Governor Mario M. Cuomo Bridge

Pavement Condition Report Appendices

Appendix A – Photos from Construction Phase……..PDF 2

Appendix B – Selection of Daily Work Reports from Construction Phase……PDF 42

Appendix C – Photos from June 2020 Investigation……..PDF 86

Appendix D - Summary Table of Blisters Observed – June 2020……..PDF 127

Appendix E - Rosphalt Coring Information……PDF 129

Appendix F – Olson Report……PDF 149

Appendix A

Photos from Construction Phase


CAT
AS225DC


SB2500D
TILCON

M. Falanga
T UC ING
MIDDLETOWN, NY
USDOT 1065492
SHUTTLE BUGGY
ROADTEC


DUNLOP
SP 252
BRIDGESTONE
M729

an Astec Industries Company

60.0008

SB250D

CAT AP600D

TILCON

Ford

New Jersey

XV·599V

COMMERCIAL


2500D
CAT AP600D
62.0078
62.571474
TILCON
WATCH THAT CHILD
H.O.PENN CAT

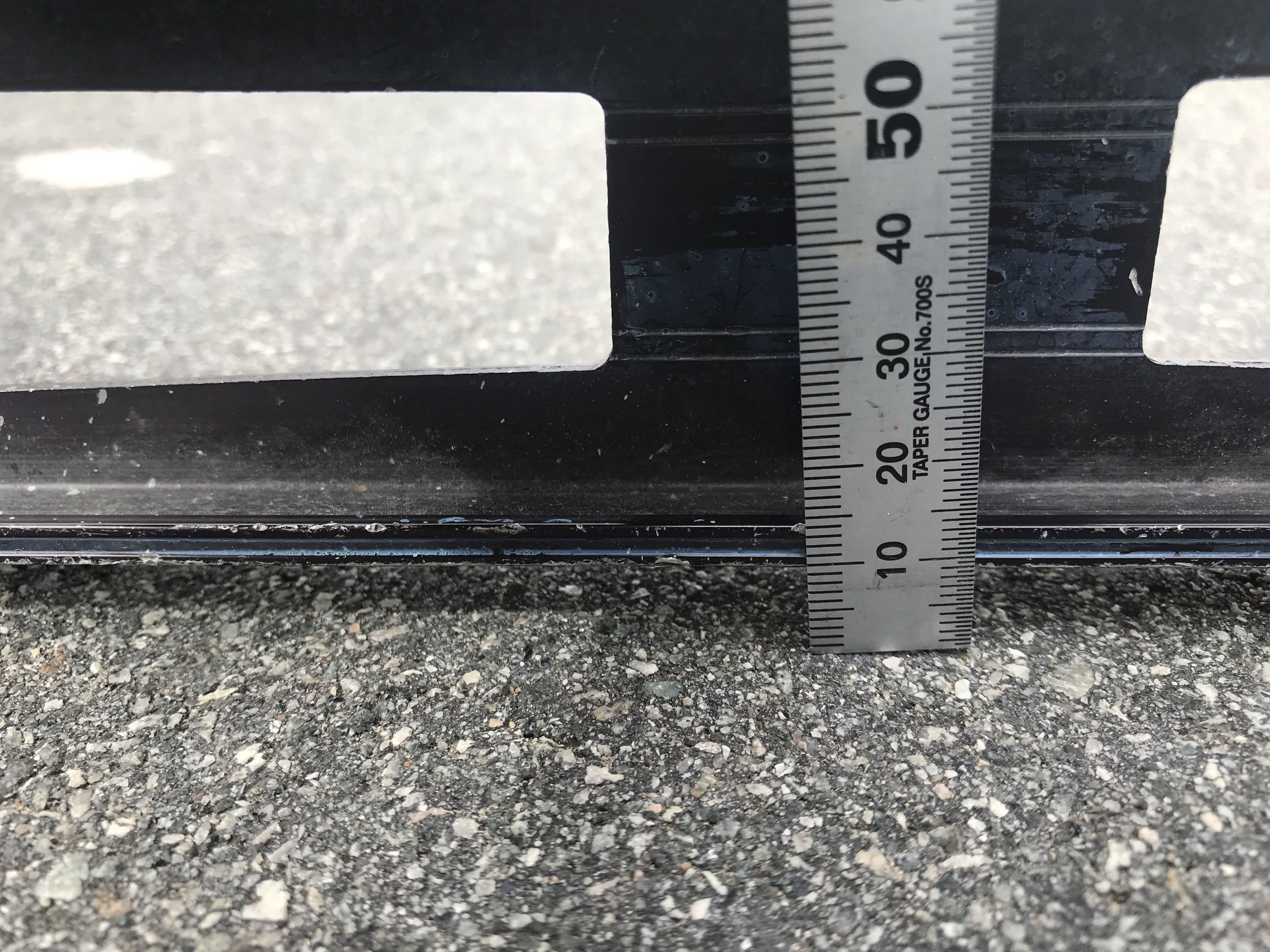

CAT
AP600D
62.0078
62.571474
TILCON
WATCH THAT CHILD
H.O.PENN
CAT


CAT
AP600D


CAT
AP600D
62.0078
62.571474
TILCON
WATCH THAT CHILD
H.O.PENN
CAT


CAT
AP600D
TILCON


TILCON
CAT
AP600D


50
40
30
20
10
TAPER GAUGE No.700S

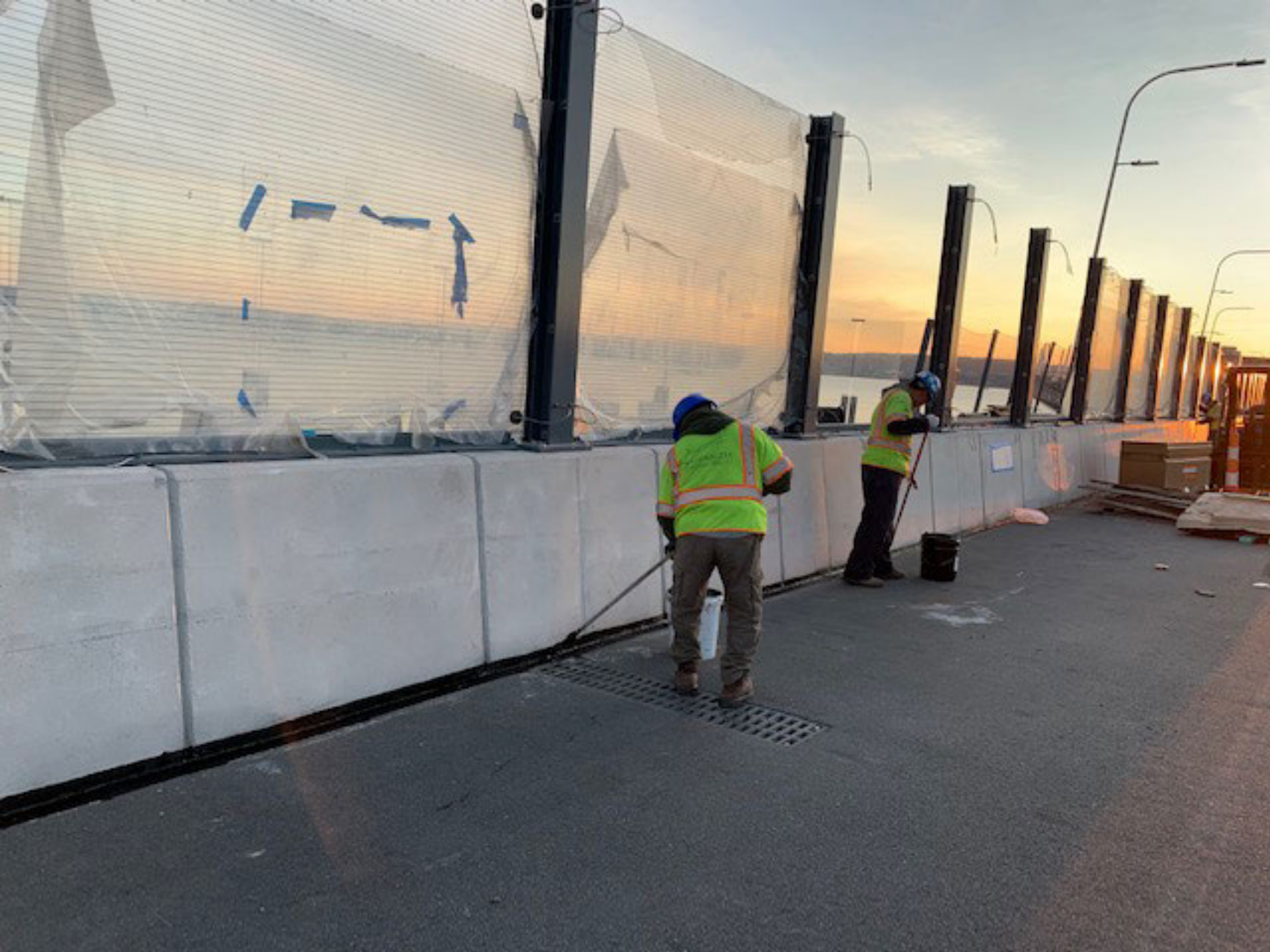

25FEET


SPEED
LIMIT
5


SHIP TO


STANLEY
25ft
ft
in
1
2
3
4
5


CHASE
Construction Products
ROBERSTON 120-29 LOW VOC EDGE SEALER
WARNING! FLAMMABLE. HARMFUL IF INHALED OR INGESTED.
DIRECTIONS:
1. The surface should be dry and free of all dust, dirt, oil, grease, or other contaminations.
2. Minor agitation using a drill or spiral mixing paddle is recommended.
3. Apply by brush, roller, or airless spray or conventional distributor from 0.1 to 0.15 gallons / SY.
VOC
This is an VOC COMPLIANT ADHESIVE at 174 g/l or 1.45 #/g
Regulatory
Contains
C.A.S. No
Material
Toluene
n-Butyl Acetate
Hydrocarbon
Heavy Naphthenic Distillate
HEALTH
FLAMMABILITY
REACTIVITY




TARANZEE

Appendix B

Selection of Daily Working Reports from Construction Phase

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA092		17	07	25	A	Tuesday		Cloudy	60 °F	Cloudy	64 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
1 of 5	09:15 to 13:30	Bertrand Lefebvre	X					☐		X	

Specification	Specification Description	BIM Category
595.98200099	Eliminator Bridgedeck Waterproofing System	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0866-00	15,16	11 - Main Span

Location	Sub-Location	Limits	
[redacted] WB		11+07	to 11+2225

Feature	Sub-Feature	Hold Point
Waterproofing		

Fabricator	Piece Mark	EOR
Stirling Lloyd - Newington, CT		X

Description of Work and Material used:

Location: Units 6, 7 & 11
Subcontractor: Venture Construction (Day Shift)
Stirling Lloyd Waterproofing System - Application of Tack Coat SA1030 /w Tack Spray Truck
Minimum Wet Film Thickness Required: N/A
Stirling Lloyd Representative on Site: Mel Zubzoanowicz
Material Applied: 6212 Gal.
Temp. of Tack: 365 F - 380 F -OK
Start/Stop: : ~ 9:30 am - 3:30pm
Width: Varied
Area Applied: 136,364 SF Total of Tack today sprayed by truck
Application Rate: 22 SF Per Gal.
Attached is Venture Construction's QC report, and highlighted plan view of location of work.

NOTES: 1) Tack coat application was inspected and accepted by QA.
2) QA inspector observed a vacuum truck vacuuming up loose aggregate (#8 Indag 3M embedded in grey eliminator) ahead of the tack crew.- OK 3) Ambient conditions and Temp. of tack verified within range. - Satisfactory

Were there any deficiencies with the work in this entry? ___No X CIF ___NCR

-QA inspector observed that SL tack coat applied today with tack truck had adhesion issues in multiple areas . These areas peeled up and SL tack material appeared and felt very brittle in comparison to previously applied SL tack in other areas applied with squeegee such as Units 1 through 3. The issue was observed approx. 1 to 2 hrs after spraying tack when automobiles began driving on the tack coat. (See attached photos.)

-Stirling Lloyd Sales Executive - Kevin McGraw was onsite today throughout the shift. He contacted the technical department for Stirling Lloyd and QA inspector was told that this failure was not an issue and that technical rep . David Lite would visit the site soon to look at the issue.

-QA inspector brought this issue to the attention of resident engineer Amr Hafez .

-Tack commenced at main span today. Later was applied in Units 6 and 7.

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Denis Pazio — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 08/06/2017

# of attachments: 7

Daily Work Report

Report #	QA092	17	07	25	A	Tuesday	Weather	AM		PM	
	Technician	YY	MM	DD	Rev	Day of the Week	Conditions	Cloudy	60 °F	Cloudy	64 °F

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Denis Pazio — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 08/06/2017

# of attachments: 7

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA092		17	07	25	A	Tuesday		Cloudy	60 °F	Cloudy	64 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
2 of 5	09:30 to 15:30	Bertrand Lefebvre	X					☐	X		

Specification	Specification Description	BIM Category
595.98200099	Eliminator Bridgedeck Waterproofing System	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0866-00	15,16	6 - Approach Unit 6

Location	Sub-Location	Limits		
[redacted] WB		6+07	to	6+1747

Feature	Sub-Feature	Hold Point
Waterproofing		

Fabricator	Piece Mark	EOR
Stirling Lloyd - Newington, CT		☐

Description of Work and Material used:

Location: Units 6, 7 & 11
Subcontractor: Venture Construction (Day Shift)
Stirling Lloyd Waterproofing System - Application of Tack Coat SA1030 /w Tack Spray Truck
Minimum Wet Film Thickness Required: N/A
Stirling Lloyd Representative on Site: Mel Zubzoanowicz
Material Applied: 6212 Gal.
Temp. of Tack: 365 F - 380 F -OK
Start/Stop: : ~ 9:30 am - 3:30pm
Width: Varied
Area Applied: 136,364 SF Total of Tack today sprayed by truck
Application Rate: 22 SF Per Gal.
Attached is Venture Construction's QC report, and highlighted plan view of location of work.

NOTES: 1) Tack coat application was inspected and accepted by QA.
2) QA inspector observed a vacuum truck vacuuming up loose aggregate (#8 Indag 3M embedded in grey eliminator) ahead of the tack crew.- OK 3) Ambient conditions and Temp. of tack verified within range. - Satisfactory

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Denis Pazio — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 08/06/2017

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA092		17	07	25	A	Tuesday		Cloudy	60 °F	Cloudy	64 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
3 of 5	09:30 to 15:30	Bertrand Lefebvre	X					☐	X		

Specification	Specification Description	BIM Category
595.98200099	Eliminator Bridgedeck Waterproofing System	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0866-00	15,16	7 - Approach Unit 7

Location	Sub-Location	Limits	
[redacted] WB		7+07	to 7+1740

Feature	Sub-Feature	Hold Point
Waterproofing		

Fabricator	Piece Mark	EOR
Stirling Lloyd - Newington, CT		☐

Description of Work and Material used:

Location: Units 6, 7 & 11
Subcontractor: Venture Construction (Day Shift)
Stirling Lloyd Waterproofing System - Application of Tack Coat SA1030 /w Tack Spray Truck
Minimum Wet Film Thickness Required: N/A
Stirling Lloyd Representative on Site: Mel Zubzoanowicz
Material Applied: 6212 Gal.
Temp. of Tack: 365 F - 380 F -OK
Start/Stop: : ~ 9:30 am - 3:30pm
Width: Varied
Area Applied: 136,364 SF Total of Tack today sprayed by truck
Application Rate: 22 SF Per Gal.
Attached is Venture Construction's QC report, and highlighted plan view of location of work.

NOTES: 1) Tack coat application was inspected and accepted by QA.
2) QA inspector observed a vacuum truck vacuuming up loose aggregate (#8 Indag 3M embedded in grey eliminator) ahead of the tack crew.- OK 3) Ambient conditions and Temp. of tack verified within range. - Satisfactory

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Denis Pazio — QA Inspector - GPI
Review by: Ted Holk — DCQAM - GPI
Date: 08/06/2017

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA092		17	07	25	A	Tuesday		Cloudy	60 °F	Cloudy	64 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
4 of 5	10:00 to 16:00	Bertrand Lefebvre	X						X		

Specification	Specification Description	BIM Category
595.98200099	Eliminator Bridgedeck Waterproofing System	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0866-00	6,7,8,9,10	11 - Main Span

Location	Sub-Location	Limits	
[redacted] WB		11+07	to 11+2225

Feature	Sub-Feature	Hold Point
Waterproofing		

Fabricator	Piece Mark	EOR
Stirling Lloyd - Newington, CT		

Description of Work and Material used:

Location: WB Unit 11
Subcontractor: Venture Construction (Day Shift)
Stirling Lloyd Waterproofing System - Application of PAR1 Primer
Minimum Wet Film Thickness Required: N/A (Full Coverage /w Roller)
Stirling Lloyd Representative on Site: Mel Zubzoanowicz
Venture Construction QC: Mike Davila
Material Applied: Used 630 Gal. of Par1 Primer
Application Start/Finish: 10:00am - 4:00pm (Stopped due to substrate temp)
Width: 27 FT
Area Applied: 60,998 SF Total
Application Rate of Primer: 97 SF per Gal.
Pull-off Strength tests performed by LiRo (Dan Murphy) in accordance with ASTM D-4541 and approved project specifications. All pull off tests performed on primed substrate passed. (Please see attached for pull- off tests and locations.)
Attached is Venture Construction's QC report, and highlighted plan view with location of work.

NOTES: 1) Primer coat was inspected and accepted by QA. 2) QA took 8 ambient readings before and throughout application activities for dew point and substrate temps.. All material applied within acceptable ambients and substrate temps. Please see attached QC' s daily report for Venture ambients. Substrate cleanliness was accepted prior to application.

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Denis Pazio — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 08/06/2017

# of attachments: 5

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA092		17	07	25	A	Tuesday		Cloudy	60 °F	Cloudy	64 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
5 of 5	10:30 to 18:00	Bertrand Lefebvre	X						X		

Specification	Specification Description	BIM Category
595.98200099	Eliminator Bridgedeck Waterproofing System	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0866-00	11a,12	11 - Main Span

Location	Sub-Location	Limits	
[redacted] WB		11+940	to 11+2225

Feature	Sub-Feature	Hold Point
Waterproofing		

Fabricator	Piece Mark	EOR
Stirling Lloyd - Newington, CT		

Description of Work and Material used:

Location: WB Unit 11
Subcontractor: Venture Construction (Day Shift)
Stirling Lloyd Waterproofing System - Application of Eliminator 2nd Coat at 60 mils with no aggregate
Minimum Wet Film Thickness Required: 60 Mils - QA Verified Range of 70-80 mils. -OK
Stirling Lloyd Representative on Site: Mel Zubzoanowicz
Venture Construction QC: Mike Davila
Material Applied: Used 1705 Gal. of Eliminator
Start/Stop: : 10:30am - 5:45 pm
Area Applied: 43,395 SF
Width: 40 ft and 30 ft
Application Rate of Primer: 25 SF per Gal /// Sprayer helper took readings of mils every 100 SF in accordance with specifications. WFT readings were not performed by QC.
Attached is Venture Construction's QC report, and Application Location Plan.

NOTES: 1) 2nd coat (grey) of Eliminator sprayed today was inspected and accepted by QA. 2) QA took 8 ambient readings before and throughout application activities for dew point and substrate temps.. All material applied within acceptable ambients and substrate temps. Please see attached QC's daily report for Venture ambients

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Denis Pazio, QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/06/2017

# of attachments: 3

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA092	17	07	25	A	Tuesday		Cloudy	60 °F	Cloudy	64 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No.	Entry #	Previous Deficient DWR No.	Previous Entry No.

OP	FileName
1	IMG_5900.JPG
1	IMG_20170725_133528.jpg
1	IMG_20170725_133538.jpg
1	IMG_20170725_154442.jpg
1	07-19 thru 08-01 Par1 Primer - 2nd coat Eliminator and SL Tack - Location Tracking Sheets.pdf
1	Venture QC Daily 07-25.pdf
1	Venture QC Daily 07-25.pdf
4	Venture QC Daily 07-25.pdf
4	07-19 thru 08-01 Par1 Primer - 2nd coat Eliminator and SL Tack - Location Tracking Sheets.pdf
4	2017-07-25 Pull-off Str Tests.pdf
4	IMG_5889.JPG
4	IMG_5912.JPG
5	Venture QC Daily 07-25.pdf
5	07-19 thru 08-01 Par1 Primer - 2nd coat Eliminator and SL Tack - Location Tracking Sheets.pdf
5	IMG_5888.JPG

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Denis Pazio — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 08/06/2017

# of attachments: 3

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	07	28	A	Friday		Cloudy	79 °F	Cloudy	68 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
1 of 7	14:00 to 05:15	Jim Best			X				X		

Specification	Specification Description	BIM Category
595.98200099	Eliminator Bridgedeck Waterproofing System	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	2	6 - Approach Unit 6

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	HP-17605

Fabricator	Piece Mark	EOR

Description of Work and Material used:

Prior to Tilcon paving unit 6 lane 1, a thorough inspection of the previously placed tack coat was performed. No deficiencies of the tack coat were identified.

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

# of attachments: 1

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	07	28	A	Friday		Cloudy	79 °F	Cloudy	68 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
2 of 7	14:00 to 05:15	Jim Best			X					X	

Specification	Specification Description	BIM Category
595.98200099	Eliminator Bridgedeck Waterproofing System	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	2	11 - Main Span

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement		HP-17606

Fabricator	Piece Mark	EOR
		X

Description of Work and Material used:

Prior to Tilcon paving the SUP lane and lanes 1 thru 3 of unit 11 Main span, a thorough inspection of the previously placed tack coat was performed. With the exception of some minor debris which was removed by TZC, No deficiencies of the tack coat were identified at the start of paving. Once paving operations began at 15:00 excessive tack damage was done by the paving operation. (refer below). Tilcon then moved to unit 6 and paved lane 1 (refer to operation 1). Following that they returned to unit 11 and resumed paving. Surface temperatures had cooled from 117 degrees Fahrenheit to 87 degrees Fahrenheit. operations did not cause excessive damage until they started the lane 1 pull (see below) after 32 feet from expansion joint header for [redacted] Sporadic damage to tack was observed for the remainder of the evening typically under the mtv and trucks. Due to this equipment being off set from the paved lane, repairs were made.

Were there any deficiencies with the work in this entry? ___No X CIF ___NCR

When Tilcon began paving the SUP lane from [redacted] expansion joint header excessive amounts of tack was being torn up by paving equipment. refer to photos. After paving 132 Tilcon abandoned the attempt and created a temporary joint. They later returned after exposed damage was repaired and continued to pave the SUP without significant damage. When starting lane 1 They again experienced excessive damage to the tack for a length of 32 feet from the [redacted] joint. After this they were able to pave for the remainder of the night with only minor damage to the tack caused by paving operations.

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

# of attachments: 30

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	07	28	A	Friday		Cloudy	79 °F	Cloudy	68 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
3 of 7	14:00 to 05:15	Alex Gerhardt	X					☐	X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	3	6 - Approach Unit 6

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement		

Fabricator	Piece Mark	EOR
		☐

Description of Work and Material used:

Subcontractor Mattiola Services applied a 4" to 6" strip of edge sealer along all perimeter edges of lane 1 for unit 6. A second application of edge sealer along perimeter edges is required after paving is complete. This has not yet been completed. Considered a work in progress.

Mattiola is also applying the second application in previous units as areas permit considered WIP until complete .

* Mattiola applied edge seal for tonight's main span paving on 7-27-16 refer to that DWR for details.

Were there any deficiencies with the work in this entry? X No ___ CIF ___ NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	07	28	A	Friday		Cloudy	79 °F	Cloudy	68 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
4 of 7	14:00 to 05:15	Jim Best	X						X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	5	11 - Main Span

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement		

Fabricator	Piece Mark	EOR

Description of Work and Material used:

Tilcon continued production paving of approach span /main span wearing surface tonight. Paving began at the [redacted] expansion joint header in SUP lane which measured approximately 12 feet wide. Tilcon placed 1-3/4" loose, compacted to 1-1/2" typical. After pulling the lane approximately 137 feet Tilcon opted to stop and move to unit 6 and pave lane 1 (approximate width 10 ft) due to tack issues (refer to operations 2). After completing lane 1 they returned to main span sup and resumed paving at the temporary joint (refer to operation 7) They experienced issues while placing and compacting along the bridge rail curb in [redacted] (refer to operation 6). After reaching the [redacted] expansion joint header they set back and pulled lanes 1, 2 and 3.

The area to be paved was clean and dry prior to paving.

Tilcon used Paveforce biodegradable asphalt solvent distributed by Caterpillar as their release agent . Approval is pending.
Approval to use of the oscillation mode on the Bomag rollers is still pending

HVEA was on site as the QC firm for density verification. Their workforce consisted of Chris Sotanski, Peter Gasparini operating Humboldt H5001EZ Gauges designated NG-4 and NG-9. Operator certifications and gauge calibrations are on file.

See attached sheets for contractor equipment, See attached BR340 and BR341 forms, See attached photos See attached revised Item 402.09710199 Waterproofing HMA 70 Series Compaction DWR check list.

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

# of attachments: 22

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	07	28	A	Friday		Cloudy	79 °F	Cloudy	68 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
5 of 7	14:00 to 05:15	Jim Best	X					☐	X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	5	6 - Approach Unit 6

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR
		☐

Description of Work and Material used:

Tilcon continued production paving of approach span /main span wearing surface tonight. Paving began at the [redacted] expansion joint header in SUP lane which measured approximately 12 feet wide. Tilcon placed 1-3/4" loose, compacted to 1-1/2" typical. After pulling the lane approximately 137 feet Tilcon opted to stop and move to unit 6 and pave lane 1 (approximate width 10 ft) due to tack issues (refer to operations 2). After completing lane 1 they returned to main span sup and resumed paving at the temporary joint (refer to operation 7) They experienced issues while placing and compacting along the bridge rail curb in [redacted] (refer to operation 6). After reaching the [redacted] expansion joint header they set back and pulled lanes 1, 2 and 3.

The area to be paved was clean and dry prior to paving.

Tilcon used Paveforce biodegradable asphalt solvent distributed by Caterpillar as their release agent . Approval is pending.
Approval to use of the oscillation mode on the Bomag rollers is still pending

HVEA was on site as the QC firm for density verification. Their workforce consisted of Chris Sotanski, Peter Gasparini operating Humboldt H5001EZ Gauges designated NG-4 and NG-9. Operator certifications and gauge calibrations are on file.

See attached sheets for contractor equipment, See attached BR340 and BR341 forms, See attached photos See attached revised Item 402.09710199 Waterproofing HMA 70 Series Compaction DWR check list.

refer to operation 4 for attachments.

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	07	28	A	Friday		Cloudy	79 °F	Cloudy	68 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
6 of 7	14:00 to 05:15	Jim Best	X					☐		X	

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	5	11 - Main Span

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR
		X

Description of Work and Material used:

Tilcon failed to properly compact the edge along the curbed bridge rail section of the bridge between piers 31 and 32. They first had difficulty getting material in place because the paver was hitting the bottom rail of the bridge rail. They tried to compact behind paver with plate compactor but had issues with the compactor picking up material and with the plate compactor keeping up with the operation. They then tried a hand roller with little effect and finally brought in a 1 ton walk behind duel drum roller used in static mode however by then the material had cooled to the point where the roller produced little effect. Later in the night they used a rosebud to reheat the rosphalt and hand tamp to try to improve the joint.

Were there any deficiencies with the work in this entry? ___No _X_CIF ___NCR

Tilcon failed to properly compact the edge along the curbed bridge rail section of the bridge between [redacted].

Conversation Log (Who, What, Where, Outcome):

Spoke with Jim Best (Tilcon) he said they would try to work on the joint to improved the compaction and seal later this week using a hot iron. I spoke with Chase representative Brock (Chase) . He had no issue with Tilcon reheating the rosphalt either by direct flame or hot iron .

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

# of attachments: 8

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	07	28	A	Friday		Cloudy	79 °F	Cloudy	68 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
7 of 7	14:00 to 05:15	Jim Best	X							X	

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	5	11 - Main Span

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement		

Fabricator	Piece Mark	EOR
		X

Description of Work and Material used:

Tilcon began rosphalt paving operations in the SUP lane at the [redacted] expansion joint at 15:00. They paved approximately 137 feet before abandoning their efforts due to tack issues and formed a transverse joint . They resumed paving at this transverse joint at 19:30.

Were there any deficiencies with the work in this entry? __No X CIF __NCR

Tilcon did not prepare the transverse joint prior to resuming paving as required by spec for item 402.09710199 section 3.10 compaction A. 4. Temporary Joints.

Conversation Log (Who, What, Where, Outcome):

I asked Jim Best if he was going to saw cut the joint as required by the spec, and Jim told me TZC told him not to.

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

# of attachments: 1

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA005	17	07	28	A	Friday		Cloudy	79 °F	Cloudy	68 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No.	Entry #	Previous Deficient DWR No.	Previous Entry No.

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

# of attachments: 1

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA005	17	07	28	A	Friday		Cloudy	79 °F	Cloudy	68 °F

OP	FileName
1	Joint Seal delivery ticket 7-28-17.pdf
2	20170728_151109.jpg
2	20170728_151214.jpg
2	20170728_152152.jpg
2	20170728_152429.jpg
2	20170728_152502.jpg
2	20170728_152511.jpg
2	20170728_152628.jpg
2	20170728_152632.jpg
2	20170728_152824.jpg
2	20170728_153100.jpg
2	20170728_153249.jpg
2	20170728_153314.jpg
2	20170728_153726.jpg
2	20170728_154323.jpg
2	20170728_155219.jpg
2	20170728_155614.jpg
2	20170728_155617.jpg
2	20170728_155621.jpg
2	20170728_155636.jpg
2	20170728_155707.jpg
2	20170728_155711.jpg
2	20170728_155719.jpg
2	20170728_155738.jpg
2	20170728_160940.jpg
2	20170728_160946.jpg
2	20170728_162128.jpg
2	20170728_162347.jpg
2	20170728_152142.jpg
2	20170728_231013.jpg
2	20170729_040241.jpg
4	20170728_152142.jpg
4	20170728_152511.jpg
4	20170728_155738.jpg
4	20170728_160940.jpg
4	20170728_160946.jpg
4	20170728_171758.jpg
4	20170728_175702 - Copy.jpg
4	20170728_175702.jpg

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

# of attachments: 1

Daily Work Report

Report #	QA005	17	07	28	A	Friday	Weather	AM		PM	
	Technician	YY	MM	DD	Rev	Day of the Week	Conditions	Cloudy	79 °F	Cloudy	68 °F

4	20170728_175711.jpg
4	20170728_184354.jpg
4	20170728_184425.jpg
4	20170728_190345.jpg
4	20170728_190720.jpg
4	20170728_190739.jpg
4	20170728_214923.jpg
4	20170728_231013.jpg
4	20170729_040241.jpg
4	20170729_043611.jpg
4	14-2030_072817-073017_AFT.pdf
4	Density gauge correlation shots 7-28-17.pdf
4	Equipment List 7-28-17.pdf
4	Rosphalt Checklist 7-28-17.pdf
6	20170728_201436.jpg
6	20170728_201608.jpg
6	20170728_203015.jpg
6	20170728_205839.jpg
6	20170728_210945.jpg
6	20170728_210952.jpg
6	20170728_230307.jpg
6	20170728_230324.jpg
7	20170728_190826.jpg

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Howard Zane, CQAM - GPI **Date:** 08/04/2017

# of attachments: 1

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	08	02	A	Wednesday		Rain	70 °F	Cloudy	66 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
1 of 6	20:00 to 04:30	Jim Best	X	X					X		

Specification	Specification Description	BIM Category
595.98200099	Eliminator Bridgedeck Waterproofing System	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	2	6 - Approach Unit 6

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement		

Fabricator	Piece Mark	EOR

Description of Work and Material used:

Prior to Tilcon paving unit 6 lanes 2, 3 and 4 a thorough inspection of the previously placed tack coat was performed. With the exception of some minor debris which was removed by TZC, No deficiencies of the tack coat were identified.

During the course of paving only sporadic pick up damage to the tack was observed and this damage, occurring in the adjacent lane caused by the mtv and trucks was repaired by TZC prior to paving. This included tack damaged during Tilcon's test run on 7-25-17.

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/13/2017

# of attachments: 1

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	08	02	A	Wednesday		Rain	70 °F	Cloudy	66 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
2 of 6	20:00 to 04:30	Alex Gerhardt	X					☐	X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	3	6 - Approach Unit 6

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement		

Fabricator	Piece Mark	EOR
		☐

Description of Work and Material used:

Subcontractor Mattiola Services applied a 4" to 6" strip of edge sealer along all perimeter edges of unit 6 lanes 2 thru 4. A second application of edge sealer along perimeter edges is required after paving is complete. This has not yet been completed. Considered a work in progress.

Mattiola is also applying the second application in previous units as areas permit considered WIP until complete .

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/13/2017

# of attachments: 3

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	08	02	A	Wednesday		Rain	70 °F	Cloudy	66 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
3 of 6	20:00 to 04:30	Jim Best	X						X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	5	6 - Approach Unit 6

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR

Description of Work and Material used:

Tilcon continued production paving of approach span /main span wearing surface tonight. Paving began at the [redacted] expansion joint header in unit 6 lane 2 which measured approximately 12 feet wide. Tilcon placed 1-3/4" loose, compacted to 1-1/2" typical. After pulling the lane to the [redacted] expansion joint header they set back and pulled lanes 3 and 4 in that order. In an effort to limit damage to the tack coat in the paved lane , Tilcon off set the mtv and trucks into the adjacent unpaved lane on each pull.

The area to be paved was clean and dry prior to paving.

Tilcon used Paveforce biodegradable asphalt solvent distributed by Caterpillar as their release agent . Approval is pending.
Tilcon also used soapy water under tires as recommended by Chase .

HVEA was on site as the QC firm for density verification. Their workforce consisted of Steve Sherwood, Peter Gasparini operating Humboldt H5001EZ Gauges designated NG-4 and NG-1. Operator certifications and gauge calibrations are on file.

See attached sheets for contractor equipment, See attached BR340 and BR341 forms, See attached photos See attached revised Item 402.09710199 Waterproofing HMA 70 Series Compaction DWR check list.

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/13/2017

# of attachments: 7

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	08	02	A	Wednesday		Rain	70 °F	Cloudy	66 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
4 of 6	20:00 to 04:30	Jim Best	X	X					X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	5	2 - Approach Unit 2

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement		

Fabricator	Piece Mark	EOR

Description of Work and Material used:

The EOR has addressed the use of oscillating rollers on bridge and taken no exception to their use. See attached.

Were there any deficiencies with the work in this entry? X No ___ CIF ___ NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/13/2017

# of attachments: 1

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	08	02	A	Wednesday		Rain	70 °F	Cloudy	66 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
5 of 6	20:00 to 04:30	Jim Best	X	X				☐	X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	5	4 - Approach Unit 4

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement		

Fabricator	Piece Mark	EOR
		☐

Description of Work and Material used:

The EOR has addressed the issue of not using a replacement roller when rollers drop out of line to refill water tanks and taken no exception to their use. See attached.

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/13/2017

# of attachments: 1

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA005		17	08	02	A	Wednesday		Rain	70 °F	Cloudy	66 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
6 of 6	20:00 to 04:30	Jim Best	X							X	

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	5	11 - Main Span

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR

Description of Work and Material used:

Were there any deficiencies with the work in this entry? __No X CIF __NCR

Tilcon utilized a joint heater, rose bud, hot iron and plate compactor attempt repair along the curb line on the north side of main span between [redacted] Tonight the worked an area from mid span upstation 175 feet. This lack of proper compaction was first addressed on 7/28/17 operation 6 for this inspector. This work is considered fail until addressed by the EOR.

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/13/2017

# of attachments: 4

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA005	17	08	02	A	Wednesday		Rain	70 °F	Cloudy	66 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No.	Entry #	Previous Deficient DWR No.	Previous Entry No.
QA005170802	1	qa005170725	9
QA005170802	4	qa005170719	5
QA005170802	5	qa005170725	8

OP	FileName
1	20170802_212846.jpg
2	20170802_212846.jpg
2	20170802_222324.jpg
2	Joint Seal delivery ticket 8-02-17.pdf
3	20170802_212756.jpg
3	20170802_212846.jpg
3	20170803_015325.jpg
3	14-2030_080217-080317_AFT-26.pdf
3	Density gauge correlation shots 8-02-17.pdf
3	Equipment List 8-02-17.pdf
3	Rosphalt Checklist 8-02-17.pdf
4	RE Rosphalt CIF RFI NOT REQUIRED - CASE 1 - 001 Oscillating Roller.msg
5	RE Rosphalt CIF RFI NOT REQUIRED - CASE 1 002 Backup Equipment.msg
6	20170802_235320.jpg
6	20170802_235331.jpg
6	20170802_235536.jpg
6	20170802_235539.jpg

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Leigh Abel, Sr. QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/13/2017

# of attachments: 4

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM	PM
TZ002		17	08	02	A	Wednesday		Clear 90 °F	Clear 90 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
1 of 1	08:00 to 08:00	Mike Ortler				X			X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Roadway

Inspection Plan	ITP Activity #	Unit
TZC-0865-00	6	12 - Bridge Unitswide

Location	Sub-Location	Limits
Approaches		to

Feature	Sub-Feature	Hold Point
Permanent Pavement		

Fabricator	Piece Mark	EOR
		X

Description of Work and Material used:

CIF for the use of oscillating rollers. Approved
Tilcon chose to use oscillating rollers in order to achieve required density

Were there any deficiencies with the work in this entry? __No X CIF __NCR

CIF submitted for acceptance of Tilcons oscillating roller

Conversation Log (Who, What, Where, Outcome):

HDR / Chase approval

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Mike Ortler — Field Engineer - Environmental - TZC

Review by: Vincent Montanti — CQC Project Manager - LiRo **Date:** 08/29/2017

# of attachments: 3

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	TZ002	17	08	02	A	Wednesday		Clear	90 °F	Clear	90 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No. | Entry # | Previous Deficient DWR No. | Previous Entry No.

OP	FileName
1	Rosphalt CIF 001 Oscillating Roller.pdf
1	BOMAG BW 161 ADO.pdf
1	BOMAG BW 191 ADO.pdf

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Mike Ortler — Field Engineer - Environmental - TZC

Review by: Vincent Montanti — CQC Project Manager - LiRo **Date:** 08/29/2017

# of attachments: 3

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA099	18	07	31	A	Tuesday			Clear	64 °F	Clear	79 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
1 of 1	14:00 to 03:30	Jim Best	X							X	

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0865-01	2,3,5	11 - Main Span

Location	Sub-Location	Limits
[redacted] EB		[redacted] to [redacted]

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR
Tilcon - Riverdale, NJ		

Description of Work and Material used:

Subcontractor, Tilcon, paved a 1.5", compacted, HMA wearing course using Rosphalt 50 over previously installed waterproofing membrane system on the main span deck. There was a tack coat applied prior to today's paving operation on the deck. Todays DWR will be a fail as there is no COC on
file for the Sterling Loyd tack coat.

I performed a walk through ahead of the paving operation and verified that the tack coat was uniformly applied and was clean and undamaged. All required edges had Royston 120-29 low VOC edge sealer applied, see attached picture. The batch number for the sealer is 31431, this is the batch
number on all of the pails in the back of Matiollas trucks. This DWR is also a fail as we need an updated copy of the COC.

I recorded the ambient and surface temperatures in addition to weather conditions, see attached checklist. During the paving
operation I collected the delivery tickets, recorded the temperatures at the start of discharge as well as in the paver as well as on the newly placed mat.
All temperatures were at least 350 during placement. I was watching for tack pickup on the trucks, paver and MTV tires. I did not observe any tack
pick up today. I verified that each truck was tarped until discharge. I recorded the start and stop time of each truck as well as the placement station.
The paver speed was consistently at 21 fpm. I verified that approved release agent, soap and water solution, was being used.

Unit 11/Main span [redacted] Lanes 2,3 and 4 was installed with Rosphalt 50 today. The mats were laid uniformly at 1-7/8" loose(1.5" compacted).
See equipment list for Paver, MTV and rollers used during today's placement.

Were there any deficiencies with the work in this entry? ___No X CIF ___NCR

There was a tack coat applied prior to today's paving operation on the deck. Todays DWR will be a fail as there is no COC on
file for the Sterling Loyd tack coat.

This DWR is also a fail as we need an updated copy of the COC for the Royston 120-29 low VOC edge sealer.

Conversation Log (Who, What, Where, Outcome):

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Robert Dixon, QA Concrete Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/11/2018

# of attachments: 14

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA099	18	07	31	A	Tuesday		Clear	64 °F	Clear	79 °F

When asked for the COC's for the Royston 120-29 low VOC edge sealer John Onorati explained to Justin Lefebvre and I that the sealer is all coming from
the same batch that was delivered to Tilcon last year. John went on to explain that the material was properly stored at their facility over the winter and
that this was verified by Brock from Chase.

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Robert Dixon, QA Concrete Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/11/2018

# of attachments: 14

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA099	18	07	31	A	Tuesday		Clear	64 °F	Clear	79 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No. Entry # Previous Deficient DWR No. Previous Entry No.

OP	FileName
1	ITP-TZC-0865 Checklist_7-31-18.pdf
1	Rosphalt Temperature Data Sheet_7-31-18.pdf
1	Rosphalt Tickets_7-31-18.pdf
1	Tilcon Equipment list_8-31-18.pdf
1	Edge sealer applied.png
1	Progress Picture 2.png
1	Progress Picture 3.png
1	Progress Picture 4.png
1	Progress Picture.png
1	Royston 120-29 Low VOC Edge Sealer Batch number.png
1	Royston 120-29 Low VOC Edge Sealer.png
1	Mattiola Invoice_7-31-18.pdf
1	MURK 4d(DB-2)NYST Asphalt Form_7-31-18.pdf
1	20180731 BR 340 and 341.pdf

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Robert Dixon, QA Concrete Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 08/11/2018

# of attachments: 14

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA099	18	08	29	A	Wednesday		Clear	81 °F	Clear	92 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
1 of 1	17:30 to 07:15	Jim Best	X							X	

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0865-01	2,3,5	1 - Approach Unit 1

Location	Sub-Location	Limits	
[redacted] EB		west abutment	to [redacted]

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR
Tilcon - Riverdale, NJ		

Description of Work and Material used:

Date of Inspection: Nightshift 8/29/2018 into 8/30/2018

Location: Units 1EB, 2EB & 3EB
Lanes/Stations:
Unit 1EB: Lane 5(12.0') West abutment (STA517+75) to [redacted] STA521+08)
Lane 6(12.0') West abutment (STA517+75) to [redacted] STA521+08)
Lane 7(12.5') West abutment (STA517+75) to Pier 2(STA521+08)
Unit 2EB: Lane 5 (12.0') [redacted] STA521+15) to [redacted] STA531+22)
Lane 6 (12.0') [redacted] STA521+15) to [redacted] STA531+22)
Lane 7 (12.5') [redacted] STA521+15) to [redacted] STA531+22)
Unit 3EB: Lane 5(12.0') [redacted] STA531+30) to [redacted] STA548+95)
Lane 6(12.0') [redacted] STA531+30) to [redacted] STA548+95)
Lane 7(12.5') [redacted] STA531+30) to [redacted] STA548+95)

Subcontractor: Tilcon
Material Installed: Rosphalt 50 (1.5" Thickness)
Release Agent: Soapy Water
Asphalt Delivery Temps: 382-433 F
Tonnage Installed: 1182.6 Tons
Prior to paving QA inspected the deck and found it to be clean and free from debris and ready to accept the Rosphalt pavement . Mattiola was onsite to install the Royston 120-29 low VOC edge sealer around the perimeter of the lanes and other vertical surfaces to be paved. Tilcon was using a MTM (Material Transfer Machine). There was minimal tack pickup by the small steel wheels on the front of the MTM. Tilcon is using a water soap
solution whenever there is an indication of tack pick up. I recorded the ambient and surface temperatures in addition to the weather conditions, see attached checklist. During the paving operation I collected the delivery tickets, recorded the temperatures at the start of discharge as well as in the paver as well as on the newly placed mat. All temperatures were at least 350 upon dumping from the truck to the MTV. I was watching for tack pickup
on the trucks, paver and MTV tires. I verified that each truck was tarped until discharge. I recorded the start and stop time of each truck as well as the placement stations, see attached "Rasphalt Truck Data Sheet". The paver speed was consistently at 14-22 fpm. Tilcon continued to wet the tires on all equipment using soapy water as needed.
-Paver speed was slowed to let the rollers and testers catch up and to bring the density values the testers were getting closer to the theoretical

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Robert Dixon — QA Concrete Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 09/19/2018

# of attachments: 5

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA099	18	08	29	A	Wednesday		Clear	81 °F	Clear	92 °F

density of 149.7.

See Paing Soe's DWR for compaction activities today.

See Paing Soe's DWr for equipment used today.

Chase representative, Brock Peterson, was on site during pavement application

Were there any deficiencies with the work in this entry? __No X CIF __NCR

-There was a tack coat applied prior to today's paving operation on the deck. Todays DWR will be a fail as there is no COC on file for the Sterling Loyd tack coat.

-The batch number for the sealer is 31431, this is the batch number on all of the pails in the back of Matiollas trucks. This DWR is also a fail as we need an updated copy of the COC.

Conversation Log (Who, What, Where, Outcome):

-Paing Soe, GPI QA, notified me of low compaction values in unit 1. I, in turn, went to notify John Beckman, Tilcon paving superintendent, who informed me he was aware of the low readings and that he was not worried about it. I later discussed this with John Onorati, Tilcon QC manager, who informed me that they are allowed to have two consecutive readings between 96-97% as long as they stop and change their methods to bring the compaction readings back up and the rolling average stays 97% or higher. Tilcon did stop, discussed the situation and decided to slow down the paving operation so the rollers/testers didn't fall so far behind and this resulted in 97% or higher the rest of the night. The next night I relayed this information to Blane Tidwell, one of TZC,s night foreman, as Sam was on vacation. Blane said he would pass the information along.

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Robert Dixon, QA Concrete Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 09/19/2018

# of attachments: 5

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA099	18	08	29	A	Wednesday		Clear	81 °F	Clear	92 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No.	Entry #	Previous Deficient DWR No.	Previous Entry No.

OP	FileName
1	ITP-TZC-0865 Checklist_8-29-18 to 8-30-18.pdf
1	Mattiola Invoice_8-29-18.pdf
1	MURK 4d(DB-2)NYST Asphalt Form_8-29-18 to 8-30-18.pdf
1	Paving Temperature Sheet_8-29-18 to 8-30-18.pdf
1	Rosphalt Tickets_8-29-18 to 8-30-18.pdf

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Robert Dixon
QA Concrete Inspector - GPI

Review by: Ted Holk
DCQAM - GPI

Date: 09/19/2018

# of attachments: 5

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM	PM
QA072		19	10	26	A	Saturday		Clear 63 °F	Clear 53 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
1 of 3	06:30 to 14:30	Jake Oronzio	X						X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0865-04	5	3 - Approach Unit 3

Location	Sub-Location	Limits
[redacted] WB		[redacted] to [redacted]

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR

Description of Work and Material used:

Prior to applying Edge sealing QA inspected the following items

-QA verified that there were no standing water (dry surface), free of all dust, dirt, oil and grease and other contaminations before applying edge sealers.

- Removed median barrier concrete splatters by using chipping hammers

-Removed and cleaned all debris by using air compressor and blower

-Deck surface (Contact surface) Temperature before applying material : 49°F@ 7:00 AM

-Applied the edge sealer as per manufacture instruction

-Ambient Temperature: 50°F

-Equipment used : Paint Rollers and Paint Brushes

- TZC laborers were onsite to install the Royston 120-29 low VOC edge sealer around the perimeter of the lanes and other median barreier vertical surfaces.

- The batch number for the sealer is 31905.

- Location: [redacted]

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Paing Soe, QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 11/04/2019

# of attachments: 3

Daily Work Report

Report #							Weather	AM		PM	
QA072	19	10	26	A	Saturday		Conditions	Clear	63 °F	Clear	53 °F
Technician	YY	MM	DD	Rev	Day of the Week						

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Paing Soe — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 11/04/2019

# of attachments: 3

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA072	19	10	26	A	Saturday		Clear	63 °F	Clear	53 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No.	Entry #	Previous Deficient DWR No.	Previous Entry No.

OP	FileName
1	IMG_4110.jpg
1	IMG_4111.jpg
1	IMG_4113.jpg
2	IMG_4115.jpg

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Paing Soe — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 11/04/2019

# of attachments: 3

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA072		19	10	28	A	Monday		Clear	60 °F	Cloudy	51 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
4 of 4	06:30 to 15:30	Jake Oronzio	X						X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0865-04	5	4 - Approach Unit 4

Location	Sub-Location	Limits
[redacted] WB		[redacted] to [redacted]

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR

Description of Work and Material used:

Prior to applying Edge sealing QA inspected the following items

-QA verified that there were no standing water (dry surface), free of all dust, dirt, oil and grease and other contaminations before applying edge sealers.

- Removed median barrier concrete splatters by using chipping hammers

-Removed and cleaned all debris by using air compressor and blower

-Deck surface (Contact surface) Temperature before applying material : 52°F@ 7:00 AM (It is acceptable as per PDS ,Below 90F)

-Applied the edge sealer as per manufacture instruction

-Ambient Temperature: 50°F

-Equipment used : Paint Rollers and Paint Brushes

- TZC laborers were onsite to install the Royston 120-29 low VOC edge sealer around the perimeter of the lanes and other median barreier vertical surfaces.

- The batch number for the sealer is 31905

-Location: [redacted]

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Paing Soe, QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 11/04/2019

# of attachments: 2

Daily Work Report

Report #							Weather	AM		PM	
QA072	19	10	28	A	Monday		Conditions	Clear	60 °F	Cloudy	51 °F
Technician	YY	MM	DD	Rev	Day of the Week						

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Paing Soe — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 11/04/2019

# of attachments: 2

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QA072		19	10	28	A	Monday		Clear	60 °F	Cloudy	51 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No. | Entry # | Previous Deficient DWR No. | Previous Entry No.

OP	FileName
1	IMG_4242.jpg
1	10-28-2019 B#4 Granite Removed Paver Tracking Sheet.pdf
2	IMG_4234.jpg
2	IMG_4239.jpg
2	10-28-2019 Bel#5 Granite Paver Tracking Sheet.pdf
3	IMG_4228.jpg
3	IMG_4229.jpg
3	MC-627-16-M-00455-B - NCA (Returned) (COC - Laticrete Fortified Mortar Bed, 254 Platinum & Permacolor grout) (1) (1).pdf
4	IMG_4244.jpg
4	IMG_4241.jpg

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Paing Soe — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 11/04/2019

# of attachments: 2

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM	PM
QA072		19	10	30	A	Wednesday		Cloudy 64 °F	Cloudy 59 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
1 of 2	06:30 to 15:30	Jake Oronzio	X						X		

Specification	Specification Description	BIM Category
402.09710199	F1 Waterproofing HMA, 70 Series Compaction	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0865-04	5	6 - Approach Unit 6

Location	Sub-Location	Limits
[redacted] WB		[redacted] to [redacted]

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR

Description of Work and Material used:

Prior to applying Edge sealing QA inspected the following items

-QA verified that there were no standing water (dry surface), free of all dust, dirt, oil and grease and other contaminations before applying edge sealers.

- Removed median barrier concrete splatters by using chipping hammers

-Removed and cleaned all debris by using air compressor and blower

-Deck surface (Contact surface) Temperature before applying material : 64F@ 9:00 AM (It is acceptable as per PDS ,Below 90F)

-Applied the edge sealer as per manufacture instruction

-Ambient Temperature: 50F

-Equipment used : Paint Rollers and Paint Brushes

- TZC laborers were onsite to install the Royston 120-29 low VOC edge sealer around the perimeter of the lanes and other median barreier vertical surfaces.

- The batch number for the sealer is 31905

-Location: [redacted]

*Note: Each Belvedere open area was not completed.

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Paing Soe, QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 11/12/2019

# of attachments: 2

Daily Work Report

Report #							Weather	AM		PM	
QA072	19	10	30	A	Wednesday		Conditions	Cloudy	64 °F	Cloudy	59 °F
Technician	YY	MM	DD	Rev	Day of the Week						

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Paing Soe, QA Inspector - GPI

Review by: Ted Holk, DCQAM - GPI **Date:** 11/12/2019

# of attachments: 2

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QA072	19	10	30	A	Wednesday		Cloudy	64 °F	Cloudy	59 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No.	Entry #	Previous Deficient DWR No.	Previous Entry No.

OP	FileName
1	IMG_4297.jpg
1	IMG_4300.jpg
2	IMG_4294.jpg
2	IMG_4295.jpg

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Paing Soe — QA Inspector - GPI

Review by: Ted Holk — DCQAM - GPI **Date:** 11/12/2019

# of attachments: 2

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
QC084		19	10	28	A	Monday		Clear	57 °F	Clear	66 °F

OP	Inspection Hours	Foreperson	IP	RE	HP	WP	Final	Weld?	Pass	Fail	N/A
4 of 4	06:00 to 16:30	Jake Oronzio	X						X		

Specification	Specification Description	BIM Category
402-	Hot Mix Asphalt (HMA) Pavements	Bridge Superstructure

Inspection Plan	ITP Activity #	Unit
TZC-0865-04	5	4 - Approach Unit 4

Location	Sub-Location	Limits
[redacted] WB		to

Feature	Sub-Feature	Hold Point
Permanent Pavement	Asphalt Pavement	

Fabricator	Piece Mark	EOR

Description of Work and Material used:

Location: [redacted]

TZC continue the application of the Royston 120-29 VOC edge sealer along the bottom edge of the median barrier on both sides. This product was applied as per manufacture's recommendations. Prior to the application of the sealer, the bottom edge on both sides of the median barrier were cleaned from debris and blew out. Surface was confirmed to be dry and no sign of standing water. Contact temperature at 07:00am was about 52F.

Work in progress.

Were there any deficiencies with the work in this entry? X No ___CIF ___NCR

Conversation Log (Who, What, Where, Outcome):

RFIs, NCRs or Submittals related to this work:

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Erick Rosario — QC Inspector - LiRo

Review by: Vincent Montanti — CQC Project Manager - LiRo **Date:** 11/18/2019

# of attachments: 2

Daily Work Report

Report #	Technician	YY	MM	DD	Rev	Day of the Week	Weather Conditions	AM		PM	
	QC084	19	10	28	A	Monday		Clear	57 °F	Clear	66 °F

OP	Sample ID	Test	Material Code	Grade	Stamp Code

DWR No. | Entry # | Previous Deficient DWR No. | Previous Entry No.

OP	FileName
1	IMG_3458.JPEG
1	IMG_3460.JPEG
1	IMG_3462.JPEG
1	IMG_3463.JPEG
1	IMG_3467.JPEG
1	IMG_3468.JPEG
1	River Road Limits.pdf
2	IMG_3474.JPEG
2	IMG_3476.JPEG
2	IMG_3477.JPEG
2	IMG_3478.JPEG
3	IMG_3470.JPEG
3	IMG_3471.JPEG
3	IMG_3472.JPEG
3	IMG_3473.JPEG
4	IMG_4241.jpg
4	IMG_4243.jpg

I certify that the work described in this report was incorporated into this contract on the date of this DWR, unless otherwise noted.

Inspector's Signature: Erick Rosario — QC Inspector - LiRo

Review by: Vincent Montanti — CQC Project Manager - LiRo **Date:** 11/18/2019

# of attachments: 2

Appendix C

Photos from June 2020 Investigation

uni-ball


16
6"


uni-ball ONYX


PLEASE
DO YOUR PART
STAY 6 FEET APART

Appendix D

Summary Table of Blisters Observed – June 2020

Rosphalt Visual Survey
Performed by Bors/Zuker - June 2020

All inspection took place at night with use of headlights for lighting
Note: Numbers shown relate to density of blisters - Scale=0-10 with 0 being no blisters
L=Light density
M=moderate density
H=heavy density
Note: Spans with no entry were not inspected

Westbound Structure

	>5% Cross Slope																										Suspended Spans			>5% Cross Slope										
[redacted]																																								
Right Shoulder						M					M	L	L											M	H	M	M					0	M	M				M				
Bus lane						M					M	L	L											M	H	M	L					0	M	M				M				
Left Lane									4	2	2	4	3	7	7								4	2	2				3	4	1	2									
Left Shoulder									4	5	5	3	4	PPC									3	3	4				4	5	1	2									

Eastbound Structure

[redacted]																																							
Right Shoulder					5	5	5	4		4						4	3	4	3	3							6	3	3	0			4	3	3	3	2	4	3	6	4		
Bus Lane					5	5	5	5		4						4	4	3	3	5							5	3	2	0			1	4	1	1	1	3	3	5	6		

Appendix E

Rosphalt Coring Information

GMMC Bridge
June 2020 Rosphalt Coring Program
Table compiled by HNTB

Notes:
Cores taken during night lane closures by Advanced Testing
Coring locations determined and coordinated by John Bors, Erik Zuker and Joe Gentile

Core Number	Core Size (in)	Date	Location	Structure	Comments
1	3	6/23/2020	WB structure, in [redacted], 10.3' West of [redacted], in bus lane 1' from bus/shoulder line	WB	Visible bump
2	3	6/23/2020	WB structure, in [redacted], 60.4' West of [redacted] in bus lane 0.5' from bus/shoulder line	WB	Visible bump
3	4	6/23/2020	WB structure, in [redacted], 54' West of [redacted], in shoulder, 5.4' from bus/shoulder line	WB	Appears Flat
4	3	6/23/2020	WB structure, in [redacted]85' West of [redacted] in shoulder, 6.6' from bus/shoulder line	WB	Appears Flat
5	3	6/23/2020	WB structure, in [redacted] 115' from [redacted] middle of bus lane	WB	Visible bump
6	3	6/23/2020	WB structure, in [redacted] 115' from [redacted] in shoulder, 1.5' from bus/shoulder line	WB	Visible bump
7	3	6/23/2020	WB structure, in [redacted] 190' from [redacted] in shoulder, 3' from bus/shoulder line	WB	Appears Flat
8	3	6/23/2020	WB structure, in [redacted] 190' from [redacted] in shoulder, 3' from bus/shoulder line	WB	Appears Flat
9	4	6/23/2020	WB structure, in [redacted] 36.5' West of [redacted] middle of bus lane	WB	Cracked blister
10	6	6/23/2020	WB structure, in [redacted] 21.7' West of [redacted] in bus lane, 4' from bus/shoulder line	WB	Cracked, not significantly raised
11	4	6/24/2020	EB structure, in [redacted] 77' East of [redacted] in shoulder, 2.5' from bus/shoulder line	EB	Visible bump
12	4	6/24/2020	EB structure, in [redacted] 77' East of [redacted] in bus lane, 7.1' from bus/shoulder line	EB	Visible bump
13	6	6/24/2020	EB structure, in [redacted] 35' East of [redacted] in shoulder, 2.2' from bus/shoulder line	EB	Visible bump
14	4	6/24/2020	EB structure, in [redacted] 35' East of [redacted] in bus lane, 1.1' from bus/shoulder line	EB	Appears Flat
15	6	6/24/2020	EB structure, in [redacted] 20' West of [redacted] in shoulder, 4' from bus/shoulder line	EB	Large cracked blister
16	6	6/24/2020	EB structure, in [redacted] 26.5' East of [redacted] in shoulder, 1.4' from bus/shoulder line	EB	Large cracked blister
17	4	6/25/2020	WB structure, in [redacted] 122' West of [redacted] in left lane, 1' from left lane/shoulder line	WB	Visible bump
18	3	6/25/2020	WB structure, in [redacted] 152' West of [redacted] in left lane, 4' from left lane/shoulder line	WB	Visible bump
19	4	6/25/2020	WB structure, in [redacted] 157' West of [redacted] in left lane 5' from left lane/shoulder line	WB	Appears Flat
20	3	6/25/2020	SUP, in [redacted] 169' East of Belveder 5 ramp, in bike lane	WB (SUP)	Moderate bump
21	3	6/25/2020	SUP, in [redacted] 47' East of Belvedere 5 ramp, bike lane, 2' from bike/ped line	WB (SUP)	
22	3	6/25/2020	SUP, in [redacted] 67.3' East of LP 06, in bike lane, 3' from bike/ped line	WB (SUP)	

From Jan. 2020

1	4	1/13/2020	From SUP	WB (SUP)	Half Bump
2	4	1/13/2020	From SUP	WB (SUP)	Half Bump
3	4	1/13/2020	From SUP	WB (SUP)	Half Bump
4	4	1/13/2020	From SUP	WB (SUP)	Bump
5	3	1/13/2020	From SUP	WB (SUP)	Half Bump
6	3	1/13/2020	From SUP	WB (SUP)	Half Bump
7	3	1/13/2020	From SUP	WB (SUP)	Half Bump

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project:**	TZ Hudson River Crossing D2
Material:	Asphalt cores w/ membrane	**Project Number:**	130419
Source:	HNTB Corporation	**Lab Number:**	20-0865
Date Sampled:	1/13/2020 / 6/23/2020 / 6/24/2020	**Sampled By:**	Advance Testing Company
Date Tested:	8/12/2020	**Tested By:**	Jonathan Valle

Report of Pull-Off Strength of Coatings Using Portable Adhesion Testers

Test Method: ASTM D 4541

Specimen General Information		
Substrate Material	**Membrane**	**Membrane Adhesion**
Rosphalt by Chase Corp.	Eliminator by Stirling Lloyd	Rosphalt Tack Coat

Testing Equipment Information				
Adhesion Tester	**Calibration Date**	**Dolly Size**	**Dolly Bonding Agent**	**Cure Time**
DeFelsko PosiTest AT-M	28-Jul-20	20 mm	ResinLab EP11HT Gray	24 hrs

Testing Information		
Testing Location	**Temperature**	**Humidity**
Laboratory	76 °F	49%

Test Results

Test	Core #	Rate of Pull (psi/s)	Test Result (PSI)*	Mode of Failure
1	1	50	456	Membrane bond failure at asphalt
2	1	50	280	Dolly bonding agent bond failure, membrane still adhered
3	2	50	494	Dolly bonding agent bond failure, membrane still adhered
4	2	50	475	Membrane bond failure at asphalt
5	3	50	452	Membrane bond failure at asphalt
6	3	50	472	Membrane bond failure at asphalt
7	7**	50	204	Asphalt tear out with membrane still adhered
8	19**	50	368	Asphalt tear out with membrane still adhered
9	19**	50	384	Asphalt tear out with membrane still adhered

* Uncertainty ± 6.5 psi.

**Sample contained subsurface voids or delamination, photographs attached

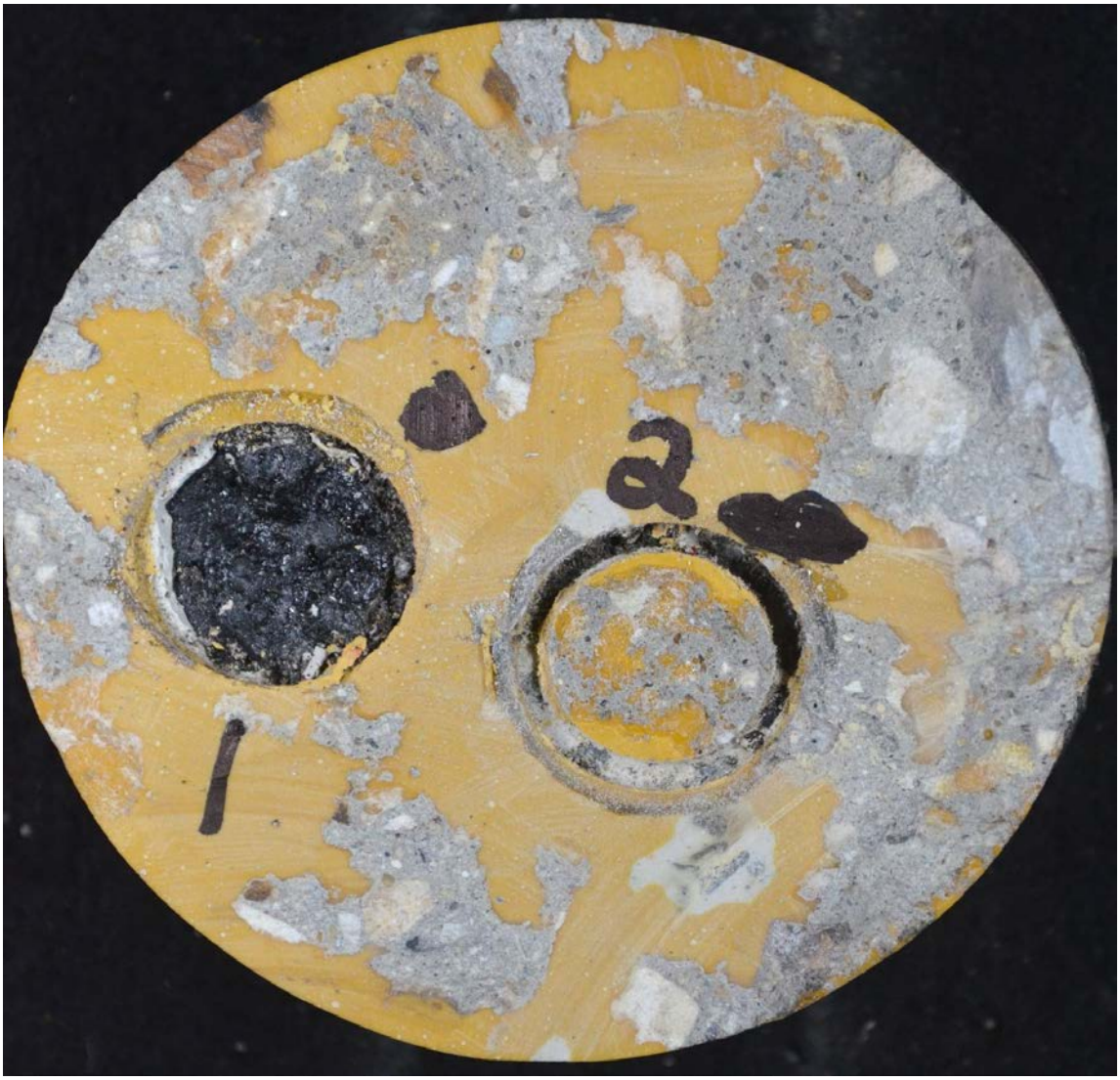
Report Reviewed By: Emily J. Rodriguez

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project:**	TZ Hudson River Crossing D2
Material:	Asphalt cores w/ membrane	**Project Number:**	130419
Source:	HNTB Corporation	**Lab Number:**	20-0865
Date Sampled:	1/13/2020	**Sampled By:**	Advance Testing Company
Date Tested:	8/12/2020	**Tested By:**	Jonathan Valle

Report of Pull-Off Strength of Coatings Using Portable Adhesion Testers

Test Method: ASTM D 4541

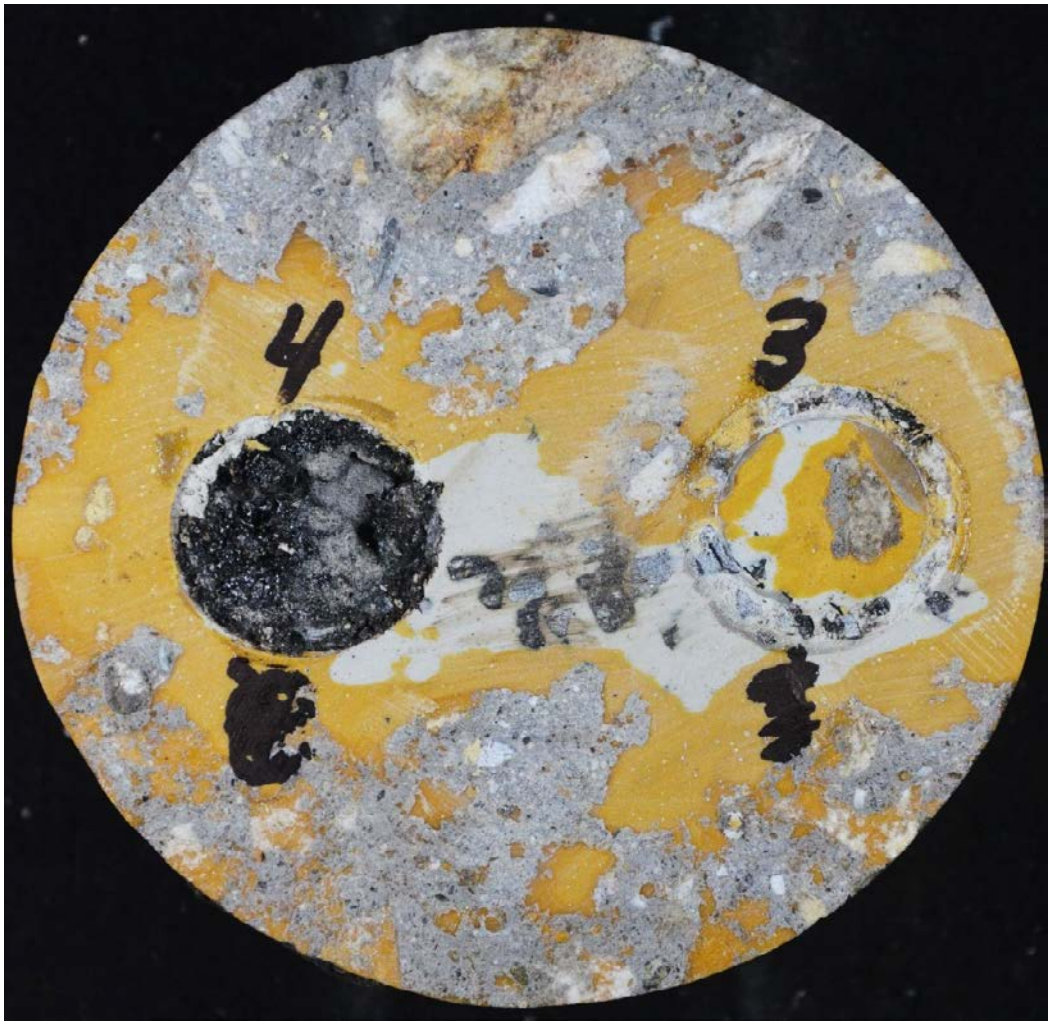


3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project:**	TZ Hudson River Crossing D2
Material:	Asphalt cores w/ membrane	**Project Number:**	130419
Source:	HNTB Corporation	**Lab Number:**	20-0865
Date Sampled:	1/13/2020	**Sampled By:**	Advance Testing Company
Date Tested:	8/12/2020	**Tested By:**	Jonathan Valle

Report of Pull-Off Strength of Coatings Using Portable Adhesion Testers

Test Method: ASTM D 4541

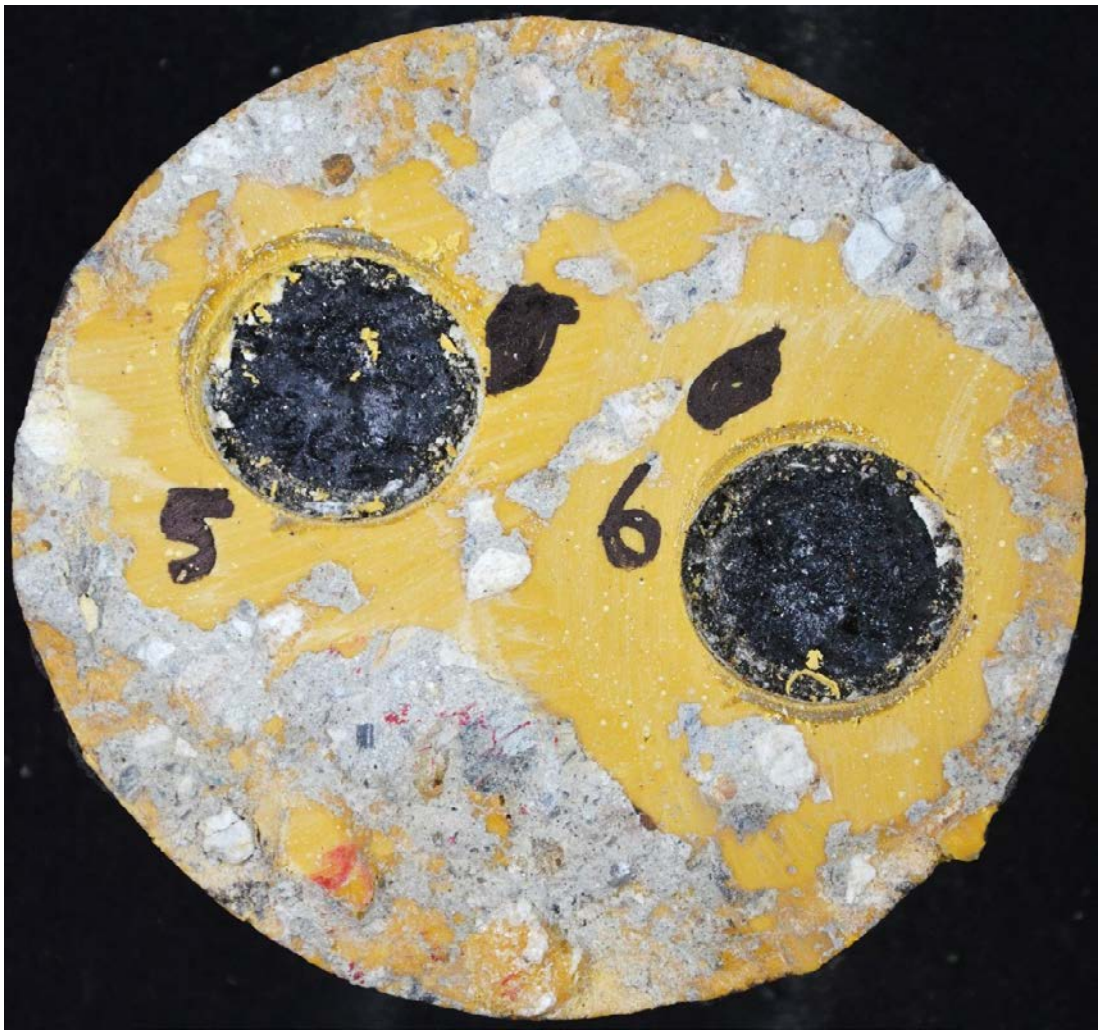


3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project:**	TZ Hudson River Crossing D2
Material:	Asphalt cores w/ membrane	**Project Number:**	130419
Source:	HNTB Corporation	**Lab Number:**	20-0865
Date Sampled:	1/13/2020	**Sampled By:**	Advance Testing Company
Date Tested:	8/12/2020	**Tested By:**	Jonathan Valle

Report of Pull-Off Strength of Coatings Using Portable Adhesion Testers

Test Method: ASTM D 4541

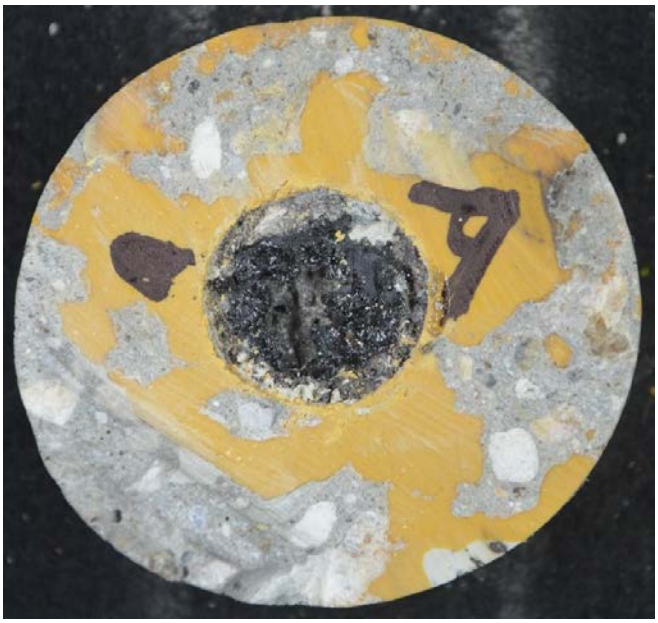


3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project:**	TZ Hudson River Crossing D2
Material:	Asphalt cores w/ membrane	**Project Number:**	130419
Source:	HNTB Corporation	**Lab Number:**	20-0865
Date Sampled:	1/13/2020	**Sampled By:**	Advance Testing Company
Date Tested:	8/12/2020	**Tested By:**	Jonathan Valle

Report of Pull-Off Strength of Coatings Using Portable Adhesion Testers

Test Method: ASTM D 4541



3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project:**	TZ Hudson River Crossing D2
Material:	Asphalt cores w/ membrane	**Project Number:**	130419
Source:	HNTB Corporation	**Lab Number:**	20-0865
Date Sampled:	1/13/2020	**Sampled By:**	Advance Testing Company
Date Tested:	8/12/2020	**Tested By:**	Jonathan Valle

Report of Pull-Off Strength of Coatings Using Portable Adhesion Testers

Test Method: ASTM D 4541

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865E
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/7/2020	**Tested By:**	John Brinsfield

Report of Bulk Specific Gravity

Test Method: ASTM D2726

Lab No.	*Core No.*	*Mass in Air (A)*	*Mass in Water (C)*	*Mass at SSD (B)*	*Volume (B-C)*	*Bulk (Gmb)*	*Daily Gmm*	*Density (pcf)*	*% Gmm*	*%Air Voids*
A	1	546.1	316.9	549.3	232.4	2.350	2.389	146.25	98.36	1.64
B	2	621.7	354.9	625.4	270.5	2.298	2.340	143.05	98.22	1.78
C	3	591.0	345.0	594.6	249.6	2.368	2.437	147.37	97.16	2.84
E	9	546.7	321.8	548.8	227.0	2.408	2.461	149.90	97.86	2.14
F	10	1277.8	749.2	1281.6	532.4	2.400	2.456	149.38	97.72	2.28
G	12	679.5	394.8	681.9	287.1	2.367	2.402	147.31	98.53	1.47
H	13	519.8	302.0	522.4	220.4	2.358	2.396	146.79	98.43	1.57
I	14									
J	15	1172.2	682.4	1175.8	493.4	2.376	2.427	147.87	97.89	2.11
K	16	1287.8	749.1	1291.5	542.4	2.374	2.424	147.77	97.95	2.05
L	19	554.1	322.3	556.1	233.8	2.370	2.407	147.51	98.46	1.54
Average						2.379	2.425	148.07	98.12	1.88

Comments: -Daily Gmm tested on each individual core and utilized to calculate %Gmm and % Air Voids.
-Core No. 1 , 2, 3, and 19 tested for Adhesion testing prior to Bulk Specific Gravity Testing
-Core No. 9 contains a crack in the middle of the core and several pry marks around perimeter of core, this could effect %Gmm and % Air Voids

-Core No. 10 contains a crack in the middle of the core, this could effect %Gmm and % Air Voids
-Core No. 14 was untestable for Bulk Specific Gravity and Maximum Theoretical Specific Gravity.

-Core. No. 15 contains a crack in the middle of the core and several pry marks aroudn the perimeter of the core, this could effect % Gmm and % Air Voids

-Core No. 16 contains a crack in the middle of the core, this could effect %% Gmm and % Air Voids.

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 1; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865A
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/12/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: ASTM D2172 Method A

Asphalt Content	*Job Mix Limits*	*General Limits*
9.25	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	21.3	4.3	95.7	*89*	*100*	*90*	*100*	*96*
#4	111.1	22.5	73.2	*62*	*76*		*90*	*69*
#8	110.1	22.3	50.9	*46*	*54*	*32*	*67*	*50*
#16	76.7	15.5	35.4	*30*	*38*			*34*
#30	54.8	11.1	24.3	*21*	*29*			*25*
#50	38.8	7.8	16.5	*14*	*21*			*17*
#100	32.7	6.6	9.9	*6*	*14*			*10*
#200	19.9	4	5.90	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	29.2	5.90						
Total	494.6	100.0						

Notes: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: Core had additional emolsion type material around sides of core, which could impact Asphalt Content.

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 2; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865B
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/12/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: ASTM D2172 Method A

Asphalt Content	*Job Mix Limits*	*General Limits*
9.11	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	24.4	4.4	95.6	*89*	*100*	*90*	*100*	*96*
#4	141.7	25.7	69.9	*62*	*76*		*90*	*69*
#8	107.9	19.6	50.3	*46*	*54*	*32*	*67*	*50*
#16	83.4	15.1	35.2	*30*	*38*			*34*
#30	59	10.7	24.5	*21*	*29*			*25*
#50	42.2	7.7	16.8	*14*	*21*			*17*
#100	34.9	6.3	10.5	*6*	*14*			*10*
#200	20.4	3.7	6.70	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	36.9	6.70						
Total	550.8	99.9						

Notes: The entire remaining sample was utilized for testing after the completion of Bulk Specific

Comments: Core had additional emolsion type material around sides of core, which could impact Asphalt Content.

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 3; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865C
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/12/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: None

Asphalt Content	*Job Mix Limits*	*General Limits*
7.4	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	25	4.6	95.4	*89*	*100*	*90*	*100*	*96*
#4	129.5	23.8	71.6	*62*	*76*		*90*	*69*
#8	104.9	19.3	52.3	*46*	*54*	*32*	*67*	*50*
#16	86.3	15.9	36.4	*30*	*38*			*34*
#30	61.5	11.3	25.1	*21*	*29*			*25*
#50	43.3	8.0	17.1	*14*	*21*			*17*
#100	35.3	6.5	10.6	*6*	*14*			*10*
#200	20.9	3.8	6.78	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	36.83	6.78						
Total	543.53	100.0						

Notes: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: N/A

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 9; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865E
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/11/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: ASTM D2172 Method A

Asphalt Content	*Job Mix Limits*	*General Limits*
7.82	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	24.5	4.9	95.1	*89*	*100*	*90*	*100*	*96*
#4	123.9	24.9	70.2	*62*	*76*		*90*	*69*
#8	96.6	19.4	50.8	*46*	*54*	*32*	*67*	*50*
#16	74.3	14.9	35.9	*30*	*38*			*34*
#30	54.2	10.9	25.0	*21*	*29*			*25*
#50	39.4	7.9	17.1	*14*	*21*			*17*
#100	34.6	6.9	10.2	*6*	*14*			*10*
#200	21.2	4.3	5.98	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	29.79	5.98						
Total	498.49	100.1						

Notes: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: Core had additional emolsion type material around sides of core, which could impact Asphalt Content.

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 10; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865F
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/11/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: None

Asphalt Content	*Job Mix Limits*	*General Limits*
7.52	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	23.9	2.0	98.0	*89*	*100*	*90*	*100*	*96*
#4	275	23.4	74.6	*62*	*76*		*90*	*69*
#8	254.1	21.6	53.0	*46*	*54*	*32*	*67*	*50*
#16	199.3	17.0	36.0	*30*	*38*			*34*
#30	132.4	11.3	24.7	*21*	*29*			*25*
#50	90	7.7	17.0	*14*	*21*			*17*
#100	78.4	6.7	10.3	*6*	*14*			*10*
#200	49.8	4.2	6.04	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	70.87	6.04						
Total	1173.77	99.9						

Specifications: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: N/A

Report Reviewed By: Emily J. Rodriguez

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 12; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865G
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/11/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: None

Asphalt Content	*Job Mix Limits*	*General Limits*
8.59	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	20.2	3.3	96.7	*89*	*100*	*90*	*100*	*96*
#4	157.7	25.6	71.1	*62*	*76*		*90*	*69*
#8	127.9	20.8	50.3	*46*	*54*	*32*	*67*	*50*
#16	95.6	15.5	34.8	*30*	*38*			*34*
#30	66.4	10.8	24.0	*21*	*29*			*25*
#50	47.5	7.7	16.3	*14*	*21*			*17*
#100	39.1	6.4	9.9	*6*	*14*			*10*
#200	23.5	3.8	6.02	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	37.05	6.02						
Total	614.95	99.9						

Specifications: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: Core had additional emolsion type material around sides of core, which could impact Asphalt Content.

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 13; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865H
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/11/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: None

Asphalt Content	*Job Mix Limits*	*General Limits*
8.44	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	16.7	3.5	96.5	*89*	*100*	*90*	*100*	*96*
#4	108.9	23.1	73.4	*62*	*76*		*90*	*69*
#8	95.6	20.3	53.1	*46*	*54*	*32*	*67*	*50*
#16	76.9	16.3	36.8	*30*	*38*			*34*
#30	53.7	11.4	25.4	*21*	*29*			*25*
#50	38.3	8.1	17.3	*14*	*21*			*17*
#100	32	6.8	10.5	*6*	*14*			*10*
#200	18.7	4	6.59	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	31.09	6.59						
Total	471.89	100.1						

Specifications: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: Core had additional emolsion type material around sides of core, which could impact Asphalt Content.

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 14; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865I
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/12/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: ASTM D2172 Method A

Asphalt Content	*Job Mix Limits*	*General Limits*
7.58	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	22.5	4.5	95.5	*89*	*100*	*90*	*100*	*96*
#4	109.3	21.8	73.7	*62*	*76*		*90*	*69*
#8	107.1	21.4	52.3	*46*	*54*	*32*	*67*	*50*
#16	79.1	15.8	36.5	*30*	*38*			*34*
#30	53.5	10.7	25.8	*21*	*29*			*25*
#50	38.8	7.7	18.1	*14*	*21*			*17*
#100	33.1	6.6	11.5	*6*	*14*			*10*
#200	20.5	4.1	7.44	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	37.28	7.44						
Total	501.18	100.0						

Notes: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: N/A

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 15; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865J
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/12/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: None

Asphalt Content	*Job Mix Limits*	*General Limits*
7.66	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	83	7.7	92.3	*89*	*100*	*90*	*100*	*96*
#4	298.7	27.8	64.5	*62*	*76*		*90*	*69*
#8	183.9	17.1	47.4	*46*	*54*	*32*	*67*	*50*
#16	142.3	13.3	34.1	*30*	*38*			*34*
#30	112.2	10.5	23.6	*21*	*29*			*25*
#50	82	7.6	16.0	*14*	*21*			*17*
#100	68.7	6.4	9.6	*6*	*14*			*10*
#200	39.5	3.7	5.83	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	62.6	5.83						
Total	1072.9	99.9						

Specifications: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: N/A

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D214187
Material:	Core No. 16; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865K
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/12/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: None

Asphalt Content	*Job Mix Limits*	*General Limits*
7.79	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	47.5	4.1	95.9	*89*	*100*	*90*	*100*	*96*
#4	295.4	25.2	70.7	*62*	*76*		*90*	*69*
#8	230.1	19.7	51.0	*46*	*54*	*32*	*67*	*50*
#16	172.2	14.7	36.3	*30*	*38*			*34*
#30	129.5	11.1	25.2	*21*	*29*			*25*
#50	96.5	8.2	17.0	*14*	*21*			*17*
#100	81.1	6.9	10.1	*6*	*14*			*10*
#200	46.5	4	6.13	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	71.81	6.13						
Total	1170.61	100.0						

Specifications: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: N/A

Emily J. Rodriguez

Report Reviewed By:

PDF

3348 Route 208, Campbell Hall, NY 10916
Phone: 845-496-1600 Fax: 845-496-1398
12960 Commerce Lake Drive, A14, Fort Myers, FL 33913
42 Day Farm Road, West Stockbridge, MA 01266
1813 State Route 7, Harpursville, NY 13787

Client:	HNTB Corporation	**Project**	TZ Hudson River Crossing D2141
Material:	Core No. 19; 9.5 mm Rosphalt	**Project Number:**	130419
Source:	Tilcon NY Inc., Riverdale	**Lab Number:**	20-0865L
Location:	In-Place	**Item Number:**	No Specification
Date Sampled:	6/23/2020	**Sampled By:**	Advance Testing
Date Tested:	8/12/2020	**Tested By:**	John Brinsfield

Extraction Test of Bituminous Paving Mixture - Centrifuge Method with Ash Correction

Test Method: None

Asphalt Content	*Job Mix Limits*	*General Limits*
7.06	*7.55*	

Sieve	*Mass*	*%Ret.*	*% Pass*	*Job Mix Limits*		*General Limits*		*Target*
2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1 1/2"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
3/4"	0	0.0	100.0	*100*	*100*	*100*	*100*	*100*
1/2"	0	0.0	100.0	*100*	*100*	*97*	*100*	*100*
3/8"	14.3	2.8	97.2	*89*	*100*	*90*	*100*	*96*
#4	132.6	26.0	71.2	*62*	*76*		*90*	*69*
#8	91.5	17.9	53.3	*46*	*54*	*32*	*67*	*50*
#16	78.8	15.4	37.9	*30*	*38*			*34*
#30	56.7	11.1	26.8	*21*	*29*			*25*
#50	40.4	7.9	18.9	*14*	*21*			*17*
#100	34.2	6.7	12.2	*6*	*14*			*10*
#200	21.8	4.3	7.90	*4.9*	*8.9*	*2*	*10*	*6.9*
pan	40.34	7.90						
Total	510.64	100.0						

Notes: The entire remaining sample was utilized for testing after the completion of Bulk Specific Gravity Testing and Maximum Theoretical Specific Gravity Testing.

Comments: N/A

Report Reviewed By: Emily J. Rodriguez

PDF

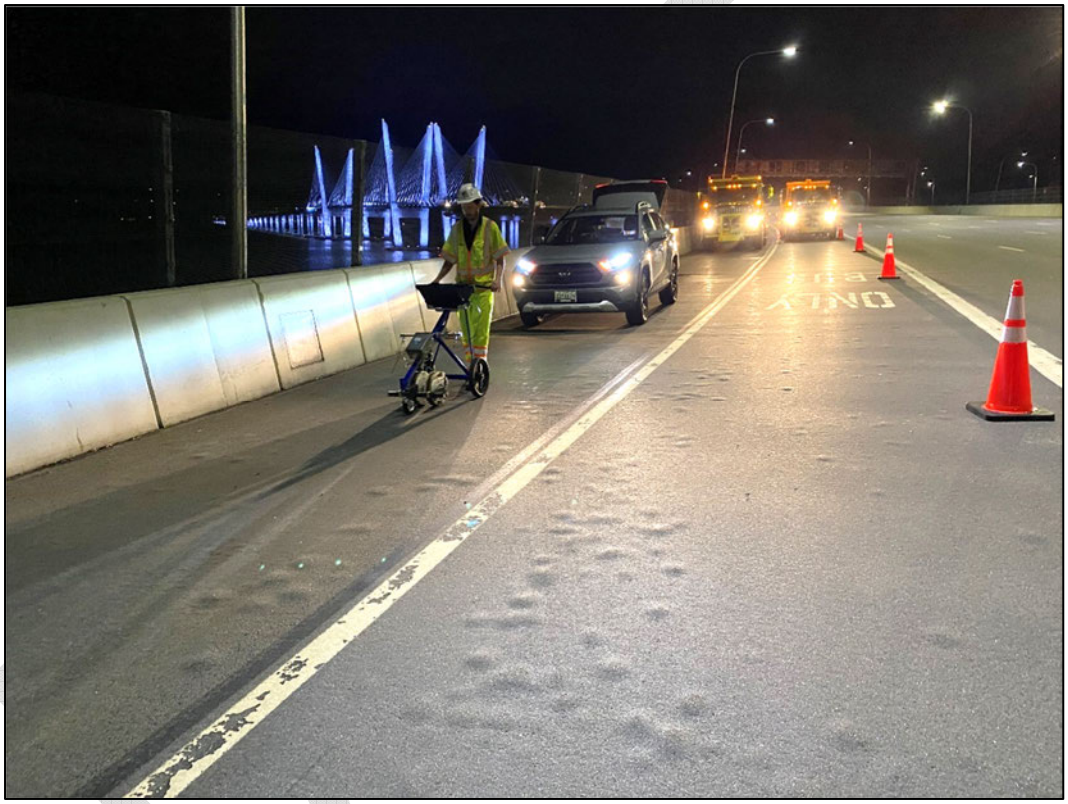
Appendix F

November 2020 Report from Olson Engineering

Olson ENGINEERING

Corporate Office:
12401 W. 49th Avenue
Wheat Ridge, CO 80033 USA
phone: 303.423.1212
fax: 303.423.6071

NONDESTRUCTIVE EVALUATION (NDE) INVESTIGATION
ROSPHALT OVERLAID BRIDGE DECK CONDITION ASSESSMENT
SONIC SURFACE SCANNER – IMPACT ECHO AND SPECTRAL ANALYSIS OF SURFACE WAVES TESTING (S^3-IE/S^3-SW)
SHARED USE PATH AND MAIN LANES OF GOVERNOR MARIO M. CUOMO BRIDGE
I-287 THRUWAY OVER THE HUDSON RIVER
NEW YORK STATE THRUWAY AUTHORITY
TARRYTOWN, NEW YORK



Prepared for:
Bittner-Shen Consulting Engineers, Inc.
921 SW Washington St., Suite 765
Portland, Oregon 97205

Attn: Mr. Robert Bittner, PE
Phone: 503-766-3562
Email: rbb@bittner-shen.com

Olson Engineering Job No. 6794A
November 3rd, 2020

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY 1
2.0 INTRODUCTION AND PROJECT BACKGROUND 4
3.0 NONDESTRUCTIVE TESTING RESULTS 8
3.1 Point-by Point IE and SASW Results 8
3.1.1 *IE Test Results* 9
3.1.2 *SASW Test Results* 12
3.2 Sonic Surface Scanner (S^3-IE) Test Results 14
3.3 Sonic Surface Scanner (S^3-IE) Results Discussion 16
3.4 Sonic Surface Scanner (S^3-IE) Test Results – Belvedere Transition Tapers 23
4.0 SONIC SURFACE SCANNER - IMPACT ECHO TEST METHOD DESCRIPTION 27
5.0 CLOSURE 29

APPENDIX A: S^3-IE Results – Shared Use Path (SUP)
APPENDIX B: S^3-IE Results – Westbound Bridge
APPENDIX C: S^3-IE Results – Eastbound Bridge

1.0 EXECUTIVE SUMMARY

Project Background and Scope

Olson Engineering was contracted by Bittner-Shen Consulting Engineers, Inc., to provide a Nondestructive Evaluation (NDE) investigation of the asphalt-overlaid bridge deck of the Governor Mario M. Cuomo Bridge which carries I-287 over the Hudson River in Tarrytown, New York. The primary focus of the investigation was to evaluate the effectiveness of NDE methods and assess and map potential internal flaws in the asphalt (~1.5 inches of Rosphalt 50) overlay on a waterproofing membrane on the concrete bridge deck panels to provide insight on unusual "blistering" observed on the surface of the asphalt overlay. The field testing was completed by Mr. Patrick Miller, Senior Engineer and Project Manager, and Ms. Lyndsay Hazelwood, Project Geologist, during nighttime hours from June 22 through the early morning hours of June 26, 2020.

Comparison of IE and SASW Test Method Application

The Impact Echo (IE) and Spectral Analyses of Surface Waves (SASW) NDE methods were evaluated for effectiveness in identifying the blisters in this investigation. The detailed evaluation of IE and SASW data from a point-by-point test study and from the overall data collected indicate that the IE method was an effective tool at identifying the blisters, while the SASW method was NOT found to be an effective tool. Olson surmises that these results are due primarily to the Rosphalt material being relatively thin (nominally 1.5 inches thick) and seemingly significantly stiffer than typical asphalt pavements (particularly given the surface test temperature of approximately 80° F). Olson found the Rosphalt blisters to behave similar to near surface delaminations of a bare concrete deck, indicating a significantly lower than expected IE resonance where it was debonded from the underlying concrete deck system. The SASW data had trouble detecting such a thin layer and often provided non-coherent data on the anomalies, due to the nature of the very shallow delamination. Therefore, the IE method was selected for full data processing and the SASW data was not used to assess the bonding/debonding conditions of the Rosphalt overlay.

S^3-IE Rosphalt 50 Blister/Bonding Condition Assessment Results

The S^3-IE results were used for the evaluation of the Rosphalt/bridge deck blisters and are presented graphically in Appendices A – C for each tested section with IE tests being conducted every 6 inches along longitudinal scan lines spaced 1 ft apart. Due to the varying deck thickness, all IE data was normalized for data evaluation/plotting purposes (average thickness of each scan line equal to a value of 1). The S^3-IE results indicate that every tested area (generally selected for scanning to assess conditions with high visible blister frequency) has some Questionable and Poor results (blisters). Based upon a geostatistical analysis using a Monte-Carlo simulation, Olson estimates that the S^3-IE testing was able to detect approximately 60 % of existing blisters due to the size (diameters) of the anomalies and the spacing of the testing grid (see Section 3.3 for further discussion). The percentage of square footage of Questionable and Poor results (blisters) within each selected test area ranged from 0.5% to 5.9% (see Table 3 in Section 3.3). Conversely then,

from 94.1% to 99.5% of the Rosphalt was found to have good contact/bonding conditions to the underlying tack coat/membrane/concrete deck, despite being generally some of the "worst" areas for visible blistering. The plots in the Appendices present an exaggeration of the statistical results based on the smoothing interpolation. Red areas (Poor conditions) in the presented plots generally represent larger diameter blisters while the yellow areas would generally represent smaller diameter blisters.

2.0 INTRODUCTION AND PROJECT BACKGROUND

Olson Engineering was contracted by Bittner-Shen to provide a Nondestructive Evaluation (NDE) investigation of the asphalt-overlaid bridge deck of the Governor Mario M. Cuomo Bridge which carries the I-287 Thruway over the Hudson River at Tarrytown, New York. The primary focus of the investigation was to evaluate the effectiveness of NDE methods and assess and map potential internal flaws in the asphalt (Rosphalt 50) bonding to the waterproofing membrane covered bridge deck to provide insight on unusual "blistering" observed on the surface of the asphalt overlay. The thin membrane is made up of a Stirling Lloyd Products, Inc. system consisting of a PAR1 Primer to bond to the underlying concrete deck plus 2 coats of Eliminator waterproofing membrane covered by SA1030 Tack Coat. The field testing was completed by Mr. Patrick Miller, PE, Senior Engineer and Project Manager, and Ms. Lyndsay Hazelwood, Project Geologist, from June 22 through the AM hours of June 26, 2020 (both are also certified for NBIS safety inspections of in-service bridges) with support from HNTB on-site project personnel.

The bridge deck of the Governor Mario M. Cuomo Bridge is comprised typically of precast concrete deck panels overlaid with a thin waterproofing membrane with a tack coat and covered by the asphalt overlay product, Rosphalt 50. The concrete deck section varies in thickness due to concrete haunches over the steel girders. The structure consists of two separate bridges (Eastbound and Westbound) each of which has a bus lane as well as 4 travel lanes. In addition, the Westbound structure has a Shared Use Path (SUP) lane for bike and pedestrian traffic on the outside (North) of the bridge. The SUP lane is coated with an approximately 1/8-inch-thick membrane layer (methyl-methyl acrylate, MMA), which is blue in color, over the Rosphalt. We understand that raised "blisters" began to develop on the surface shortly after the placement of the Rosphalt a few years ago. The "blisters" were primarily observed in the SUP lane, presumably due to ease of walking access. We understand per HNTB that micro-milling of the Roshpalt blisters in the SUP temporarily eliminated the blisters, but the blisters reappeared within a few weeks, although it is unclear if they are the same blisters that existed previously as no mapping was done prior to micro-milling. The blisters are typically 4 to 8 inches in diameter and less than ½" in height and at this time have been observed throughout the SUP, right shoulder and bus lane and left shoulder and lane of the westbound lanes, and right shoulder and bus lane of the eastbound lanes which were scanned in this investigation. A photograph of the blisters, best observed at night looking toward vehicle headlights, is shown below in Figure 1 and they can be seen on the cover of this report as

well along with the Sonic Surface Scanner (S^3). Olson has not previously encountered blistered asphalt pavement defects such as these. Informal, project-anonymous conversations by our Chief Engineer Larry Olson with several asphalt pavement engineers at the Transportation Research Board Annual Meeting in January earlier this year in Washington DC found only one who had heard of asphalt blistering and that was on a tennis court in Alabama.

Figure 1. The "blisters" in question. Blisters are typically 4 to 8 inches and diameter and are observed throughout the bridge; however, the frequency of blisters varies from span to span.

The NDE investigation was performed using Olson Engineering's Sonic Surface Scanner (S^3) to perform Impact Echo (IE) testing (after ASTM C1383) and Spectral Analysis of Surface Waves (SASW) testing (ACI 228.2R). The S^3 equipment is shown in Figure 2 below. Testing was performed longitudinally on the westbound bridge in portions of the Shared Use Path (SUP), and main lanes consisting of the right shoulder and bus lane and left shoulder and left lane. Testing was performed longitudinally on the eastbound bridge in the right shoulder and bus lane. Test lines were performed at nominally 1-foot transverse spacing, while individual tests were acquired every 6 inches as the system was rolled along the deck surface. Additional IE and SASW tests were

performed on a limited point-by-point basis using an Olson Instruments NDE 360, IE-1 test head, and SASW bar to evaluate signature responses of visibly blistered and sound areas. The point by-point study is discussed in detail in Section 3.1 below.

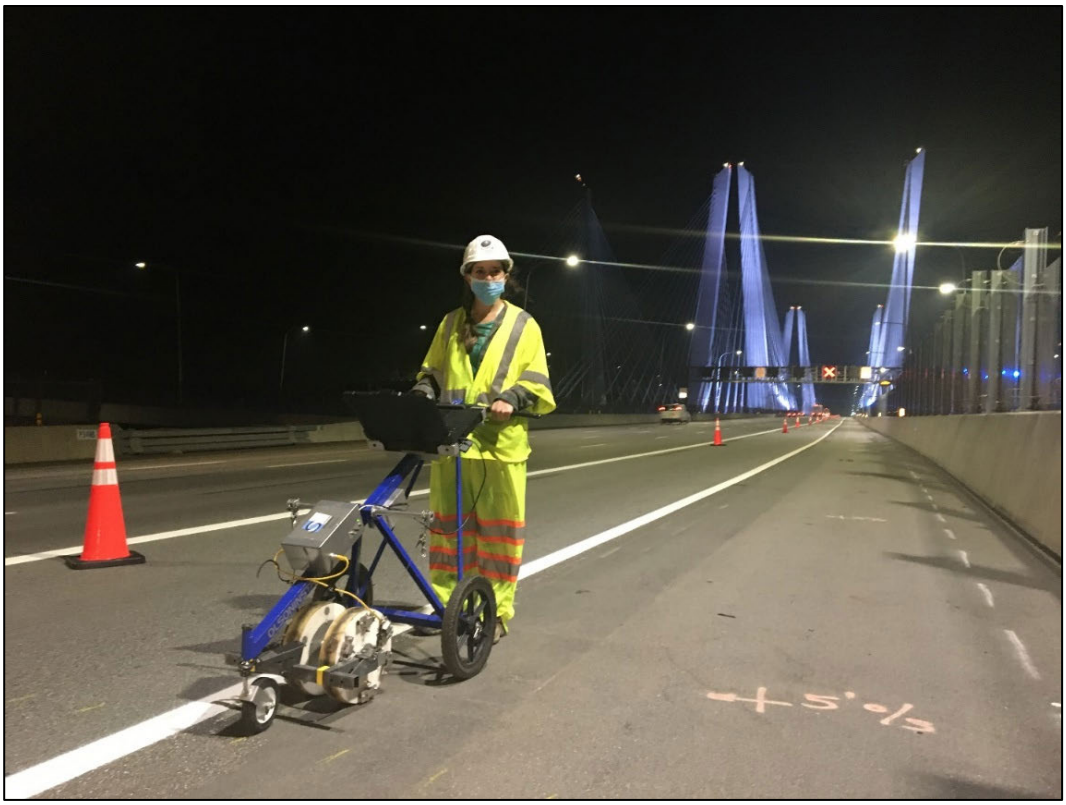


Figure 2. Photo of the S^3-IE/SW transducer wheels, cart and computer for data acquisition on the Westbound structure. Note that the transducer wheels are spaced 6 inches apart with an IE test on the right wheel and SASW tests between the two wheels simultaneously conducted every 6 inches along the scan lines as the cart was slowly walked along the bridge deck.

The IE method is mostly sensitive to cracking/delamination/debonding parallel to the test surface and is also capable of detecting internal voids and honeycombs. The method involves applying a low-strain impact (tap) using a small impact solenoid and recording the deck surface response with a displacement transducer. The resonant frequency for sound overlaid decks is a function of the deck thickness and wave velocity. Typically, if all elements of a deck are well-bonded, the IE results will exhibit well damped, medium amplitude signals which produce sharp and consistent resonant frequencies that indicate the full thickness of the slab. Near surface delaminations/debonds typically create low frequency, higher amplitude vibrations (flexural

resonance) that result in an apparent thickness increase of the section without the compressional wave full-depth resonant echo. Further explanation of the IE test method can be found in Section 5.0 below.

The SASW method is mostly sensitive to cracking perpendicular to the test surface or changes in layered velocity/contact conditions. The method involves applying a low-strain impact (tap) using a small impact solenoid and analyzing the dispersion of the surface wave using two nearby displacement transducers at a known spacing. The dispersion curve (wavelength vs. velocity) for sound overlaid decks is a function of the asphalt overlay and underlying concrete deck surface wave velocity and is often found to be relatively constant through the pavement section for stiffer, colder asphalt. Near surface delaminations/debonds (either at an asphalt/concrete interface or at potentially corroding reinforcing bar within the concrete) create an abrupt drop in surface wave velocity at the approximate depth of the anomaly.

Based upon Olson's prior experience testing bridge decks, we have found that the IE method is best suited to bare concrete decks and is less effective on decks with asphalt overlay, particularly on thick overlays and at warmer temperatures (above 70°). On past projects we have found that the SASW method is the better assessment tool for asphalt overlaid concrete decks to identify asphalt overlay/concrete debonding and deeper delamination due to corrosion of the top and bottom reinforcing steel in the concrete deck itself. However, due to the uniqueness of this project, with a relatively thin, hard, low-porosity asphalt layer (Rosphalt) and anomalies presenting at the test surface, Olson was not sure which test would provide the best assessment without testing in the field. Therefore, the S^3 system was set to simultaneously perform both IE and SASW testing at each test point for post-processing evaluation of the results of the two methods.

3.0 NONDESTRUCTIVE TESTING RESULTS

3.1 Point-by Point IE and SASW Results

A point-by-point IE and SASW study was conducted on a section of the eastbound lanes in order to establish baselines for interpreting the S^3 data. The tests utilized an Olson Instruments NDE 360 data acquisition system, IE-1 test head (shown in Figure 3 below) as well as an SASW test bar. IE and SASW tests were performed at a total of 28 locations across 4 individual blisters of varying size (4" – 7.5" diameter) on the centers and edges of the blisters as well as in incremental distances on visibly sound Rosphalt away from and between the blisters. The testing was performed to further understand the anomaly data signature and to investigate how far the anomalies extended (if at all) beyond the visual apparent boundaries of the blister. Figure 4 presents a photograph of the tested blisters. The approximate edge of the blister was outlined with yellow lumber crayon and the blisters were numbered left to right.

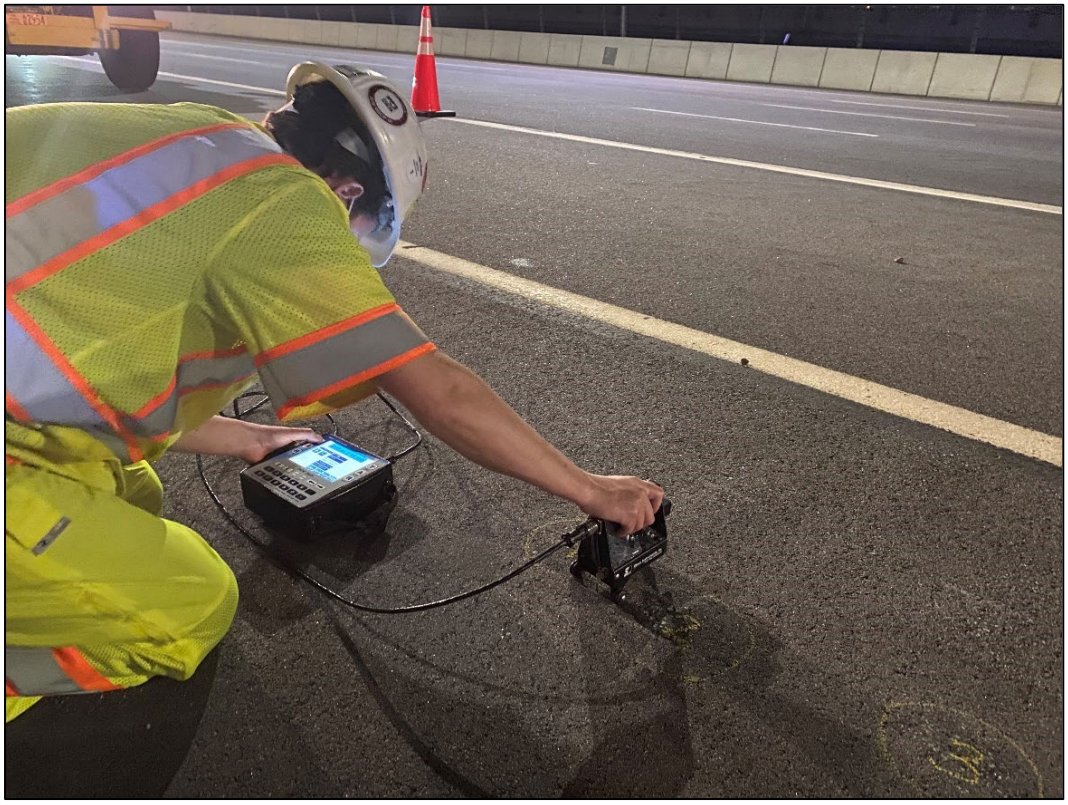


Figure 3. IE testing on individual blisters with an Olson Instruments NDE 360 data acquisition system and IE-1 test head.

Figure 4. Photograph of group of 4 blisters evaluated with point-by-point IE and SASW testing in the eastbound right shoulder.

3.1.1 *IE Test Results*

The IE results from the point-by-point study are presented below in Figure 5 with color-coded points indicating condition. Tests taken directly from the center of each blister, with the exception of the smaller 4-inch diameter blister, yielded high-amplitude, low-frequency echoes that result in a thickness calculation much higher than the expected thickness of the bridge deck. An example of this "Poor" condition is shown in Figure 6. Tests taken 1 inch or greater away from a blister yielded "Sound" IE results – with a lower signal amplitude and with a reasonably sharp, consistent frequency peak that correspond to the expected thickness of the deck at that location (see Figure 7). Tests from the edges of or in-between closely-spaced blisters yielded Questionable results with thickness echoes (frequency peaks) in-between the Sound and Poor condition results as presented in Figure 8.

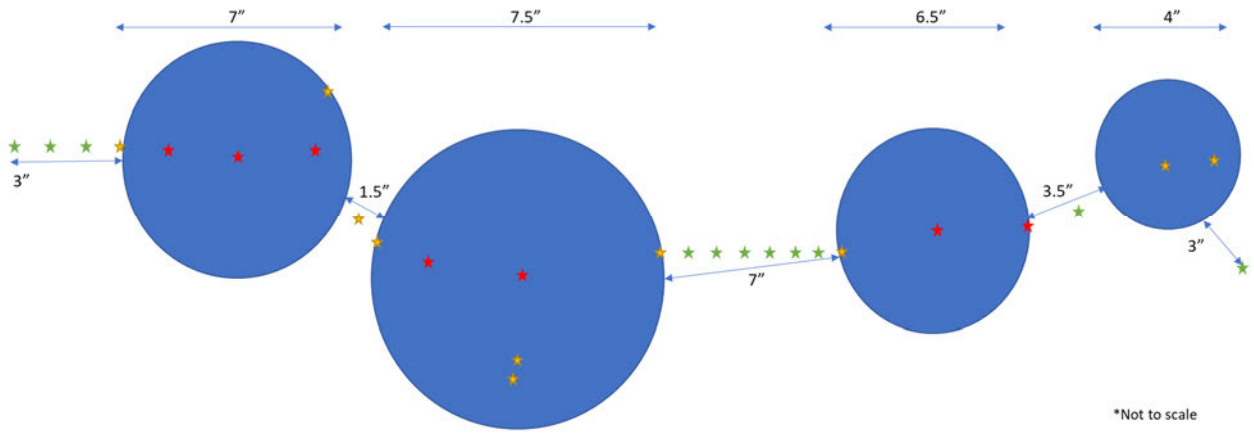


Figure 5. Schematic showing the approximate location and size of blisters shown in Figure 4 and test points, color coded by result. Green points indicate a “sound” condition, yellow points indicate a “questionable condition, and red points indicate a “poor” condition.

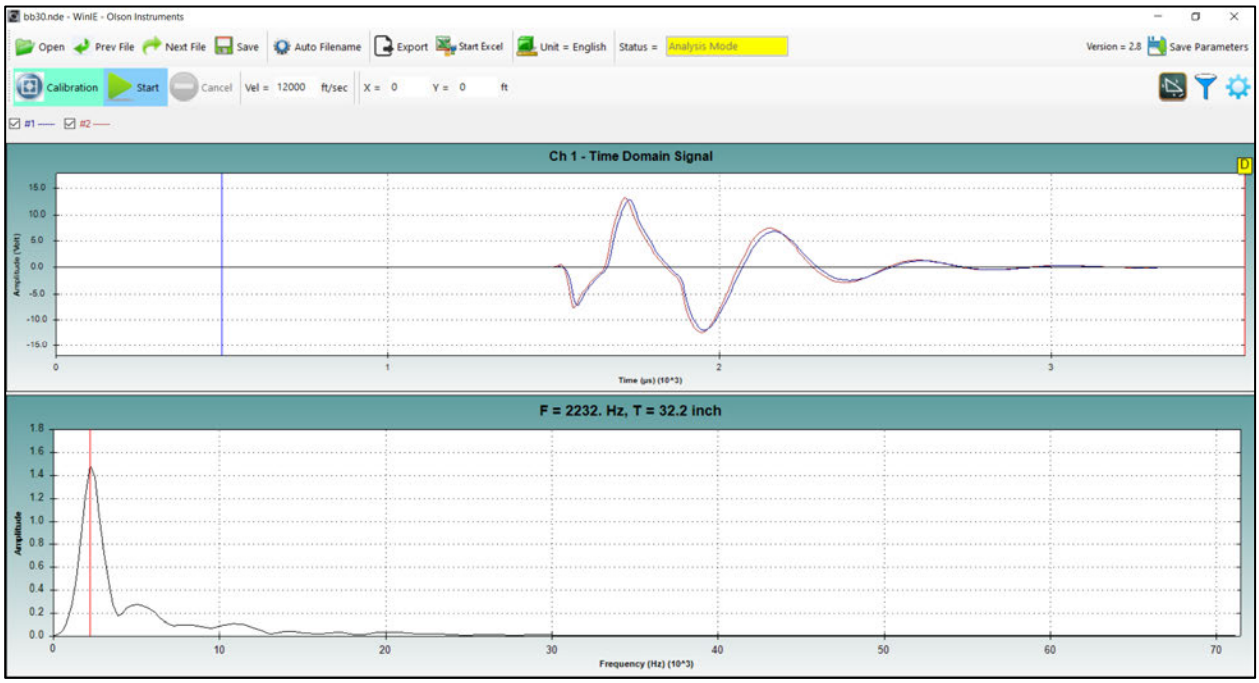


Figure 6. IE result from the center of a blister showing a high-amplitude, low-frequency echo marked by the vertical cursor at 2232 Hz in the bottom plot that corresponds to a high apparent thickness echo (32.2 inches – flexural resonance). Classified as “Poor” debonded, blistered condition. The top plot is the voltage response to the impact of the displacement transducer versus time from which FFT calculations produced the bottom linear frequency displacement spectra plot.

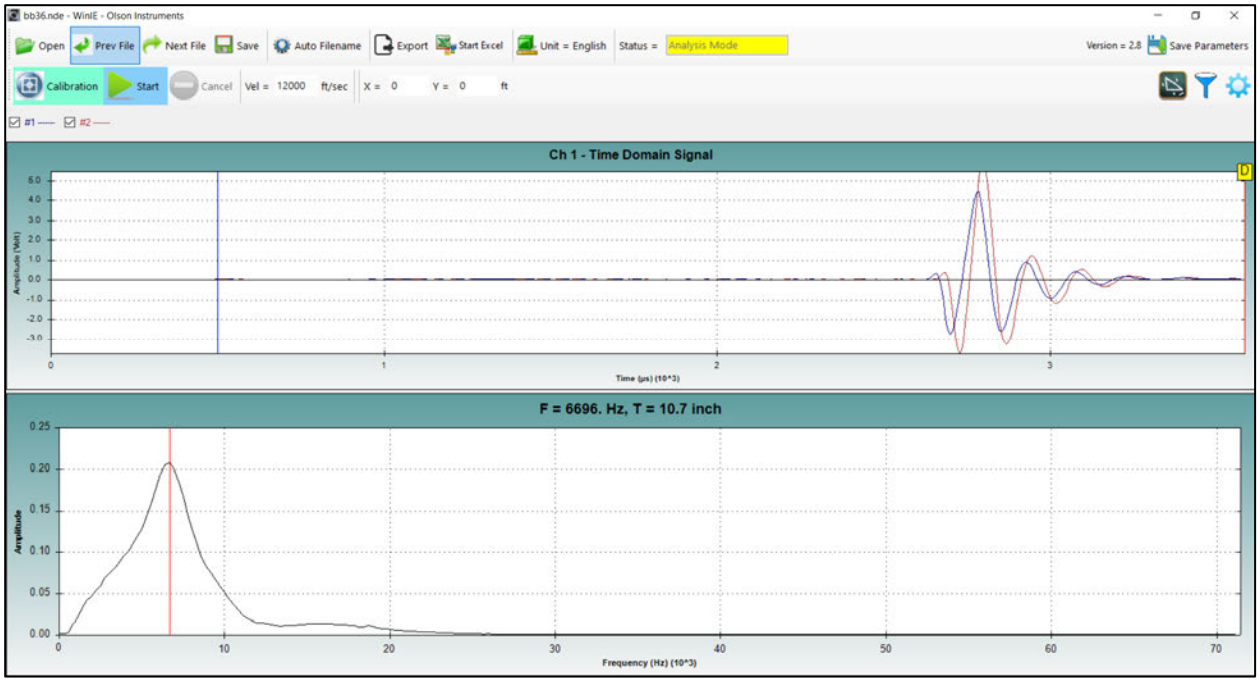


Figure 7. IE result from 2 inches off the edge of a blister that shows a typical result for "Sound" conditions with a calculated thickness matching the expected deck thickness (10.7 inches).

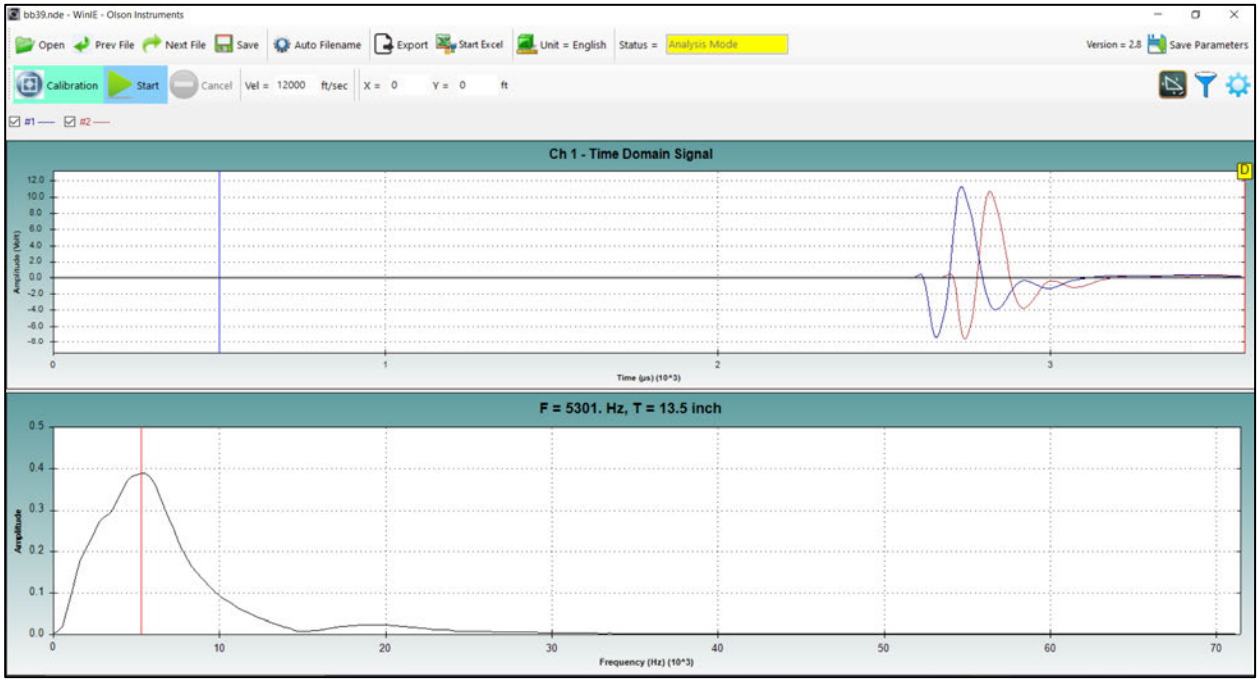


Figure 8. IE result from the edge of a blister. The slightly thick IE result (13.5 inches) indicates "Questionable" Rosphalt bonding conditions.

The point-by-point IE results clearly illustrate that the IE method is effective at detecting the blister anomalies. The results indicate that larger blisters (6+" diameter) will have a much different signature than Sound Rosphalt/concrete deck (bonded) condition areas, with a resonant frequency significantly lower than expected for blisters (calculated thickness change from 10.7 to 32.2 inches or 201% increase in these examples). The data also shows that tests on small blisters (4" diameter or less), at the edge of blisters, and the area between closely spaced blisters will have a discernable increase in calculated thicknesses (calculated thickness change from 10.7 to 13.5 inches or 26.2% increase in these examples). While testing on the centers of the larger blisters (presumably the highest part of the defect) yielded consistent "Poor" results, the height of the blister does not seem to affect detection/condition-rating as much as the diameter of the blister and/or the proximity of the test to the edge of the blister. The point-by-point IE testing confirmed the field analysis of the S^3-IE data, which also indicated that the IE test method was capable of identifying the blisters when the blisters were directly tested on with the rolling Sonic Surface Scanner.

3.1.2 *SASW Test Results*

The point-by-point SASW testing proved to be ineffective for detecting the blisters. In general, the testing performed on or partially over any blister resulted in incoherent SASW data. Note that the data quality was good; however, the phase between the two measurement transducers was typically incoherent, due to the delamination type response of the Rosphalt layer. Even the point-by-point data away from the blisters lacked coherence, possibly due to lack of excitation at higher frequencies with the small hand-held hammer impactor. Therefore, the point-by-point SASW testing was inconclusive in terms of its applicability for detecting the Rosphalt blisters.

Due to the inconclusiveness of the point-by-point study, Olson also evaluated SASW data from the S^3 system which produced more coherent SASW data with the smaller (higher frequency) solenoid impactor. We chose to evaluate a small section of the Westbound [redacted] Right shoulder, which had an area of numerous closely spaced blisters that was visually apparent and noted during field testing. The SASW dispersion curve at each test point was exported. The velocity at the approximate Rosphalt/tack coat/membrane/concrete interface was plotted for evaluation. Note, that during the evaluation the SASW data was plotted numerous ways and the full depth of data from wavelengths of 2 to 6+ inches was evaluated. Figure 9 below presents the "best" SASW

results of the area, while the IE results from the same area (larger area evaluated) are presented in Figure 10.

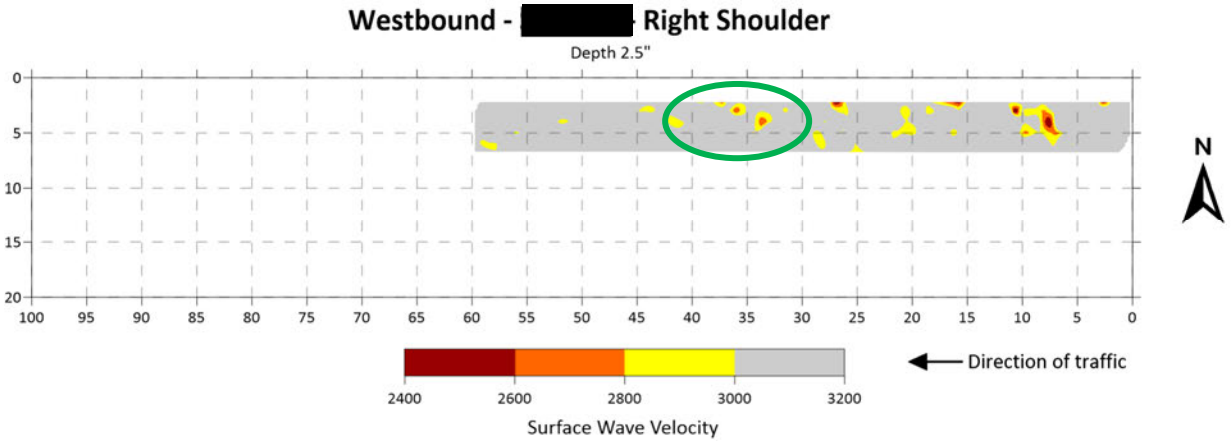


Figure 9. S³ - SASW Results of Westbound [redacted] Right Shoulder and Lane (partial). Y = 0 is at north barrier wall, X = 0 is at lamp post 17 with X increasing to the west. The green oval notes the area of significant blisters visually noted from X = 31 – 42 feet and Y = 2 – 6 feet. Slower velocities were expected to correspond to areas of blisters in the SASW results.

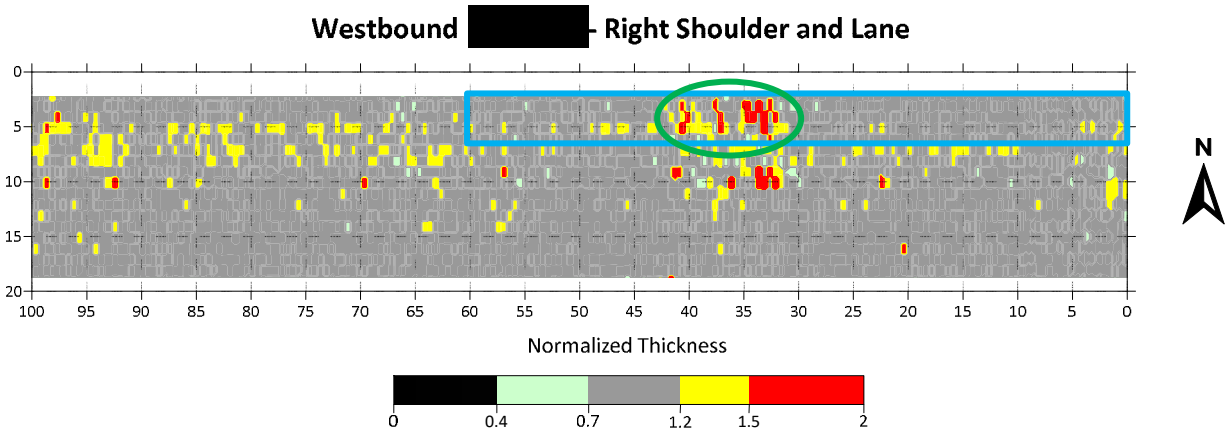


Figure 10. S³-IE Results of Westbound [redacted] Right Shoulder and Lane – comparison area in blue box. Y = 0 is at north barrier wall, X = 0 is at lamp post 17 with X increasing to the west. The green oval notes the area of significant (high-frequency) blisters visually noted from X = 31 – 42 feet and Y = 2 – 6 feet. As discussed further below in Section 3.2, red denotes a blister, yellow is an incipient/smaller blister, gray is normal bonded deck area, light green is a shallow echo not associated with blistering and black is an embedded feature such as metal scuppers, steel expansion joints, etc.

As presented in Figure 9, the Sonic Surface Scanner results of the SASW data analyses did not clearly indicate the area of a noted high concentration of blisters, whereas the IE analyses did (Figure 10). This evaluation was based on noted visual observations, as well as detailed analysis of each data point within the comparison area, where the blister signature was obvious in the IE analysis and agreed well with field notes. In general, the surface wave wavelengths of less than 1.5inches (the thickness of the fairly hard Rosphalt) were difficult to excite; therefore, the SASW information typically started right at the depth of the Rosphalt/Concrete interface or below, making the Rosphalt difficult to evaluate. Also, based upon the point-by-point study, it is likely that SASW testing on the blisters resulted in non-coherent data due to the delamination type vibratory response, and was thrown out during the analysis process. Thus, blister locations were removed from the dataset because an accurate dispersion curve could not be calculated.

[redacted]

Due to the results of the evaluation of both methods using the Sonic Surface Scanner and the point-by-point testing, the S^3-IE method was selected for full data processing and the S^3-SW processing was not conducted any further after this initial evaluation of both methods. Note that the IE data also has the advantage of being faster to analyze. On normal asphalt overlaid decks at warmer temperatures with typical overlay thicknesses of 3 inches or more the S^3-SW method has been found to be far superior to the S^3-IE method as it is difficult to get resonant echoes from warm to hot asphalt overlays.

3.2 Sonic Surface Scanner (S^3-IE) Test Results

As noted above in the project background, the thickness of the bridge deck is variable as the portions directly over steel girders are thickened by concrete haunches. Because the IE analysis

is most easily based/visualized relying on changes in apparent thickness, the expected thickness changes must be accounted for. Therefore, the thickness calculated for each data point was normalized to an average thickness of that longitudinal S^3 scan line. Based on the results from the point-by-point study presented above, observed variation along individual S^3 scan lines, and careful review of that variation, S^3-IE colors and resonant cutoff values for resonant echoes in Figure 10 above that are indicative of Sound-gray, Questionable-yellow (incipient/smaller diameter blisters) and Poor-red (larger diameter blisters) conditions were established for the IE results as follows: test points near a value of 1 (1 being the deck thickness) with a normalized range of 0.7 – 1.2) were categorized as "Sound"; test points with a normalized thickness increase of 20 – 50 % (1.2 – 1.5) above the normalized average thickness were categorized as "Questionable"; and, test points with an average thickness more than 50% greater (>1.5) than the normalized average thickness were categorized as "Poor". There were a few isolated points denoted as light green with values more than 30% below (0.4 – 0.7) the average normalized thickness, [redacted] Points more than 60% below (<0.4) the average thickness were manually selected in the data to reflect data on top of the metal scuppers, expansion joints, and other steel features such as drain-pipe covers (shown as black in Figure 10 above). The full results from the S^3-IE testing are presented in map view images in Appendices A, B, and C for the SUP, westbound and eastbound lane test areas, respectively.

[redacted]

Given the relatively small diameter of the blisters and the spacing of the test lines and wheel transducers, it was observed during the field investigation that some of the visible blisters were not captured by the S^3-IE testing (see Section 3.3 for further discussion). As the point-by-point study illustrated, a test from as little as 1 inch from the edge of a blister will likely result in a "Sound" condition rating. If additional S^3-IE testing were to be performed, IE tests could be conducted on both wheels (eliminating the SASW testing) with alternating impacts spaced at 6 inches apart for a tighter test grid spacing.

3.3 Sonic Surface Scanner (S^3-IE) Results Discussion

There are several different ways to summarize the IE data and calculate the percentage areas of blisters. First, the test points can be assessed individually as summarized in Table 1. Table 1 lists the total number of test points in each test area and the percentage of those points that indicate a Rosphalt blister. Using this approach, the blister areas are summarized as follows: 1) the tested SUP spans results range from 3.4% to 10.1% "Questionable" or "Poor" with an average of 6.1% with outliers at 9.3% and 10.1% at Spans 22 and 2, respectively 2) the tested Rosphalt overlaid Westbound spans results range from 0.4% to 4.2% "Questionable" or "Poor" with an average of 2.0% and the outlier of 0.4% at [redacted] and 3) the tested Eastbound spans results ranged from 1.0% to 2.3% "Questionable" or "Poor" with an average of 1.7%.

A separate approach is presented in Table 2, which presents the summary statistics pulled from the graphics presented in the Appendices. This summary takes into account the "natural neighbor" interpolation between test points that was performed by the plotting program "Surfer". For each area tested the percentages of each condition (Sound, Questionable, Poor and Steel Features) are listed. Note that steel features (black on the S^3-IE results plots), includes the scupper covers, expansion joints or other steel covers/items. Any 'thin' test points (green on the S^3-IE

results plots) are included in the Sound condition column of Table 2. The percentages of defect areas presented in Table 2 are similar but generally slightly lower on average than those in Table 1, with the exception of the Eastbound averages, due to consecutive test points sometimes indicating the same defect (Table 2 accounts for the test location geometry). With this approach, the blister areas are summarized as follows: 1) the tested SUP spans results range from 3.4% to 9.2% combined "Questionable" or "Poor" with an average of 2.9% with outliers at 7.7% and 9.2% at [redacted] and 2, respectively 2) the tested Rosphalt overlaid Westbound spans results range from 0.9% to 9.4% "Questionable" or "Poor" combined with an average of 1.9% and the outlier of 9.4% at [redacted], and 3) the tested Eastbound spans results ranged from 2.2% to 5.4% combined "Questionable" or "Poor" with an average of 1.9%.

Table 1: Summary of S³-IE Test Results Based on Number of Test Points

Bridge Section	Span	Lane(s)	Start Location	Test Direction	Length (ft)	Total Test Area (ft^2)	Total # of IE Test Points	# of Points Steel <0.4	# of Points Sound .4-1.2	# of Points Questionable 1.2-1.5	# of Points Poor >1.5	% of Points Steel	% of Points Sound	% of Points Questionable and Poor
SUP	[redacted]	Pedestrian	[redacted]	East	505.2	2526	3009	147	2557	274	31	4.9	85.0	10.1
SUP	[redacted]	Bike	[redacted]	East	634.9	4444	7230	3	6926	194	107	0.0	95.8	4.2
SUP	[redacted]	Pedestrian	[redacted]	East	290	1450	2013	19	1807	160	27	0.9	89.8	9.3
SUP	[redacted]	Bike	[redacted]	East	280.1	1961	3195	0	3087	65	43	0.0	96.6	3.4
SUP	[redacted]	Bike	[redacted] East end of Belvedere	East	396.5	2379	4530	0	4292	112	126	0.0	94.7	5.3
SUP	[redacted]	Bike and Pedestrian	LP 65	East	100	1000	2021	24	1908	54	35	1.2	94.4	4.4
WB	[redacted]	Right Shoulder	LP 84	West	76	608	1420	43	1280	59	38	3.0	90.1	6.8
WB	[redacted]	Right Shoulder	LP 39	West	118.4	947	2019	7	1860	136	16	0.3	92.1	7.5
WB	[redacted]	Right Shoulder and Lane	LP 17	West	171.3	2912	5856	0	5238	576	42	0.0	89.4	10.6
WB	[redacted]	Right Lane	LP 65	West	169.3	1354	2987	0	2902	78	7	0.0	97.2	2.8
WB	[redacted]	Right Lane	LP 71	West	168.8	1519	3324	0	3220	95	9	0.0	96.9	3.1
WB	[redacted]	Right Shoulder and Lane	LP 73	West	168.2	1850	3914	0	3766	126	22	0.0	96.2	3.8
WB	[redacted]	Left Shoulder and Lane	[redacted]	West	135.7	2171	1758	0	1717	39	2	0.0	97.7	2.3
WB	[redacted]	Left Shoulder and Lane	LP 27	West	81	810	4338	12	4235	75	16	0.3	97.6	2.1
WB	[redacted]	Rosphalt	[redacted]	West	87	348	861	0	845	14	2	0.0	98.1	1.9
EB	[redacted]	Right Shoulder and Lane	LP 65	East	164.2	1642	3547	0	3464	61	22	0.0	97.7	2.3
EB	[redacted]	Right Shoulder and Lane	LP 40	East	155.5	2644	5502	9	5292	167	34	0.2	96.2	3.7
EB	[redacted]	Right Lane	LP 83	East	191.6	1724	3767	0	3581	147	39	0.0	95.1	4.9
EB	[redacted]	Right Shoulder	LP 84	East	168.8	1350	2933	0	2772	107	54	0.0	94.5	5.5

Table 2: Summary of S³-IE Test Results Based on Interpolated Surfer Plots

Bridge Section	Span	Lane(s)	Start Location	Test Direction	Length (ft)	Total Test Area (ft^2)	Steel Features (% area)	Sound (% area)	Questionable (% area)	Poor (% area)
SUP	[redacted]	Pedestrian	[redacted]	East	505.2	2526	4.2	86.6	8.3	0.9
SUP	[redacted]	Bike	[redacted]	East	634.9	4444	0.1	96.0	2.7	1.3
SUP	[redacted]	Pedestrian	[redacted]	East	290	1450	0.9	91.4	6.7	1.0
SUP	[redacted]	Bike	[redacted]	East	280.1	1961	0.0	96.6	2.3	1.0
SUP	[redacted]	Bike	[redacted] East end of Belvedere	East	396.5	2379	0.0	94.0	3.1	2.8
SUP	[redacted]	Bike and Pedestrian	LP 65	East	100	1000	1.1	94.7	2.8	1.5
WB	[redacted]	Right Shoulder	LP 84	West	76	608	2.8	93.0	3.3	0.8
WB	[redacted]	Right Shoulder	LP 39	West	118.4	947	0.4	94.0	5.0	0.6
WB	[redacted]	Right Shoulder and Lane	LP 17	West	171.3	2912	0.0	90.6	8.8	0.7
WB	[redacted]	Right Lane	LP 65	West	169.3	1354	0.0	97.6	2.1	0.2
WB	[redacted]	Right Lane	LP 71	West	168.8	1519	0.0	97.4	2.4	0.3
WB	[redacted]	Right Shoulder and Lane	LP 73	West	168.2	1850	0.0	96.7	2.8	0.5
WB	[redacted]	Left Shoulder and Lane	[redacted]	West	135.7	2171	0.2	95.1	3.9	0.8
WB	[redacted]	Left Shoulder and Lane	LP 27	West	81	810	0.0	98.1	1.8	0.08
WB	[redacted]	Rosphalt	[redacted]	West	87	348	0.0	99.1	0.8	0.1
EB	[redacted]	Right Shoulder and Lane	LP 65	East	164.2	1642	0.0	97.8	1.6	0.6
EB	[redacted]	Right Shoulder and Lane	LP 40	East	155.5	2644	0.1	96.8	2.6	0.5
EB	[redacted]	Right Lane	LP 83	East	191.6	1724	0.0	95.3	3.7	1.0
EB	[redacted]	Right Shoulder	LP 84	East	168.8	1350	0.0	94.6	3.7	1.7

*Sound includes normalized thickness data from 0.4 – 1.2

However, as stated above in Section 3.2, based upon field observations, the S^3-IE testing was not identifying every visually apparent blister, due to the size of the blisters (typically between 4 to 8 inches in diameter) and the fixed test grid spacing (0.5 feet longitudinally and 1.0 foot transversely). This is due to the defect of interest being, on average, significantly smaller than the test grid. In geostatistics, this is the so-called "nugget" effect; the test grid was not tight enough to find every nugget. Therefore, a geostatistical evaluation using a Monte-Carlo style simulation of the test grid, typical defect size, and typical concentration of defects (based upon measured test results) was performed to estimate the percentage of blisters identified/found by the S^3-IE testing. The simulation assumed a consistent average blister size of 6" diameter (based upon field observations) and an IE test point size of 1" diameter at the 1.0' x 0.5' test grid (fixed by the S^3 system). The simulation was run 100 times for three different test cases of varying observed defect density. The average simulated test results of each of the three cases were similar. The simulation indicated that 85% of positive (meaning a defect is indicated) test points were likely unique blisters, while the other 15% of positive points are likely redundant blisters. The simulation also indicated that on average 59.7% of defects were located via testing, while 40.3% were missed. The number of positive (defect) test points was scaled based upon the simulation results and is presented in Table 3. This number of positive test points, given the test area, can be used to calculate the percentage of defective (blister) area. For this calculation, a defect (blister) size of 6" in diameter is assumed. The calculated percentage area is presented in Table 3.

As observed in Table 3, the calculated defective area from the simulation area is typically less than the areas presented in Tables 1 and 2, despite the simulation showing that only approximately 60% of defects were identified. This again relates to the fundamental problem of the sampling grid not being dense enough to accurately characterize the number of small defects. The percentages presented in Table 1 assume that each test point represents an equal area of 1' x 0.5' (the sample grid) or 0.5 ft^2. However, a typical blister of 6" diameter has an area of only 0.20 ft^2. Therefore, the defective area presented in Table 1 is an over-estimate. The summary presented in Table 2, and indeed the plots themselves (presented in the Appendices), suffer from the same issue, with the interpolation indicating areas larger than the actual defects. This phenomenon is likely an advantage in the results plotting (Appendices), as it depicts the defects in a more visible manner (based on the size of the test area) even if it is an exaggeration. Olson concludes that the most accurate percent defective areas statistics are presented in Table 3. These values are

summarized as follows: 1) the SUP spans simulation results range from 1.9% to 3.6% “Questionable” or “Poor” with an average of 2.6%, 2) the Rosphalt overlaid Westbound spans results range from 0.5% to 5.9% with an average of 3.5% and the outlier of 0.5% at [redacted], and 3) the tested Eastbound spans results ranged from 1.4% to 3.3% “Questionable” or “Poor” with an average of 2.5%.

Table 3: Summary of S^3-IE Test Results Corrected with Monte-Carlo Simulation

Span	Lane(s)	Start Location	Test Direction	Length (ft)	Total Test Area (ft^2)	Total # of IE Test Points	# of Measured Questionable and Poor	Simulation Corrected # of Positive Results	Simulation Corrected Blister Area (ft^2)	Simulation Corrected Blister % Area
[redacted]	Pedestrian	[redacted]	East	505.2	2526	3009	305	434	85.3	3.4%
[redacted]	Bike	[redacted]	East	634.9	4444	7230	301	429	84.1	1.9%
[redacted]	Pedestrian	[redacted]	East	290	1450	2013	187	266	52.3	3.6%
[redacted]	Bike	[redacted]	East	280.1	1961	3195	108	154	30.2	1.5%
[redacted]	Bike	[redacted] East end of Belvedere	East	396.5	2379	4530	238	339	66.5	2.8%
[redacted]	Bike and Pedestrian	LP 65	East	100	1000	2021	89	127	24.9	2.5%
[redacted]	Right Shoulder	LP 84	West	76	608	1420	97	138	27.1	4.5%
[redacted]	Right Shoulder	LP 39	West	118.4	947	2019	152	216	42.5	4.5%
[redacted]	Right Shoulder and Lane	LP 17	West	171.3	2912	5856	618	880	172.8	5.9%
[redacted]	Right Lane	LP 65	West	169.3	1354	2987	85	121	23.8	1.8%
[redacted]	Right Lane	LP 71	West	168.8	1519	3324	104	148	29.1	1.9%
[redacted]	Right Shoulder and Lane	LP 73	West	168.2	1850	3914	148	211	41.4	2.2%
[redacted]	Left Shoulder and Lane	[redacted]	West	135.7	2171	1758	41	58	11.5	0.5%
[redacted]	Left Shoulder and Lane	LP 27	West	81	810	4338	91	130	25.4	3.1%
[redacted]	Rosphalt	[redacted]	West	87	348	861	16	23	4.5	1.3%
[redacted]	Right Shoulder and Lane	LP 65	East	164.2	1642	3547	83	118	23.2	1.4%
[redacted]	Right Shoulder and Lane	LP 40	East	155.5	2644	5502	201	286	56.2	2.1%
[redacted]	Right Lane	LP 83	East	191.6	1724	3767	186	265	52.0	3.0%
[redacted]	Right Shoulder	LP 84	East	168.8	1350	2933	161	229	45.0	3.3%

* Simulation corrected blister area assumes 6” diameter blisters.

3.4 Sonic Surface Scanner (S^3-IE) Test Results – Belvedere Transition Tapers

Testing using the S^3-IE system was also performed on both 'Tides of Tarrytown' Belvedere #6 concrete transition tapers. The testing was performed on a 1-foot transverse spacing across the full lane width (scans from 1 to 11 feet). The tapers were measured to be 5'4" in length. The total concrete thickness (taper and bridge deck) was found to be approximately 20 inches at the top of the taper and sloping to approximately 13.5 inches at the taper toe. Delaminations/debonds typically create low frequency, higher amplitude vibrations (flexural resonance) that result in an apparent thickness increase of the section. Therefore, the debonded areas register as thicker than the maximum belvedere transition thickness (>20 inches) and are shown as red in the results figures below. The S^3-IE results indicate extensive delamination of both concrete tapers from the concrete bridge deck. The delaminations are concentrated at the 'toe' (thinnest) of the tapers. Figure 12 presents a simulated example of the expected tapers test results for sound deck conditions, while Figures 13 and 14 present the measured data from the East and West tapers, respectively, which shows extensive delamination of both concrete tapers.

Figure 11. Transition taper at Belvedere #6 showing the S³-IE system at X=0 (top of the taper, West). Scans run West to East down the taper.

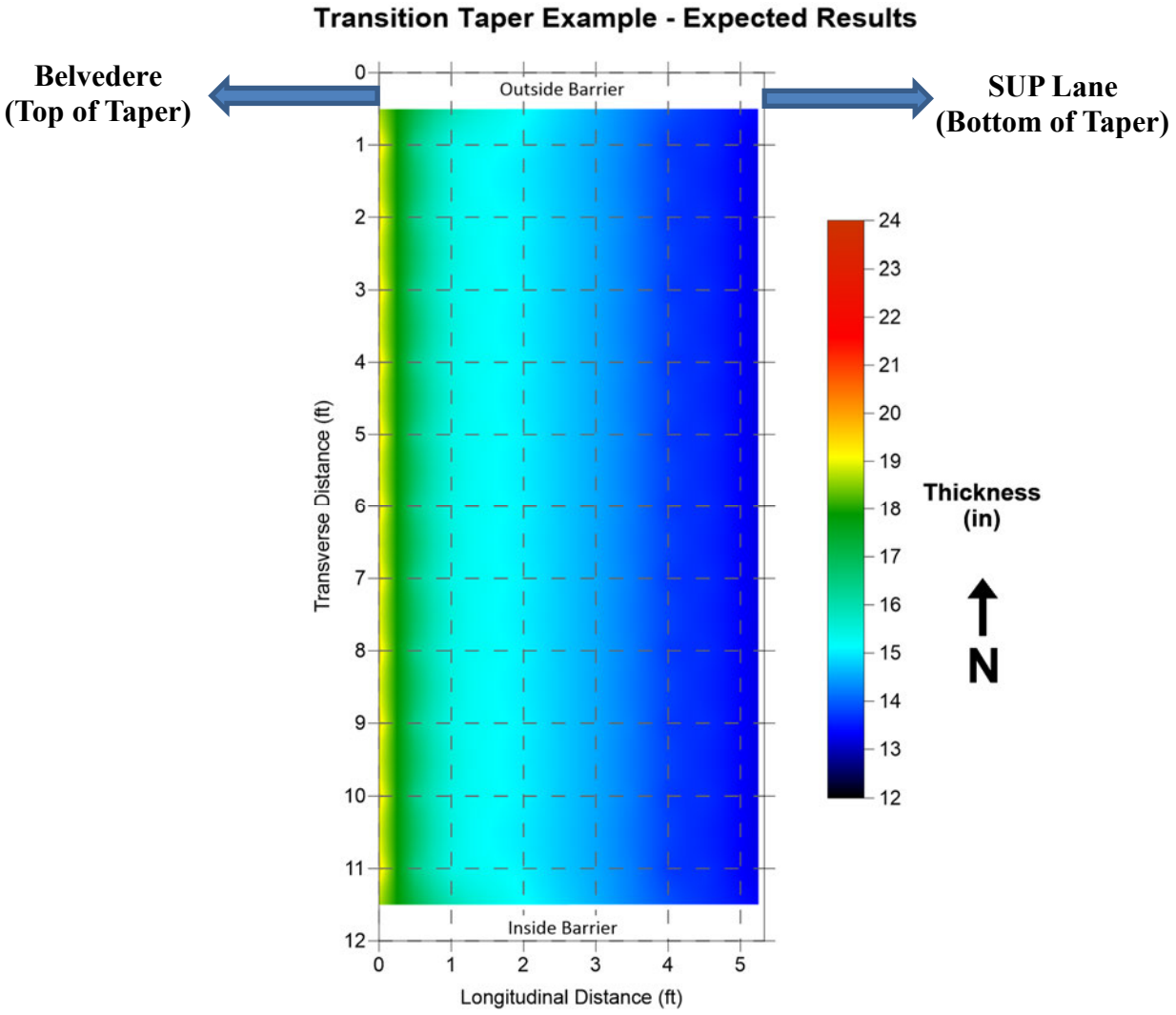


Figure 12. Simulated S³-IE Results of a Belvedere #6 transition taper to illustrate the expected results for sound deck conditions. X = 0 is at the top of the taper, Y = 0 (top) is at the North outside barrier wall.

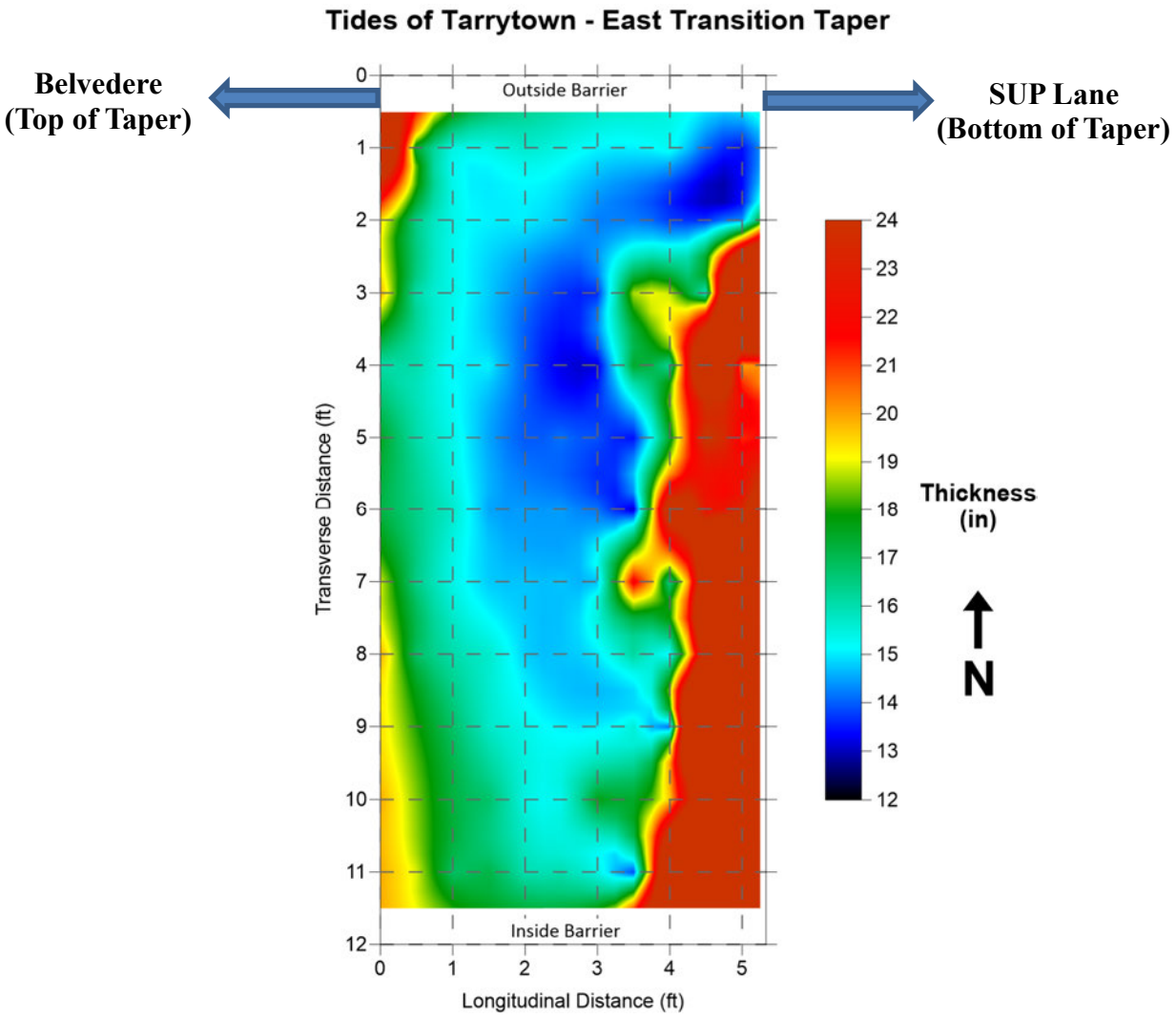


Figure 13. S^3-IE Results of Tides of Tarrytown Belvedere #6 East transition taper. X = 0 is at the top of the taper, Y = 0 (top) is at the North outside barrier wall. The red areas (increased apparent thickness due flexural resonance from the debond) indicate the approximate area of significant delamination.

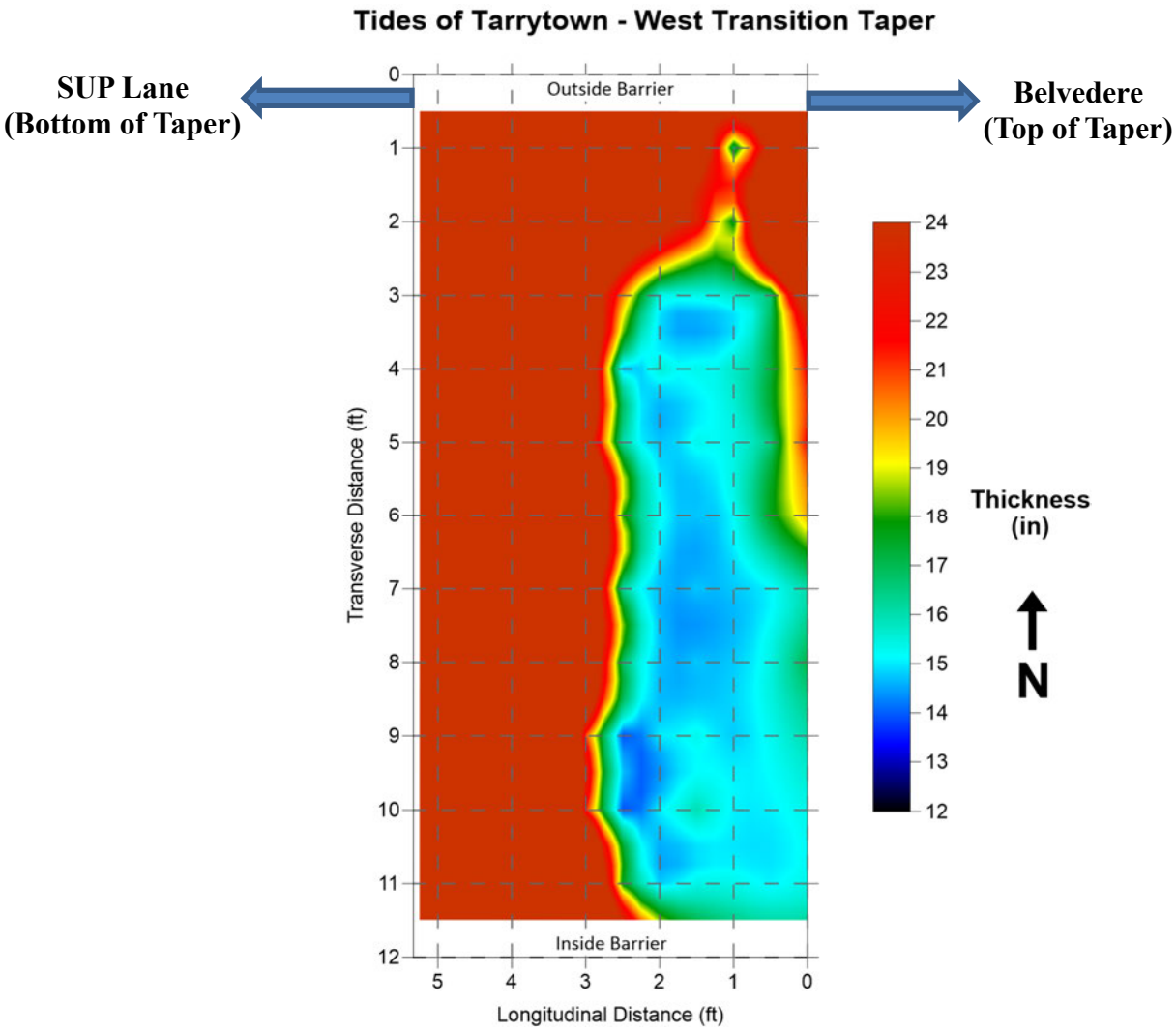


Figure 14. S^3-IE Results of Tides of Tarrytown Belvedere #6 West transition taper X = 0 (right) is at the top of the taper, Y = 0 (top) is at the North outside barrier wall. The red areas (increased apparent thickness due flexural resonance from the debond) indicate the approximate area of significant delamination.

4.0 SONIC SURFACE SCANNER - IMPACT ECHO TEST METHOD DESCRIPTION

The IE method (ASTM C1383) involves impacting the concrete surface with a small solenoid impactor or similar and identifying the reflected wave energy with a displacement or accelerometer receiver mounted on the surface near (within 50 mm, 2 inches) the impact point. A simplified diagram of the method is presented in Figure 15 for point-by-point testing. For concrete thinner than 18 to 24 inches, a solenoid impactor is used to impact the concrete and the resulting displacement response of the receiver is recorded. The resonant echoes are usually not apparent in the time domain. The resonant echoes are more easily identified in the frequency domain. Consequently, the time domain test data are processed with a Fast Fourier Transform (FFT) which allows identification of frequency peaks (echoes). The displacement spectrum of the receiver or the transfer function (receiver displacement output/hammer force input vs. frequency) are used to determine the resonant peaks. If the thickness of a structural member is known, the IE compressional wave velocity (V_P) and member echo thickness can be determined by the following equations:

$$V_P = 2*d*f/\beta \text{ and} \quad (1)$$

$$d = \beta*V_P/(2*f) \quad (2)$$

where d = slab thickness, f = resonant frequency peak. The above equation is modified by a β (Beta) factor of 0.96 for walls and slabs and a typical factored IE velocity for slab concrete is 12,500 ft/s. Delaminations are indicated by low frequency flexural resonances that correspond to greater than expected thicknesses and also by high-amplitude responses in the time domain.

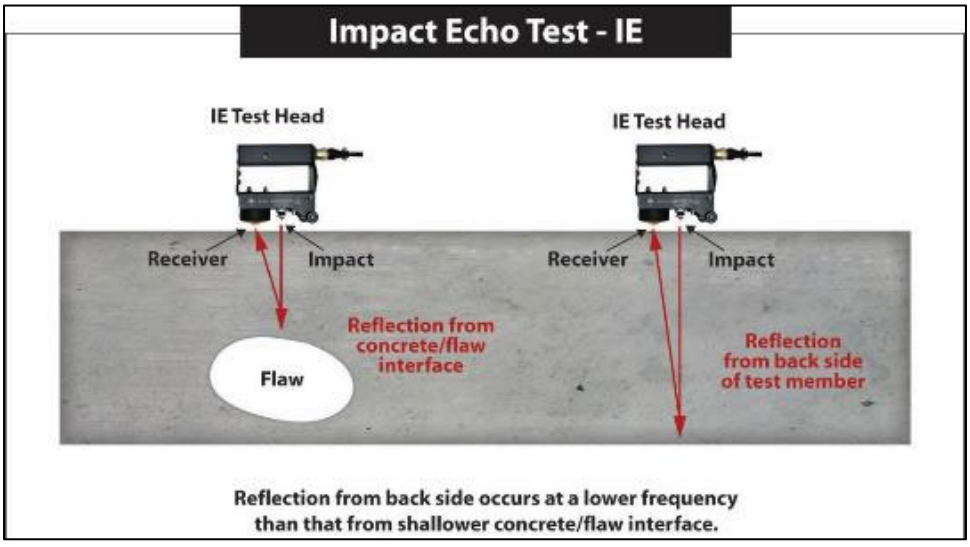


Figure 15. Illustration of Impact Echo (IE) Test Method – point-by-point testing.

The S^3 performs an IE and SASW test at each test location (6 inch intervals) as rolled along the surface when the brass displacement transducers are lined up with an IE test conducted with an impact from the solenoid on the right wheel and an SASW test connected between the wheels spaced 6 inches apart for this study. The S^3 system is used to perform extensive IE and SASW testing on asphalt overlaid concrete decks and asphalt pavements. The Sonic Surface Scanner (S^3) is shown in Figure 16 where the wheels are offset 30 degrees to allow for alternating impacts of the solenoids on the left and right wheels for impact echo testing only on bare concrete decks typically.

Figure 16. Sonic Surface Scanner (S^3) for slow-rolling Impact Echo (and Surface Waves) Scanning of Concrete Decks/Slabs and Asphalt Pavements with tests every 6 inches – note solenoid impactors on sides of sensor wheels and brass displacement transducers on wheel surface that are offset 30 degrees for alternating IE tests on the left and right wheels as it is rolled along.

5.0 CLOSURE

The field portion of this NDE investigation was performed in accordance with generally accepted testing procedures. If additional information is developed that is pertinent to the findings of this investigation or we can provide any additional information or consultation on potential repairs or further investigation, please contact our office.

Respectfully submitted,

OLSON ENGINEERING, INC.

_____

Lyndsay Hazelwood
Project Geologist

_____

Patrick K. Miller, P.E.
Senior Engineer and Project Manager

_____

Larry D. Olson, P.E.
Chief Engineer

(1 PDF copy emailed)