CHAPTER 3

CONSTRUCTION

This chapter will briefly define the construction operation used for the original construction of the test track as well as the replacement HMA sections. In addition, the QC and QA data collected for the subgrade and engineered fill, base course, and HMA are presented. Table 75 shows the schedule of the WesTrack construction activities relative to the other WesTrack activities. The construction activity schedules for placement of the subgrade and engineered fill, base course, and HMA are shown in Tables 76, 77, and 78, respectively.

3.1 CONSTRUCTION OPERATIONS—ORIGINAL CONSTRUCTION

The construction operations for placement of the subgrade and engineered fill, base course, and HMA are briefly presented below. In addition, the process used to rework the base course during the construction of the HMA replacement sections is briefly presented.

3.1.1 Subgrade and Engineered Fill

Clearing and grubbing of the track footprint to a depth of approximately 75 mm (3 in.) was the first construction operation. The stripped material was stockpiled outside of the immediate track area. The stripped footprint was scarified with rippers on a motor grader (Figure 40) to an approximate depth of 150 mm (6 in.), moisture conditioned (Figure 41) to achieve optimum moisture content, and compacted with a self-propelled, pad-foot compactor (Figure 42).

The primary focus for the subgrade construction was uniformity. Placing the subgrade and engineered fill material at the desired density and moisture content was important but was of secondary importance to uniformity. The natural soils at the track site were relatively uniform; however, local material variations did exist. The natural material was fine-grained, but varied from an area of clean sand at the southeast corner of the track (nearest the river) to fat clays in isolated areas on both tangents.

To produce as uniform as possible subgrade and engineered fill material, the natural soil was excavated and distributed around the track with self-elevating, self-propelled earth movers (Figure 43). The material was further blended with an agricultural disc which aided in breaking up soil agglomerations and allowed for more uniform moisture control. The material was placed in approximately 75-mm (3-in.) lifts and was further blended and shaped with the motor grader. Water was added using a self-propelled water truck (Figure 41). Compaction was achieved by using dispersed earthmoving traffic patterns and a pad-foot compactor (Figure 42).

Subgrade and engineered fill finishing tolerances were kept as tight as possible to ensure uniformity of pavement support. Initially, a dual slope, laser system was used to obtain the desired elevations on the subgrade and engineered fill. The use of this equipment was not effective and the subgrade and engineered fill elevations were obtained with a wire line set on each side of the tangents and automatic cross-slope control. The cross-slope was verified with control hubs driven to grade at regular intervals along the tangents.

The subgrade material, when compacted and dried, became very difficult to fine grade. The surface became very hard and when sufficient shearing force was applied with the cutting edge of the motor grader to trim the subgrade and engineered fill, the material would often shear tens of millimeters into the grade. This behavior caused concern with the grading crew, who attempted to avoid the problem by filling the sheared areas to finish the grade to the desired elevations. Relatively thin layers of material were placed and compacted in this finishing operation. This unorthodox approach resulted in a grade that was irregular, too low for the most part and stratified with shear planes. This technique proved to be unsatisfactory because of the nonuniformity of the material.

To solve the shearing problem during fine grading, the existing nonuniform surface was pulverized after additional material was added (Figure 44). After recompaction and prior to hardening of the surface of the engineered fill, the surface was carefully trimmed to finish grade with the wire and cross-slope control on the motor grader.

As the subgrade was finished, construction traffic was routed around the finished sections to avoid damage to the grade as well as to avoid additional compaction. The surface of the engineered fill was kept damp with side sprays of water from a water truck.

3.1.2 Base Course

The base course was produced at a pit near the track (Figure 45). Four stockpiles of material were produced, combined with a four-bin feeder system and mixed with a pugmill to achieve maximum uniformity of gradation and moisture content (Figure 46). The aggregate base was hauled with 10-wheel dump trucks from the base course blending area to the track and back dumped onto the finished subgrade (Figure 47). This hauling and initial placing operation was used to remove base course haul traffic from the finished subgrade. The trucks hauling the base course traveled on the previously placed base course.

A motor grader was used to spread the base course to its approximate final grade (Figure 48). A vibratory roller compacted the base course (Figure 49). The roller had a smooth, steel drum and pneumatic tires. The grade was finished using the same wire line and cross-slope control system on the motor grader as that used for fine finishing the subgrade and engineered fill. A prime coat was placed on the finished base course.

Determining the actual finished surface elevations of the base course was difficult with conventional survey equipment. The coarse surface and the need for precise survey rod placement required unusual diligence. It appears the surface of both the subgrade and engineered fill and the base course were within 3 mm (0.1 in.) of the desired grade.

3.1.3 Hot-Mix Asphalt

The HMA was produced at Granite Construction's plant at Dayton, Nevada (Figure 50). Stockpiles of aggregate for the project were established in January 1995 for mixture design purposes and to provide a uniform material feed. Four stockpiles of aggregate and four cold feeds were used to produce the HMA (Figure 51).

Hydrated lime was added to damp aggregate through a metering and pugmill system as shown in Figure 52. A parallel flow drum drying and mixing unit was used to heat the aggregate and initiate the mixing of the asphalt binder and the heated aggregate (Figure 53). Mixing was completed with an external continuous pugmill mixer (Figure 54). A baghouse was used as the primary air quality control system. Fines from the baghouse were metered back into the drum dryer/mixer as shown in Figure 55.

The mixed HMA was elevated and stored in silos (Figure 56) prior to loading onto the haul units (Figure 57). Loading of the hot-mix was in three drops (front, back, and middle of the trailer) from the storage silo for each of the three trailers used on the haul units. Tarpaulins were placed on all loads of hot-mix at the plant to minimize temperature loss and minimize "temperature segregation" during the last 3 days of construction. One-way haul times from the plant to the laydown site were approximately 50 minutes. Because each section required approximately 55 to 64 Mg (60 to 70 tons), a pair of truck-trailer combinations were used to pave each section. The trucks traveled in pairs throughout the paving operation.

After the truck haul to the paving site, the HMA was transferred to the enlarged hopper of the laydown machine (Figure 58) with a material transfer device (Figure 59). The capacity of the laydown machine, laydown machine hopper, and material transfer device was approximately four haul-trailer loads. After the laydown machine started, one or two additional trailers of HMA were transferred to the material transfer device and to the paving machine. The paving machine paved the entire section without stopping.

Breakdown, intermediate, and final rollers were used to compact the HMA. A dual drum, steel wheel, vibratory roller was used for breakdown rolling (Figure 60). A pneumatic tired roller was used for intermediate rolling (Figure 61). Finish or final rolling was achieved with a dual drum, steel wheel, vibratory roller (Figure 62).

To minimize segregation and to provide for uniform density at the end of each section, the paving of a section was extended about 3 m (10 ft) beyond the planned length. This temporary extension was used to stop and reverse the direction of the rollers and was removed prior to the start of placement of the next section (Figure 63). The first 25 m (82 ft) of every section was used to start the laydown machine and move the rollers into the test section from the adjacent lanes. The compaction of the first 25 m (82 ft) was not uniform in comparison with the remainder of the section.

Following compaction, the pavement surface was profiled with an 8-m (25-ft) California-type profilograph to determine the profile index of each section. The track was then profile ground using a diamond grinder in the transition areas between the test portion of the sections. Two sections were ground to reduce the HMA thickness to 150 mm (6 in.).

3.2 CONSTRUCTION OPERATIONS—REPLACEMENT SECTIONS

3.2.1 Pavement Removal

In May and June 1997, ten sections (sections 5, 6, 7, 8, 9, 13, 21, 24, 25, and 26) placed during the original construction of WesTrack were removed and replaced. The sections were removed to the base course using a cold milling process (Figure 64). To re-establish the grade of the base course disturbed during the cold milling process, aggregate base was mined from the track shoulders and placed as needed with a front-end loader and motor grader (Figure 65). The base course material was then compacted using a vibratory, steel wheel roller. Following the compaction and fine-grading operation, the aggregate base was primed with an MC-70 cutback asphalt at an approximate rate of 0.9 L per square meter (0.2 gal) per square yard.

3.2.2 Hot-Mix Asphalt

The HMA was produced at Granite Construction's plant at Lockwood, Nevada (Figure 66). Four stockpiles of aggregate and four of the available cold feeds were used to produce the HMA (Figure 67).

Hydrated lime was added to damp aggregate through a metering and pugmill system as shown in Figure 68. A counter flow drum drying and mixing unit was used to heat the aggregate and initiate the mixing of the asphalt binder and the heated aggregate (Figure 69). A baghouse was used as the primary air quality control system. Fines from the baghouse were metered back into the drum dryer/mixer as shown in Figure 70.

The mixed HMA was elevated and stored in silos (Figure 71) prior to loading onto the haul units (Figure 72). Loading of the HMA was in three drops (front, back, and middle of the trailer) from the storage silo for each of the three trailers used on the haul units. Tarpaulins were placed on all loads at the plant to minimize temperature loss and minimize temperature segregation. One-way haul times from the plant to the laydown site were approximately 70 minutes. Because each section required approximately 55 to 64 Mg (60 to 70 tons), a pair of truck-trailer combinations were used to pave each section. The trucks traveled in pairs throughout the paving operation.

After the truck haul to the paving site, the HMA was transferred with a material transfer device (Figure 73) to the enlarged hopper of the laydown machine (Figure 74). The capacity of the laydown machine, laydown machine hopper, and material transfer device was approximately four trailer loads of HMA. After the laydown machine started, one or two additional trailers of HMA were transferred to the material transfer device and to the paving machine. The paving machine paved the entire section without stopping.

Breakdown, intermediate, and final rollers were used to compact the HMA. A dual drum, steel wheel, vibratory roller was used for breakdown rolling (Figure 75). A pneumatic tired roller was used for intermediate rolling (Figure 61). Finish or final rolling was achieved with a dual drum, steel wheel, vibratory roller (Figure 76).

To minimize segregation and to provide for uniform density at the end of each section, the paving of a section was extended about 3 m (10 ft) beyond the planned length. This temporary extension was used to stop and reverse the direction of the rollers and was removed prior to the start of placement of the next section (Figure 63). The first 25 m (82 ft) of every section was used to start the laydown machine and move the rollers into the test section from the adjacent lanes. The compaction of the first 25 m (82 ft) was not uniform in comparison with the remainder of the section.

Following compaction, the pavement surface was profiled with an 8-m (25-ft) California-type profilograph to determine the profile index of each section. The track was then profile ground using a diamond grinder to establish a track profile that provided the desired ride quality. The grinding was restricted to the transition areas between the sections.

3.3 SUBGRADE AND ENGINEERED FILL QUALITY CONTROL/QUALITY ASSURANCE

The sampling and testing plan scheduled during the construction operation is shown in Tables 23 and 24 and further defined in reference 3. Density and moisture content were determined for QC/QA purposes, and a series of other tests were performed to characterize the subgrade and engineered fill material for pavement design and pavement performance modeling. Detailed summaries of these results can be found in WesTrack Technical Reports UNR-29 (*76*), NCE-4 (*35*), and NCE-8 (*37*). Data are provided for four lifts as described in the following sections.

3.3.1 Moisture and Density Relationships

Table 79 contains a summary of the relative density data collected during construction. Tables 80 through 83 contain Atterberg Limits, California Bearing Ratio (CBR) values, R values, and soil classification information collected on specific sections of the tangents. Lift 3 was pulverized, mixed, and recompacted and has been identified as lift 4. Therefore, the actual property data of importance are those associated with lifts 1, 2, and 4.

3.3.2 Structural Load-Carrying Capacity

Cone penetrometer values were also obtained during construction of the subgrade and engineered fill. These data were converted to CBR values by use of U.S. Army Corps of Engineers' software (*36*) and Livneh's equation (*38*). The calculated CBR values are shown in Table 84 for the U.S. Army Corps of Engineers' conversion approach and Table 85 for Livneh's equation for the various dates of testing.

FWD data were used to calculate modulus values for the subgrade and engineered fill as previously discussed. These data are presented in Table 86 by section number and date of testing for the subgrade and engineered fill. As previously discussed, laboratory tests were performed to define the resilient modulus of the subgrade and engineered fill. Laboratory-determined resilient modulus values are shown in Table 87 for the subgrade and engineered fill.

CBR values were determined in the laboratory for samples compacted to the in situ density and moisture content. CBR values for the subgrade and engineered fill are shown in Table 88 by section number.

3.4 BASE COURSE QUALITY CONTROL/QUALITY ASSURANCE

The sampling and testing performed during the construction operation are shown in Tables 23 and 24 and further defined in reference 3. Gradation, density, and moisture content tests were performed for QC/QA purposes, and a series of other tests were performed to characterize the subgrade and engineered fill material for pavement design and pavement performance modeling. Detailed summaries of these results can be found in WesTrack Technical Reports UNR-29 (*76*) and NCE-4 (*35*).

3.4.1 Gradation

Gradation of the base course material as produced from a single circuit crushing operation near the track site is shown in Table 89. The gradation variability was judged to be excessive and the crushing operation was altered to create four stockpiles of materials separated by size. These four stockpiles were combined with the use of a cold feed system and a continuous pugmill mixer. The moisture was then adjusted during this blending/mixing operation as previously discussed. The average gradation of the two lifts of base course is shown in Table 90.

3.4.2 Moisture and Density Relationships

Table 91 contains a summary of the moisture and density data collected during construction. Tables 92 and 93 contain Atterberg Limits, CBR values, R values, Los Angeles abrasion, and sand equivalent information collected on specific sections of the tangents.

3.4.3 Structural Load-Carrying Capacity

Cone penetrometer values were also obtained during construction of the base course material. These data were converted to CBR values by use of the U.S. Army Corps of Engineers' software (*36*) and Livneh, Ishai, and Livneh (*38*). The calculated CBR values are shown in Table 84 for the U.S. Army Corps of Engineers' conversion method and in Table 85 for Livneh's equation 3 for the various dates of testing.

FWD data were used to calculate modulus values for the base course as previously discussed. These data are presented in Table 86 by section number and date of testing for the base course. As previously discussed, laboratory tests were performed to define the resilient modulus of the subgrade and engineered fill. Laboratory-determined resilient modulus values are shown in Table 87 for the base course.

CBR values were determined in the laboratory for samples compacted to the in situ density and moisture content. CBR values for the base course are shown in Table 88 by section number.

3.4.4 Thickness

Thicknesses of the base course as determined by rod and level are shown in Table 94. These data were obtained at seven locations for each section. The design thickness of the base course was 300 mm (12 in.). The desired thickness control was achieved.

3.5 HOT-MIX ASPHALT QUALITY CONTROL—ORIGINAL CONSTRUCTION

Prior to the start of production, the HMA plant was calibrated. This calibration included determination of individual cold feed rates for each aggregate, calibration of the scale belt, and calibration of the asphalt binder delivery system. During the placement of the HMA at WesTrack, additional calibrations were performed. The initial calibration was performed on September 8, 1995. Additional calibrations were performed on September 25, 26, 28, and 29, 1995.

HMA was placed on the ramps to the test track on September 9 and September 13, 1995, to determine the constructability of the HMA and to determine the gradation, asphalt binder contents, and the volumetrics.

The construction of the "trial lane" and the "test lane" was performed on the dates shown in Table 95. The bottom lift of the trial lane was placed first, followed by placement of the bottom lift of the test lane. Likewise, the top lift of the trial lane was placed prior to the top lift of the test lane. Placement of the trial lanes prior to the test lanes allowed for adjustments in the binder contents and gradations as well as in the construction operation. The test lanes are the lanes on which the traffic was placed and the WesTrack performance information obtained.

The QC sampling and test plan for original construction is detailed in WesTrack Technical Reports UNR-8 (*41*) and UNR-18 (*21*). Test results can be found in the following reports:

- Asphalt Binder Content — WesTrack Technical Report UNR-14 (*39*)
- Aggregate Gradation — WesTrack Technical Report UNR-21 (*40*)
- Volumetrics — WesTrack Technical Report UNR-8 (*41*)

The samples for most of the HMA QC/QA testing were obtained from the haul at the hot-mix plant as shown in Figure 77.

3.5.1 Asphalt Binder Content

Asphalt binder contents were determined during construction by the FHWA's MRL and HLA. Ignition ovens and nuclear test methods were used. The asphalt binder contents obtained by the FHWA are contained in WesTrack Technical Report UNR-14 (*39*). Asphalt binder contents obtained from core samples and determined by HLA have been corrected with an ignition oven calibration factor based on an extensive testing and evaluation program and are reported in WesTrack Technical Report UNR-15 (*42*).

The asphalt binder content QC information guided the process control associated with the production of the HMA. Typically, the asphalt binder contents determined by the ignition and nuclear methods were greater than the target values used to set the HMA plant. In general, the asphalt binder contents determined by the nuclear device were greater than the asphalt binder contents reported by the use of the ignition oven (*39*).

The asphalt binder contents determined as part of the QC process were judged to be incorrect (because of incorrect calibration factors) and are not reported in this report but are contained in WesTrack Technical Report UNR-14 (*39*). Asphalt binder contents used for model development are those associated with the QA testing program and are contained in WesTrack Technical Report UNR-15 (*42*) and reported herein.

3.5.2 Aggregate Gradation

Aggregate gradations were measured during construction by the FHWA's MRL and HLA. Gradations were performed on selected cold feed samples during construction. Testing of all cold feed samples was completed after construction by HLA.

Gradations were also measured after ignition testing by FHWA and HLA. The samples used for ignition oven testing by the FHWA were obtained from the haul vehicles. One sample per section was typically tested during construction. The ignition oven samples tested by HLA were obtained from cores. Five samples were obtained per section and tested by HLA. These data were used to adjust the hot-mix plant cold feeds during construction.

Test results from FHWA and HLA for cold feed samples and ignition oven samples are reported in WesTrack Technical Report UNR-21 (*40*). Data comparisons between sample locations are reported in references 40 and 43.

After construction, extensive testing was performed as part of the QA effort to define the influence of the ignition oven and solvent extraction procedures on aggregate gradation. Based on the information obtained from this study and reported in WesTrack Technical Report UNR-22, (*44*) the gradation information obtained from the cores was used as the QA data and for pavement performance modeling. These data are reported in Section 3.6.2 of this report.

3.5.3 Volumetric Test Results

The volumetric test results obtained during construction are reported in WesTrack Technical Report UNR-8 (*41*) and discussed below. These test results were not used for performance modeling purposes because corrections in asphalt binder contents were made as part of the QA program and the volumetrics were recalculated based on the revised data and reported in WesTrack Technical Report UNR-9 (*45*).

3.5.3.1 Fine-Graded Mixture

Asphalt binder content, theoretical maximum specific gravity of the mixture, and mixture volumetrics of field-mixed/laboratory-compacted (FMLC) samples are reported for the fine-graded mixture placed on the test lane in Table 96. In general, an increase in measured asphalt binder content was noted as the target asphalt content increased. As expected, the theoretical maximum specific gravity decreased, the air void content decreased, and the voids filled with asphalt (VFA) increased with an increase in measured asphalt binder content.

An examination of data for the fine-graded mixtures with optimum asphalt binder content (Table 96) (sections 1, 4, 15, and 17) indicates an air void content on the high side of the 3 to 5 percent requirement, voids in the mineral aggregate (VMA) above the 13 minimum requirement, and VFA on the low side of the desired range of 65 to 75. Data were obtained by the FHWA MRL as well as by Brent Rauhaut Engineering as part of NCHRP Project 9-7.

3.5.3.2 Fine-Plus-Graded Mixture

Asphalt binder content, theoretical maximum specific gravity of the mixture, and mixture volumetrics of FMLC samples are reported for the fine-plus-graded mixture placed on the test lane in Table 97. In general, an increase in measured asphalt binder content was noted as the target asphalt binder content increased. As expected, the theoretical maximum specific gravity decreased, the air void content decreased, and the VFA increased with an increase in measured asphalt binder content.

The fine-plus-graded mixture was produced by adding approximately 1.5 to 2.0 percent by weight of additional baghouse fines to the fine-graded mixture. A comparison of Tables 96 and 97 indicates that when the baghouse fines were increased the air void content decreased, the VMA decreased, and the VFA increased, as expected.

An examination of data for the fine-plus-graded mixtures with optimum asphalt binder content (Table 97) (sections 11, 12, 19, and 20) indicates an air void content on the low side of the 3 to 5 percent requirement, VMA at or slightly below the 13 minimum requirement, and VFA above the desired range of 65 to 75.

3.5.3.3 Coarse-Graded Mixture

Asphalt binder content, theoretical maximum specific gravity of the mixture, and mixture volumetrics of FMLC samples are reported for the coarse-graded mixture placed on the test lane in Table 98. In general, an increase in asphalt binder content was noted as the target asphalt content increased. As expected, the theoretical maximum specific gravity decreased, the air void content decreased and the VFA increased with an increase in measured asphalt binder content.

An examination of data for the coarse-graded mixtures with optimum asphalt binder content (Table 98) (sections 5, 6, 23, and 24) indicates considerable variability in test results. The air void content is variable and exceeds the range of 3 to 5 percent air voids. The VMA is mostly above 13 for the bottom lift and below 13 for the top lift. The VFA is highly variable with 2 of 8 values outside the desired range of 65 to 75. It should be noted that Superpave gyratory compactor problems were noted during the placement of the top lift of the coarse-graded mixture. The possible impact of these problems on the mixture volumetrics reported in Table 98 is not known.

3.5.3.4 Summary

Tables 96, 97, and 98 present the QC volumetric data obtained during construction for the test lane. These data were used to adjust the gradations, asphalt binder contents, and mixture volumetrics during construction. These data should not be used for performance modeling because corrections have been made based on adjustments in asphalt binder contents using solvent extraction as a referee method. WesTrack Technical Report UNR-9 (*45*) or the QA information for original construction presented below should be used for the corrected volumetric information.

3.6 HOT-MIX ASPHALT QUALITY ASSURANCE—ORIGINAL CONSTRUCTION

The QA sampling and test plan for original construction is detailed in WesTrack Technical Report UNR-18 (*21*). Test results can be found in the following reports:

- Asphalt Binder Content — WesTrack Technical Report UNR-15 (*42*)
- Aggregate Gradation — WesTrack Technical Report UNR-22 (*44*)
- Volumetrics — WesTrack Technical Report UNR-9 (*45*)

3.6.1 Asphalt Binder Content

An extensive QA program was conducted to accurately determine the asphalt binder content in the WesTrack sections. Details of this testing program can be found in WesTrack Technical Report UNR-15 (*42*) and references 46, 47, and 48. The major effort of the study was to define a "correct" ignition oven "calibration factor." This included the testing of laboratory-prepared mixtures at different gradations, with and without hydrated lime and with and without asphalt binder. Mixture samples from selected test sections and laboratory-prepared samples were also extensively tested with the use of a solvent extraction method as a referee method.

Asphalt binder content data resulting from this QA test program are contained in Tables 99, 100, and 101 for the fine-, fine-plus-, and coarse-graded mixtures, respectively. In general, five samples were used to develop the statistical data reported for each test section. The top and bottom lift data are reported separately. The asphalt binder content variability information presented for the individual sections is very low (for most sections) as compared with typical construction QC/QA data.

3.6.2 Aggregate Gradation

Extensive testing was performed as part of the QA program to define the effect of performing the ignition test prior to determining aggregate gradation. The results of this study are reported in WesTrack Technical Report UNR-22 (*44*) and references 46, 47, and 48. The major effort of the study was to define a correction factor for aggregate gradation resulting from the use of the ignition oven. This study included the testing of laboratory-prepared mixtures at different gradations with and without hydrated lime and with and without asphalt binder. Mixture samples from the selected test sections and laboratory-prepared samples were also extensively tested with the use of a solvent extraction method as a referee method.

Based on this study, a suitable correction factor could not be determined for aggregate gradation adjustments because consistent changes in gradations were not noted when post-ignition gradations were compared with pre-ignition test gradations. Gradations on the core samples obtained and tested as part of the QC effort were used as the QA data for the project.

Tables 102 and 103 contain aggregate gradation information obtained on the core samples taken during construction and tested by the ignition test for asphalt binder content and gradation. The data are available for both the top lift (Table 102) and the bottom lift (Table 103) by section number for each individual sieve. Statistical information including mean, standard deviation, coefficient of variation, and number of samples is shown in the tables for all sieve sizes by section.

Tables 104 through 109 contain a summary of the aggregate gradation by section. Average values for gradation by sieve size are shown for the top and bottom lifts of the fine-, fine-plus-, and coarse-graded mixtures. Multiple sections of the fine, fine plus, and coarse mixtures were placed on a given day during construction. Thus, the aggregate gradation information can be summarized for a given construction day because the plant aggregate cold feeds were not changed during the day. Tables 110 through 112 compare the top and bottom lift average gradations for a given construction day.

These average gradations and the statistics are compared with the target gradations for the fine-, fine-plus-, and coarse-graded mixtures.

3.6.3 Volumetric Test Results

The volumetric properties of the WesTrack mixtures were determined on samples of HMA obtained from the trucks at the hot-mix plant area. The bulk samples of hot-mix were stored in sealed metal buckets in the LTPP MRL until tested. Five sample locations per lift per section were obtained during construction. Two gyratory compaction and two theoretical maximum specific gravity specimens were split from each sample location for testing. A Pine Instruments Superpave Gyratory Compactor was used to compact all samples in the QA testing program. The same model Pine Instruments compactor was used in the mixture design process and for QC testing.

In addition to the bulk specific gravity of the compacted specimens and the theoretical maximum specific gravity of the loose mixes, several other material properties are needed to establish volumetric properties. QA asphalt binder contents reported above and blended aggregate bulk specific gravity (reported above and identical to those used for mixture design purposes) were used in the volumetric calculations. The specific gravity of the asphalt cement reported by the supplier and verified during and after construction was used.

A total of 520 specimens were compacted and tested. The samples represent five samples per lift per test section. The testing was performed by HLA. Data are reported for the following properties in WesTrack Technical Report UNR-9 (*45*):

- Asphalt binder content (percent).
- Theoretical maximum specific gravity of HMA (Rice).
- Percent air voids.
- Percent VMA.
- Percent VFA.
- Percent compaction at initial number of gyrations (Gmmi).
- Percent compaction at design number of gyrations (Gmmd).
- Percent compaction at maximum number of gyrations (Gmmm).
- Filler-to-asphalt (F/A) ratio or dust-to-binder ratio.

3.6.3.1 Fine-Graded Mixture

Asphalt binder content, theoretical maximum specific gravity of the mixture, mixture volumetrics, and filler-to-asphalt ratio are reported for the fine-graded mixtures placed on the test lanes in Table 113 for the top lift and Table 114 for the bottom lift. Individual test results upon which these summary statistics are based are contained in Appendix A of WesTrack Technical Report UNR-9 (*45*). The relationship between air void content and asphalt binder content is shown in Figures 78 and 79 for the top and bottom lifts of the fine-graded mixture. An increase in measured asphalt binder content was noted as the target asphalt binder content was increased. In general, the theoretical maximum specific gravity decreased; the air void content decreased (Figures 78 and 79); the VFA increased; and the values of Gmmi, Gmmd, and Gmmm increased with an increase in measured asphalt binder content.

An examination of the data for the fine-graded mixtures with optimum asphalt binder content (Tables 113 and 114—sections 1, 4, 15, and 17), indicates an air void content on the high side of the 3 to 5 percent requirement, VMA above the 13 minimum requirement, and VFA mostly in the desired range of 65 to 75.

3.6.3.2 Fine-Plus-Graded Mixture

Asphalt binder content, theoretical maximum specific gravity of the mixture, mixture volumetrics, and filler-to-asphalt ratio are reported for the fine-plus-graded mixtures placed on the test lanes in Table 115 for the top lift and Table 116 for the bottom lift. Individual test results upon which these summary statistics are based are contained in Appendix A of WesTrack Technical Report UNR-9 (*45*). The relationship between air void content and asphalt binder content is shown in Figures 80 and 81 for the top and bottom lifts of the fine-plus-graded mixture. An increase in measured asphalt binder content was noted as the target asphalt binder content was increased. In general, the theoretical maximum specific gravity decreased; the air void content decreased (Figures 80 and 81); the VFA increased; and the values of Gmmi, Gmmd, and Gmmm increased with an increase in measured asphalt binder content.

An examination of the data for the fine-plus-graded mixtures with optimum asphalt binder content (Tables 115 and 116—sections 11, 12, 19, and 20), indicates an air void content below the 3 to 5 percent requirement, VMA below the 13 minimum requirement, and VFA above the desired range of 65 to 75.

The fine-plus-graded mixture was produced by adding approximately 1.5 to 2.0 percent by weight baghouse fines to the fine-graded mixture. A comparison of the data in Tables 113 and 116 for the two mixtures indicates that when the baghouse fines were increased, the air void content decreased (compare Figures 78 and 79 with Figures 80 and 81), the VMA decreased (1.5 to 2 percentage points), and the VFA increased (10 to 15 percentage points).

3.6.3.3 Coarse-Graded Mixture

Asphalt binder content, theoretical maximum specific gravity of the mixture, mixture volumetrics, and filler-to-asphalt ratio are reported for the coarse-graded mixture placed on the test lane in Table 117 for the top lift and Table 118 for the bottom lift. Individual test results upon which these summary statistics are based are contained in Appendix A of WesTrack Technical Report UNR-9 (*45*). The relationship between air void content and asphalt binder content is shown in Figures 82 and 83 for the top and bottom lifts of the coarse-graded mixture. An increase in measured asphalt binder content was noted as the target asphalt binder content was increased. In general, the theoretical maximum specific gravity decreased; the air void content decreased (Figures 82 and 83); the VFA increased; and the values of Gmmi, Gmmd, and Gmmm increased with an increase in measured asphalt binder content.

An examination of the data for the coarse-graded mixtures with optimum asphalt binder content (Tables 117 and 118—sections 5, 6, 23, and 24) indicates an air void content in the range of 2.5 to 3.5 percent for the top lift and 4 to 5 percent range for the bottom lift; VMA at the 12 percent level for the top lift and above the 13 minimum requirement for the bottom lift; and VFA on the high side of the desired range of 65 to 75 for the top lift and in the desired range for the bottom lift.

3.6.3.4 Summary

The volumetric QA data presented in Tables 112 through 118 represent the data that should be used for pavement performance modeling and are the "official" WesTrack volumetric information produced from FMLC samples.

Plots of percent air voids versus asphalt binder content (Figures 78 through 83) show the expected trends for all mixes. The percent air voids at the optimum asphalt binder content level were within 1.0 to 1.5 percent of the mix design target of 4.0 percent for the fine- and coarse-graded mixtures (Table 119). A decrease in air voids was observed from the bottom lift to the top lift for most of the mixtures (Table 119). This decrease in air void content was largely due to the increased amount of material passing the 0.075-mm (No. 200) sieve incorporated in the top lift versus the bottom lift. This trend was most obvious for the coarse-graded mixture.

The variability of the volumetric data associated with the coarse-graded mixture test results was more than double that observed for the fine- and fine-plus-graded mixtures. When a conservative outlier detection procedure was applied to the data, 0.5 percent of both the fine and fine plus test results were identified as outliers. Five percent of the test results were identified as outliers when the same procedure was applied to the coarse-graded mixture data.

The trends in the volumetric data with increase in asphalt binder content and increase in minus 0.075-mm (No. 200) material are as expected. The fine plus mixture "closed-up" with the addition of baghouse fines.

3.6.4 In-Place Air Voids

In-place air void data obtained from cores removed from the pavement immediately after construction are shown in Table 129. In-place air void content data is presented for the top and bottom lift. Note that two measurements were made for the bottom lift: one measurement immediately after construction and prior to placement of the top lift and the second measurement after the placement of the top lift. A statistically significant difference in the reported in-place air void content was noted in 6 of the 26 sections. In all six cases, the air void content decreased after placement of the top lift. The change in air void content was of the order of 0.7 to 1.2 percent.

WesTrack Technical Report UNR-12 (*55*) contains individual core air void contents and thickness measurements reported by mixture number and not section number.

3.6.5 Thickness

The as-built thicknesses for the HMA placed during the original construction of WesTrack are shown in Table 120 (*55*). The target thickness was 150 mm (6 in.). Sections 24 and 26 were diamond ground to adjust the thickness to 150 mm (6 in.). Thickness data are reported at four locations per section. Thickness variations between sections are in part a result of the differences in gradation, asphalt binder content, and target in-place air voids.

3.7 HOT-MIX ASPHALT QUALITY CONTROL—REPLACEMENT SECTIONS

Prior to the start of production, the HMA plant was calibrated. This calibration included determination of cold feed rates for each aggregate, calibration of the scale belt, and calibration of the asphalt binder delivery system. During the placement of the HMA at WesTrack, additional calibrations were performed.

HMA was placed on the ramps to the test track on May 23 and May 30, 1997, to determine the constructability and to determine the gradation, asphalt binder content, and the mix volumetrics. Additional trial sections were placed on the access road to WesTrack on June 20, 1997. The amount of fines returned from the baghouse, the cold feeds, the asphalt binder content, and the roller pattern were adjusted during the placement of the trail sections.

The test lane of the track was placed in two lifts on June 23 and June 28, 1997. The test lanes are the lanes on which the traffic was placed and the WesTrack performance information obtained.

The QC sampling and test plan for the replacement sections is detailed in WesTrack Technical Report UNR-19 (*22*). Test results can be found in the following reports:

- Asphalt Binder Content — WesTrack Technical Report UNR-16 (*49*)

- Aggregate Gradation — WesTrack Technical Report UNR-23 (*50*)
- Volumetrics — WesTrack Technical Report UNR-10 (*51*)

Asphalt binder contents were determined during construction by FHWA and HLA. An ignition oven was used and was calibrated with known asphalt binder contents and with blank aggregates.

Samples of HMA were obtained from behind the paver. One sample per section was tested to determine asphalt binder content during construction. A more extensive testing program using both ignition ovens and solvent extraction techniques was performed after construction. The ignition oven was used to determine asphalt binder contents from core samples; loose HMA samples were used for solvent reflux extraction. These postconstruction data were used to develop the performance models for the project and are reported in WesTrack Technical Report UNR-17 (*52*).

WesTrack Technical Report UNR-16 (*49*) contains the QC testing results for the asphalt binder content of the coarse-graded replacement section mixtures placed at WesTrack during construction. The measured asphalt binder contents display a trend of increasing asphalt binder content as the target asphalt binder content was increased during production. The ignition oven test results were generally higher than the target values. Mixture gyratory compacted volumetrics suggested that the proper asphalt binder contents were being used during production (WesTrack Technical Report UNR-10) (*51*). The apparent conflict in data between the measured asphalt binder content, plant setting for target asphalt binder content, and FMLC volumetrics was a problem throughout the construction of the replacement sections. This suggests the need for refinements in the ignition oven calibration and testing procedure and/or developing and understanding laboratory-mixed/laboratory-compacted (LMLC) versus FMLC volumetrics.

3.7.1 Aggregate Gradation

Aggregate gradations were determined during construction by FHWA and HLA. Gradations were performed on selected cold feed samples during construction. Testing of all cold feed samples was completed after construction by HLA.

Gradations were also performed after ignition testing by FHWA and HLA. The samples used for ignition testing were obtained from behind the paver. Test results are reported in WesTrack Technical Report UNR-23 (*50*) for these QC tests. These data were used to adjust the hot-mix plant during construction.

After construction, an extensive laboratory program was initiated to determine the asphalt binder content and gradation of the sections placed during reconstruction. Additional ignition oven and solvent extraction testing was performed and is reported in WesTrack Technical Report UNR-24 (*53*). These QA data were used for performance modeling.

3.7.2 Volumetric Test Results

The volumetric test results obtained during construction are reported in WesTrack Technical Report UNR-10 (*51*). These test results should not be used for performance modeling purposes because corrections in asphalt binder contents were made as part of the QA program and the volumetrics were recalculated based on the revised data. The revised data are reported in WesTrack Technical Report UNR-11 (*54*).

Asphalt content, theoretical maximum specific gravity of the HMA, and mixture volumetrics of FMLC samples are reported for the test sections in WesTrack Technical Report UNR-10 (*51*). In general, an increase in measured asphalt binder content was noted as the target asphalt binder content increased. As expected, the theoretical maximum specific gravity decreased, the air void content decreased, and the VFA increased with an increase in measured asphalt binder content.

An examination of data for the test lane with the optimum asphalt binder content (sections 35, 36, 39, and 54) indicates an air void content between the 3 to 5 percent requirement, VMA in a range of 15 to 16 (minimum of 13 required), and VFA within the desired range of 65 to 75.

3.8 HOT-MIX ASPHALT QUALITY ASSURANCE—REPLACEMENT SECTIONS

The QA sampling and test plan for replacement section construction is detailed in WesTrack Technical Report UNR-19 (*22*). Test results can be found in the following reports:

- Asphalt Binder Content — WesTrack Technical Report UNR-17 (*52*)
- Aggregate Gradation — WesTrack Technical Report UNR-24 (*53*)
- Volumetrics — WesTrack Technical Report UNR-11 (*54*)

3.8.1 Asphalt Binder Content

An extensive QA program was conducted to accurately determine the asphalt binder content in the WesTrack sections. Details of this testing program can be found in WesTrack Technical Report UNR-17 (*52*) and reference 48. The major efforts of the study were to define an ignition oven "calibration factor" and to determine the asphalt content by use of the solvent (reflux) method. Determining the asphalt binder content was not as simple as originally anticipated. As stated above, both ignition and solvent (reflux) methods were used after construction was completed. HLA and UNR both performed a significant amount of asphalt binder calibration testing on loose mixtures. Regardless of the ignition calibration procedure employed (blank aggregate versus known asphalt), bias existed in the asphalt binder content data established with the ignition oven. The "known" asphalt binder content method (calibration based on testing HMA samples at known asphalt binder contents), which is currently recommended by AASHTO, showed significant bias. The same finding was observed on the original construction of WesTrack.

The reflux method showed no bias and lower variability than the ignition method. Some states have also indicated that the reflux method is more reliable and consistent with typical plant operations. Therefore, the asphalt binder content data obtained using the reflux method on loose hot-mix samples obtained from behind the paver were selected as the QA data for the WesTrack replacement sections. These asphalt binder content data are summarized in Table 121 for each section for both the top and bottom lifts. Individual sample asphalt contents and summary statistics are shown in Tables 122 and 123.

For the mixtures with the optimum asphalt binder contents (sections 35, 36, 39, and 54), the asphalt binder content was near the target value of 5.8 for the bottom lift and 0.1 to 0.3 percentage points high for the top lift (Table 121). For the low asphalt binder content mixtures in the bottom lift, the asphalt binder contents were 0.1 to 0.2 percentage points higher than the 5.2 percent target value. For the high asphalt binder content mixtures in the bottom lift, the asphalt binder contents were 0.5 percentage points lower than the target value of 6.4 percent.

For the low asphalt binder content mixtures in the top lift, the asphalt binder contents were 0.3 to 0.8 percentage points higher than the 5.2 percent target value. For the high asphalt binder content mixtures in the top lift, the asphalt binder contents were 0.3 to 0.4 percentage points lower than the target value of 6.4 percent. The desired separation of asphalt binder contents among the low, optimum, and high asphalt binder contents was not achieved, that is, asphalt binder contents on seven of the eight replacement mixes did not differ significantly from each other.

The asphalt binder content variability information presented for the individual sections is very low (for most sections) as compared with typical construction QC/QA data. Thirteen of the sixteen reported standard deviations are lower than 0.30.

3.8.2 Aggregate Gradation

Based on the extensive calibration study contained in WesTrack Technical Report UNR-24 (*53*), the decision was made to use the aggregate gradations obtained from the loose mix samples collected from behind the paving machine after ignition oven testing. This decision was based on several factors discussed below.

An attempt was made to establish an ignition oven correction factor for the aggregate gradations used in the replacement section mixtures. This investigation included defining the difference between the target gradation and the ignition oven gradation and the difference between the reflux extraction gradation and the ignition oven gradation. It was not possible to obtain a correction factor by performing regression analyses on these differences. The differences were not consistent in magnitude nor direction from the target value. This same result was obtained with the original construction samples (WesTrack Technical Report UNR-22) (*44*).

The calibration study indicated that the aggregate gradation was not significantly affected by the ignition oven. The differences between the target values and the ignition oven calibrations and between the reflux gradations and the ignition oven gradations were small in comparison with the test method variability.

From the standpoint of thermal breakdown of aggregates in the ignition test, it may be desirable to use the reflux extraction method to determine asphalt binder content and aggregate gradation. But, environmental, health, and safety problems with solvent and the time required to perform the test have greatly reduced the use of the reflux test for asphalt binder content and aggregate gradation determination.

For the replacement sections, a total of five samples were tested with the reflux extractor from each section, providing a large database from which to determine asphalt gradation. An equal number of samples were tested for each section for gradation after the ignition asphalt binder content determinations. Because the gradation results after the two different binder content determinations did not differ significantly, gradation information after either could be used with equal confidence. The decision was made to use the gradation information after ignition oven testing to be consistent with the test methods used for the HMA placed during original construction of WesTrack.

Tables 124 and 125 contain aggregate gradation information obtained on the loose mix samples taken from behind the laydown machine during construction and tested with the ignition test for asphalt binder content and gradation. The data are available for both the top (Table 124) and bottom (Table 125) lifts by section number for each individual sieve. Statistical information including mean, standard deviation, coefficient of variation, and number of samples is shown in the tables for the combined gradations from all the sections. Reference 48 contains individual sample test results for each section and individual gradation statistics for both top and bottom lifts.

3.8.3 Volumetric Test Results

The QA volumetric properties of the WesTrack mixtures were determined on samples of HMA obtained from the trucks at the hot-mix plant area. The bulk samples of hot-mix were stored in sealed metal buckets in the LTPP MRL until tested. QA testing started soon after construction was completed.

Five samples were obtained per lift per section during construction. Two gyratory compaction and two theoretical maximum specific gravity specimens were split from each sample location for testing. A Pine Instruments Superpave Gyratory Compactor was used to compact all samples in the QA testing program. A Troxler Superpave Gyratory Compactor was used in the mix design and QC operations. However, an extensive experiment was conducted beforehand which indicated that no significant difference was exhibited in the bulk specific gravities of specimens compacted with each device.

In addition to the bulk specific gravity of the compacted specimens and the theoretical maximum specific gravity of the loose mixes, several other material properties were needed to establish volumetric properties. QA asphalt binder contents reported above and blended aggregate bulk specific gravity (reported above and identical to those used for mixture design purposes) were used in the volumetric calculations. The specific gravity of the asphalt cement reported by the supplier and verified during and after construction was used.

A total of 160 specimens were compacted and tested. The samples represent five samples per lift per test section. The testing was performed by the UNR. Data are reported for the following properties in WesTrack Technical Report UNR-11 (*54*):

- Asphalt binder content.
- Theoretical maximum specific gravity of HMA.
- Percent air voids.
- Percent VMA.
- Percent VFA.
- Percent compaction at initial number of gyrations (Gmmi).
- Percent compaction at design number of gyrations (Gmmd).
- Percent compaction at maximum number of gyrations (Gmmm).
- Filler-to-asphalt ratio.

Asphalt binder content, theoretical maximum specific gravity of the mixture, mixture volumetrics, and filler-to-asphalt ratio are reported for the coarse-graded replacement mixture placed on the test lane in Table 126 for the top lift and Table 127 for the bottom lift. Individual test results upon which these summary statistics are based are contained in Appendix A of WesTrack Technical Report UNR-11 (*54*). The relationship between air void content and asphalt binder content is shown in Figures 84 and 85 for the top and bottom lifts of this coarse-graded mixture. Table 128 presents a summary of volumetric data by section with the sections arranged from low to high target asphalt binder contents. A general increase in measured asphalt binder content was noted as the target asphalt binder content increased. The reported differences in measured asphalt binder content between the low, optimum, and high contents were not as large as desired. In general, the theoretical maximum specific gravity decreased; the air void content decreased (Figures 84 and 85); the VFA increased; and the values of Gmmi, Gmmd, and Gmmm increased with an increase in measured asphalt binder content.

The data scatter reported for the coarse mixture volumetrics was larger than that reported for the fine and fine plus mixtures placed during original construction of WesTrack. Difficulties in sampling and handling the coarse mixtures probably caused this relatively high variability.

These QA data are considered to be the most representative of the volumetrics for the replacement mixtures. These data were used for performance modeling.

3.8.4 In-Place Air Voids

In-place air void content information for the replacement sections is shown in Table 130 (*56*). A comparison can be made between the target air void content (4, 8, and 12 percent) versus the actual air void content in the sections. Five core samples were taken per section to establish air void content and thickness. WesTrack Technical Report UNR-13 (*56*) contains individual core sample air void contents.

3.8.5 Thickness

The as-built thicknesses for the HMA placed during construction of the replacement section on WesTrack are shown in Table 130 (*56*). The target total thickness was 150 mm (6 in.). Five thickness measurements were made from core samples for each section. WesTrack Technical Report UNR-13 (*56*) contains individual core sample air void contents.

Figure 40. Scarification of natural soil with ripper.

Figure 41. Moisture addition to subgrade material.

Figure 42. Subgrade and engineered fill compaction.

Figure 43. Self-propelled, elevating earth movers.

Figure 44. Engineered fill pulverization.

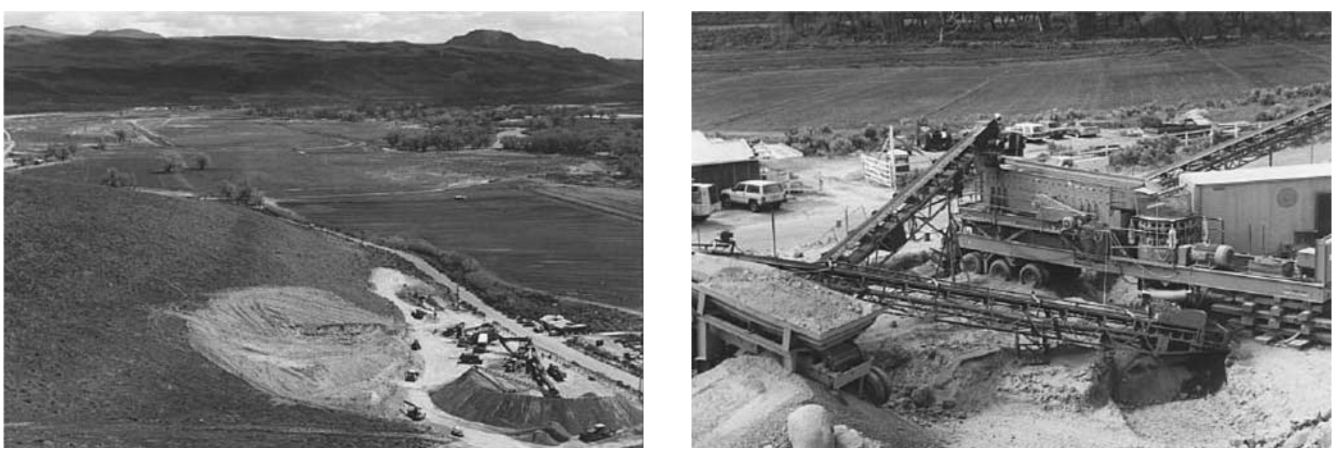

Figure 45. Base course crushing operation.

Figure 46. Base course blending operation.

Figure 47. Base course dumping operation.

Figure 48. Base course spreading operation.

Figure 49. Base course compaction operation.

Figure 50. Dayton hot-mix asphalt production plant.

Figure 51. Dayton hot-mix plant—cold feed.

Figure 52. Dayton hot-mix plant—lime addition.

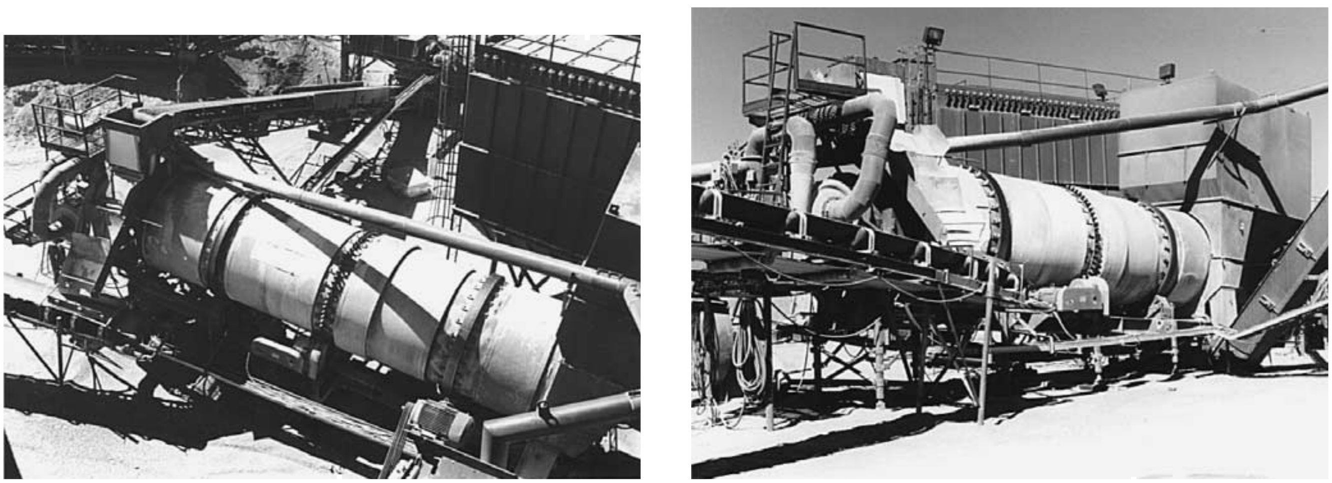

Figure 53. Dayton hot-mix plant—drum heating and mixing.

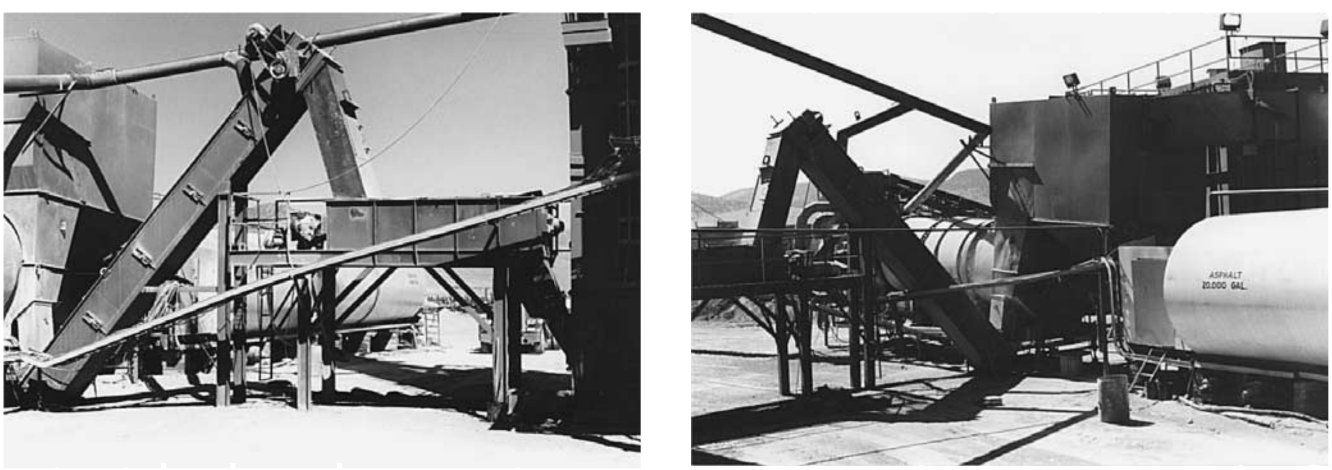

Figure 54. Dayton hot-mix plant—external mixer.

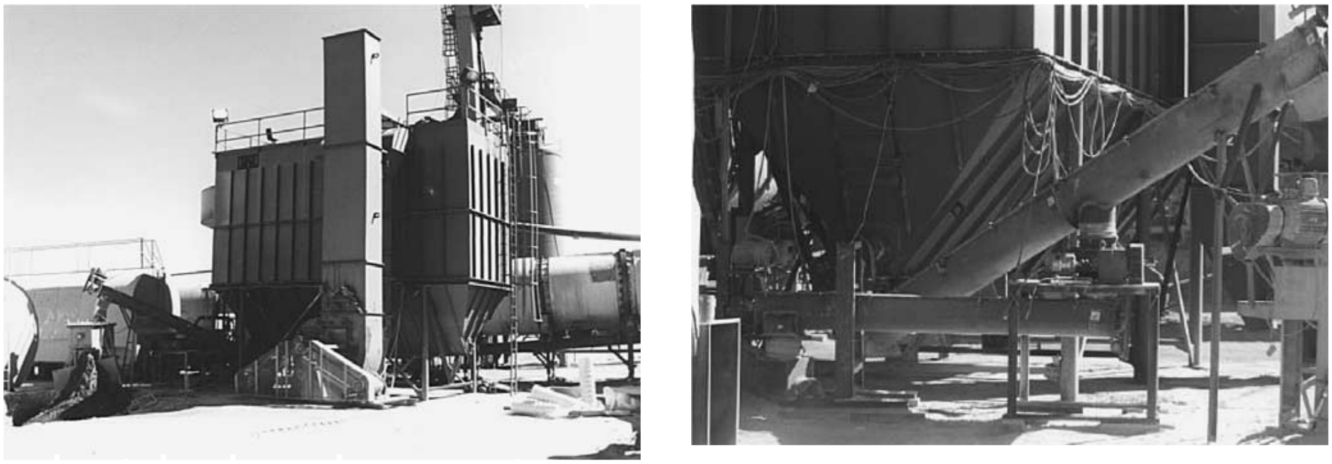

Figure 55. Dayton hot-mix plant—baghouse fines return system.

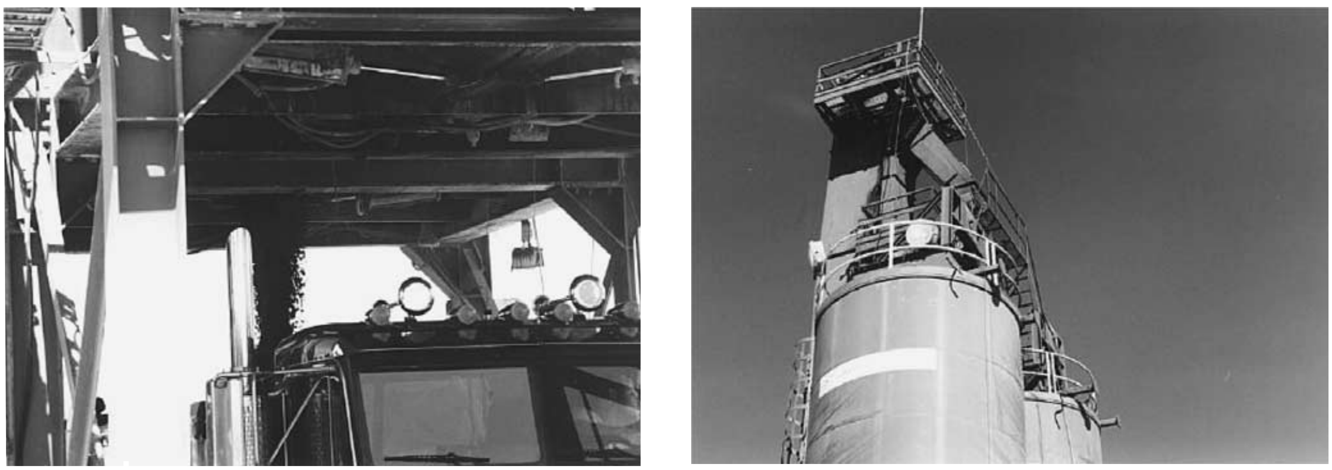

Figure 56. Dayton hot-mix plant—silo storage.

Figure 57. Hot-mix asphalt—haul units.

Figure 58. Hot-mix asphalt—laydown machine.

Figure 59. Hot-mix asphalt—material transfer device.

Figure 60. Hot-mix asphalt—breakdown roller.

Figure 61. Hot-mix asphalt—intermediate roller.

Figure 62. Hot-mix asphalt—final roller.

Figure 63. End of section removal.

Figure 64. Cold milling process.

Figure 65. Reworking base course.

Figure 66. Lockwood hot-mix asphalt production plant.

Figure 67. Lockwood hot-mix plant—cold feed.

Figure 68. Lockwood hot-mix plant—lime addition.

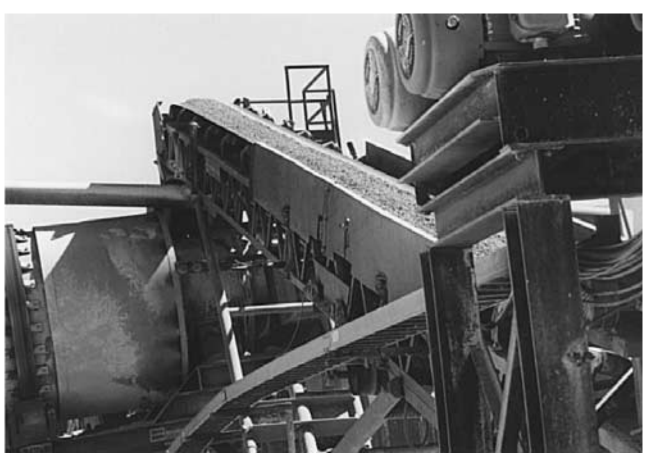

Figure 69. Lockwood hot-mix plant—drum heating and mixing.

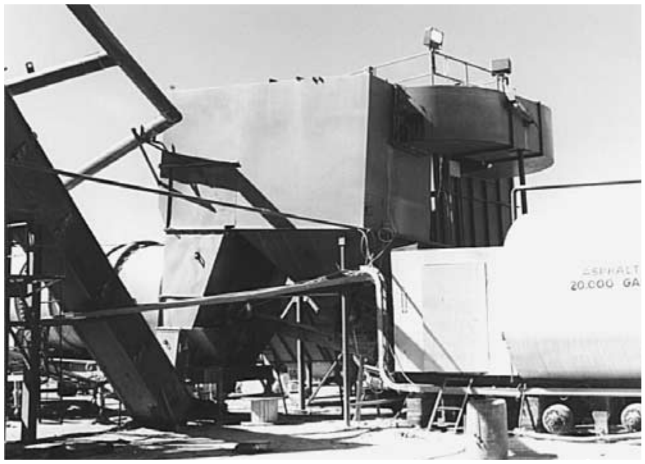

Figure 70. Lockwood hot-mix plant—baghouse fines return system.

Figure 71. Lockwood hot-mix plant—silo storage.

Figure 72. Hot-mix asphalt—haul units.

Figure 73. Hot-mix asphalt—material transfer device.

Figure 74. Hot-mix asphalt—laydown machine.

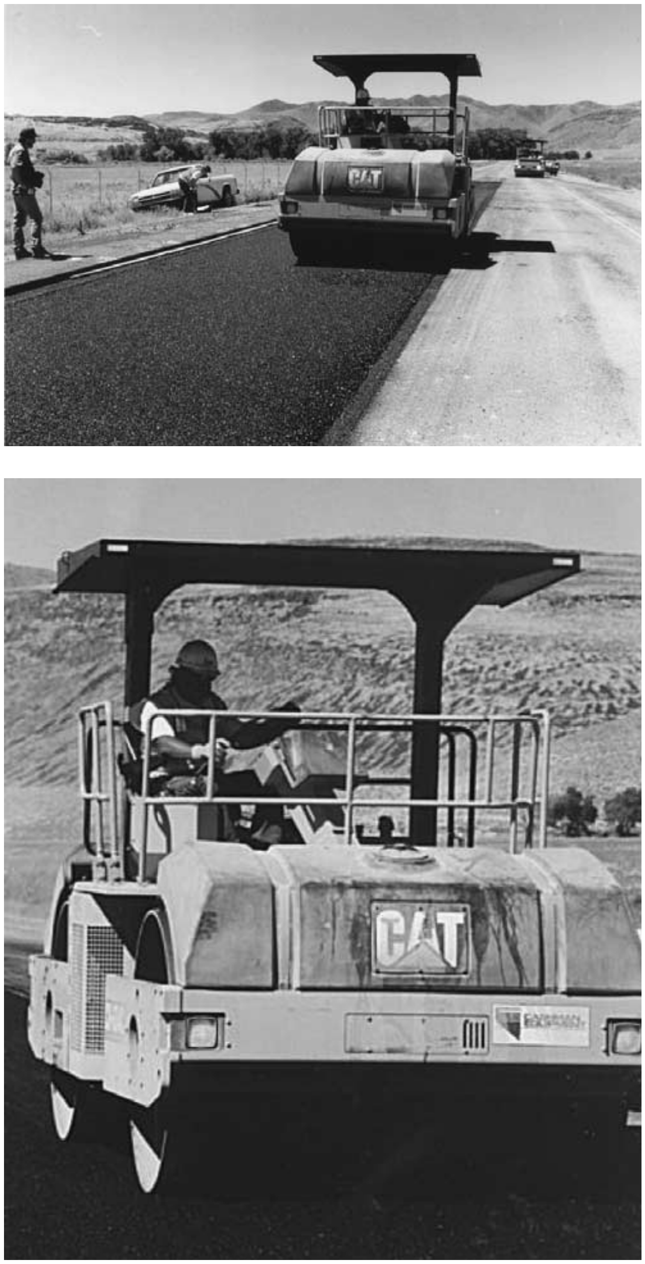

Figure 75. Hot-mix asphalt—breakdown roller.

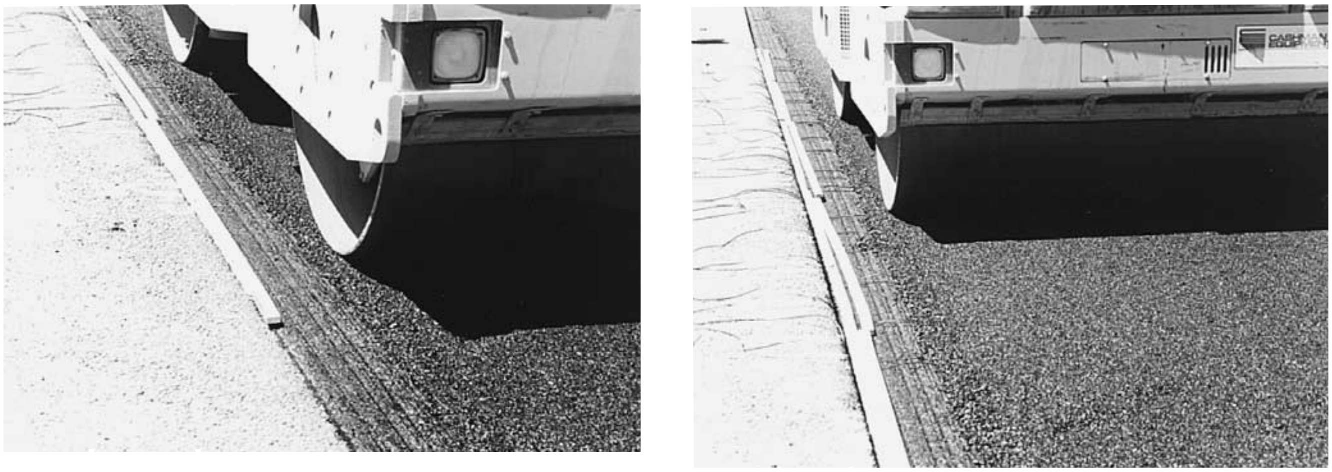

Figure 76. Hot-mix asphalt—final roller.

Figure 77. Hot-mix sampling from haul unit.

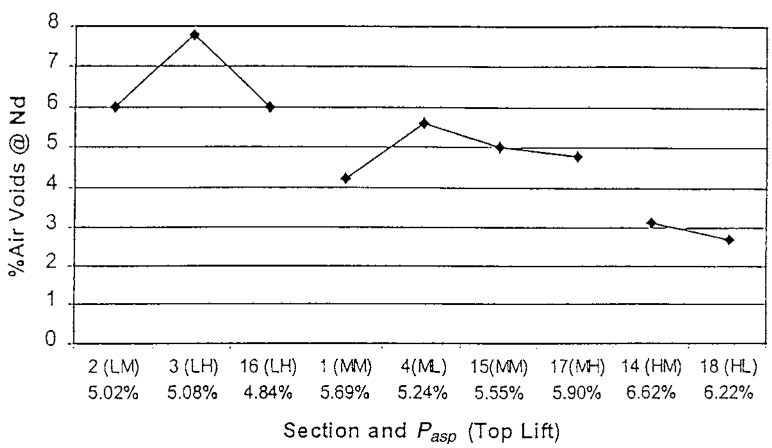

Figure 78. Fine mix top lift air voids (original construction).

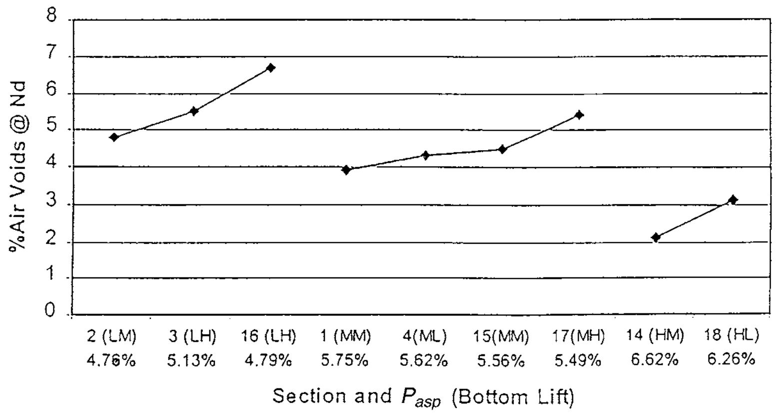

Figure 79. Fine mix bottom lift air voids (original construction).

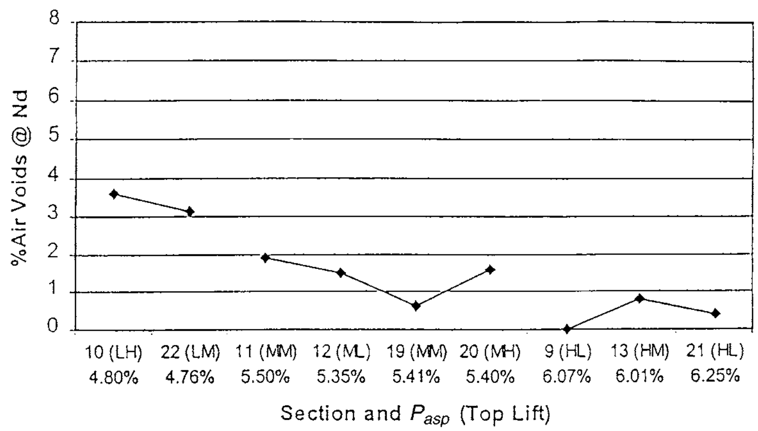

Figure 80. Fine plus mix top lift air voids (original construction).

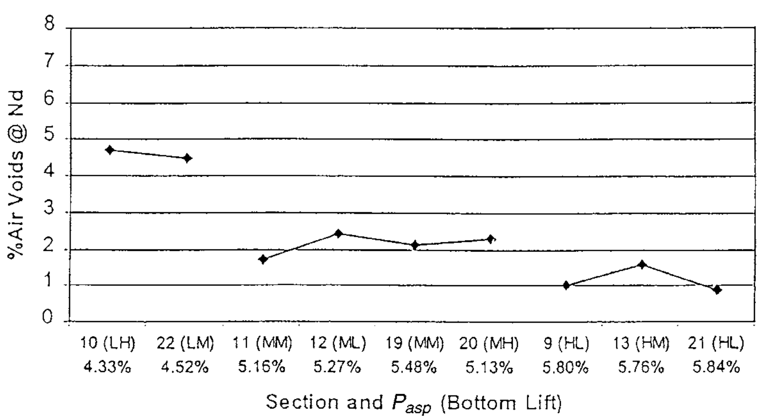

Figure 81. Fine plus mix bottom lift air voids (original construction).

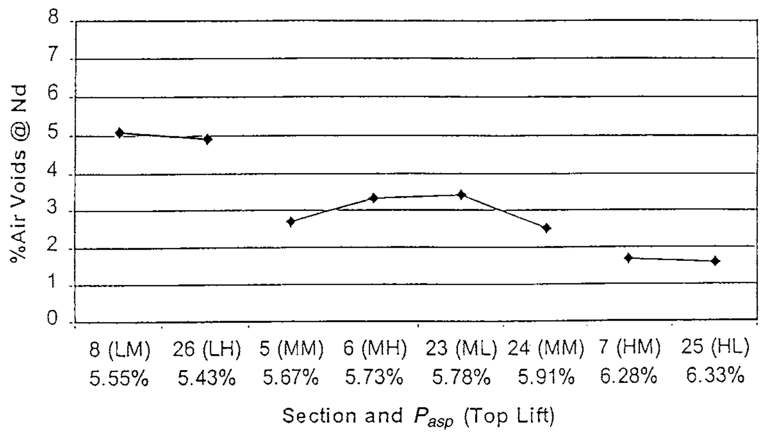

Figure 82. Coarse mix top lift air voids (original construction).

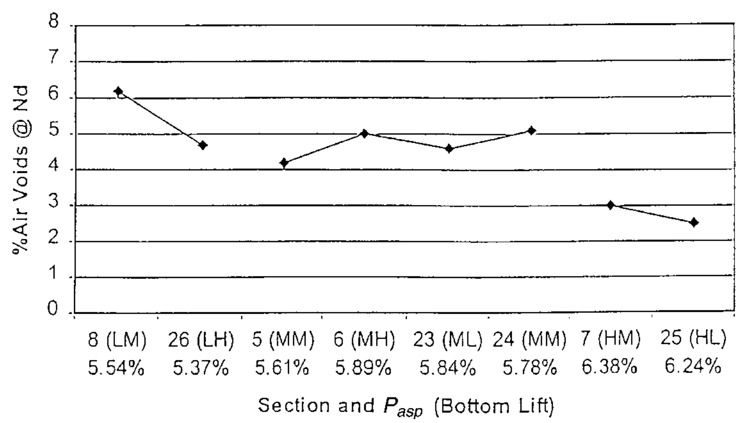

Figure 83. Coarse mix bottom lift air voids (original construction).

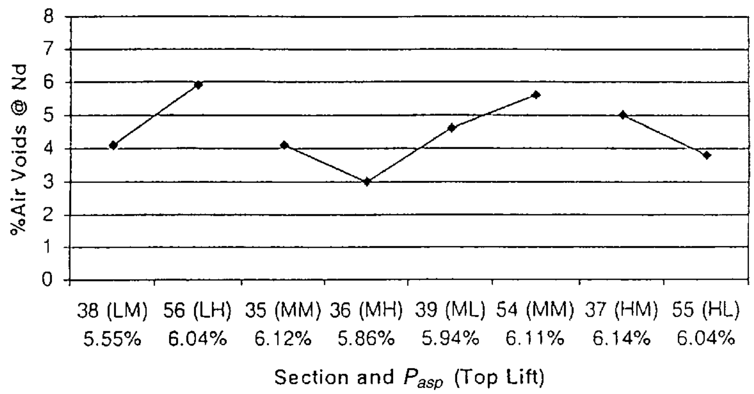

Figure 84. Replacement mixture top lift air voids.

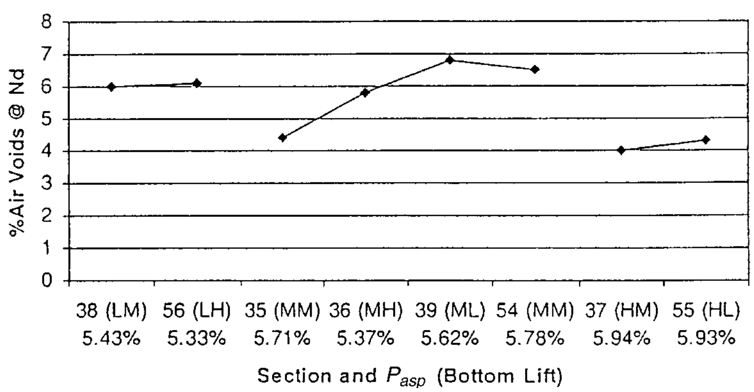

Figure 85. Replacement mixture bottom lift air voids.

TABLE 75 WesTrack activities

Date	Traffic ESAL x 10^6		Activity	Comments
	Original Sections	Replacement Sections		
October 1994			Project approved.	
January 1995			Geometric design and experimental design completed.	
May 1995			Start construction.	
May 1995 through August 1995			Fill and subgrade completed.	May 31, 1995 through August 16, 1995, dates of fill and subgrade preparation.
August 1995			Base course placement completed.	August 21, 1995 through August 31, 1995, dates of base course placement.
October 1995			HMA placement completed - original construction.	September 8, 1995 through October 7, 1995, dates of HMA placement.
March 1996	-0-		Start of traffic.	
June 1996			Open house.	
November 1996	1.46		Mill and fill five rutted sections (50 mm).	Sections 7, 9, 13, 21, and 25.
January 1997	1.79		Carson River flood.	
June 1997	2.77	-0-	Construction of replacement sections.	May 23, 1997 through June 28, 1997. Remove sections - 5, 6, 7, 8, 9, 13, 21, 24, 25, and 26. Replace with 35, 36, 37, 38, 39, 43, 51, 54, 55, and 56.
October 1997	3.4	0.58	Mill sections with rutting and roughness (25 mm) (wheelpaths only).	Sections 2, 3, 36, 37, 54, 55, and 56.
January 1998	4.1	1.28	Cold patchings.	
March 1998	4.4	1.6	Mill and fill in wheelpaths (50 mm) or patch with special cold mix (section 2).	Left wheelpath 2, 3, and 10.
March 1999	5.0	2.23	Trafficking completed.	

1 in. = 25.4 mm

TABLE 76 Construction activities—subgrade and engineered fill and base course

Date	Activity	Comments
May 31, 1995 through June 14, 1995	Place and compact layer 1 of subgrade and engineered fill.	
June 2, 1995 through June 23, 1995	Place and compact layer 2 of subgrade and engineered fill	
June 21, 1995 through July 7, 1995	Place and compact layer 3 of subgrade and engineered fill	
August 4, 1995 through August 16, 1995	Place and compact layer 4 of subgrade and engineered fill	
August 21, 1995 through August 28, 1995	Place and compact layer 1 of base course.	
August 29, 1995 through August 31, 1995	Place and compact layer 2 of base course.	

TABLE 77 Construction schedule for original construction

Date	Mixture	Lift	Lane	Section Numbers*
9-14-95	Fine	Bottom	Trial	1, 2, 3, 4, 14, 15, 16, 17, and 18
9-15-95	Fine plus	Bottom	Trial	19, 20, 21, 22, 9, 10, 11, 12, and 13
9-16-95	Coarse	Bottom	Trial	5, 6, and 7
9-18-95	Coarse	Bottom	Trial	8, 23, 24, 25, and 26
9-20-95	Fine	Bottom	Test	1, 2, 3, 4, 14, 15, 16, 17, and 18
9-21-95	Fine plus	Bottom	Test	19, 20, 21, 22, 9, 10, 11, 12, and 13
9-22-95	Fine	Top	Trial	1, 2, 3, 4, 14, 15, 16, 17, and 18
9-27-95	Fine plus	Top	Trial	19, 20, 21, 22, 9, 10, 11, 12, and 13
9-27-95	Fine plus	Bottom	Test	13
9-30-95	Coarse	Bottom	Test	5, 6, 7, 8, 23, 24, 25, and 26
10-1-95	Coarse	Top	Trial	5, 6, 7, 8, 23, 24, 25, and 26
10-2-95	Fine	Top	Test	1, 2, 3, 4, 14, 15, 16, 17, and 18
10-3-95	Fine plus	Top	Test	19, 20, 21, 22, 9, 10, 11, 12, and 13
10-4-95	Coarse	Top	Test	5, 6, 7, 8, 23, 24, 25, and 26

*Section numbers follow order of placement.

TABLE 78 Construction schedule for replacement sections

Date	Lift	Lane	Section Numbers
5-23-97	Bottom	Trial	35, 37, 38, 39, 55, and 56
5-30-97	Top	Trial	35, 37, 38, 39, 55, and 56
6-20-97	Bottom	Trial*	A, B, and C
6-23-97	Bottom	Test	35, 36, 37, 38, 39, 54, 55, and 56
6-28-97	Top	Test	35, 36, 37, 38, 39, 54, 55, and 56

*Access road.

TABLE 79 WesTrack summary of relative density for subgrade and engineered fill

	Subgrade Lift (Relative Density in percent)											
	1			2			3			4		
Section	**Mean**	**Std.**	**PWL**	**Mean**	**Std.**	**PWL**	**Mean**	**Std.**	**PWL**	**Mean**	**Std.**	**PWL**
1	88.30	0.96	9.72	91.18	1.58	85.38	91.92	1.16	100.00	93.76	1.16	100.00
2	89.90	3.35	47.35	93.96	0.77	74.26	92.00	1.16	100.00	93.80	1.81	87.05
3	91.60	2.63	63.69	92.34	1.52	94.56	93.58	2.25	64.12	93.96	1.84	85.95
4	91.10	2.97	58.21	91.06	2.56	63.70	92.18	1.92	83.40	93.26	1.48	88.71
5	92.16	2.13	76.52	91.32	1.32	93.67	91.46	0.81	100.0	92.94	1.28	87.07
6	93.44	1.78	70.61	90.66	0.69	98.98	91.14	2.01	76.79	93.50	1.29	96.95
7	90.58	1.76	71.28	93.16	1.17	87.63	92.72	2.45	66.94	93.68	1.78	87.42
8	91.56	1.64	91.54	90.32	1.72	66.53	91.72	2.43	68.56	93.38	1.15	98.58
9	86.90	4.01	27.72	91.00	2.03	74.79	91.28	1.63	86.24	93.60	1.85	84.66
10	92.92	1.70	81.23	91.50	1.77	86.30	92.50	1.93	81.65	92.76	0.54	100.00
11	89.84	1.28	45.73	91.66	1.71	89.64	92.78	1.72	83.64	94.20	1.30	99.94
12	91.14	1.45	76.85	91.66	1.67	90.88	91.78	1.27	100.00	94.60	1.17	98.13
13	92.46	1.93	81.67	90.76	1.80	74.26	92.18	2.29	72.10	93.42	0.95	87.35
14	89.84	1.51	57.81	90.54	1.55	72.94	93.62	0.94	81.54	93.08	1.69	81.54
15	91.42	1.40	93.44	90.16	3.22	49.85	92.64	1.05	96.01	93.74	1.51	95.81
16	93.08	2.69	60.75	90.10	1.40	64.81	91.32	1.47	90.03	94.20	2.32	71.51
17	93.50	1.04	82.14	90.80	1.74	75.56	91.30	1.33	92.98	93.76	0.84	100.00
18	94.04	0.85	93.80	93.28	2.14	69.82	93.40	0.62	99.98	92.34	0.42	100.00
19	92.74	1.60	86.52	91.48	1.11	99.98	92.78	1.53	87.07	91.86	1.57	57.81
20	91.32	1.40	91.54	91.42	0.51	94.56	91.54	1.43	94.56	92.92	0.39	100.00
21	91.54	2.75	61.23	92.24	1.61	93.46	90.88	1.16	88.71	93.34	1.53	89.24
22	91.34	1.68	86.24	93.34	1.15	83.64	93.46	0.67	97.31	93.70	1.51	95.19
23	92.80	2.10	77.53	90.78	0.98	91.79	92.58	1.64	88.44	93.28	1.66	85.67
24	89.74	3.08	49.44	92.44	1.53	92.75	90.74	1.13	86.24	94.00	1.64	93.16
25	88.20	3.11	35.54	91.94	1.70	90.97	92.94	1.70	89.93	93.36	1.97	79.65
26	91.42	0.98	100.00	92.04	1.96	82.08	93.10	1.08	91.54	93.60	1.12	100.00
Average	**91.26**	**1.99**	**68.39**	**91.58**	**1.57**	**82.42**	**92.21**	**1.49**	**86.88**	**93.46**	**1.38**	**90.44**

TABLE 80 Engineered fill lift 1

Section Number	Liquid Limit AASHTO T 89-93	Plasticity Index AASHTO T 90-92	CBR, % (value at in-place density) AASHTO T 193-92	Resistance (R-Value) AASHTO T190-93	Soil Classification AASHTO M 145
1					
2	40	19			A-6
3	37	20	4	5	A-6
4					
5	37	15	11	8	A-6
6					
7					
8	36	14	7	8	A-6
9					
10	47	26	5	<5	A-7-6
11					
12					
13	44	25	10	5	A-7-6
14					
15					
16	33	13	9	<5	A-6
17					
18	40	20			A-6
19					
20	34	16	11	<5	A-6
21					
22	36	18			A-6
23					
24	40	21	5	<5	A-6
25	42	22			A-7-6
26					

TABLE 81 Engineered fill lift 2

Section Number	Liquid Limit AASHTO T 89-93	Plasticity Index AASHTO T 90-92	CBR, % (value at in-place density) AASHTO T 193-92	Resistance (R-Value) AASHTO T190-93	Soil Classification AASHTO M 145
1					
2	42	21			A-7-6
3					
4					
5	38	20			A-6
6					
7	32	13			A-6
8					
9	31	13	2	<5	A-6
10					
11					
12					
13	NA	NA	18	60	A-2-4
14	30	11			A-6
15					
16	37	19			A-6
17	37	19	4	<5	A-6
18	36	19	2	<5	A-6
19	40	22			A-6
20					
21					
22					
23					
24					
25	47	25	4	<5	A-7-6
26					

TABLE 82 Engineered fill lift 3

Section Number	Liquid Limit AASHTO T 89-93	Plasticity Index AASHTO T 90-92	CBR, % (value at in-place density) AASHTO T 193-92	Resistance (R-Value) AASHTO T190-93	Soil Classification AASHTO M 145
1					
2	39	19	5	<5	A-6
3					
4					
5					
6					
7					
8	35	16	3	<5	A-6
9	46	25	3	<5	A-7-6
10					
11	47	32	4	<5	A-7-6
12	47	26			A-7-6
13	45	21			A-7-6
14	47	27			A-7-6
15	48	28	4	<5	A-7-6
16					
17					
18					
19					
20					
21	40.0	22.0	2.0	<5	A-6
22	39	20	3	<5	A-6
23					
24	35	17			A-6
25					
26	36	19			A-6

TABLE 83 Engineered fill lift 4

Section Number	Liquid Limit AASHTO T 89-93	Plasticity Index AASHTO T 90-92	CBR, % (value at in-place density) AASHTO T 193-92	Resistance (R-Value) AASHTO T190-93	Soil Classification AASHTO M 145
1					
2	45	25	5	<5	A-7-6
3					
4					
5					
6					
7					
8	33	16			A-6
9	37	23			A-6
10					
11	35	19			A-6
12	34	19	3	<5	A-6
13	33	18	5	<5	A-6
14	38	19	4	<5	A-6
15	42	23			A-7-6
16					
17					
18					
19					
20					
21	38	20			A-6
22	36	19	7	<5	A-6
23					
24	39	21			A-6
25					
26	36	18	5	<5	A-6

TABLE 84 Base course and subgrade soil CBR values from U.S. Army Corps of Engineers' software, units in percent

Section	CBR Base Course			CBR Subgrade Soil		
	LTWP	CNTR	RTWP	LTWP	CNTR	RTWP
DCP Testing on November 11, 1996						
7	65	83	74	11	9	8
9	82	85	74	13	10	10
13	62	65	77	16	16	18
21	80	82	90	12	17	25
25	74	73	55	8	8	9
DCP Testing on May 23, 1997						
5	78	75	55	8	11	7
6	83	79	80	11	17	9
8	82	84	81	11	7	11
24	75	78	83	7	8	10
26	73	82	81	9	13	15
DCP Testing on September 24, 1997						
23	45	60	58	11	7	11
36	35	23	41	22	7	7
37	70	67	81	8	10	7
54	59	62	70	9	7	12
55	87	85	62	7	7	9
56	87	77	84	7	10	12
DCP Testing on April 22, 1999						
1	91	79	82	8	9	9
35	94	92	84	9	6	7
11	64	83	91	7	11	9
15	83	81	98	15	12	10
19	81	83	89	9	11	10
54	74	91	98	12	7	11

Note: RTWP = Right wheelpath
CNTR = Center of lane
LTWP = Left wheelpath
DCP = Dynamic Cone Penetrometer
CBR = California Bearing Ratio

TABLE 85 Base course and subgrade soil CBR values from Livneh equation, units in percent

Section	CBR Base Course			CBR Subgrade Soil		
	LTWP	CNTR	RTWP	LTWP	CNTR	RTWP
DCP Testing on November 11, 1996						
7	93	119	118	14	9	10
9	104	129	100	15	14	13
13	72	76	84	18	18	20
21	123	141	145	14	20	32
25	99	112	72	10	10	8
DCP Testing on May 23, 1997						
5	99	80	63	9	9	7
6	125	93	100	18	7	9
8	133	99	118	15	11	14
24	91	102	99	8	9	11
26	102	121	118	12	16	23
DCP Testing on September 24, 1997						
36	35	24	49	13	4	6
37	80	80	99	9	14	7
23	51	67	67	15	9	15
54	71	74	78	13	7	11
55	102	104	76	6	8	9
56	114	110	119	12	13	14
DCP Testing on April 22, 1999						
1	85	72	78	8	9	8
35	104	104	85	9	6	7
11	63	80	89	6	10	8
15	80	91	131	20	16	10
19	84	95	97	9	9	9
54	69	97	106	14	6	16

Note: RTWP = Right wheelpath
CNTR = Center of lane
LTWP = Left wheelpath
DCP = Dynamic Cone Penetrometer
CBR = California Bearing Ratio

TABLE 86 Backcalculated moduli for the base course and subgrade soil, units in MPa

Section	Base Course		Subgrade Soil	
	CNTR	RTWP	CNTR	RTWP
FWD Testing on October 28, 1996				
7	164	166	77	75
9	168	231	89	83
13	156	260	93	101
21	114	107	144	112
25	130	138	103	91
FWD Testing on May 16, 1997				
5	224	217	55	54
6	165	191	47	47
8	161	204	50	49
24	149	212	49	47
26	172	223	48	49
FWD Testing on September 16, 1997				
36	114	111	61	60
37	113	153	68	66
23	125	169	69	62
54	119	140	63	62
55	129	161	78	71
56	112	158	57	65
FWD Testing on March 10, 1999				
1	156	130	77	73
35	188	190	77	75
11	185	173	88	87
15	131	177	77	82
19	215	213	76	68
54	152	200	66	59

1 ksi = 6.9 MPa

Note: RTWP = Right wheelpath
CNTR = Center of lane

TABLE 87 Results of resilient modulus testing for base and subgrade soil, units in MPa

Section No.	Base Modulus	Subgrade Modulus
5	64	77
6	76	95
7	71	95
8	106	111
9	105	111
13	59	53
21	70	94
23	69	96
24	73	99
25	75	100
26	76	100

1 ksi = 6.9 MPa

TABLE 88 Laboratory-determined CBR for the base course and subgrade soil at in situ density, units in percent

Section No.	Average CBR
Base Course	
1	130
2	150
3	56
6	123
8	121
11	108
15	151
17	121
21	150
22	113
24	110
Subgrade Soil	
8	5
9	3
13	11
21	2
24	5
25	4
26	5

TABLE 89 Preconstruction gradation testing from single circuit operation of NATC (type II class B) base course material

	Cumulative Percent Passing Each Sieve									
	25-mm 1-in.	19-mm .75-in.	12.5-mm .5-in.	9.5-mm .375-in.	4.75-mm No. 4	2.00-mm No. 10	1.18-mm No. 16	0.425-mm No. 40	0.150-mm No. 100	0.075-mm No. 200
4/19/95	100.0	89.6	74.2	63.1	44.3	31.7	27.3	20.5	13.3	9.2
4/20-21/95	100.0	89.9	76.0	63.7	41.9	29.8	24.9	19.8	14.5	10.4
4/21/95	100.0	93.6	75.5	62.4	39.0	27.4	22.4	16.8	10.9	7.6
4/21/95	100.0	91.6	76.6	64.4	42.3	28.4	23.1	17.3	11.2	7.7
4/21/95	100.0	88.7	68.0	54.5	33.5	21.9	17.8	13.3	8.6	6.1
4/24/95	100.0	94.1	78.4	66.1	44.0	32.6	27.5	19.9	12.0	8.3
4/24/95	100.0	94.5	81.2	68.7	43.5	28.5	23.3	17.0	10.7	7.4
4/24/95	100.0	87.4	66.5	51.1	25.6	13.2	10.4	7.7	5.3	3.9
4/25/95	100.0	88.0	72.7	60.1	31.1	18.6	15.4	11.8	8.1	6.1
4/25/95	100.0	94.1	82.2	71.5	47.3	34.2	28.5	21.3	13.7	9.7
4/26/95	100.0	95.1	79.7	67.9	47.5	33.5	27.5	21.3	15.3	11.3
4/26/95	100.0	93.4	79.0	67.1	45.3	31.1	19.2	13.5	11.5	9.9
Average	100.0	91.7	75.8	63.4	40.4	27.6	22.3	16.7	11.3	8.1
Std. Dev.	0.000	2.800	4.886	5.866	6.880	6.464	5.600	4.305	2.869	2.113
NDOT Spec.	100	90-100			35-65		15-40			2-10

TABLE 90 Gradation of base course placed at WesTrack

Sieve Size		Percent Passing
1-in.	25-mm	100.0
3/4-in.	19-mm	93.6
1/2-in.	12.5-mm	73.2
3/8-in.	9.50-mm	59.6
No. 4	4.75-mm	37.5
No. 8	2.36-mm	28.3
No. 16	1.18-mm	23.6
No. 40	0.425-mm	18.4
No. 100	0.15-mm	12.6
No. 200	0.075-mm	9.2

Note: The above gradations are an average based on 145 samples.
1 in. = 25.4 mm

TABLE 91 Base course moisture density QC/QA data

WesTrack - Base Construction (PWL, Compaction and Moisture Content)												
	Compaction (%)						Moisture Content (%)					
	Lift 1			Lift 2			Lift 1			Lift 2		
Section	Mean	Std.	PWL	Mean	Std.	PWL	Mean	Std.	PWL	Mean	Std.	PWL
1	101.54	1.46	85	101.32	0.98	93	7.02	0.20	53	7.48	0.58	78
2	101.26	1.26	84	101.74	1.10	97	7.48	0.57	78	7.02	0.63	51
3	101.18	0.65	100	104.64	0.78	65	7.46	0.11	100	6.86	0.63	42
4	101.28	1.33	83	103.80	0.93	91	7.22	0.24	81	7.24	0.81	60
5	100.76	0.80	82	103.44	1.91	78	7.20	0.79	59	7.72	0.22	100
6	101.78	0.83	100	104.38	1.41	65	7.30	0.51	70	7.82	0.69	88
7	101.96	1.85	84	104.20	1.78	66	7.08	0.37	57	8.22	0.29	100
8	102.36	1.43	99	104.10	1.46	71	7.64	0.61	85	8.64	0.23	99
9	101.98	1.37	95	103.98	1.55	73	7.76	0.30	100	7.70	0.54	91
10	102.68	1.06	100	104.64	1.40	59	7.74	0.29	100	7.32	1.03	59
11	100.24	0.71	75	102.86	0.15	100	7.42	0.41	84	7.88	0.49	100
12	98.92	1.68	100	101.56	1.26	90	7.28	0.31	80	7.90	0.57	100
13	100.28	1.08	91	101.38	1.51	81	7.00	0.57	50	7.44	0.43	84
14	103.82	0.99	89	103.48	0.81	100	6.78	0.55	36	6.76	0.22	0
15	103.60	0.95	96	104.28	1.03	74	7.24	0.70	61	7.00	0.25	0
16	103.28	1.21	95	104.04	1.18	78	7.16	0.30	66	7.04	0.40	13
17	103.18	0.52	100	102.90	0.51	100	7.46	0.44	85	7.06	0.68	27
18	103.68	0.30	100	104.40	0.64	82	7.50	0.17	100	6.88	0.53	12
19	103.74	1.02	90	103.16	0.79	100	7.46	0.44	85	6.66	0.55	3
20	103.42	1.52	85	103.30	0.91	100	7.50	0.64	77	6.80	0.39	0
21	103.12	1.98	79	101.94	0.86	100	6.60	0.51	23	6.74	0.78	39
22	102.54	2.95	58	102.76	1.57	94	7.84	0.24	100	7.14	0.42	62
23	103.82	0.64	100	102.32	0.86	100	7.78	0.51	97	7.56	0.36	97
24	104.44	0.55	84	101.18	1.43	78	7.88	0.69	89	7.10	0.81	54
25	102.34	1.05	100	101.64	1.86	80	8.02	0.56	100	6.68	0.41	23
26	102.68	0.69	100	101.70	1.01	99	8.54	0.25	100	6.98	0.27	48
Average by Lift												
South	101.25	1.19	90.60	103.23	1.25	79.17	7.35	0.41	76.80	7.63	0.55	81.07
North	103.36	1.11	90.34	102.85	1.04	91.18	7.52	0.46	78.40	6.95	0.47	29.07
Both	102.30	1.15	90.47	103.04	1.14	85.17	7.44	0.43	77.60	7.29	0.51	55.07
Average by Base Layer												
South	102.24	1.22	84.88				7.49	0.48	78.94			
North	103.11	1.07	90.76				7.24	0.46	53.74			
Both	102.67	1.15	87.82				7.37	0.47	66.34			

TABLE 92 WesTrack granular base lab test data for lift 1

Section Number	Liquid Limit AASHTO T 89-93	Plasticity Index AASHTO T 90-92	CBR AASHTO T 193-92	Resistance (R-Value) AASHTO T190-93	LA Abrasion % loss 500 rev.	Sand Equivalent AASHTO T 176
1	NA	NP				
2	NA	NP	100	79	18.3	34
3						
4						
5						
6						
7						
8	NA	NP	100	76	18.3	34
9	NA	NP				
10						
11	NA	NP	100	75	19.2	40
12						
13	NA	NP				
14						
15	NA	NP	100	82	17.8	38
16						
17						
18						
19						
20						
21	NA	NP	100	80	17.9	41
22	NA	NP				
23						
24	NA	NP	87	80	18.8	36
25	NA	NP				
26	NA	NP				

TABLE 93 WesTrack granular base lab test data for lift 2

Section Number	Liquid Limit AASHTO T 89-93	Plasticity Index AASHTO T 90-92	CBR AASHTO T 193-92	Resistance (R-Value) AASHTO T190-93	LA Abrasion % loss 500 rev.	Sand Equivalent AASHTP T 176
1	NA	NP	100	80	18.3	
2						
3	NA	NP	100	81	19.4	
4	NA	NP				
5	NA	NP				
6	NA	NP	100	79	19.4	
7						
8						
9						
10						
11						
12	NA	NP				
13						
14						
15	NA	NP	100	82	17.8	38
16						
17	NA	NP	100	78	19	
18	NA	NP				
19						
20	NA	NP				
21						
22	NA	NP	100	79	17.8	
23						
24						
25						
26	NA	NP				

TABLE 94 As-built base thickness of WesTrack original test sections

		Section Station (Thickness meters)						
Section	Layer	0+5	0+10	0+25	0+35	0+45	0+55	0+65
1	Agg Base	0.292	0.301	0.298	0.294	0.299	0.304	0.308
2	Agg Base	0.306	0.299	0.292	0.299	0.302	0.301	0.296
3	Agg Base	0.282	0.287	0.284	0.281	0.286	0.286	0.291
4	Agg Base	0.298	0.299	0.303	0.305	0.305	0.302	0.302
5	Agg Base	0.306	0.305	0.304	0.303	0.304	0.305	0.301
6	Agg Base	0.306	0.306	0.306	0.302	0.306	0.304	0.307
7	Agg Base	0.306	0.305	0.303	0.302	0.304	0.305	0.307
8	Agg Base	0.305	0.305	0.305	0.302	0.304	0.302	0.306
9	Agg Base	0.311	0.309	0.308	0.309	0.311	0.310	0.311
10	Agg Base	0.322	0.322	0.322	0.325	0.323	0.317	0.315
11	Agg Base	0.300	0.299	0.306	0.301	0.302	0.305	0.302
12	Agg Base	0.293	0.283	0.292	0.292	0.298	0.296	0.294
13	Agg Base	0.296	0.290	0.294	0.296	0.301	0.292	0.293
14	Agg Base	0.313	0.313	0.316	0.315	0.307	0.311	0.307
15	Agg Base	0.324	0.324	0.323	0.320	0.324	0.324	0.319
16	Agg Base	0.313	0.318	0.318	0.317	0.316	0.317	n/a
17	Agg Base	0.316	0.314	0.313	0.309	0.313	0.312	0.312
18	Agg Base	0.311	0.312	0.310	0.313	0.309	0.309	0.311
19	Agg Base	0.309	0.310	0.308	0.309	0.310	0.308	0.312
20	Agg Base	0.311	0.312	0.311	0.312	0.312	0.312	0.312
21	Agg Base	0.318	0.318	0.321	0.317	0.318	0.314	0.315
22	Agg Base	0.308	0.311	0.314	0.310	0.306	0.300	0.301
23	Agg Base	0.299	0.309	0.307	0.302	0.301	0.298	0.299
24	Agg Base	0.311	0.309	0.308	0.306	0.306	0.302	0.307
25	Agg Base	0.301	0.297	0.305	0.304	0.301	0.305	0.304
26	Agg Base	0.307	0.311	0.312	0.310	0.308	0.306	0.306

1 ft = 0.305 m

TABLE 95 Construction schedule for original construction

Date	Mixture	Lift	Lane	Section Numbers*
9-14-95	Fine	Bottom	Trial	1, 2, 3, 4, 14, 15, 16, 17, 18
9-15-95	Fine plus	Bottom	Trial	9, 10, 11, 12, 13, 19, 20, 21, 22
9-16-95	Coarse	Bottom	Trial	5, 6, 7
9-18-95	Coarse	Bottom	Trial	8, 23, 24, 25, 26
9-20-95	Fine	Bottom	Test	1, 2, 3, 4, 14, 15, 16, 17, 18
9-21-95	Fine plus	Bottom	Test	9, 10, 11, 12, 13, 19, 20, 21, 22
9-22-95	Fine	Top	Trial	1, 2, 3, 4, 14, 15, 16, 17, 18
9-27-95	Fine plus	Top	Trial	9, 10, 11, 12, 13, 19, 20, 21, 22
9-27-95	Fine plus	Bottom	Test	13
9-30-95	Coarse	Bottom	Test	5, 6, 7, 8, 23, 24, 25, 26
10-1-95	Coarse	Top	Trial	5, 6, 7, 8, 23, 24, 25, 26
10-2-95	Fine	Top	Test	1, 2, 3, 4, 14, 15, 16, 17, 18
10-3-95	Fine plus	Top	Test	9, 10, 11, 12, 13, 19, 20, 21, 22
10-4-95	Coarse	Top	Test	5, 6, 7, 8, 23, 24, 25, 26

*Section numbers follow order of placement.

TABLE 96 Original construction quality control volumetrics—gyratory compaction fine-graded mixture (test lane)

Section No.*	Mix Designation	Lift	Target Asphalt Content, %	Ignition Asphalt Content, %	Theoretical Max. Specific Gravity	Air Void Content, %	VMA, %	VFA, %	Lab Compactor
2 LM	Fine	Top	4.7	4.50	2.450	6.0	13.0	54.2	FHWA
		Bottom	4.7	5.07	2.415	4.6	13.6	65.7	BRE
3 LH	Fine	Top	4.7	4.57	2.425	5.6	13.6	59.1	FHWA
		Bottom	4.7	3.94	2.443	5.8	12.6	54.0	BRE
16 LH	Fine	Top	4.7	4.28	2.429	5.6	13.3	57.4	FHWA
		Bottom	4.7	4.98	2.425**	5.2	13.6	61.8	BRE
1 MM	Fine	Top	5.4	5.10	2.427	5.7	14.1	59.7	FHWA
		Bottom	5.4	5.71	2.404	3.7	13.7	73.2	FHWA
4 ML	Fine	Top	5.4	4.83	2.429	7.6	15.6	51.0	FHWA
		Bottom	5.4	5.10	2.412	5.1	14.1	63.9	FHWA
15 MM	Fine	Top	5.4	5.27	2.427	5.7	14.3	60.3	FHWA
		Bottom	5.4	5.17	2.414	4.4	13.5	67.1	FHWA
17 MH	Fine	Top	5.4	5.47	2.417	5.3	14.5	63.2	FHWA
		Bottom	5.4	5.35	2.407	4.6	14.1	67.3	FHWA
14 HM	Fine	Top	6.1	5.90	2.402	2.3	12.7	82.1	BRE
		Bottom	6.1	6.18	2.379	1.2	12.8	90.5	FHWA
18 HL	Fine	Top	6.1	5.98	2.408	3.8	13.8	72.9	FHWA
		Bottom	6.1	5.48	2.405	3.9	13.6	71.5	FHWA

* "xy" = Design asphalt content/Design air void content L = Low, M = Medium (or Optimum), H = High
**Without moisture correction or dry back.
FHWA = FHWA Mobile Laboratory
BRE = Brent Rauhaut Engineering, NCHRP Project 9-7

TABLE 97 Original construction quality control volumetrics—gyratory compaction fine-plus-graded mixture (test lane)

Section No.	Mix Designation	Lift	Target Asphalt Content, %	Ignition Asphalt Content, %	Theoretical Max. Specific Gravity	Air Void Content, %	VMA, %	VFA, %	Lab Compactor
22 LM	Fine Plus	Top	4.7	5.12	2.411	2.8	12.0	77.1	BRE
		Bottom	4.7	5.10	2.419	4.6	13.5	65.7	BRE
10 LH	Fine Plus	Top	4.7	5.29	2.413	3.3	12.6	74.1	BRE
		Bottom	4.7	4.66	2.422	4.5	12.9	64.6	BRE
19 MM	Fine Plus	Top	5.4	5.93	2.391	2.0	12.8	84.6	FHWA
		Bottom	5.4	5.85	2.405	3.4	13.5	74.8	FHWA
20 MH	Fine Plus	Top	5.4	6.08	2.393	2.1	13.1	83.6	FHWA
		Bottom	5.4	5.96	2.391	1.7	12.6	86.3	FHWA
11 MM	Fine Plus	Top	5.4	5.94	2.401	3.2	13.5	76.7	FHWA
		Bottom	5.4	5.78	2.394	2.3	12.9	81.8	FHWA
12 ML	Fine Plus	Top	5.4	6.04	2.410	3.2	13.3	76.3	FHWA
		Bottom	5.4	5.37	2.404	3.2	12.9	75.3	FHWA
21 HL	Fine Plus	Top	6.1	6.82	2.387	0.9	12.8	93.3	BRE
		Bottom	6.1	5.92	2.382	0.9	12.2	92.2	BRE
9 HL	Fine Plus	Top	6.1	6.72	2.366	0.2	12.9	98.2	FHWA
		Bottom	6.1	6.44	2.350	0.2	12.9	100	FHWA
13 HM	Fine Plus	Top	6.1	6.60	2.379	0.2	12.3	98.8	BRE
		Bottom	6.1	6.37	2.391	0.6	12.0	95.3	BRE

FHWA = FHWA Mobile Laboratory
BRE = Brent Rauhaut Engineering, NCHRP Project 9-7

TABLE 98 Original construction quality control volumetrics—gyratory compaction coarse-graded mixture (test lane)

Section No.	Mix Designation	Lift	Target Asphalt Content, %	Ignition Asphalt Content, %	Theoretical Max. Specific Gravity	Air Void Content, %	VMA, %	VFA, %	Lab Compactor
8 LM	Coarse	Top	5.0	4.89	2.434	4.8	12.0	60.0	BRE
		Bottom	5.0	5.32	2.404	4.7	13.4	64.9	BRE
26 LH	Coarse	Top	5.0	4.98	2.436	6.5	13.6	52.3	BRE
		Bottom	5.0	5.34	2.386	3.8	13.2	71.3	BRE
5 MM	Coarse	Top	5.7	4.89	2.403	3.8	12.2	68.6	FHWA
		Bottom	5.7	5.26	2.413	6.2	14.4	56.8	FHWA
6 MH	Coarse	Top	5.7	5.55	2.413	4.2	12.8	67.3	FHWA
		Bottom	5.7	5.05	2.422	7.5	15.1	50.1	FHWA
23 ML	Coarse	Top	5.7	5.81	2.398	1.7	11.3	85.3	FHWA
		Bottom	5.7	5.05	2.421	8.2	15.8	47.7	FHWA
24 MM	Coarse	Top	5.7	6.31	2.389	2.0	12.4	83.7	FHWA
		Bottom	5.7	5.11	2.412	7.9	15.9	49.9	FHWA
7 HM	Coarse	Top	6.4	6.58	2.377	0.6	11.9	94.8	BRE
		Bottom	6.4	6.44	2.374	4.8	15.6	69.1	BRE
25 HL	Coarse	Top	6.4	6.06	2.382	1.1	11.6	90.4	FHWA
		Bottom	6.4	6.09	2.370	2.7	13.5	79.9	FHWA

FHWA = FHWA Mobile Laboratory
BRE = Brent Rauhaut Engineering, NCHRP Project 9-7

TABLE 99 Original construction fine mix core asphalt contents from regression with reflux

Section	Mix Type	Lift	Target	Correction Factor	Corrected P_{asp}					Average	Standard Deviation	COV	Max	Min	Range
					1	2	3	4	5						
1 MM	Fine	Top	5.4	0.00894	5.35	5.88	5.67	5.65	5.88	5.69	0.22	3.83	5.88	5.35	0.53
		Bottom	5.4	0.00894	5.69	6.00	6.09	5.23		5.75	0.39	6.75	6.09	5.23	0.86
2 LM		Top	4.7	0.00894	5.08	5.04	4.93	5.01	5.05	5.02	0.06	1.11	5.08	4.93	0.15
		Bottom	4.7	0.00894		4.40	5.07	4.92	4.63	4.76	0.30	6.26	5.07	4.40	0.67
3 LH		Top	4.7	0.00894	4.93	5.14	4.96	5.08	5.30	5.08	0.15	2.94	5.30	4.93	0.37
		Bottom	4.7	0.00894	5.17	4.88	5.27	4.88	5.44	5.13	0.25	4.83	5.44	4.88	0.56
4 ML		Top	5.4	0.00894	5.26	5.28	5.67	5.08	4.89	5.24	0.29	5.56	5.67	4.89	0.78
		Bottom	5.4	0.00894	5.60	5.56	5.69	5.63	5.62	5.62	0.05	0.90	5.69	5.56	0.14
14 HM		Top	6.1	0.00894		6.10	6.38	6.23	6.16	6.22	0.12	1.98	6.38	6.10	0.29
		Bottom	6.1	0.00894	6.62	6.73	6.72		6.43	6.62	0.14	2.15	6.73	6.43	0.31
15 MM		Top	5.4	0.00894	5.57	5.85	5.35	5.36	5.62	5.55	0.21	3.71	5.85	5.35	0.50
		Bottom	5.4	0.00894	5.90	5.60	5.48	5.55	5.28	5.56	0.22	4.01	5.90	5.28	0.62
16 LH		Top	4.7	0.00894	4.78	5.00	4.75	4.94	4.73	4.84	0.12	2.55	5.00	4.73	0.28
		Bottom	4.7	0.00894	4.33	5.12	4.96	4.73	4.79	4.79	0.30	6.26	5.12	4.33	0.80
17 MH		Top	5.4	0.00894	5.82	5.95	6.03	6.03	5.65	5.90	0.16	2.76	6.03	5.65	0.38
		Bottom	5.4	0.00894	5.80	5.48	5.17	5.55	5.43	5.49	0.23	4.10	5.80	5.17	0.63
18 HL		Top	6.1	0.00894	6.20	6.18	6.36	6.17	6.16	6.22	0.08	1.34	6.36	6.16	0.20
		Bottom	6.1	0.00894	6.39	6.25	5.97	6.23	6.45	6.26	0.19	2.97	6.45	5.97	0.48

TABLE 100 Original construction fine plus mix core asphalt contents from regression with reflux

Section	Mix Type	Lift	Target	Correction Factor	Corrected P_{asp} 1	2	3	4	5	Average	Standard Deviation	COV	Max	Min	Range
19		Top	5.4	0.00684	5.55	5.51	5.36	5.13	5.51	5.41	0.17	3.19	5.55	5.13	0.42
MM		Bottom	5.4	0.00684	5.66	5.35	5.53	5.53	5.35	5.48	0.14	2.46	5.66	5.35	0.31
20		Top	5.4	0.00684	5.58	5.39	5.30	5.40	5.31	5.40	0.11	2.12	5.58	5.30	0.28
MH		Bottom	5.4	0.00684	5.68	4.97	5.18	4.76	5.05	5.13	0.35	6.74	5.68	4.76	0.92
21		Top	6.1	0.00684	6.33	6.41	6.08	6.24	6.20	6.25	0.12	1.98	6.41	6.08	0.32
HL		Bottom	6.1	0.00684	5.46	5.82	6.05	6.05	5.83	5.84	0.24	4.12	6.05	5.46	0.59
22		Top	4.7	0.00684	4.73	4.87	4.86	4.70	4.64	4.76	0.10	2.09	4.87	4.64	0.23
LM		Bottom	4.7	0.00684	4.74	4.61	4.50	4.48	4.24	4.52	0.19	4.10	4.74	4.24	0.50
9	Fine	Top	6.1	0.00684	5.86	5.78	5.96	6.33	6.42	6.07	0.29	4.73	6.42	5.78	0.64
HL	Plus	Bottom	6.1	0.00684	5.54	5.93	5.82	5.83	5.87	5.80	0.15	2.55	5.93	5.54	0.38
10		Top	4.7	0.00684	5.01	4.52	4.75	4.88	4.86	4.80	0.18	3.81	5.01	4.52	0.49
LH		Bottom	4.7	0.00684	4.51	4.36	4.21	4.26		4.33	0.13	3.10	4.51	4.21	0.30
11		Top	5.4	0.00684	5.55	5.44	5.53	5.68	5.31	5.50	0.14	2.53	5.68	5.31	0.37
MM		Bottom	5.4	0.00684	5.49	5.05	5.21	4.61	5.43	5.16	0.35	6.80	5.49	4.61	0.87
12		Top	5.4	0.00684	5.51	5.18	5.22	5.53	5.33	5.35	0.16	3.01	5.53	5.18	0.35
ML		Bottom	5.4	0.00684	5.77	5.13	5.34	5.21	4.92	5.27	0.32	6.02	5.77	4.92	0.85
13		Top	6.1	0.00684	5.71	6.06	5.89	6.15	6.24	6.01	0.21	3.54	6.24	5.71	0.53
HM		Bottom	6.1	0.00684	5.78	5.46	5.79	5.60	6.19	5.76	0.28	4.79	6.19	5.46	0.74

TABLE 101 Original construction coarse mix core asphalt contents from regression with reflux

Section	Mix Type	Lift	Target	Correction Factor	Corrected P_{asp} 1	2	3	4	5	Average	Standard Deviation	COV	Max	Min	Range
5		Top	5.7	0.00605	5.50	5.72	5.90	5.58	5.64	5.67	0.15	2.66	5.90	5.50	0.40
MM		Bottom	5.7	0.00605	5.49	5.59	5.64		5.69	5.61	0.08	1.49	5.69	5.49	0.19
6		Top	5.7	0.00605	5.73	5.64	5.88	5.63	5.75	5.73	0.10	1.79	5.88	5.63	0.25
MH		Bottom	5.7	0.00605	5.88	5.64	5.79	6.05	6.06	5.89	0.18	3.01	6.06	5.64	0.42
7		Top	6.4	0.00605	6.03	6.34	6.31	6.36	6.39	6.28	0.15	2.34	6.39	6.03	0.36
HM		Bottom	6.4	0.00605	6.39	6.55	6.37	6.34	6.27	6.38	0.10	1.59	6.55	6.27	0.27
8		Top	5	0.00605	5.49	5.56	5.39	5.68	5.63	5.55	0.11	2.07	5.68	5.39	0.29
LM		Bottom	5	0.00605	5.54	5.64	5.37	5.59		5.54	0.12	2.15	5.64	5.37	0.27
23	Coarse	Top	5.7	0.00605	5.91	5.70	5.92	5.59	5.80	5.78	0.14	2.46	5.92	5.59	0.33
ML		Bottom	5.7	0.00605	5.73	5.85	5.98	5.82	5.83	5.84	0.09	1.55	5.98	5.73	0.25
24		Top	5.7	0.00605		6.03	5.76	5.99	5.86	5.91	0.12	2.11	6.03	5.76	0.27
MM		Bottom	5.7	0.00605	5.76	5.61	5.92		5.84	5.78	0.13	2.29	5.92	5.61	0.31
25		Top	6.4	0.00605	6.22	6.38	6.36	6.34	6.34	6.33	0.06	0.98	6.38	6.22	0.16
HL		Bottom	6.4	0.00605	6.24	6.12	6.17	6.34	6.30	6.24	0.09	1.47	6.34	6.12	0.22
26		Top	5	0.00605	5.17	5.69	5.38	5.28	5.64	5.43	0.23	4.16	5.69	5.17	0.52
LH		Bottom	5	0.00605	5.43	5.46	5.57	5.01	5.39	5.37	0.21	3.98	5.57	5.01	0.56

TABLE 102 Accumulated percent passing from core data—top lift (original construction)

		19-mm (3/4-in.) Sieve			12.5-mm (1/2-in.) Sieve			9.5-mm (3/8-in.) Sieve			4.75 mm (#4) Sieve			2.36 mm (#8) Sieve		
Gradation	Section	Mean	Std	n	Mean	Std	n	Mean	Std	n	Mean	Std	n	Mean	Std	n
Fine	1	100.0	0.0	5	87.7	1.9	5	76.0	2.2	5	49.8	1.8	5	38.8	1.4	5
	2	100.0	0.0	6	88.5	1.6	6	76.6	1.6	6	49.9	1.3	6	83.3	1.2	6
	3	100.0	0.0	5	87.8	1.1	5	77.6	1.4	5	52.0	1.5	5	40.4	1.2	5
	4	99.9	0.2	5	87.2	3.3	5	75.0	4.5	5	50.3	4.2	5	39.2	3.4	5
	14	100.0	0.0	5	88.4	1.6	5	76.7	2.2	5	51.5	2.6	5	40.0	2.0	5
	15	100.0	0.0	5	88.7	1.4	5	77.5	2.5	5	51.7	2.2	5	40.2	1.8	5
	16	100.0	0.0	5	88.5	1.1	5	76.3	1.8	5	50.8	2.2	5	39.7	1.9	5
	17	99.9	0.2	5	89.3	2.0	5	78.3	2.1	5	53.0	2.5	5	41.5	2.0	5
	18	100.0	0.0	5	87.0	1.3	5	75.5	1.8	5	51.1	1.6	5	39.8	1.2	5
Stats for averages		100.0	0.0	9	88.1	0.7	9	76.6	1.1	9	51.1	1.1	9	39.8	1.0	9
Stats of independent		100.0	0.1	46	88.2	1.8	46	76.6	2.4	46	51.1	2.3	46	39.8	1.9	46
Samples				Max												
				Min												
Fine+	9	100.0	0.0	5	85.1	2.2	5	72.8	3.0	5	48.6	2.6	5	37.8	2.0	5
	10	100.0	0.0	5	86.1	2.2	5	74.7	2.3	5	50.4	2.4	5	39.7	1.8	5
	11	100.0	0.0	4	88.7	2.2	4	78.1	2.1	4	52.0	1.9	4	40.1	1.4	4
	12	100.0	0.0	5	87.9	1.5	5	76.3	1.8	5	50.3	1.9	5	38.7	1.2	5
	13	100.0	0.0	5	87.1	1.5	5	76.5	1.8	5	49.5	1.8	5	38.6	1.4	5
	19	100.0	0.0	3	86.2	1.9	3	75.1	2.5	3	51.4	2.1	3	40.3	1.4	3
	20	100.0	0.0	5	87.3	1.2	5	75.8	1.9	5	51.5	1.5	5	39.9	1.3	5
	21	99.9	0.3	5	87.0	1.0	5	76.9	1.6	5	53.0	1.8	5	41.5	1.4	5
	22	100.0	0.0	5	86.3	2.0	5	74.5	2.5	5	50.4	2.7	5	38.8	2.1	5
Stats for averages		100.0	0.0	9	86.8	1.1	9	75.6	1.5	9	50.8	1.3	9	39.5	1.1	9
Stats for independent		100.0	0.1	42	86.8	1.9	42	75.6	2.4	42	50.7	2.3	42	39.4	1.8	42
Samples				Max												
				Min												
Coarse	5	100.0	0.0	5	79.2	1.4	5	65.1	2.7	5	41.1	2.3	5	27.4	1.1	5
	6	100.0	0.0	5	78.0	2.7	5	63.9	2.4	5	40.0	2.1	5	27.5	1.2	5
	7	100.0	0.0	6	78.9	2.5	6	64.6	2.1	6	41.5	1.2	6	28.7	1.1	6
	8	100.0	0.0	5	82.1	1.7	5	68.6	2.3	5	44.4	1.9	5	30.2	1.1	5
	23	100.0	0.0	5	79.8	2.6	5	65.7	2.5	5	42.4	2.2	5	29.1	1.0	5
	24	100.0	0.0	5	78.5	1.8	5	64.1	1.9	5	41.7	1.8	5	28.7	1.2	5
	25	100.0	0.0	5	79.2	2.1	5	64.4	1.9	5	42.3	1.9	5	29.4	1.2	5
	26	100.0	0.0	5	78.1	4.7	5	63.5	5.7	5	40.8	3.8	5	28.0	2.2	5
Stats for averages		100.0	0.0	8	792	1.3	8	65.0	1.6	8	41.8	1.3	8	28.6	1.0	8
Stats for independent		100.0	0.0	41	79.2	2.7	41	65.0	6.4	41	41.8	2.4	41	28.6	1.5	41
Samples				Max												
				Min												

(continued on next page)

TABLE 102 (Continued)

		1.18 mm (#16) Sieve			0.600 mm (#30) Sieve			0.300 mm (#50) Sieve			0.150 mm (#100) Sieve			0.075 mm (#200) Sieve		
Gradation	Section	Mean	Std	n	Mean	Std	n	Mean	Std	n	Mean	Std	n	Mean	Std	n
Fine	1	34.3	1.3	5	27.8	1.0	5	16.2	0.7	5	8.1	0.4	5	5.1	0.2	5
	2	33.9	0.9	6	27.6	0.5	6	15.8	0.4	6	8.1	0.3	6	5.0	0.2	6
	3	35.9	1.1	5	29.1	0.9	5	15.8	0.7	5	8.0	0.4	5	5.1	0.1	5
	4	34.8	2.8	5	28.3	1.9	5	15.4	0.9	5	7.5	0.4	5	4.4	0.4	5
	14	35.5	1.7	5	29.0	1.2	5	16.0	0.6	5	8.0	0.2	5	4.9	0.3	5
	15	35.5	1.5	5	29.0	1.1	5	16.7	0.6	5	8.5	0.4	5	5.2	0.4	5
	16	35.1	1.7	5	28.6	1.3	5	16.0	0.9	5	8.0	0.4	5	4.9	0.2	5
	17	36.8	1.7	5	29.8	1.4	5	16.8	0.8	5	8.4	0.4	5	5.1	0.3	5
	18	35.2	1.2	5	28.7	1.2	5	16.5	0.7	5	8.4	0.4	5	5.1	0.4	5
Stats for averages		35.2	0.9	9	28.7	0.7	9	16.1	0.5	9	8.1	0.3	9	5.0	0.3	9
Stats of independent		35.2	1.7	46	28.6	1.3	46	16.1	0.8	46	8.1	0.4	46	5.0	0.4	46
Samples																
Fine+	9	33.6	1.6	5	27.8	1.2	5	16.4	0.8	5	8.6	0.6	5	5.2	0.5	5
	10	35.2	1.4	5	29.0	1.0	5	17.1	0.7	5	9.1	0.4	5	5.6	0.3	5
	11	35.4	1.2	4	29.0	0.9	4	16.8	0.4	4	8.9	0.7	4	5.5	0.6	4
	12	34.3	0.9	5	28.4	0.7	5	17.2	0.5	5	9.4	0.2	5	6.0	0.1	5
	13	34.1	1.1	5	28.1	0.8	5	16.9	0.7	5	9.1	0.1	5	5.7	0.1	5
	19	35.8	1.2	3	29.5	0.9	3	17.9	0.4	3	9.3	0.1	3	5.8	0.1	3
	20	35.4	1.1	5	29.1	0.8	5	17.0	0.5	5	8.8	0.4	5	5.2	0.4	5
	21	36.7	1.2	5	30.1	0.9	5	18.0	0.7	5	9.0	1.0	5	5.4	1.0	5
	22	34.3	1.8	5	28.2	1.3	5	16.6	1.1	5	8.6	0.7	5	5.3	0.7	5
Stats for averages		35.0	1.0	9	28.8	0.8	9	17.1	0.5	9	9.0	0.3	9	5.5	0.3	9
Stats for independent		34.9	1.5	42	28.8	1.1	42	17.1	0.8	42	9.0	0.6	42	5.5	0.5	42
Samples																
Coarse	5	20.0	0.6	5	15.5	0.4	5	12.0	0.5	5	9.0	0.3	5	6.5	0.2	5
	6	20.4	0.6	5	15.7	0.5	5	12.0	0.5	5	8.8	0.4	5	6.3	0.4	5
	7	21.2	1.0	6	16.1	0.8	6	12.0	0.7	6	8.7	0.9	6	6.4	0.5	6
	8	22.0	0.6	5	16.7	0.3	5	12.6	0.2	5	9.3	0.2	5	6.7	0.2	5
	23	21.4	0.3	5	16.5	0.2	5	12.6	0.3	5	9.5	0.2	5	7.0	0.2	5
	24	21.0	0.7	5	16.0	0.5	5	12.2	0.5	5	9.1	0.4	5	6.6	0.4	5
	25	21.5	0.8	5	16.4	0.6	5	12.4	0.3	5	9.2	0.5	5	6.7	0.4	5
	26	20.4	1.3	5	15.5	0.8	5	11.7	0.6	5	8.7	0.4	5	6.3	0.4	5
Stats for averages		21.0	0.7	8	16.1	0.5	8	12.2	0.3	8	9.0	0.3	8	6.6	0.2	8
Stats for independent		21.0	1.0	41	16.1	0.7	41	12.2	0.5	41	9.0	0.5	41	6.6	0.4	41
Samples																

TABLE 103 Accumulated percent passing from core data—bottom lift (original construction)

		19-mm (3/4-in.) Sieve			12.5-mm (1/2-in.) Sieve			9.5-mm (3/8-in.) Sieve			4.75 mm (#4) Sieve			2.36 mm (#8) Sieve		
Gradation	Section	Mean	Std	n	Mean	Std	n	Mean	Std	n	Mean	Std	n	Mean	Std	n
Fine	1	100.0	0.0	4	85.1	3.9	4	70.6	6.1	4	43.0	5.3	4	32.6	3.7	4
	2	100.0	0.0	4	87.3	3.9	4	74.5	5.9	4	46.2	6.2	4	35.1	4.7	4
	3	100.0	0.0	4	88.7	3.0	4	76.2	3.6	4	48.4	3.7	4	36.5	3.1	4
	4	100.0	0.0	5	89.9	1.9	5	78.3	1.0	5	49.9	0.6	5	37.9	0.7	5
	14	100.0	0.0	5	89.0	3.5	5	76.9	4.7	5	49.5	4.0	5	38.0	3.0	5
	15	100.0	0.0	4	86.9	2.4	4	75.5	2.7	4	49.0	2.2	4	37.4	1.6	4
	16	100.0	0.0	5	90.2	2.2	5	77.4	4.2	5	49.0	5.1	5	36.9	4.0	5
	17	100.0	0.0	5	88.4	1.2	5	75.8	2.3	5	48.6	2.6	5	36.8	1.8	5
	18	100.0	0.0	5	88.3	1.4	5	76.6	2.1	5	49.8	2.6	5	38.0	2.1	5
Stats for averages		100.0	0.0	9	88.2	1.6	9	75.7	2.2	9	48.2	2.2	9	36.6	1.7	9
Stats of independent		100.0	0.0	41	88.3	2.6	41	75.9	4.0	41	48.6	4.0	41	36.7	3.1	41
Samples				Max												
				Min												
Fine+	9	100.0	0.0	5	91.2	0.6	5	81.4	1.4	5	55.0	2.3	5	42.6	1.8	5
	10	100.0	0.0	4	87.1	5.3	4	74.9	6.6	4	48.7	6.6	4	37.5	5.0	4
	11	100.0	0.0	5	89.7	1.7	5	79.6	2.3	5	53.1	2.7	5	40.8	2.5	5
	12	99.9	0.3	5	89.5	1.7	5	79.1	3.3	5	52.8	5.6	5	40.4	4.7	5
	13	100.0	0.0	3	86.9	1.4	3	75.7	1.3	3	49.5	0.4	3	38.2	0.5	3
	19	100.0	0.0	5	90.1	1.4	5	80.1	2.0	5	53.3	3.9	5	41.5	2.1	5
	20	100.0	0.0	5	87.8	3.4	5	74.9	5.7	5	48.5	5.5	5	37.7	4.0	5
	21	100	0	5	87.2	2.5	5	74.3	4.7	5	47.3	3.7	5	37.2	2.6	5
	22	100.0	0.0	5	90.1	1.6	5	78.7	2.5	5	52.4	2.3	5	40.5	1.8	5
Stats for averages		100.0	0.0	9	88.8	1.6	9	77.6	2.7	9	51.2	2.7	9	39.6	2.0	9
Stats for independent		100.0	0.1	42	88.8	2.8	42	77.8	4.2	42	51.6	4.5	42	39.7	3.2	42
Samples				Max												
				Min												
Coarse	5	100.0	0.0	5	82.9	2.5	5	67.3	2.9	5	42.1	1.7	5	27.3	1.3	5
	6	100.0	0.0	4	81.4	2.1	4	66.3	3.0	4	42.4	2.3	4	28.0	1.4	4
	7	100.0	0.0	3	80.5	2.5	3	64.9	2.1	3	40.3	2.0	3	26.9	1.3	3
	8	100.0	0.0	5	82.6	2.3	5	67.5	2.7	5	42.9	1.8	5	28.0	1.2	5
	23	100.0	0.0	5	83.3	2.2	5	67.9	2.6	5	43.2	1.8	5	28.2	1.0	5
	24	100.0	0.0	5	82.2	1.4	5	65.3	2.6	5	41.7	2.2	5	27.6	1.4	5
	25	100.0	0.0	5	79.8	2.3	5	65.1	1.9	5	41.8	1.7	5	27.9	1.1	5
	26	100.0	0.0	5	80.7	4.3	5	64.8	5.1	5	41.0	3.8	5	27.1	2.2	5
Stats for averages		100	0	8	81.7	1.3	8	66.1	1.3	8	41.9	1.0	8	27.6	0.5	8
Stats for independent		100	0	37	81.7	2.6	37	66.2	3.0	37	42.0	2.2	37	27.7	1.3	37
Samples				Max												
				Min												

(continued on next page)

TABLE 103 (Continued)

		19-mm (3/4-in.) Sieve			12.5-mm (1/2-in.) Sieve			9.5-mm (3/8-in.) Sieve			4.75 mm (#4) Sieve			2.36 mm (#8) Sieve		
Gradation	Section	Mean	Std	n	Mean	Std	n	Mean	Std	n	Mean	Std	n	Mean	Std	n
Fine	1	100.0	0.0	4	85.1	3.9	4	70.6	6.1	4	43.0	5.3	4	32.6	3.7	4
	2	100.0	0.0	4	87.3	3.9	4	74.5	5.9	4	46.2	6.2	4	35.1	4.7	4
	3	100.0	0.0	4	88.7	3.0	4	76.2	3.6	4	48.4	3.7	4	36.5	3.1	4
	4	100.0	0.0	5	89.9	1.9	5	78.3	1.0	5	49.9	0.6	5	37.9	0.7	5
	14	100.0	0.0	5	89.0	3.5	5	76.9	4.7	5	49.5	4.0	5	38.0	3.0	5
	15	100.0	0.0	4	86.9	2.4	4	75.5	2.7	4	49.0	2.2	4	37.4	1.6	4
	16	100.0	0.0	5	90.2	2.2	5	77.4	4.2	5	49.0	5.1	5	36.9	4.0	5
	17	100.0	0.0	5	88.4	1.2	5	75.8	2.3	5	48.6	2.6	5	36.8	1.8	5
	18	100.0	0.0	5	88.3	1.4	5	76.6	2.1	5	49.8	2.6	5	38.0	2.1	5
Stats for averages		100.0	0.0	9	88.2	1.6	9	75.7	2.2	9	48.2	2.2	9	36.6	1.7	9
Stats of independent		100.0	0.0	41	88.3	2.6	41	75.9	4.0	41	48.6	4.0	41	36.7	3.1	41
Samples				Max												
				Min												
Fine+	9	100.0	0.0	5	91.2	0.6	5	81.4	1.4	5	55.0	2.3	5	42.6	1.8	5
	10	100.0	0.0	4	87.1	5.3	4	74.9	6.6	4	48.7	6.6	4	37.5	5.0	4
	11	100.0	0.0	5	89.7	1.7	5	79.6	2.3	5	53.1	2.7	5	40.8	2.5	5
	12	99.9	0.3	5	89.5	1.7	5	79.1	3.3	5	52.8	5.6	5	40.4	4.7	5
	13	100.0	0.0	3	86.9	1.4	3	75.7	1.3	3	49.5	0.4	3	38.2	0.5	3
	19	100.0	0.0	5	90.1	1.4	5	80.1	2.0	5	53.3	3.9	5	41.5	2.1	5
	20	100.0	0.0	5	87.8	3.4	5	74.9	5.7	5	48.5	5.5	5	37.7	4.0	5
	21	100	0	5	87.2	2.5	5	74.3	4.7	5	47.3	3.7	5	37.2	2.6	5
	22	100.0	0.0	5	90.1	1.6	5	78.7	2.5	5	52.4	2.3	5	40.5	1.8	5
Stats for averages		100.0	0.0	9	88.8	1.6	9	77.6	2.7	9	51.2	2.7	9	39.6	2.0	9
Stats for independent		100.0	0.1	42	88.8	2.8	42	77.8	4.2	42	51.6	4.5	42	39.7	3.2	42
Samples				Max												
				Min												
Coarse	5	100.0	0.0	5	82.9	2.5	5	67.3	2.9	5	42.1	1.7	5	27.3	1.3	5
	6	100.0	0.0	4	81.4	2.1	4	66.3	3.0	4	42.4	2.3	4	28.0	1.4	4
	7	100.0	0.0	3	80.5	2.5	3	64.9	2.1	3	40.3	2.0	3	26.9	1.3	3
	8	100.0	0.0	5	82.6	2.3	5	67.5	2.7	5	42.9	1.8	5	28.0	1.2	5
	23	100.0	0.0	5	83.3	2.2	5	67.9	2.6	5	43.2	1.8	5	28.2	1.0	5
	24	100.0	0.0	5	82.2	1.4	5	65.3	2.6	5	41.7	2.2	5	27.6	1.4	5
	25	100.0	0.0	5	79.8	2.3	5	65.1	1.9	5	41.8	1.7	5	27.9	1.1	5
	26	100.0	0.0	5	80.7	4.3	5	64.8	5.1	5	41.0	3.8	5	27.1	2.2	5
Stats for averages		100	0	8	81.7	1.3	8	66.1	1.3	8	41.9	1.0	8	27.6	0.5	8
Stats for independent		100	0	37	81.7	2.6	37	66.2	3.0	37	42.0	2.2	37	27.7	1.3	37
Samples				Max												
				Min												

TABLE 104 Original construction fine mix top lift gradation of cores after ignition (n = 5/section)

Sieve Size		Target	Fine Mix Top Lift—Average Percent Passing								
			Section Number								
(mm)	(US)		1	2	3	4	14	15	16	17	18
19.0	3/4-in.	99.9	100.0	100.0	100.0	99.9	100.0	100.0	100.0	99.9	100.0
12.5	1/2-in.	88.5	87.7	88.5	87.8	87.2	88.4	88.7	88.5	89.3	87.0
9.50	3/8- in.	75.4	76.0	76.6	77.6	75.0	76.7	77.5	76.3	78.3	75.5
4.75	No. 4	48.9	49.8	49.9	52.0	50.3	51.5	51.7	50.8	53.0	51.1
2.36	No. 8	38.4	38.8	38.3	40.4	39.2	40.0	40.2	39.7	41.5	39.8
1.18	No. 16	33.9	34.3	33.9	35.9	34.8	35.5	35.5	35.1	36.8	35.2
0.60	No. 30	27.6	27.8	27.6	29.1	28.3	29.0	29.0	28.6	29.8	28.7
0.30	No. 50	15.7	16.2	15.8	15.8	15.4	16.0	16.7	16.0	16.8	16.5
0.15	No. 100	6.8	8.1	8.1	8.0	7.5	8.0	8.5	8.0	8.4	8.4
0.075	No. 200	3.6	5.1	5.0	5.1	4.4	4.9	5.2	4.9	5.1	5.1
Surface Area (ft^2/lb)			29.1	28.7	29.3	27.5	29.0	30.0	28.9	30.1	29.6
Surface Area (m^2/kg)			5.95	5.88	6.00	5.63	5.93	6.14	5.91	6.16	6.06
Ratio #4 to #50			3.07	3.16	3.29	3.27	3.22	3.10	3.18	3.15	3.10

TABLE 105 Original construction fine mix bottom lift gradation of cores after ignition (n = 5/section)

Sieve Size		Target	Fine Mix Bottom Lift—Average Percent Passing								
			Section Number								
(mm)	(US)		1	2	3	4	14	15	16	17	18
19.0	3/4-in.	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
12.5	1/2-in.	88.5	85.1	87.3	88.7	89.9	89.0	86.9	90.2	88.4	88.3
9.50	3/8-in.	75.4	70.6	74.5	76.2	78.3	76.9	75.5	77.4	75.8	76.6
4.75	No. 4	48.9	43.0	46.2	48.4	49.9	49.5	49.0	49.0	48.6	49.8
2.36	No. 8	38.4	32.6	35.1	36.5	37.9	38.0	37.4	36.9	36.8	38.0
1.18	No. 16	33.9	28.7	30.8	32.1	33.3	33.6	33.0	32.5	32.5	33.3
0.60	No. 30	27.6	23.6	25.3	26.1	27.3	27.7	27.0	26.6	26.0	27.1
0.30	No. 50	15.7	14.2	14.4	15.0	15.5	15.5	15.9	15.3	14.3	15.5
0.15	No. 100	6.8	6.9	7.2	7.1	7.5	7.8	7.8	7.5	7.4	7.5
0.075	No. 200	3.6	4.1	4.2	4.2	4.3	4.5	4.7	4.4	4.6	4.5
Surface Area (ft^2/lb)			24.7	25.7	26.1	27.0	27.6	27.9	26.9	26.8	27.3
Surface Area (m^2/kg)			5.06	5.26	5.35	5.54	5.65	5.71	5.51	5.48	5.60
Ratio #4 to #50			3.03	3.21	3.23	3.22	3.19	3.08	3.20	3.40	3.21

TABLE 106 Original construction fine plus mix top lift gradation of cores after ignition (n = 5/section)

Sieve Size		Target	Fine Plus Mix Top Lift—Average Percent Passing								
			Section Number								
(mm)	(US)		9	10	11	12	13	19	20	21	22
19.0	3/4-in.	99.9	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0
12.5	1/2-in.	88.8	91.2	87.1	89.7	89.5	86.9	90.1	87.8	87.2	90.1
9.5	3/8-in.	76.1	81.4	74.9	79.6	79.1	75.7	80.1	74.9	74.3	78.7
4.75	No. 4	50.4	55.0	48.7	53.1	52.8	49.5	53.5	48.5	47.3	52.4
2.36	No. 8	40.2	42.6	37.5	40.8	40.4	38.2	41.5	37.7	37.2	40.5
1.18	No. 16	35.8	37.6	33.2	36.2	35.5	33.8	36.6	33.6	33.0	35.8
0.60	No. 30	29.7	31.2	27.5	29.9	29.0	27.7	30.0	27.7	27.4	29.3
0.30	No. 50	18.2	18.1	16.5	18.1	17.1	16.1	17.8	16.2	17.2	16.8
0.15	No. 100	9.6	10.0	8.5	9.9	8.8	8.4	9.3	8.3	8.6	8.3
0.075	No. 200	6.4	6.2	5.2	6.5	5.4	5.5	5.7	5.1	5.3	4.9
Surface Area (ft^2/lb)			33.5	29.4	33.5	30.6	29.8	31.9	29.0	29.7	29.5
Surface Area (m^2/kg)			6.87	6.01	6.87	6.27	6.10	6.53	5.95	6.09	6.04
Ratio #4 to #50			3.04	2.95	2.93	3.09	3.07	3.01	2.99	2.75	3.12

TABLE 107 Original construction fine plus mix bottom lift gradation of cores after ignition (n = 5/section)

Sieve Size		Target	Fine Plus Mix Top Lift—Average Percent Passing								
			Section Number								
(mm)	(US)		9	10	11	12	13	19	20	21	22
19.0	3/4-in.	99.9	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0
12.5	1/2-in.	88.8	91.2	87.1	89.7	89.5	86.9	90.1	87.8	87.2	90.1
9.5	3/8-in.	76.1	81.4	74.9	79.6	79.1	75.7	80.1	74.9	74.3	78.7
4.75	No. 4	50.4	55.0	48.7	53.1	52.8	49.5	53.5	48.5	47.3	52.4
2.36	No. 8	40.2	42.6	37.5	40.8	40.4	38.2	41.5	37.7	37.2	40.5
1.18	No. 16	35.8	37.6	33.2	36.2	35.5	33.8	36.6	33.6	33.0	35.8
0.60	No. 30	29.7	31.2	27.5	29.9	29.0	27.7	30.0	27.7	27.4	29.3
0.30	No. 50	18.2	18.1	16.5	18.1	17.1	16.1	17.8	16.2	17.2	16.8
0.15	No. 100	9.6	10.0	8.5	9.9	8.8	8.4	9.3	8.3	8.6	8.3
0.075	No. 200	6.4	6.2	5.2	6.5	5.4	5.5	5.7	5.1	5.3	4.9
Surface Area (ft^2/lb)			33.5	29.4	33.5	30.6	29.8	31.9	29.0	29.7	29.5
Surface Area (m^2/kg)			6.87	6.01	6.87	6.27	6.10	6.53	5.95	6.09	6.04
Ratio #4 to #50			3.04	2.95	2.93	3.09	3.07	3.01	2.99	2.75	3.12

TABLE 108 Original construction coarse mix top lift gradation of cores after ignition (n = 5/section)

Sieve Size		Target	Coarse Mix Top Lift—Average Percent Passing							
			Section Number							
(mm)	(US)		5	6	7	8	23	24	25	26
19.0	3/4-in.	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
12.5	1/2-in.	82.4	79.0	78.0	78.9	82.1	79.8	78.5	79.2	78.1
9.5	3/8-in.	64.6	65.1	63.9	64.6	68.6	65.7	64.1	64.4	63.5
4.75	No. 4	41.2	41.1	40.0	41.5	44.4	42.4	41.7	42.3	40.8
2.36	No. 8	27.8	27.4	27.5	28.7	30.2	29.1	28.7	29.4	28.0
1.18	No. 16	19.7	20.0	20.4	21.2	22.0	21.4	21.0	21.5	20.4
0.60	No. 30	14.6	15.5	15.7	16.1	16.7	16.5	16.0	16.4	15.5
0.30	No. 50	10.8	12.0	12.0	12.0	12.6	12.6	12.2	12.4	11.7
0.15	No. 100	7.7	9.0	8.8	8.7	9.3	9.5	9.1	9.2	8.7
0.075	No. 200	5.1	6.5	6.3	6.4	6.7	7.0	6.6	6.7	6.3
Surface Area (ft^2/lb)			27.1	26.7	27.0	28.3	28.7	27.6	28.0	26.5
Surface Area (m^2/kg)			5.55	5.47	5.53	5.79	5.88	5.65	5.73	5.44
Ratio #4 to #50			3.43	3.33	3.46	3.52	3.37	3.42	3.41	3.49

TABLE 109 Original construction coarse mix bottom lift gradation of cores after ignition (n = 5/section)

Sieve Size		Target	Coarse Mix Bottom Lift—Average Percent Passing							
			Section Number							
(mm)	(US)		5	6	7	8	23	24	25	26
19.0	3/4-in.	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
12.5	1/2-in.	82.4	82.9	81.4	80.5	82.6	83.3	82.2	79.8	80.7
9.5	3/8-in.	64.6	67.3	66.3	64.9	67.5	67.9	65.3	65.1	64.8
4.75	No. 4	41.2	42.1	42.4	40.3	42.9	43.2	41.7	41.8	41.0
2.36	No. 8	27.8	27.3	28.0	26.9	28.0	28.2	27.6	27.9	27.1
1.18	No. 16	19.7	19.8	20.0	19.5	20.0	20.1	20.0	20.3	19.5
0.60	No. 30	14.6	15.1	14.9	14.6	14.9	15.0	15.0	15.2	14.5
0.30	No. 50	10.8	11.0	10.9	10.8	11.0	11.1	11.0	11.2	10.6
0.15	No. 100	7.7	8.0	7.7	7.7	7.9	7.9	7.9	8.0	7.6
0.075	No. 200	5.1	5.7	5.4	5.4	5.7	5.6	5.5	5.6	5.3
Surface Area (ft^2/lb)			24.9	24.2	24.0	24.8	24.7	24.5	24.8	23.7
Surface Area (m^2/kg)			5.09	4.95	4.91	5.08	5.07	5.01	5.08	4.86
Ratio #4 to #50			3.83	3.89	3.73	3.90	3.89	3.79	3.73	3.87

TABLE 110 Aggregate gradation summary for fine-graded mixture—original construction

Sieve Size		Target	Top Layer				Bottom Layer			
(mm)	(US)		Mean	Std Dev	COV	n	Mean	Std Dev	COV	n
19.0	3/4-in.	100	100	0.1	0.1	46	100	0.0	0.0	41
12.5	1/2-in.	88.5	88.2	1.8	2.0	46	88.3	2.6	3.0	41
9.50	3/8-in.	75.4	76.6	2.4	3.1	46	75.9	4.0	5.3	41
4.75	No. 4	48.9	51.1	2.3	4.5	46	48.6	4.0	8.3	41
2.36	No. 8	38.4	39.8	1.9	4.1	46	36.7	3.1	8.4	41
1.18	No. 16	33.9	35.2	1.7	4.8	46	32.3	2.6	8.1	41
0.60	No. 30	27.6	28.6	1.3	4.5	46	26.4	2.0	7.7	41
0.30	No. 50	15.7	16.1	0.8	4.7	46	15.1	1.3	8.4	41
0.15	No. 100	6.8	8.1	0.4	5.5	46	7.4	0.6	8.5	41
0.075	No. 200	3.6	5.0	0.4	7.4	46	4.4	0.5	11.0	41

TABLE 111 Aggregate gradation summary for fine-plus-graded mixture—original construction

Sieve Size		**Target**	**Top Layer**				**Bottom Layer**			
(mm)	**(US)**		**Mean**	**Std Dev**	**COV**	**n**	**Mean**	**Std Dev**	**COV**	**n**
19.0	3/4-in.	100	100	0.1	0.1	42	100	0.1	0.1	42
12.5	1/2-in.	88.8	86.8	1.9	2.2	42	88.8	2.8	3.2	42
9.50	3/8-in.	76.1	75.6	2.4	3.2	42	77.8	4.2	5.5	42
4.75	No. 4	50.4	50.7	2.3	4.5	42	51.6	4.5	8.8	42
2.36	No. 8	40.2	39.4	1.8	4.6	42	39.7	3.2	8.2	42
1.18	No. 16	35.8	34.9	1.5	4.3	42	35.1	2.8	8.0	42
0.60	No. 30	29.7	28.8	1.1	4.0	42	29.0	2.1	7.1	42
0.30	No. 50	18.2	17.1	0.8	4.7	42	17.1	1.4	8.0	42
0.15	No. 100	9.6	9.0	0.6	6.5	42	8.9	1.1	11.9	42
0.075	No. 200	6.4	5.5	0.5	9.9	42	5.5	1.0	17.9	42

TABLE 112 Aggregate gradation summary for coarse-graded mixture—original construction

Sieve Size		**Target**	**Top Layer**				**Bottom Lift**			
(mm)	**(US)**		**Mean**	**Std Dev**	**Cov**	**n**	**Mean**	**Std Dev**	**Cov**	**n**
19.0	3/4-in.	100	100	0.0	0.0	41	100	0	0	37
12.5	1/2-in.	82.4	79.2	2.7	3.4	41	81.7	2.6	3.2	37
9.50	3/8-in.	64.6	65.0	6.4	9.9	41	66.2	3.0	4.6	37
4.75	No. 4	41.2	41.8	2.4	5.7	41	42.0	2.2	5.2	37
2.36	No. 8	27.8	28.6	1.5	5.2	41	27.7	1.3	4.8	37
1.18	No. 16	19.7	21.0	1.0	4.6	41	19.9	0.8	4.1	37
0.60	No. 30	14.6	16.1	0.7	4.2	41	14.9	0.6	3.9	37
0.30	No. 50	10.8	12.2	0.5	4.4	41	11.0	0.4	4.1	37
0.15	No. 100	7.7	9.0	0.5	5.6	41	7.9	0.4	5.0	37
0.075	No. 200	5.1	6.6	0.4	6.0	41	5.5	0.3	5.1	37

TABLE 113 Fine mix top lift gyratory volumetrics summary (QA) (original construction)

Section 1 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.69	2.434	4.2	13.0	68.1	89.1	95.8	96.8	1.31
Standard Deviation	0.22	0.000	0.8	0.7	4.1	0.9	0.8	0.8	0.00
Coefficient of Variation	3.87	0.000	19.1	5.6	6.1	1.0	0.8	0.8	0.00
Max	5.88	2.434	5.8	14.5	72.3	90.2	96.6	97.5	1.31
Min	5.35	2.434	3.4	12.3	60.0	87.4	94.2	95.3	1.31
Range	0.53	0.000	2.4	2.1	12.2	2.7	2.4	2.3	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 2 (LM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.02	2.436	6.0	14.0	57.2	87.6	94.0	95.0	1.39
Standard Deviation	0.06	0.000	0.4	0.4	1.8	0.5	0.4	0.4	0.00
Coefficient of Variation	1.20	0.000	6.9	2.7	3.1	0.6	0.4	0.4	0.00
Max	5.08	2.436	6.7	14.6	59.7	88.3	94.6	95.5	1.39
Min	4.93	2.436	5.4	13.5	54.4	86.9	93.3	94.3	1.39
Range	0.15	0.000	1.2	1.1	5.4	1.4	1.2	1.2	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 3 (LH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.08	2.479	7.8	14.2	45.2	86.4	92.2	93.1	1.76
Standard Deviation	0.15	0.000	0.4	0.4	1.5	1.3	0.4	0.4	0.00
Coefficient of Variation	2.95	0.000	5.5	2.8	3.3	1.5	0.5	0.4	0.00
Max	5.30	2.479	8.5	14.9	47.2	89.7	92.8	93.6	1.76
Min	4.93	2.479	7.2	13.7	42.7	85.0	91.5	92.5	1.76
Range	0.37	0.000	1.3	1.2	4.6	4.7	1.3	1.2	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 4 (ML)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.24	2.422	5.6	14.3	61.1	88.2	94.4	95.4	1.12
Standard Deviation	0.29	0.000	0.3	0.2	1.2	0.2	0.3	0.3	0.00
Coefficient of Variation	5.53	0.000	4.8	1.7	2.0	0.2	0.3	0.3	0.00
Max	5.67	2.422	5.9	14.6	63.5	88.6	95.0	95.9	1.12
Min	4.89	2.422	5.0	13.8	59.5	87.9	94.1	95.0	1.12
Range	0.78	0.000	0.9	0.8	4.1	0.8	0.9	0.8	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 14 (HM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.62	2.407	3.1	13.9	77.7	90.3	96.9	97.9	1.03
Standard Deviation	0.12	0.000	0.3	0.3	1.6	0.4	0.3	0.3	0.00
Coefficient of Variation	1.81	0.000	9.2	1.8	2.1	0.4	0.3	0.3	0.00
Max	6.38	2.407	3.4	14.2	79.8	90.9	97.3	98.2	1.03
Min	6.10	2.407	2.7	13.6	75.9	90.0	96.6	97.5	1.03
Range	0.28	0.000	0.7	0.6	3.9	0.9	0.7	0.7	0.00
Number of Replicates	5	3	6	6	6	6	6	6	6
Section 15 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.55	2.433	5.0	13.7	63.5	88.6	95.0	96.0	1.34
Standard Deviation	0.21	0.000	0.4	0.4	2.0	0.4	0.4	0.4	0.00
Coefficient of Variation	3.78	0.000	8.3	2.7	3.2	0.5	0.4	0.4	0.00
Max	5.85	2.433	5.7	14.3	66.6	89.2	95.6	96.5	1.34
Min	5.35	2.433	4.4	13.1	60.1	88.0	94.3	95.2	1.34
Range	0.50	0.000	1.3	1.2	6.5	1.2	1.3	1.4	0.00
Number of Replicates	5	4	8	8	8	8	8	8	8

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TABLE 113 (Continued)

Section 16 (LH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	4.84	2.427	6.0	14.2	57.6	87.7	94.0	95.0	1.33
Standard Deviation	0.12	0.000	0.3	0.3	1.3	0.3	0.3	0.3	0.00
Coefficient of Variation	2.48	0.000	5.1	2.0	2.3	0.4	0.3	0.3	0.00
Max	5.00	2.427	6.6	14.7	59.6	88.1	94.4	95.3	1.33
Min	4.73	2.427	5.6	13.7	55.1	87.1	93.4	94.4	1.33
Range	0.27	0.000	1.0	1.0	4.5	1.0	1.0	0.9	0.00
Number of Replicates	5	4	8	8	8	8	8	8	8
Section 17 (MH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.90	2.426	4.8	14.0	66.0	88.9	95.2	96.2	1.23
Standard Deviation	0.16	0.000	0.3	0.2	1.3	0.4	0.3	0.3	0.00
Coefficient of Variation	2.71	0.000	5.8	1.8	2.0	0.5	0.3	0.3	0.00
Max	6.03	2.426	5.3	14.5	67.5	89.3	95.5	96.5	1.23
Min	5.65	2.426	4.5	13.8	63.6	88.0	94.7	95.7	1.23
Range	0.38	0.000	0.8	0.7	3.9	1.3	0.8	0.8	0.00
Number of Replicates	5	4	8	8	8	8	8	8	8
Section 18 (HL)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.22	2.401	2.7	13.4	80.0	90.7	97.3	98.3	1.1
Standard Deviation	0.08	0.000	0.5	0.4	3.0	0.5	0.5	0.5	0.0
Coefficient of Variation	1.29	0.000	18.6	3.3	3.8	0.5	0.5	0.5	0.0
Max	6.36	2.401	3.5	14.1	83.7	91.3	97.9	98.9	1.1
Min	6.16	2.401	2.1	12.8	75.3	89.9	96.5	97.5	1.1
Range	0.20	0.000	1.4	1.2	8.4	1.5	1.4	1.3	0.0
Number of Replicates	5	5	10	10	10	10	10	10	10

TABLE 114 Fine mix bottom lift gyratory volumetrics summary (QA) (original construction)

Section 1 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.75	2.409	3.9	13.7	71.6	89.3	96.1	97.1	0.94
Standard Deviation	0.39	0.000	0.2	0.2	1.3	0.4	0.2	0.2	0.00
Coefficient of Variation	6.78	0.000	6.0	1.5	1.8	0.4	0.2	0.2	0.00
Max	6.09	0.000	4.3	14.0	73.7	89.8	96.5	97.5	0.00
Min	5.23	0.000	3.5	13.4	69.7	88.7	95.7	96.8	0.00
Range	0.86	0.000	0.7	0.7	4.0	1.1	0.7	0.7	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 2 (LM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	4.76	2.408	4.8	13.7	64.9	88.5	95.2	96.2	1.05
Standard Deviation	0.30	0.000	0.6	0.5	2.8	0.7	0.6	0.5	0.00
Coefficient of Variation	6.30	0.000	11.6	3.7	4.3	0.8	0.6	0.5	0.00
Max	5.07	0.000	5.6	14.4	69.3	89.7	96.0	97.0	0.00
Min	4.40	0.000	4.0	12.9	61.2	87.4	94.4	95.6	0.00
Range	0.67	0.000	1.6	1.5	8.1	2.3	1.6	1.4	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 3 (LH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.13	2.434	5.5	13.7	60.1	87.9	94.5	95.5	1.14
Standard Deviation	0.25	0.000	0.2	0.1	0.7	0.4	0.2	0.2	0.00
Coefficient of Variation	4.87	0.000	2.9	1.1	1.2	0.5	0.2	0.2	0.00
Max	5.44	0.000	5.7	13.9	61.3	88.3	94.8	95.8	0.00
Min	4.88	0.000	5.2	13.4	59.1	86.8	94.3	95.3	0.00
Range	0.56	0.000	0.5	0.4	2.3	1.5	0.5	0.5	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 4 (ML)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.62	2.413	4.3	13.8	68.9	88.9	95.7	96.8	1.01
Standard Deviation	0.05	0.000	0.4	0.3	1.8	0.5	0.4	0.3	0.00
Coefficient of Variation	0.89	0.000	8.3	2.3	2.7	0.5	0.4	0.4	0.00
Max	5.69	0.000	5.0	14.5	71.1	89.3	96.1	97.1	0.00
Min	5.56	0.000	3.9	13.4	65.2	87.9	95.0	96.1	0.00
Range	0.13	0.000	1.2	1.0	6.0	1.4	1.2	1.0	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 14 (HM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.62	2.401	2.1	13.2	84.3	91.0	97.9	98.9	0.92
Standard Deviation	0.14	0.000	0.2	0.2	1.4	0.3	0.2	0.2	0.00
Coefficient of Variation	2.11	0.000	10.7	1.5	1.7	0.3	0.2	0.2	0.00
Max	6.73	0.000	2.4	13.5	86.4	91.5	98.2	99.1	0.00
Min	6.43	0.000	1.8	12.9	82.0	90.7	97.6	98.6	0.00
Range	0.30	0.000	0.7	0.6	4.3	0.8	0.7	0.5	0.00
Number of Replicates	5	4	8	8	8	8	8	8	8
Section 15 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.56	2.418	4.5	13.8	67.3	88.5	95.5	96.6	1.14
Standard Deviation	0.22	0.000	0.3	0.3	1.6	0.4	0.3	0.3	0.00
Coefficient of Variation	3.96	0.000	6.9	2.0	2.4	0.4	0.3	0.3	0.00
Max	5.90	0.000	4.9	14.2	70.0	89.3	96.0	97.0	0.00
Min	5.28	0.000	4.0	13.3	65.2	88.0	95.1	96.2	0.00
Range	0.62	0.000	0.9	0.8	4.8	1.3	0.9	0.8	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10

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TABLE 114 (Continued)

Section 16 (LH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	4.79	2.449	6.7	13.9	52.2	86.9	93.3	94.3	1.34
Standard Deviation	0.30	0.000	0.3	0.3	1.2	0.4	0.3	0.3	0.00
Coefficient of Variation	6.26	0.000	4.7	2.1	2.4	0.4	0.3	0.3	0.00
Max	5.12	0.000	7.2	14.4	53.7	87.4	93.7	94.7	0.00
Min	4.33	0.000	6.3	13.6	50.3	86.3	92.8	93.9	0.00
Range	0.79	0.000	0.9	0.8	3.4	1.1	0.9	0.8	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 17 (MH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.49	1.951	5.4	13.8	60.7	87.9	94.6	95.6	1.23
Standard Deviation	0.23	0.000	0.2	0.2	1.0	0.3	0.2	0.2	0.00
Coefficient of Variation	4.19	0.000	3.9	1.4	1.6	0.3	0.2	0.2	0.00
Max	5.80	0.000	5.8	14.1	61.6	88.2	94.8	95.8	0.00
Min	5.17	0.000	5.2	13.6	59.1	87.4	94.2	95.2	0.00
Range	0.63	0.000	0.6	0.5	2.6	0.8	0.6	0.6	0.00
Number of Replicates	5	5	8	8	8	8	8	8	8
Section 18 (HL)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.26	2.412	3.1	13.3	77.0	89.8	96.9	98.0	1.0
Standard Deviation	0.19	0.000	0.4	0.4	2.5	0.7	0.4	0.4	0.0
Coefficient of Variation	3.04	0.000	13.4	2.8	3.2	0.7	0.4	0.4	0.0
Max	6.45	0.000	3.8	14.0	81.6	90.7	97.7	98.5	0.0
Min	5.97	0.000	2.3	12.7	73.1	88.4	96.2	97.4	0.0
Range	0.48	0.000	1.4	1.3	8.5	2.4	1.4	1.1	0.0
Number of Replicates	5	5	10	10	10	10	10	10	10

TABLE 115 Fine plus mix top lift gyratory volumetrics summary (QA) (original construction)

Section 9 (HL)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.07	2.356	-0.2	12.3	102.0	95.0	100.2	100.5	0.95
Standard Deviation	0.29	0.000	0.2	0.2	1.8	0.2	0.2	0.2	0.00
Coefficient of Variation	4.78	0.000	-87.1	1.5	1.7	0.2	0.2	0.2	0.00
Max	6.42	2.356	0.1	12.5	104.9	95.4	100.6	100.8	0.95
Min	5.78	2.356	-0.6	12.0	99.5	94.6	99.9	100.4	0.95
Range	0.64	0.000	0.6	0.6	5.4	0.8	0.6	0.5	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 10 (LH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	4.80	2.415	3.6	12.3	71.2	89.8	96.4	97.4	1.44
Standard Deviation	0.18	0.000	0.5	0.5	3.0	0.5	0.5	0.5	0.00
Coefficient of Variation	3.75	0.000	14.3	3.7	4.3	0.5	0.5	0.5	0.00
Max	5.01	2.415	4.3	13.0	75.8	90.4	97.2	98.1	1.44
Min	4.52	2.415	2.8	11.7	66.8	89.1	95.7	96.7	1.44
Range	0.49	0.000	1.5	1.4	9.0	1.3	1.5	1.4	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 11 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.50	2.407	1.9	11.8	84.0	91.2	98.1	99.0	1.28
Standard Deviation	0.14	0.000	0.3	0.2	1.9	0.4	0.3	0.2	0.00
Coefficient of Variation	2.55	0.000	13.8	2.0	2.3	0.5	0.3	0.2	0.00
Max	5.68	2.407	2.3	12.1	88.1	92.2	98.7	99.4	1.28
Min	5.31	2.407	1.3	11.3	81.1	90.6	97.7	98.8	1.28
Range	0.37	0.000	1.0	0.9	7.0	1.6	1.0	0.6	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 12 (ML)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.35	2.396	1.5	11.6	87.5	91.8	98.5	99.4	1.35
Standard Deviation	0.16	0.000	0.1	0.1	1.0	0.2	0.1	0.2	0.00
Coefficient of Variation	2.99	0.000	9.3	1.0	1.2	0.2	0.1	0.2	0.00
Max	5.53	2.396	1.7	11.8	88.9	92.0	98.7	99.8	1.35
Min	5.18	2.396	1.3	11.5	85.9	91.4	98.3	99.1	1.35
Range	0.35	0.000	0.4	0.4	3.0	0.6	0.4	0.7	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 13 (HM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.01	2.394	0.8	11.8	93.1	92.5	99.2	99.8	1.20
Standard Deviation	0.21	0.000	0.3	0.2	2.1	0.7	0.3	0.1	0.00
Coefficient of Variation	3.49	0.000	33.0	2.0	2.3	0.7	0.3	0.1	0.00
Max	6.24	2.394	1.4	12.2	95.7	93.4	99.5	100.1	1.20
Min	5.71	2.394	0.5	11.5	88.9	91.2	98.6	99.7	1.20
Range	0.53	0.000	0.9	0.8	6.8	2.2	0.9	0.4	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 19(MM)	P_{asp}	Gmm	%VT	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.41	2.374	0.6	11.7	95.1	92.7	99.4	100.3	1.19
Standard Deviation	0.17	0.000	0.2	0.2	1.8	0.2	0.2	0.2	0.00
Coefficient of Variation	3.14	0.000	38.3	1.7	1.9	0.2	0.2	0.2	0.00
Max	5.55	2.374	0.8	12.0	97.6	92.9	99.7	100.7	1.19
Min	5.13	2.374	0.3	11.5	92.9	92.3	99.2	100.0	1.19
Range	0.42	0.000	0.6	0.5	4.7	0.6	0.6	0.7	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10

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TABLE 115 (Continued)

Section 20 (MH)	P_{asp}	Gmm	%VT	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.40	1.911	1.6	12.1	87.1	91.6	98.4	99.3	1.13
Standard Deviation	0.11	1.068	0.9	0.8	5.8	1.0	0.9	0.9	0.00
Coefficient of Variation	2.04	55.9	55.8	6.6	6.7	1.1	0.9	0.9	0.00
Max	5.58	2.389	3.7	14.0	90.6	92.1	98.9	99.8	1.13
Min	5.30	2.389	1.1	11.6	73.2	89.2	96.3	97.2	1.13
Range	0.28	0.000	2.6	2.4	17.3	2.9	2.6	2.6	0.00
Number of Replicates	5	5	8	8	8	8	8	8	8
Section 21 (HL)	P_{asp}	Gmm	%VT	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.25	2.380	0.4	12.1	96.7	93.0	99.6	100.2	1.06
Standard Deviation	0.12	0.000	0.2	0.2	2.0	0.3	0.2	0.4	0.00
Coefficient of Variation	1.92	0.000	61.4	1.8	2.1	0.3	0.3	0.4	0.00
Max	6.41	2.380	0.8	12.5	99.4	93.6	99.9	100.8	1.06
Min	6.08	2.380	0.1	11.8	93.4	92.6	99.2	99.7	1.06
Range	0.33	0.000	0.8	0.7	6.1	1.0	0.8	1.1	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 22 (LM)	P_{asp}	Gmm	%VT	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	4.76	2.408	3.1	12.1	74.7	90.3	96.9	97.9	1.3
Standard Deviation	0.10	0.000	0.4	0.3	2.3	0.3	0.4	0.4	0.0
Coefficient of Variation	2.10	0.000	12.3	2.8	3.1	0.4	0.4	0.4	0.0
Max	4.87	2.408	3.9	12.9	77.3	90.6	97.3	98.3	1.3
Min	4.64	2.408	2.7	11.7	69.6	89.4	96.1	97.1	1.3
Range	0.23	0.000	1.3	1.1	7.8	1.2	1.3	1.2	0.0
Number of Replicates	5	5	10	10	10	10	10	10	10

TABLE 116 Fine plus mix bottom lift gyratory volumetrics summary (QA) (original construction)

Section 9 (HL)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.80	2.374	1.0	12.4	92.1	92.8	99.0	99.5	1.23
Standard Deviation	0.15	0.000	0.2	0.2	1.4	0.4	0.2	0.3	0.00
Coefficient of Variation	2.59	0.000	19.3	1.4	1.6	0.5	0.2	0.3	0.00
Max	5.93	2.374	1.3	12.7	94.7	93.2	99.4	99.9	1.23
Min	5.54	2.374	0.6	12.1	90.0	92.0	98.7	99.2	1.23
Range	0.39	0.000	0.6	0.6	4.7	1.2	0.6	0.8	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 10 (LH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	4.33	1.939	4.7	12.6	62.9	88.2	95.3	96.4	1.47
Standard Deviation	0.13	1.084	0.3	0.3	1.6	0.4	0.3	0.3	0.00
Coefficient of Variation	3.00	55.9	6.8	2.3	2.6	0.4	0.3	0.3	0.00
Max	4.51	2.424	5.2	13.1	64.7	88.6	95.7	96.7	1.47
Min	4.21	2.424	4.3	12.3	60.0	87.6	94.8	95.9	1.47
Range	0.30	0.000	0.9	0.8	4.7	1.0	0.9	0.8	0.00
Number of Replicates	5	5	8	8	8	8	8	8	8
Section 11 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.16	1.912	1.7	11.9	85.5	91.2	98.3	99.1	1.45
Standard Deviation	0.35	0.000	0.3	0.3	2.4	0.4	0.3	0.3	0.00
Coefficient of Variation	6.78	0.000	19.3	2.5	2.8	0.4	0.3	0.3	0.00
Max	5.49	2.390	2.2	12.4	88.2	91.6	98.6	99.5	1.45
Min	4.61	2.390	1.4	11.6	82.0	90.6	97.8	98.7	1.45
Range	0.88	0.000	0.9	0.8	6.3	1.0	0.9	0.8	0.00
Number of Replicates	5	5	8	8	8	8	8	8	8
Section 12 (ML)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.27	2.404	2.4	12.1	80.2	90.5	97.6	98.6	1.27
Standard Deviation	0.32	0.000	0.3	0.3	2.3	0.4	0.3	0.3	0.00
Coefficient of Variation	6.07	0.000	14.2	2.5	2.9	0.5	0.4	0.3	0.00
Max	5.77	2.404	3.0	12.6	83.1	91.1	98.0	99.0	1.27
Min	4.92	2.404	2.0	11.7	76.5	90.0	97.0	98.0	1.27
Range	0.85	0.000	1.0	0.9	6.6	1.1	1.0	1.1	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 13 (HM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.76	1.920	1.6	12.0	87.1	91.7	98.4	99.1	1.21
Standard Deviation	0.28	1.073	0.3	0.3	2.4	0.5	0.3	0.2	0.00
Coefficient of Variation	4.86	55.9	21.1	2.4	2.8	0.5	0.3	0.2	0.00
Max	6.19	2.400	2.1	12.4	90.1	92.1	98.9	99.5	1.21
Min	5.46	2.400	1.1	11.6	83.3	91.0	97.9	98.8	1.21
Range	0.73	0.000	0.9	0.8	6.8	1.1	0.9	0.7	0.00
Number of Replicates	5	5	8	8	8	8	8	8	8
Section 19 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.48	2.401	2.1	12.1	83.1	90.8	97.9	98.8	1.29
Standard Deviation	0.14	0.000	0.4	0.3	2.5	0.5	0.4	0.3	0.00
Coefficient of Variation	2.55	0.000	17.6	2.7	3.0	0.5	0.4	0.3	0.00
Max	5.66	2.401	2.6	12.6	86.9	91.6	98.5	99.2	1.29
Min	5.35	2.401	1.5	11.6	79.7	90.1	97.4	98.5	1.29
Range	0.31	0.000	1.0	0.9	7.2	1.5	1.0	0.7	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10

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TABLE 116 (Continued)

Section 20 (MH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.13	2.409	2.3	11.7	80.6	90.7	97.7	98.6	1.24
Standard Deviation	0.35	0.000	0.5	0.4	3.1	0.7	0.5	0.4	0.00
Coefficient of Variation	6.82	0.000	19.8	3.5	3.8	0.8	0.5	0.4	0.00
Max	5.68	2.409	3.2	12.6	83.9	91.7	98.2	99.0	1.24
Min	4.76	2.409	1.8	11.3	74.2	89.3	96.8	97.8	1.24
Range	0.92	0.000	1.4	1.3	9.7	2.4	1.4	1.1	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 21 (HL)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.84	2.386	0.9	11.9	92.9	92.3	99.1	99.7	1.10
Standard Deviation	0.24	0.000	0.4	0.3	3.0	0.7	0.4	0.2	0.00
Coefficient of Variation	4.11	0.000	45.7	2.9	3.3	0.8	0.4	0.2	0.00
Max	6.05	2.386	1.5	12.5	95.6	93.3	99.5	100.0	1.10
Min	5.46	2.386	0.5	11.6	88.3	91.1	98.5	99.2	1.10
Range	0.59	0.000	0.9	0.8	7.3	2.2	0.9	0.8	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 22 (LM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	4.52	2.414	4.5	12.9	65.6	88.5	95.5	96.6	1.3
Standard Deviation	0.19	0.000	0.4	0.3	1.9	0.4	0.4	0.3	0.0
Coefficient of Variation	4.20	0.000	8.1	2.5	2.9	0.4	0.4	0.3	0.0
Max	4.74	2.414	5.1	13.5	69.3	89.1	96.2	97.2	1.3
Min	4.24	2.414	3.8	12.3	62.5	87.9	94.9	96.0	1.3
Range	0.50	0.000	1.3	1.2	6.9	1.2	1.3	1.2	0.0
Number of Replicates	5	5	10	10	10	10	10	10	10

TABLE 117 Coarse mix top lift gyratory volumetrics summary (QA) (original construction)

Section 5 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.67	2.399	2.7	12.1	77.6	87.8	97.3	98.7	1.57
Standard Deviation	0.15	0.000	0.3	0.3	2.1	0.8	0.3	0.3	0.00
Coefficient of Variation	2.65	0.000	12.0	2.4	2.7	0.9	0.3	0.3	0.00
Max	5.90	2.399	4.1	13.3	80.4	89.4	97.7	99.2	1.57
Min	5.50	2.399	2.3	11.7	69.4	86.2	95.9	97.5	1.57
Range	0.40	0.000	1.8	1.6	11.0	3.3	1.8	1.7	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 6 (MH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.73	2.411	3.3	12.2	73.5	86.8	96.7	98.2	1.60
Standard Deviation	0.10	0.000	0.8	0.7	4.6	0.9	0.8	0.7	0.00
Coefficient of Variation	1.75	0.000	23.9	5.8	6.3	1.0	0.8	0.7	0.00
Max	5.88	2.411	4.7	13.5	79.2	87.7	97.6	99.0	1.60
Min	5.63	2.411	2.4	11.4	65.1	84.9	95.3	96.8	1.60
Range	0.25	0.000	2.3	2.1	14.1	2.8	2.3	2.2	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 7 (HM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.28	2.382	1.7	12.3	86.5	88.5	98.3	99.6	1.36
Standard Deviation	0.15	0.000	0.2	0.2	1.8	0.4	0.2	0.4	0.00
Coefficient of Variation	2.39	0.000	14.7	1.8	2.0	0.5	0.2	0.4	0.00
Max	6.39	2.382	2.0	12.6	88.9	89.2	98.7	100.0	1.36
Min	6.03	2.382	1.3	12.0	84.3	87.8	98.0	98.7	1.36
Range	0.36	0.000	0.7	0.6	4.7	1.4	0.7	1.3	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 8 (LM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.55	2.430	5.1	13.0	61.1	85.8	94.9	96.4	1.90
Standard Deviation	0.11	0.000	0.7	0.6	3.2	0.5	0.7	0.6	0.00
Coefficient of Variation	1.98	0.000	12.9	4.6	5.2	0.6	0.7	0.7	0.00
Max	5.68	2.430	6.3	14.1	65.4	86.4	95.8	97.2	1.90
Min	5.39	2.430	4.2	12.2	55.2	84.8	93.7	95.2	1.90
Range	0.29	0.000	2.1	1.9	10.1	1.6	2.1	2.0	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 23 (ML)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.78	2.420	3.4	12.0	71.8	86.8	96.6	98.1	1.84
Standard Deviation	0.14	0.000	0.3	0.3	2.0	0.4	0.3	0.3	0.00
Coefficient of Variation	2.42	0.000	9.4	2.4	2.7	0.4	0.3	0.3	0.00
Max	5.92	2.420	4.0	12.6	74.6	87.3	97.0	98.4	1.84
Min	5.59	2.420	3.0	11.6	68.3	85.9	96.0	97.6	1.84
Range	0.33	0.000	1.0	0.9	6.3	1.3	1.0	0.8	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 24 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.91	2.399	2.5	12.1	79.2	87.7	97.5	98.9	1.56
Standard Deviation	0.12	0.000	0.4	0.4	2.8	0.5	0.4	0.4	0.00
Coefficient of Variation	2.03	0.000	16.3	3.1	3.5	0.6	0.4	0.4	0.00
Max	6.03	2.399	3.2	12.8	82.6	88.4	98.0	99.4	1.56
Min	5.76	2.399	2.0	11.7	74.6	87.0	96.8	98.2	1.56
Range	0.27	0.000	1.2	1.1	8.0	1.5	1.2	1.2	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10

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TABLE 117 (Continued)

Section 25 (HL)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.33	1.902	1.6	12.5	87.6	88.3	98.4	99.8	1.40
Standard Deviation	0.06	1.063	0.9	0.8	6.0	1.0	0.9	0.7	0.00
Coefficient of Variation	0.95	55.9	54.5	6.2	6.8	1.1	0.9	0.7	0.00
Max	6.38	2.377	3.1	13.8	96.0	89.3	99.5	100.6	1.40
Min	6.22	2.377	0.5	11.5	77.5	86.6	96.9	98.6	1.40
Range	0.16	0.000	2.7	2.4	18.5	2.7	2.7	2.1	0.00
Number of Replicates	5	5	8	8	8	8	8	8	8
Section 26 (LH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.43	2.424	4.9	13.0	62.3	85.9	95.1	96.4	1.75
Standard Deviation	0.23	0.000	1.0	0.9	4.9	1.0	1.0	1.0	0.00
Coefficient of Variation	4.24	0.000	20.4	7.1	7.9	1.2	1.1	1.0	0.00
Max	5.69	2.424	6.2	14.2	67.7	87.5	96.1	97.4	1.75
Min	5.17	2.424	3.9	12.0	56.0	84.6	93.8	95.1	1.75
Range	0.52	0.000	2.4	2.2	11.7	2.9	2.4	2.3	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10

TABLE 118 Coarse mix bottom lift gyratory volumetrics summary (QA) (original construction)

Section 5 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.61	2.395	4.2	13.5	69.1	85.9	95.8	97.4	1.36
Standard Deviation	0.08	0.000	0.5	0.4	2.5	0.5	0.5	0.4	0.00
Coefficient of Variation	1.43	0.000	10.8	3.0	3.6	0.5	0.5	0.4	0.00
Max	5.69	2.395	4.7	13.9	76.8	87.3	97.1	98.7	1.36
Min	5.49	2.395	2.9	12.3	66.5	85.1	95.3	96.9	1.36
Range	0.20	0.000	1.8	1.6	10.3	2.2	1.8	1.8	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 6 (MH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.89	2.404	5.0	14.1	65.6	85.1	95.0	96.6	1.31
Standard Deviation	0.18	0.000	1.8	1.6	7.5	1.9	1.8	1.7	0.00
Coefficient of Variation	3.06	0.000	35.5	11.3	11.4	2.3	1.9	1.7	0.00
Max	6.06	2.404	8.5	17.3	71.7	86.4	96.3	97.9	1.31
Min	5.64	2.404	3.7	13.0	50.9	81.4	91.5	93.1	1.31
Range	0.42	0.000	4.9	4.4	20.8	5.0	4.9	4.7	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 7 (HM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.38	2.383	3.0	13.6	77.9	86.6	97.0	98.4	1.15
Standard Deviation	0.10	0.000	0.9	0.8	5.3	1.0	0.9	0.6	0.00
Coefficient of Variation	1.57	0.000	29.1	5.8	6.8	1.1	0.9	0.7	0.00
Max	6.55	2.383	4.3	14.8	88.1	88.3	98.6	99.2	1.15
Min	6.27	2.383	1.4	12.2	70.6	85.2	95.7	97.4	1.15
Range	0.28	0.000	2.9	2.6	17.6	3.1	2.9	1.8	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 8 (LM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.54	2.429	6.2	14.0	56.6	84.2	93.8	95.2	1.61
Standard Deviation	0.12	0.000	1.7	1.6	6.3	1.5	1.7	1.7	0.00
Coefficient of Variation	2.17	0.000	28.2	11.4	11.1	1.8	1.9	1.8	0.00
Max	5.64	2.429	10.8	18.3	65.2	85.5	95.7	96.4	1.61
Min	5.37	2.429	4.3	12.3	40.8	80.1	89.2	90.6	1.61
Range	0.27	0.000	6.6	6.0	24.5	5.4	6.6	5.8	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 23 (ML)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.84	2.394	4.6	14.1	67.8	85.4	95.4	97.0	1.30
Standard Deviation	0.09	0.000	1.2	1.0	5.9	1.3	1.2	1.1	0.00
Coefficient of Variation	1.54	0.000	25.2	7.4	8.6	1.5	1.2	1.1	0.00
Max	5.98	2.394	6.4	15.7	78.1	87.2	97.3	98.7	1.30
Min	5.73	2.394	2.7	12.4	59.5	83.5	93.6	95.4	1.30
Range	0.25	0.000	3.6	3.3	18.6	3.7	3.6	3.4	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 24 (MM)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.78	2.409	5.1	14.0	63.7	84.8	94.9	96.5	1.38
Standard Deviation	0.13	0.000	1.1	1.0	5.1	1.0	1.1	1.1	0.00
Coefficient of Variation	2.25	0.000	21.0	7.0	8.0	1.2	1.1	1.1	0.00
Max	5.92	2.409	6.7	15.5	70.3	86.0	96.2	97.8	1.38
Min	5.61	2.409	3.8	12.8	56.4	83.3	93.3	94.9	1.38
Range	0.31	0.000	2.9	2.7	13.9	2.7	2.9	2.9	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10

(continued on next page)

TABLE 118 (Continued)

Section 25 (HL)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.24	1.901	2.5	13.3	81.3	87.2	97.5	99.0	1.17
Standard Deviation	0.09	1.063	1.1	1.0	6.6	1.2	1.1	1.1	0.00
Coefficient of Variation	1.44	55.9	44.9	7.6	8.1	1.4	1.2	1.1	0.00
Max	6.34	2.376	4.4	14.9	85.9	88.1	98.2	99.7	1.17
Min	6.12	2.376	1.8	12.6	70.6	85.1	95.6	97.2	1.17
Range	0.22	0.000	2.6	2.3	15.2	3.0	2.6	2.6	0.00
Number of Replicates	5	5	8	8	8	8	8	8	8
Section 26 (LH)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.37	2.389	4.7	13.9	66.6	85.8	95.3	96.9	1.27
Standard Deviation	0.21	0.000	0.9	0.8	4.1	0.9	0.9	0.8	0.00
Coefficient of Variation	3.91	0.000	18.5	5.6	6.2	1.0	0.9	0.8	0.00
Max	5.57	2.389	6.4	15.5	72.0	86.6	96.4	97.8	1.27
Min	5.01	2.389	3.6	13.0	58.5	84.2	93.6	95.2	1.27
Range	0.56	0.000	2.8	2.5	13.5	2.4	2.8	2.6	0.00
Number of Replicates	5	5	10	10	10	10	10	10	10

TABLE 119 Volumetric properties of optimum asphalt binder content mixtures (original construction)

Mixture Designation	Section	Lift	Air Voids, Percent	VMA, Percent	VFA, Percent	Gmmi, Percent	Gmmd, Percent	Gmmm, Percent
Fine	1	Top	4.2	13.0	68.1	89.1	95.8	96.8
		Bottom	3.9	13.7	71.6	89.3	96.1	97.1
	4	Top	5.6	14.3	61.1	88.2	94.4	95.4
		Bottom	4.3	13.8	68.9	88.9	95.7	96.8
	15	Top	5.0	13.7	63.5	88.6	95.0	96.0
		Bottom	4.5	13.8	67.3	88.5	95.5	96.6
	17	Top	4.8	14.0	66.0	88.9	95.2	96.2
		Bottom	5.4	13.8	60.7	87.9	94.6	95.6
Fine Plus	11	Top	1.9	11.8	84.0	91.2	98.1	99.0
		Bottom	1.7	11.9	85.5	91.2	98.3	99.1
	12	Top	1.5	11.6	87.5	91.8	98.5	99.4
		Bottom	2.4	12.1	80.2	90.5	97.6	98.6
	19	Top	0.6	11.7	95.1	92.7	99.4	100.3
		Bottom	2.1	12.1	83.1	90.8	97.9	98.8
	20	Top	1.6	12.1	87.1	91.6	98.4	99.3
		Bottom	2.3	11.7	80.6	90.7	97.7	98.6
Coarse	5	Top	2.7	12.1	77.6	87.8	97.3	98.7
		Bottom	4.2	13.5	69.1	85.9	95.8	97.4
	6	Top	3.3	12.2	73.5	86.8	96.7	98.2
		Bottom	5.0	14.1	65.6	85.1	95.0	96.6
	23	Top	3.4	12.0	71.8	86.8	96.6	98.1
		Bottom	4.6	14.1	67.8	85.4	95.4	97.0
	24	Top	2.5	12.1	79.2	87.7	97.5	98.9
		Bottom	5.1	14.0	63.7	84.8	94.9	96.5

TABLE 120 As-built pavement thickness of WesTrack original test sections (original construction, before grinding)

Section Station (Thickness meters)					
Section	**Layer**	**0+25**	**0+35**	**0+45**	**0+55**
1	AC	0.174	0.179	0.175	0.174
2	AC	0.169	0.165	0.160	0.160
3	AC	0.169	0.172	0.162	0.169
4	AC	0.165	0.163	0.162	0.159
5	AC	0.168	0.168	0.169	0.170
6	AC	0.167	0.175	0.173	0.181
7	AC	0.174	0.174	0.133	0.170
8	AC	0.169	0.175	0.169	0.171
9	AC	0.161	0.159	0.161	0.165
10	AC	0.162	0.158	0.158	0.163
11	AC	0.165	0.170	0.174	0.169
12	AC	0.168	0.170	0.166	0.162
13	AC	0.171	0.164	0.168	0.173
14	AC	0.165	0.156	0.157	0.163
15	AC	0.156	0.157	0.156	0.151
16	AC	0.163	0.166	0.164	0.163
17	AC	0.164	0.166	0.165	0.162
18	AC	0.158	0.162	0.155	0.155
19	AC	0.160	0.164	0.172	0.166
20	AC	0.170	0.174	0.180	0.173
21	AC	0.164	0.159	0.157	0.160
22	AC	0.162	0.158	0.148	0.158
23	AC	0.161	0.158	0.166	0.157
24	AC	0.184	0.186	0.183	0.184
25	AC	0.164	0.165	0.167	0.161
26	AC	0.181	0.181	0.183	0.184

1 ft = 0.305 m

TABLE 121 Official WesTrack replacement section asphalt content data summary

Section	Target	Top Lift				Bottom Lift			
		Average	Std. Dev.	COV	Range	Average	Std. Dev.	COV	Range
38 LM	5.2	5.55	0.13	2.3	0.34	5.43	0.11	2.0	0.25
56 LH	5.2	6.04	0.11	1.9	0.25	5.33	0.13	2.5	0.25
35 MM1	5.8	6.12	0.12	2.0	0.28	5.71	0.13	2.3	0.22
36 MH	5.8	5.86	0.10	1.7	0.24	5.37	0.16	2.9	0.31
39 ML	5.8	5.94	0.27	4.6	0.70	5.62	0.27	4.9	0.75
54 MM2	5.8	6.11	0.08	1.3	0.19	5.78	0.16	2.7	0.30
37 HM	6.4	6.14	0.12	2.0	0.29	5.94	0.22	3.7	0.52
55 HL	6.4	6.04	0.33	5.5	0.94	5.93	0.18	3.1	0.35

TABLE 122 WesTrack replacement mixture top lift asphalt content by reflux method with outliers removed, units in percent

Sec #	Target		HLA							UNR										Combined Results (Outliers Removed)			
			Determinations							Determination													
	P_{asp}	V_{air}	1	2	3	Average	Std Dev	COV	Range	1	2	3	4	5	6	Average	Std Dev	COV	Range	Average	Std Dev	COV	Range
35 MM1	5.8	8	6.32	6.10	6.09	6.17	0.13	2.11	0.23	5.98	6.10					6.04	0.08	1.40	0.12	6.12	0.12	2.02	0.28
36 MH	5.8	12	5.90	5.93	5.88	5.90	0.03	0.43	0.05	5.69	5.92					5.81	0.16	2.80	0.24	5.86	0.10	1.69	0.24
37 HM	6.4	8	6.00	6.29	6.24	6.18	0.16	2.51	0.29	6.07	6.12					6.10	0.04	0.58	0.05	6.14	0.12	1.95	0.29
38 LM	5.2	8	4.79	4.10	4.50	4.46	0.35	7.76	0.69	5.50	5.59	5.58	5.38	5.72		5.55	0.13	2.25	0.34	5.55	0.13	2.25	0.34
39 ML	5.8	4	6.12	5.92	6.28	6.11	0.18	2.95	0.36	5.80	5.58					5.69	0.16	2.73	0.22	5.94	0.27	4.59	0.70
54 MM2	5.8	8	6.05	6.03	6.15	6.08	0.06	1.06	0.12	6.12	6.22					6.17	0.07	1.15	0.10	6.11	0.08	1.26	0.19
55 HL	6.4	4	6.05	5.99	6.53	6.19	0.30	4.78	0.54	5.59	6.06					5.83	0.33	5.71	0.47	6.04	0.33	5.52	0.94
56 LH	5.2	12	6.10	6.12	6.14	6.12	0.02	0.33	0.04	5.95	5.89					5.92	0.04	0.72	0.06	6.04	0.11	1.86	0.25

Shaded data discarded from analysis because of unacceptable testing variability. See WesTrack Technical Report UNR-17.

TABLE 123 WesTrack replacement mixture bottom lift asphalt content by reflux method with outliers removed, units in percent

Sec #	Target		HLA							UNR										Combined Results (Outliers Removed)			
			Determinations							Determination													
	P_{asp}	V_{air}	1	2	3	Average	Std Dev	COV	Range	1	2	3	4	5	6	Average	Std Dev	COV	Range	Average	Std Dev	COV	Range
35 MM1	5.8	8	6.26	6.44	6.37	6.36	0.09	1.43	0.18	5.78	5.79	5.56				5.71	0.13	2.28	0.22	5.71	0.13	2.28	0.22
36 MH	5.8	12	6.58	5.05	5.63	5.75	0.77	13.43	1.53	5.52	5.39	5.21				5.37	0.16	2.90	0.31	5.37	0.16	2.90	0.31
37 HM	6.4	8	6.58	7.42	6.76	6.92	0.44	6.39	0.84	5.63	5.48	5.82	6.12	6.15	6.00	5.87	0.27	4.64	0.67	5.94	0.22	3.67	0.52
38 LM	5.2	8	6.51	6.32	6.58	6.47	0.13	2.08	0.26	5.47	5.30	5.44	5.54	5.29	5.53	5.43	0.11	2.02	0.25	5.43	0.11	2.02	0.25
39 ML	5.8	4	7.43	6.56	7.06	7.02	0.44	6.22	0.87	6.03	5.28	5.34	5.70	5.67	5.70	5.62	0.27	4.89	0.75	5.62	0.27	4.89	0.75
54 MM2	5.8	8	6.28	6.03	6.13	6.15	0.13	2.05	0.25	5.95	5.65	5.73				5.78	0.16	2.69	0.30	5.78	0.16	2.69	0.30
55 HL	6.4	12	6.73	6.43	6.51	6.56	0.16	2.37	0.30	5.87	5.79	6.14				5.93	0.18	3.09	0.35	5.93	0.18	3.09	0.35
56 LH	5.2	4	5.71	5.73	5.93	5.79	0.12	2.10	0.22	5.23	5.48	5.28				5.33	0.13	2.48	0.25	5.33	0.13	2.48	0.25

Shaded data discarded from analysis because of unacceptable testing variability. See WesTrack Technical Report UNR-17.

TABLE 124 Replacement top lift gradation of loose mix after ignition (n = 5/section)

Sieve Size		Target	Replacement Mix Top Lift—Average Percent Passing								Average	Std Dev
			Section Number									
(mm)	(US)		35	36	37	38	39	54	55	56		
19.0	3/4 in.	99.2	100.0	99.8	100.0	99.9	100.0	99.8	99.9	99.8	99.9	0.22
12.5	1/2-in.	82.8	84.0	84.1	83.3	83.8	83.4	84.9	86.3	84.6	84.3	2.30
9.50	3/8-in.	69.5	69.5	68.7	68.7	69.9	69.3	71.0	71.5	69.8	69.8	2.44
4.75	No. 4	41.4	39.1	40.0	39.1	40.6	39.6	41.3	40.5	40.0	40.0	1.70
2.36	No. 8	25.6	24.0	25.4	24.6	25.6	24.3	25.7	25.1	25.3	25.0	1.03
1.18	No. 16	16.8	16.0	16.7	16.5	17.4	16.1	16.8	16.6	17.0	16.6	0.61
0.6	No. 30	12.1	11.5	12.0	11.8	12.6	11.6	11.9	12.0	12.2	11.9	0.46
0.3	No. 50	9.1	8.8	9.1	9.0	9.7	8.9	9.0	9.2	9.4	9.3	0.38
0.15	No. 100	7.2	7.0	7.2	7.1	7.7	7.1	7.2	7.4	7.5	7.3	0.35
0.075	No. 200	5.8	5.6	5.8	5.7	6.2	5.7	5.8	6.0	6.1	5.9	0.31
Surface Area (ft^2/lb)			22.4	23.2	22.8	24.5	22.7	23.1	23.6	24.1		
Surface Area (m^2/kg)			4.59	4.75	4.67	5.01	4.65	4.73	4.84	4.93		
Ratio #4 to #50			4.45	4.40	4.36	4.19	4.46	4.58	4.41	4.26		

TABLE 125 Replacement bottom lift gradation of loose mix after ignition (n = 5/section)

Sieve Size		Target	Replacement Mix Bottom Lift—Average Percent Passing								Average	Std Dev
			Section Number									
(mm)	(US)		35	36	37	38	39	54	55	56		
19.0	3/4 in.	99.2	99.8	99.2	99.8	99.5	99.6	99.8	99.6	99.8	99.5	0.60
12.5	1/2-in.	82.8	85.3	84.3	85.1	87.0	84.2	84.9	84.3	85.3	85.1	1.90
9.50	3/8-in.	69.5	70.3	69.9	70.1	72.4	69.1	71.3	69.3	71.6	70.5	2.00
4.75	No. 4	41.4	41.3	39.4	40.3	42.4	39.3	41.5	39.8	41.8	40.7	1.70
2.36	No. 8	25.6	25.4	24.2	24.3	25.9	24.2	25.3	24.2	25.7	24.9	1.10
1.18	No. 16	16.8	16.4	15.9	15.9	16.9	15.7	16.7	16.0	17.0	16.2	0.60
0.6	No. 30	12.1	11.6	11.3	11.3	11.9	11.0	11.9	10.6	12.0	11.4	0.70
0.3	No. 50	9.1	8.6	8.0	8.5	8.9	8.2	8.9	8.0	9.0	8.4	0.60
0.15	No. 100	7.2	6.6	6.6	6.7	7.0	6.2	6.9	6.2	7.1	6.6	0.50
0.075	No. 200	5.8	5.1	5.3	5.4	5.5	4.8	5.6	5.1	5.7	5.2	0.50
Surface Area (ft^2/lb)			21.5	21.3	21.8	22.6	20.5	22.5	20.7	23.0		
Surface Area (m^2/kg)			4.40	4.37	4.46	4.63	4.19	4.62	4.24	4.70		
Ratio #4 to #50			4.83	4.90	4.77	4.74	4.82	4.68	5.0	4.66		

TABLE 126 Replacement mixture top lift gyratory volumetrics summary (QA)

Section 35	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.12	2.421	4.1	16.1	74.7	86.1	95.9	97.4	1.05
Standard Deviation	0.12	0.008	0.2	0.2	1.4	0.3	0.2	0.2	0.03
Coefficient of Variation	2.02	0.347	5.6	1.5	1.9	0.4	0.2	0.2	2.57
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 36	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.86	2.416	3.0	15.1	80.3	86.8	97.0	98.3	1.09
Standard Deviation	0.10	0.011	1.2	0.7	7.3	1.2	1.2	1.0	0.04
Coefficient of Variation	1.69	0.448	40.5	4.8	9.1	1.4	1.3	1.1	3.39
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 37	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.14	2.442	5.0	16.2	69.2	85.2	95.0	96.4	1.15
Standard Deviation	0.12	0.013	0.6	0.2	3.3	0.5	0.6	0.6	0.05
Coefficient of Variation	1.95	0.515	11.4	1.2	4.8	0.6	0.6	0.6	4.15
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 38	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.55	2.439	4.1	15.0	73.0	86.1	95.9	97.4	1.29
Standard Deviation	0.13	0.013	1.1	0.6	6.1	1.0	1.1	1.0	0.06
Coefficient of Variation	2.34	0.515	26.0	3.7	8.4	1.2	1.1	1.1	4.27
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 39	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.94	2.433	4.6	16.0	71.3	85.6	95.4	96.8	1.13
Standard Deviation	0.27	0.010	0.6	0.4	3.5	0.7	0.6	0.6	0.04
Coefficient of Variation	6.11	0.415	14.2	2.7	4.9	0.8	0.7	0.7	3.30
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 54	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.11	2.442	5.6	16.7	66.9	84.7	94.4	95.8	1.17
Standard Deviation	0.08	0.012	1.4	0.9	6.4	1.3	1.4	1.4	0.05
Coefficient of Variation	1.31	0.488	24.6	5.1	9.5	1.5	1.5	1.4	3.91
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 55	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.04	2.420	3.8	15.8	76.3	86.2	96.2	97.7	1.13
Standard Deviation	0.33	0.011	1.1	0.6	5.5	1.0	1.1	1.1	0.04
Coefficient of Variation	5.46	0.471	27.9	3.9	7.2	1.2	1.1	1.1	3.61
Number of Replicates	5	5	10	10	10	10	10	10	10
Section 56	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	6.04	2.452	5.9	16.6	64.5	84.5	94.1	95.5	1.28
Standard Deviation	0.11	0.010	0.7	0.4	3.4	0.7	0.7	0.7	0.04
Coefficient of Variation	1.82	0.400	11.9	2.6	5.3	0.9	0.7	0.8	3.31
Number of Replicates	5	5	10	10	10	10	10	10	10

TABLE 127 Replacement mixture bottom lift gyratory volumetrics summary (QA)

Section (35)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.71	2.437	4.4	15.5	71.6	85.9	95.6	96.9	1.04
Standard Deviation	0.12	0.006	0.9	0.6	4.7	0.8	0.9	0.9	0.02
Coefficient of Variation	2.10	0.243	20.6	4.1	6.5	0.9	1.0	1.0	2.11
Number of Replicates	3	4	8	8	8	8	8	8	8
Section (36)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.37	2.445	5.8	16.1	64.3	84.5	94.2	95.6	1.15
Standard Deviation	0.16	0.013	1.0	0.7	4.9	1.0	1.0	1.1	0.05
Coefficient of Variation	2.98	0.514	17.9	4.1	7.6	1.1	1.1	1.1	4.46
Number of Replicates	3	5	10	10	10	10	10	10	10
Section (37)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.94	2.423	4.0	15.8	74.9	86.0	96.0	97.4	1.03
Standard Deviation	0.22	0.009	0.7	0.4	4.0	0.7	0.7	0.7	0.03
Coefficient of Variation	3.70	0.354	18.1	2.6	5.4	0.8	0.7	0.7	2.77
Number of Replicates	5	5	10	10	10	10	10	10	10
Section (38)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.43	2.454	6.0	16.0	62.9	84.3	94.0	95.4	1.23
Standard Deviation	0.11	0.012	0.9	0.5	4.6	0.9	0.9	0.9	0.05
Coefficient of Variation	2.03	0.501	15.0	2.9	7.3	1.1	1.0	0.9	4.46
Number of Replicates	6	5	10	10	10	10	10	10	10
Section (39)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.62	2.452	6.8	17.0	60.1	83.8	93.2	94.5	1.24
Standard Deviation	0.27	0.009	1.1	0.8	5.0	1.1	1.1	1.1	0.04
Coefficient of Variation	4.80	0.354	16.7	4.7	8.4	1.3	1.2	1.2	3.06
Number of Replicates	6	5	10	10	10	10	10	10	10
Section (54)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.78	2.452	6.5	16.9	61.5	85.3	93.5	94.8	1.20
Standard Deviation	0.16	0.006	0.5	0.6	1.7	4.7	0.5	0.5	0.03
Coefficient of Variation	2.77	0.247	7.5	3.3	2.7	5.5	0.5	0.5	2.10
Number of Replicates	3	5	10	10	10	10	10	10	10
Section (55)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.93	2.429	4.3	15.9	72.7	85.8	95.7	97.1	1.00
Standard Deviation	0.18	0.007	0.3	0.1	1.6	0.4	0.3	0.3	0.02
Coefficient of Variation	3.04	0.286	6.1	0.8	2.2	0.5	0.3	0.3	2.24
Max	6.14	2.439	4.6	16.0	76.0	86.4	96.2	97.7	1.03
Min	5.79	2.420	3.8	15.7	70.7	85.3	95.4	96.8	0.96
Range	0.35	0.019	0.9	0.3	5.3	1.1	0.9	0.8	0.06
Number of Replicates	3	5	10	10	10	10	10	10	10
Section (56)	P_{asp}	Gmm	%VTM	%VMA	%VFA	%Gmmi	%Gmmd	%Gmmm	F/A
Average	5.33	2.455	6.1	16.0	62.5	84.3	93.9	95.3	1.29
Standard Deviation	0.14	0.019	1.8	1.0	9.6	1.6	1.8	1.8	0.09
Coefficient of Variation	2.63	0.761	29.7	6.4	15.3	2.0	1.9	1.9	6.64
Max	5.48	2.477	7.8	16.8	79.9	87.3	97.2	98.5	1.40
Min	5.23	2.427	2.8	14.1	53.6	82.6	92.2	93.5	1.16
Range	0.25	0.050	4.9	2.7	26.2	4.6	4.9	5.0	0.24
Number of Replicates	3	5	10	10	10	10	10	10	10

TABLE 128 Volumetric properties of replacement section mixtures

Mixture Designation Section	Lift	Asphalt Content, Percent	Air Voids, Percent	VMA, Percent	VFA, Percent	Gmmi, Percent	Gmmd, Percent	Gmmm, Percent
38 LM	Top	5.55	4.1	15.0	73.0	86.1	95.9	97.4
	Bottom	5.43	6.0	16.0	62.9	84.3	94.0	95.4
56 LH	Top	6.04	5.9	16.6	64.5	84.5	94.1	95.5
	Bottom	5.33	6.1	16.0	62.5	84.3	93.9	95.3
35 MM1	Top	6.12	4.1	16.1	74.7	86.1	95.9	97.4
	Bottom	5.71	4.4	15.5	71.6	85.9	95.6	96.9
36 MH	Top	5.86	3.0	15.1	80.3	86.8	97.0	98.3
	Bottom	5.37	5.8	16.1	64.3	84.5	94.2	95.6
39 ML	Top	5.94	4.6	16.0	71.3	85.6	95.4	96.8
	Bottom	5.62	6.8	17.0	60.1	83.8	93.2	94.5
54 MM2	Top	6.11	5.6	16.7	66.9	84.7	94.4	95.8
	Bottom	5.78	6.5	16.9	61.5	85.3	93.5	94.8
37 HM	Top	6.14	5.0	16.2	69.2	85.2	95.0	96.4
	Bottom	5.94	4.0	15.8	74.9	86.0	96.0	97.4
55 HL	Top	6.04	3.8	15.8	76.3	86.2	96.2	97.7
	Bottom	5.93	4.3	15.9	72.7	85.8	95.7	97.1

TABLE 129 WesTrack summary statistics of core air voids in test lane (original construction)

Section Number and Type	Target		Core Air Voids Statistics Without Outliers										Stat. Signi. Bet. Lifts (Pooled σ) $\alpha = 0.05$
			Bottom Lift						Stat. Sig. Bet.	Top Lift			
			Before Top Lift			After Top Lift			Before and After				
	P_{asp}	V_{air}	Mean	Std.	PWL	Mean	Std.	PWL	(Pooled σ) $\alpha = 0.05$	Mean	Std.	PWL	
01-MM1	5.4	8	8.30	0.80	78	8.54	0.90	67	No	8.75	0.73	62	No
02-LM	4.7	8	9.65	0.99	27	9.31	0.98	39	No	10.37	1.03	7	No
03-LH1	4.7	12	11.24	0.57	65	11.40	0.50	77	No	12.43	0.34	99	Yes
04-ML	5.4	4	6.46	0.56	0	6.30	0.60	0	No	6.55	0.23	0	No
14-HM	6.1	8	7.05	1.18	50	6.50	0.60	22	No	9.00	0.29	50	Yes
15-MM2	5.4	8	8.74	0.71	63	8.53	1.01	63	No	8.69	0.40	77	No
16-LH2	4.7	12	11.43	0.70	71	11.26	0.42	71	No	12.23	0.20	100	Yes
17-MH	5.4	12	10.96	0.71	48	10.96	0.66	48	No	11.04	0.60	52	No
18-HL	6.1	4	5.17	0.50	38	4.27	0.64	88	Yes	4.33	1.18	57	No
19-MM1	5.4	8	8.03	0.63	95	8.11	0.77	83	No	7.16	0.62	59	No
20-MH	5.4	12	9.55	0.27	0	9.81	0.71	1	No	10.91	0.35	41	Yes
21-HL1	6.1	4	4.42	0.59	83	4.00	0.55	100	No	4.18	0.59	94	No
22-LM	4.7	8	8.76	0.38	72	9.28	0.60	34	No	8.07	0.18	100	Yes
9-HL2	6.1	4	2.92	0.46	44	2.49	0.57	20	No	3.91	0.47	100	Yes
10-LH	4.7	12	12.89	0.72	55	12.74	0.76	62	No	11.79	0.82	78	No
11-MM2	5.4	8	7.42	0.38	87	7.08	0.60	55	No	7.85	0.25	100	Yes
12-ML	5.4	4	4.72	0.44	72	3.96	0.31	100	Yes	4.55	0.29	97	Yes
13-HM	6.1	8	7.22	0.24	81	6.09	0.66	7	Yes	5.91	0.49	0	No
5-MM1	5.7	8	8.24	0.64	89	7.04	0.98	51	No	8.07	0.35	100	No
6-MH	5.7	12	11.71	0.36	100	11.30	0.34	80	No	10.78	0.56	36	No
7-HM	6.4	8	8.05	0.52	100	8.29	0.99	66	No	6.87	0.65	43	Yes
8-LM	5.0	8	8.43	0.54	85	8.89	0.97	54	No	8.50	0.76	73	No
23-ML	5.7	4	6.67	0.64	0	6.55	0.29	0	No	4.92	0.39	57	Yes
24-MM2	5.7	8	8.27	0.49	96	7.50	0.23	100	Yes	7.20	0.56	62	No
25-HL	6.4	4	3.95	0.49	100	2.58	0.36	12	Yes	3.67	0.64	85	Yes
26-LH	5.0	12	9.09	0.42	0	8.22	0.29	0	Yes	10.97	0.64	49	Yes

TABLE 130 In-place air voids and thickness for replacement sections

Section Description	Target Air Voids, Percent	Lift	Air Voids, Percent				Thickness, In.		
			Mean	Standard Deviation	Range	No. of Samples	Mean	Standard Deviation	No. of Samples
35 MM1	8	Top	7.6	0.4	1.1	5	2.8	0.11	5
		Bottom	8.2	0.3	0.9	5	3.3	0.13	5
36 MH	12	Top	12.5	0.4	1.1	5	3.0	0.12	5
		Bottom	11.7	1.7	4.2	5	2.9	0.11	5
37 HM	8	Top	8.0	0.4	1.0	5	2.9	0.11	5
		Bottom	7.0	0.4	1.1	5	3.5	0.14	5
38 LM	8	Top	8.7	0.8	1.9	5	2.7	0.11	5
		Bottom	8.2	0.5	1.2	5	3.4	0.13	5
39 ML	4	Top	6.2	0.7	1.8	5	2.7	0.11	5
		Bottom	4.0	0.5	1.3	5	3.3	0.13	5
54 MM2	8	Top	8.2	0.7	1.6	5	2.8	0.11	5
		Bottom	8.9	0.6	1.5	5	3.2	0.13	5
55 HL	4	Top	4.6	0.6	1.5	5	2.9	0.12	5
		Bottom	4.3	0.6	1.4	5	3.3	0.13	5
56 LH	12	Top	13.7	0.7	1.9	5	2.8	0.11	5
		Bottom	10.4	0.2	0.5	5	3.2	0.13	5

1 in. = 25.4 mm