October 9, 1992

EnviroTire, Inc.
1904 Third Avenue, Suite 222
Seattle, Washington, 98101

Attention: Don Russell

Subject: PlusRide Asphalt - Pavement Condition Survey

Dear Mr. Russell,

In accordance with your request, I have completed review of the majority of the existing PlusRide Asphalt projects constructed prior to 1987. The pavement condition survey and subsequent calculation of the pavement condition index (PCI) were made following the APWA procedures of "PAVER". Transmitted is the following information produced in conjunction with the project review:

1) Summary of PlusRide Asphalt project review

2) Pavement Condition Index (PCI) calculation and summary sheets

3) Pavement Condition Evaluation work sheets

Approximately 45 PlusRide pavements constructed between 1979 and 1986 were reviewed. The results of the review show extreme variation of pavement performance, often within the same project. The variation ranges from immediate failure to exceptional performance. As you are aware, I was the PlusRide representative on the project during the construction of most of the pavements included within this review. Therefore I am knowledgeable of the production procedures that were followed and problems that occurred at the time the projects were paved. Review of these pavements leads me to conclude that of those pavements that have failed, or performed poorly, the cause is by far due to improper mix properties as opposed those of design or placement.
I have reached this conclusion because it is apparent to me that the performance can be traced, in nearly every instance of poor performance, to problems with mixture production. Production of PlusRide requires the addition of rubber granules and a high minus 200 content. These requirements were provided by specification. How the Contractor achieved production of specification material was the Contractor’s responsibility. Since most Contractors did not have facilities to accommodate these additional requirements, it was necessary for them to modify and invent ways to try to meet specifications (at the lowest cost), and an element of risk of performance problems was introduced. Various procedures, too numerous to list, were used to introduce the rubber granules and a mineral filler to meet the minus 200 requirement. Most of the Contractors had a positive means of adding the rubber; usually in 60 lb sacks. The minus 200 requirement was the major problem. Most asphalt plants are not equipped with a mineral filler feed system. So, the contractor would first try to avoid or reduce the need for a mineral filler by trying to find a "blend sand" containing a high percentage of minus 200. Most of the time, however, a mineral filler was still required and the contractor would then search for a suitable (acceptable) filler and invent some way to introduce it into the asphalt plant. This aspect became the most critical element in the production of PlusRide, and I believe became the source of most performance problems.

The function of the minus 200 material in PlusRide is to fill voids within the coarse aggregate/rubber granule matrix to produce a compacted pavement with low air voids. Therefore it is critical the mineral filler be uniformly controlled. Another reason mineral filler is critical is the affect on asphalt demand. Minus 200, or mineral filler, has a very large surface area compared to volume. If the mineral filler fluctuates there is a marked change in the amount of asphalt cement required to coat the particle surfaces. Too little mineral filler will result in excessive asphalt and cause drain down in the trucks, mix segregation, fat spots in the roadway and bleeding. Too much mineral filler will result in insufficient asphalt cement and cause low pavement density, premature cracking, raveling and potholes. In my opinion, this was the cause of most of the early distress or failures that have occurred on PlusRide projects.

In spite of the many problems that occurred most of the PlusRide pavements are still in service and a number are performing extremely well. Several projects provide conclusive evidence of performance exceeding standard practice. For your information a brief list of those projects and description of the pavement distress reduced by the use of PlusRide asphalt are as follows:
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In conclusion, it is my opinion a properly constructed PlusRide Asphalt pavement will provide improved pavement performance. Consistent performance is directly related to control of the mineral filler and rubber content during mix production at the asphalt plant. Unfortunately many early projects lacked the proper equipment for control of the mixture components and jeopardized pavement success. The solution to this problem is the use of both a rubber feed system and a mineral filler feed system. I recommend the continued development of equipment to provide positive control of these elements on all future PlusRide II projects.

Thank you for the opportunity to review the PlusRide projects. Please call if you have any questions regarding the information or results of this review.

Sincerely,

LINDEN ENGINEERING

Robert N. Linden, P.E.
PLUSRIDE ASPHALT
PROJECT PAVEMENT REVIEW

ALASKA

1979  Carnation Road, Fairbanks  May 12, 1992
This project is on the frontage road along Airport Way at the intersection with University Street and was the first paving of PlusRide asphalt in North America. The pavement is on a 90 degree curve and is about 250 feet long. The University of Alaska-Fairbanks research department has monitored the section for deicing and skid resistance under icy conditions. The pavement is still in good condition. It appears to look about the same as when I first examined it in November, 1981.

1980  Old Seward Highway, Anchorage  Non-Existent
This project failed almost immediately after construction and was removed and replaced. The cause of the failure was a result of improper mix production and construction procedures.

1981  Peger Road, Fairbanks  Non-Existent
This project was at the intersection of Van Horn and Peger Road. The pavement performed adequately for about 10 years, but has now been replaced.
1981 Upper Huffman, Anchorage May 13, 1992

This is a two-lane street with no shoulders located on a steep hill side along the east limits of Anchorage. The PlusRide section is one mile long and the pavement is in good condition with no indication of raveling. The primary distress is transverse thermal cracks. There are a couple of areas in the lower end with humps and sags caused by frost heaving. At the upper end there is a short side by side control section. The PlusRide is performing better than the control section with respect to reduction of transverse cracking.

1983 Lemon Road, Juneau May 11, 1992

The pavement is in fair condition. The roadway is worn and has a few aggregate popouts. The major distress is high severity raveling adjacent to longitudinal joints in the center of each lane. This is more pronounced around curves. This raveling is caused by low density in the joint area which was a result of insufficient compaction at time of construction. During construction the mix was very tender due to aggregate particle shape and gradation. Mix production was with a drum plant and only two aggregate stockpiles, so adjustment of aggregate gradation was limited. In order to prevent excessive horizontal and transverse movement of the mat, the finish roller was used for breakdown compaction. As a result, the density of the mat was reduced next to the unconfined edge of
each paving pass. There are also some potholes on the Lemon Creek bridge caused by delamination. This overlay was directly on the concrete bridge deck and it appears the tack coat was insufficient in some areas. Considering the construction problems at the time of paving the pavement has held up well. The DOT has let a contract to overlay the PlusRide on Lemon Road because of the raveled longitudinal joints.

1985 A-C Couplet, Anchorage May 12, 1992

"A" street length, 0.77 mile
"C" street length, 0.64 mile

These two streets are in the downtown area and together form an arterial; "A" street is one-way to downtown and "C" street is one-way from downtown. PlusRide was selected for these streets as a solution to a rutting problem and also for skid resistance over insulated sections on "A" street. The paving was done in two different years. "A" street was paved in August, 1985 and "C" street was paved in May, 1986. Both streets are in excellent condition. The only distress on either street is transverse cracking and some open longitudinal cracks. Since they were paved in different years, they have somewhat different mixture compositions. "C" street has more transverse cracks, but less severity than "A" street. "C" street also has less joint cracks (longitudinal).
Average transverse crack spacing:

"A" street - 135 l.f.
"C" street - 96 l.f.

Richardson Highway, Fairbanks  May 12, 1992
The project is about 80 miles east of Fairbanks. The PlusRide section is about 1/2 mile in length and paved over an insulated section. The insulation has not worked very well and the section has considerable frost heaving. Consequently the section is under contract for reconstruction. The PlusRide section is intact, but maintenance crews have filled in low areas to smooth out the bumps. The PlusRide section has 6 transverse cracks with an average spacing of 350 feet. The conventional pavement has cracks at 50 foot intervals. The PlusRide section is wearing well with no raveling except for the last 50 feet of the westbound lane (south end). This location has moderate raveling and alligator cracking which may have been caused by opening to traffic before the mat had cooled to 140 degrees.

New Seward Highway, Anchorage  May 14, 1992
This section is on the highway approaching Anchorage and PlusRide was used approaching the first traffic light coming into the City for its skid resistance properties. The general appearance of the pavement is excellent. As with other pavements in the area, transverse cracks with a width of 1/2 inch (plus or
minus) occur about every 50 feet with up to 200 feet maximum spacing. The average spacing is 84 feet. The pavement texture is excellent. The PlusRide has some low severity rutting in the right lane up to 5/8 inch depth. Most of the standard mix has already been overlayed due to excessive rutting. The was done by maintenance forces last year after 7 years of service. Ruts in the standard mix, southbound, exceed 1 inch depth. All the pavement, except the PlusRide section, is to be milled off and repaved this year.

1986

Minnesota Avenue, Anchorage

May 13, 1992

The road is a main arterial located in the south west part of Anchorage. There is a new overpass at 100th street, so a portion of PlusRide pavement was removed approaching the 100th street intersection. The pavement is in excellent condition, both southbound and northbound. There are transverse thermal cracks, but there are no longitudinal cracks. Average crack spacing is 235 feet southbound and 228 feet northbound. Some low severity rutting is present in the wheel paths which was measured at 1/4 to 1/2 inch southbound and 3/8 to 5/8 inch northbound. The standard mix has ruts measured at 3/4 inch southbound and 5/8 to 3/4 inch northbound.

1986

Airport Way, Fairbanks

Non-Existent
The pavement was overlayed because of low skid resistance caused by bleeding. The bleeding occurred because the pavement only contained about 2 percent rubber instead of 3 percent, as designed, with the result being an over-asphalted mixture. This was a construction error by the contractor, Earthmovers. This occurred because Earthmovers would not allow the PlusRide representative access to the plant for assistance with calibration and checking of rubber usage.

ARIZONA

1985  Highway 260, Springerville  March 26, 1992

The project is located about 8 miles west of Eager in the White mountains (eastern Arizona). The PlusRide lanes are 13 feet wide and a mile long. The pavement has a half mile stagger, with the eastbound lane starting a half mile past the westbound lane. The westbound lane has considerable longitudinal and transverse cracking. It is expected this will progress into block cracking. Most of the cracks have been filled with asphalt by maintenance crews. The surface texture was good with some aggregate popouts, but no rutting. A pavement condition survey was made for the westbound lane. The eastbound lane has similar cracking but also has moderate raveling which had been fog sealed. The fog seal appeared to have been used to
seal the cracks and stop raveling. Cause of the raveling eastbound was not apparent, however review of the paving report indicates the probable cause is low asphalt content. The standard mix adjacent to the PlusRide has an ACFC surface course which displays transverse cracks primarily of moderate severity. The ACFC appeared to be recent, however Larry Scofield said he believed this was done at initial paving. In any event, the ACFC surface eliminates a fair comparison with PlusRide performance.

1985 Highway 87, Mesa March 25, 1992
This project is north of Mesa on a heavily traveled highway better known as the Bee-Line. The pavement is flushed in the wheel paths for 1/3 to 1/2 of the project length (1 mile), but has not rutted. There are two areas of potholes, raveling and alligator cracking. This appears to be a subgrade and/or mixture problem. Both areas were small, less than 30 square feet. There was also one very flushed spot which must have been a plant production problem. There are some aggregate popouts in the southbound lane. Larry Scofield said he observed this several years ago, but it appears not to have progressed further. The conventional mix on both ends has an OGFC surface course which appeared to be recent, but Scofield said it was placed during initial paving.
The project contains test sections of PlusRide 12, ARCO asphalt-rubber hot mix and standard control mix, all of varying thicknesses. The control section, 0.20' thick has high severity block cracking (essentially failed), the 0.30' thick control section had moderate severity block cracking and the 0.50' thick control section has extensive transverse and longitudinal cracking. In addition, all of the control sections have been chip sealed. The PlusRide sections are still serving well. The 0.15' section has considerable low severity block cracking, mostly in the southbound lane. The 0.15' w/SAMI section is in similar condition, but somewhat less distress. The 0.25' section has some cracking, but not as extensive as the other two PlusRide sections. The major distress is at the north end of the 0.25' section (Section 6) which has been patched or replaced for about 400 feet of the northbound lanes, and both lanes have been chip sealed to that point. There are also 3 or 4 areas of alligator cracking that progressed to small pot holes, and have been patched in section 6. Another distress in PlusRide is an open centerline joint of moderate severity pretty much throughout the project. No rutting was observed. There were a few areas where excessive tack coat bled through the PlusRide. The ARCO sections are also
performing well and the pavement condition (PCI) is about the same as PlusRide. Jack Van Kirk stated all the sections, with possible exception of Section 1 - 0.25' ARCO, will be recycled and repaved in 1994.

1988 I-40 Needles No Review
1988 I-80 Donner Pass No Review
1991 Inyo County No Review

COLORADO

1985 Lamar Airport, Lamar Non-Existential
The pavement raveled and potholed. It was overlayed in 1992.
1985 Peterson AFB, Colorado Springs No Review
This pavement consisting of test sections on the apron is still in service. It was reported that the PlusRide has developed some potholes and appears lean of asphalt cement.
1986 88th Ave, Arvada Sept. 29, 1992
The pavement has considerable distress variation including large areas of patching. In addition there are areas of fat spots and raveling and considerable transverse and longitudinal cracks. Appears the major cause was poor quality control at the asphalt plant.
1986
Quincy Street, Aurora
The pavement raveled and potholed. It was milled off and replaced in 1992.

1986
Boulder Airport, Boulder
Sept. 28, 1992
The pavement surface of the runway and taxiway are in excellent condition. Distress consists of transverse and longitudinal thermal cracks which are attributed to the subbase, which was severely cracked prior to the 1" overlay of PlusRide 8. The cracks have been filled with a crack sealant. The north half of the taxiway was removed this year for realignment construction.

1986
Monte Vista Airport
No Review
The runway is 60 ft x 7,000 ft. One paver pass, about 12 ft x 1500 ft, raveled and was seal coated. The remainder is still in service and has thermal and reflective cracks.

IOWA
1985
I-35, Des Moines
Non-Existant
Project was resurfaced as part of D.O.T. resurfacing project for that area of the interstate highway. PlusRide was performing satisfactorily.

1985
Highway 69, Des Moines
May 28, 1992
This project is 2 miles north of I-35 and is a PlusRide 12 overlay of PCCP. The existing concrete panels are 18 feet long. It appears that most or all joints and/or cracks have reflected through the PlusRide. The
surface is in good condition with very little wear except for aggregate pitting. The texture is coarse and the macrotexture is dense and smooth. Rubber granules are present, but have very little protrusion. The centerline joint is open, slightly, the full length of the project. All cracks are low severity and have been filled with an asphalt cement, without routing. There are a couple of patched areas which appear to be a result of spalling of the underlying existing concrete joints. The south end of the PlusRide section is joined by an overlay of conventional mix. It has extensive cracking which has the appearance of block cracking rather than reflective cracking.

MASSACHUSETTS

1986 Route 123, Brockton Jan. 17, 1992

The pavement surface is in excellent condition. The traffic ADT is over 30,000. It was snowing, this date, and the pavement was wet. The rubber granules were visible, but not predominate to the eye. There are a few flushed areas which are believed due to overheating of the mix - up to 380 degrees. There is one section about 30 feet long in the right wheel path, northbound, with alligator cracking. This appeared to be caused by base failure. The section of route 123 has areas free of distress. The ramps have considerable transverse cracks. There was no indication of raveling or
potholing. Half of the project was paved with verglimit, which has considerable cracking and severe shoving at intersections. There was no standard control section on the project.

MINNESOTA

1984 I-94, St. Cloud May 29, 1992

The pavement is in good condition, no patching although a 1/2 cubic foot spall exists at the beginning of paving at the west end of the travel lane. The surface texture is coarse, but very smooth. The rubber granules have very little protrusion. The macro texture is near polished. There is very little fracture of the coarse aggregate - specifications required 15% minimum. The pavement is full depth ACP with 1 1/2 inch overlay of PlusRide 12. Transverse cracks occur at about 100 foot intervals. Some pitting has occurred, but are in the magnitude of about 1 per 10 square feet. Some rutting has occurred and rutting information received from Minn. D.O.T. shows low severity in the travel lane. The standard ACP was rutted severely and the ruts had been filled in by maintenance forces in the travel lane. The most likely cause of rutting in the PlusRide was from rutting in the leveling course, but could also be from the base course. Minn. D.O.T. selected this project to test for possible reduction of salt for ice control.
Maintenance reported they did not see any difference between PlusRide and the control section. However, a motorist reported observation of deicing on the PlusRide section.

1984
Route 61, Forest Lake Non-Existent Pavement failed and was replaced in first year. Factors causing failure were lack of mix cohesion caused by a coated coarse aggregate, low coarse aggregate fracture, low filler content, poor equipment and cold & rainy weather.

MONTANA
1983
Highway 12 - McDonald Pass, Helena Oct. 1, 1992 The pavement is in good condition. Distress consists primarily of transverse thermal cracks, at about 100 ft spacing and open longitudinal joints. There is also some chain wear in the traffic lanes. The first 1/4 mile of paving, westbound, has moderate to severe raveling. This is in contrast to the rest of the project and the records indicate this was caused by improper feed of the mineral filler (fly ash). The control section, an OGFC, has already failed and was chip sealed for repair. In the process, the west 0.15 mile of PlusRide was also chip sealed.
NEVADA

1982  I-80, Verdi  Non-Existent
Pavement was replaced in the first year. Cause of failure was low mineral filler content, high voids and inadequate compaction equipment.

NEW JERSEY

1984  Rt. 41, Cherry Hill  No Review
At last report, this project was in excellent condition. Refer to Joe Smith for further information.

1988  Newark Overlays  No Review
Refer to Joe Smith for further information.

1990  Newark Overlays  Non-existent
Pavement was removed due to high severity raveling. Probable cause was out of specification mix production by the contractor. Millings were used in first recycling of PlusRide asphalt in the U.S.A.

1991  Ferry Street, Newark  Jan. 18, 1992
The pavement placed during the first day of paving is uniform and in satisfactory condition. Pavement placed the second and third day has developed pot holes in the right lane. One pot hole had been patched and at least one other was still deteriorating. The pot holes have developed over the cobblestones and no tack coat was present. The pavement appeared to be yielding and pushing into the voids surrounding the cobblestones. At one location the pavement only had a 1 inch
thickness. At about three quarters distance, from start of paving, raveling and pot holing is occurring in the left lane. At this area the mix looks very dry and is crumbling. At the end of paving the pavement is extremely flushed. It would appear that quality control at the asphalt plant caused extreme variation of the plant mix. (note: After this review the contractor made repairs to pot holes and raveled areas.)

NEW MEXICO

1984 Highway 64, Chama Non-Existent
Pavement performed poorly and was replaced within a couple of years. The pavement lacked cohesion which led to raveling, shoving and tearing to the mat. The primary cause was poor fine aggregate quality, inconsistent plant production and cold weather paving.

NEW YORK

1983 Van Wyck Expwy Bridge, JFK Airport Jan. 18, 1992
This bridge is part of the terminal access system and crosses over the Van Wyck Expressway near terminal A. Most of the PlusRide has been replaced. None of the pavement on the bridge itself still exists. The reason for this is unknown; possibly it was replaced as part of bridge repairs. It appears the expansion dams have been replaced and there are new bridge rails and a new
curb on the left side. What remains of the PlusRide 16 is a 30 foot section at the beginning approach on the right side. The section has no distress at all. Another 30 feet section exists at the end approach on the right side. The section has some deformation or rutting of approximately 1/4 inch. Another 60 foot long section exists off the end of the bridge on the left side. This section has 3 transverse cracks. Also some surface aggregate popouts are present, but there is no raveling. Much of the terminal access road system is under construction and it is presumed this bridge and pavement will soon be reconstructed.

1990
Albany
No Review

OKLAHOMA

1882
Route 270, Seiling
Non-existent
This project has been resurfaced. The pavement was in service for a number of years, but raveling and potholes created maintenance problems and ultimately called for rehabilitation. The poor performance was a result of poor quality control at the asphalt plant, poor equipment and insufficient compaction equipment.
1985  
**Route 97 - Lava Butte, Bend**  
Feb. 29, 1992
The highway has been reconstructed by the addition of passing lanes through the test section. This made it impossible to make a pavement condition survey because of the heavy traffic. General observations are that the pavement is showing low severity raveling. There are also some transverse and longitudinal cracks. The pavement is generally in fair condition. The most notable distress was alligator cracking at the north end in the northbound lanes for a section about 150 to 200 feet long. It would appear this is caused by a mix production deficiency. I was not able to distinguish between the PlusRide test sections or other test sections on the project.

1986  
**Garfield street, Corvallis**  
Feb. 27, 1992
The street is in, excellent condition. There were 3 cracks in the entire length totalling about 20 feet in length. Two of the cracks are in the Petromat overlay section (17 l.f.) and one is in the non-petromat section (3 l.f.) There is some raveling of low severity in the parking zone on the south side of the street and at the 29th street stop sign. Studded tires may have caused some of the raveling.

1987  
**Springhill Overlay**  
No-Review

1988  
**26462-01-88 Overlay**  
No-Review

1990  
**Benton County Overlays**  
No-Review
RHODE ISLAND

1987 So. County Trail, Warwick Jan. 18, 1992

The overall pavement condition is good. There is a strange distress occurring for the first 300 feet of the project in the right hand lane in front of a fuel oil supply company. The pavement is developing 3" to 4" diameter potholes. The potholes are developing in nearly a straight line in the right wheel path. At first this distress appeared to be a mix flaw. However, closer review indicated some type of external cause. In the same location there are transverse gouges in the pavement which appear to have been made by some type of equipment, either snow removal or some other type of heavy equipment. The only other distress noted are 3 transverse cracks and 1 longitudinal crack which are also near the beginning of the project. Also, there is a depressed area in the ramp radius that appears to be a base failure.

SOUTH DAKOTA

1982 St. Patrick I.C., Rapid City Non-Existental

This pavement performed poorly and has been replaced. Pot holing, raveling and delamination occurred throughout the project. It is believed the primary cause was insufficient asphalt content.
TENNESSEE

1982  Route 165, Tellico Plains  No-Review
This project is believed to still be in service.

UTAH

1984  Highway 40, Strawberry Shed  Non-Existent
This pavement was milled off and replaced the following year. The pavement raveled, delaminated and potholed in several areas, causing maintenance and traffic safety problems. It is believed the primary cause was stripping of the aggregates. In addition, moisture was present at the interface with PlusRide and the underlying asphalt pavement which probably contributed to the delamination.

WASHINGTON

1982  118th Street, Bellevue  March 23, 1992
This overlay over existing PCC pavement is still performing well. The PlusRide section is on the southbound lane and the northbound lane has a standard Petromat with Class B asphalt overlay. At the north end of the PlusRide there is a short control section of Class B without Petromat. The PlusRide has slightly less cracking than the Petromat section and considerably less than the control section. The section has been in service for 10 years which far exceeds the 5 to 6 years that the City of Bellevue expected. Near the entrance to Newport Shores there is
a section where the PlusRide has worn down to the underlying pavement and has received some patching. The surface has always had an open texture which gives the appearance of raveling, but for the most part, raveling has not occurred.

1982

Highway 97, Union Gap, Yakima       Feb. 19, 1992
The PlusRide has some areas of raveling and aggregate popouts, but is still performing well. The original flushing and fat spots have worn away and not caused any problem. There are two transverse cracks and some rutting in the left turn lane. Conversely, the Class B asphalt control section on the north end has moderate bleeding and low to moderate severity rutting in all lanes.

1982

I-82, Yakima R. Bridge, Yakima       Feb. 19, 1992
The PlusRide overlay on the northbound bridge has no distress except for cracks over the expansion dams. The control Class D asphalt on the Naches R. bridge shows low raveling, cracking over the expansion dams and spalling of the overlay in the right lane.

1982

The westbound off-ramp is in near perfect condition except for some aggregate popouts. The westbound on-ramp has patching and potholes caused by weak subbase from poor drainage.
1983  Mt. St. Helens  Feb. 27, 1992
Except for one raveled out section, 60 ft x 6" in the 3 1/2" section, the pavement is in excellent condition. The only other distress is minor aggregate popouts. The adjacent control section has considerable distress in the form of moderate raveling, which could be freeze/thaw damage.

1983  Bellevue Streets  March, 1992
There were four streets paved with PlusRide under this contract. The first one paved was 164th S.E. which occurred in October, 1983. Due to poor mix quality, it didn't perform well and was overlayed last year. The other three were 104th S.E., Somerset Blvd. and 139th S.E. These were all paved in June, 1984. All are in excellent condition, but have some localized distress as follows: Somerset Blvd. is over a mile in length, the only distress is 4 or 5 small potholes located near the entrance from Newport Way where traffic turns onto the PlusRide to head up Somerset. This may be due to poor drainage and/or spinning of tires. 139th has two small alligator sections, less than 20 square feet, which appear to be caused by poor subbase. 104th has an alligrated section some 300 feet long, southbound, in the curve area; a local resident said this has always been a problem area caused by poor subbase.
The left lane still has no visible distress. The right lane has patches from original debonding that occurred in 1982. There are also 4 or 5 places of 5 to 10 square feet where PlusRide is worn down to the deck surface.

There were four streets paved with PlusRide under this contract. All were paved in June, 1986. The streets are N.E. 8th Ave., 112th Ave. S.E., S.E. Newport Way and Lake Hills Connector. 8th Avenue is still in near perfect condition except for raveling of the feather edge at the west end and small potholes developing near the west end of the eastbound lane. The potholes may be due to clumps of PlusRide dropped ahead of the paver from truck beds. 112th has had extensive patching of alligator sections. The distress areas form from alligator cracking caused by weak subgrade and progress to potholes and delamination requiring patching. The northbound lanes paved with Class B asphalt are also suffering the same alligator cracking, but have not required patching to this point. Newport Way has localized distress, some areas have been patched, others are raveling and potholing and there is nine hundred feet with no distress. This could be caused by poor subbase and/or mix production variation. Lake Hills Connector has virtually no distress, however the
first 800 feet of the right lane has been overlayed; reason unknown. This may also have been necessary because of poor subbase.

1985

Dahlgren Road, Stanwood

Feb. 18, 1992

This is an overlay of PCC pavement and is in very good condition. There is some reflective cracks, primarily of the longitudinal edge of PCC. In addition there is minor aggregate popouts and one raveled distress area at the north end of the southbound lane which was caused by a plant mix problem.

1985

Northgate P&R Lot, Seattle

March 21, 1992

This overlay is at the northwest quadrant of the lot. There is some low severity raveling over about 10% of the surface due to a coarse texture and fuel spills. No cracking has occurred and the remainder of the surface is in very good condition.

1986

Sand Point Way, Seattle

March 21, 1992

The only distress is some rock pitting and wear in the wheel paths. There are no cracks in the project. The north end of the project was a Petromat overlay approaching the 145th street traffic light. PlusRide shoved on the Petromat under traffic braking and was replaced soon after paving. This application should not be attempted in the future.
WYOMING

1985 Rawlins Airport, Rawlins Sept. 29, 1992
The surface of the runway has extensive transverse and longitudinal cracking, both thermal and reflective. In addition there is low to moderate raveling. It is scheduled for repaving in 1993. The taxiway and apron have been sealed. The cause of the distress is attributed to the application of a thin 1" overlay of PlusRide 12 resulting in low density and subsequent loss of durability.

CANADA

ALBERTA

1985 Highway 47, Edson No Review
No recent report about this project, however it is believed to still be in service.

BRITISH COLUMBIA

1981 Victoria Streets Non-Existent
Four streets were paved in this first use of PlusRide in Canada. The pavement raveled severely which was attributed to poor aggregate quality and improper mix composition.
1982  B.C. Ferry Dock, Victoria  Non-Existent
This small project was a trial of PlusRide over a
 timber dock. The mix production was a major cause of
 failure.

ONTARIO

1990  Toronto  Non-Existent
This pavement was milled and recycled as the first
 attempt at recycling PlusRide asphalt. No details of
 the pavement performance are known.

SASKATCHEWAN

1986  Trans-Canada Highway, Regina  Non-Existent
The mix performed poorly and experienced raveling and
 potholing soon after paving. The cause was attributed
to poor quality control of the old Pioneer continuous
 plant, which did not meet specifications for paving.
July 17, 1992

Donald L. Russell
President/CEO
Envirotire, Inc.
1904 Third Avenue, Suite 222
Seattle, Washington 98101

Dear Mr. Russell,

This letter is in response to your request for a statement of my experience and professional opinion regarding the performance of PlusRide asphalt.

PlusRide asphalt is a rubber modified asphalt concrete paving material that contains ground crumb rubber from discarded tires. This material was invented and developed in Sweden during the late 1960's. The process was patented in the United States and provides for a range of rubber content from 1% to 6%, or 20 lbs to 120 lbs in a ton of PlusRide asphalt.

The first application of PlusRide asphalt in the United States occurred in 1978, in Alaska. At that time the patent holder was All Seasons Surfacing Corporation (ASSC). I was Chief Engineer for ASSC from 1981 to 1986. During that period of time about 50 projects used PlusRide asphalt for resurfacing of highways, streets, bridges and airports.

Earlier this year, I revisited most of the PlusRide projects that were constructed through 1986. In general, the pavement on those projects is in excellent condition. Where comparisons could be made with conventional pavement, the PlusRide pavement has demonstrated superior performance by a reduction of all forms of cracking and resistance to wheel rutting.

Since Alaska was the earliest and one of the largest users of PlusRide asphalt, I think it is appropriate to reference a statement from a State of Alaska DOT & PF engineer, Kieth Morberg, P.E. is Chief of the Design Branch in Anchorage and he stated to me that, "crumb rubber asphalt has demonstrated areas of superior performance". I believe it is also significant to point out that there continues to be annual applications of this material in Sweden.
In closing, it is my observation and opinion that PlusRide asphalt has proven to be both a technologically feasible product and a viable paving material.

Sincerely,

LINDEN ENGINEERING

[Signature]

Robert N. Linden, P.E.