00	0.0985	0.2791	0.3558	0.6490
455	0.00	0.0872	0.2053	0.2233	0.4188
610	0.00	0.3117	0.7031	0.9378	1.7358
760	0.00	0.3397	0.7260	0.9255	1.4033
915	0.00	0.2732	0.5997	0.7379	1.1271

* Surface measurements missing.

Table F 9. Permanent strain in 706C3

Vertical Strain (%)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
Surface*						
135	0.00	-0.4124	-0.6118	-0.8162	-1.1987	-1.5151
250	0.00	-0.1373	-0.2050	-0.2993	-0.5159	-0.7189
380	0.00	-0.0981	-0.1520	-0.2324	-0.4247	-0.6382
535	0.00	-0.0826	-0.1161	-0.1713	-0.2773	-0.4448
685	0.00	-0.0047	0.0118	0.0096	-0.0250	-0.1120
840	0.00	0.0167	0.0472	0.0490	0.0286	-0.0499
990	0.00	0.0264	0.0471	0.0531	0.0522	-0.0130
1145	0.00	0.0553	0.0969	0.1053	0.1105	0.050493
1295	0.00	0.0785	0.1212	0.1330	0.1391	0.080356
1450	0.00	0.0639	0.0975	0.1071	0.1188	0.071231
Longitudinal Strain (%)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
75	0.00	0.0007	0.0066	-0.0020	-0.0550	-0.1158
190	0.00	-0.0150	-0.0125	-0.0324	-0.0945	-0.1847
305	0.00	0.0363	0.0561	0.0561	0.0376	-0.0209
455	0.00	0.0674	0.1096	0.1244	0.1318	0.0911
610	0.00	0.0629	0.0983	0.1151	0.1276	0.0957
760	0.00	0.0606	0.0989	0.1148	0.1317	0.1048
915	0.00	0.0662	0.1083	0.1252	0.1359	0.1015
Transverse Strain (%)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
75		0.2516	0.3782	0.4675	0.6211	0.7154
190	0.00	0.1176	0.1851	0.2165	0.2640	0.2579
305	0.00	0.0810	0.1177	0.1316	0.1517	0.1230
455	0.00	0.1465	0.2138	0.2487	0.3067	0.3124
610	0.00	0.1822	0.2681	0.3130	0.3909	0.4093
760	0.00	0.1606	0.2355	0.2756	0.3383	0.3499
915	0.00	0.0075	0.0116	0.0133	0.0158	0.0141

* Surface measurements missing.

Table F 10. Permanent strain in 706C4

Vertical Strain (%)							
	Load Repetition						
Depth (mm)	0	100	500	1000	5000	10000	25000
Surface*							
135	0.00	-0.8438	-2.0447	-2.4556	-3.5243	-4.0720	-5.0488
250	0.00	-0.6086	-1.5148	-1.7895	-2.4529	-2.8242	-3.4111
380	0.00	-0.2169	-0.5657	-0.6919	-1.1242	-1.4369	-2.0038
535	0.00	-0.1221	-0.3448	-0.3878	-0.4567	-0.6017	-0.7329
685	0.00	-0.0802	-0.2092	-0.2431	-0.2691	-0.3586	-0.3340
840	0.00	-0.1509	-0.3599	-0.4027	-0.5231	-0.6530	-0.6902
990	0.00	-0.0634	-0.1536	-0.1690	-0.1834	-0.2673	-0.2476
1145	0.00	-0.0419	-0.0959	-0.1123	-0.1249	-0.2126	-0.1720
1295	0.00	-0.0488	-0.1105	-0.1256	-0.1342	-0.2218	-0.2289
1450	0.00	-0.9988	-2.4299	-2.9296	-4.2543	-4.9201	-6.1754
Longitudinal Strain (%)							
	Load Repetition						
Depth (mm)	0	100	500	1000	5000	10000	25000
76	0.00	-0.0724	-0.1948	-0.2571	-0.3485	-0.4796	-0.6046
197	0.00	-0.0580	-0.1629	-0.2033	-0.2729	-0.3789	-0.5029
305	0.00	-0.0357	-0.1001	-0.1292	-0.1556	-0.2422	-0.3415
454	0.00	-0.0092	-0.0413	-0.0443	0.0536	0.0401	0.2101
622	0.00	-0.0282	-0.0762	-0.0945	-0.0538	-0.1144	-0.1085
762	0.00	-0.0077	-0.0522	-0.0644	-0.0090	-0.0738	-0.1389
914	0.00	-0.0128	-0.0643	-0.0825	-0.0242	-0.0974	-0.0739
Transverse Strain (%)							
	Load Repetition						
Depth (mm)	0	100	500	1000	5000	10000	25000
76	0.00	-0.0093	-0.0626	-0.0478	0.0949	0.1100	0.2900
197	0.00	-0.1288	-0.3023	-0.3519	-0.4051	-0.4981	-0.5299
305	0.00	0.0008	-0.0339	-0.1700	0.0310	0.0055	0.1863
454	0.00	0.0306	0.0245	0.0339	0.1733	0.1584	0.2602
622	0.00	0.0197	-0.0011	0.0116	0.1321	0.1267	0.2384
762	0.00	0.0069	0.0092	0.0050	0.0926	0.0639	0.1256
914	0.00	-0.0238	-0.0714	-0.0862	-0.0129	-0.0727	0.0103

* Surface measurements missing.

Table F 11. Permanent strain in 706C5

Vertical Strain (%)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
Surface*						
135	0.00	-0.8992	-1.5862	-1.8822	-2.7574	-3.7822
250	0.00	-0.2990	-0.5273	-0.6963	-1.1956	-1.8092
380	0.00	-0.2742	-0.6215	-0.8294	-1.3527	-2.4472
535	0.00	-0.2465	-0.5021	-0.6519	-1.2554	-2.2450
685	0.00	-0.1399	-0.2062	-0.3246	-0.6865	-1.1292
840	0.00	-0.0497	-0.0499	-0.1393	-0.3492	-0.5450
990	0.00	-0.0234	-0.0036	-0.1222	-0.3995	-0.8187
1145	0.00	-0.0580	-0.0092	-0.1160	-0.3627	-0.5984
1295	0.00	0.0554	0.1125	0.0147	-0.2073	-0.3630
1450	0.00	0.0606	0.1040	0.0031	-0.2015	-0.3241
Longitudinal Strain (%)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
75	0.00	0.0636	0.1233	0.0337	-0.1908	-0.3807
190	0.00	0.2631	0.5369	0.2091	-0.3215	-0.6500
305	0.00	0.0455	0.0754	0.0019	-0.1743	-0.4037
455	0.00	0.0711	0.1685	0.1166	0.0393	0.0871
610	0.00	0.1004	0.1901	0.1137	-0.0184	-0.0830
760	0.00	0.0853	0.1717	0.0967	-0.0600	-0.1182
915	0.00	0.0679	0.1484	0.0763	-0.0652	-0.1152
Transverse Strain (%)						
	Load Repetition					
Depth (mm)	0	250	500	1000	2500	5000
76	0.00	-0.2357	-0.3048	-0.4183	-0.5952	-0.7612
187	0.00	-0.0938	-0.1087	-0.2076	-0.4029	-0.5658
298	0.00	0.0965	0.1995	0.1352	0.0292	0.1509
457	0.00	0.1736	0.3351	0.2931	0.2284	0.5936
619	0.00	0.1842	0.3705	0.3265	0.3572	0.7404
765	0.00	0.1846	0.3568	0.3006	0.2124	0.3708
914	0.00	0.1900	0.3685	0.3164	0.2730	0.4059

* Surface measurements missing.

Table F 12. Permanent strain in 706C6

Vertical Strain (%)			
	Load Repetition		
Depth (mm)	0	250	500
Surface*			
135	0.00	-1.3450	-1.9453
250	0.00	-0.8940	-1.3438
380	0.00	-1.1527	-1.7760
535	0.00	-1.0734	-1.6086
685	0.00	-0.6196	-0.9593
840	0.00	-0.5390	-0.8221
990	0.00	-0.7852	-1.1970
Longitudinal Strain (%)			
	Load Repetition		
Depth (mm)	0	500	1000
75	0.00	-0.0795	-0.1719
190	0.00	-0.1288	-0.2819
305	0.00	-0.0144	-0.1122
455	0.00	0.2976	0.4234
610	0.00	0.2170	0.2481
760	0.00	0.1535	0.1475
915	0.00	0.0779	0.0321
Transverse Strain (%)			
	Load Repetition		
Depth (mm)	0	500	1000
75	0.00	0.2725	0.4132
190	0.00	0.1037	0.0674
305	0.00	0.1804	0.2157
455	0.00	0.7630	1.0510
610	0.00	1.0189	1.4539
760	0.00	0.6458	0.8570
915	0.00	0.5705	0.7127

* Surface measurements missing.

APPENDIX G: DYNAMIC DISPLACEMENT & STRAIN TEST RESULTS

Table G 1. Maximum peak vertical displacements in base & subgrade (TS706C1)

706C1	Vertical Displacement (mm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps	Stack A									
0	-0.2484	-0.0965	-0.2920	-0.3793	-0.4028	-0.2002	-0.1947	-0.1202	-0.1376	-0.0348
100	-0.1012	-0.0914	-0.3600	-0.4257	-0.4820	-0.2358	-0.2186	-0.1421	-0.1497	-0.0344
500	-0.0884	-0.0888	-0.3768	-0.4434	-0.5634	-0.2488	-0.2210	-0.1492	-0.1544	-0.0381
1000	-0.1123	-0.0926	-0.4123	-0.5317	-0.6275	-0.2790	-0.2656	-0.1680	-0.1614	-0.0478
5000	-0.0974	-0.0538	-0.1439	-0.6112	-0.7498	-0.3139	-0.3408	-0.2549	-0.2118	-0.0458
	Stack B									
0	-0.1011	-0.0748	-0.3835	-0.4706						
100	-0.0817	-0.0715	-0.4209	-0.4782						
500	-0.1154	-0.0673	-0.4159	-0.5034						
1000	-0.0853	-0.0743	-0.4545	-0.5737						
5000	-0.1073	-0.1130	-0.6967	-0.7405						

Table G 2. Maximum peak longitudinal displacements (A) in subgrade (TS706C1)

706C1	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps	Stack A						
0	-0.0397	-0.0252	-0.0191	-0.0407	-0.0305	-0.0266	-0.0232
100	-0.0321	-0.0270	-0.0342	-0.0563	-0.0362	-0.0343	-0.0296
500	-0.0264	-0.0258	-0.0406	-0.0644	-0.0525	-0.0370	-0.0251
1000	-0.0320	-0.0339	-0.0465	-0.0921	-0.0582	-0.0408	-0.0344
5000	-0.0423	-0.0178	-0.0070	-0.0703	-0.0582	-0.0536	-0.0468
	Stack B						
0	-0.0078	-0.0107	-0.0100	-0.0118	-0.0077		
100	-0.0075	-0.0085	-0.0072	-0.0167	-0.0069		
500	-0.0074	-0.0103	-0.0093	-0.0130	-0.0099		
1000	-0.0081	-0.0108	-0.0120	-0.0137	-0.0054		
5000	-0.0096	-0.0161	-0.0127	-0.0144	-0.0136		

Table G 3. Maximum peak longitudinal displacements (B) in subgrade (TS706C1)

706C1	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.1572	0.0662	0.0916	0.1798	0.1354	0.1291	0.0706
100	0.1657	0.0762	0.1240	0.2216	0.1639	0.1720	0.0858
500	0.1863	0.0763	0.1366	0.2635	0.1948	0.1853	0.0862
1000	0.1847	0.0854	0.1531	0.3131	0.2373	0.2364	0.1144
5000	0.1675	0.0417	0.0158	0.1564	0.2903	0.3332	0.1486
				Stack B			
0	0.1997	0.1464	0.1450	0.2441	0.1846		
100	0.2032	0.1626	0.1532	0.2597	0.2297		
500	0.1828	0.1683	0.1812	0.2756	0.2504		
1000	0.2318	0.1711	0.1917	0.3424	0.2899		
5000	0.3697	0.2746	0.4045	0.4505	0.4817		

Table G 4. Maximum peak longitudinal displacements (C) in subgrade (TS706C1)

706C1	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-0.0325	-0.0123	-0.0096	-0.0245	-0.0249	-0.0351	-0.0276
100	-0.0393	-0.0132	-0.0141	-0.0320	-0.0314	-0.0463	-0.0329
500	-0.0343	-0.0148	-0.0150	-0.0426	-0.0390	-0.0584	-0.0389
1000	-0.0233	-0.0167	-0.0213	-0.0518	-0.0478	-0.0661	-0.0506
5000	-0.0334	-0.0167	-0.0202	-0.0446	-0.0698	-0.0980	-0.0593
				Stack B			
0	-0.0499	-0.0406	-0.0315	-0.0721	-0.0593		
100	-0.0455	-0.0478	-0.0381	-0.0856	-0.0698		
500	-0.0411	-0.0442	-0.0454	-0.0907	-0.0745		
1000	-0.0408	-0.0538	-0.0496	-0.1101	-0.0917		
5000	-0.0435	-0.0493	-0.0947	-0.1689	-0.1716		

Table G 5. Maximum peak transverse displacements in subgrade (TS706C1)

706C1	Transverse Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.2033	0.0406	0.0589	0.1864	0.1250	0.1372	0.0904
100	0.1944	0.0892	0.0853	0.2221	0.1459	0.1583	0.0962
500	0.1910	0.0294	0.0875	0.1337	0.1105	0.1578	0.0725
1000	0.2627	0.0392	0.0953	0.2655	0.1242	0.1484	0.1079
5000	0.2216	0.0432	0.0091	0.1097	0.2194	0.1912	0.1039
				Stack B			
0	0.0039	0.0057	0.0095	0.0070	0.0131		
100	0.0037	0.0077	0.0116	0.0077	0.0194		
500	0.0030	0.0053	0.0115	0.0159	0.0197		
1000	0.0044	0.0057	0.0085	0.0103	0.0222		
5000	0.0053	0.0134	0.0149	0.0039	0.0245		

Table G 6. Maximum peak vertical displacements in subgrade (TS706C2)

706C2	Vertical Displacement (mm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps	Stack A									
0	-0.3173	-0.0945	-0.3749	-0.4199	-0.5447	-0.2538	-0.3059	-0.1850	-1.0880	-1.9875
100	-0.1641	-0.1030	-0.6667	-0.7387	-0.8970	-0.4177	-0.4687	-0.2939	-1.6046	-2.1043
500	-0.1685	-0.0793	-0.8415	-0.9841	-1.0236	-0.4755	-0.4758	-0.3751	-0.6762	-2.0536
1000	-0.1013	-0.1005	-0.7264	-0.8847	-0.9230	-0.4321	-0.4845	-0.3424	-1.2859	-2.0113
2500	-0.1516	-0.1216	-0.9094	-1.2203	-1.0765	-0.5246	-0.4861	-0.4511	-1.0566	-2.3362
	Stack B									
0	-0.1605	-0.1395	-0.4266	-0.2196						
100	-0.1806	-0.1491	-0.5139	-0.2164						
500	-0.1499	-0.1239	-0.5463	-0.3023						
1000	-0.1783	-0.1110	-0.6265	-0.3118						
2500	-0.1512	-0.0854	-0.6308	-0.4241						

Table G 7. Maximum peak longitudinal displacements (A) in subgrade (TS706C2)

706C2	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps	Stack A						
0	-0.0359	-0.0316	-0.0398	-0.0547	-0.0355	-0.0355	-0.0421
100	-0.0445	-0.0707	-0.0820	-0.1106	-0.0683	-0.0707	-0.0769
500	-0.0442	-0.0647	-0.1171	-0.1693	-0.0951	-0.0934	-0.1002
1000	-0.0421	-0.0980	-0.0957	-0.1529	-0.0945	-0.0856	-0.1008
2500	-0.0556	-0.1186	-0.1212	-0.2471	-0.1173	-0.1082	-0.1096
	Stack B						
0	-0.0078	-0.0054	-0.0094	-0.0100	-0.0060		
100	-0.0134	-0.0082	-0.0112	-0.0120	-0.0108		
500	-0.0127	-0.0092	-0.0117	-0.0129	-0.0099		
1000	-0.0121	-0.0106	-0.0139	-0.0124	-0.0078		
2500	-0.0138	-0.0082	-0.0141	-0.0152	-0.0103		

Table G 8. Maximum peak longitudinal displacements (B) in subgrade (TS706C2)

706C2	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.1342	0.0519	0.1174	0.0173	0.1120	0.0688	0.0968
100	0.1920	0.1114	0.2514	0.3559	0.2254	0.1551	0.1650
500	0.2254	0.1443	0.3170	0.4637	0.3275	0.1854	0.1562
1000	0.2168	0.1361	0.2688	0.4238	0.3205	0.1727	0.1568
2500	0.3055	0.1909	0.3291	0.6362	0.4176	0.2566	0.1610
				Stack B			
0	0.2382	0.1321	0.2479	0.2936	0.2013		
100	0.2637	0.1716	0.3133	0.3679	0.2990		
500	0.2507	0.1745	0.4141	0.5141	0.3601		
1000	0.2952	0.1708	0.3342	0.5494	0.3450		
2500	0.3365	0.2167	0.4713	0.6717	0.4574		

Table G 9. Maximum peak longitudinal displacements (C) in subgrade (TS706C2)

706C2	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-0.0444	-0.0101	-0.0213	-0.0360	-0.0311	-0.0484	-0.0322
100	-0.0183	-0.0133	-0.0334	-0.0651	-0.0505	-0.0776	-0.0502
500	-0.0234	-0.0176	-0.0465	-0.0896	-0.0658	-0.0799	-0.0514
1000	-0.0237	-0.0167	-0.0400	-0.0778	-0.0652	-0.0800	-0.0558
2500	-0.0362	-0.0220	-0.0473	-0.1028	-0.0848	-0.0933	-0.0610
				Stack B			
0	-0.0533	-0.0566	-0.0486	-0.0711	-0.0697		
100	-0.0640	-0.0669	-0.0561	-0.0845	-0.1066		
500	-0.0321	-0.0700	-0.0772	-0.1437	-0.1328		
1000	-0.0579	-0.0704	-0.0665	-0.1359	-0.1271		
2500	-0.0505	-0.0919	-0.1018	-0.2007	-0.1789		

Table G 10. Maximum peak transverse displacements in subgrade (TS706C2)

706C2	Transverse Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.1736	0.0574	0.0650	0.0185	0.1010	0.1531	0.0957
100	0.1843	0.0920	0.1496	0.3395	0.1804	0.3188	0.1350
500	0.1929	0.1024	0.2060	0.4010	0.2378	0.3149	0.1805
1000	0.2164	0.0742	0.1977	0.3839	0.2158	0.2396	0.1865
2500	0.2386	0.0914	0.2229	0.4966	0.2213	0.3014	0.1827
				Stack B			
0	0.0041	0.0073	0.0107	0.0195	0.0203		
100	0.0086	0.0142	0.0136	0.0177	0.0302		
500	0.0081	0.0128	0.0108	0.0196	0.0329		
1000	0.0114	0.0126	0.0097	0.0189	0.0204		
2500	0.0120	0.0104	0.0102	0.0254	0.0293		

Table G 11. Maximum peak vertical displacements in subgrade (TS706C3)

706C3	Vertical Displacement (mm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps	Stack A									
0	-0.1045	-0.0708	-0.3168	-0.2876	-0.4040	-0.1966	-0.1858	-0.0858	-0.0889	-0.0293
250	-0.0984	-0.0651	-0.3546	-0.3071	-0.4247	-0.2107	-0.1954	-0.0927	-0.0914	-0.0289
500	-0.0979	-0.0743	-0.3283	-0.2866	-0.3920	-0.1922	-0.1747	-0.0839	-0.0851	-0.0282
1000	-0.0939	-0.0599	-0.3234	-0.2822	-0.3935	-0.1907	-0.1715	-0.0816	-0.0844	-0.0263
2500	-0.0874	-0.0577	-0.3895	-0.3344	-0.4399	-0.2166	-0.1935	-0.0906	-0.0919	-0.0289
5000	-0.0874	-0.0567	-0.3786	-0.3357	-0.4251	-0.2134	-0.1931	-0.0915	-0.0893	-0.0278
	Stack B									
0	-0.0967	-0.0519	-0.1415	-0.5473						
250	-0.0894	-0.0525	-0.1385	-0.5503						
500	-0.0882	-0.0505	-0.1297	-0.5039						
1000	-0.0856	-0.0511	-0.1196	-0.4885						
2500	-0.0856	-0.0500	-0.1289	-0.5619						
5000	-0.0840	-0.0524	-0.1258	-0.5378						

Table G 12. Maximum peak longitudinal displacements (A) in subgrade (TS706C3)

706C3	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps	Stack A						
0	-0.0306	-0.0258	-0.0488	-0.0716	-0.0367	-0.0285	-0.0244
250	-0.0295	-0.0233	-0.0536	-0.0821	-0.0397	-0.0303	-0.0271
500	-0.0286	-0.0214	-0.0505	-0.0741	-0.0367	-0.0262	-0.0258
1000	-0.0265	-0.0241	-0.0524	-0.0705	-0.0393	-0.0272	-0.0263
2500	-0.0311	-0.0355	-0.0737	-0.0895	-0.0421	-0.0375	-0.0339
5000	-0.0333	-0.0340	-0.0742	-0.0821	-0.0427	-0.0320	-0.0294
	Stack B						
0	-0.0057	-0.0076	-0.0063	-0.0057	-0.0064		
250	-0.0058	-0.0067	-0.0054	-0.0043	-0.0060		
500	-0.0048	-0.0082	-0.0065	-0.0053	-0.0076		
1000	-0.0056	-0.0067	-0.0058	-0.0059	-0.0069		
2500	-0.0086	-0.0060	-0.0104	-0.0119	-0.0145		
5000	-0.0060	-0.0080	-0.0054	-0.0048	-0.0067		

Table G 13. Maximum peak longitudinal displacements (B) in subgrade (TS706C3)

706C3	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.1561	0.0979	0.1272	0.1662	0.1639	0.1119	0.0615
250	0.1586	0.1077	0.1527	0.1813	0.1837	0.1273	0.0663
500	0.1600	0.1041	0.1387	0.1584	0.1657	0.1176	0.0594
1000	0.1566	0.1065	0.1414	0.1561	0.1659	0.1161	0.0588
2500	0.1561	0.1394	0.1865	0.1805	0.1973	0.1287	0.0652
5000	0.1605	0.1402	0.1824	0.1750	0.1865	0.1346	0.0636
				Stack B			
0	0.2075	0.0471	0.0889	0.1997	0.1493		
250	0.2081	0.0597	0.0985	0.2167	0.1598		
500	0.2023	0.0598	0.0860	0.1907	0.1387		
1000	0.1994	0.0609	0.0847	0.1839	0.1360		
2500	0.2052	0.0757	0.0935	0.2297	0.1367		
5000	0.2087	0.0727	0.1013	0.2345	0.1453		

Table G 14. Maximum peak longitudinal displacements (C) in subgrade (TS706C3)

706C3	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-0.0196	-0.0095	-0.0141	-0.0224	-0.0267	-0.0402	-0.0271
250	-0.0131	-0.0098	-0.0179	-0.0288	-0.0363	-0.0438	-0.0292
500	-0.0187	-0.0096	-0.0172	-0.0293	-0.0304	-0.0414	-0.0273
1000	-0.0177	-0.0099	-0.0188	-0.0283	-0.0323	-0.0408	-0.0289
2500	-0.0099	-0.0115	-0.0221	-0.0335	-0.0347	-0.0517	-0.0323
5000	-0.0126	-0.0125	-0.0208	-0.0352	-0.0370	-0.0426	-0.0308
				Stack B			
0	-0.0356	-0.0228	-0.0552	-0.0382	-0.0460		
250	-0.0281	-0.0163	-0.0643	-0.0417	-0.0473		
500	-0.0286	-0.0139	-0.0603	-0.0401	-0.0461		
1000	-0.0280	-0.0132	-0.0558	-0.0391	-0.0434		
2500	-0.0344	-0.0140	-0.0727	-0.0582	-0.0636		
5000	-0.0306	-0.0154	-0.0596	-0.0476	-0.0461		

Table G 15. Maximum peak transverse displacements in subgrade (TS706C3)

706C3	Transverse Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.2367	0.0564	0.0417	0.1487	0.1284	0.1221	0.0045
250	0.2403	0.0575	0.0465	0.1506	0.1348	0.1394	0.0047
500	0.2468	0.0455	0.0400	0.1359	0.1250	0.1237	0.0042
1000	0.2515	0.0556	0.0425	0.1346	0.1217	0.1186	0.0042
2500	0.2433	0.0487	0.0530	0.1624	0.1423	0.1369	0.0048
5000	0.2620	0.0539	0.0566	0.1595	0.1409	0.1355	0.0047
				Stack B			
0	0.0029	0.0050	0.0061	0.0087	0.0056		
250	0.0037	0.0043	0.0067	0.0094	0.0046		
500	0.0034	0.0036	0.0062	0.0092	0.0048		
1000	0.0030	0.0056	0.0061	0.0115	0.0048		
2500	0.0036	0.0049	0.0052	0.0082	0.0050		
5000	0.0034	0.0059	0.0066	0.0076	0.0055		

Table G 16. Maximum peak vertical displacements in subgrade (TS706C4)

706C4	Vertical Displacement (mm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps	Stack A									
0	-0.0786	-0.0677	-0.1452	-0.2242	-0.1557	-0.0926	-0.2241	-0.0639	-0.0380	-0.0270
100	-0.0799	-0.0749	-0.2167	-0.2981	-0.2384	-0.1452	-0.3315	-0.0898	-0.0486	-0.0414
500	-0.0669	-0.0606	-0.2636	-0.3610	-0.3551	-0.1663	-0.2613	-0.1013	-0.0593	-0.0485
1000	-0.0600	-0.0605	-0.2691	-0.3158	-0.3035	-0.1779	-0.3625	-0.1002	-0.0512	-0.0437
5000	-0.0592	-0.0547	-0.1946	-0.2853	-0.0993	-0.0645	-0.2163	-0.0940	-0.0572	-0.0402
10000	-0.0496	-0.0478	-0.2877	-0.3171	-0.3161	-0.1862	-0.3799	-0.0866	-0.0615	-0.0450
25000	-0.0477	-0.0473	-0.3185	-0.4431	-0.4114	-0.1893	-0.2660	-0.1191	-0.0681	-0.0480
	Stack B									
0	-0.1061	-0.1109	-0.3639	-0.1627						
100	-0.0970	-0.1299	-0.5057	-0.1974						
500	-0.1032	-0.0792	-0.5895	-0.2498						
1000	-0.0852	-0.0848	-0.5873	-0.2613						
5000	-0.0787	-0.0736	-0.6842	-0.2514						
10000	-0.0909	-0.0642	-0.7107	-0.2889						
25000	-0.0892	-0.0469	-1.0598	-0.4328						

Table G 17. Maximum peak longitudinal displacements (A) in subgrade (TS706C4)

706C4	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps	Stack A						
0	-0.0150	-0.0165	-0.0173	-0.0213	-0.0210	-0.0131	-0.0113
100	-0.0227	-0.0205	-0.0209	-0.0271	-0.0329	-0.0233	-0.0169
500	-0.0175	-0.0131	-0.0229	-0.0485	-0.0440	-0.0284	-0.0168
1000	-0.0153	-0.0171	-0.0314	-0.0315	-0.0332	-0.0309	-0.0231
5000	-0.0153	-0.0166	-0.0225	-0.0238	-0.0108	-0.0093	-0.0087
10000	-0.0207	-0.0215	-0.0413	-0.0328	-0.0423	-0.0340	-0.0232
25000	-0.0187	-0.0285	-0.0366	-0.0634	-0.0397	-0.0283	-0.0163
	Stack B						
0	-0.0149	-0.0121	-0.0108	-0.0136	-0.0115		
100	-0.0120	-0.0127	-0.0103	-0.0155	-0.0110		
500	-0.0142	-0.0123	-0.0119	-0.0155	-0.0123		
1000	-0.0125	-0.0146	-0.0111	-0.0159	-0.0108		
5000	-0.0123	-0.0125	-0.0113	-0.0160	-0.0129		
10000	-0.0120	-0.0075	-0.0113	-0.0142	-0.0125		
25000	-0.0108	-0.0125	-0.0119	-0.0177	-0.0105		

Table G 18. Maximum peak longitudinal displacements (B) in subgrade (TS706C4)

706C4	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.0589	0.0223	0.2033	0.0686	0.0267	0.0371	0.0455
100	0.1021	0.0334	0.2111	0.1264	0.0465	0.0773	0.0755
500	0.0993	0.0254	0.0962	0.2251	0.0968	0.1103	0.0544
1000	0.0986	0.0478	0.0957	0.1199	0.0700	0.1382	0.0900
5000	0.0524	0.0153	0.0150	0.0799	0.0084	0.0161	0.0366
10000	0.1160	0.0466	0.1811	0.1071	0.0679	0.1264	0.0121
25000	0.0907	0.0697	0.2836	0.2330	0.0263	0.0754	0.0310
				Stack B			
0	0.1444	0.0457	0.0943	0.0953	0.0872		
100	0.1592	0.0640	0.1409	0.1313	0.1428		
500	0.1464	0.0630	0.1930	0.1786	0.1737		
1000	0.1958	0.0837	0.1721	0.2097	0.1937		
5000	0.1964	0.0988	0.2335	0.1603	0.1615		
10000	0.2465	0.1333	0.2106	0.1639	0.2529		
25000	0.4175	0.1962	0.4777	0.2737	0.3191		

Table G 19. Maximum peak longitudinal displacements (C) in subgrade (TS706C4)

706C4	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-0.0234	-0.0093	-0.0178	-0.0281	-0.0306	-0.0249	-0.0106
100	-0.0155	-0.0072	-0.0268	-0.0365	-0.0356	-0.0337	-0.0178
500	-0.0181	-0.0093	-0.0298	-0.0487	-0.0461	-0.0409	-0.0165
1000	-0.0175	-0.0099	-0.1125	-0.0538	-0.0505	-0.0465	-0.0190
5000	-0.0169	-0.0079	-0.1206	-0.0407	-0.0297	-0.0277	-0.0168
10000	-0.0191	-0.0119	-0.0334	-0.0505	-0.0412	-0.0482	-0.0278
25000	-0.0210	-0.0162	-0.0903	-0.0689	-0.0518	-0.0550	-0.0207
				Stack B			
0	-0.0341	-0.0203	-0.0229	-0.0309	-0.0302		
100	-0.0398	-0.0211	-0.0345	-0.0386	-0.0467		
500	-0.0422	-0.0212	-0.0457	-0.0589	-0.0577		
1000	-0.0493	-0.0268	-0.0434	-0.0613	-0.0669		
5000	-0.0420	-0.0262	-0.0489	-0.0599	-0.0483		
10000	-0.0473	-0.0278	-0.0518	-0.0658	-0.0796		
25000	-0.0512	-0.0428	-0.1073	-0.1421	-0.1022		

Table G 20. Maximum peak transverse displacements in subgrade (TS706C4)

	Transverse Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.1116	0.0051	1.3195	0.0286	0.0380	0.0518	0.0184
100	0.1121	0.0056	1.3130	0.0629	0.0440	0.0742	0.0175
500	0.1116	0.0315	1.4537	0.0361	0.0483	0.0941	0.0320
1000	0.1288	0.0072	1.6339	0.0527	0.0515	0.0686	0.0291
5000	0.1189	0.0051	1.6431	0.0248	0.0101	0.0195	0.0106
10000	0.1217	0.0063	1.3034	0.0610	0.0541	0.0765	0.0053
25000	0.1533	0.0367	1.8133	0.0682	0.0185	0.0511	0.0248
				Stack B			
0	0.0037	0.0062	0.0045	0.0035	0.0081		
100	0.0046	0.0055	0.0049	0.0037	0.0138		
500	0.0049	0.0059	0.0046	0.0034	0.0177		
1000	0.0042	0.0055	0.0038	0.0040	0.0167		
5000	0.0038	0.0055	0.0048	0.0046	0.0150		
10000	0.0046	0.0048	0.0043	0.0033	0.0139		
25000	0.0052	0.0051	0.0043	0.0037	0.0201		

Table G 21. Maximum peak vertical displacements in subgrade (TS706C5)

706C5	Vertical Displacement (mm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps					Stack A					
0	-0.1972	-0.1170	-0.3878	-0.3897	-0.3561	-0.1823	-0.3158	-0.1810	-0.1419	-0.0801
100	-0.1005	-0.0833	-0.4188	-0.3721	-0.3309	-0.1602	-0.2879	-0.1697	-0.1405	-0.0770
500	-0.0764	-0.0642	-0.3383	-0.3432	-0.2707	-0.1374	-0.2501	-0.1318	-0.1070	-0.0577
1000	-0.1297	-0.0584	-0.3754	-0.4022	-0.3579	-0.1412	-0.2667	-0.1554	-0.1186	-0.0557
5000	-0.0797	-0.0577	-0.4680	-0.4449	-0.3248	-0.1649	-0.2916	-0.1768	-0.1309	-0.0588
10000	-0.1121	-0.0491	-0.1038	-0.4887	-0.3972	-0.1925	-0.3488	-0.2189	-0.1674	-0.0699
					Stack B					
0	-0.1109	-0.0680	-0.7119	-0.8397						
100	-0.1014	-0.0558	-0.6658	-0.7540						
500	-0.0741	-0.0498	-0.5240	-0.6321						
1000	-0.0897	-0.0535	-0.6197	-0.7448						
5000	-0.1044	-0.0579	-0.8610	-0.8160						
10000	-0.1486	-0.0758	-1.1848	-1.1485						

Table G 22. Maximum peak longitudinal displacements (A) in subgrade (TS706C5)

706C5	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-0.0244	-0.0191	-0.0210	-0.0568	-0.0428	-0.0401	-0.0418
100	-0.0367	-0.0184	-0.0182	-0.0425	-0.0394	-0.0269	-0.0293
500	-0.0335	-0.0171	-0.0184	-0.0393	-0.0362	-0.0299	-0.0280
1000	-0.0355	-0.0191	-0.0191	-0.0441	-0.0403	-0.0262	-0.0258
5000	-0.0383	-0.0249	-0.0230	-0.0454	-0.0406	-0.0283	-0.0267
10000	-0.0523	-0.0257	-0.0052	-0.0544	-0.0592	-0.0405	-0.0408
0	-0.0067	-0.1630	-0.0081	-0.0095	-0.0090		
100	-0.0069	-0.1220	-0.0073	-0.0049	-0.0092		
500	-0.0053	-0.1142	-0.0075	-0.0064	-0.0073		
1000	-0.0062	-0.1233	-0.0096	-0.0053	-0.0081		
5000	-0.0063	-0.1027	-0.0090	-0.0085	-0.0090		
10000	-0.0081	-0.1024	-0.0108	-0.0088	-0.0100		

Table G 23. Maximum peak longitudinal displacements (B) in subgrade (TS706C5)

706C5	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.0781	0.0173	0.0836	0.2423	0.1028	0.0707	0.0773
100	0.1181	0.0317	0.0968	0.2578	0.0954	0.0581	0.0644
500	0.1180	0.0363	0.0777	0.0037	0.0761	0.0527	0.0474
1000	0.1265	0.0507	0.1113	0.2436	0.0881	0.0503	0.0608
5000	0.1530	0.0656	0.1436	0.2955	0.0956	0.0612	0.0603
10000	0.1438	0.0059	0.0275	0.0478	0.1497	0.0617	0.0757
				Stack B			
0	0.1333	0.1025	0.1636	0.3725	0.2291		
100	0.1321	0.0868	0.1556	0.3669	0.2317		
500	0.1261	0.1073	0.1174	0.2845	0.1834		
1000	0.1449	0.0618	0.1486	0.3514	0.2001		
5000	0.2247	0.0805	0.2488	0.4985	0.2952		
10000	0.3000	0.0649	0.3482	0.7487	0.3830		

Table G 24. Maximum peak longitudinal displacements (C) in subgrade (TS706C5)

706C5	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-0.0137	-0.0140	-0.0226	-0.0554	-0.0418	-0.0398	-0.0333
100	-0.0052	-0.0137	-0.0217	-0.0582	-0.0414	-0.0429	-0.0305
500	-0.0093	-0.0097	-0.0169	-0.0421	-0.0368	-0.0353	-0.0248
1000	-0.0075	-0.0134	-0.0211	-0.0472	-0.0384	-0.0373	-0.0270
5000	-0.0098	-0.0143	-0.0288	-0.0566	-0.0439	-0.0374	-0.0302
10000	-0.0084	-0.0092	-0.0065	-0.0654	-0.0524	-0.0390	-0.0369
				Stack B			
0	-0.0273	-0.1668	-0.0548	-0.1179	-0.1335		
100	-0.0233	-0.1927	-0.0566	-0.0999	-0.1280		
500	-0.0238	-0.1468	-0.0409	-0.0824	-0.1012		
1000	-0.0245	-0.1775	-0.0516	-0.1027	-0.1030		
5000	-0.0292	-0.1414	-0.0796	-0.1350	-0.1639		
10000	-0.0532	-0.1446	-0.1139	-0.2072	-0.2164		

Table G 25. Maximum peak transverse displacements in subgrade (TS706C5)

706C5	Transverse Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.1311	0.0112	0.0608	0.2805	0.1272	0.0985	0.0902
100	0.0965	0.0069	0.0738	0.2879	0.1242	0.0895	0.0737
500	0.1342	0.0112	0.0450	0.0048	0.1086	0.0781	0.0575
1000	0.0816	0.0193	0.1543	0.2531	0.1007	0.0759	0.0787
5000	0.1268	0.0070	0.1161	0.3004	0.1514	0.0867	0.0726
10000	0.1098	0.0061	0.0226	0.0436	0.1715	0.0863	0.0945
				Stack B			
0	0.0078	0.0116	0.0099	0.0124	0.0276		
100	0.0081	0.0116	0.0101	0.0205	0.0287		
500	0.0068	0.0069	0.0089	0.0133	0.0167		
1000	0.0076	0.0083	0.0070	0.0123	0.0232		
5000	0.0080	0.0102	0.0096	0.0160	0.0323		
10000	0.0099	0.0099	0.0084	0.0111	0.0374		

Table G 26. Maximum peak vertical displacements in subgrade (TS706C6)

706C6	Vertical Displacement (mm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps	Stack A									
0	-0.1573	-0.1418	-1.3450	-1.4277	-1.2117	-0.7193	-1.1003	-0.5198	-0.0631	-0.1734
250	-0.1503	-0.1294	-1.5574	-1.5760	-1.1876	-0.7028	-1.0891	-0.5206	-0.0781	-0.2041
500	-0.1743	-0.1411	-1.7817	-1.7842	-1.2805	-0.7473	-1.1796	-0.5674	-0.0795	-0.2680
	Stack B									
0	-0.1416	-0.1223	-1.2944	-2.1755						
250	-0.1648	-0.1318	-1.3387	-2.3394						
500	-0.1958	-0.1328	-1.4975	-2.5813						

Table G 27. Maximum peak longitudinal displacements (A) in subgrade (TS706C6)

706C6	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps	Stack A						
0	-0.0643	-0.0226	-0.0810	-0.2170	-0.1702	-0.1128	-0.1371
250	-0.0637	-0.0456	-0.1106	-0.2256	-0.1696	-0.1141	-0.1320
500	-0.0773	-0.0678	-0.1348	-0.2584	-0.1807	-0.1190	-0.1380
	Stack B						
0	-0.0243	-0.0170	-0.0176	-0.0143	-0.0166		
250	-0.0313	-0.0208	-0.0194	-0.0186	-0.0202		
500	-0.0302	-0.0236	-0.0228	-0.0170	-0.0218		

Table G 28. Maximum peak longitudinal displacements (B) in subgrade (TS706C6)

706C6	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps	Stack A						
0	0.2464	0.1663	0.4283	0.8995	0.5197	0.4437	0.3585
250	0.3097	0.2511	0.5732	1.1310	0.5936	0.4411	0.3530
500	0.4260	0.3025	0.7218	1.3231	0.6793	0.4856	0.3930
	Stack B						
0	0.5863	0.3222	0.6521	1.2879	0.9951		
250	0.6763	0.4502	0.7958	1.3682	1.1168		
500	0.7775	0.5256	0.9324	1.5807	1.2372		

Table G 29. Maximum peak longitudinal displacements (C) in subgrade (TS706C6)

706C6	Longitudinal Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-0.0217	-0.0253	-0.0587	-0.1327	-0.1105	-0.1029	-0.1006
250	-0.0252	-0.0333	-0.0688	-0.1490	-0.1225	-0.1161	-0.1086
500	-0.0264	-0.0405	-0.0812	-0.1756	-0.1363	-0.1249	-0.1163
				Stack B			
0	-0.1047	-0.0797	-0.1051	-0.4785	-0.3055		
250	-0.1395	-0.0706	-0.1315	-0.4592	-0.3152		
500	-0.1491	-0.0845	-0.1541	-0.5255	-0.3409		

Table G 30. Maximum peak transverse displacements in subgrade (TS706C6)

706C6	Transverse Displacement (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	0.2883	0.1188	0.3804	0.5960	0.4216	0.3791	0.2957
250	0.2687	0.1461	0.4288	0.6924	0.4272	0.3680	0.2676
500	0.2805	0.1646	0.5059	0.8408	0.4574	0.3851	0.2797
				Stack B			
0	0.0092	0.0257	0.0157	0.0028	0.0313		
250	0.0195	0.0240	0.0171	0.0029	0.0589		
500	0.0251	0.0290	0.0173	0.0046	0.0468		

Table G 31. Maximum peak vertical strains in subgrade (TS706C1)

706C1	Vertical Strain (µm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps	Stack A									
0	-2438	-815	-1736	-2347	-2226	-1351	-1166	-774	-726	-237
100	-1005	-775	-2148	-2640	-2669	-1593	-1312	-916	-791	-234
500	-888	-758	-2260	-2758	-3127	-1683	-1329	-962	-816	-259
1000	-1136	-793	-2482	-3314	-3488	-1889	-1599	-1085	-854	-326
5000	-1007	-468	-881	-3832	-4182	-2132	-2058	-1648	-1121	-312
	Stack B									
0	-1102	-606	-2540	-3314						
100	-894	-581	-2798	-3375						
500	-1271	-549	-2783	-3564						
1000	-942	-609	-3051	-4069						
5000	-1202	-937	-4769	-5294						

Table G 32. Maximum peak longitudinal strains (A) in subgrade (TS706C1)

706C1	Longitudinal Strain (µm)						
Depth (mm)	75	190	305	455	610	760	915
Reps	Stack A						
0	-246	-161	-138	-259	-204	-168	-147
100	-200	-173	-248	-358	-242	-218	-187
500	-164	-166	-294	-410	-352	-235	-159
1000	-199	-217	-337	-586	-390	-258	-217
5000	-263	-115	-51	-445	-389	-339	-296
	Stack B						
0	-50	-63	-58	-73	-46		
100	-48	-50	-41	-104	-42		
500	-47	-61	-54	-81	-60		
1000	-52	-64	-69	-85	-33		
5000	-62	-95	-73	-89	-82		

Table G 33. Maximum peak longitudinal strains (B) in subgrade (TS706C1)

706C1				Longitudinal Strain (µm)			
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	976	423	663	1144	906	818	446
100	1029	488	898	1410	1096	1089	542
500	1158	489	990	1677	1304	1174	544
1000	1149	548	1110	1993	1589	1498	723
5000	1042	268	114	991	1942	2112	939
				Stack B			
0	1287	866	838	1515	1117		
100	1310	962	886	1612	1389		
500	1180	996	1049	1710	1516		
1000	1497	1013	1109	2125	1755		
5000	2392	1626	2337	2790	2912		

Table G 34. Maximum peak longitudinal strains (C) in subgrade (TS706C1)

706C1				Longitudinal Strain (µm)			
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-202	-79	-70	-156	-166	-222	-174
100	-244	-84	-102	-204	-210	-293	-208
500	-213	-95	-109	-271	-261	-370	-246
1000	-145	-107	-154	-330	-320	-419	-320
5000	-208	-107	-146	-283	-467	-621	-375
				Stack B			
0	-322	-240	-182	-447	-359		
100	-294	-283	-221	-531	-422		
500	-265	-262	-263	-563	-451		
1000	-263	-319	-287	-684	-555		
5000	-281	-292	-547	-1046	-1038		

Table G 35. Maximum peak transverse strains in subgrade (TS706C1)

706C1	Transverse Strain (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps	Stack A						
0	1306	303	413	1241	792	841	612
100	1244	664	598	1475	923	969	651
500	1217	218	613	887	698	966	490
1000	1671	291	668	1759	786	908	729
5000	1398	319	64	720	1383	1168	699
	Stack B						
0	1224	53	276	1095	1647		
100	1436	74	474	1441	1857		
500	1202	235	385	405	2036		
1000	1442	269	599	1086	1619		
5000	1903	117	1215	2165	2687		

Table G 36. Maximum peak vertical strains in subgrade (TS706C2)

706C2	Vertical Strain (μm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps	Stack A									
0	-2638.1	-766.42	-2134.3	-2588.4	-3661.7	-1655.2	-1809.1	-1307.9	-1755.2	-2319.4
100	-1376.7	-838.81	-3814.4	-4570.2	-6074.1	-2730.6	-2776.7	-2080	-2590.8	-2447.5
500	-1428	-649.81	-4848.7	-6114.9	-6986.4	-3117.7	-2823.7	-2657.8	-1090.3	-2386.3
1000	-864.03	-826.18	-4212.1	-5515.6	-6327.1	-2840.1	-2882.7	-2429.3	-2087	-2349.7
5000	-1308.5	-1007.3	-5346.8	-7645.4	-7425.4	-3459	-2899.4	-3206.5	-1718.5	-2723.8
	Stack B									
0	-1446.3	-1122.9	-1336.9	-949.49						
100	-1639.6	-1209.3	-1606.6	-935.42						
500	-1373	-1013.6	-1697.3	-1306.1						
1000	-1642.4	-912.77	-1944.5	-1346.3						
5000	-1403.3	-708.06	-1945.9	-1827.7						

Table G 37. Maximum peak longitudinal strains (A) in subgrade (TS706C2)

706C2	Longitudinal Strain (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-239	-220	-267	-344	-232	-218	-271
100	-296	-492	-549	-696	-446	-435	-496
500	-294	-451	-784	-1065	-621	-575	-646
1000	-281	-684	-641	-962	-617	-527	-650
5000	-371	-831	-813	-1551	-765	-667	-707
				Stack B			
0	-54	-34	-57	-67	-40		
100	-93	-50	-67	-80	-72		
500	-88	-56	-71	-85	-66		
1000	-84	-66	-84	-82	-52		
5000	-96	-51	-85	-100	-68		

Table G 38. Maximum peak longitudinal strains (B) in subgrade (TS706C2)

706C2	Longitudinal Strain (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	893	361	786	109	732	423	624
100	1279	775	1683	2240	1472	954	1064
500	1503	1007	2123	2918	2138	1141	1008
1000	1447	950	1802	2665	2093	1064	1012
5000	2043	1337	2206	3991	2725	1581	1039
				Stack B			
0	1648	814	1495	1946	1338		
100	1827	1059	1889	2436	1987		
500	1740	1077	2495	3398	2393		
1000	2051	1055	2014	3631	2293		
5000	2341	1338	2839	4431	3039		

Table G 39. Maximum peak longitudinal strains (C) in subgrade (TS706C2)

706C2	Longitudinal Strain (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-295	-70	-142	-227	-203	-297	-207
100	-122	-92	-224	-410	-330	-477	-324
500	-156	-123	-312	-564	-429	-492	-331
1000	-158	-117	-268	-490	-426	-493	-360
5000	-242	-154	-317	-645	-553	-575	-394
				Stack B			
0	-369	-349	-293	-471	-463		
100	-444	-412	-338	-560	-709		
500	-223	-432	-465	-950	-882		
1000	-402	-435	-401	-898	-844		
5000	-351	-568	-613	-1324	-1188		

Table G 40. Maximum peak transverse strains in subgrade (TS706C2)

706C2	Transverse Strain (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	1225	357	452	112	693	1002	621
100	1294	570	1038	2041	1234	2082	874
500	1346	633	1427	2400	1624	2050	1167
1000	1506	458	1369	2288	1472	1557	1203
5000	1648	562	1538	2931	1505	1952	1174
				Stack B			
0	26	46	76	95	129		
100	56	91	96	86	192		
500	52	82	76	95	208		
1000	73	81	69	91	129		
5000	77	66	72	122	184		

Table G 41. Maximum peak vertical strains in subgrade (TS706C3)

706C3	Vertical Strain (µm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps	Stack A									
0	-1010	-620	-1749	-2012	-2131	-1212	-1011	-612	-447	-197
250	-955	-571	-1960	-2149	-2240	-1299	-1064	-662	-459	-194
500	-952	-652	-1815	-2005	-2067	-1185	-951	-598	-427	-190
1000	-915	-526	-1789	-1976	-2075	-1175	-933	-582	-424	-177
2500	-855	-508	-2160	-2342	-2321	-1335	-1053	-646	-461	-194
5000	-858	-500	-2103	-2353	-2245	-1316	-1051	-653	-448	-187
	Stack B									
0	-910	-415	-850	-4206						
100	-845	-420	-833	-4236						
500	-835	-405	-780	-3880						
1000	-812	-410	-720	-3765						
2500	-814	-402	-778	-4337						
5000	-802	-421	-760	-4161						

Table G 42. Maximum peak longitudinal strains (A) in subgrade (TS706C3)

706C3	Longitudinal Strain (µm)						
Depth (mm)	75	190	305	455	610	760	915
Reps	Stack A						
0	-208	-164	-309	-419	-212	-188	-150
250	-200	-149	-340	-480	-229	-200	-167
500	-194	-136	-320	-433	-211	-173	-159
1000	-180	-154	-332	-412	-226	-179	-162
2500	-211	-226	-467	-523	-243	-247	-209
5000	-226	-217	-471	-479	-246	-211	-181
	Stack B						
0	-38	-47	-43	-42	-42		
100	-39	-42	-37	-32	-39		
500	-32	-50	-45	-39	-50		
1000	-38	-41	-40	-43	-45		
2500	-58	-37	-72	-88	-96		
5000	-40	-49	-37	-35	-44		

Table G 43. Maximum peak longitudinal strains (B) in subgrade (TS706C3)

706C3	Longitudinal Strain (µm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	1058	623	807	972	946	739	379
250	1075	686	969	1060	1059	841	408
500	1084	663	880	926	955	777	365
1000	1062	679	897	912	956	766	362
2500	1059	889	1183	1054	1137	850	401
5000	1089	895	1157	1023	1075	889	392
				Stack B			
0	1402	291	613	1474	985		
100	1406	369	678	1600	1055		
500	1367	369	592	1407	915		
1000	1348	376	583	1357	897		
2500	1387	467	644	1695	902		
5000	1412	450	698	1731	959		

Table G 44. Maximum peak longitudinal strains (C) in subgrade (TS706C3)

706C3	Longitudinal Strain (µm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-133	-60	-178	-131	-154	-266	-167
250	-89	-62	-277	-188	-210	-289	-180
500	-127	-61	-109	-171	-175	-273	-168
1000	-120	-63	-119	-165	-186	-269	-178
2500	-67	-73	-419	-222	-200	-342	-199
5000	-85	-80	-371	-205	-213	-281	-189
				Stack B			
0	-241	-141	-380	-282	-304		
100	-190	-101	-443	-308	-312		
500	-193	-86	-415	-296	-304		
1000	-189	-81	-384	-289	-286		
2500	-233	-87	-501	-429	-420		
5000	-207	-95	-411	-352	-304		

Table G 45. Maximum peak transverse strains in subgrade (TS706C3)

706C3	Transverse Strain (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	1527	369	253	944	902	815	32
250	1545	375	282	955	946	928	33
500	1585	297	242	861	876	823	29
1000	1614	363	258	852	853	789	30
2500	1558	318	321	1028	997	910	34
5000	1676	352	343	1009	987	900	34
				Stack B			
0	19	32	39	51	37		
100	24	27	43	55	31		
500	23	23	39	53	32		
1000	20	35	38	67	32		
2500	24	31	33	48	33		
5000	23	37	41	44	36		

Table G 46. Maximum peak vertical strains in subgrade (TS706C4)

706C4	Vertical Strain (μm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps				Stack A						
0	-804	-558	-939	-1340	-832	-608	-1048	-430	-307	-198
100	-823	-621	-1404	-1783	-1276	-955	-1553	-605	-393	-304
500	-695	-508	-1715	-2166	-1906	-1095	-1227	-683	-480	-356
1000	-626	-508	-1752	-1895	-1630	-1171	-1703	-676	-415	-321
5000	-623	-462	-1271	-1713	-534	-425	-1017	-634	-463	-295
10000	-524	-405	-1885	-1909	-1702	-1228	-1790	-584	-499	-330
25000	-508	-404	-2098	-2672	-2216	-1248	-1254	-804	-551	-353
				Stack B						
0	-1078	-869	-2103	-1168						
100	-996	-1025	-2929	-1418						
500	-1075	-630	-3426	-1798						
1000	-892	-677	-3416	-1881						
5000	-836	-592	-4002	-1811						
10000	-973	-518	-4173	-2083						
25000	-967	-381	-6261	-3122						

Table G 47. Maximum peak longitudinal strains (A) in subgrade (TS706C4)

706C4	Longitudinal Strain (µm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-95	-105	-116	-134	-149	-92	-78
100	-144	-131	-141	-170	-233	-164	-117
500	-111	-84	-154	-305	-312	-200	-116
1000	-97	-109	-212	-198	-236	-217	-160
5000	-97	-107	-151	-150	-76	-65	-60
10000	-132	-138	-279	-206	-300	-240	-160
25000	-119	-183	-247	-399	-282	-200	-113
				Stack B			
0	-88	-73	-71	-83	-73		
100	-71	-76	-68	-94	-69		
500	-84	-74	-79	-95	-78		
1000	-74	-88	-73	-97	-68		
5000	-73	-75	-75	-97	-81		
10000	-71	-45	-75	-86	-79		
25000	-64	-75	-79	-107	-66		

Table G 48. Maximum peak longitudinal strains (B) in subgrade (TS706C4)

706C4	Longitudinal Strain (µm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	372	142	390	430	189	261	314
100	645	213	404	794	329	544	520
500	629	162	374	1415	687	776	375
1000	625	306	565	754	497	973	621
5000	333	98	101	502	59	113	253
10000	738	299	530	674	482	890	83
25000	578	448	543	1466	187	531	214
				Stack B			
0	855	275	621	580	549		
100	942	385	928	799	900		
500	867	379	1273	1087	1094		
1000	1159	504	1135	1276	1221		
5000	1162	595	1540	973	1017		
10000	1461	804	1390	995	1593		
25000	2476	1184	3154	1656	2009		

Table G 49. Maximum peak longitudinal strains (C) in subgrade (TS706C4)

706C4	Longitudinal Strain (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-148	-59	-120	-177	-217	-175	-73
100	-98	-46	-130	-229	-252	-237	-123
500	-115	-59	-180	-306	-327	-288	-114
1000	-111	-64	-191	-339	-358	-327	-131
5000	-107	-50	-135	-256	-210	-195	-116
10000	-121	-76	-225	-318	-292	-340	-192
25000	-134	-104	-253	-433	-368	-387	-143
				Stack B			
0	-202	-122	-151	-188	-190		
100	-236	-127	-228	-235	-294		
500	-250	-128	-302	-358	-364		
1000	-292	-161	-286	-373	-421		
5000	-249	-158	-322	-364	-304		
10000	-280	-167	-342	-399	-502		
25000	-304	-258	-709	-860	-643		

Table G 50. Maximum peak transverse strains in subgrade (TS706C4)

706C4	Transverse Strain (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	719	31	2533	176	259	377	116
100	723	35	2521	386	299	539	111
500	721	196	2794	222	328	684	202
1000	832	45	3144	324	350	498	184
5000	768	32	3155	152	68	141	67
10000	786	39	2502	375	367	556	33
25000	989	230	3469	419	126	371	157
				Stack B			
0	23	38	29	23	55		
100	29	34	32	24	94		
500	31	36	30	22	120		
1000	26	33	25	26	113		
5000	23	34	31	30	102		
10000	29	30	28	22	95		
25000	32	31	28	24	136		

Table G 51. Maximum peak vertical strains in subgrade (TS706C5)

706C5 Depth (mm)	Vertical Strains (µm)									
Reps					Stack A					
0	-1478	-951	-2966	-2382	-2021	-1295	-1706	-1095	-945	-507
100	-762	-681	-3212	-2279	-1882	-1138	-1555	-1027	-935	-487
500	-583	-526	-2603	-2104	-1539	-976	-1351	-797	-712	-364
1000	-992	-480	-2895	-2468	-2039	-1005	-1442	-941	-789	-352
5000	-614	-476	-3626	-2739	-1857	-1175	-1581	-1073	-874	-373
10000	-871	-407	-810	-3021	-2281	-1374	-1901	-1332	-1119	-444
					Stack B					
0	-1029	-554	-4224	-5228						
100	-948	-455	-3959	-4710						
500	-698	-407	-3129	-3964						
1000	-848	-438	-3707	-4680						
5000	-998	-477	-5179	-5174						
10000	-1437	-629	-7235	-7401						

Table G 52. Maximum peak longitudinal strains (A) in subgrade (TS706C5)

706C5				Longitudinal Strains (µm)			
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-155	-141	-140	-392	-284	-259	-306
100	-234	-136	-121	-293	-261	-174	-215
500	-213	-126	-122	-270	-240	-193	-205
1000	-226	-141	-127	-304	-267	-169	-189
5000	-244	-184	-153	-313	-269	-183	-196
10000	-333	-190	-34	-375	-393	-262	-299
				Stack B			
0	-42	-531	-54	-60	-55		
100	-44	-396	-49	-31	-57		
500	-34	-369	-50	-40	-45		
1000	-40	-401	-64	-34	-50		
5000	-40	-337	-60	-53	-56		
10000	-52	-337	-72	-55	-62		

Table G 53. Maximum peak longitudinal strains (B) in subgrade (TS706C5)

706C5	Longitudinal Strains (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	497	128	555	1672	682	457	566
100	751	234	643	1777	632	375	472
500	750	268	515	25	503	340	347
1000	804	374	739	1677	583	325	445
5000	974	485	955	2037	633	396	442
10000	916	43	183	329	993	399	555
				Stack B			
0	847	334	1084	2346	1413		
100	840	282	1031	2310	1427		
500	802	346	778	1790	1129		
1000	922	200	985	2213	1233		
5000	1434	264	1652	3141	1821		
10000	1920	214	2320	4712	2365		

Table G 54. Maximum peak longitudinal strains (C) in subgrade (TS706C5)

706C5	Longitudinal Strains (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-87	-103	-150	-382	-277	-258	-244
100	-33	-101	-144	-401	-274	-277	-223
500	-59	-72	-112	-290	-243	-228	-181
1000	-48	-99	-140	-325	-254	-241	-198
5000	-63	-105	-192	-390	-291	-242	-221
10000	-54	-68	-44	-451	-348	-253	-271
				Stack B			
0	-173	-544	-363	-743	-823		
100	-148	-625	-375	-629	-789		
500	-151	-474	-271	-518	-623		
1000	-156	-576	-342	-647	-635		
5000	-186	-463	-529	-851	-1011		
10000	-341	-476	-759	-1304	-1336		

Table G 55. Maximum peak transverse strains in subgrade (TS706C5)

706C5	Transverse Strains (mm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	755	71	399	1877	835	657	620
100	558	43	485	1921	814	596	506
500	777	71	295	32	711	519	394
1000	473	123	1012	1685	660	505	539
5000	737	45	763	2001	991	577	498
10000	640	39	148	290	1120	573	647
				Stack B			
0	47	73	61	75	179		
100	49	73	63	124	186		
500	41	44	55	80	108		
1000	46	52	43	74	150		
5000	48	65	60	97	209		
10000	60	63	52	67	241		

Table G 56. Maximum peak vertical strains in subgrade (TS706C6)

706C6	Vertical Strain (μm)									
Depth (mm)	135	250	380	535	685	840	990	1145	1295	1450
Reps					Stack A					
0	-1548	-1208	-8049	-9579	-6344	-4997	-5231	-3462	-250	-474
250	-1501	-1113	-9436	-10685	-6259	-4907	-5219	-3486	-309	-558
500	-1752	-1219	-10872	-12161	-6772	-5232	-5680	-3808	-315	-733
					Stack B					
0	-1312	-1080	-7249	-12763						
250	-1547	-1173	-7580	-13872						
500	-1847	-1188	-8522	-15391						

Table G 57. Maximum peak longitudinal strains (A) in subgrade (TS706C6)

706C6	Longitudinal Strain (μm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-438	-149	-548	-1468	-1152	-766	-897
250	-435	-302	-748	-1525	-1146	-774	-863
500	-529	-449	-912	-1746	-1221	-807	-903
				Stack B			
0	-148	-115	-115	-91	-116		
250	-190	-141	-127	-118	-141		
500	-184	-160	-150	-107	-152		

Table G 58. Maximum peak longitudinal strains (B) in subgrade (TS706C6)

706C6	Longitudinal Strain (µm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	1678	1099	2896	6088	3517	3014	2346
250	2114	1661	3878	7645	4010	2992	2309
500	2914	2005	4886	8941	4586	3294	2571
				Stack B			
0	3574	2185	4270	8155	6958		
250	4119	3058	5210	8623	7788		
500	4734	3576	6113	9943	8625		

Table G 59. Maximum peak longitudinal strains (C) in subgrade (TS706C6)

706C6	Longitudinal Strain (µm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	-148	-167	-397	-898	-747	-699	-658
250	-172	-221	-465	-1007	-827	-787	-710
500	-180	-268	-550	-1187	-921	-847	-761
				Stack B			
0	-638	-541	-688	-3031	-2136		
250	-850	-479	-861	-2895	-2199		
500	-908	-575	-1010	-3304	-2377		

Table G 60. Maximum peak transverse strains in subgrade (TS706C6)

706C6	Transverse Strain (µm)						
Depth (mm)	75	190	305	455	610	760	915
Reps				Stack A			
0	713	2360	4138	2810	2472	1910	713
250	876	2652	4763	2823	2384	1719	876
500	986	3126	5765	3011	2489	1793	986
				Stack B			
0	59	153	108	18	203		
250	124	142	118	19	379		
500	160	172	119	30	299		

APPENDIX H: DYNAMIC STRESS TEST RESULTS

Table H 1. Maximum measured peak vertical stress in subgrade

706C1	Load = 27-kN, Tire pressure = ???-kPa		
	z = 381-mm	z = 381-mm	z = 381-mm
	Vertical Stress (kPa)	Longitudinal Stress (kPa)	Transverse Stress (kPa)
Repetitions	GF	GF	GF
0	GF	GF	GF
100	-13.01	-8.68	-2.63
500	-14.92	-10.55	-3.35
1000	-13.56	-8.65	-4.29
5000	GF	GF	GF

* - Gauge failure

704C2	Load = 40-kN, Tire pressure = ???-kPa								
	z = 191-mm			z = 381-mm			z = 533-mm		
Repetitions	Vertical Stress (kPa)	Longitudinal Stress (kPa)	Transverse Stress (kPa)	Vertical Stress (kPa)	Longitudinal Stress (kPa)	Transverse Stress (kPa)	Vertical Stress (kPa)	Longitudinal Stress (kPa)	Transverse Stress (kPa)
0	-70.26	-17.30	-12.31	-25.46	-12.06	-3.07	-16.02	-7.12	-3.05
100	-71.03	-20.96	-16.49	-28.65	-13.50	-7.09	-18.32	-8.65	-4.67
500	-64.59	-19.63	-7.53	-25.42	-13.01	-4.47	-17.41	-7.82	-4.13
1000	-69.78	-22.89	-20.66	-28.32	-14.53	-6.70	-19.64	-9.23	-4.97
2500	-76.76	-26.36	-20.17	-29.26	-16.10	-7.83	-18.93	-9.72	-5.37

aaaaa

Table H 1. Maximum measured peak vertical stress in subgrade (cont.)

706C3	Load = 22-kN, Tire pressure = ???-kPa		
	z = 381-mm Vertical Stress (kPa)	z = 381-mm Longitudinal Stress (kPa)	z = 381-mm Transverse Stress (kPa)
Repetitions			
0	-18.97	-12.16	-1.85
250	-18.15	-10.99	-2.76
500	-19.16	-10.76	-2.24
1000	-18.58	-10.73	-2.36
2500	-19.16	-11.01	-3.23
5000	-20.88	-11.25	-3.41

706C4	Load = 22-kN, Tire pressure = ???-kPa		
	z = 381-mm Vertical Stress (kPa)	z = 381-mm Longitudinal Stress (kPa)	z = 381-mm Transverse Stress (kPa)
Repetitions			
0	-10.13		
100	-10.34	-7.95	-4.74
500	-9.48	-7.86	-2.08
1000	GF	-8.86	-3.79
5000	GF	-8.45	-3.60
10000	GF	-7.67	-4.50
25000	GF	-7.54	-2.43

Table H 1. Maximum measured peak vertical stress in subgrade (cont.)

706C5	Load = 27-kN, Tire pressure = ???-kPa					
	Z = 191			Z = 381		
	Vertical Stress (kPa)	Longitudinal Stress (kPa)	Transverse Stress (kPa)	Vertical Stress (kPa)	Longitudinal Stress (kPa)	Transverse Stress (kPa)
Repetitions						
0	-52.32	-13.24	-8.43	-12.41	-9.22	-4.24
100	-37.97	-10.37	-8.28	-10.74	-9.13	-5.30
500	-41.17	-11.53	-7.76	-11.09	-9.43	-4.65
1000	-39.30	-13.22	-8.26	-10.88	-9.15	-4.17
5000	-46.90	-10.85	-7.83	-10.56	-9.41	-5.41
10000	-35.19	-6.03	-5.56	-5.39	-6.60	-4.42

706C6	Load = 40-kN, Tire pressure = ???-kPa		
	z = 381-mm Vertical Stress (kPa)	z = 381-mm Longitudinal Stress (kPa)	z = 381-mm Transverse Stress (kPa)
Repetitions	-23.63	-15.96	-12.37
0	-23.85	-16.25	-11.22
250	-24.45	-16.83	-10.92
500	-23.63	-15.96	-12.37

APPENDIX I RESULTS OF ASPHALT MIXTURE TESTING

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Dr. Janoo,

On November 8, 2001 hot mix asphalt samples were received at the Nebraska Department of Roads Materials and Research Testing Laboratories from the paving performed October 25, 2001 on the CRREL Pavement Subgrade Performance Study, SPR-2(208) test section 705. The mix was submitted in 3 boxes and was produced by Blaktop Inc. of West Lebanon, New Hampshire. The mix was identified as a New Hampshire State DOT Type "C" mix. The following is information supplied by the contractor:

Binder: PG 64-22 from Hudson Liquid Asphalt Corporation – Providence, Rhode Island

Material	**% in Mix**	**Specific Gravity**
Screened Natural Sand	34.0	2.647
Washed Stone Screenings	14.6	2.766
3/8" Crushed Stone	32.9	2.802
½" Crushed Stone	18.5	2.808

Asphalt Content 6.1%

The objective was to report the quality of the mix produced by performing a volumetric analysis, measuring the consensus properties, and testing its performance in the Asphalt Pavement Analyzer. The analysis was somewhat limited due to the fact that all of the materials tested were from the plant produced hot-mix and there were no samples of virgin aggregate taken. Therefore all of the consensus properties were from ignition oven material that is generally affected by the high heat of the burn off process. The following 3 pages are a summary of the test results:

Sieve Analysis (AASHTO T-30)

Sieve	% Retained	% Passing
1”	0.0	100.0
¾”	0.0	100.0
½”	2.3	97.7
3/8”	11.5	88.5
#4	33.6	66.4
#8	43.8	56.2
#16	53.0	47.0
#30	65.4	34.6
#50	77.9	22.1
#100	87.0	13.0
#200	93.1	6.9

Binder Content By Ignition Oven (AASHTO T-308)

6.28 %

Fine Aggregate Angularity (AASHTO T-304, method “A”)

FAA = 45.7

Course Aggregate Angularity (ASTM D5821)

CAA = 97/97

Sand Equivalent (AASHTO T-176)

Sand Equivalent = 81

Flat and Elongated Particles (ASTM D4791, 5:1 ratio)

Flat and Elongated = 3

Aggregate Specific Gravity (AASHTO T-84 and T-85)

Specific Gravity = 2.721 performed on ignition oven sample

Moisture Sensitivity (AASHTO T-283)

TSR = 85.6%

Marshall Test Results

(50 Blow Compaction)

Air Voids = 2.4 %
VMA = 14.8 %
Stability = 3275 lbs
Flow = 14

(75 Blow Compaction)

Air Voids = 1.5 %
VMA = 13.9 %
Stability = 3360
Flow = 14

Gyratory Test Results

(134 Gyrations)

Air Voids @ Ninitial = 6.5 %
Air Voids @ Ndesign = 1.3 %
Air Voids @ Nmax = 0.9 %
VMA = 13.7 %
VFA = 90.6 %

(152 Gyrations)

Air Voids @ Ninitial = 6.7 %
Air Voids @ Ndesign = 0.9 %
Air Voids @ Nmax = 0.5 %
VMA = 13.4 %
VFA = 93.2 %

Asphalt Pavement Analyzer Results

Chamber Environment = 147° F (64°C) Dry Test
Wheel Load 100 lbs (0.44 kN)
Hose Pressure 100 psi (690 kPa)
8000 Load Cycles

Set 1 Results

6.92% Air Voids
Test was discontinued at 4984 Load Cycles with 11.74 mm of rutting

Set 2 Results

6.74% Air Voids
Test was discontinued at 4984 Load Cycles with 11.11 mm of rutting

Set 3 Results

7.12% Air Voids
Test was discontinued at 4984 Load Cycles with 10.66 mm of rutting

This concludes the series of testing on the submitted hot mix samples.
If you have any questions, please feel free to call at 402-479-4677.

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Nebraska Department of Roads