1993 TOUR OF MODIFIED BINDER PAVEMENTS

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16. ABSTRACT

A pavement tour of modified asphalt binder pavements was conducted in April and May of 1993 by various personnel from the Construction and Materials sections of the Washington State Department of Transportation and the Asphalt Paving Association of Washington. The tour participants' comments for each section of pavement are summarized and a brief discussion of the relative performance of the sections is presented.

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1993 TOUR OF
MODIFIED BINDER PAVEMENTS

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INTRODUCTION

The 1993 tour of modified binder pavements was conducted on September 30, October 4, 5, 7, and 27. Participants in the tour were Rod Finkle, Bob Gietz, Newton Jackson, Ron Schultz, Keith Kay, Jim Walter, and Linda Pierce of the Materials Laboratory, Tom Nelson from the Construction Office, and Keith Anderson from the Research Office. Wes Bogart of the Asphalt Paving Association of Washington accompanied the group to visit the District 1 projects on September 30. Coleman Wyckoff represented the APAW on the October 7th leg of the trip to Districts 3 and 4. Bob Gietz conducted the tour of the eastern Washington projects on October 4 and 5 and Keith Anderson surveyed the northern most projects in District 1 on October 27.

The purpose of the tour was to evaluate the performance of pavements that were constructed with asphalt mixes which had been modified with additives to enhance performance. The short and long term benefits of each of these additives is of interest to the Department which must make decisions on the cost benefits associated with their use. Each of the participants on this tour are involved either directly in making these decisions or indirectly in providing the necessary performance data that supports these decisions.

ASPHALT AND ADDITIVE DESCRIPTIONS

A brief description of each of the additives and their intended function are included below:

AC-5P

A lower viscosity asphalt cement with a polymer additive. The polymer additive could be a number of different synthetic rubber compounds. AC-5P was developed by the asphalt producers as a substitute for chips seals on the west side of the mountains. The polymer additive adds additional flexibility to the mix to resist fatigue cracking.

AC-5P2

AC-5P2 is a second generation AC-5P and is inclusive in a series of polymer modified asphalts titled AC-5P1, AC-5P2, and AC-5P3. They were developed by the asphalt producers in response to our need for a more flexible asphalt cement to use in thin Class G overlays.

AC-20R

This is an asphalt cement modified with a synthetic rubber polymer used for Class B or Class D mixes. The asphalt cement is a heavier grade and the polymer is generally a styrene-butadiene. The additive is designed to give greater fatigue resistance to the mix and to increase the aggregate-asphalt bond to prevent ravelling, especially in the open-graded Class D pavements.

Asphalt-Rubber (International Surfacings Inc. Process)

Asphalt-Rubber is a standard asphalt cement such as AR4000W or AR2000W with a crumb rubber additive. The crumb rubber is derived from the recycling of rubber tires. The

crumb rubber is added to the asphalt cement and heated and mixed until the rubber particles are reacted with the asphalt. This reaction results in the absorption of some of the lighter fractions of the asphalt cement into the rubber and also the melting of some of the rubber into the asphalt cement. The additive is designed to give a more flexible pavement that is resistance to fatigue cracking and ravelling similar to the AC-20R.

PBA-6

PBA-6 is an asphalt cement included in a suite of cements which have been chosen or designed to give good performance in specific climatic regimes. These performance based asphalt cements have properties which allow them to survive in climates with certain ranges in high and low temperatures. PBA-6 is an asphalt cement which should perform well in a hot summer/cold winter climate.

The reason PBA-6 was chosen for the projects inspected on this tour was not entirely because it is a performance based asphalt cement. PBA-6 is a highly polymer modified asphalt cement. In the past we have specified polymer asphalt cements to increase the fatigue life of a pavement and to increase its resistance to rutting and ravelling. A number of polymer modified asphalt cements have been included in contracts with the contractor making the choice of which cement to use. Going to the PBA-6 specification will eliminate having to make a choice from the list and simplify the process for both the contractor and the state.

PBA-6GR (US Oil Process)

PBA-6GR is a performance based modified asphalt similar to PBA-6. The designation GR indicates that the cement contains ground rubber derived form the recycling of tires. PBA-6GR meets all of the specification for PBA-6 except for ductility. Very finely ground rubber is blended into the mixture of

asphalt cement at the suppliers plant and delivered as a final product to the contractor. It requires no special handling by the contractor. U.S. Oil of Tacoma, Washington was the first producer of PBA-6GR in the state. They developed the product as a result of the ISTEA legislation requiring states to use recycled tire rubber in pavements.

PlusRide

PlusRide is a proprietary product which contains recycled tire rubber added as an aggregate substitute. The rubber particles are added at the pug mill where they are mixed with the aggregate and asphalt cement for each load of mix. The suppliers of PlusRide say that their product will have greater fatigue resistance due to its higher elasticity, a more skid-resistant and durable surface texture, and a longer service life. PlusRide II is identical to the original PlusRide product. The "II" designation was added to reflect the fact that the projects paved by the new patent holder, Envirotire, would have a 5 year performance guarantee.

BoniFibers

BoniFibers are polyester fibers approximately 1/2 inch in length which are added to the asphalt mix at the pug mill. They are claimed to increase the pavements' resistance to the formation of cracks, potholes, and ruts.

Carbon Black

Carbon black, also called lamp black, is an additive used mainly by tire manufacturers. It is added to the asphalt mix at the pug mill similar to BoniFibers and the PlusRide rubber particles. The carbon black is added to reinforce the binder and reduce its temperature susceptibility. The reduced temperature susceptibility should result in less cracking at lower ambient temperatures and greater flushing and rutting resistance at higher ambient temperatures.

PROJECT EVALUATIONS

A recording secretary, Keith Anderson, captured comments from the various tour participants. The comments are recorded below for each of the pavement sections.

SR 92 MP 3.37 to 5.97, Near Granite Falls

Contract 3596 - District 1 Chip Seal
Roadway Section: 0.06 Class G
Asphalt Type: AC-5P2
Year Paved: 1990

Pavement is in good condition except for some minor amounts of transverse cracking in the westbound lane. There has been essentially no change in the condition of the pavement from the 1991 survey.

SR 92 MP 5.97 to 8.26, Near Granite Falls

Contract 3249 - SR 532, et al. District Wide Seal -North
Roadway Section: 0.06 Class G
Asphalt Type: AC-5P
Additive Type: Dupont Elvax
Dosage: 2.25% by weight
Year Paved: 1989

The westbound lane is in poor condition with alligator cracking and longitudinal cracking evident at the western end of the section. The westbound lane also shows extensive patching and potholing, especially near the outside edge of the overlay which is not underlain by PCC pavement. The eastern portion of the project is showing less distressed. It appears that the loaded trucks hauling out of a gravel pit east of the test section are having a pronounced effect on the performance of the westbound lanes.

This section is showing even more distress than that observed in the 1991 survey. Some confusion exists over the 1991 survey regarding the location of the distress. The 1991 survey indicated most of the distress was located in the eastbound lanes, whereas the 1993 survey indicated the westbound lanes had the most distress. One can only assume that the most recent survey was correct and that the major distress is located in the westbound lanes. The author of the previous report has been severely reprimanded for his error.

SR 520 MP 3.98 to 5.87, East of Evergreen Point Floating Bridge

Contract 2324 - Evergreen Point Bridge to SR 908
Roadway Section: 0.06 Class D
Asphalt Type: Standard
Additive Type: Crumb Rubber (International Surfacings Process)
Year Paved: 1982

The westbound lanes are worn or rutted to a depth of 1/2 inch and in some places the underlying pavement is exposed. Patching is also present in the wheel paths of the outside lane.

The eastbound lanes show substantially more wear than the westbound lanes. The inside lane immediately east of the Evergreen Point Bridge has been overlaid and other areas of patching were also noted. In several areas the overlay is worn through to the underlying pavement. Possible theories to explain the greater wear in the eastbound direction include; (1) trucks hauling flammable materials are restricted from using the I-90 tunnels, (2) more studded tire use by Bellevue drivers.

This location was not inspected in the 1991 tour.

5TH AVENUE Denny Way to Olive Street, City of Seattle

Roadway Section: 0.12 Class D
Asphalt Type: AC-5 and AR4000W
Additive Type: Crumb Rubber (PlusRide II)
Year Paved: 1993

The surface has a variable appearance with some areas very open and segregated and other areas very tight and flushed. Large clumps of loose, almost foam like rubber, were found on the surface of the roadway. It appears that there is quite a variation in the gradation of the mix from one lane to the next.

This section was paved in 1993 and was therefore not surveyed previously.

Coal Creek Parkway - City of Bellevue

Asphalt Type: PlusRide

The eastbound lane is PlusRide and the westbound lane is Class B, both over an old PCC pavement. The PlusRide is ravelling, especially near the transverse reflection cracks over the joints in the PCCP. The Class B is also ravelling at the transverse cracks. The biggest difference between the two sections is the surface ravelling. The PlusRide has the appearance of a chip seal due to the excessive ravelling while the Class B has a very tight appearance.

This location was not inspected in the 1991 tour.

SR 530 MP 30.90 to 31.50, East of Arlington

Contract 3249 - SR 532, et al. District Wide Seal - North
Roadway Section: 0.06 Class G
Asphalt Type: AC-5P
Year Paved: 1989

It was difficult to decide if we were looking at the correct pavement. Some thought it was a BST. We had not the time or inclination to investigate further on this trip. The difficulty in finding this section negates its value to the tour and it will be dropped from further analysis.

The 1991 survey indicated no distress.

Former SR 530 MP 3.37 to 3.80, North of Stanwood

Contract: 2937 - Skagit County Line to Dahlgren Road
Roadway Section: 0.12 Class B
Additive Type: Crumb Rubber (PlusRide)
Dosage: 3% by weight of the total mix
Year Paved: 1985

The pavement is in good condition with no defects noted.

The 1991 survey picked up some longitudinal and transverse reflection cracking from the underlying PCC pavement that this current survey missed. One must assume that the cracking must be localized in nature if one survey picked it up and another missed it.

Former SR 530 MP 3.80 to 4.23, North of Stanwood

Contract: 2937 - Skagit County Line to Dahlgren Road
Roadway Section: 0.12 Class B
Additive Type: Polyester Fibers (BoniFibers)
Dosage: 5 pounds per ton of mix
Year Paved: 1985

Some transverse cracking noted and alligator cracking where the overlay is not underlain by PCC pavement.

The previous survey noted minor longitudinal and transverse reflection cracking. The current survey indicates a progression of the defects to a more sever stage.

Former SR 530 MP 4.23 to 5.10, North of Stanwood

Contract: 2937 - Skagit County Line to Dahlgren Road
Roadway Section: 0.12 Class B (CONTROL SECTION)
Year Paved: 1985

Some ravelling and flushing of a minor nature is present.

The 1991 survey noted longitudinal and transverse reflection cracking not picked up in this survey. The control section is still performing equal too or better than the test section of PlusRide and BoniFibers.

SR 9 MP 68.00 to 74.50, Acme Vicinity

Contract: 3814 - 1990 Thin Overlays
Roadway Section: 0.06 Class D
Asphalt Type: AC-5P
Year Paved: 1990

The southbound lane has numerous full depth patches located on the shoulders, in the wheel paths and between wheel paths. The patching is related to a lack of structure rather than any surface defects in the pavement. The northbound lane is in much better condition except for the section north of Acme which has several large blade patches. These patches appear to be necessitated by settlement of the shoulder fill. Some longitudinal cracking was also noted in the northbound lane north of Acme. There was no ravelling or wear noted in either lane.

A few longitudinal cracks were observed in 1991, otherwise the pavement was in very good condition. The existing condition indicates a rapid deterioration has occurred in the two years since the last survey.

SR 9 MP 94.58 to 97.43, Sumas Vicinity

Contract: 3591 - SR 546 to Johnson Creek Bridge 9/360
Roadway Section: 0.06 Class G
Asphalt Type: AC-5P
Year Paved: 1990

The pavement is in poor condition. The joints and cracks from the underlying PCC pavement have reflected through the overlay throughout the entire section. The pavement not underlain by PCC is badly cracked with both longitudinal and alligator cracking present. The transverse reflection cracks have been joint sealed in many locations throughout the section which gives an indication of the severity of the defect. It appears that the southbound lane is in worse condition than the northbound (loaded versus unloaded trucks?). Ravelling and wear do not seem to be a problem.

The 1991 survey noted the same type of reflective cracking although no progression to alligator cracking was mentioned. The southbound lane was noted as having the more severe distress. The rate of deterioration has been rapid in the two years since the last inspection.

SR 513 MP 8.55 TO 9.29, Seattle

Contract: 2976
Roadway Section: 0.12 Class B
Asphalt Type: AR4000W
Additive Type: Crumb Rubber (PlusRide)
Year Paved: 1986

Pavement is in excellent shape. Some ravelling in the wheelpaths but the shoulder areas look very tight. No other distress noted.

The pavement was not rated in 1991.

SR-5 MP 105.82 TO 109.20, Olympia

Contract: 3636
Roadway Section: 0.06 Class D
Asphalt Type: AC-20P
Year Paved: 1989

Pavement is in excellent condition. The rutting noted from the PMS files is not visible on the roadway.

The pavement was not rated in 1991.

SR-5 MP 108.90 TO 109.20 NB, Olympia

Contract: 3636
Roadway Section: 0.06 Class D
Asphalt Type: AR4000W
Additive Type: Control
Year Paved: 1989

Control section is also in excellent condition.

SR-5 MP 104.45 TO 105.82, Olympia

Contract: 3782
Roadway Section: 0.06 Class D
Asphalt Type: PMA-60
Year Paved 1990

Pavement is in excellent condition.

The pavement was not rated in 1991.

SR-5 MP 101.23 TO 104.45, Olympia

Contract: 3939
Roadway Section: 0.06 Class D
Asphalt Type: AC-20P
Year Paved 1991

Pavement is in excellent condition.

The pavement was not rated in 1991.

I-5 MP 85.51 to 87.15, North of Centralia

Contract 4036 - Lewis County Line to SR 12
Roadway Section: 0.15 Class D Modified
Asphalt Type: PBA-6
Year Paved: 1992

Pavement is in excellent condition with no defects noted.

This was a project that was paved after the 1991 survey.

I-5 MP 87.15 to 88.03, North of Centralia

Contract 4036 - Lewis County Line to SR 12
Roadway Section: 0.15 Class D Modified
Asphalt Type: PBA-6GR
Additive Type: Crumb Rubber (U.S. Oil Process)
Year Paved: 1992

The only defect noted were fat spots in the wheel paths. The overall appearance of the pavement is richer that the PBA-6. An additional 0.05% asphalt was added to the PBA-6 mix design by the HQ Asphalt Lab to make the PBA-6GR mix design. It appears that the additional asphalt was not needed and has resulted in localized flushing in the wheel paths.

This was a project that was paved after the 1991 survey.

SR 101 MP 87.40 to 88.94, Hoquiam

Contract 3913 - 22nd St. to Little Hoquiam River Br. & Riverside Bridge 101/125E
Roadway Section: 0.06 Class D
Asphalt Type: AR2000W
Additive Type: Crumb Rubber (International Surfacings Process)
Year Paved: 1991

Pavement is in excellent condition with no rutting, cracking or ravelling noted.

This was a project that was paved after the 1991 survey.

SR 433 MP 0.92 to 1.31, Longview Vicinity

Contract: 3317 - Longview Vicinity Paving
Roadway Section: 0.08 Class G
Asphalt Type: AC-20R
Year Paved: 1988

Rutting is beginning to be evident but the pavement overall is holding up quite well to the severe logging truck traffic. Some shoving was noted at intersections. The use of the AC-20R appears to have been justified in this installation.

The 1991 survey indicated that the pavement was holding up well to the heavy truck traffic with no rutting apparent.

SR 432 MP 2.55 to 4.44, Longview Vicinity

Contract: 3317 - Longview Vicinity Paving
Roadway Section: 0.12 Class B
Asphalt Type: AC-20R
Year Paved: 1988

Minor rutting is beginning to be evident. The westbound outside lane appears to have the most sever rutting. The pavement has a very rich appearance although it is not really flushed. Some localized patching of potholes was noted in the striped gore near the bridge and at the bridge pavement seat in the eastbound direction. These were also noted in 1991.

The rutting and flushed appearance of the pavement is the major changes noted from the previous survey. Heavily loaded truck traffic is the apparent cause of both the rutting and the flushed appearance.

SR 5 MP 0.28 to 2.42, Vancouver Vicinity

Contract: 3044 - Columbia River to 39th Street
Roadway Section: 0.06 Class D
Asphalt Type: Standard and AC-20R
Additive Type: Crumb rubber and styrene-butadiene polymer
Dosage: 1.4% by weight of rubber and 1.2 to 2.0% by weight of polymer
Year Paved: 1986

Wear and ravelling were noted randomly throughout the project with no one pavement type escaping. The polymer section is looking richer that the rubber-asphalt sections and is not showing as much ravelling. Wear/ravelling was noted especially in the vicinity of bridge overpasses.

All of the sections on this contract were in excellent condition in 1991 with no distress noted.

SR 82 MP 33.85 to 36.32, Yakima

Contract Number: 4102
Roadway Section: 0.08 Class D
Asphalt Type: PBA-6
Year Paved: 1992

This section has not been visually rated, however the PMS files indicate zero defects.

SR 90 MP 121.96 to 124.11, East of Ellensburg

Contract Number: 4249
Roadway Section: 0.08 Class D Modified
Asphalt Type: PBA-6GR
Additive Type: Crumb Rubber (US Oil Process)
Year Paved: 1993

This section has not been visually rated and no PMS data is available.

SR 90 MP 124.11 to 126.40, East of Ellensburg

Contract Number: 4249
Roadway Section: 0.08 Class D Modified
Asphalt Type: PBA-6
Year Paved: 1993

This section has not been visually rated and no PMS data is available.

SR 195 MP 22.39 to 29.14, North of Pullman

Contract: 3805 - Armstrong Road to Albion Road
Roadway Section: 0.08 ft. Class D
Asphalt Type: AR2000W
Additive Type: Crumb rubber (International Surfacings Process)
Dosage: 16 to 20% by weight of the total binder
Year Paved: 1990

The longitudinal and transverse cracks noted appearing to be reflected from the thermal cracks in the underlying ACP. No rutting or flushing were observed. The surface is dense and uniform in texture and color. The section has a characteristic darker appearance than the adjoining sections of ACP. This apparently relates to the ability of the section to remain frost free during the winter months.

Transverse reflection cracking was the only defect noted in 1991.

SR 290 MP 11.69 to 18.38, East of Flora Road

Contract: 3003 - Flora Road to Idaho State Line
Roadway Section: 0.15 Class B
Asphalt Type: AR4000W
Additive Type: Carbon Black
Dosage: 25 lb. per ton of mix
Year Paved: 1985
Carbon Black Section: 11.69 to 12.54 EB
Control Section: 11.69 to 12.54 WB

The carbon black section is showing less cracking and flushing then the control section. The control section had a relatively frequent single longitudinal crack in the right lane. The control section had at least twice as many transverse cracks as the carbon black section and several of the transverse cracks stopped at the centerline between the eastbound and westbound lanes. Bob estimated that the carbon black section will have at least an extended life of 1 year over the control section. It was also noted that this route serves substantial truck traffic from Idaho that bypasses the stateline scales on I-90.

The 1991 survey noted the same difference in performance with the carbon black section having less distress than the control section.

DISCUSSION

It is difficult to compare the performance of one section with another section because of the different ages of the pavements. In order to facilitate such a comparison the sections have been sorted by condition and age and are shown in the table on page 17.

The projects with an overall rating of Poor present interesting comparisons in performance. It is obvious that the two project on SR-9 near Acme and Sumas are not performing very well considering that they are only 3 years old. The section near Granite Falls on SR-92 is also not performing very well for its age, but the heavy truck traffic that this section is experiencing provides some insight to the poor performance. On the other hand, the project on SR-520 is performing exceptionally well for a pavement that is in a high traffic area and 11 years old. We have been tracking this section as an experimental feature since its construction, and it has only been in the last two years that we have seen a down turn in performance.

The second group of two projects are those rated fair or fair to poor. We don't know the exact age of the PlusRide section, but assume it is somewhere in the 1980 to 1983 range. The performance is adequate, but as noted in the comments, the control section of conventional asphalt mix is showing less ravelling. The SR-290 section which is serving as a control for the carbon black section appears to be performing on a par conventional asphalt pavements of a similar age.

There are 11 section rated in the Good category. Three of these sections were built in 1985 and three in 1986. All of these are showing very good performance for their age. The carbon black section on SR-290 is doing much better than its counterpart control section which is rated in the Poor category. The BoniFibers and PlusRide sections on SR-530 near

Stanwood are also performing quite well although this highway has a very low ADT. The sections on I-5 in Vancouver are all performing quite adequately for their age at this point, although distress in the form of ravelling is beginning to be more prevalent. The sections on SR 432 and 433 are also somewhat outstanding considering their age and the amount of truck traffic that impacts them. Two sections which were not rated very highly, considering their relative youth, were the Centralia section of PBA-6GR which is only 1 year old and the PlusRide section on 5th Avenue which was just finished in 1993. In defense of the PBA-6GR, the flushing and rich spots which were the factors, which caused the rating of the section to be downgraded from Very Good to Good, may or may not prove to be detrimental in the long term.

In the Very Good category, the performance of the control section for the BoniFibers and PlusRide sections near Stanwood would be outstanding if it were not tempered by the low traffic volumes on this route. The PlusRide section on SR 513 was also rated high, but again the low traffic volumes on this particular section are felt to be a real factor in the performance being shown. Probably the outstanding performers of the Very Good category are the sections of I-5 thru Olympia. The traffic volumes may not rival Seattle or Vancouver or even Tacoma, but they are substantial and the oldest of the sections is four years old.

In summary, the outstanding performers are the SR-520 crumb rubber section just east of the Evergreen Point Bridge, the SR-290 carbon black section in Spokane, the crumb rubber and polymer sections of I-5 through Vancouver, and the three sections of polymer modified asphalt in the Olympia vicinity. The biggest disappointments are the two sections of polymer modified pavement on SR-9 near Sumas and Acme, the new section of PlusRide in the downtown Seattle, and the PBA-6GR section near Centralia.

PAVEMENT SECTIONS

D	STATE ROUTE	MILEPOST	LOCATION	CONTRACT NUMBER	ROADWAY SECTION	ASPHALT TYPE	ADDITIVE TYPE	YEAR PAVED	PERFORMANCE
1	9	94.58 to 97.43	Sumas	3591	0.06 G	AC-5P	-	1990	Very Poor
1	520	3.98 to 5.87	Bellevue	2324	0.06 G	-	Inter. Surf. Crumb Rubber	1982	Poor
1	92	5.97 to 8.26	Granite F.	3249	0.06 G	AC-5P	Elvax	1989	Poor
1	9	68.0 to 73.6	Acme	3814	0.06 D	AC-5P	-	1990	Poor
1	COAL CREEK PARKWAY	Vic. of I-405	Bellevue	-	-	-	PlusRide	-	Fair to Poor
6	290	11.69 to 12.54 WB	Spokane	3003	0.15 B	AR4000W	(Control)	1985	Fair
1	530	3.37 to 3.80	Stanwood	2937	0.12 B	AR4000W	PlusRide	1985	Good
1	530	3.80 to 4.23	Stanwood	2937	0.12 B	AR4000W	Bonifibers	1985	Good
6	290	11.69 to 12.54 EB	Spokane	3003	0.15 B	AR4000W	Carbon Black	1985	Good
4	5	0.28 to 2.42	Vancouver	3044	0.06 D	AC-20R	Crumb Rubber	1986	Good
4	5	0.28 to 2.42	Vancouver	3044	0.06 D	AC-20P	Polymer	1986	Good
4	5	0.28 to 2.42	Vancouver	3044	0.06 D	AR4000W	(Control)	1986	Good
4	433	0.92 to 1.31	Longview	3317	0.08 G	AC-20R	-	1988	Good
4	432	7.70 to 9.58	Longview	3317	0.12 B	AC-20R	-	1988	Good
6	195	25.81 to 29.14	Pullman	3805	0.08 D	AR2000W	Inter. Surf. Crumb Rubber	1990	Good
3	5	87.15 to 88.03	Centralia	4036	0.15 D Mod	PBA-6GR	US Oil Crumb Rubber	1992	Good
1	5th Ave.	Denny Way to Olive	Seattle	SA1959	0.12 A	AC-5 & AR4000W	PlusRide 2	1993	Good
1	530	4.23 to 5.10	Stanwood	2937	0.12 B	AR4000W	(Control)	1985	Very Good
1	513	8.55 to 9.29	Seattle	2976	0.12 B	AR4000W	PlusRide	1986	Very Good
3	5	105.82 to 109.20	Olympia	3636	0.06 D	AC-20P	-	1989	Very Good
3	5	108.90 to 109.12	Olympia	3636	0.06 D	AR4000W	(Control)	1989	Very Good

PAVEMENT SECTIONS

D	STATE ROUTE	MILEPOST	LOCATION	CONTRACT NUMBER	ROADWAY SECTION	ASPHALT TYPE	ADDITIVE TYPE	YEAR PAVED	PERFORMANCE
3	5	104.45 to 105.82	Olympia	3782	0.06 D	PMA-60	Polymer	1990	Very Good
1	92	3.37 to 5.97	Granite F.	3596	0.06 G	AC-5P2	-	1990	Very Good
3	5	101.23 to 104.45	Olympia	3939	0.06 D	AC-20P	Polymer	1991	Very Good
3	101	87.40 to 88.94	Hoquiam	3913	0.06 D	AR2000W	Inter. Surf. Crumb Rubber	1991	Very Good
3	5	85.51 to 87.15	Centralia	4036	0.15 D Mod	PBA-6	Chevron	1992	Very Good
5	82	33.85 to 36.32	Yakima	4102	0.08 D	PBA-6	-	1992	Very Good
5	90	121.96 to 124.11	Ellensburg	4249	0.08 D Mod	PBA-6GR	US Oil Crumb Rubber	1993	Very Good
5	90	124.11 to 126.40	Ellensburg	4249	0.08 D Mod	PBA-6	Polymer	1993	Very Good

CONCLUSIONS

The conclusions which can be drawn from the current survey results are not that different then those stated in the report on the 1991 survey. The additional two years of performance history have in most cases just confirmed the previous conclusions.

1. We are able to build satisfactory modified binder pavements with no significant construction problems (since the last survey PBA-6 and PBA-6GR, to be specific).
2. The use of these materials on roadways needing additional structural improvement makes it difficult to measure whether the modifier improved the performance of the pavement. Many of these sections are showing advanced stages of fatigue distress (longitudinal, transverse and alligator cracking). The construction of control sections of unmodified binder pavement on the same roadways (which in many cases was not possible) would have been provided the side-by-side performance comparison needed to drawn more definitive conclusions.
3. We have used modifiers in locations where there was a bonafide need for enhanced performance. We cannot demonstrate that their use was, or was not, cost effective because of the short time that each of the pavements have been in service. It appears, however, that in cases were there was a need for structural improvement to the roadway section, the modified binders have not added substantially to the ability to resist fatigue resulting from the application of heavy loads.