WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION
MATERIALS OFFICE

WA-RD-116.1

FINAL REPORT

ASPHALT PAVEMENT DISTRESS INVESTIGATION

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Materials Office
Report No. 152

August, 1979

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SUMMARY

Two forms of pavement distress were noted on recent asphalt concrete overlay projects. A general loss of wearing surface under traffic action, termed surface ravelling, was observed on three projects starting the first season after construction. A concentrated, localized loss of surface material in narrow longitudinal strips, designated as strip ravelling, was observed on four projects approximately the second season after completion.

Construction record reviews and field testing and sampling of these projects along with four undistressed projects were made to define the construction methods and equipment used and to obtain samples from areas of good and bad pavement condition. These samples were tested to determine quality of compacted mix, and of the aggregate and asphalt constituents.

Common factors from the projects showing surface ravelling were a thin lift pavement overlay placed late in the paving season with a tendency toward less than optimum asphalt content. The resulting pavement had high air void content and was readily abraded by traffic during ensuing severe winter weather. Recurrence of this type of problem can best be prevented by increased emphasis on proper compaction and mix design. Remedial work on the present projects should be directed toward a seal coat application.

Strip ravelled projects were found to have similar pavement properties in ravelled and non-ravelled sections and generally to be within desirable limits. Lower strength in resilient modulus tests and physically observed asphalt stripping in the ravelled sections indicate a localized failure of the asphalt aggregate bond. The failure occurrence in narrow longitudinal strips indicates a cause associated with paving operations--possibly differential compaction or hydrocarbon contamination. Preventive measures should ensure uniform

compaction and more thorough checking of stripping tendencies. Corrective measures will require continued patching and possibly removal and replacement of affected pavement.

CONCLUSIONS

Conclusions presented in the following section are based upon project records, field examination and sampling, and the subsequent testing of samples in the Central Materials Lab. At the preparation of this report, no data is yet available from the scanning electron microscope and gas chromatography analyses at WSU. Additional or modifying conclusions may be drawn at the completion of that work.

Surface Ravelling Projects

The review of project records, field procedures, and sample analysis did not identify any defective materials or equipment to which this phenomenon could be attributed. The projects all were deteriorating soon after completion, indicating a defect present upon completion rather than developing with age. It is not definite at this time whether the ravelling will continue to progress and extend, or has reached its maximum severity. There are several factors noted from the surface ravelling projects to which, taken singly or in combination, the ravelling may be attributed:

1. Two of the projects involved thin lifts of wearing course.
2. All of the projects were paved fairly late in the paving season.
3. Asphalt cement content on two of the projects was significantly below the mix design value.
4. The air void content of the resulting pavement as shown by both record and test sample cores is excessive.
5. The winter weather immediately following completion has been noted as abnormally early and severe, both in low temperatures and precipitation.
6. The normal healing and surface kneading effects from being subject to pneumatic-tired traffic were not sufficient to obtain a surface seal prior to this severe winter exposure.

To summarize the foregoing, the chief cause of the early surface ravelling is the high air void content resulting from less than adequate compaction of a somewhat underasphalted mix which was subject to particularly severe climatic conditions.

Strip Ravelling Projects

The development of strip ravelling does not appear to occur immediately following completion of paving. It appears to take from one to two winter seasons to appear, thus apparently indicating a condition developing with time rather than present immediately upon construction. This is further borne out by the lack of any identifiable deficiency in either asphalt or aggregate material from the strip-ravelled areas of these projects.

The projects involved do have a number of common factors in materials and construction methods. All projects were paved "off-season," either early or late in the normal paving season. All used vibratory steel rollers for compaction with three of the four using windrow pickup units. There is no indication of excessive aging of the asphalt cement, of variable mix gradation as would be associated with segregated mix, or of excessive air voids leading to high water permeability. There is a repetitious similar pattern of occurrence in all projects--a definite lower Resilient Modulus in the ravelled areas and an appreciable lateral variation in pavement density. The observation of aggregate particles lacking asphalt coating is common to all strip-ravelled sections, as is the rapid deterioration of pavement in these areas subject to mechanical stress in the presence of water.

At this juncture the primary mode of failure is considered to be a stripping deterioration produced by localized failure of the aggregate asphalt bond. Most severe occurrence of this stripping is on Contract 0700, a project now known to have used a stripping-prone aggregate. The nonuniform density observed in the strip-ravelled areas must also produce a differential water

permeability and result in higher moisture contents in the areas where horizontal drainage is impeded. The occurrence pattern of longitudinal strips corresponds to the pattern of movement of all paving construction equipment, so it is not possible to definitely assign a cause. There could be a contaminant such as hydraulic oil or diesel fuel in minor amounts resulting from defective equipment. An alternate possibility is a decompaction or damage to the pavement integrity by vibratory compaction rollers operated after pavement temperature has decreased.

RECOMMENDATIONS

Surface Ravelling

As preventive measures to preclude future occurrence of this type of defect, the following measures are recommended with their primary emphasis directed toward ensuring adequate compaction, particularly of thin wearing course lifts:

1. Review and assurance of proper project mix design.
2. Insistence on adequate compaction control including early checks on actual density by core analysis.
3. Development of compaction procedures tied to the use of test sections for thin wearing course lifts.
4. Special attention to pavement compaction in early- and late-season paving to ensure dense, impermeable wearing surfaces.

Corrective measures to the present pavements should be directed toward reducing penetration of water into the wearing course. Surface seal coating with either liquid asphalts or asphalt-rubber with a suitable cover aggregate should be effective.

Strip Ravelling Projects

In order to eliminate this type of defect from future projects, there should be measures instituted to ensure uniform compaction across the entire pavement width. This should include emphasis on completing compaction while pavement is still flexible and use of pneumatic-tired equipment to eliminate lateral "bridging". There should be more investigation and checking of stripping properties, particularly with the specific source of asphalt to be used on a project. Particular emphasis needs to be placed on these measures where wearing course is being placed at the limits (either early or late) of the paving season.

The corrective measures for the strip-ravelled projects will as a minimum require patching of all affected areas. If the development of this defect progresses, particularly in the case of stripping-prone material as on Contract 0700, it may be necessary to replace the pavement wearing course. As a part of any anticipated replacement, it is recommended that at least a portion of the present pavement be removed for possible recycling. A conventional overlay without removal is not recommended due to the probable continued deterioration of the present wearing course.

INTRODUCTION

During the 1976 and 1977 paving seasons, problems on construction of several asphalt overlay projects came to the attention of the Materials Office. As a consequence, periodic observations were made of these sections which seemed to have stabilized without further distress during the summer of 1978. With the arrival of winter, 1978, the projects were noted as experiencing increased distress. In addition, several other overlay projects more recently completed began to exhibit similar patterns of deterioration. This rapid disintegration, possibly aggravated by unusually severe winter weather, provided the initiating force for this study.

The type of defect noted has consisted of the loss of the pavement wearing surface by two different modes. In one mode, a general loss of wearing surface has occurred in the areas subject to traffic abrasion. In some cases this has progressed to a complete loss of a thin lift wearing course in localized areas. This overall loss has been termed Surface Ravelling for the purpose of this study. The second mode of surface deterioration takes the nature of localized, concentrated loss in restricted longitudinal strips near the travelled wheel paths. Adjacent pavement showing no defect is found both laterally and longitudinally from the deteriorated strips. The ravelling area is generally less than a foot in width and has in some areas exceeded one inch in depth. This second form of pavement loss has been designated as Strip Ravelling.

The investigations of these defective pavements were initiated by communications of concern from the districts involved. Starting in early 1979, it became evident that a significant number of projects were involved with sufficient common factors to justify a combined study of the problems. A preliminary review of the design and construction records of these projects was made. There were no readily apparent common factors to which the pavement deficiencies could

be attributed. There did appear to be a discernible difference in the pattern of the defective areas. Surface Ravelling occurred generally throughout the affected project. Strip Ravelling, however, was confined to limited areas within the project. A more intensive sampling and testing program was felt to be indicated in the case of Strip Ravelling, therefore, as it appeared to be due to a condition occurring only in limited sections.

In order to determine the source of the pavement deterioration, it was determined to launch a threefold in-depth investigation:

1. A comprehensive field inspection and review including further examination of project construction records and files.
2. On-site testing and sampling of pavement in distressed and non-distressed areas.
3. Laboratory testing of pavement samples including design reviews and detailed breakdown of aggregates and asphalts.

The failure investigations involved a total of 11 paving projects. Four projects free of ravelling defects were chosen as reference standards of good pavement performance:

1. Contract 9221, SR 90, MP 191.89 to MP 200.36 - Grant County Line to Schrag
2. Contract 9232, SR 90, MP 200.36 to MP 208.16 - Schrag to Jct. SR 21
3. Contract 9258, SR 90, MP 208.16 to MP 218.60 - Jct. SR 21 to Ritzville
4. Contract 0293, SR 395, MP 82.46 to MP 95.91 - Jct. SR 26 to Ritzville

Three projects were studied which showed surface ravelling:

1. Contract 0994, SR 14, MP 19.63 to MP 27.38 - County Road 142 to Prindle
2. Contract 1073, SR 2, MP 286.93 to MP 291.31 - SR 90 to Houston
3. Contract 1085, SR 195, MP 86.22 to MP 89.78 - Paradise Rd. to Mullan Hill Rd.

Four projects exhibited strip ravelling:

1. Contract 0233, SR 97, MP 201.25 to MP 233.38 - Wenatchee to Chelan
2. Contract 0262, SR 12, MP 311.37 to MP 324.61 - Vansycle Canyon to Lowden
3. Contract 0438, SR 28, MP 36.48 to MP 52.89 - Winchester to Jct. SR 17
4. Contract 0700, SR 2, MP 104.74 to MP 114.13 - Peshastin Creek Bridge to Monitor Vicinity

PROCEDURES

Project and Site Inspections

Preliminary site visits were made by Materials' representatives during original construction in the fall of 1976 on two of the projects now displaying strip ravelling. Return visits and communication from district personnel disclosed the progression of the defective areas and revealed other projects beginning to display similar patterns. The onset of surface ravelling was marked and rapid immediately following their completion during the 1978 construction season.

A project record review of construction and final record data was performed to summarize and compare pavement construction records for the projects showing premature distress. This review included the initially reported strip ravelling projects, additional strip ravelling sections, and a number of projects showing surface ravelling.

These record summaries were used for background data for a comprehensive review tour made March 6-9, 1979. The review group was comprised of representatives from Materials, Construction, and Maintenance departments, as well as paving industry and supplier representatives. During the period of April 19-20, 1979, a second interview team from the Construction Division and the Asphalt Paving Association made individual project-by-project contacts with project personnel involved in construction of the study projects.

Concurrent with research on contract records of distressed projects, four sections were selected as reference projects on the basis of established satisfactory performance. Three of the projects involve an asphalt concrete pavement over an asphalt concrete base course. They have been in use since 1973 and have had data collected as a part of other paving research. The fourth project is an asphalt overlay approximately contemporary with the strip ravelling projects.

Original data for each classification of project (Reference, Surface Ravelling, and Strip Ravelling) have been summarized in Tables 1, 2, and 3, respectively. The data are all derived from standard construction test methods and specifications with no known discrepancies as to standards or specifications between projects.

Field Sampling and Testing

The collection of field samples was conducted to further define properties of the as-constructed pavement of both study and reference projects, and to pinpoint pavement samples to specific areas of performance. Specifically, within the strip-ravelled projects, areas had been noted which appeared free of the ravelling characteristics. It also appeared desirable to obtain samples of apparently sound pavement immediately adjacent to the ravelled strips for comparison. Cores taken from ravelled strips were from apparently sound pavement longitudinally adjacent to well-developed ravelled "potholes". Initial sampling was by diamond-bit core drilling using water as the drilling fluid. Core depth was extended to include the original pavement with the recent overlay.

Because of certain peculiarities in the behavior of the ravelled areas and in order to obtain more massive samples, ravelled sections of the strip and surface ravelling projects had block samples removed by cutting with a light-weight electric jackhammer. Sampling work was done by both Materials Laboratory personnel and by district personnel after coordination as to type and location of sample sites.

Concurrent with core sampling, in-place pavement densities were determined using a nuclear density gauge. All readings were taken in the back-scatter mode. In addition to readings at core locations, densities were taken at one-foot intervals laterally across the pavement section. These cross sections were taken near the areas of core sampling. In the course of analyzing pavement samples, several projects showed possible aggregate-related defects including

lack of asphalt coating and presence of crumbled, fractured aggregate. Mineral aggregate samples were obtained to permit examination of stripping potential and to review the project mix design. For Contract 0438 and Contract 0700, samples were obtained from remainders of the original contract stockpiles. Asphalt concrete for Contracts 1073 and 1085 was produced from a common commercial plant. Remaining stockpiles at this plant and pit-run material from the gravel pit source were sampled.

A summary of the field samples and tests conducted in this study is shown in Table 4.

Sample Analysis

The analytical program for samples under this study utilized standard test methods and procedures already in use at the Central Materials Laboratory. Research techniques under development at Washington State University were also proposed for characterizing asphalt cements and asphalt mixes. This work was done under a cooperative agreement by the Nuclear Radiation Chemistry Department.

The following tests were performed in the Central Laboratory on asphalt pavement and asphalt cement samples as noted:

1. Determination of Resilient Modulus - 4-in.-dia. cores
2. Determination of Pavement Density and Air Void Content - cores and block sample
3. Determination of Volatile Distillates - cores and blocks
4. Determination of Asphalt Content and Aggregate Gradation - cores and blocks
5. Abson Recovery of Asphalt, Determination of Residual Penetration, Ductility, Absolute, and Kinematic Viscosity - original asphalts; core and block material
6. Rolling Thin Film Oven Aging, Ductility, Penetration and Viscosity of Aged Residue

7. Rostler Fractionation of Asphalt - original and recovered asphalts

Generally, pavement samples from all projects were submitted for the above series of tests. Since the defects noted appear to originate from the surface, testing was done on the wearing surface course separated from the remainder of the pavement core.

There were some exceptions to the general test series due to certain sample peculiarities or other conditions. Within the surface ravelling projects, the wearing course samples from Contract 1073, SR 90 to Houston Avenue, were too thin to permit determination of the resilient modulus. No fractionation was run on recovered asphalt on Contract 0994, County Road 142 to Prindle. Core samples from strip-ravelled sections on Contract 0700, Peshastin Creek Br. to Monitor, proved too fragile for determination of resilient modulus values.

Due to the research nature of the test methods employed for the special tests at Washington State University, they cannot readily be described by standard test terminology. Core samples from strip ravelling and from reference projects have been submitted for scanning electron microscope image photography (micrographs) intended to disclose the nature of the asphalt binder film. Samples of recovered and original asphalts from the strip-ravelled and the reference projects are to be tested by chromatographic fractional separation to identify constituent asphalt fractions, determine fractional molecular weights by viscosimetry and Gel Permeation Chromatography, and analyze carbon, hydrogen, and nitrogen contents. Data from these tests have been delayed in delivery and will be part of a second-stage report on this study.

A review mix design, including stripping analysis by the Lottman procedure, was performed for Class B and G mixes from aggregates produced on Contracts 1073 and 1085. This aggregate was also analyzed for wear resistance by the Los Angeles abrasion test and for aggregate degradation. Aggregate from Contract 0438 and Contract 0700 was tested for stripping potential by the Lottman procedure. Under

this procedure the stripping tendency is measured by the decline in strength when a compacted mix sample is subjected to vacuum saturation with water and a freeze-thaw cycle.

RESULTS

In the course of this study it became apparent that the probable origins of the two forms of ravelling were as diverse as their physical appearance. In this section the discussion of test results and in subsequent sections the analysis and conclusions have been separated by the class of project defect. Since the Reference Projects are proposed as examples of projects free from ravelling defects, the results from testing on them are presented first, followed by Surface Ravelling projects, and then results from the Strip Ravelling projects. A separate report will be used to present results of testing at WSU.

Reference Projects

Project Record Review

Project record data for these projectshave been previously shown in Table 1. The three projects on SR 90 differ from those under study in that they were all new construction and were not subject to traffic prior to completion. Their construction periods cover a range of seasonal times from early to late season. A common type of aggregate source was used (basalt quarries). A variety of asphalt suppliers was used. Similar types of asphalt plant and pavers were used. A significant difference in compaction equipment is shown for Contract 0293, which used vibratory steel rollers, where pneumatic-tired rollers had been used on the other projects. Air flow density control tests on the three SR 90 projects indicate marginal values overall. Air void content of record cores also indicates that compaction achieved only minimum acceptable densities.

Field Inspection and Sampling

From previous knowledge, these projects exhibited no ravelling defects. On the three older sections (9221, 9232, and 9258) an anticipated amount of thermal cracking is present. Contract 0293 does not show any cracking.

All cores taken were recovered sound and intact. No nuclear densities were taken on these projects. Pavement cores on the three SR 90 projects were taken from the driving lane. Unanticipated traffic control problems on Contract 0293 forced coring to be done on the shoulder section of the roadway. Shoulder and driving lane on this project were paved in a single pass, so samples should be typical of the material under traffic.

Pavement Sample Analysis

A summary of the results of tests on the pavement cores is shown in Table 5. Complete test results of individual samples are listed in Appendix A. The samples tested for gradation were combined from the wearing course levels of two cores in order to provide material for recovery of asphalt for further tests. The gradation for Contract 9221 is significantly coarser than for the other three projects. Asphalt contents are higher than the recorded test averages for the projects. The air void contents are lower than the record cores, with those projects exposed to traffic for the longest time showing more density increase. As previously mentioned, samples on Contract 0293 had not been subject to traffic.

Resilient modulus, asphalt content, and air void values obtained on wearing course cores taken in 1976 are shown also in Table 5. These 1976 values represent average results from a more extensive sampling program and serve primarily to reinforce the validity of the current samples.

Asphalt Sample Analysis

In addition to tests on samples under this study, data are available on the original contract samples and, for the projects on SR 90, from core samples obtained in 1976. These values are summarized in Table 6. The overall asphalt hardening is approximately what would be expected from tests on the original asphalts and furthermore indicate only moderate

additional post-construction hardening. The Rostler chemical analysis data indicate relatively high asphaltene contents for all samples. The ratio $[(N + A_1)/(A_2 + P)]$, the maltenes ratio, is an indicator of overall aging potential with values of 1.2 or less generally accepted as low potential for aging. Severe aging is associated with maltenes ratio values of 2.0 or greater, so the values for these samples would indicate low to slight aging potential.

Surface Ravelling Projects

Project Record Review

Table 2 shows the project record data for these projects. Two projects utilized Class G mix in thin wearing courses and all were paved late in the normal paving season for their particular area. The compaction mode is common to all three, and the two Class G mix projects showed either marginal control values or no compaction control at all. Air voids for lab-compacted mix show a tendency toward high void content. The marginal compaction control readings are further borne out by the high air void content of the record cores. Project records for Contracts 1073 and 1085 revealed that the commercial source used for these projects had not had a recent mix design performed. Ordered asphalt contents for the projects had been based on previous use and checks with stability values obtained from current production.

Field Inspection and Sampling

The surface ravelling pattern appeared to be general over the entire affected project. Cores and block samples were taken at locations showing the most severe ravelling. Core samples were recovered intact from these projects. Block samples were taken from Contract 0994 to provide more material for gradation tests on the wearing course. Block samples were taken from Contract 1085 to more closely examine the interface conditions

between surface and levelling courses. Traffic service conditions on Contract 1073 differ substantially from all other projects in this study. This section consists of the principal north-south arterial route in Spokane (North Division Street) and as such is subject to intense traffic. Maintenance of the street is the responsibility of the City of Spokane. In response to the need for ice-free surfaces, city forces use de-icing salt heavily on this and all other arterial routes. This results in wet conditions for this section of pavement when most rural areas would have been either frozen or cleared of snow by plowing.

Project inspectors on other projects from the source used for Contracts 1073 and 1085 had noted aggregate fracturing under steel-wheel compaction equipment. Samples from 1073 and 1085 were examined under magnification for aggregate particle fracture. On both projects, significant numbers of 1/4-in. minus particles were found which readily disintegrated when probed. These occurred on the cored faces and within the bulk of the sample as well. This type of soft particle was not noted on other projects in the study.

Pavement Sample Analysis

Results of tests on core and block samples are shown in Table 7. Contract 1085 was paved in two separate sections. Results are shown for samples from each section. Complete test results of individual samples are listed in Appendix A. Tests for volatile distillates were not made on this series of projects. Gradation on the two Class G projects shows some coarseness in the finer sizes, Contract 0994 being low from #10 down, 1073 from the #40 down. Contract 1085 samples show desirable gradation. Asphalt contents agree well with the project record data, as do air voids. The air void contents are considerably in excess of the desired maximum.

Resilient modulus values are very low for the projects where they could be determined. Normal values for new ACP would range from 5×10^5 upwards.

Asphalt Sample Analysis

Results of tests on recovered asphalts are shown in Table 8. Original asphalt data for Contracts 1073 and 1085 are included also. These projects used a common asphalt source. Values are shown for the asphalt as received and for the Rolling Thin Film Oven residue.

The recovered asphalt properties appear well within the normal values to be expected. This is further confirmed when comparison is made with the test data for thin film aged samples.

Aggregate and Mix Design Review

Stockpiled and pit-run aggregate from Contracts 1073 and 1085 were subjected to Los Angeles Abrasion and Degradation tests. Results of these tests are shown in Table 9 which also includes specification limits for the two tests. The pit-run material was crushed as received, separated on a 1½" screen to check for possible soft material present in the original fines, and the coarser fraction then re-crushed. The results indicate that materials from this source are acceptable on the Los Angeles Abrasion tests. The materials from stockpile achieve the minimum acceptable values for degradation. Degradation test values on the fine material present in the pit-run material may be deficient.

From the Mix Design procedure, recommended asphalt contents of 6.5% and 7.0% for Class B and Class G, respectively, were computed. This contrasts with ordered project values of 6.0% for Class B and 6.3% for Class G.

Strip Ravelling Projects

Project Record Review

Project data for the strip ravelling projects have been previously presented in Table 3. These projects all used Class B mix as wearing course. All projects involved overlays of existing pavements. On Contracts 0262 and 0438, sections within the project used untreated surfacing

as a cushion course. Construction timing of all four projects was at the limits of the normal paving season for their areas--0233 and 0438 being paved early in the year, 0262 and 0700 paved at the end of the season. A variety of aggregate and asphalt sources was used with asphalt contents near the design value except for Contract 0262 which was below the design recommendation by about one-half percent. Asphalt mix plants were assorted. Paving equipment used Kocal windrow pickup feeders on three of the four projects. Vibratory steel rollers are common to all projects, with pneumatic-tired rollers also used on Contract 0700. Air flow control tests showed deficient compaction on Contract 0438, minimal acceptable values on 0233 and 0262, and near optimum values for Contract 0700. Lab-compacted air voids fall within the desired range (2.5-5.0), with record cores showing slightly high air voids.

Field Inspection and Sampling

In terms of severity of strip ravelling, Contract 0233 would rank lowest with infrequent areas over the entire project. Contracts 0262 and 0438 show considerable development of moderate strip ravelling with some notable sections defect-free. These sections are a portion of Contract 0262 west of the town of Touchet on which a higher asphalt content was used, and a section of 0438 from Winchester to Naylor Jct. which has an untreated surfacing bushing course. A section east of Lowden on 0262 has an untreated bushing course also, but has considerable longitudinal cracking with mild strip ravelling.

Sampling of these strip ravelling projects was programmed to obtain samples of the remaining materials within the ravelled strips, samples of apparently sound pavement immediately adjacent to the ravelled strips, and samples from reference areas noted as free of ravelling for substantial distances. Sound, intact cores were obtained from adjacent and reference areas on all projects. Wearing course portions of cores from apparently

sound pavement within the ravelled strips disintegrated under the core bit and were very difficult to obtain intact. On Contract 0700 no cores could be obtained undamaged enough for Resilient Modulus testing. With extra care, marginally intact core material was obtained from 0262 and 0438, although exposed surfaces showed extensive ravelling and loss. Complete disintegration and crumbling of some cores was noted on all projects except 0233 where reasonably stable cores were taken. On all projects, the underlying pavements in the ravelled areas were substantially intact.

Block sampling had not been originally conceived as a part of the investigation but was instituted after the noted problems in coring ravelled areas. Pavement was removed by perimeter cutting with a jack-hammer to a depth of several inches around an approximately 1 by 3 foot block, spanning a strip-ravelled area and including sound pavement on both sides. This block was then removed intact by prying with crowbars. In the course of cutting around the block area, a substantial difference in pavement rigidity was noted. Across the ravelled section the wearing course was more crumbly and less tough than immediately adjacent. The interface of the new wearing course was noted to show a brown tint in the ravelled area when separated from the underlying pavement. This was accompanied by the presence of substantially more moisture than was noted downslope in the direction of pavement drainage.

In the field observation of strip-ravelled areas, there was a lack of asphalt coating of aggregate particles. This was noted in materials picked from the ravelled strips, in cores and core material which had crumbled during coring, and in the block samples cut out. This was further confirmed in close-up examinations under magnification. This tendency was observed to some degree in all samples from Contract 0700, but not to any marked degree in samples outside the ravelled strips on the other projects.

Pavement Density Sections

Nuclear gauge readings of pavement densities as taken at roadway sections are shown in Figures 1 through 4. These plots have been prepared using the median density value as a base line. Average density readings from core locations have been plotted as solid circles on these cross sections. As an index to the variation of density across a section, standard deviation values were computed for each set of readings across a roadway lane. The more severely ravelled pavement sections show a higher variability in density than unravelled sections. This is particularly notable on Contract 0262. Referring to Figure 2, the cross section from the ravelled area at MP 321.35 shows a deviation of 7.2 compared with values of 2.6, 3.6, and 4.4 for the non-ravelled sections. Similarly, from Figure 3, the ravelled sections show deviation values of 7.5, 6.4, and 7.5 compared to 2.9 for the reference section at MP 314.64.

Pavement Sample Analysis

Results of tests on core and block samples are shown in Table 10 for Contracts 0233 and 0262, and in Table 11 for Contracts 0438 and 0700. These values are in general agreement with the project averages as shown in Table 2. There is a slight increase in the material passing #200 and a resulting decrease in sand/silt ratio. This is attributable to the cutting of aggregate particles during coring. The asphalt content of the recovered samples is somewhat higher than the overall project averages. The air void contents are slightly lower than the record core values.

In organizing the sampling program for the strip-ravelled projects, it was proposed that a specific characteristic should be able to be isolated when results from ravelled, adjacent, and reference areas were compared. For the values obtained in gradation and asphalt content testing of cores, no such distinctions can be noted. The gradations appear very

similar with no more variation between areas than would be normally noted between duplicate samples. The air void contents show similar trends and are all within values which have generally shown acceptable service. Volatile distillate contents show no difference between areas; however, Contract 0700 is somewhat higher overall.

In examining resilient modulus, there appears to be a clear and consistent variation noted with samples from ravelled sections showing substantially lower values than adjacent sections, which are somewhat lower than the reference areas. These data are graphically shown in Figure 5 with comparable information added for the Reference Projects. It should be noted that it was not possible to perform this test on core material from ravelled strips on Contract 0700 due to their deterioration. This variation in stress response is in complete agreement with the variation in pavement rigidity noted in removing block samples.

Asphalt Sample Analysis

Recovered asphalt samples were tested for specification properties and Rostler fractionation. Backup samples of material originally supplied to the contract were also submitted for test, both in the as-shipped condition and after Rolling Thin Film Oven Aging. Complete tabulations of these test results are included in Appendix B. For these projects, as for the surface-ravelled projects, no marked deterioration or alteration of the asphalt cement was noted. Results for two values from these tests are presented here, Absolute Viscosities in Figure 6 and Penetration Test results in Figure 7.

Referring to Figure 6, only Contract 0233 shows any measurable variation in asphalt properties between ravelled and adjacent areas. A trend toward less hardening in samples from the reference section on Contract 0262 is reversed for Contract 0438. Generally the recovered asphalt viscosities are similar to those obtained after Rolling Thin Film Oven

Aging. The hardening observed in this test on Contract 0262 may be attributed to surface burning which was performed on this project to correct an early tendency to bleeding. Comparison with data from the Reference Projects shows asphalts of substantially greater stiffness and aging delivering satisfactory performance. Only absolute viscosity data after RTFC aging was available for the original asphalts on the reference projects.

Figure 7 shows data from the penetration test and includes original asphalt data and core data obtained in 1976 for the Reference Projects. The same patterns of performance appear here as in the viscosity data. The recovered asphalts show no substantial variation between behavioral areas (strip, adjacent, reference) and all show approximately the same properties as were obtained from the Rolling Thin Film Aged Residue. The greater degree of hardening as shown by decreased penetration on Contract 0262 is similar to that observed in the viscosity tests.

Mix Design Review

Samples of mineral aggregate from Contracts 0438 and 0700 were submitted for mix design and to check the tendency for stripping. A complete mix design was performed on aggregate from Contract 0700 which re-confirmed the original asphalt recommendation of 5.9 to 6.0 percent. The mix design samples stripped severely. Examination of the tested samples revealed that the quartzitic aggregate was notably lacking in asphalt coating.

Samples from Contract 0438 were prepared at the project average asphalt content with and without anti-strip additive. No stripping was noted in the Lottman test for the specimens without anti-strip, and there was no difference in performance between the two sets of samples.

ACKNOWLEDGEMENTS

Due to the sudden appearance of defects studied in this investigation, field work was conducted on a priority time schedule which required considerable adjustment and revision of manpower and equipment schedules. Personnel of District Materials and Maintenance Sections were in all cases very accommodating and prompt in rendering the assistance and support needed. Particular gratitude is due the Maintenance Crews of the Wenatchee, Ephrata, Pasco, and Walla Walla Divisions. Without the equipment and assistance provided by Materials Divisions in Districts 2 and 5, the field work would have been greatly impeded. Sampling work performed by District Materials Crews from Districts 4 and 6 were carried out under climatic inconvenience in a prompt and professional manner. Finally, a special thanks is due to the lab technician personnel of the Central Laboratory Asphalt Section for maintaining technical excellence throughout a protracted and massive program of expedited lab analysis.

TABLE 1

PROJECT DATA: REFERENCE PROJECTS

Contract & SR		9221 - SR 90	9232 - SR 90	9258 - SR 90	0293 - SR 395
Section		Grant Co Line-Schrag	Schrag-Jct SR 21	Jct SR 21-Ritzville	Jct SR 26-Ritzville
Pavement:	Class	B	B	B	B
	Courses	0.15' W, 0.15' L	0.15' W, 0.25' L	0.15' W, 0.20' L	0.20' W, 0.25' L
Construction Dates		10-4-72 to 5-21-73	7-2-73 to 7-24-73	5-16-73 to 6-12-73	8-20-76 to 10-20-76
Aggregate:	Source	QS AD-147	QS AD-121	QS AD-137	QS AD-74
	Type	Basalt Quarry	Basalt Quarry	Basalt Quarry	Basalt Quarry
Asphalt:	Source	Sound Ref.	Shell: Sea. & E. Pasco	Husky	Husky
	Design %	6.2	5.8	6.2-6.3	5.6
	Field %	6.2	5.5	6.2	6.0
Asphalt Plant		Batch	Batch	CMI Batch	Batch
Paving Machine		Note 2	Note 2	Note 2	Cedar-Rapids
Compaction:	Equip.	Pneu/Stat Steel	Pneu/Stat Steel	Pneu/Stat Steel	Vib Steel/Stat Stl
	Control	Air Flow	Air Flow	Air Flow	Nuclear Density
Control Values:					
AirFlow (sec)		68 (49-112)	84 (40-172)	58 (34-108)	--
Nuclear Density (pcf)		--	--	--	141 (139-149)
Air Voids: (%)	Mix Design	4.0	3.8	2.7	3.8
	Record Cores	9.0	10.7	11.4	8.4

Notes: 1. Tabular values listed as xx (xx-xx) are: Project Average (Range: low-high).
2. Exact paver make not available; used conventional laydown with direct fill from end-dump trucks.

TABLE 2

PROJECT DATA: SURFACE RAVELLING PROJECTS

Contract & SR		0994 - SR 14	1073 - SR 2	1085 - SR 195
Section		Co Rd 142-Prindle	SR 90 to Houston Ave	Paradise Rd-Mullan Hill Rd
Pavement:	Class	G	G	B
	Courses	0.09' L, 0.06' W	0.05' L, 0.05' W	0.15' L, 0.15' W
Construction Dates		10-19-78 to 10-25-78	7-24-78 to 9-23-78 (Note 3)	9-29-78 to 10-17-78
Aggregate:	Source	Oregon 27	PS C-269	PS C-269
	Type	Gravel	Basalt Gravel	Basalt Gravel
Asphalt:	Source	Douglas	Husky	Husky
	Design %	6.4	6.3 (Note 2)	6.0 (Note 2)
	Field %	6.5	6.1	6.0
Asphalt Plant		Drum	Batch	Batch
Paving Machine		Blaw Knox w/Kocal Feed	--	
Compaction:	Equip.	Vib Steel	Vib Steel	Vib Steel
	Control	Air Flow	None	Nucl Density & Air Flow
Control Values:				
Air Flow (sec)		59 (46-70)	--	93 (20-166)
Nuclear Density (pcf)		--	--	144.8 (139.5-149.2)
Air Voids: (%)	Mix Design	4.5	8.0	5.3
	Record Cores	11.6	13.9	11.7

Notes: 1. Tabular values listed as xx (xx-xx) are: Project Average (Range: low-high).
2. Indicates asphalt content ordered. No mix design performed prior to construction (commercial source).
3. Wearing course placed at night.

TABLE 3

PROJECT DATA: STRIP RAVELLING PROJECTS

Contract & SR		0233 - SR 97	0262 - SR 12	0438 - SR 28	0700 - SR 2
Section		Wenatchee-Chelan	Vansycle Canyon-Lowden	Winchester-Jct SR 17	Peshastin Cr Br-Monitor
Pavement:	Class	B G	B	B	B
	Courses	0.15-0.20' W 0.05' L	0.12'-0.22' W	0.15' & 0.20' W	0.15' W
Construction Dates:		4-21-77 to 6-10-77	10-4-76 to 11-4-76	4-18-77 to 5-13-77	9-27-77 to 11-8-77
Aggregate:	Source	PS K-197	QS 0-101	PS GT-46	PS K-111
	Type	Gravel	Basalt Quarry	Basalt Gravel	Gravel
Asphalt:	Source	U.S. Oil	Shell: E. Pasco	Sound Ref.	U.S. Oil
	Design %	5.4-5.5	6.4-6.5	5.9-6.0	5.9-6.0
	Field %	5.5	6.0	5.9	5.9
Asphalt Plant		Batch w/Baghouse	Drum	Batch	Batch
Paving Machine		Barber-Greene w/Kocal Feed	Blaw-Knox w/Kocal Feed	Cedar-Rapids	Barber-Greene w/Kocal Feed
Compaction:	Equip.	Vib Steel	Vib Steel	Vib Steel	Vib Steel/Pneu
	Control	Air Flow	Air Flow	Air Flow	Air Flow
Control Values:					
Air Flow (sec)		87 (50-105)	70 (12-204)	19 (<10-75)	105 (18-167)
Nuclear Density (pcf)		--	--	--	--
Air Voids: (%)	Mix Design	2.6	4.0	4.5	3.5
	Record Cores	8.2	10.3	10.5	9.9

Notes: 1. Tabular values listed as xx (xx-xx) are: Project Average (Range: low-high).

TABLE 4

SUMMARY - FIELD SAMPLES AND TESTS

	Cores	Blocks	Densities	Aggregate
Surface Ravelling Projects				
Contract 0994 - SR 14 Co. Rd. 142 to Prindle	16	1	--	--
Contract 1073 - SR 2 SR 90 to Houston	10	--	--	5/8-3/8 Stockpile 3/8-0 Stockpile Pit Run
Contract 1085 - SR 195 Paradise Rd. - Mullan Hill Rd.	16	2	--	
Strip Ravelling Projects				
Contract 0233 - SR 97 Wenatchee-Chelan	20	--	20 Cores 2 Sections	--
Contract 0262 - SR 12 Vansycle Canyon-Lowden	55	2	55 Cores 8 Sections	--
Contract 0438 - SR 28 Winchester-Soap Lake	33	1	33 Cores 2 Sections	5/8-0 Stockpile
Contract 0700 - SR 2 Peshastin-Monitor	27	2	27 Cores 1 Section	5/8-0 Stockpile
Reference Projects				
Contract 0293 - SR 395 SR 26-Ritzville	5	--	--	--
Contract 9221 - SR 90 Grant Co. Line to Schrag	5	--	--	--
Contract 9232 - SR 90 Schrag to Jct. SR 21	5	--	--	--
Contract 9258 - SR 90 Jct. SR 21 to Ritzville	5	--	--	--

TABLE 5

PAVEMENT SAMPLE ANALYSIS: REFERENCE PROJECTS

Project	9221	9232	9258	0293
Gradation (% Passing)				
5/8	100	100	100	100
1/2	99	97	99	99
3/8	86	90	93	91
1/4	64	74	74	72
#10	36	37	36	38
#40	18	16	15	18
#80	12	10	9	10
#200	7.0	6.4	5.1	5.6
Sand/Silt	5.2	5.8	7.1	6.9
Asphalt Content (%)	7.0	6.4	7.0	6.7
Density (pcf)	148.4	154.8	153.3	143.9
Air Voids (%)	6.8	4.8	4.3	9.5
Resilient Modulus (psi x 10^5)				
0.05 sec	7.5	4.9	3.7	5.6
0.10 sec	5.9	3.7	2.9	4.4
Volatile Distillates (%)	--	--	--	--
Previous Samples (1976)				
Resilient Modulus (psi x 10^5)				
0.05 sec	6.2	5.7	4.6	--
0.10 sec	4.8	4.4	3.4	--
Asphalt Content (%)	6.7	6.0	6.7	
Air Voids (%)	6.2	5.9	4.2	

TABLE 6

ASPHALT SAMPLE ANALYSIS: REFERENCE PROJECTS

Project	9221	9232	9258	0293
Abson Recovery:				
Pen. (77°F)	29	51	41	34
Visc: Abs (140°F) p.	11,807	6107	5231	7653
Kin (270°F) cst.	781	614	528	636
Ductility 45°F cm.	8.25	14.25	9.25	8.75
Chemical Analysis (Rostler) (%)				
Asphaltenes	38.2	33.9	30.8	34.7
Nitrogens, Gp I] (N)	3.3	3.9	3.8	6.7
Nitrogens, Gp II]	19.8	15.1	14.6	12.6
1st Acidaffins (A_1)	11.4	7.5	9.9	12.5
2nd Acidaffins (A_2)	16.3	23.6	26.5	20.1
Paraffins (P)	10.3	15.5	14.2	12.9
$(N + A_1)/(A_2 + P)$	1.32	0.71	0.71	0.99
Original AC/RTFC Residue				
Pen. (77°F)	90 / 52	90 / 51	94 / 53	87 / 53
Visc: Abs (140°F) p.	-- 3565	-- 5300	-- 3243	-- 3718
Kin (275°F) cst.	287 / 441	319 / 550	280 / 446	--
Ductility 45°F cm.	9	12.8	21.7	
1976 Cores (Recovered)				
Pen. (77°F)	40	45	46	
Visc: Abs (140°F) p.				
Kin (275°F) cst.				
Ductility 45°F cm.	17.0	11.6	10.8	

TABLE 7

PAVEMENT SAMPLE ANALYSIS: SURFACE RAVELLING PROJECTS

Project	0994	1073	1085	
Sample Area	Cl. G ACP	Cl. G ACP	Section 1 Cl. B ACP	Section 2 Cl. B ACP
Gradation (% Passing)				
5/8	100	100	100	100
1/2	100	100	98	99
3/8	98	99	87	90
1/4	79	85	72	76
#10	40	48	43	44
#40	20	20	17	17
#80	10	12	11	11
#200	7.2	7.7	6.7	6.7
Sand/Silt	5.6	6.3	6.4	6.5
Asphalt Content (%)	6.3	6.4	6.2	6.2
Density (pcf)	126.9	137.9	141.6	134.0
Air Voids (%)	15.5	12.0	10.8	15.7
Resilient Modulus (psi x 10^5)				
0.05 sec	2.0	Note 1	2.4	1.4
0.10 sec	1.3		1.3	0.95

Notes: 1. Course lifts on Contract 1073 too thin for Resilient Modulus determination.

TABLE 8

ASPHALT SAMPLE ANALYSIS: SURFACE RAVELLING PROJECTS

Project	0994	1073	1085 Sect. 1	1085 Sect. 2	Original Asphalt 1073 & 1085 As Shipped	Original Asphalt 1073 & 1085 RTFC Residue
Abson Recovery:						
Pen. (77°F)	63	53	60	53	85	54
Visc: Abs (140°F) p.	2137	3795	3221	3561	1564	3696
Kin (270°F) cst.	393	526	490	512	345	497
Ductility 45°F cm.	60+	34	60+	18.5	60+	29.25
Chemical Analysis (Rostler) (%)						
Asphaltenes		29.1	27.8	28	23.0	27.9
Nitrogens, Gp I](N)		3.7	3.1	4.2	6.6	2.1
Nitrogens, Gp II](N)		14.7	16.3	16.4	14.3	14.0
1st Acidaffins (A_1)		14.1	15.7	16.2	16.5	14.9
2nd Acidaffins (A_2)		25.9	26.1	23.9	28.0	28.1
Paraffins (P)		11.0	10.6	12.0	11.3	12.0
$(N + A_1)/(A_2 + P)$		0.94	0.98	0.98	0.97	0.82

TABLE 9

MINERAL AGGREGATE TEST RESULTS PS C-269

Sample	Los Angeles Abrasion Wear % @500 Rev.	Spec. Max.	Degradation	Spec.[1] Min.
1/2"-3/8" Stockpile	23[2]	35	29	30
3/8"-0 Stockpile	22[3] 25[4]	35 35	47	30
Pit Run - Initial Fines (1½" minus)	25[2] 34.4[4]	35 35	21	30
Pit Run - Crushed After Fines Separation (Initial 1½" plus)			52	30

Notes:
1. Minimum for wearing course.
2. Gradation B used: 3/4-3/8
3. Gradation C used: 3/8-#4
4. Gradation D used: #4-#8

TABLE 10

PAVEMENT SAMPLE ANALYSIS: STRIP-RAVELLED PROJECTS

Project	0233			0262		
Sample Area	Ravelled	Adjacent	Reference	Ravelled	Adjacent	Reference
Gradation (% Passing)						
5/8	100	100	100	100	100	100
1/2	99	99	94	99	99	99
3/8	90	87	88	85	88	88
1/4	72	70	69	66	69	70
#10	44	42	41	33	35	36
#40	22	22	20	17	16	19
#80	12	12	12	10	10	11
#200	7.1	7.3	7.3	6.3	7.1	7.1
Sand/Silt	6.0	5.8	5.6	5.3	5.0	5.1
Asphalt Content (%)	6.1	5.8	5.6	6.2	6.4	6.8
Density (pcf)	146.1	144.9	148.7	142.6	146.8	147.4
Air Voids (%)	5.7	5.8	3.8	9.5	6.8	6.4
Resilient Modulus (psi x 10^5)						
0.05 sec	2.3	4.3	6.0	2.4	6.5	7.1
0.10 sec	1.5	2.9	4.3	1.8	5.1	5.4
Volatile Distillates (%)	0.05	0.04	0.04	0.04	0.03	0.02

TABLE 11

PAVEMENT SAMPLE ANALYSIS: STRIP-RAVELLED PROJECTS

Project	0438			0700		
Sample Area	Ravelled	Adjacent	Reference	Ravelled	Adjacent	Reference
Gradation (% Passing)						
5/8	100	100	100	100	100	100
1/2	99	98	98	99	99	98
3/8	89	89	87	88	87	90
1/4	74	72	70	67	69	72
#10	39	38	38	38	38	40
#40	16	15	15	19	19	20
#80	10	10	10	11	12	12
#200	7.1	7.0	7.2	7.0	7.3	7.1
Sand/Silt	5.4	5.4	5.2	5.4	5.3	5.8
Asphalt Content (%)	6.2	6.8	5.9	5.7	5.9	6.2
Density (pcf)	148.1	145.9	147.6	140.2	142.4	144.6
Air Voids (%)	7.4	8.9	7.8	10.2	8.6	6.9
Resilient Modulus (psi x 10^5)						
0.05 sec	1.7	3.4	4.5	Note 1	2.8	2.7
0.10 sec	1.2	2.1	3.5		1.9	1.9
Volatile Distillates (%)	0.04	--	0.02	0.08	0.06	0.04

Note 1: Core samples from ravelled areas on Contract 0700 were too fragile to determine Resilient Modulus.

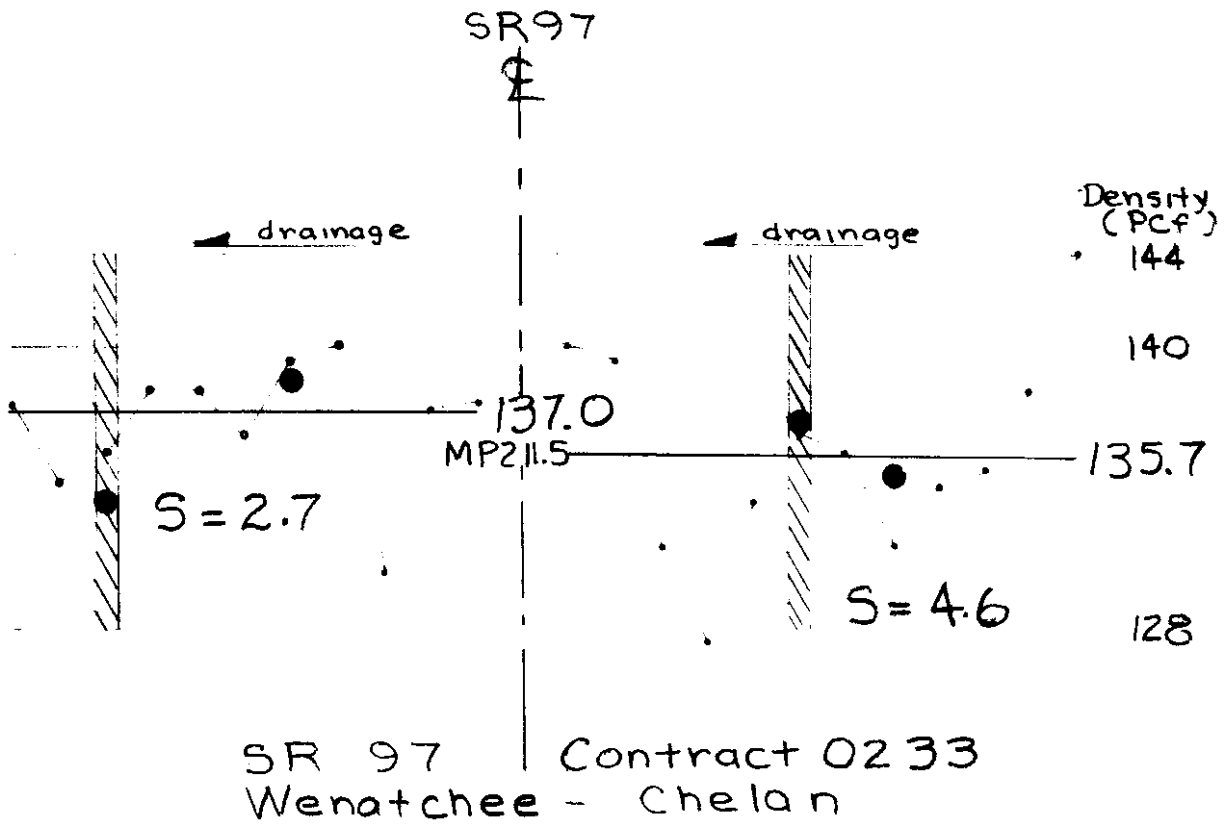

FIGURE 1
Pavement Density Cross Section
Contract 0233

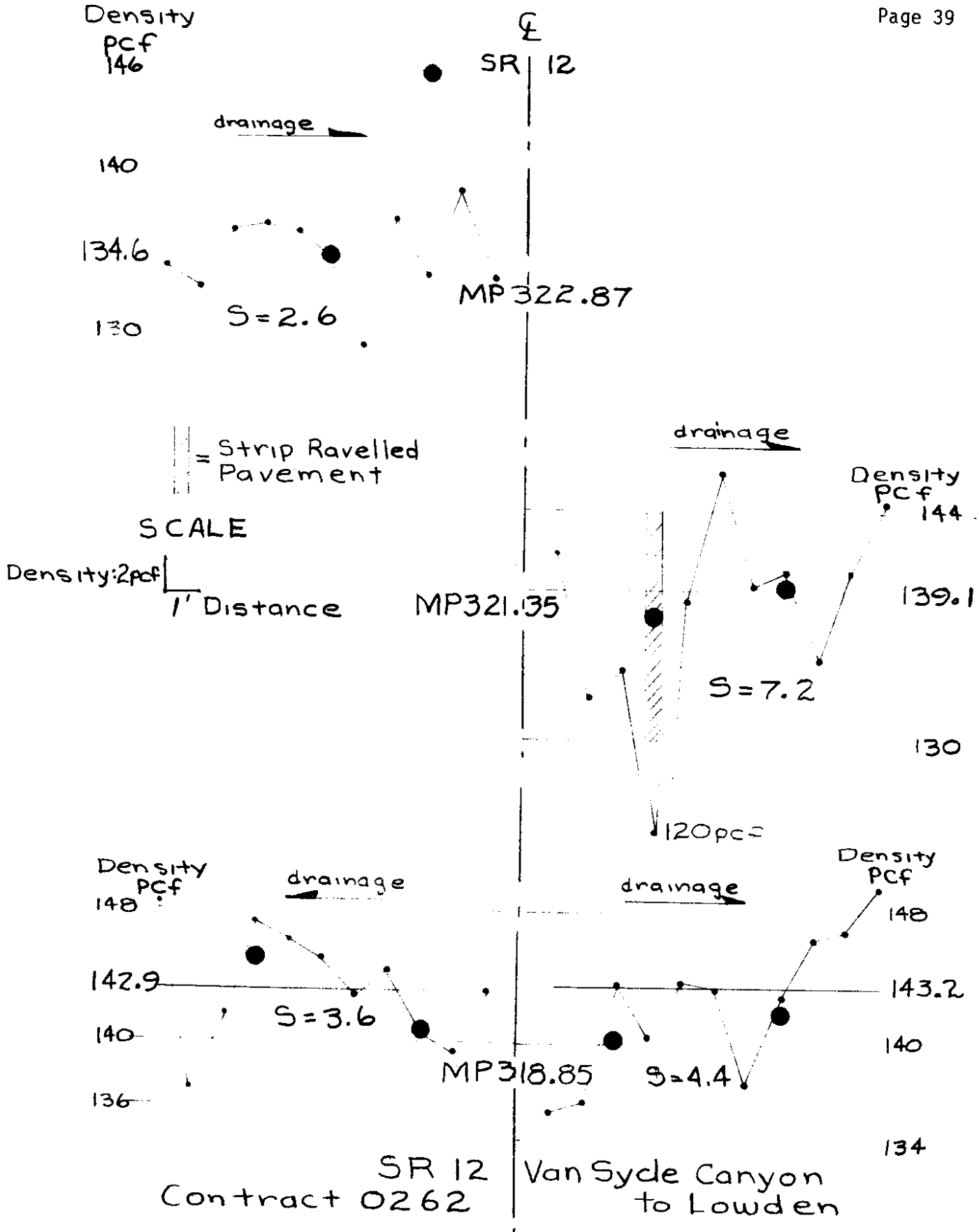

FIGURE 2
Pavement Density Cross Section
Contract 0262

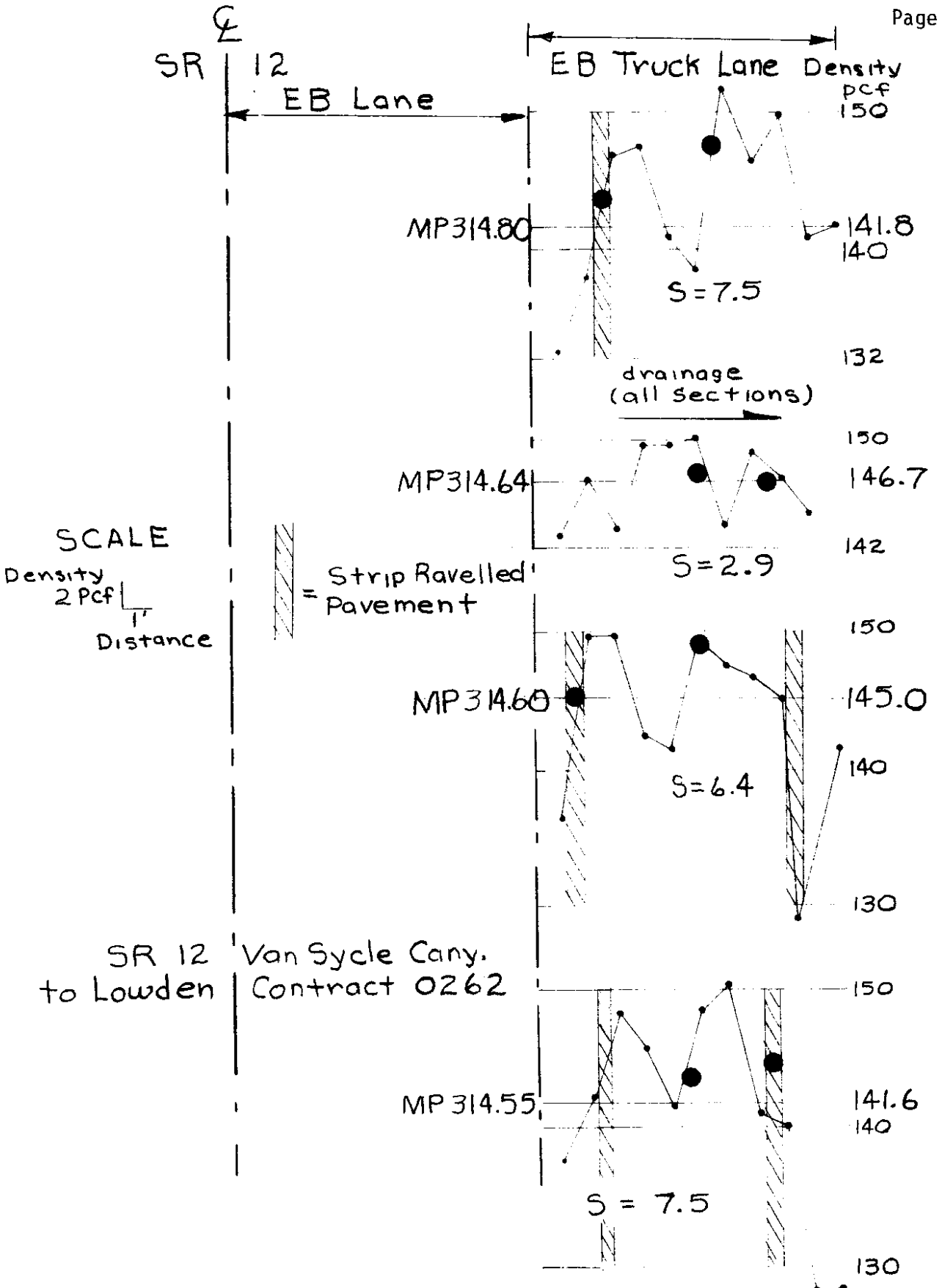

FIGURE 3
Pavement Density Cross Sections
Contract 0262

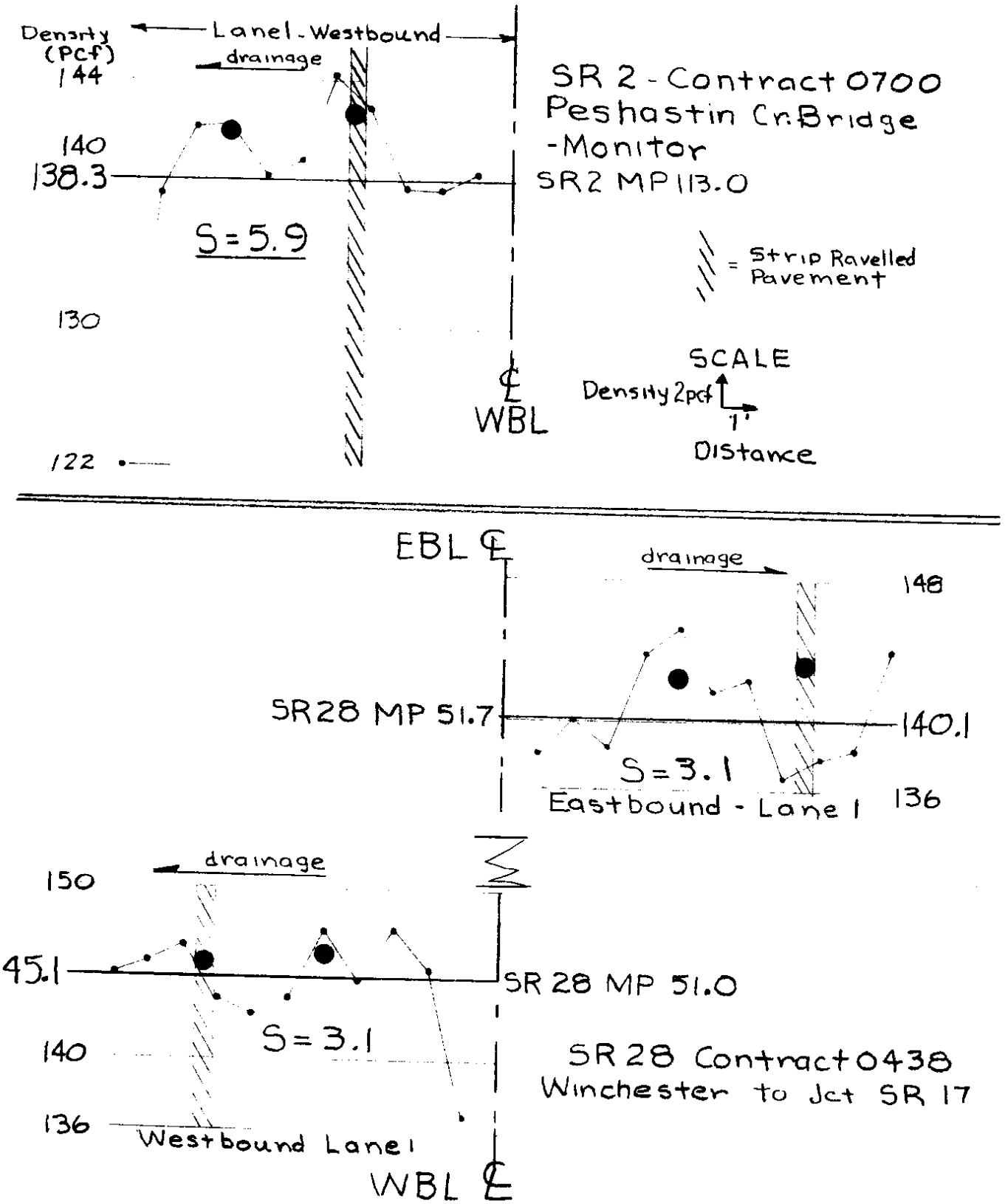

FIGURE 4
Pavement Density Cross Sections
Contracts 0438 & 0700

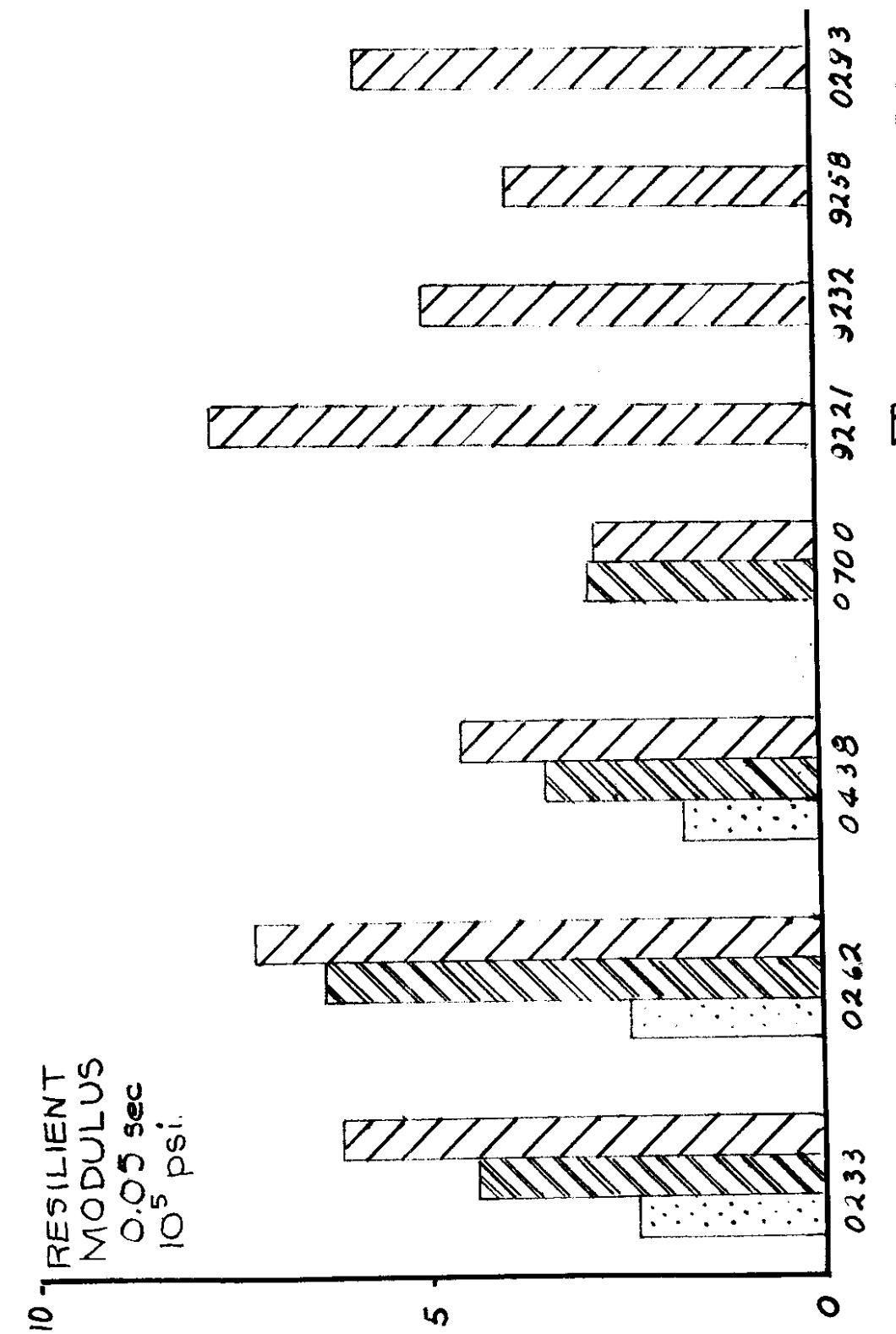

FIGURE 5. STRESS RESPONSE STRIP RAVELLED PROJECTS

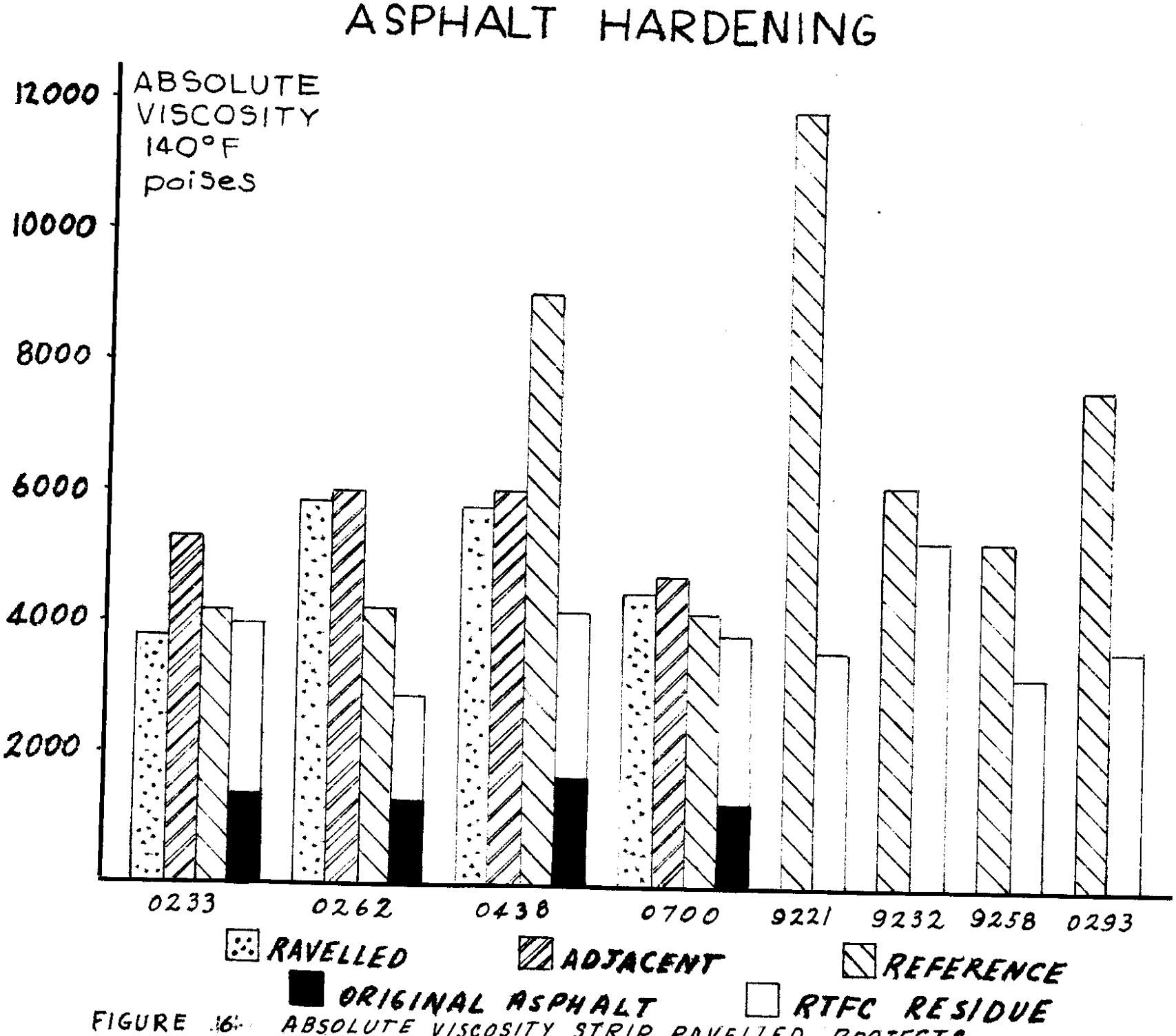

FIGURE 16. ABSOLUTE VISCOSITY STRIP RAVELLED PROJECTS

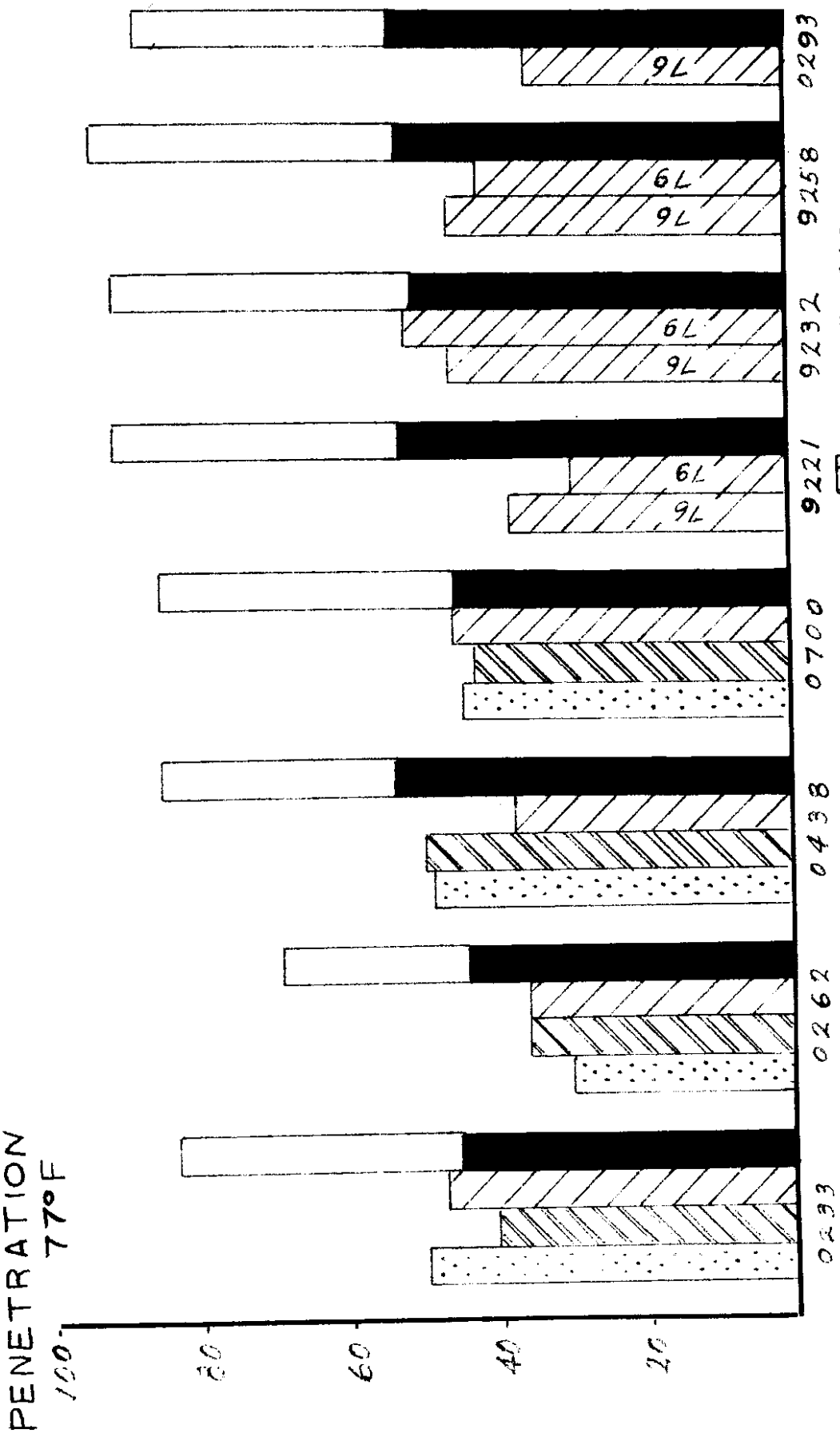

FIGURE 7 ASPHALT PENETRATION - STRIP RAVELLED PROJECTS

APPENDIX A

PAVEMENT SAMPLE TEST RESULTS

PAVEMENT SAMPLE TEST RESULTS

Project: SR 90, Contract 9221
Location: Grant Co. Line to Schrag

Sample:								
Lab No.	X-517	X-518	X-519	X-520	X-521			
Field No.	1	2	3	4	5			
MP	196.00 EB	---------->						
Location	6' Rt	---------->						
Performance Area	Reference	---------->						
Notes:			Note 1	Note 2	Note 1			
Gradation % Passing								
5/8	100	100						
1/2	99	99						
3/8	87	86						
1/4	64	65						
#10	35	36						
#40	18	18						
#80	12	11						
#200	7.3	6.6						
Sand/Silt	4.8	5.5						
Asphalt Content (%)	6.8	7.1						
Density (pcf)	149.1	147.7						
Air Voids (%)	6.4	7.2						
Resilient Modulus (psi x 10^5)								
0.05 sec	8.0	7.0						
0.10 sec	6.0	5.7						
Volatile Distillates (%)								

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 90, Contract 9232
Location: Schrag to Jct. SR 21

Sample:							
Lab No.	X-512	X-513	X-514	X-515	X-516		
Field No.	1	2	3	4	5		
MP	204.00 EB	----------	----------	----------	---------->		
Location	7.5' Rt	----------	----------	----------	---------->		
Performance Area	Reference	----------	----------	----------	---------->		
Notes:	Note 2			Note 1	Note 1		
Gradation % Passing							
5/8		100	100				
1/2		97	97				
3/8		88	92				
1/4		73	75				
#10		36	38				
#40		16	17				
#80		10	11				
#200		6.3	6.5				
Sand/Silt		5.7	5.8				
Asphalt Content (%)		6.3	6.3				
Density (pcf)		155.0	154.6				
Air Voids (%)		4.6	4.9				
Resilient Modulus (psi x 10^5)							
0.05 sec		5.0	4.8				
0.10 sec		3.7	3.6				
Volatile Distillates (%)							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 90, Contract 9258
Location: Jct. SR 21 to Ritzville

Sample:							
Lab No.	X-507	X-508	X-510	X-509	X-511		
Field No.	1	2	4	3	5		
MP	213.90 WB	---------->					
Location	9' Lt	---------->					
Performance Area	Reference	---------->					
Notes:	Note 1	-------- Note 3 -------		Note 2			
Gradation % Passing							
5/8		100			100		
1/2		99			99		
3/8		91			93		
1/4		73			74		
#10		41			36		
#40		19			15		
#80		13			9		
#200		9.1			5.1		
Sand/Silt		4.5			7.1		
Asphalt Content (%)		6.8			7.0		
Density (pcf)		153.0	153.6				
Air Voids (%)		4.5	4.1				
Resilient Modulus (psi x 10^5)							
0.05 sec		3.6	3.8		4.1		
0.10 sec		3.0	2.8		3.5		
Volatile Distillates (%)							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 395, Contract 0293
Location: Jct. SR 26 to Ritzville

Sample:							
Lab No.	X-522	X-523	X-524	X-525	X-526		
Field No.	1	2	3	4	5		
MP	86.1	----------	----------	----------	----------	->	
Location	13' Rt	----------	----------	----------	----------	->	
Performance Area	Reference	----------	----------	----------	----------	->	
Notes:	Note 1	Note 2	Note 2				
Gradation % Passing							
5/8				100	100		
1/2				100	98		
3/8				90	91		
1/4				73	72		
#10				38	38		
#40				18	19		
#80				10	10		
#200				5.9	5.2		
Sand/Silt				6.4	7.3		
Asphalt Content (%)				6.8	6.6		
Density (pcf)				144.1	143.7		
Air Voids (%)				9.9	9.1		
Resilient Modulus (psi x 10^5)							
0.05 sec				5.6	--		
0.10 sec				4.4	--		
Volatile Distillates (%)							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 14, Contract 0994 (Cores)
Location: County Rd. No. 142 to Prindle

Sample:							
Lab No.	X-607	X-608	X-609	X-610	X-611	X-612	X-613
Field No.	1	2	3	4	5	6	7
MP	26.75						
Location	10' Rt	8' Rt	6' Rt	3' Rt	3' Lt	5' Lt	7.5' Lt
Performance Area	Surface Ravelling						
Notes:							
Gradation % Passing							
5/8							
1/2							
3/8							
1/4							
#10							
#40							
#80							
#200							
Sand/Silt							
Asphalt Content (%)							
Density (pcf)			107.4		122.7	131.4	130.7
Air Voids (%)			28.6		18.4	12.7	13.1
Resilient Modulus (psi x 10^5)							
0.05 sec	2.4	3.2	2.0	2.1	1.5	2.0	2.3
0.10 sec	1.6	1.9	1.2	1.3	0.96	1.2	1.5
Volatile Distillates (%)							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 14, Contract 0994 (Cores)
Location: County Rd. No. 142 to Prindle

Sample:							
Lab No.	X-614	X-615	X-616	X-617	X-618	X-619	X-620
Field No.	8	9	10	11	12	13	14
MP	26.75	24.72					
Location	10' Lt	10' Rt	8' Rt	5.5' Rt	3.5' Rt	3' Lt	5' Lt
Performance Area	Surface Ravelling						
Notes:							
Gradation % Passing							
5/8							
1/2							
3/8							
1/4							
#10							
#40							
#80							
#200							
Sand/Silt							
Asphalt Content (%)							
Density (pcf)	129.8	125.5	131.9	127.8	128.1	126.5	127.2
Air Voids (%)	13.7	16.5	13.3	15.0	14.8	15.9	15.4
Resilient Modulus (psi x 10^5)							
0.05 sec	1.5	1.6	2.4	1.8	--	2.0	2.0
0.10 sec	0.98	0.98	1.6	1.3	--	1.2	1.2
Volatile Distillates (%)							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 14, Contract 0994 (Cores)
Location: County Rd. No. 142 to Prindle

Sample:							
Lab No.	X-621	X-622					
Field No.	15	16					
MP	24.72	---------->					
Location	8' Lt	10' Lt					
Performance Area	Surface Ravelling						
Notes:							
Gradation % Passing							
5/8							
1/2							
3/8							
1/4							
#10							
#40							
#80							
#200							
Sand/Silt							
Asphalt Content (%)							
Density (pcf)	135.9	130.2					
Air Voids (%)	9.6	13.4					
Resilient Modulus (psi x 10^5)							
0.05 sec	2.3	2.0					
0.10 sec	1.4	1.2					
Volatile Distillates (%)							

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 14, Contract 0994 (Block Samples)
Location: County Rd. 142 to Prindle

Sample: Lab No.	X-623	X-624	X-625	X-626	X-627	X-628	X-629
Field No.	A	B	C	D	E	F	G
MP	26.75	---------->			24.72	---------->	
Location	1.5' Rt	2.5' Rt	4.0' Rt	5.0' Rt	1.5' Rt	2.5' Rt	4.0' Rt
Performance Area	Surface Ravelling	---------->					
Notes:			Note 1	Note 1		Note 1	
Gradation % Passing							
5/8							
1/2	100	100			100		100
3/8	100	98			98		98
1/4	81	76			80		80
#10	40	37			42		42
#40	21	19			21		21
#80	10	10			11		11
#200	7.0	7.2			7.1		7.5
Sand/Silt	5.7	5.1			6.0		5.6
Asphalt Content (%)	6.6	4.4			7.3		6.9
Density (pcf)	126.0	123.4			126.6		126.0
Air Voids (%)	16.2	18.0			15.8		16.2
Resilient Modulus (psi x 10^5)							
0.05 sec							
0.10 sec							
Volatile Distillates (%)							

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 14, Contract 0994 (Block Samples)
Location: County Rd. 142 to Prindle

Sample:							
Lab No.	X-630						
Field No.	H						
MP	24.72						
Location	5.0' Rt						
Performance Area	Surface Ravelling						
Notes:	Note 1						
Gradation % Passing							
5/8							
1/2							
3/8							
1/4							
#10							
#40							
#80							
#200							
Sand/Silt							
Asphalt Content (%)							
Density (pcf)							
Air Voids (%)							
Resilient Modulus (psi x 10^5)							
0.05 sec							
0.10 sec							
Volatile Distillates (%)							

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 2, Contract 1073
Location: SR 90 to Houston Ave.

Sample:							
Lab No.	X-589	X-590	X-594	X-598	X-591	X-592	X-593
Field No.	1	2	6	10	3	4	5
MP	287.38	287.38	287.44	287.77	287.38	287.44	287.44
Location	13' Rt ℄ Rt Ln-Lt WP	16' Rt ℄ Rt Ln-B WP	19' Rt ℄ Rt Ln-Rt WP	19' Rt ℄ Rt Ln-Rt WP	19' Rt ℄ Rt Ln-Rt WP	13' Rt ℄ Rt Ln-Lt WP	16' Rt ℄ Rt Ln-B WP
Performance Area	Surface Ravelling →						
Notes:	← Note 3 →						Note 2
Gradation % Passing							
5/8		100					
1/2		100					
3/8		99					
1/4		86					
#10		50					
#40		20					
#80		13					
#200		8.0					
Sand/Silt		6.3					
Asphalt Content (%)		6.4					
Density (pcf)	139.5	138.6	137.5	135.3			
Air Voids (%)	10.3	11.2	12.5	13.9			
Resilient Modulus (psi x 10^5)							
0.05 sec							
0.10 sec							
Volatile Distillates (%)					0.0		

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 2, Contract 1073
Location: SR 90 to Houston Avenue

Sample:								
Lab No.	X-595	X-596	X-597					
Field No.	7	8	9					
MP	287.77	---------->						
Location	10' Rt ℄ Rt Ln ℄ NB Ln	13' Rt ℄ Rt Ln-Lt WP	16' Rt ℄ Rt Ln-B WP					
Performance Area	Surface Ravelling	---------->						
Notes:								
Gradation % Passing								
5/8		100						
1/2		100						
3/8		99						
1/4		84						
#10		47						
#40		19						
#80		12						
#200		7.4						
Sand/Silt		6.3						
Asphalt Content (%)		6.5						
Density (pcf)	140.7	--	135.8					
Air Voids (%)	10.5	--	13.7					
Resilient Modulus (psi x 10^5)								
0.05 sec								
0.10 sec								
Volatile Distillates (%)								

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 195, Contract 1085
Location: Paradise Rd. to Mullan Hill Rd.

Sample:							
Lab No.	X-599	X-600	X-601	X-602	X-603	X-604	X-605
Field No.	1	2	3	4	5	6	7
MP	86.58	→	→	→	88.89	→	→
Location	3.0' Lt ℄	9.0' Lt ℄	5.0' Rt ℄	8.0' Rt ℄	3.0' Rt ℄	6.0' Rt ℄	9.0' Rt ℄
Performance Area	Surface Ravelling	→	→	→	→	→	→
Notes:	Note 3		Note 1	Note 1	Note 3		Note 1
Gradation % Passing							
5/8	100				100		
1/2	97				99		
3/8	86				93		
1/4	71				79		
#10	42				45		
#40	17				18		
#80	10				11		
#200	6.7				6.9		
Sand/Silt	6.3				6.5		
Asphalt Content (%)	6.2				5.9		
Density (pcf)	141.5	141.6			136.0	133.7	
Air Voids (%)	10.9	10.8			14.3	15.8	
Resilient Modulus (psi x 10^5)							
0.05 sec	2.2	2.6			1.4	Too thin	
0.10 sec	1.7	1.8			9.5	to run	
Volatile Distillates (%)							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 195, Contract 1085
Location: Paradise Rd. to Mullan Hill Rd.

Sample:		
Lab No.	X-606	
Field No.	8	
MP	88.89	
Location	15.0' Rt ℄	
Performance Area	Surface Ravelling	
Notes:	Note 1	
Gradation % Passing		
5/8		
1/2		
3/8		
1/4		
#10		
#40		
#80		
#200		
Sand/Silt		
Asphalt Content (%)		
Density (pcf)		
Air Voids (%)		
Resilient Modulus (psi x 10^5)		
0.05 sec		
0.10 sec		
Volatile Distillates (%)		

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 195, Contract 1085 (Block Samples)
Location: Paradise Rd. to Mullan Hill Rd.

Sample:							
Lab No.	1B	2A	3B	4A			
Field No.	88.89	86.57	88.89	86.57			
MP	4.5' Rt ℄	10.0' Rt ℄	7.0' Rt ℄	11.5' Rt ℄			
Location							
Performance Area	Surface Ravelling ---------->						
Notes:							
Gradation % Passing							
5/8	100	100	100	100			
1/2	99	97	98	99			
3/8	89	87	89	89			
1/4	74	73	74	72			
#10	42	42	45	43			
#40	17	18	17	18			
#80	10	11	11	10			
#200	6.7	6.8	6.6	6.5			
Sand/Silt	6.3	6.2	6.8	6.6			
Asphalt Content (%)	6.2	6.3	6.5	6.3			
Density (pcf)	133.3	143.6	132.8	139.8			
Air Voids (%)	16.1	9.5	16.6	11.9			
Resilient Modulus (psi x 10^5)							
0.05 sec							
0.10 sec							
Volatile Distillates (%)							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 97, Contract 0233
Location: Wenatchee to Chelan

Sample:		X-487	X-488	X-489	X-490	X-491	X-492
	Lab No.	1	2	3	4	5	6
	Field No.	212.8				212.78	
	MP	3.4' Lt	3.4' Lt	5.9' Lt	5.9' Lt	3.6' Lt	3.6' Lt
	Location						
Performance Area		Raveled		Adjacent		Reference	
Notes:		------Note 3---------		-------Note 3--------		------Note 3---------	
Gradation % Passing							
5/8		100		100		100	
1/2		99		99		99	
3/8		89		88		87	
1/4		72		69		71	
#10		44		42		43	
#40		22		22		21	
#80		12		13		12	
#200		7.2		7.3		7.6	
Sand/Silt		6.1		5.7		5.6	
Asphalt Content (%)		6.7		5.8		5.7	
Density (pcf)		--	149.3	--	145.4	--	147.4
Air Voids (%)		--	4.4	--	5.9	--	4.6
Resilient Modulus (psi x 10^5)							
0.05 sec		--	3.2	5.2	1.6	5.4	5.6
0.10 sec		--	2.2	3.8	1.0	4.1	4.0
Volatile Distillates (%)		0.08	--	0.05	--	0.05	--

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 97, Contract 0233
Location: Wenatchee to Chelan

Sample:							
Lab No.	X-493	X-494	X-495	X-496	X-497	X-498	X-500
Field No.	7	8	9	10	11	12	14
MP	212.78	→	211.5	→	→	→	→
Location	5.7' Lt	5.7' Lt	6.0' Rt	→	→	8.0' Rt	→
Performance Area	Reference		Ravelled		Ravelled	Adjacent	
Notes:	Note 3		Note 3		Note 2		
Gradation % Passing							
5/8		100		100		100	100
1/2		90		99		98	98
3/8		88		90		87	83
1/4		67		73		69	66
#10		39		45		42	41
#40		20		22		22	21
#80		13		12		12	12
#200		6.9		6.9		7.2	7.2
Sand/Silt		5.7		6.1		5.8	5.7
Asphalt Content (%)		5.4		5.8			
Density (pcf)	--	149.9	144.0	146.0		5.8	5.6
Air Voids (%)	--	2.9	6.7	5.5		143.5	143.2
						7.1	7.3
Resilient Modulus (psi x 10^5)							
0.05 sec		6.6	--	2.8		5.2	4.6
0.10 sec		4.6	--	1.9		3.4	3.0
Volatile Distillates (%)	0.03				0.03		

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 97, Contract 0233
Location: Wenatchee to Chelan

Sample:							
Lab No.	X-499	X-501	X-502	X-503	X-504	X-506	X-505
Field No.	13	15	16	17	18	20	19
MP	211.5						
Location	8.0' Rt	9.0' Rt			3.0' Lt		
Performance Area	Adjacent	Ravelled	Ravelled		Adjacent		Adjacent
Notes:	Note 2	Note 1	Note 3		Note 3		Note 1
Gradation % Passing							
5/8			100		100		
1/2			99		99		
3/8			90		90		
1/4			71		74		
#10			43		44		
#40			21		22		
#80			12		13		
#200			7.3		7.5		
Sand/Silt			5.9		5.9		
Asphalt Content (%)			5.9		6.0		
Density (pcf)			--	145.0	--	147.5	
Air Voids (%)			--	6.1	--	4.5	
Resilient Modulus (psi x 10^5)							
0.05 sec			1.5	1.7	3.6	5.8	
0.10 sec			1.0	1.0	2.4	3.8	
Volatile Distillates (%)	0.02	--	0.05	--	0.02	--	

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-432	X-433	X-434	X-435	X-436	X-437	X-438
Lab No.	1	2	3	3A	4	5	6
Field No.	321.35	←	←	←	→	→	→
MP	4.0' Rt	←	←	←	8.0' Rt	→	→
Location	Ravelled	←	←	←	Adjacent	→	→
Performance Area	Note 2	Note 1	Note 3		Note 3		Note 1
Notes:							
Gradation % Passing							
5/8			100		100		
1/2			98		100		
3/8			88		92		
1/4			67		74		
#10			34		38		
#40			17		18		
#80			10		11		
#200			6.1		7.1		
Sand/Silt			5.6		5.4		
Asphalt Content (%)			6.4		6.7		
Density (pcf)		--		--	143.5	--	
Air Voids (%)		--		--	8.9	--	
Resilient Modulus (psi x 10^5)							
0.05 sec		--		--	8.6	4.9	
0.10 sec		--		--	6.8	3.7	
Volatile Distillates (%)	0.03	--		--	--	0.04	

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-439	X-440	X-441	X-442	X-443	X-444
Lab No.	6A	7	8	9	11	12
Field No.	321.35	322.85	-->	-->	-->	-->
MP	8.0' Rt	2.7' Lt	-->	-->	6.0' Lt	-->
Location						
Performance Area	Adjacent	Ravelled		Ravelled	Adjacent	
Notes:	Note 2	Note 3		Note 1	Note 3	
Gradation % Passing						
5/8		100			100	
1/2		98			98	
3/8		77			77	
1/4		56			58	
#10		31			32	
#40		12			17	
#80		11			10	
#200		7.0			6.6	
Sand/Silt		4.4			4.8	
Asphalt Content (%)		5.4			5.1	
Density (pcf)		141.4	144.8		140.1	--
Air Voids (%)		10.2	8.0		11.0	--
Resilient Modulus (psi x 10^5)						
0.05 sec		--	--		7.2	8.2
0.10 sec		--	--		7.4	7.6
Volatile Distillates (%)				0.03		0.02

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample: Lab No.	X-445	X-446	X-447	X-448	X-450	X-449
Field No.	13	14	15	16	18	17
MP	322.87	---------->				
Location	2.7' Lt	---------->		6.0' Lt	---------->	
Performance Area	Reference		Reference	Reference		Reference
Notes:	Note 3		Note 2	Note 3		Note 1
Gradation % Passing						
5/8	100			100		
1/2	100			99		
3/8	92			86		
1/4	75			71		
#10	39			37		
#40	19			18		
#80	12			11		
#200	7.4			7.6		
Sand/Silt	5.3			4.9		
Asphalt Content (%)	7.0			6.4		
Density (pcf)	149.2	150.5		144.8	146.6	
Air Voids (%)	5.2	4.4		8.0	6.9	
Resilient Modulus (psi x 10^5)						
0.05 sec	7.0	6.2		6.0	6.5	
0.10 sec	5.7	5.0		5.4	5.0	
Volatile Distillates (%)			0.05			

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-471	X-472	X-474	X-473	X-475	X-477	X-476
Lab No.	39	40	42	41	43	45	44
Field No.							
MP	314.60 EBTL	---------->			314.64 EBTL	---------->	
Location	1.5' Rt	6.0' Rt	---------->		---------->	---------->	
Performance Area	Ravelled	Adjacent		Adjacent	Reference	---------->	
Notes:	Note 1	------- Note 3 --------		Note 1	------ Note 3 --------		Note 1
Gradation % Passing							
5/8		100			100		
1/2		99			99		
3/8		92			88		
1/4		71			69		
#10		33			35		
#40		16			23		
#80		11			13		
#200		7.2			7.1		
Sand/Silt		4.6			4.9		
Asphalt Content (%)		7.0			6.6		
Density (pcf)		145.5	150.8		149.2	148.6	
Air Voids (%)		7.6	4.2		5.2	5.6	
Resilient Modulus (psi x 10^5)							
0.05 sec		--	7.8		8.1	7.1	
0.10 sec		--	5.8		5.2	5.8	
Volatile Distillates (%)	0.05			0.03			

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-464	X-465	X-466	X-467	X-468	X-469	X-470
Lab No.	32	33	34	35	36	37	38
Field No.	314.55 EBTL					314.60 EBTL	
MP	8.5' Rt		5.5' Rt			1.5' Rt	
Location							
Performance Area	Ravelled		Adjacent		Adjacent	Ravelled	
Notes:	Note 3				Note 2	Note 3	
Gradation % Passing							
5/8	100		100	100		100	
1/2	97		98	100		100	
3/8	78		86	91		88	
1/4	59		68	70		71	
#10	31		37	35		34	
#40	16		15	16		16	
#80	10		10	10		11	
#200	5.7		7.0	7.2		7.7	
Sand/Silt	5.4		5.3	4.9		4.4	
Asphalt Content (%)	5.3		6.8	6.6		7.0	
Density (pcf)	--	--	--	148.5		145.1	142.3
Air Voids (%)	--	--	--	5.7		7.8	9.6
Resilient Modulus (psi x 10^5)							
0.05 sec	--	--	--	7.6		--	--
0.10 sec	--	--	--	5.0		--	--
Volatile Distillates (%)					0.02		

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:							
Lab No.	X-457	X-459	X-458	X-460	X-461	X-462	X-463
Field No.	25	27	26	28	29	30	31
MP	318.85	---------->					314.55 EB TL
Location	3.0' Rt	---------->		8.0' Rt	---------->		8.5' Rt
Performance Area	Reference	---------->					Ravelled
Notes:			Note 2	------- Note 3 -------		Note 1	Note 2
Gradation % Passing							
5/8	100	100		100			
1/2	99	99		98			
3/8	89	90		84			
1/4	69	71		64			
#10	36	38		34			
#40	18	19		18			
#80	11	11		11			
#200	6.9	7.3		7.1			
Sand/Silt	5.2	5.2		4.8			
Asphalt Content (%)	6.9	7.3		6.1			
Density (pcf)	--	147.3		144.9	144.8		
Air Voids (%)	--	6.4		8.6	8.0		
Resilient Modulus (psi x 10^5)							
0.05 sec	8.0	5.9		4.2	7.2		
0.10 sec	6.0	4.4		2.8	5.3		
Volatile Distillates (%)			0.02				0.05

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:							
Lab No.	X-451	X-453	X-452	X-454	X-455	X-456	
Field No.	19	21	20	22	23	24	
MP	318.85	---------->					
Location	3.0' Lt	---------->		8.0' Lt	---------->		
Performance Area							
Notes:	Reference Note 3		Note 1	Reference Note 3		Reference Note 1	
Gradation % Passing							
5/8	100			100			
1/2	100			99			
3/8	89			90			
1/4	69			75			
#10	36			40			
#40	18			20			
#80	11			12			
#200	6.8			7.6			
Sand/Silt	5.3			5.3			
Asphalt Content (%)	7.6			6.4			
Density (pcf)	146.0	145.6		144.9	--		
Air Voids (%)	7.3	7.5		8.0	--		
Resilient Modulus (psi x 10^5)							
0.05 sec	8.2	9.8		14.0	9.5		
0.10 sec	7.8	7.7		9.9	8.0		
Volatile Distillates (%)					0.03		

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:							
Lab No.	X-478	X-479	X-480	X-481	X-482	X-483	
Field No.	46	47	48	49	50	51	
MP	314.64 EBTL	---------->	---------->	314.80 EBTL	---------->	---------->	
Location	8.5' Rt	---------->	---------->	2.5' Rt	---------->	---------->	
Performance Area	Reference	---------->	---------->	Ravelled	---------->	---------->	
Notes:	------- Note 3 ---------		Note 2		------- Note 3 ---------		
Gradation % Passing							
5/8	100				100		
1/2	100				100		
3/8	87				87		
1/4	66				71		
#10	31				36		
#40	15				17		
#80	10				11		
#200	6.3				6.6		
Sand/Silt	4.9				5.5		
Asphalt Content (%)	6.5				6.0		
Density (pcf)	150.5	150.9			143.2	--	
Air Voids (%)	4.4	4.2			9.0	--	
Resilient Modulus (psi x 10^5)							
0.05 sec	8.4	7.8			--	--	
0.10 sec	5.3	5.6			--	--	
Volatile Distillates (%)			0.02	0.03		0.02	

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:							
Lab No.	X-484	X-485	X-486	X-632	X-636	None	
Field No.	52	53	54	Box #2	Box #6	Sack Sample	
MP	314.80 EBTL ---------->			314.55	314.8	322.85	
Location	6.5' Rt ---------->			8.3-9.0' Rt	1.6-2.2' Rt	2.7' Lt	
Performance Area	Adjacent ---------->			Ravelled ---------->		Ravelled	
Notes:	------- Note 3 --------		Note 1				
Gradation % Passing							
5/8	100			100	100	100	
1/2	99			99	99	99	
3/8	91			85	86	79	
1/4	71			64	68	59	
#10	36			34	36	31	
#40	17			16	18	16	
#80	11			9	12	10	
#200	7.3			5.1	7.4	6.0	
Sand/Silt	4.9			6.7	4.9	5.2	
Asphalt Content (%)	6.3			5.9	6.5	7.0	
Density (pcf)	149.9	149.4		144.8	144.6	--	
Air Voids (%)	4.8	5.1		8.0	8.2	--	
Resilient Modulus (psi x 10^5)							
0.05 sec	6.8	8.2		--	--		
0.10 sec	4.8	5.6		--	--		
Volatile Distillates (%)			0.02				

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:							
Lab No.	X-555	X-556	X-558	X-560	X-562	X-563	
Field No.	1	2	4	6	8	9	
MP	38.0	38.0	38.0	38.0	41.0	41.0	
Location	9.0' Rt	9.0' Rt	6.0' Rt	6.0' Rt	6.0' Rt	6.0' Rt	
Performance Area	Reference ---------->						
Notes:	Note 3		Note 3		Note 3		
Gradation % Passing							
5/8	Not reported due to lab error		100		100		
1/2			99		97		
3/8			86		86		
1/4			70		72		
#10			38		37		
#40			16		15		
#80			10		10		
#200			7.3		7.1		
Sand/Silt			5.2		5.2		
Asphalt Content (%)			5.6		6.1		
Density (pcf)	148.8	--	147.5	147.0	145.4	--	
Air Voids (%)	7.1	--	7.9	8.2	9.2	--	
Resilient Modulus (psi x 10^5)							
0.05 sec	6.0	6.1	5.2	5.2	5.6	4.6	
0.10 sec	4.6	4.8	4.4	4.8	3.8	3.5	
Volatile Distillates (%)		0.02				0.02	

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:							
Lab No.	X-564	X-565	X-557	X-561	X-559	X-566	
Field No.	10	11	3	7	5	12	
MP	41.0	41.0	38.0	41.0	38.0	41.0	
Location	6.0' Rt	6.0' Rt	9.0' Rt	6.0' Rt	6.0' Rt	9.0' Rt	
Performance Area	Reference						
Notes:	-------Note 3---------		Note 1	Note 2	Note 1	Note 1	
Gradation % Passing							
5/8	100						
1/2	98						
3/8	89						
1/4	68						
#10	35						
#40	14						
#80	10						
#200	6.6						
Sand/Silt	5.3						
Asphalt Content (%)	5.5						
Density (pcf)	146.1	--					
Air Voids (%)	8.8	--					
Resilient Modulus (psi x 10^5)							
0.05 sec	2.7	4.6					
0.10 sec	1.9	3.4					
Volatile Distillates (%)		0.02					

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:							
Lab No.	X-567	X-569	X-568	X-570	X-571	X-572	X-573
Field No.	13	15	14	16	17	17A	18
MP	51.7 EB						
Location	5.0' Rt	5.0' Rt	5.0' Rt	8.5' Rt	8.5' Rt	8.5' Rt	8.5' Rt
Performance Area	Adjacent		Adjacent	Ravelled			
Notes:	Note 3		Note 2	Note 3		Note 2	Note 1
Gradation % Passing							
5/8	100			100			
1/2	98			98			
3/8	87			86			
1/4	70			70			
#10	38			40			
#40	15			15			
#80	10			10			
#200	7.0			7.3			
Sand/Silt	5.4			5.5			
Asphalt Content (%)	6.2			6.7			
Density (pcf)	146.3	--		148.5	147.1		
Air Voids (%)	8.6	--		6.9	8.1		
Resilient Modulus (psi x 10^5)							
0.05 sec	--	--		1.7	--		
0.10 sec	--	--		1.2	--		
Volatile Distillates (%)		0.0			0.05		

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:	X-574	X-575	X-576	X-577	X-578	X-579	X-580
Lab No.	19	20	21	22	23	24	24A
Field No.	51 WB	→	→	→	→	→	→
MP	5' Lt	→	→	8.5' Lt	→	→	→
Location	Adjacent	→	Adjacent	Ravelled	→	→	→
Performance Area			Note 1	Note 1	Note 1		
Notes:							
Gradation % Passing							
5/8	100	100				100	100
1/2	98	98				100	99
3/8	87	92				90	92
1/4	72	73				75	75
#10	39	38				38	31
#40	15	15				17	15
#80	10	10				11	9
#200	7.2	6.9				6.7	6.7
Sand/Silt	5.4	5.5				5.7	4.6
Asphalt Content (%)	7.1	7.1				5.9	4.1
Density (pcf)	149.2	147.5				--	--
Air Voids (%)	6.8	7.9				--	--
Resilient Modulus (psi x 10^5)							
0.05 sec	--	3.4				--	--
0.10 sec	--	2.1				--	--
Volatile Distillates (%)							0.02

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:							
Lab No.	X-581	X-582	X-583	X-584	X-585	X-586	
Field No.	24B	Extract 24A-B	25	26	27	28	
MP	51 WB	→	49.0 WB	→	→	→	
Location	8.5' Lt	→	→	→	→	5.0' Lt	
Performance Area	Ravelled	→	Reference	→	→	→	
Notes:			Note 3		Note 1	Note 1	
Gradation % Passing							
5/8	100	100	100				
1/2	99	99	98				
3/8	91	88	88				
1/4	75	74	72				
#10	39	41	41				
#40	15	16	16				
#80	10	11	11				
#200	7.3	7.4	7.7				
Sand/Silt	5.3	5.5	5.3				
Asphalt Content (%)	6.9	7.4	6.1				
Density (pcf)	151.7	--	148.2	--			
Air Voids (%)	5.3	--	7.4	--			
Resilient Modulus (psi x 10^5)							
0.05 sec	3.3		4.0	3.8			
0.10 sec	3.3		3.1	3.2			
Volatile Distillates (%)		0.02		0.01			

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:							
Lab No.	X-587	X-588	X-649				
Field No.	29	30	Box #3				
MP	49.0 WB	---------->	51.7 NB				
Location	5.0' Lt	---------->	8.6-9.3' Rt				
Performance Area	Reference	---------->	Ravelled				
Notes:	------ Note 3 --------						
Gradation % Passing							
5/8	100		100				
1/2	96		97				
3/8	85		85				
1/4	67		72				
#10	37		42				
#40	15		16				
#80	10		11				
#200	7.1		7.4				
Sand/Silt	5.2		5.7				
Asphalt Content (%)	6.1		5.9				
Density (pcf)	147.6	150.2	146.9				
Air Voids (%)	7.8	6.2	8.3				
Resilient Modulus (psi x 10^5)							
0.05 sec	3.8	4.7	--				
0.10 sec	3.0	4.0	--				
Volatile Distillates (%)							

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 2, Contract 0700
Location: Peshastin Creek Br. to Monitor Vic.

Sample:							
Lab No.	X-527	X-528	X-530	X-531	X-533	X-532	
Field No.	1	2	3A	4	6	5	
MP	113 WB	-->	-->	-->	-->	-->	
Location	4.5' Lt	-->	-->	8.0' Lt	-->	-->	
Performance Area	Ravelled	-->	-->	Adjacent	-->	-->	
Notes:	Note 2	Note 1	Note 1			Note 2	
Gradation % Passing							
5/8				100			
1/2				99			
3/8				86			
1/4				68			
#10				36	Void		
#40				18			
#80				11			
#200				7.4			
Sand/Silt				4.9			
Asphalt Content (%)				5.7			
Density (pcf)				142.4	142.1		
Air Voids (%)				8.4	8.6		
Resilient Modulus (psi x 10^5)							
0.05 sec				2.2	2.4		
0.10 sec				1.4	1.6		
Volatile Distillates (%)		0.09				0.06	

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 2, Contract 0700
Location: Peshastin Creek Br. to Monitor Vic.

Sample:							
Lab No.	X-534	X-535	X-536	X-529	X-537	X-538	X-539
Field No.	9	10	11	3	12	13	14
MP	110.70 WB	----------	----------	----------	----------	----------	---------->
Location	8.0' Lt	----------	---------->	Core Lost	5.0' Lt	----------	---------->
Performance Area	Adjacent	----------	---------->		Ravelled	----------	---------->
Notes:	------- Note 3 ---------		Note 1		------- Note 3 ---------		Note 1
Gradation % Passing							
5/8		100				100	
1/2		98				100	
3/8		89				86	
1/4		70				67	
#10		38				36	
#40		19				18	
#80		11				11	
#200		6.8				6.9	
Sand/Silt		5.6				5.2	
Asphalt Content (%)		6.0				5.6	
Density (pcf)	143.4	143.0					
Air Voids (%)	7.8	8.0					
Resilient Modulus (psi x 10^5)							
0.05 sec	2.3	2.3					
0.10 sec	1.6	1.5					
Volatile Distillates (%)			0.07				0.04

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 2, Contract 0700
Location: Peshastin Creek Br. to Monitor Vic.

Sample: Lab No.	X-540	X-541	X-542	X-543	X-544	X-545
Field No.	15	15A	16	17	18	19
MP	110.70 WB	---------->				108.75 EB
Location	5.5' Lt	---------->		8.0' Lt	---------->	10.0' Lt
Performance Area	Reference	---------->				Ravelled
Notes:	Note 2	------- Note 3 ---------		------- Note 3 ---------		Note 1
Gradation % Passing						
5/8		100		100		
1/2		99		98		
3/8		89		92		
1/4		73		72		
#10		40		40		
#40		19		19		
#80		11		11		
#200		6.1		6.2		
Sand/Silt		6.6		6.5		
Asphalt Content (%)		6.5		6.3		
Density (pcf)		144.9	146.6	142.1	142.5	
Air Voids (%)		6.8	5.7	8.6	8.4	
Resilient Modulus (psi x 10^5)						
0.05 sec		2.2	--	1.6	2.7	
0.10 sec		1.4	--	1.0	1.9	
Volatile Distillates (%)	0.06					

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 2, Contract 0700
Location: Peshastin Cr. Br. to Monitor Vic.

Sample:							
Lab No.	X-546	X-547	X-548	X-549	X-550	X-551	X-552
Field No.	20	21	22	23	24	25	26
MP	108.25 EB	----------	----------	----------	----------	108.30 EB	----------
Location	10.0' Rt	---------->	6.0' Rt	----------	----------	10.0' Rt	----------
Performance Area	Ravelled	---------->	Adjacent	----------	----------	Reference	----------
Notes:	Note 1	Note 1	--------Note 3---------		Note 1	--------Note 3---------	
Gradation % Passing							
5/8			100			100	
1/2			99			98	
3/8			87			91	
1/4			70			72	
#10			41			40	
#40			20			20	
#80			13			13	
#200			7.8			7.8	
Sand/Silt			5.3			5.1	
Asphalt Content (%)			6.1			6.0	
Density (pcf)			142.1	141.4		146.8	--
Air Voids (%)			8.6	10.1		5.6	--
Resilient Modulus (psi x 10^5)							
0.05 sec			3.4	3.9		2.8	3.4
0.10 sec			2.6	2.7		1.7	2.2
Volatile Distillates (%)					0.04		0.04

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

PAVEMENT SAMPLE TEST RESULTS

Project: SR 2, Contract 0700
Location: Peshastin Cr. Br. to Monitor Vic.

Sample:								
Lab No.	X-553	X-554	X-644	X-640				
Field No.	27	28	Box #6	Box 2 - 2 Pieces				
MP	108.30 EB	---------->	108.25 EB	113.0 WB				
Location	6.0' Rt	---------->	9.0' Rt	3.8-4.4' Lt				
Performance Area	Reference	----------	----------	---------->				
Notes:	------- Note 3---------							
Gradation % Passing								
5/8	100		100	100				
1/2	99		97	99				
3/8	89		88	89				
1/4	72		66	69				
#10	41		39	38				
#40	21		20	18				
#80	13		12	11				
#200	8.4		7.4	6.7				
Sand/Silt	4.9		5.3	5.7				
Asphalt Content (%)	6.0		5.7	5.8				
Density (pcf)	145.5	144.8	140.6	139.3-140.7				
Air Voids (%)	6.5	6.9	10.6	10.4 9.5				
Resilient Modulus (psi x 10^5)								
0.05 sec	3.7	4.2						
0.10 sec	2.5	2.8						
Volatile Distillates (%)								

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

APPENDIX B

ASPHALT SAMPLE TEST RESULTS

ASPHALT SAMPLE ANALYSIS

Project: SR 90, Contract 9221
Location: Grant Co. Line to Schrag

Sample:							
Lab No.	X-517	X-518	X-519	X-520	X-521		
Field No.	1	2	3	4	5		
MP	196.00 EB	---------->					
Location	6' Rt	---------->					
Performance Area	Reference	---------->					
Notes:	------ Note 3 --------		Note 1	Note 2	Note 1		
Absorption Recovery							
Pen. (77°F)	29						
Visc: Abs (140°F) p.	11,807						
Kin (270°F) cst.	781						
Ductility, 45°F, cm.	8.25						
Chemical Analysis (Rostler, %)							
Asphaltenes	38.2						
Nitrogens Gp I] (N)	3.3						
Nitrogens Gp II]	19.8						
1st Acidaffins (A_1)	11.4						
2nd Acidaffins (A_2)	16.3						
Paraffins (P)	10.3						
$(N + A_1)/(A_2 + P)$	1.32						

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 90, Contract 9232
Location: Schrag to Jct. SR 21

Sample:							
Lab No.	X-512	X-513	X-514	X-515	X-516		
Field No.	1	2	3	4	5		
MP	204.00 EB	---------->					
Location	7.5' Rt	---------->					
Performance Area	Reference	---------->					
Notes:	Note 2	------ Note 3 --------		Note 1	Note 1		
Abson Recovery							
Pen. (77°F)		51					
Visc: Abs (140°F) p.		6,107					
Kin (270°F) cst.		614					
Ductility, 45°F, cm.		14.25					
Chemical Analysis (Rostler, %)							
Asphaltenes		33.9					
Nitrogens Gp I] (N)		3.9					
Nitrogens Gp II]		15.1					
1st Acidaffins (A_1)		7.5					
2nd Acidaffins (A_2)		23.6					
Paraffins (P)		15.5					
$(N + A_1)/(A_2 + P)$		0.71					

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 90, Contract 9258
Location: Jct. SR 21 to Ritzville

Sample:	X-507	X-508	X-510	X-509	X-511		
Lab No.	1	2	4	3	5		
Field No.	213.90 WB	---------->					
MP	9' Lt	---------->					
Location	Reference	---------->					
Performance Area	Note 1	------ Note 3 --------		Note 2			
Notes:							
Absorption Recovery							
Pen. (77°F)		41					
Visc: Abs (140°F) p.		5,231					
Kin (270°F) cst.		528					
Ductility, 45°F, cm.		9.25					
Chemical Analysis (Rostler, %)							
Asphaltenes		30.8					
Nitrogens Gp I] (N)		3.8					
Nitrogens Gp II]		14.6					
1st Acidaffins (A_1)		9.9					
2nd Acidaffins (A_2)		26.5					
Paraffins (P)		14.2					
$(N + A_1)/(A_2 + P)$		0.71					

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 395, Contract 0293
Location: Jct. SR 26 to Ritzville

Sample:							
Lab No.	X-522	X-523	X-524	X-525	X-526		
Field No.	1	2	3	4	5		
MP	86.1	---------->					
Location	13' Rt	---------->					
Performance Area	Reference	---------->					
Notes:	Note 1	Note 1	Note 2	------ Note 3 --------			
Abson Recovery							
Pen. (77°F)				34			
Visc: Abs (140°F) p.				7,653			
Kin (270°F) cst.				636			
Ductility, 45°F, cm.				8.75			
Chemical Analysis (Rostler, %)							
Asphaltenes				34.7			
Nitrogens Gp I] (N)				6.7			
Nitrogens Gp II]				12.6			
1st Acidaffins (A_1)				12.5			
2nd Acidaffins (A_2)				20.1			
Paraffins (P)				12.9			
$(N + A_1)/(A_2 + P)$				0.99			

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 14, Contract 0994, Block Samples (Note 4)
Location: Co. Rd. No. 142 to Prindle

Sample: Lab No.	X-623 A	X-624 B	X-625 C	X-626 D	X-627 E	X-628 F	X-629 G
Field No.							
MP	26.75 -->				24.72 -->		
Location	1.5' Rt	2.5' Rt	4.0' Rt	5.0' Rt	1.5' Rt	2.5' Rt	4.0' Rt
Performance Area	Surfacing Ravelling -->						
Notes:							
Abson Recovery							
Pen. (77°F)			57	60		59	
Visc: Abs (140°F) p.			2,482	2,360		2,233	
Kin (270°F) cst.			422	408		398	
Ductility, 45°F, cm.			42.75	60+		60+	
Chemical Analysis (Rostler, %)							
Asphaltenes							
Nitrogens Gp I] (N)							
Nitrogens Gp II]							
1st Acidaffins (A_1)							
2nd Acidaffins (A_2)							
Paraffins (P)							
$(N + A_1)/(A_2 + P)$							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction
4. Asphalt sample analysis for this project on block samples only.

ASPHALT SAMPLE ANALYSIS

Project: SR 14, Contract 0994, Block Samples (Note 4)
Location: Co. Rd. No. 142 to Prindle

Sample:							
Lab No.	X-630						
Field No.	H						
MP	24.72						
Location	5.0' Rt						
Performance Area	Surface Ravelling						
Notes:							
Absorption Recovery							
Pen. (77°F)	60						
Visc: Abs (140°F) p.	2,123						
Kin (270°F) cst.	398						
Ductility, 45°F, cm.	60+						
Chemical Analysis (Rostler, %)							
Asphaltenes							
Nitrogens Gp I] (N)							
Nitrogens Gp II]							
1st Acidaffins (A_1)							
2nd Acidaffins (A_2)							
Paraffins (P)							
$(N + A_1)/(A_2 + P)$							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction
4. Asphalt sample analysis for this project on block samples only.

ASPHALT SAMPLE ANALYSIS

Project: SR 2, Contract 1073
Location: SR 90 to Houston Ave.

Sample:							
Lab No.	X-589	X-590	X-594	X-598	X-591	X-592	X-593
Field No.	1	2	6	10	3	4	5
MP	287.38	→	287.44	287.77	287.38	287.44	→
Location	13' Rt ℄ Rt Ln-Lt WP	16' Rt ℄ Rt Ln-B WP	19' Rt ℄ Rt Ln-Rt WP	19' Rt ℄ Rt Ln-Rt WP	19' Rt ℄ Rt Ln-Rt WP	13' Rt ℄ Rt Ln-Lt WP	16' Rt ℄ Rt Ln-B WP
Performance Area	Surface Ravelling	→					→
Notes:	←	Note 3	→		Note 5	Note 4	Note 2
Abson Recovery							
Pen. (77°F)		52					
Visc: Abs (140°F) p.		4,018					
Kin (270°F) cst.		542					
Ductility, 45°F, cm.		18.25					
Chemical Analysis (Rostler, %)							
Asphaltenes		29.6					
Nitrogens Gp I] (N)		3.7					
Nitrogens Gp II]		14.7					
1st Acidaffins (A_1)		13.9					
2nd Acidaffins (A_2)		26.1					
Paraffins (P)		11.1					
$(N + A_1)/(A_2 + P)$		0.92					

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction
4. Lottman Stripping Test only
5. Volatile Distillate Test only

ASPHALT SAMPLE ANALYSIS

Project: SR 2, Contract 1073
Location: SR 90 to Houston Ave.

Sample:							
Lab No.	X-595	X-596	X-597				
Field No.	7	8	9				
MP	287.77 ---------->						
Location	10' Rt ℄ Rt Ln ℄ NB	13' Rt ℄ LL Lt Ln-Lt WP	16' Rt ℄ Rt Ln-B WP				
Performance Area	Surface Ravelling ---------->						
Notes:	----------	Note 3 ----------					
Absorption Recovery							
Pen. (77°F)		54					
Visc: Abs (140°F) p.		3,572					
Kin (270°F) cst.		510					
Ductility, 45°F, cm.		50.0					
Chemical Analysis (Rostler, %)							
Asphaltenes		28.6					
Nitrogens Gp I] (N)		17.1					
Nitrogens Gp II]		3.9					
1st Acidaffins (A_1)		14.3					
2nd Acidaffins (A_2)		25.7					
Paraffins (P)		10.8					
$(N + A_1)/(A_2 + P)$		0.95					

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction
4. Lottman Stripping Test only
5. Volatile Distillate Test only

ASPHALT SAMPLE ANALYSIS

Project: SR 195, Contract 1085
Location: Paradise Rd. to Mullan Hill Rd.

Sample:							
Lab No.	X-599	X-600	X-601	X-602	X-603	X-604	X-605
Field No.	1	2	3	4	5	6	7
MP	86.58 ---------->				88.89 ---------->		
Location	3.0' Lt ℄	9.0' Lt ℄	5.0' Rt ℄	8.0' Rt ℄	3.0' Rt ℄	6.0' Rt ℄	9.0' Rt ℄
Performance Area	Surface Ravelling ---------->						
Notes:	------ Note 3 --------		Note 1	Note 1	------ Note 3 --------		Note 1
Abson Recovery							
Pen. (77°F)	66				52		
Visc: Abs (140°F) p.	3,192				3,783		
Kin (270°F) cst.	498				529		
Ductility, 45°F, cm.	60+				18.5		
Chemical Analysis (Rostler, %)							
Asphaltenes	27.8				28.0		
Nitrogens Gp I] (N)	3.1				4.2		
Nitrogens Gp II]	16.3				16.4		
1st Acidaffins (A_1)	15.7				16.2		
2nd Acidaffins (A_2)	26.1				23.9		
Paraffins (P)	10.6				12.0		
$(N + A_1)/(A_2 + P)$	0.98				0.98		

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 195, Contract 1085
Location: Paradise Rd. to Mullan Hill Rd.

Sample:							
Lab No.	X-606						
Field No.	8	1B	2A	3B	4A		
MP	88.89	88.89	86.57	88.89	86.57		
Location	15.0' Rt ℄	4.5' Rt ℄	10.0' Rt ℄	7.0' Rt ℄	11.5' Rt ℄		
Performance Area	Surface Ravelling ---------->						
Notes:	Note 1						
Absen Recovery							
Pen. (77°F)		56	55	52	60		
Visc: Abs (140°F) p.		3,410	3,429	3,490	3,042		
Kin (270°F) cst.		507	496	501	476		
Ductility, 45°F, cm.							
Chemical Analysis (Rostler, %)							
Asphaltenes							
Nitrogens Gp I] (N)							
Nitrogens Gp II]							
1st Acidaffins (A_1)							
2nd Acidaffins (A_2)							
Paraffins (P)							
$(N + A_1)/(A_2 + P)$							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 97, Contract 0233
Location: Wenatchee to Chelan

Sample:	X-487	& X-488	X-489	& X-490	X-491	& X-492
Lab No.	1	& 2	3	& 4	5	& 6
Field No.	212.8	---------->	---------->	---------->	212.78	---------->
MP	3.4' Lt	---------->	5.9' Lt	---------->	3.6' Lt	---------->
Location	Ravelled	---------->	Adjacent	---------->	Reference	---------->
Performance Area	------ Note 3 --------		------ Note 3 --------		------ Note 3 --------	
Notes:						
Abson Recovery						
Pen. (77°F)	63		45		53	
Visc: Abs (140°F) p.	2,483		4,458		3,274	
Kin (270°F) cst.	339		426		384	
Ductility, 45°F, cm.	60+		54.5		60+	
Chemical Analysis (Rostler, %)						
Asphaltenes					29.8	
Nitrogens Gp I] (N)					4.7	
Nitrogens Gp II]					18.7	
1st Acidaffins (A_1)					7.6	
2nd Acidaffins (A_2)					23.0	
Paraffins (P)					13.9	
$(N + A_1)/(A_2 + P)$					0.97	

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 97, Contract 0233
Location: Wenatchee to Chelan

Sample:	X-493	& X-494	X-495	& X-496	X-497	X-498	& X-500
Lab No.	7	8	9	10	11	12	14
Field No.	212.78	→	211.5	→	→	→	→
MP	5.7' Lt	→	6.0' Rt	→	→	8.0' Rt	→
Location							
Performance Area	Reference	→	Ravelled	→	→	Adjacent	→
Notes:	Note 3		Note 3		Note 2	Note 3	
Abson Recovery							
Pen. (77°F)	40		48			33	
Visc: Abs (140°F) p.	5,181		3,713			7,039	
Kin (270°F) cst.	448		399			503	
Ductility, 45°F, cm.	17.5		60+			13.0	
Chemical Analysis (Rostler, %)							
Asphaltenes	31.6		28.4			32.8	
Nitrogens Gp I] (N)	8.0		8.9			5.7	
Nitrogens Gp II]	18.8		20.8			20.5	
1st Acidaffins (A_1)	7.7		7.6			7.2	
2nd Acidaffins (A_2)	19.1		7.0			13.3	
Paraffins (P)	14.9		27.4			19.5	
$(N + A_1)/(A_2 + P)$	1.01		1.08			1.08	

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 97, Contract 0233
Location: Wenatchee to Chelan

Sample:							
Lab No.	X-499	X-501	X-502	& X-503	X-504	& X-506	X-505
Field No.	13	15	16	& 17	18	& 20	19
MP	211.5	----------	----------	----------	----------	----------	---------->
Location	8.0' Rt	9.0' Rt	---------->		5.0' Lt	----------	---------->
Performance Area	Adjacent	Ravelled	---------->		Adjacent	----------	---------->
Notes:	Note 2	Note 1	------ Note 3 --------		------ Note 3 --------		Note 1
Abson Recovery							
Pen. (77°F)			38		42		
Visc: Abs (140°F) p.			5,214		4,896		
Kin (270°F) cst.			450		434		
Ductility, 45°F, cm.			17.25		17.75		
Chemical Analysis (Rostler, %)							
Asphaltenes							
Nitrogens Gp I] (N)							
Nitrogens Gp II]							
1st Acidaffins (A_1)							
2nd Acidaffins (A_2)							
Paraffins (P)							
$(N + A_1)/(A_2 + P)$							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-432	X-433	X-434	X-435	X-436	X-437	X-438
Lab No.	1	2	3	& 3A	4	& 5	6
Field No.	321.35	---	----------	----------	----------	----------	---------->
MP	4.0' Rt	---	----------	---------->	8.0' Rt	----------	---------->
Location	Ravelled	---	----------	---------->	Adjacent	----------	---------->
Performance Area	Note 2	Note 1	------ Note 3 --------		------ Note 3 --------		Note 1
Notes:							
Abson Recovery							
Pen. (77°F)			28		25		
Visc: Abs (140°F) p.			6,323		7,030		
Kin (270°F) cst.			463		479		
Ductility, 45°F, cm.			6.5		6.0		
Chemical Analysis (Rostler, %)							
Asphaltenes			24.2		26.4		
Nitrogens Gp I] (N)			7.9		8.7		
Nitrogens Gp II]			23.9		13.9		
1st Acidaffins (A_1)			7.1		18.9		
2nd Acidaffins (A_2)			24.3		19.4		
Paraffins (P)			12.0		13.3		
$(N + A_1)/(A_2 + P)$			1.10		1.24		

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-439	X-440	X-441 &	X-442	X-443	X-444 &
Lab No.	6A	7	8	9	11	12
Field No.	321.35	322.85	---	---	---	--->
MP	8.0' Rt	2.7' Lt	---	--->	6.0' Lt	--->
Location	Adjacent	Ravelled	---	--->	Adjacent	--->
Performance Area	Note 2	------ Note	3 -------	Note 1	------ Note	3 -------
Notes:						
Abson Recovery						
Pen. (77°F)		19			18	
Visc: Abs (140°F) p.		11,230			13,438	
Kin (270°F) cst.		583			638	
Ductility, 45°F, cm.		0.25			0.50	
Chemical Analysis (Rostler, %)						
Asphaltenes						
Nitrogens Gp I] (N)						
Nitrogens Gp II]						
1st Acidaffins (A_1)						
2nd Acidaffins (A_2)						
Paraffins (P)						
$(N + A_1)/(A_2 + P)$						

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:							
Lab No.	X-445	X-446	X-447	X-448	X-450	X-449	
Field No.	13	& 14	15	16	& 18	17	
MP	322.87	---------->	---------->	---------->	---------->	---------->	
Location	2.7' Lt	---------->	---------->	6.0' Lt	---------->	---------->	
Performance Area	Reference	---------->	---------->	---------->	---------->	---------->	
Notes:	------ Note 3 --------		Note 2	------ Note 3 --------		Note 1	
Absorption Recovery							
Pen. (77°F)	36			32			
Visc: Abs (140°F) p.	4,167			5,017			
Kin (270°F) cst.	402			420			
Ductility, 45°F, cm.	20.0			12.0			
Chemical Analysis (Rostler, %)							
Asphaltenes				25.6			
Nitrogens Gp I] (N)				6.6			
Nitrogens Gp II]				24.6			
1st Acidaffins (A_1)				6.3			
2nd Acidaffins (A_2)				22.5			
Paraffins (P)				14.4			
$(N + A_1)/(A_2 + P)$				1.02			

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-451	X-453 &	X-452	X-454	X-455 &	X-456
Lab No.	19	21	20	22	23	24
Field No.	318.85	→	→	→	→	→
MP	3.0' Lt	→	→	8.0' Lt	→	→
Location	Reference	→	→	→	→	→
Performance Area	Note 3		Note 1	Note 3		Note 1
Absorption Recovery						
Pen. (77°F)	30			33		
Visc: Abs (140°F) p.	5,243			4,978		
Kin (270°F) cst.	427			422		
Ductility, 45°F, cm.	9.0			9.75		
Chemical Analysis (Rostler, %)						
Asphaltenes	23.0			22.9		
Nitrogens Gp I] (N)	6.8			7.8		
Nitrogens Gp II]	25.5			24.2		
1st Acidaffins (A_1)	6.5			7.4		
2nd Acidaffins (A_2)	23.7			23.5		
Paraffins (P)	14.3			14.2		
$(N + A_1)/(A_2 + P)$	1.03			1.05		

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:							
Lab No.	X-457	X-459	X-458	X-460	X-461	X-462	X-463
Field No.	25	& 27	26	28	& 29	30	31
MP	318.85	---------->	---------->	---------->	---------->	---------->	314.55 EBTL
Location	3.0' Rt	---------->	---------->	8.0' Rt	---------->	---------->	8.5' Rt
Performance Area	Reference	---------->	---------->	---------->	---------->	---------->	Ravelled
Notes:	------ Note 3 --------		Note 2	------ Note 3 --------		Note 1	Note 2
Absorption Recovery							
Pen. (77°F)	50			30			
Visc: Abs (140°F) p.	2,808			5,403			
Kin (270°F) cst.	339			428			
Ductility, 45°F, cm.	60+			10.5			
Chemical Analysis (Rostler, %)							
Asphaltenes	23.6						
Nitrogens Gp I] (N)	7.7						
Nitrogens Gp II]	22.6						
1st Acidaffins (A_1)	9.2						
2nd Acidaffins (A_2)	24.0						
Paraffins (P)	12.4						
$(N + A_1)/(A_2 + P)$	1.11						

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-464	X-465	X-466	X-467	X-468	X-469	X-470
Lab No.	32	& 33	34	& 35	36	37	& 38
Field No.	314.55 EBTL	---------->	---------->	---------->	---------->	314.60 EBTL	---------->
MP Location	8.5' Rt	---------->	5.5' Rt	---------->	---------->	1.5' Rt	---------->
Performance Area	Ravelled	---------->	Adjacent	---------->	---------->	Ravelled	---------->
Notes:	------ Note 3	--------	------ Note 3	--------	Note 2	------ Note 3	--------
Absorption Recovery							
Pen. (77°F)	30		62			29	
Visc: Abs (140°F) p.	5,272		2,075			5,936	
Kin (270°F) cst.	440		303			451	
Ductility, 45°F, cm.	8.50		60+			9.0	
Chemical Analysis (Rostler, %)							
Asphaltenes	24.0		24.6				
Nitrogens Gp I] (N)	6.4		10.5				
Nitrogens Gp II]	24.8		21.0				
1st Acidaffins (A_1)	8.7		10.4				
2nd Acidaffins (A_2)	20.7		21.1				
Paraffins (P)	16.3		13.1				
$(N + A_1)/(A_2 + P)$	1.04		1.19				

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-471	X-472	X-474	X-473	X-475	X-477	X-476
Lab No.	39	40	& 42	41	43	& 45	44
Field No.							
MP	314.60 EBTL	---------->			314.64 EBTL		
Location	1.5' Rt	6.0' Rt					
Performance Area	Ravelled	Adjacent		Reference			
Notes:	Note 1	Note 3		Note 1	Note 3		Note 1
Abson Recovery							
Pen. (77°F)		35			37		
Visc: Abs (140°F) p.		4,353			3,800		
Kin (270°F) cst.		394			382		
Ductility, 45°F, cm.		14.25			24.0		
Chemical Analysis (Rostler, %)							
Asphaltenes					23.6		
Nitrogens Gp I] (N)					6.2		
Nitrogens Gp II]					24.8		
1st Acidaffins (A_1)					7.1		
2nd Acidaffins (A_2)					24.6		
Paraffins (P)					13.5		
$(N + A_1)/(A_2 + P)$					1.01		

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:	X-478	X-479 &	X-480	X-481	X-482	X-483 &
Lab No.	46	47	48	49	50	51
Field No.	314.64 EBTL	---------->		314.80 EBTL	---------->	
MP	8.5' Rt	---------->		2.5' Rt	---------->	
Location						
Performance Area	Reference	---------->		Ravelled	---------->	
Notes:	------ Note 3 --------		Note 2		------ Note 3 --------	
Abson Recovery						
Pen. (77°F)	42				31	
Visc: Abs (140°F) p.	3,220				5,160	
Kin (270°F) cst.	354				427	
Ductility, 45°F, cm.	35.5				10.0	
Chemical Analysis (Rostler, %)						
Asphaltenes						
Nitrogens Gp I] (N)						
Nitrogens Gp II]						
1st Acidaffins (A_1)						
2nd Acidaffins (A_2)						
Paraffins (P)						
$(N + A_1)/(A_2 + P)$						

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 12, Contract 0262
Location: Vansycle Canyon to Lowden

Sample:							
Lab No.	X-484	X-485	X-486	X-632	X-636	None	
Field No.	52	& 53	54	Box 2 W.C.	Box 6 W.C.	Sack Sample	
MP	314.80 EBTL	---------->	---------->	314.55	314.8	322.85	
Location	6.5 ' Rt	---------->	---------->	8.3-9.0' Rt	1.6-2.2' Rt	2.7' Lt	
Performance Area	Adjacent	---------->	---------->	Ravelled	---------->	---------->	
Notes:	------ Note 3 --------		Note 1				
Absorption Recovery							
Pen. (77°F)	41			30	34	27	
Visc: Abs (140°F) p.	3,523			5,340	4,635	6,260	
Kin (270°F) cst.	376			446	409	465	
Ductility, 45°F, cm.	45.5			9.0	11.25	7.75	
Chemical Analysis (Rostler, %)							
Asphaltenes							
Nitrogens Gp I] (N)							
Nitrogens Gp II]							
1st Acidaffins (A_1)							
2nd Acidaffins (A_2)							
Paraffins (P)							
$(N + A_1)/(A_2 + P)$							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:	X-555	X-556	X-558	X-560	X-562	X-563
Lab No.	1	& 2	4	& 6	8	& 9
Field No.						
MP	38.0	→	→	→	41.0	→
Location	9.0' Rt	→	6.0' Rt	→	→	→
Performance Area	Reference	→	→	→	→	→
Notes:	Note 3	→	Note 3	→	Note 3	→
Absorption Recovery						
Pen. (77°F)	36		35		39	
Visc: Abs (140°F) p.	9,943		10,379		9,186	
Kin (270°F) cst.	758		742		709	
Ductility, 45°F, cm.	10.25		9.5		13.25	
Chemical Analysis (Rostler, %)						
Asphaltenes	28.4		31.0		30.6	
Nitrogens Gp I] (N)	2.2		1.7		1.1	
Nitrogens Gp II]	17.9		15.0		14.1	
1st Acidaffins (A_1)	12.0		11.3		14.0	
2nd Acidaffins (A_2)	28.0		27.3		24.8	
Paraffins (P)	12.9		12.9		15.2	
$(N + A_1)/(A_2 + P)$	0.72		0.74		0.74	

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:							
Lab No.	X-564	& X-565	X-557	X-561	X-559	X-566	
Field No.	10	11	3	7	5	12	
MP	41.0	---------->	38.0	41.0	38.0	41.0	
Location	6.0' Rt	---------->	9.0' Rt	6.0' Rt	---------->	9.0' Rt	
Performance Area	Reference	----------	----------	----------	----------	----------	----->
Notes:	------ Note 3 --------		Note 1	Note 2	Note 1	Note 1	
Absorption Recovery							
Pen. (77°F)	33						
Visc: Abs (140°F) p.	10,289						
Kin (270°F) cst.	773						
Ductility, 45°F, cm.	9.0						
Chemical Analysis (Rostler, %)							
Asphaltenes							
Nitrogens Gp I] (N)							
Nitrogens Gp II]							
1st Acidaffins (A_1)							
2nd Acidaffins (A_2)							
Paraffins (P)							
$(N + A_1)/(A_2 + P)$							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:	X-567	X-569	X-568	X-570	X-571	X-572	X-573
Lab No.	13	& 15	14	16	& 17	17A	18
Field No.	51.7 EB	---------->					
MP	5.0' Rt	---------->		8.5' Rt	---------->		
Location	Adjacent	---------->		Ravelled	---------->		
Performance Area	------ Note 3 --------		Note 2	------ Note 3 ---------		Note 2	Note 1
Notes:							
Abson Recovery							
Pen. (77°F)	39			43			
Visc: Abs (140°F) p.	8,056			5,982			
Kin (270°F) cst.	688			613			
Ductility, 45°F, cm.	13.5			29.25			
Chemical Analysis (Rostler, %)							
Asphaltenes	30.4			28.8			
Nitrogens Gp I] (N)	2.1			0.9			
Nitrogens Gp II]	17.7			15.8			
1st Acidaffins (A_1)	11.0			14.2			
2nd Acidaffins (A_2)	25.1			17.8			
Paraffins (P)	15.7			22.0			
$(N + A_1)/(A_2 + P)$	0.69			0.80			

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:	X-574	X-575	X-576	X-577	X-578	X-579	X-580
Lab No.	19	& 20	21	22	23	24	& 24A
Field No.	51 WB						
MP							
Location	5' Lt			8.5' Lt			
Performance Area	Adjacent			Ravelled			
Notes:	Note 3		Note 1	Note 1	Note 1	Note 3	
Abson Recovery							
Pen. (77°F)	58					9	
Visc: Abs (140°F) p.	4,049					151,197	
Kin (270°F) cst.	521					2,677	
Ductility, 45°F, cm.	60+					-	
Chemical Analysis (Rostler, %)							
Asphaltenes							
Nitrogens Gp I] (N)							
Nitrogens Gp II]							
1st Acidaffins (A_1)							
2nd Acidaffins (A_2)							
Paraffins (P)							
$(N + A_1)/(A_2 + P)$							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:	X-581	X-582	X-583	X-584	X-585	X-586
Lab No.	24B	24 A-B	25	& 26	27	28
Field No.	51 WB	→	49.0 WB	→	→	→
MP	8.5' Lt	→	→	→	→	5.0' Lt
Location						
Performance Area	Ravelled	→	Reference	→	→	→
Notes:			------ Note 3 --------		Note 1	Note 1
Absorption Recovery						
Pen. (77°F)	50	62	40			
Visc: Abs (140°F) p.	5,008	3,680	6,901			
Kin (270°F) cst.	546	490	639			
Ductility, 45°F, cm.	44.5	60+	9.5			
Chemical Analysis (Rostler, %)						
Asphaltenes			28.6			
Nitrogens Gp I] (N)			1.5			
Nitrogens Gp II]			15.6			
1st Acidaffins (A_1)			13.4			
2nd Acidaffins (A_2)			28.1			
Paraffins (P)			12.9			
$(N + A_1)/(A_2 + P)$			0.74			

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 28, Contract 0438
Location: Winchester to Jct. SR 17

Sample:							
Lab No.	X-587	X-588	X-649				
Field No.	29	& 30	Box 3				
MP	49.0 WB	---------->	51.7 NB				
Location	5.0' Lt	---------->	8.6-9.3' Rt				
Performance Area	Reference	---------->	Ravelled				
Notes:	------ Note 3 --------						
Absorption Recovery							
Pen. (77°F)	40		37				
Visc: Abs (140°F) p.	7,450		8,392				
Kin (270°F) cst.	684		690				
Ductility, 45°F, cm.	15.0		11.5				
Chemical Analysis (Rostler, %)							
Asphaltenes							
Nitrogens Gp I] (N)							
Nitrogens Gp II]							
1st Acidaffins (A_1)							
2nd Acidaffins (A_2)							
Paraffins (P)							
$(N + A_1)/(A_2 + P)$							

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 2, Contract 0700
Location: Icicle Ditch Spillway Br. & Peshastin Creek Br. to Monitor Vic.

Sample:							
Lab No.	X-527	X-528	X-530	X-531	&	X-533	X-532
Field No.	1	2	3A	4		6	5
MP	113 WB ---------->						
Location	4.5' Lt ---------->			8.0' Lt ---------->			
Performance Area	Ravelled ---------->			Adjacent ---------->			
Notes:	Note 2	Note 1	Note 1	------ Note 3 --------			Note 2
Absorption Recovery							
Pen. (77°F)				49			
Visc: Abs (140°F) p.				3,795			
Kin (270°F) cst.				390			
Ductility, 45°F, cm.				60+			
Chemical Analysis (Rostler, %)							
Asphaltenes				28.4			
Nitrogens Gp I] (N)				7.7			
Nitrogens Gp II]				20.3			
1st Acidaffins (A_1)				8.2			
2nd Acidaffins (A_2)				20.0			
Paraffins (P)				15.1			
$(N + A_1)/(A_2 + P)$				1.05			

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 2, Contract 0700
Location: Icicle Ditch Spillway Br. & Peshastin Creek Br. to Monitor Vic.

Sample:	X-534	X-535	X-536	X-529	X-537	X-538	X-539
Lab No.	9	& 10	11	3	12	& 13	14
Field No.	110.8 WB	---------->		113 WB	110.8 WB	---------->	
MP	8.0' Lt	---------->		4.5' Lt	5.0' Lt	---------->	
Location	Adjacent	---------->		Ravelled	---------->		
Performance Area	----- Note 3 --------		Note 1		------ Note 3 --------		Note 1
Notes:				Core Lost			
Abson Recovery							
Pen. (77°F)	41				47		
Visc: Abs (140°F) p.	4,649				3,933		
Kin (270°F) cst.	425				396		
Ductility, 45°F, cm.	37.75				60+		
Chemical Analysis (Rostler, %)							
Asphaltenes					28.8		
Nitrogens Gp I] (N)					6.2		
Nitrogens Gp II]					23.9		
1st Acidaffins (A_1)					10.4		
2nd Acidaffins (A_2)					20.0		
Paraffins (P)					13.3		
$(N + A_1)/(A_2 + P)$					1.08		

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 2, Contract 0700
Location: Icicle Ditch Spillway Br. & Peshastin Creek Br. to Monitor Vic.

Sample:	X-540	X-541	X-542	X-543	X-544	X-545	X-546
Lab No.	15	15A	& 16	17	& 18	19	20
Field No.							
MP	110.8 WB	---------->		---------->		108.2 EB	---------->
Location	5.5' Lt	---------->		8.0' Lt	---------->	10.0' Lt	10.0' Rt
Performance Area	Reference	---------->		---------->		Ravelled	---------->
Notes:	Note 2	------ Note 3	--------	------ Note 3	--------	Note 1	Note 1
Absorption Recovery							
Pen. (77°F)		50		42			
Visc: Abs (140°F) p.		3,433		4,421			
Kin (270°F) cst.		383		428			
Ductility, 45°F, cm.		60+		31.25			
Chemical Analysis (Rostler, %)							
Asphaltenes		27.9					
Nitrogens Gp I] (N)		0.7					
Nitrogens Gp II]		26.6					
1st Acidaffins (A_1)		8.8					
2nd Acidaffins (A_2)		18.0					
Paraffins (P)		18.2					
$(N + A_1)/(A_2 + P)$		0.95					

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 2, Contract 0700
Location: Icicle Ditch Spillway Br. & Peshastin Creek Br. to Monitor Vic.

Sample:							
Lab No.	X-547	X-548	& X-549	X-550	X-551	& X-552	
Field No.	21	22	& 23	24	25	& 26	
MP	108.2 EB	---------->			108.3 EB	---------->	
Location	10.0' Rt	6.0' Rt	---------->		10.0' Rt	---------->	
Performance Area	Ravelled	Adjacent	---------->		Reference	---------->	
Notes:	Note 1	------ Note 3 --------		Note 1	------ Note 3 --------		
Absorption Recovery							
Pen. (77°F)		35			44		
Visc: Abs (140°F) p.		5,581			3,949		
Kin (270°F) cst.		463			396		
Ductility, 45°F, cm.		18.75			60+		
Chemical Analysis (Rostler, %)							
Asphaltenes							
Nitrogens Gp I] (N)							
Nitrogens Gp II]							
1st Acidaffins (A_1)							
2nd Acidaffins (A_2)							
Paraffins (P)							
$(N + A_1)/(A_2 + P)$							

Notes:
1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction

ASPHALT SAMPLE ANALYSIS

Project: SR 2, Contract 0700
Location: Icicle Ditch Spillway Br. & Peshastin Creek Br. to Monitor Vic.

Sample:							
Lab No.	X-553	X-554	X-644	X-640			
Field No.	27	& 28	Box 6	Box 2, 2 Pieces			
MP	108.3 EB	---------->	108.25 EB	113.0 WB			
Location	6.0' Rt	---------->	9.0	3.8-4.4' Lt			
Performance Area	Reference	----------	----------	---------->			
Notes:	------ Note 3 --------						
Abson Recovery							
Pen. (77°F)	46		45	37			
Visc: Abs (140°F) p.	4,728		3,997	5,529			
Kin (270°F) cst.	424		399	472			
Ductility, 45°F, cm.	40.0		20.75	9.5			
Chemical Analysis (Rostler, %)							
Asphaltenes	30.7			29.2			
Nitrogens Gp I] (N)	3.6			7.4			
Nitrogens Gp II]	18.9			22.2			
1st Acidaffins (A_1)	8.9			10.2			
2nd Acidaffins (A_2)	23.0			21.2			
Paraffins (P)	12.8			10.6			
$(N + A_1)/(A_2 + P)$	0.99			1.20			

Notes: 1. Sample reserved (not tested)
2. Sample sent to WSU
3. Samples combined for extraction