

Bio-based Asphalt Rejuvenator

Game changing advance in
pavement preservation.



Agency – Vendor Partnership

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UV Rays, air and water lead to asphalt binder oxidation.

Oxidation damages the asphalt bitumen, resulting in hardening and embrittlement of the asphalt surface.

2019 Study

Found that, “rejuvenating seals are a low-cost option for preventing or retarding the surface deterioration of pavements...”

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Evaluation of Rejuvenating Fog Seals



Littorast™ rejuvenator is applied to Section 5.2 of the NCA Test Road.

A rejuvenating fog seal is a type of pavement preservation treatment applied to an existing asphalt pavement surface to preserve its functional and structural integrity and delay a more costly rehabilitation treatment in the near future.

A fog seal consists of a slow setting asphalt emulsion (e.g., SS-1, SS-1H, CSS-1 and CSS-1H) diluted with one to four equal parts of water and applied at rates between 0.06 – 0.13 gal/yd² on an existing pavement surface without a cover aggregate. It is intended to penetrate into the surface pores of the pavement to seal very small cracks and surface voids as well as coat surface aggregate particles. Pavement surfaces with high void contents are more susceptible to oxidative aging due to greater exposure of the binder to air and higher temperatures. The asphalt binder becomes stiff, and consequently, more brittle through oxidation, leading to deterioration.

Rejuvenators can be used to fog seals to true raveled and aged pavements by improving penetration into the pavement and improve the flexibility of the aged binder. Rejuvenators are petroleum or bit based oils with chemical and physical characteristics selected to restore properties of the aged asphalt binder in the surface layer. Adding a rejuvenator to a fog seal reduces the likelihood of cohesive failure within the asphalt binder film and can slow the rate of aging caused by oxidation. For

National Center for
NCAT
at Auburn University

Table 2. Performance-based classification of rejuvenating products.

Grade	Surface Treatment Product
A	BioRestor [®]
	RePlay [™]
B	Regen-X [™]
	Delta Mist [™]
	Reclamite [®]
C	CMS-1PF
	RejuveSeal

Why choose a bio-based solution?

- Bio-based products are derived from plants and other agricultural, marine, and forestry materials.
- Bio-based products provide renewable alternatives to petroleum products.



USDA Bio-preferred Program was established by the 2002 Farm Act & expanded in 2018.

The two major components:

1. Mandatory purchasing requirements for federal agencies and their contractors.
2. A voluntary labeling initiative.

The Program's purpose is to spur economic development, create new jobs and provide new markets for farm commodities.

Executive Order on Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy. September 12, 2022

USDA BioPreferred products:

Strengthen the US economy

Support rural communities

Sequester carbon to fight climate change

Are generally safer than the alternatives

Perform as well as or better than the alternatives

Represent technological advances and innovations

New USDA Report Shows Continued Growth in Biobased Sector Benefits Every State and the Environment



CONTRIBUTED A TOTAL OF
\$470B
VALUE ADDED TO THE
U.S. ECONOMY



DISPLACED
9.4
MILLION BARRELS OF
OIL A YEAR



SUPPORTED A TOTAL OF
4.6M
AMERICAN JOBS THROUGH
DIRECT, INDIRECT, AND
INDUCED CONTRIBUTIONS





RePLAY

west
Asphalt-Rejuvenating Sealer

RePlay is a penetrating fog seal that restores asphalt strength and flexibility, retarding the growth of cracks and slowing the unravelling of the asphalt surface.

RePlay is 88% biobased, mostly derived from domestic soybeans.

Recycled Styrofoam is also used in the formula.



RePlay restores asphalt elasticity and strength.

RePlay penetrates the surface of asphalt up to 1.25”.

The oils in RePlay restore the oil in the asphalt binder lost to oxidation.

Polymers from the Styrofoam bind to the asphalt, restoring its strength.

RePlay extends the useful life of asphalt 5-7 years per application.

RePlay Value Proposition

- It is quick to apply.
- Cures in 30 minutes.
- It is clear – no restriping needed.
- It is 100% non-toxic.
- It is carbon negative.
- It does not darken asphalt.
- No polluting runoff.
- Can be applied in cool temperatures and at night.
- Cost \$.14 - \$.22 p/SF – Installed
- Cost reduced 50% when self installed



Replay Testing Acknowledgements

This would not be possible without you!

- Art Spillman
- Craig Thompson
- Steve Cespedes
- Brant Foster
- Roger Anderson
- Todd Staple
- Pat Grill
- Coast Pavement Services
- PDX Operations Department
- PDX Maintenance Department
- Marine Maintenance Department



Port of Portland Statistics

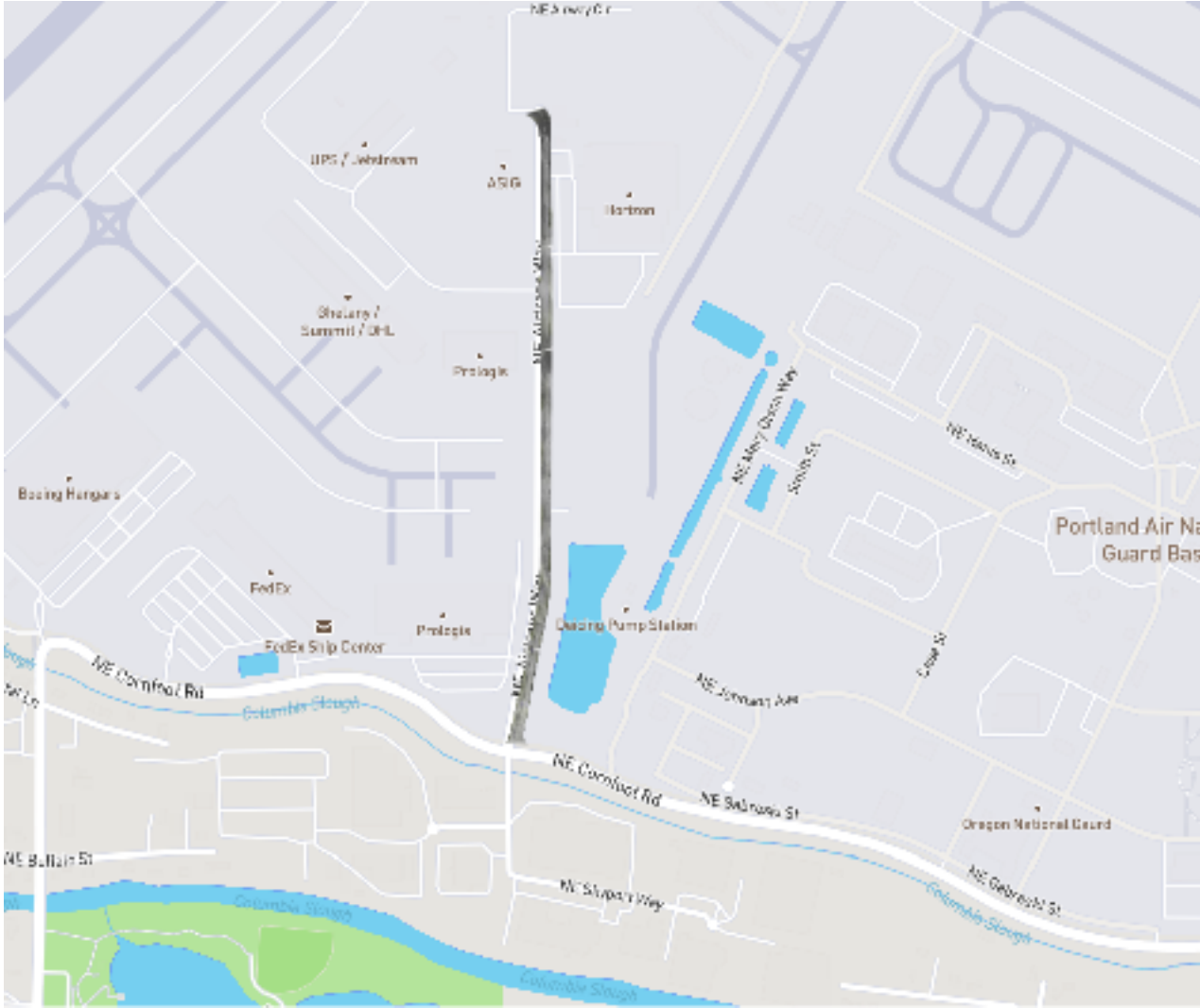
Facility	Square foot
Marine	23,440,579
General Aviation	11,251,081
PDX	43,348,574
Total	78,040,233



Airtran's Way location



Drone images





Troutdale Airport Runway Example

TTD -- Pavement Cracking Sketch

Crack_Width_IN	Total_Sum_FT
less than 0.5in	888.02
0.5in_1.0in	748.79
1.0in_1.5in	3971.94
1.5in_2.0in	7511.48
2.0in_2.5in	9060.25
2.5in_2.9in	9088.41
greater than 3in	9867.79
Total Sum Feet:	40036.58
Total Sum Miles:	7.73

AREA 1

Crack_Width_IN	Total_Sum_FT
less than 0.5in	0.33
0.5in_1.0in	60.2
1.0in_1.5in	466.93
1.5in_2.0in	1104.8
2.0in_2.5in	663.80
2.5in_2.9in	314.00
greater than 3in	290.62
Total Sum Feet:	1900.02
Total Sum Miles:	0.55

AREA 2

Crack_Width_IN	Total_Sum_FT
less than 0.5in	0.4
0.5in_1.0in	118.38
1.0in_1.5in	276.43
1.5in_2.0in	795.24
2.0in_2.5in	956.68
2.5in_2.9in	193.14
greater than 3in	116.75
Total Sum Feet:	1862.48
Total Sum Miles:	0.35

AREA 3

Crack_Width_IN	Total_Sum_FT
less than 0.5in	1.84
0.5in_1.0in	8.08
1.0in_1.5in	30.17
1.5in_2.0in	89.7
2.0in_2.5in	795.95
2.5in_2.9in	641.02
greater than 3in	667.75
Total Sum Feet:	2511.83
Total Sum Miles:	0.49

AREA 4

Crack_Width_IN	Total_Sum_FT
less than 0.5in	148.73
0.5in_1.0in	218.49
1.0in_1.5in	876.36
1.5in_2.0in	2038.15
2.0in_2.5in	2335.47
2.5in_2.9in	803.40
greater than 3in	1017.15
Total Sum Feet:	7427.13
Total Sum Miles:	1.41

AREA 5

Crack_Width_IN	Total_Sum_FT
less than 0.5in	151.2
0.5in_1.0in	141.03
1.0in_1.5in	486.05
1.5in_2.0in	1194.15
2.0in_2.5in	1230.99
2.5in_2.9in	1106.33
greater than 3in	1097.89
Total Sum Feet:	7407.62
Total Sum Miles:	1.40

AREA 6

Crack_Width_IN	Total_Sum_FT
less than 0.5in	85.35
0.5in_1.0in	26.52
1.0in_1.5in	487.77
1.5in_2.0in	867.69
2.0in_2.5in	1,488.75
2.5in_2.9in	2625.27
greater than 3in	3,084.49
Total Sum Feet:	8199.84
Total Sum Miles:	1.58

AREA 7

Crack_Width_IN	Total_Sum_FT
less than 0.5in	3.17
0.5in_1.0in	50.16
1.0in_1.5in	648.12
1.5in_2.0in	739.04
2.0in_2.5in	1006.06
2.5in_2.9in	1,715.04
greater than 3in	2,339.48
Total Sum Feet:	6499.07
Total Sum Miles:	1.23

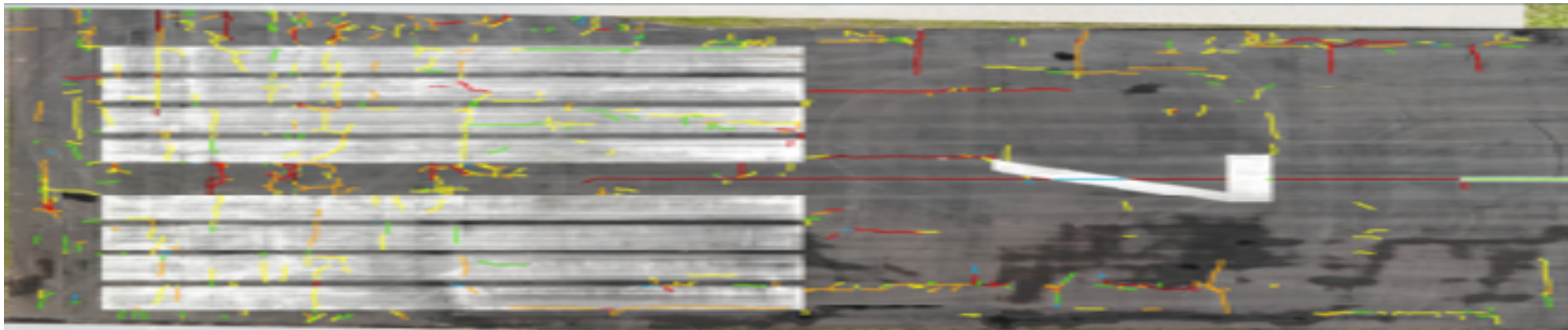
AREA 8

Crack_Width_IN	Total_Sum_FT
less than 0.5in	0
0.5in_1.0in	135.73
1.0in_1.5in	664.12
1.5in_2.0in	609.13
2.0in_2.5in	511.94
2.5in_2.9in	671.1
greater than 3in	1,229.17
Total Sum Feet:	3822.19
Total Sum Miles:	0.72



Crack assessment example

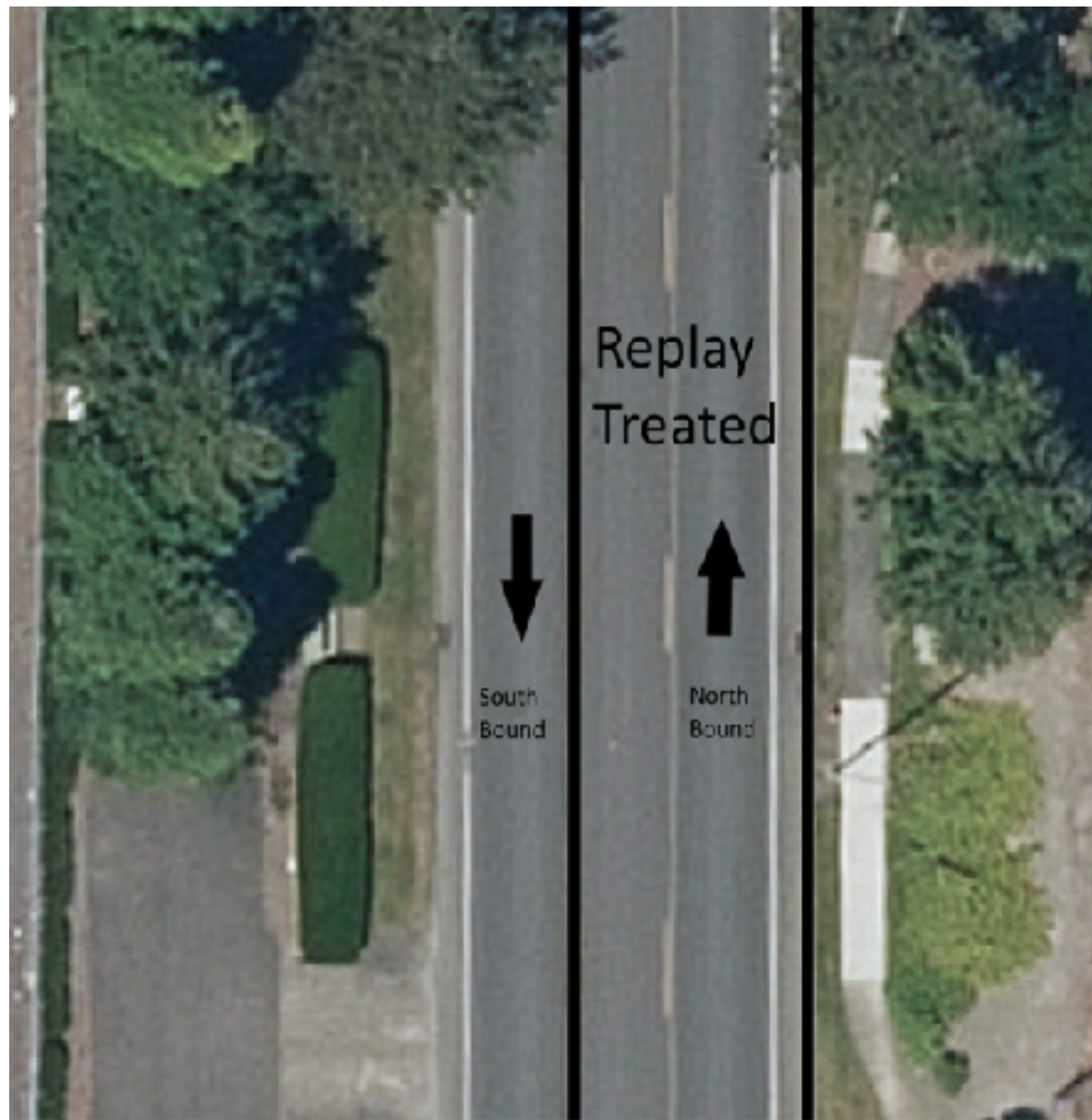
Area 1	
Crack Width Inches	Total Sum Foot
Less than .5"	0.33
0.5"-1.0"	60.2
1"-1.5"	466.93
1.5"-2"	1104.1
2"-2.5"	663.81
2.5"-2.9"	314.03
greater than 3"	290.61
Total sum foot	2900.01
Toatal sum miles	0.55





Airtans Way





Tests

Project: Airtrans Way – Replay Trial

Samples submitted:

Fifteen core samples identified by Table I.

Requested Testing:

Extract and recover the asphalt binder from the top 3/8-inch layer of each core and determine the Absolute Viscosity and Dynamic Shear Rheology (DSR) properties at 60°C.

Summary of Testing:

The top 3/8-inch layer of each core was subjected to extraction (ASTM D2172) and each binder was recovered using the Rotary Evaporator Method (ASTM D5404). Each recovered binder was tested for Absolute Viscosity as per ASTM D2171 and DSR as per AASHTO T315. Test data are reported by Tables II and III.



Sample	Complex Modulus, 60°C, G*, kPa	Viscosity, 60°C, η*, Pa·s	Phase Angle, 60°C, δ, °
SB Airtrans Way STA 14+95			
Untreated (Core No. 1)	38.93	4248.3	66.4
SB Airtrans Way STA 14+95			
Untreated (Core No. 2)	39.11	4277.8	66.1
SB Airtrans Way STA 14+95			
Untreated (Core No. 3)	38.96	4196.1	68.2
Center Airtrans Way STA 14+96			
Untreated (Core No. 4)	27.07	2921.7	67.9
Treated (Core No. 10)	15.84	1681.4	70.4
% Decrease	41.49	42.45	-3.68
Center Airtrans Way STA 15+01			
Untreated (Core No. 5)	26.72	2881.8	68.0
Treated (Core No. 11)	15.61	1682.9	70.8
% Decrease	41.58	42.64	-4.12
Center Airtrans Way STA 15+06			
Untreated (Core No. 6)	27.22	2942.0	67.7
Treated (Core No. 12)	15.71	1665.6	70.6
% Decrease	42.29	43.39	-4.28
NB Airtrans Way STA 14+96			
Untreated (Core No. 7)	36.70	3966.7	67.7
Treated (Core No. 13)	21.27	2262.8	70.1
% Decrease	42.04	42.97	-3.55
NB Airtrans Way STA 15+01			
Untreated (Core No. 8)	37.02	4004.1	67.6
Treated (Core No. 14)	21.14	2251.8	69.9
% Decrease	42.90	43.78	-3.40
NB Airtrans Way STA 15+06			
Untreated (Core No. 9)	37.21	4024.7	67.6
Treated (Core No. 15)	21.38	2278.1	69.8
% Decrease	42.54	43.40	-3.25

Friction test

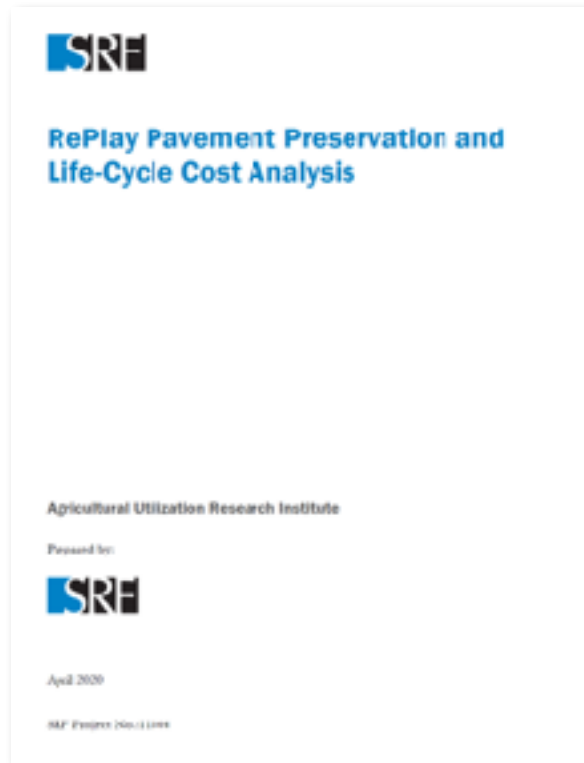
Summary		Direction	mU Avg	mph Avg	Date
Baseline		NB	0.8	41.3	7/2/2021
Post-App 72hr		NB	0.791	41.4	8/20/2021
Post-App 96hr		NB	0.786	41.5	8/21/2021
Summary		Direction	mU Avg	mph Avg	Date
Baseline		SB	0.714	41.7	7/2/2021
Post-App 72hr		SB	0.821	39.2	8/20/2021
Post-App 96hr		SB	0.832	40.7	8/21/2021



T6 Pervious pavement



Multiple Studies Affirm RePlay Works



For more information

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**Technical
Data
Here**

