Torres-Rojas, Genara

From: kaattonito@news12.com
Sent: Monday, October 26, 2015 4:10 PM
To: Olivencia, Mildred
Cc: Torres-Rojas, Genara; Van Duyne, Sheree; Ng, Danny
Subject: Freedom of Information Online Request Form

Information:

First Name: Karin
Last Name: Attonito
Company: News 12 NJ
Mailing Address 1: 450 Raritan Center Parkway
Mailing Address 2:
City: Edison
State: NJ
Zip Code: 08904
Email Address: kaattonito@news12.com
Phone: 732-346-3204
Required copies of the records: No

List of specific record(s):
Please provide the inspection schedule, procedures and follow-upcompliance requirements for the Holland Tunnel, Lincoln Tunnel and George Washington Bridge, along with a definition of codes. Please provide records of all inspections, follow-up inspections, and all subsequent follow-up documents of the Holland Tunnel, Lincoln Tunnel and George Washington Bridge from 2010 - present.

THE PORT AUTHORITY OF NY & NJ

FOI Administrator

May 12 , 2016

Ms. Karin Attonito
News 12 NJ
450 Raritan Center Parkway
Edison, NJ 08904

Re: Freedom of Information Reference No. 16428

Dear Ms. Attonito:

This is in response to your October 26, 2015 request, which has been processed under the Port Authority's Freedom of Information Code, copy enclosed, for copies of the following records: the inspection schedule, procedures and follow-up compliance requirements for the Holland Tunnel, Lincoln Tunnel and George Washington Bridge, along with a definition of codes. Please provide records of all inspections, follow-up inspections, and all subsequent follow-up documents of the Holland Tunnel, Lincoln Tunnel and George Washington Bridge from 2010 to the date of your request.

In an effort to provide available documents as quickly as possible, we are responding to a portion of your request at this time. We will continue the processing of your request as expeditiously as possible and to the extent that our review would permit us to provide you with additional responsive documents while the review is ongoing, we will endeavor to do so.

Material responsive to your request can be found on the Port Authority's website at http://corpinfo.panynj.gov/documents/16428-O-1/. Paper copies of the available records are available upon request.

Certain portions of the material responsive to your request are exempt from disclosure as, among other classifications, security.

Please refer to the above FOI reference number in any future correspondence relating to your request.

Very truly yours,

Danny Ng
FOI Administrator

Enclosure

4 World Trade Center, 18th Floor
150 Greenwich Street
New York, NY 10007
T: 212 435 3642 F: 212 435 7555

Engineering
Quality Assurance Division
B03-925.106

Port Authority Facility Condition Survey Program

Lincoln Tunnel Air Ducts and Drum Rings, 41st Underpass and Miscellaneous Chambers

September 2011

Engineering Department

THE PORT AUTHORITY OF NY & NJ

JENNY
ENGINEERING
CORPORATION
CONSULTING ENGINEERS

2 EDISON PLACE • SPRINGFIELD, NEW JERSEY 07081
973 379-6699 FAX: 973 379-6774

October 17, 2011

Mr. C. John Lin, P.E.
Assistant Chief Engineer, Quality Assurance
The Port Authority of New York & New Jersey
3 Gateway Center, 3rd Floor
Newark, N.J. 07102

Attention: Mr. Camille Dagher, P.E.
Project Manager
Quality Assurance Division

Reference: P. A. Agreement No. 405-11-022
Professional Services for the Condition Survey of
Lincoln Tunnel Air Ducts and Drum Rings

Subject: **Final Report Submittal**

Gentlemen:

We are pleased to submit 12 copies of the Port Authority Condition Survey Program inspection report for the Lincoln Tunnel Air Ducts and Drum Rings in accordance with our Agreement No. 405-11-022.

The report covers the results of a field inspection of the above referenced tunnels. Independent quality control by our senior technical and management staff have ensured the thoroughness and accuracy of all work on this project. The report adheres to current practices and standards of the Port Authority of New York and New Jersey.

Very truly yours,

JENNY ENGINEERING CORPORATION

Stanley Niemiec, P.E.
Vice President, Chief Engineer

Enclosure

TABLE 2 SUMMARY OF 2011 SAFETY ITEMS					
Safety Item #	**Location**	**Station**	**Description**	**Recommendation**	**Figure #/ Photo #**
S1	NJ Portal Sump Chamber #2	--	Railing posts around sump pit are completely rusted through and the railing is not attached to the wall.	Replace railing.	E4/E1
S2	Expressway Sump Room at 33rd St.	--	Manhole rungs missing.	Replace manhole rungs.	E2/E2
S3	Expressway Sump Room at 36th St.	--	Bottom rungs of the access ladder are severely corroded with 50% section loss.	Repair or replace ladder.	E2/E3

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III. SCOPE OF WORK AND INSPECTION PROCEDURE

A condition survey was performed on the Lincoln Tunnel. The survey included the north, center and south tunnels, the 41st Street Underpass located adjacent to the Port Authority Bus Terminal and miscellaneous chambers (New Jersey Portal Gallery and Sumps, New York Portal and Lincoln Tunnel Expressway Sumps). The purpose of the survey was to determine and document the condition of the tunnels, identify any structural and/or non-structural deficiencies that might present potential safety hazards, and to develop recommendations for correcting any deficiencies that were found.

[redacted]

B. Inspection Procedure

Generally, a five-member crew was utilized for the inspection. Two, two-member teams, each lead by a professional licensed engineer, conducted inspections of the exhaust and blower ducts simultaneously. The fifth member served as safety support for both teams and also inspected the roadway area. The inspection generally consisted of the following procedures:

1. The inspection of the ducts and roadway area was always conducted in the tunnel closed to traffic, as scheduled by the facility.

2. The roadway walk-through inspection was 100% visual, with hands-on inspections performed at locations where findings were deemed to be significant. The inspection was coordinated with the facility personnel and utilized the scheduled tunnel closing. Tunnel stationing was based on the station markers located on the far wall (no safety walk) side of the tunnels. All crew members wore safety vests while working in the roadway areas.

3. The exhaust and blower ducts were inspected 100% visually, with hands-on inspections performed at locations where findings were deemed to be significant (approximately 10% hands-on). Entry to the ducts was made through the various ventilation buildings from the tunnel roadway, and was coordinated with the facility. Illumination was provided by means of hand held battery operated flashlights and floodlights. Tunnel stationing for deficiency locations in the blower ducts was based on measurements taken from station markers painted on the duct walls. Stationing for

deficiency locations in the exhaust ducts was based on measurements taken from survey plaques attached to the roadway ceiling hangers, or station markers painted on the duct walls (generally in the bent sections). A gas detector was carried in the exhaust duct to monitor oxygen and carbon monoxide levels. The inspection crews wore disposable coveralls, hard hats, and other appropriate personal and safety equipment for the inspection of the ducts.

[redacted]

5. The miscellaneous chambers were inspected 100% visually, with hands-on inspections performed at locations where findings were deemed to be significant (approximately 10% hands-on). Entry to the chambers was made through roadway manholes and hatches in the pump rooms and was coordinated with the facility. Illumination was provided by means of hand held battery operated flashlights and floodlights. A gas detector was carried in the sump rooms to monitor oxygen and carbon monoxide levels. The inspection crews wore disposable coveralls, hard hats and other appropriate personal and safety equipment for the inspection of the chambers.

6. The tunnels were inspected at night between the hours of 11:00 p.m. and 5:00 a.m., subject to the requirements of the Facility Operations and the PA police.

The primary deficiencies expected in a subaqueous tunnel are related to the watertightness of the structure. Therefore, emphasis was placed on recording water leaks and leak related damages to the structures. Other signs of distress such as cracking and spalling of the concrete liner and corrosion of steel or cast iron elements were also identified. Passive leaks, deposits, minor efflorescence and other minor deficiencies of no structural significance and not requiring repairs, were generally not recorded.

Notes and Photographs

The terminology used for description of the deficiencies is based on the Port Authority of New York and New Jersey's condition survey definitions and terminology (page xiii) and the Repair Recommendation Guide for Tunnels (Figure 3). Deficiencies were recorded during the inspection on field forms with each sheet representing 100 linear feet of tunnel.

Photographs were taken during the inspection of significant or typical deficiencies. The location and orientation of the photos were noted on the field forms.

C. Condition Survey Definitions and Terminology

Definitions of Recommendation Categories

Hands-On - Inspection: Close-up inspection from not further away than arm's length where the member or element can be physically touched.

Visual - Inspection: The inspection from a reasonable distance of a member or element where initial determination of the condition can be made.

Four categories of repair recommendations are identified and defined as follows:

Immediate - Requires immediate action including possible closing of the structure or areas affected for safety reasons until interim remedial measures, such as shoring or removal of potentially unsafe structures (or elements) can be implemented. These closings or interim remedial actions, if any, always require immediate action upon discovery.

Priority - Conditions for which no immediate action may be required, or for which immediate action has been completed, but for which further investigations, design, and implementation of interim or long-term repairs should be undertaken on a priority basis, i.e., taking precedence over all other scheduled work.

Safety - Conditions that present a potential hazard and which should be repaired as soon as possible.

Routine - Conditions requiring further investigation or remedial work that can be undertaken as part of a scheduled maintenance program or other scheduled project, or routine facility maintenance, depending on the action required.

Definitions of Condition Ratings

The following terms are used to rate the condition of structural systems or individual elements and are defined below. When a term is applied to an overall system, it does not mean that some other element of the system may not be in a different condition.

Excellent - Element is in as-new condition

Good - Element is sound and performing its functions, although it shows signs of use and may require some minor repairs, mostly routine.

Fair - Element is still performing adequately at this time but needs priority and/or routine repairs to prevent further deterioration and to restore it to good condition.

Poor - Element cannot be relied upon to continue to perform its original function without immediate and/or priority repairs.

IV. HISTORY OF TUNNEL AND INSPECTION FINDINGS PRESENTATION METHODS

A. History of the Lincoln Tunnel

The first (center) tube of the Midtown Hudson Tunnel was authorized in the 1930s and construction was completed in 1937. The second (north) tunnel was completed in 1945, and the third (south) tunnel was completed in 1957. Control and operation of the tunnel is under the Port Authority of NY & NJ. The facility generally consists of three parallel, two-lane vehicular tunnel tubes and three ventilation buildings. The facility is located between Weehawken, New Jersey and mid-town Manhattan.

[redacted]

B. Evaluation of Deficiencies

Figure 3 shows the classifications of deficiencies in the tunnel in terms of repair recommendation categories (no repair required, routine, priority and immediate). Cracks within concrete linings and concrete elements are classified by category as to crack size, orientation and any signs of recent propagation or measurable deflection. Spalls are categorized by size, propagation into the lining or element, and the extent of concrete deterioration around the spall.

Deficiencies within the cast iron sections of the tunnel lining are classified by cracks, corrosion, and miscellaneous deficiencies. Cracks are categorized by width, length, location and any measurable lining deflection. Corrosion of the cast iron segments is categorized by the severity of the corrosion and amount of section loss. Miscellaneous deficiencies include missing, loose, or severely deteriorated bolts; missing grout plugs; or dry leaks and deposits. Steel elements of the tunnels and underground structures are also classified by the severity of corrosion and amount of section loss.

Water infiltration into the tunnel is classified separately by whether the water inflow is gushing, flowing, dripping, or seeping. Repair recommendations for any water leak combined with another deficiency as cited above are summarized in a separate classification table in Figure 3.

The criteria indicated in Figure 3 shall serve only as a guide for determining a repair recommendation. Engineering judgment shall be used to determine the effect of all deficiencies on the integrity of the structure.

C. Inspection Findings Presentation Methods

Priority, safety, and routine repair items are presented in tabular form and supplemented with figures furnishing the locations of the repair items (deficiencies). The tables provide a description of the deficiency, location, repair recommendation, and photo reference, if used. Photos are used to enhance the description of an item, or to record the status of a previously reported repair item.

V. STRUCTURE DESCRIPTION, INSPECTION FINDINGS AND RECOMMENDATIONS

A. NORTH TUNNEL

[redacted]

2. Inspection Findings and Repair Recommendations

The overall condition of the north tunnel is good.

[redacted]

Safety Items:

No safety items were noted for the north tunnel during the current inspection.

Routine Repairs:

Routine repairs are presented in Tables A2, A3 and A4 and their locations are shown on Figure A1.

Findings with No Recommendations:

There are 4 findings with no recommendations at 92 locations. The findings with no recommendations are presented in Table A5 and their locations are shown on Figure A1.

TABLE A2 NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R1	Drum Ring & Steel Bent	160+50 to 160+62 (1 loc.) 164+96 168+00 to 168+11 (3 locs.) 170+92 172+20 to 172+95 (4 locs.) 173+18 174+25 to 174+53 (4 locs.) 176+10 to 176+50 (4 locs.) 177+38 to 177+76 (3 locs.) 187+76 188+26 189+76 191+26 191+80 196+78 197+84 to 197+96 (2 locs.) 200+22 202+22 204+78 205+74 207+70 214+70 224+60	Medium to large spalls in the underside of the roadway slab with exposed reinforcement and hollow areas – no loose concrete. (37 locs.)	Clean, patch and repair.
R2	Drum Ring & Steel Bent	162+70 166+58 173+44 177+74 182+05 186+35 190+66 194+98 197+08	Moderate to severe corrosion of manhole frames w/ seeps or drips. (9 locs.)	Clean and paint manhole covers and frames and seal leaks.

TABLE A2 (Continued) NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R2 (continued)	Drum Ring & Steel Bent	200+06 204+87 209+58 214+28 218+94 224+10 228+90 232+98	Moderate to severe corrosion of manhole frames w/ seeps or drips. (8 locs.)	Clean and paint manhole covers and frames and seal leaks.
R3	Drum Ring & Steel Bent	159+56 161+62 162+51 167+26 to 168+00 (6 locs.) 168+10 to 168+80 (4 locs.) 169+04 to 169+97 (25 locs.) 170+00 to 170+59 (10 locs.) 171+38 192+96 193+42 195+17 195+50 199+87 199+91 201+94 (2 locs.) 206+84 206+92 214+14 214+26 215+92 215+98 216+12 to 217+00 (23 locs.) 217+00 to 217+82 (10 locs.) 219+20 219+20 to 219+82 (6 locs.)	Seeps. (103 locs.)	Clean and seal leaks.

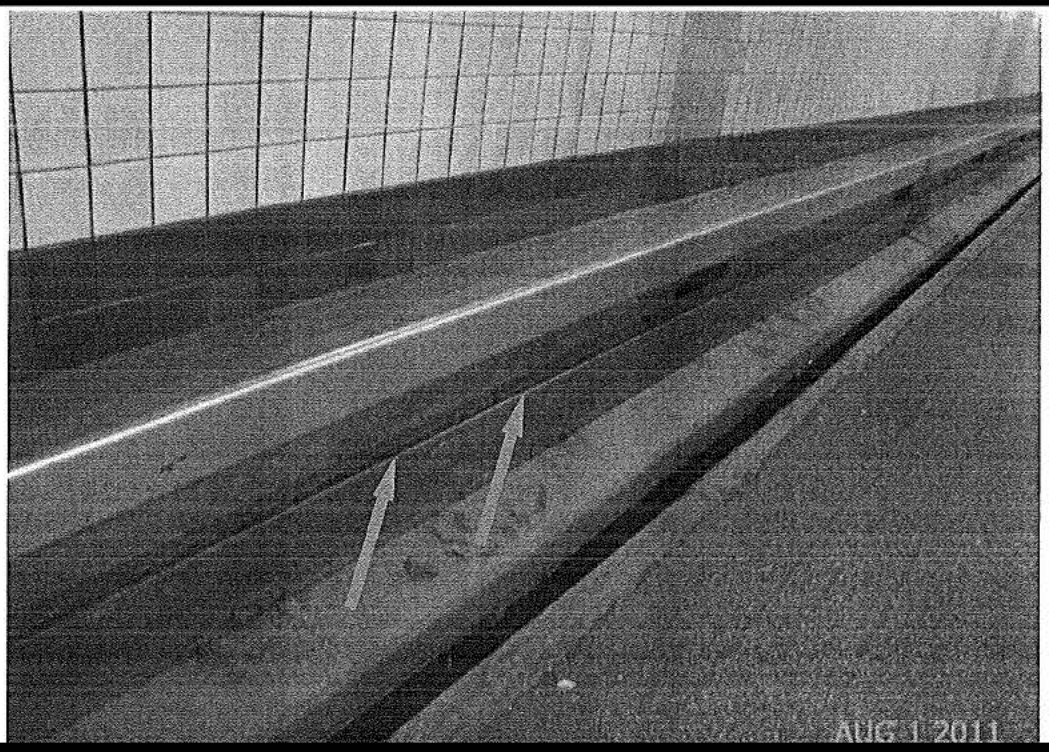
TABLE A2 (Continued) NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R3 (Continued)	Drum Ring & Steel Bent	221+80 to 221+90 (4 locs.) 222+51 to 222+80 (2 locs.) 224+14 to 224+93 (4 locs.) 225+31 to 225+98 (8 locs.) 226+12 226+98 to 227+00 (2 locs.) 227+80 228+72 to 228+98 (3 locs.) 229+27 229+54 to 229+86 (5 locs.) 230+10 to 230+92 (14 locs.) 231+08 to 231+34 (10 locs.) 232+14 to 232+82 (13 locs.) 233+06 to 234+20 (26 locs.)	Seeps. (94 locs.)	Clean and seal leaks.
R4	Drum Ring	199+75 201+95 218+92	Water inflow from valve behind plate in side walls. (3 locs.)	Locate source of leak, seal leak and repair.

TABLE A3 NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS EXHAUST AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R5	Drum Ring & Steel Bent	169+00 169+10 to 169+18 (4 locs.) 170+38 221+81 232+04 233+32 to 233+50 (11 locs.)	Seeps and drips. (19 locs.)	Clean and seal leaks.
R6	Drum Ring	172+80 172+84 172+88 222+57	Exposed ring joint with drips or seeps. (4 locs.)	Clean, seal leaks and patch.
R7	Steel Bent	230+30 to 231+00 (4 loc.) 231+34 to 231+47 (3 locs.) 233+26 to 233+53 (1 loc.)	Medium spalls in side walls and ceiling with exposed, corroded reinforcement and adjacent hollow concrete. (8 locs.)	Remove hollow concrete. Clean and patch.

TABLE A4 NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R8	Drum Ring & Steel Bent	169+92 170+08 to 170+16 (3 locs.) 170+47 208+10 219+50 229+10 231+25 (2 locs.) 232+25 232+40 232+90 233+20 234+20 to 234+24 (5 locs.)	Seeps and drips. (19 locs.)	Clean and seal leaks.
R9	Drum Ring & Steel Bent	201+30 205+50 214+50 224+30 227+70 228+44	Missing/damaged vent port covers. (6 locs.)	Replace vent port covers.
R10	Drum Ring & Steel Bent	168+20 170+20 207+65	Seeping from hatch of valve chambers. (3 locs.)	Locate source of leaks and repair.
R11	Drum Ring & Steel Bent	190+60 194+92 204+90 214+20 230+95	Cracked or spalled pavement. (5 locs.)	Repair pavement.
R12	Steel Bent	162+70 169+92	Water seeping from splicing chamber/fire extinguisher cabinet. (2 locs.)	Clean and seal leak.
R13	Drum Ring & Steel Bent	170+04 to 170+15 (1 loc.) 230+ 58 to 230+84 (2 locs.) 232+92 233+46 to 233+54 (1 loc.)	Areas of missing tiles. (5 locs.)	Replace missing tiles.

TABLE A5 NORTH TUNNEL FINDINGS WITH NO RECOMMENDATIONS OF THE 2011 CONDITION SURVEY					
Finding #	**Tunnel Type**	**Duct**	**Station**	**Description**	**Figure #**
1	Drum Ring	Exhaust	172+30 to 174+75 (45 locs.) 221+00 to 221+43 (9 locs.) 221+80 to 223+00 (24 locs.)	Small spalls adjacent hollow concrete over tie rods. (78 locs.)	A1
2	Drum Ring	Exhaust	221+30 to 221+43 (1 loc.)	Deteriorated joint between tunnel and vent building with 200 sq. ft. of hollow/delaminated concrete. (1 loc.)	A1
3	Drum Ring	Exhaust	170+18 to 170+32 (1 loc.) 222+56 to 222+80 (2 loc.)	Medium spalls in tunnel lining and adjacent hollow concrete. (3 locs.)	A1
4	Drum Ring	Roadway	172+00 to 172+20 (1 loc.) 173+60 to 173+69 (1 loc.) 174+21 to 174+34 (1 loc.) 174+75 to 174+90 (1 loc.) 175+36 to 175+75 (1 loc.) 175+95 to 176+05 (1 loc.) 176+07 to 176+66 (1 loc.) 176+32 to 177+00 (1 loc.) 177+13 to 180+00 (1 loc.) 225+51 to 225+74 (1 loc.)	Separation of the steel curb plate up to 1" from concrete wall caused by pack rust. (10 locs.)	A1

[redacted]



[redacted]

B. CENTER TUNNEL

[redacted]

2. Inspection Findings and Repair Recommendations

The overall condition of the center tunnel is good.

[redacted]

Safety Items:

No safety items were noted for the center tunnel during the current inspection.

Routine Repairs:

Routine repairs are presented in Tables B2, B3 and B4 and their locations are shown on Figure B1.

Findings with No Recommendations:

There is 1 finding with no recommendations at 40 locations. The finding with no recommendations is presented in Table B5 and its locations are shown on Figure B1.

TABLE B2 CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R1	Drum Ring & Steel Bent	160+61 165+50 168+60 172+60 175+84 177+08 to 177+34 (2 locs.) 181+60 189+35 190+96 191+92 195+80 197+20 (Mid-River Sump) 197+65	Medium to large spalls in the underside of the roadway slab with exposed reinforcement and hollow areas – no loose concrete. (14 locs.)	Clean, patch and repair.
R2	Drum Ring & Steel Bent	165+26 167+60 167+83 168+08 to 168+35 (6 locs.) 168+61 168+88 169+42 to169+70 (3 locs.) 170+30 to 170+84 (8 locs.) 171+06 to 171+38 (6 locs.) 172+48 to 172+98 (8 locs.) 180+24 to 180+64 (3 locs.) 215+97 to 217+28 (11 locs.) 218+10 220+36 to 220+50 (6 locs.) 221+16 to 221+44 (7 locs.) 226+20	Seeps. (65 locs.)	Clean and seal leaks.

TABLE B2 (Continued) CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R2 (Continued)	Drum Ring & Steel Bent	226+86 to 228+13 (41 locs.) 228+74 230+16 to 231+00 (18 locs.) 231+06 to 231+16 (4 locs.) 231+68 232+52 to 232+90 (10 locs.) 233+48 233+64 233+75 234+25 to 234+94 (9 locs.) 235+16 to 236+46 (19 locs.) 236+85 237+02 to 237+04 (4 locs.) 237+42 to 237+60 (5 locs.) 238+84 239+00 239+20 to 239+92 (8 locs.) 240+36 to 240+78 (4 locs.) 241+54 to 241+88 (2 locs.) 242+53	Seeps. (133 locs.)	Clean and seal leaks.
R3	Drum Ring	172+22 to 172+36 (6 locs.) 208+18 to 208+26 (2 locs.) 215+17 220+30 224+10 232+40 233+06 to 233+40 (3 locs.) 235+00 to 235+15 (8 locs.)	Medium spalls with exposed ring joints. (23 locs.)	Clean and patch spall.

TABLE B3 CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS EXHAUST DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R4	Drum Ring & Steel Bent	168+08 to 168+73 (6 locs.) 169+90 170+18 221+46 226+14 to 226+34 (3 locs.) 227+18 231+80 233+46 to 233+48 (2 locs.) 238+03 241+50 242+44 to 242+53 (4 locs.)	Seeps and drips. (22 locs.)	Clean and seal leaks.
R5	Drum Ring	221+46 226+14 to 226+44 (4 locs.) 227+18 227+87 230+96	Exposed ring joints with passive leaks. (8 locs.)	Clean and seal leaks.
R6	Drum Ring	172+78 221+79 220+90 to 221+30 (8 locs.)	Small spalls and adjacent hollow concrete over tie rods with some tie rods exposed. (10 locs.)	Remove hollow concrete. Clean and patch.
R7	Steel Bent	238+00 to 242+53 (57 locs.)	Concentration of fine to wide cracks along perimeter of exhaust duct and adjacent hollow concrete. (57 locs.)	Clean and seal cracks.

TABLE B4 CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R8	Drum Ring & Steel Bent	166+80 167+05 169+80 227+00 231+08 231+95 233+60 234+90 242+53	Seeps and drips. (9 locs.)	Clean and seal leaks.
R9	Drum Ring & Steel Bent	170+30 172+75 178+30 184+20 200+72 to 200+84 (2 locs.) 202+70 to 202+76 (1 loc.) 203+72 to 203+84 (1 loc.) 204+32 207+24 to 207+80 (1 loc.) 210+18 to 210+32 (1 loc.) 214+96 216+60 218+60 to 218+70 (1 loc.) 225+35 227+90 to 228+00 (2 locs.) 228+70 to 229+00 (3 locs.) 231+95 to 232+10 (1 loc.) 233+05 to 233+80 (1 loc.) 233+84 to 233+96 (1 loc.) 234+50 235+20 to 237+70 (3 locs.) 242+53	Cracked or spalled pavement. (28 locs.)	Repair pavement.

TABLE B4 CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R10	Drum Ring & Steel Bent	170+25 170+70 171+50 171+70 172+50 172+70 172+90 173+15 173+40 173+60 173+75 174+10 174+30 174+70 174+90 176+80 177+15 177+35 177+55 177+75 177+90 178+20 179+15 179+55 179+75 179+95 181+10 182+35 182+60	Missing/damaged vent port covers in the ceiling slab. (29 locs.)	Replace vent port covers.

TABLE B4 (Continued) CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R10 (Continued)	Drum Ring & Steel Bent	182+80 189+20 189+39 189+90 190+10 192+80 193+70 194+15 194+40 197+30 223+09 225+50 226+80 227+00 239+88 240+74 241+08	Missing/damaged vent port covers in the ceiling slab. (17 locs.)	Replace vent port covers.
R11	Drum Ring	220+80 to 220+90 (1 loc.)	Area of missing tiles. (1 loc.)	Replace missing tiles.

TABLE B5 CENTER TUNNEL FINDINGS WITH NO RECOMMENDATIONS OF THE 2011 CONDITION SURVEY BLOWER AIR DUCT				
Finding #	**Tunnel Type**	**Station**	**Description**	**Figure #**
1	Drum Ring	207+80 to 209+80 (14 locs.) 211+40 to 218+00 (26 locs.)	Medium spalls in side walls and adjacent hollow concrete. (40 locs.)	B1

C. SOUTH TUNNEL

[redacted]

2. Inspection Findings and Repair Recommendations

The overall condition of the south tunnel is good. However, the overall condition of the roadway slab is fair due to the numerous areas of hollow, delaminated and spalled concrete noted in the underside of the roadway slab.

[redacted]

Safety Items:

No safety items were noted for the center tunnel during the current inspection.

Routine Repairs:

Routine repairs are presented in Tables C2, C3 and C4 and their locations are shown on Figure C1.

Findings with No Recommendations:

There is 1 finding with no recommendations at 4 locations. The finding with no recommendations is presented in Table C5 and its locations are shown on Figure C1.

TABLE C2 SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R1	Drum Ring & Steel Bent	161+00 to 161+10 (1 loc.) 161+62 to 161+92 (3 locs.) 163+66 to 164+96 (3 locs.) 165+96 to 166+00 (1 loc.) 167+18 to 167+70 (4 locs.) 168+34 to 168+70 (4 locs.) 170+00 to 174+00 (10 locs.) 174+32 to 174+38 (2 locs.) 175+09 to 176+83 (8 locs.) 178+15 to 178+33 (3 locs.) 180+26 to 181+86 (7 locs.) 182+12 to 184+98 (8 locs.) 185+10 to 186+72 (8 locs.) 187+14 to 187+70 (2 locs.) 187+91 to 192+73 (17 locs.) 193+84 to 194+00 (2 locs.) 196+03 to 196+91 (4 locs.) 197+25 to 200+41 (9 locs.) 199+40 (Mid-River Sump) 199+60 (Mid-River Sump) 200+00 to 200+27 (4 locs.) 205+00 to 205+92 (4 locs.) 206+58 to 208+46 (9 locs.) 209+02 to 209+65 (3 locs.) 210+02 to 210+83 (4 locs.) 211+32 to 212+11 (6 locs.) 213+53 to 213+71 (2 locs.) 213+95 to 215+00 (5 locs.) 215+15 to 215+77 (3 locs.) 216+25 to 216+50 (3 locs.) 218+40 to 218+73 (3 locs.)	Medium to large spalls in the underside of the roadway slab with exposed reinforcement and hollow areas – no loose concrete. (144 locs.)	Clean, patch and repair.

TABLE C2 (Continued) SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R1 (Continued)	Drum Ring & Steel Bent	219+44 to 219+91 (4 locs.) 220+42 to 220+93 (3 locs.) 221+61 to 222+89 (6 locs.) 223+18 to 223+22 (1 loc.) 224+23 to 224+27 (1 loc.) 226+14 to 226+88 (3 locs.) 227+40 to 227+94 (3 locs.) 228+00 to 231+24 (11 locs.) 233+00 to 233+96 (3 locs.) 234+12 to 235+50 (3 locs.) 235+84 to 236+10 (3 locs.) 236+40 to 236+90 (3 locs.) 237+08 to 237+36 (3 locs.) 238+70 to 238+96 (2 locs.)	Medium to large spalls in the underside of the roadway slab with exposed reinforcement and hollow areas – no loose concrete. (49 locs.)	Clean, patch and repair.
R2	Drum Ring & Steel Bent	162+12 166+90 175+18 184+18 195+40 207+04 212+32	Moderate to severe corrosion of manhole frames w/ seeps or drips. (7 locs.)	Clean and paint manhole covers and frames and seal leaks.
R3	Drum Ring & Steel Bent	160+46 to 160+98 (8 locs.) 161+16 to 161+68 (5 locs.) 162+17 to 162+26 (4 locs.) 162+88 163+56 164+26 to 164+82 (4 locs.) 166+12 166+74 168+24 168+48to 168+96 (8 locs.) 169+04 to 169+92 (14 locs.)	Seeps and drips. (48 locs.)	Clean and seal leaks.

TABLE C2 (Continued) SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R3 (Continued)	Drum Ring & Steel Bent	170+48 to 170+76 (4 locs.) 172+20 to 172+26 (3 locs.) 173+89 176+40 178+24 178+56 180+24 180+99 181+60 to 181+70 (3 locs.) 188+44 201+94 203+48 204+26 209+40 213+10 to 213+60 (4 locs.) 216+90 218+16 to 218+29 (3 locs.) 220+46 to 220+98 (17 locs.) 221+22 to 223+76 (64 locs.) 224+68 225+04 to 226+77 (21 locs.) 227+04 to 227+84 (9 locs.) 228+02 to 229+78 (17 locs.) 230+12 to 230+66 (2 locs.) 231+24 to 231+68 (4 locs.) 232+04 to 233+98 (12 locs.) 234+69	Seeps and drips. (177 locs.)	Clean and seal leaks.

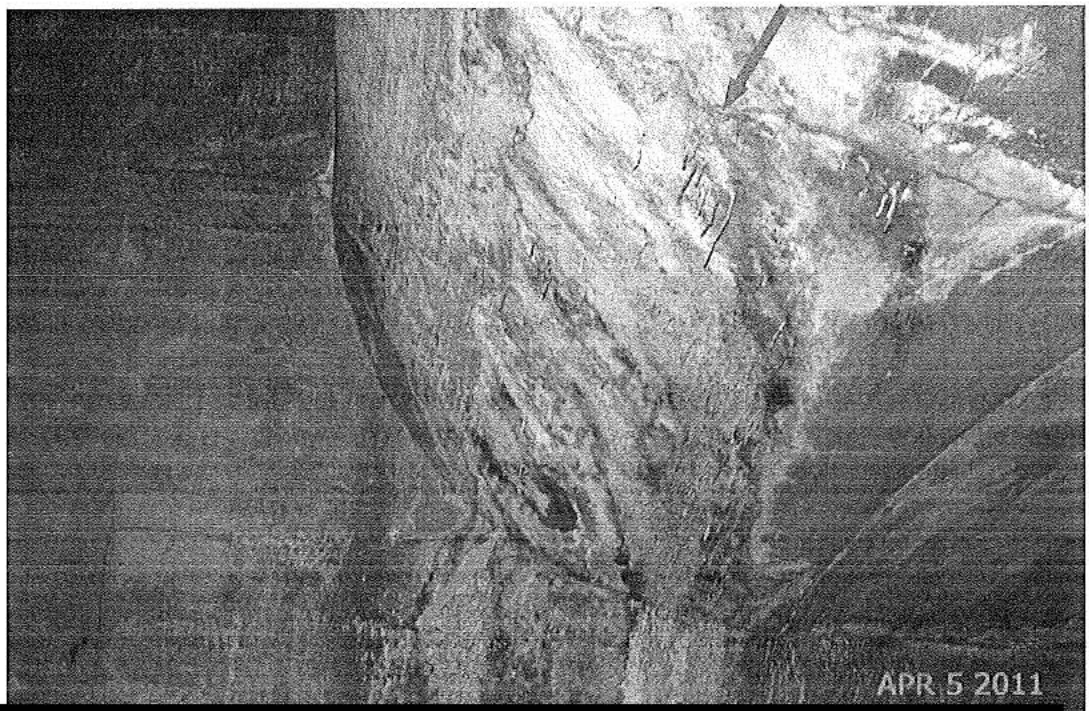
TABLE C2 (Continued) SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R3 (Continued)	Drum Ring & Steel Bent	235+06 to 235+62 (2 locs.) 236+62 to 236+76 (3 locs.) 237+54 to 237+98 (5 locs.) 238+16 to 238+80 (8 locs.) 239+16 to 239+76 (4 locs.)	Seeps and drips. (22 locs.)	Clean and seal leaks.
R4	Drum Ring	170+08 170+94 171+16 to 171+82 (22 locs.) 172+03	Medium spalls with exposed ring joints. (25 locs.)	Clean and patch spalls.
R5	Steel Bent	224+34 to 224+56 (1 loc.) 231+83 to 231+90 (1 loc.) 237+31 237+61 237+71 238+66 239+34 to 239+57 (3 locs.)	Medium spalls with exposed steel at invert. (9 locs.)	Clean and patch.

TABLE C3 SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS EXHAUST AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R6	Drum Ring & Steel Bent	160+68 to 160+76 (2 locs.) 161+16 162+06 166+20 to 166+71 (8 locs.) 167+90 168+23 to 168+54 (10 locs.) 172+75 to 172+77 (2 locs.) 225+00 234+71 to 234+95 (5 locs.) 235+18 235+21 235+78 235+55 236+26 237+50 238+43 239+80	Seeps and drips. (39 locs.)	Clean and seal leaks.
R7	Steel Bent	234+71 to 236+64 (18 locs.) 237+06 to 238+27 (12 locs.) 238+58 to 239+18 (7 locs.) 239+59 to 240+20 (6 locs.)	Concentration of fine to wide cracks along exhaust duct perimeter and adjacent hollow concrete in south wall. (43 locs.)	Clean and seal cracks. Remove hollow concrete. Clean and patch.

TABLE C4 SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R8	Drum Ring & Steel Bent	160+80 160+95 161+02 161+15 165+45 166+63 to 166+70 (3 locs.) 166+98 167+80 168+04 168+50 to 168+66 (7 locs.) 169+02 169+20 169+50 170+50 187+06 195+85 210+05 222+90 239+40	Seeps and drips. (27 locs.)	Clean and seal leaks.
R9	Drum Ring	176+40 181+20 185+85 190+50 195+10 199+84 199+98 209+98 219+25 223+15	Oil/asphalt seeps from splicing chambers. (10 locs.)	Locate source of leaks and seal.
R10	Steel Bent	234+30	Asphalt seep from construction joint. (1 loc.)	Locate source of leak and seal.
R11	Drum Ring & Steel Bent	165+00 to 165+11 (1 loc.) 224+10 to 224+18 (1 loc.) 234+28 to 234+32 (1 loc.) 234+80 to 234+84 (1 loc.)	Areas of missing tiles. (4 locs.)	Replace missing tiles.

TABLE C4 SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R12	Drum Ring & Steel Bent	182+35 to 182+37 187+25 to 187+28 187+37 to 187+43 188+55 to 188+63 189+38 to 189+41 190+20 to 190+26 191+46 to 191+54 191+68 to 191+81 192+19 to 190+24 192+40 to 192+44 194+24 to 194+44 195+81 to 195+85 197+10 to 197+31 197+49 to 197+54	Crack/split in steel curb plate caused by pack rust. (14 locs.)	Repair curb plates.

TABLE C5 SOUTH TUNNEL FINDINGS WITH NO RECOMMENDATIONS OF THE 2011 CONDITION SURVEY EXHAUST AIR DUCT				
Finding #	**Tunnel Type**	**Station**	**Description**	**Figure #**
1	Drum Ring	161+55 to 161+68 (1 loc.) 164+12 165+32 to 165+40 (1 loc.) 166+16 to 166+30 (3 locs.) 166+90 to 167+17 (3 locs.) 167+84 172+70 175+10 175+35 176+42 204+22 to 204+38 (1 loc.) 221+80 222+85	Medium spalls in tunnel lining and adjacent hollow concrete. (17 locs.)	C1



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D. 41st STREET UNDERPASS

[redacted]

2. Inspection Findings and Repair Recommendations

The overall condition of the underpass is good.

Priority Repairs:

There were no priority repairs noted during the previous or current inspection.

Safety Items:

There were no safety items noted during the current inspection.

Routine Repairs:

Routine repairs are presented in Tables D1, D2, D3 and D4 and their locations are shown in Figures D1 and D2.

TABLE D1 41ST STREET UNDERPASS ROUTINE REPAIR RECOMMENDATIONS SUPPLY AIR (BLOWER) CHAMBER					
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R1	Steel Bent	4+33 4+73 4+86 5+20 6+64 6+87 6+98 7+30 7+42 7+48 7+62 7+70 7+75 7+85 8+08 8+23 8+48	Seeps. (17 locs.)	Clean and seal leaks.	D1

TABLE D2 41ST STREET UNDERPASS ROUTINE REPAIR RECOMMENDATIONS EXHAUST AIR CHAMBER					
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R2	Steel Bent	4+00 4+32 4+66 4+90 5+05 to 5+20 (7 locs.) 5+28 5+45 5+77 5+99 6+30 to 6+77 (6 locs.) 6+79 7+37 7+43 7+73 7+78 7+84 8+08 8+27	Seeps. (29 locs.)	Clean and seal leaks.	D1

TABLE D3 41ST STREET UNDERPASS ROUTINE REPAIR RECOMMENDATIONS BUS TERMINAL EXHAUST CHAMBER					
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R3	Steel Bent	5+00 5+09 5+88	Seeps and drips. (3 locs.)	Clean and seal leaks.	D2
R4	Steel Bent	4+62 5+98 (Exhaust fan #3)	Vertical medium crack w/ loose block in CMU. (2 locs.)	Re-point block and seal crack.	D2
R5	Steel Bent	4+76 (Exhaust fan #3)	Vertical full height wide crack in CMU wall of duct to exhaust fan #3. (2 locs.)	Seal crack.	D2
R6	Steel Bent	5+09 to5+15 5+16 to 5+26	Large spalls. (2 locs.)	Clean and patch spalls.	D2
R7	Steel Bent	5+65 5+98 6+30 7+30 7+98 8+26	Deteriorated construction joints w/ large areas of adjacent delaminated concrete. (6 locs.)	Clean and patch construction joints.	D2
R8	Steel Bent	5+55	20 sq. ft. of hollow patch in ceiling. (1 loc.)	Repair patch.	D2

TABLE D4 41ST STREET UNDERPASS ROUTINE REPAIR RECOMMENDATIONS ROADWAY					
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R9	Steel bent	3+38 3+90 3+95 4+00 4+10 4+20 4+28 6+84	Wide cracks in roadway pavement. (8 locs.)	Seal cracks.	D1
R10	Steel bent	4+28 5+10 5+18	Seeps in ceiling. (3 locs.)	Clean and seal leaks.	D1

E. MISCELLANEOUS CHAMBERS

[redacted]

2. Inspection Findings and Repair Recommendations

The overall condition of the New York Portal Tunnel Sump Rooms, the Lincoln Tunnel Expressway Sump Rooms and the New Jersey Portal Gallery is good.

Priority Repairs:

One priority repair was recommended during the previous inspection in the New York Portal Center Tunnel Sump Room and has been repaired. This priority consisted of four large spalls on the ceiling slab with exposed, severely corroded, debonded and completely rusted through reinforcement. The entire ceiling slab of the Sump Room was been replaced with precast concrete slabs. No new priority repairs were noted during the current inspection.

Safety Items:

Three safety items were noted during the current inspection. One of the safety items consist of missing manhole rungs in the 33rd St. Sump Room. Another safety items consist of a severely corroded access ladder in the 36th St. Sump Room and railing posts around the sump pit areas completely rusted through and the railings are not attached to the walls in the NJ Portal Sump Room. The location and description of the items are furnished in Table E1 and their locations are also shown on Figures E2 and E4.

Routine Repairs:

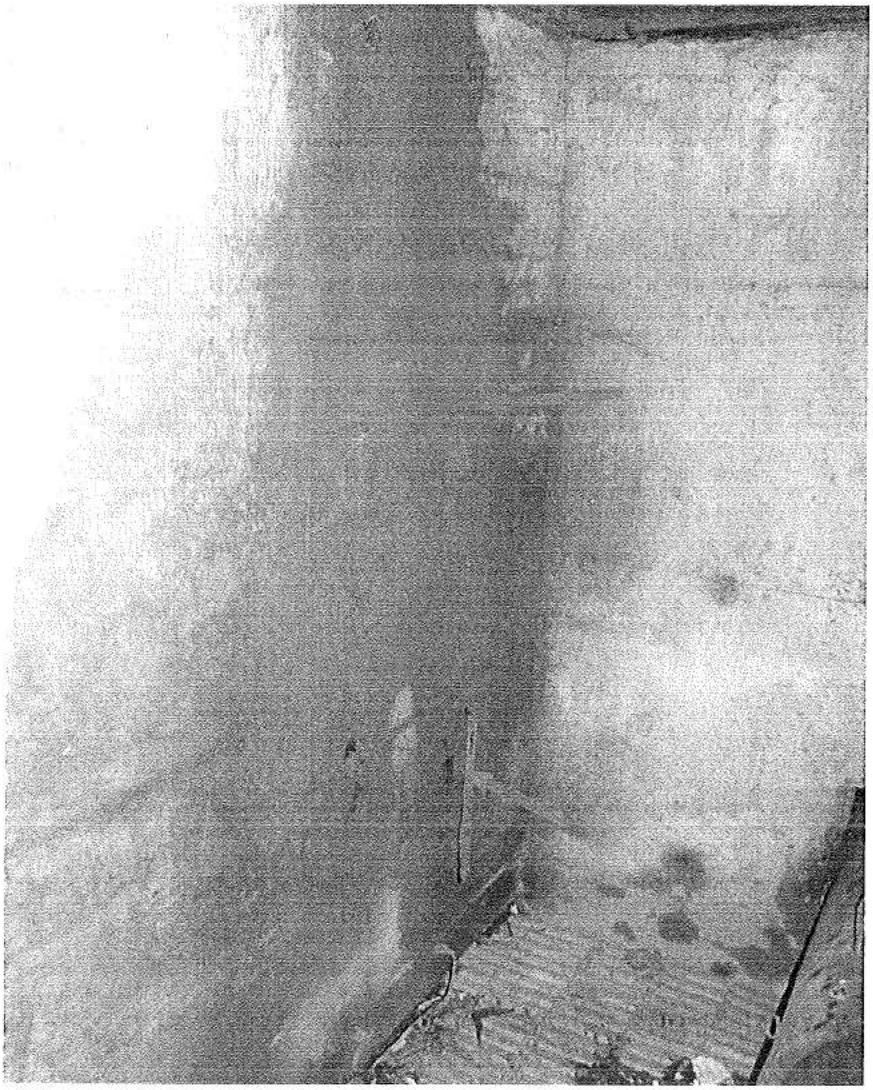
Routine repairs are presented in Tables E2, E3 and E4 and their locations are shown in Figures E1, E2, E3 and E4.

TABLE E1 MISCELLANEOUS CHAMBERS SAFETY ITEMS					
Safety Item #	**Location**	**Station**	**Description**	**Repair Recommendation**	**Figure # / Photo #**
S1	NJ Portal Sump Chamber #2	--	Railing posts around sump pit are completely rusted through and the railing is not attached to the wall. (1 loc.)	Replace railing.	E4/E1
S2	Expressway Sump Room at 33rd St.	--	Manhole rungs missing. (1 loc.)	Replace manhole rungs.	E2/E2
S3	Expressway Sump Room at 36th St.	--	Bottom rungs of the access ladder are severely corroded with 50% section loss. (1 loc.)	Repair or replace ladder.	E2/E3

TABLE E2 MISCELLANEOUS CHAMBERS ROUTINE REPAIR RECOMMENDATIONS NEW YORK PORTAL SUMP ROOMS					
Routine Repair #	**Location**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R1	North Tunnel NY Portal Sump Room	--	Seeps (15 locs.).	Clean and seal leaks.	E1
R2	North Tunnel NY Portal Sump Room	--	Deteriorated concrete and medium spalls with exposed, severely corroded beam. Up to ¼" section loss of the bottom flange of beams around manhole (2 locs.).	Repair spalls and corroded beam.	E1
R3	Center Tunnel NY Portal Sump Room	--	Joints between precast concrete panels seeping. (1 loc.)	Seal joints.	E1

TABLE E3 MISCELLANEOUS CHAMBERS ROUTINE REPAIR RECOMMENDATIONS LINCOLN TUNNEL EXPRESSWAY SUMP ROOMS					
Routine Repair #	**Location**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R4	36th St. Sump Room	--	Seeps (5 locs.).	Clean and seal leaks.	E2
R5	39th St. Sump Room	--	Seeps (2 locs.).	Clean and seal leak.	E3

TABLE E4 MISCELLANEOUS CHAMBERS ROUTINE REPAIR RECOMMENDATIONS NEW JERSEY PORTAL GALLERY AND SUMP CHAMBERS					
Routine Repair #	**Location**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R6	Gallery Passageway	0+02	Dripping water around manhole with ponding water above manhole in duct bank. (1 loc.)	Clean, seal leak and repair as required.	E4
R7	Gallery Passageway	0+08 0+13 0+73 1+15	Seeps in ceiling. (4 locs.)	Clean and seal leaks.	E4
R8	Gallery Passageway	1+22 to 1+45	Fine crack seeping in wall. (3 locs.)	Seal leak and crack.	E4
	Gallery East Stairway	East & West Walls			
R9	Gallery Passageway	0+70	Severe corrosion of cable support. (1 loc.)	Repair cable support.	E4
R10	Gallery Passageway	0+19 1+10 2+20 to 2+25 (4 locs.)	Small to medium spall and adjacent hollow concrete. (6 locs.)	Repair spall as required.	E4
R11	South Tunnel Valve Chamber	--	Seeping around pipe. (1 loc.)	Seal leak.	E4
R12	Sump Chamber # 1	--	Steel beam in ceiling with severely corroded bottom flange. (1 loc.)	Repair bottom flange as required.	E4
R13	Sump Chamber # 1	--	Medium spall (2 sq. ft. x 2" deep) with delaminated concrete and severely corroded reinforcement adjacent to steel beam. (1 loc.)	Repair as required.	E4
R14	Sump Chamber # 1	--	Small to medium spalls around manhole and adjacent hollow concrete. (2 locs.)	Repair as required.	E4
R15	Sump Chamber # 1	--	Construction joint seeping. (1 loc.)	Seal leak and repair as required.	E4
R16	Sump Chamber # 1 Sump Chamber # 2	--	Fine to medium crack seeping in ceiling. (9 locs.)	Seal leak and crack.	E4
R17	Sump Chamber # 2	--	Seep in ceiling around pipe block out. (1 loc.)	Seal leak.	E4
R18	Sump Chamber # 2	--	Wide crack in ceiling slab with adjacent hollow concrete. (1 loc.)	Repair as required.	E4



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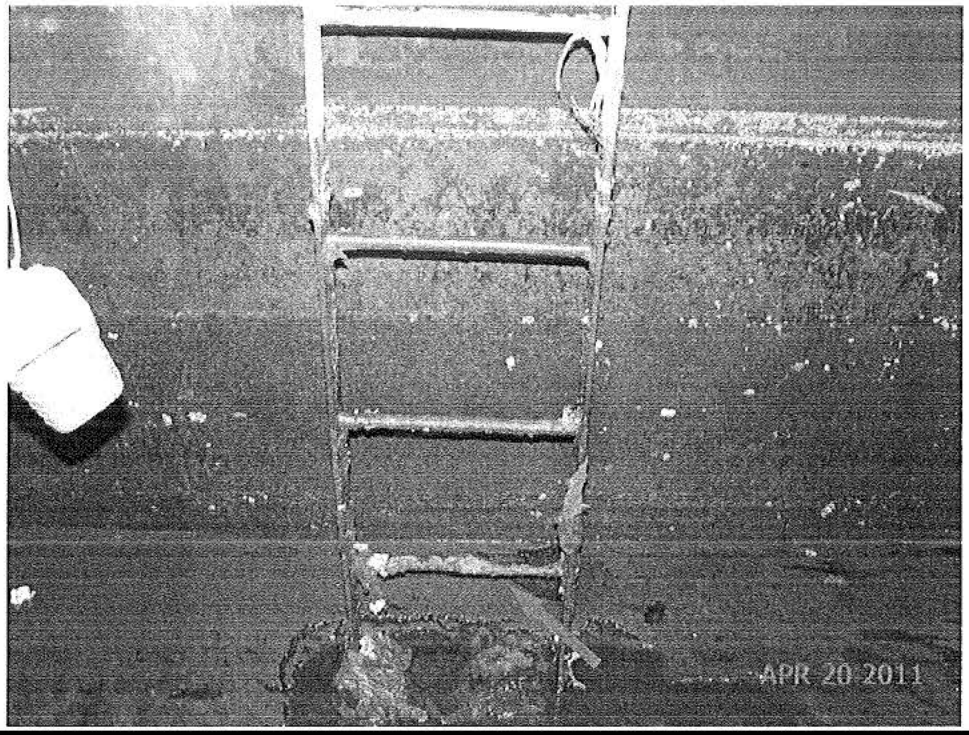

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APPENDIX A

AVAILABLE DOCUMENTS

AVAILABLE DOCUMENTS

1. Port Authority Facility Condition Survey Program; Guidelines for Condition Survey of Tunnels, March 2002.

2. Port Authority Facility Condition Survey Program; Lincoln Tunnel Air Ducts and Drum Rings, September 2009.

3. Lincoln Tunnel Contract Numbers:
   MH-F – 10
   MH-F – 20
   MH-F – 21
   MHT – 1
   MHT – 1A
   MHT – 4
   MHT – 5
   MHT – 5B
   MHT – 6
   MHT – 14
   MHT – 51
   MHT – 55
   MHT – 56
   MHT – 319
   LT – 160.007
   LT – 160.008
   LT – 160.009
   LT – 160.036
   LT – 160.038

Engineering Quality
Assurance Division
B03-925.113

Port Authority Facility Condition Survey Program

Lincoln Tunnel
Air Ducts and Drum Rings

December 2013

Engineering Department

THE PORT AUTHORITY OF NY & NJ

JENNY
ENGINEERING
CORPORATION
CONSULTING ENGINEERS

2 EDISON PLACE • SPRINGFIELD, NEW JERSEY 07081
973 379-6699 FAX: 973 379-6774

December 28, 2013

Mr. C. John Lin, P.E.
Assistant Chief Engineer, Quality Assurance
The Port Authority of New York & New Jersey
3 Gateway Center, 3rd Floor
Newark, N.J. 07102

Attention: Mr. Camille Dagher, P.E.
Project Manager
Quality Assurance Division

Reference: P. A. Agreement No. 405-13-020
Professional Services for the Condition Survey of
Lincoln Tunnel Air Ducts and Drum Rings

Subject: **Final Report Submittal**

Gentlemen:

We are pleased to submit 12 copies of the Port Authority Condition Survey Program inspection report for the Lincoln Tunnel Air Ducts and Drum Rings in accordance with our Agreement No. 405-13-020.

The report covers the results of a field inspection of the above referenced tunnels. Independent quality control by our senior technical and management staff have ensured the thoroughness and accuracy of all work on this project. The report adheres to current practices and standards of the Port Authority of New York and New Jersey.

Very truly yours,

JENNY ENGINEERING CORPORATION

Stanley Niemiec, P.E.
Vice President, Chief Engineer

Enclosure

TABLE 2
SUMMARY OF 2013 SAFETY REPAIR RECOMMENDATIONS

Safety Repair	Location	Station	Description	Recommendation	Figure #/ Photo #
S1	NJ Portal Sump Chamber #2	–	Railing posts around sump pit are completely rusted through and the railing is not attached to the wall.	Replace railing.	E4/E1
S2	Expressway Sump Room at 33rd St.	--	Manhole rungs missing.	Replace manhole rungs.	E2/E2
S3	Expressway Pump Room at 33rd St.	–	Exit door leading to roadway without sign for active roadway.	Install sign.	E2/E3
S4	Expressway Sump Room at 36th St.	–	Bottom rungs of the access ladder are severely corroded with 75% section loss.	Repair or replace ladder.	E2/E4

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III. SCOPE OF WORK AND INSPECTION PROCEDURE

A condition survey was performed on the Lincoln Tunnel. The survey included the north, center and south tunnels, the 41st Street Underpass located adjacent to the Port Authority Bus Terminal, and miscellaneous chambers (New Jersey Portal Gallery and Sumps, New York Portal and Lincoln Tunnel Expressway Sumps). The purpose of the survey was to determine and document the condition of the tunnels, identify any structural and/or non-structural deficiencies that might present potential safety hazards, and to develop recommendations for correcting any deficiencies that were found.

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B. Inspection Procedure

Generally, a six-member crew was utilized for the inspection. Two, two-member teams, each lead by a professional licensed engineer, conducted inspections of the exhaust and blower ducts simultaneously. The third two-member team served as safety support for both teams and also inspected the roadway area. The inspection generally consisted of the following procedures:

1. The inspection of the ducts and roadway area was always conducted in the tunnel closed to traffic, as scheduled by the facility.

2. The roadway walk-through inspection was 100% visual, with hands-on inspections performed at locations where findings were deemed to be significant. The inspection was coordinated with the facility personnel and utilized the scheduled tunnel closing. Tunnel stationing was based on the station markers located on the far wall (no safety walk) side of the tunnels. All crew members wore safety vests while working in the roadway areas.

3. The exhaust and blower ducts were inspected 100% visually, with hands-on inspections performed at locations where findings were deemed to be significant (approximately 10% hands-on). Entry to the ducts was made through the various ventilation buildings from the tunnel roadway, and was coordinated with the facility. Illumination was provided by means of hand held battery operated flashlights and floodlights. Tunnel stationing for deficiency locations in the blower ducts was based on measurements taken from station markers painted on the duct walls. Stationing for deficiency locations in the exhaust ducts was based on measurements taken from survey plaques attached to the roadway ceiling hangers, or station markers painted on the duct walls (generally in the bent sections). A gas detector was carried in the

exhaust duct to monitor oxygen and carbon monoxide levels. The inspection crews wore disposable coveralls, hard hats, and other appropriate personal and safety equipment for the inspection of the ducts.

[redacted]

5. The miscellaneous chambers were inspected 100% visually, with hands-on inspections performed at locations where findings were deemed to be significant (approximately 10% hands-on). Entry to the chambers was made through roadway manholes and hatches in the pump rooms and was coordinated with the facility. Illumination was provided by means of hand held battery operated flashlights and floodlights. A gas detector was carried in the sump rooms to monitor oxygen and carbon monoxide levels. The inspection crews wore disposable coveralls, hard hats and other appropriate personal and safety equipment for the inspection of the chambers.

6. The tunnels were inspected at night between the hours of 11:00 p.m. and 5:00 a.m., subject to the requirements of the Facility Operations and the PA police.

The primary deficiencies expected in a subaqueous tunnel are related to the watertightness of the structure. Therefore, emphasis was placed on recording water leaks and leak related damages to the structures. Other signs of distress such as cracking and spalling of the concrete liner and corrosion of steel or cast iron elements were also identified. Passive leaks, deposits, minor efflorescence and other minor deficiencies of no structural significance and not requiring repairs, were generally not recorded.

Notes and Photographs

The terminology used for description of the deficiencies is based on the Port Authority of New York and New Jersey's condition survey definitions and terminology (page xiii) and the Repair Recommendation Guide for Tunnels (Figure 3). Deficiencies were recorded during the inspection on field forms with each sheet representing 100 linear feet of tunnel.

Photographs were taken during the inspection of significant or typical deficiencies. The location and orientation of the photos were noted on the field forms.

C. Condition Survey Definitions and Terminology

Definitions of Recommendation Categories

Hands-On - Inspection: Close-up inspection from not further away than arm's length where the member or element can be physically touched.

Visual - Inspection: The inspection from a reasonable distance of a member or element where initial determination of the condition can be made.

Four categories of repair recommendations are identified and defined as follows:

Immediate - Requires immediate action including possible closing of the structure or areas affected for safety reasons until interim remedial measures, such as shoring or removal of potentially unsafe structures (or elements) can be implemented. These closings or interim remedial actions, if any, always require immediate action upon discovery.

Priority - Conditions for which no immediate action may be required, or for which immediate action has been completed, but for which further investigations, design, and implementation of interim or long-term repairs should be undertaken on a priority basis, i.e., taking precedence over all other scheduled work.

Safety - Conditions that present a potential hazard and which should be repaired as soon as possible.

Routine - Conditions requiring further investigation or remedial work that can be undertaken as part of a scheduled maintenance program or other scheduled project, or routine facility maintenance, depending on the action required.

Definitions of Condition Ratings

The following terms are used to rate the condition of structural systems or individual elements and are defined below. When a term is applied to an overall system, it does not mean that some other element of the system may not be in a different condition.

Excellent - Element is in as-new condition

Good - Element is sound and performing its functions, although it shows signs of use and may require some minor repairs, mostly routine.

Fair - Element is still performing adequately at this time but needs priority and/or routine repairs to prevent further deterioration and to restore it to good condition.

Poor - Element cannot be relied upon to continue to perform its original function without immediate and/or priority repairs.

IV. HISTORY OF TUNNEL AND INSPECTION FINDINGS PRESENTATION METHODS

A. History of the Lincoln Tunnel

The first (center) tube of the Midtown Hudson Tunnel was authorized in the 1930s and construction was completed in 1937. The second (north) tunnel was completed in 1945, and the third (south) tunnel was completed in 1957. Control and operation of the tunnel is under the Port Authority of NY & NJ. The facility generally consists of three parallel, two-lane vehicular tunnel tubes and three ventilation buildings. The facility is located between Weehawken, New Jersey and mid-town Manhattan.

Figure 1 shows a profile of the north, center and south tunnels and also indicates the duct airflows for each tube. Typical tunnel cross sections are shown in Figure 2. A brief description of each tunnel is given in Chapter V.

B. Evaluation of Deficiencies

Figure 3 shows the classifications of deficiencies in the tunnel in terms of repair recommendation categories (no repair required, routine, priority and immediate). Cracks within concrete linings and concrete elements are classified by category as to crack size, orientation and any signs of recent propagation or measurable deflection. Spalls are categorized by size, propagation into the lining or element, and the extent of concrete deterioration around the spall.

Deficiencies within the cast iron sections of the tunnel lining are classified by cracks, corrosion, and miscellaneous deficiencies. Cracks are categorized by width, length, location and any measurable lining deflection. Corrosion of the cast iron segments is categorized by the severity of the corrosion and amount of section loss. Miscellaneous deficiencies include missing, loose, or severely deteriorated bolts; missing grout plugs; or dry leaks and deposits. Steel elements of the tunnels and underground structures are also classified by the severity of corrosion and amount of section loss.

Water infiltration into the tunnel is classified separately by whether the water inflow is gushing, flowing, dripping, or seeping. Repair recommendations for any water leak combined with another deficiency as cited above are summarized in a separate classification table in Figure 3.

The criteria indicated in Figure 3 shall serve only as a guide for determining a repair recommendation. Engineering judgment shall be used to determine the effect of all deficiencies on the integrity of the structure.

C. Inspection Findings Presentation Methods

Priority, safety, and routine repair items are presented in tabular form and supplemented with figures furnishing the locations of the repair items (deficiencies). The tables provide a description of the deficiency, location, repair recommendation, and photo reference, if used. Photos are used to enhance the description of an item, or to record the status of a previously reported repair item.

V. STRUCTURE DESCRIPTION, INSPECTION FINDINGS AND RECOMMENDATIONS

A. NORTH TUNNEL

[redacted]

2. Inspection Findings and Repair Recommendations

The overall condition of the north tunnel is good.

Priority Repairs:

There were 2 priority repairs recommended at 14 locations during the previous inspection, of which 2 locations have been repaired and 4 new locations were noted during the current inspection, all remain priority repairs at 16 locations. The priority repairs consist of approximately 240 sf. of concrete removed from the underside of the roadway slab with exposed reinforcement and the separation of the steel curb plate up to 3½" from the concrete wall caused by pack rust. The locations and descriptions of the repairs are furnished in Table A1 and the locations are also shown on Figure A1.

Safety Repairs:

No safety repairs were noted for the north tunnel during the current inspection.

Routine Repairs:

There were 13 routine repairs at 250 locations noted during the current inspection.
Routine repairs are presented in Tables A2, A3 and A4 and their locations are shown on Figure A1.

Findings with No Recommendations:

There are 4 findings with no recommendation at 94 locations. The findings with no recommendation are presented in Table A5 and their locations are shown on Figure A1.

TABLE A2 NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R1	Drum Ring & Steel Bent	160+50 to 160+62 (1 loc.) 164+96 168+00 to 168+11 (3 locs.) 170+92 172+20 to 172+95 (4 locs.) 173+18 174+20 to 174+74 (3 locs.) 176+10 to 176+50 (4 locs.) 177+38 to 177+76 (3 locs.) 187+76 188+26 189+76 191+26 191+80 196+78 197+84 to 197+96 (2 locs.) 200+22 202+22 203+72 204+78 205+74 207+70 208+00 214+70 222+38 224+60	Medium to large spalls in the underside of the roadway slab with exposed reinforcement and hollow concrete areas – no loose concrete. (39 locs.)	Clean, patch and repair.
R2	Drum Ring & Steel Bent	162+70 166+58 173+44 177+74	Moderate to severe corrosion of manhole frames w/ seeps or drips. (4 locs.)	Clean and paint manhole covers and frames and seal leaks.

TABLE A2 (Continued) NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R2 (cont'd)	Drum Ring & Steel Bent	182+05 186+35 190+66 194+98 197+08 200+06 204+87 209+58 214+28 218+94 224+10 228+90 232+98	Moderate to severe corrosion of manhole frames w/ seeps or drips. (13 locs.)	Clean and paint manhole covers and frames and seal leaks.
R3	Drum Ring & Steel Bent	159+56 161+62 167+26 to 168+00 (6 locs.) 168+10 to 168+80 (4 locs.) 169+04 to 169+97 (25 locs.) 170+00 to 170+59 (10 locs.) 171+38 192+96 195+17 195+50 199+87 199+91 206+84 206+92	Seeps. (55 locs.)	Clean and seal leaks.

TABLE A2 (Continued) NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R3 (Cont'd)	Drum Ring & Steel Bent	215+98 216+12 to 217+00 (19 locs.) 217+00 to 217+82 (8 locs.) 218+20 to 218+80 (15 locs.) 219+20 to 219+82 (7 locs.) 221+45 221+48 221+80 221+90 224+14 224+15 228+72 231+04 to 231+34 (8 locs.) 232+14 to 232+80 (7 locs.) 233+10 to 234+22 (6 locs.)	Seeps. (78 locs.)	Clean and seal leaks.
R4	Drum Ring	201+95 219+00	Water inflow from valve behind plate in side walls. (2 locs.)	Locate source of leak, seal leak and repair.

TABLE A3 NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS EXHAUST AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R5	Drum Ring & Steel Bent	170+15 221+81 232+04 232+18 233+32 to 233+50 (11 locs.)	Seeps and drips. (15 locs.)	Clean and seal leaks.
R6	Drum Ring	172+80 172+84 172+88 222+57	Exposed ring joint with drips or seeps. (4 locs.)	Clean, seal leaks and patch.
R7	Steel Bent	230+30 to 231+00 (4 locs.) 231+34 to 231+47 (3 locs.) 233+26 to 233+53 (1 loc.)	Medium spalls in side walls and ceiling with exposed, corroded reinforcement and adjacent hollow concrete. (8 locs.)	Remove hollow concrete. Clean and patch.

TABLE A4 NORTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R8	Drum Ring & Steel Bent	170+16 170+47 208+10 214+60 219+50 231+25 233+20 234+20 to 234+24 (5 locs.)	Seeps and drips. (12 locs.)	Clean and seal leaks.
R9	Drum Ring & Steel Bent	201+30 214+50 223+40 223+62 224+30 227+70 228+44	Missing/damaged vent port covers. (7 locs.)	Replace vent port covers.
R10	Drum Ring & Steel Bent	207+65 227+40	Seeping from hatch of valve chambers. (2 loc.)	Locate source of leaks and repair.
R11	Drum Ring & Steel Bent	230+95	Cracked or spalled pavement. (1 loc.)	Repair pavement.
R12	Steel Bent	162+70	Water seeping from splicing chamber/fire extinguisher cabinet. (1 loc.)	Clean and seal leak.
R13	Drum Ring & Steel Bent	165+75 to 165+80 (1 loc.) 170+04 to 170+15 (1 loc.) 228+88 230+58 to 230+84 (2 locs.) 231+25 232+92 233+46 to 233+54 (2 locs.)	Areas of missing tiles. (9 locs.)	Replace missing tiles.

TABLE A5 NORTH TUNNEL FINDINGS WITH NO RECOMMENDATIONS					
Finding #	**Tunnel Type**	**Location**	**Station**	**Description**	**Figure #**
1	Drum Ring	Exhaust Duct	172+30 to 174+75 (45 locs.) 221+00 to 221+43 (9 locs.) 221+80 to 223+00 (24 locs.)	Small spalls with adjacent hollow concrete over tie rods. (78 locs.)	A1
2	Drum Ring	Exhaust Duct	221+30 to 221+43 (1 loc.)	Deteriorated joint between tunnel and vent building with 200 sq. ft. of hollow concrete. (1 loc.)	A1
3	Drum Ring	Exhaust Duct	170+18 to 170+32 (1 loc.) 222+56 to 222+80 (2 locs.)	Medium spalls in tunnel lining with adjacent hollow concrete. (3 locs.)	A1
4	Drum Ring	Roadway	161+17 to 161+24 (1 loc.) 172+00 to 172+20 (1 loc.) 173+60 to 173+69 (1 loc.) 174+21 to 174+34 (1 loc.) 174+75 to 174+90 (1 loc.) 175+36 to 175+75 (1 loc.) 175+95 to 176+05 (1 loc.) 176+07 to 176+66 (1 loc.) 176+32 to 177+00 (1 loc.) 177+13 to 180+00 (1 loc.) 206+24 to 206+60 (1 loc.) 225+51 to 225+74 (1 loc.)	Separation of the steel curb plate up to 1" from concrete wall caused by pack rust. (12 locs.)	A1

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B. CENTER TUNNEL

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2. Inspection Findings and Repair Recommendations

The overall condition of the center tunnel is good.

Priority Repairs:

There were 2 priority repairs at the 2 locations recommended during the previous inspection, one of which has been completed and one remains outstanding. The outstanding priority repair consists of an approximate 450 sf. area of the tunnel invert with 6" of concrete lining and 90% of the reinforcement removed. No new priority repairs were noted during the current inspection. The location and description of the repair is furnished in Table B1 and the location is also shown on Figure B1.

Safety Repairs:

No safety repairs were noted for the center tunnel during the current inspection.

Routine Repairs:

There were 11 routine repairs at 329 locations noted during the current inspection.
Routine repairs are presented in Tables B2, B3 and B4 and their locations are shown on Figure B1.

Findings with No Recommendations:

There is 1 finding with no recommendation at 40 locations. The finding with no recommendation is presented in Table B5 and its locations are shown on Figure B1.

TABLE B2 CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R1	Drum Ring & Steel Bent	160+61 165+50 168+60 172+60 175+84 177+08 177+34 181+60 189+35 190+96 191+92 195+80 197+30 (Mid-River Sump) 197+65	Medium to large spalls in the underside of the roadway slab with exposed reinforcement and hollow areas – no loose concrete. (14 locs.)	Clean, patch and repair.
R2	Drum Ring & Steel Bent	164+46 to 164+64 (6 locs.) 164+98 165+26 167+60 167+83 168+08 168+61 170+30 to 170+50 (8 locs.) 171+06 to 171+32 (3 locs.) 172+42 180+24 to 180+64 (3 locs.) 183+56 216+00 to 217+28 (10 locs.) 220+36 to 220+50 (6 locs.)	Seeps. (44 locs.)	Clean and seal leaks.

TABLE B2 (Continued) CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R2 (Cont'd)	Drum Ring & Steel Bent	226+86 to 228+00 (39 locs.) 233+48 233+64 234+70 to 234+94 (4 locs.) 235+41 to 235+57 (7 locs.) 239+20 to 239+72 (2 locs.) 240+54 to 240+78 (3 locs.)	Seeps. (57 locs.)	Clean and seal leaks.
R3	Drum Ring	172+00 to 172+36 (9 locs.) 172+80 198+73 208+18 to 208+26 (2 locs.) 214+05 215+17 220+30 224+10 232+40 233+06 to 233+40 (3 locs.) 235+00 to 235+15 (8 locs.)	Medium spalls with exposed ring joints. (29 locs.)	Clean and patch spall.

TABLE B3 CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS EXHAUST AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R4	Drum Ring & Steel Bent	168+08 to 168+73 (6 locs.) 169+90 170+18 221+46 226+14 to 226+34 (3 locs.) 231+80 233+46 to 233+49 (2 locs.) 238+03 241+50 242+44 to 242+53 (4 locs.)	Seeps and drips. (21 locs.)	Clean and seal leaks.
R5	Drum Ring	221+46 226+14 to 226+44 (4 locs.) 227+18 227+87 230+96	Exposed ring joints with passive leaks. (8 locs.)	Clean and seal leaks.
R6	Drum Ring	172+78 220+90 to 221+40 (9 locs.) 221+79	Small spalls and adjacent hollow concrete over tie rods with some tie rods exposed. (11 locs.)	Remove hollow concrete. Clean and patch.
R7	Steel Bent	238+00 to 242+53 (57 locs.)	Concentration of fine to wide cracks along perimeter of exhaust duct and adjacent hollow concrete. (57 locs.)	Clean and seal cracks.

TABLE B4 CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R8	Drum Ring & Steel Bent	234+90 242+53	Seeps and drips. (2 locs.)	Clean and seal leaks.
R9	Drum Ring & Steel Bent	178+30 200+72 to 200+84 (2 locs.) 207+24 to 207+80 (1 loc.) 210+18 to 210+32 (1 loc.) 218+60 to 218+70 (1 loc.) 225+35 228+70 231+95 to 232+10 (1 loc.) 235+20 237+25 237+70	Cracked or spalled pavement. (12 locs.)	Repair pavement.

TABLE B4 (Continued) CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R10	Drum Ring & Steel Bent	162+06 162+74 162+89 163+05 163+18 163+34 163+48 163+63 163+82 164+05 164+23 164+43 164+63 164+83 165+03 165+41 165+63 165+83 166+63 167+23 168+83 169+23 169+42 169+63 170+03 170+25 170+70 171+32 171+53 172+50 172+70 172+90	Missing/damaged vent port covers in the ceiling slab. (32 locs.)	Replace vent port covers.

TABLE B4 (Continued) CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R10 (Cont'd)	Drum Ring & Steel Bent	173+15 173+40 173+60 173+75 173+92 174+10 174+30 174+70 174+90 175+12 176+72 177+15 177+35 177+55 177+75 177+90 178+20 179+15 179+65 179+75 179+95 181+10 182+35 182+60 182+80 189+20 189+39 189+95 190+10 193+70 194+16	Missing/damaged vent port covers in the ceiling slab. (31 locs.)	Replace vent port covers.

TABLE B4 (Continued) CENTER TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R10 (Cont'd)	Drum Ring & Steel Bent	194+47 197+30 221+40 221+50 223+09 225+50 226+80 239+88 240+74 241+08	Missing/damaged vent port covers in the ceiling slab (10 locs.)	Replace vent port covers.
R11	Drum Ring	220+80 to 220+95 (1 loc.)	Area of missing tiles. (1 loc.)	Replace missing tiles.

TABLE B5 CENTER TUNNEL FINDINGS WITH NO RECOMMENDATIONS					
Finding #	**Tunnel Type**	**Location**	**Station**	**Description**	**Figure #**
1	Drum Ring	Blower Duct	207+80 to 209+80 (14 locs.) 211+40 to 218+00 (26 locs.)	Medium spalls in side walls and adjacent hollow concrete. (40 locs.)	B1

C. SOUTH TUNNEL

[redacted]

2. Inspection Findings and Repair Recommendations

The overall condition of the south tunnel is good. However, the condition of the roadway slab is fair due to the numerous areas of hollow, delaminated and spalled concrete noted in the underside of the roadway slab.

Priority Repairs:

There were 3 priority repairs at 26 locations recommended during the previous inspection of which 1 has been repaired at 1 location and 1 has been repaired at 12 out of 24 locations. Therefore, 2 priority repairs remain outstanding at 13 locations. These outstanding priority repairs consist of areas of removed concrete from the underside of the roadway slab with exposed reinforcement in the blower duct and leakage through the ring joint of the exhaust duct resulting in seepage through the ceiling and south wall of the roadway. No new priority repairs were noted during the current inspection. The locations and descriptions of the repairs are furnished in Table C1 and their locations are shown on Figure C1.

Safety Repairs:

No safety repairs were noted for the center tunnel during the current inspection.

Routine Repairs:

There were 12 routine repairs at 491 locations noted during the current inspection.
Routine repairs are presented in Tables C2, C3 and C4 and their locations are shown on Figure C1.

Findings with No Recommendations:

There is 1 finding with no recommendation at 17 locations. The finding with no recommendation is presented in Table C5 and its locations are shown on Figure C1.

TABLE C2 SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R1	Drum Ring & Steel Bent	161+00 to 161+10 (1 loc.) 161+62 to 161+92 (3 locs.) 163+60 to 163+96 (3 locs.) 164+58 to 164+74 (3 locs.) 165+96 to 166+00 (1 loc.) 167+18 to 167+82 (4 locs.) 168+34 to 168+70 (5 locs.) 170+00 to 172+74 (14 locs.) 174+21 to 174+38 (3 locs.) 175+09 to 176+73 (9 locs.) 178+15 to 178+33 (3 locs.) 180+26 to 181+86 (9 locs.) 182+04 to 184+98 (9 locs.) 185+10 to 186+72 (8 locs.) 187+14 to 187+70 (2 locs.) 187+91 to 192+73 (17 locs.) 193+84 to 194+00 (2 locs.) 196+03 to 196+91 (4 locs.) 197+25 to 200+41 (10 locs.) 199+40 (Mid-River Sump) 200+00 to 200+27 (4 locs.) 205+00 to 205+92 (4 locs.) 206+58 to 208+46 (9 locs.) 209+02 to 209+65 (3 locs.) 210+02 to 210+83 (4 locs.) 211+32 to 212+11 (6 locs.) 213+53 to 213+71 (2 locs.) 213+87 to 215+00 (7 locs.) 215+15 to 215+77 (3 locs.) 216+25 to 216+50 (3 locs.)	Medium to large spalls in the underside of the roadway slab with exposed reinforcement and hollow areas – no loose concrete. (156 locs.)	Clean, patch and repair.

TABLE C2 (Continued) SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R1 (Cont'd)	Drum Ring & Steel Bent	219+44 to 219+91 (4 locs.) 220+42 to 220+93 (3 locs.) 221+61 to 222+89 (6 locs.) 224+23 to 224+27 (1 loc.) 226+14 to 226+88 (3 locs.) 227+40 to 227+94 (3 locs.) 228+00 to 231+24 (12 locs.) 233+00 to 233+96 (4 locs.) 234+12 to 235+50 (3 locs.) 235+84 to 236+10 (4 locs.) 236+40 to 236+90 (3 locs.) 237+08 to 237+50 (3 locs.) 238+70 to 238+96 (2 locs.) 239+26 to 239+50 (2 locs.)	Medium to large spalls in the underside of the roadway slab with exposed reinforcement and hollow areas – no loose concrete. (53 locs.)	Clean, patch and repair.
R2	Drum Ring & Steel Bent	184+18	Moderate to severe corrosion of manhole frames w/ seeps or drips. (1 loc.)	Clean and paint manhole covers and frames and seal leaks.
R3	Drum Ring & Steel Bent	162+17 to 162+88 (10 locs.) 163+22 to 163+74 (4 locs.) 165+32 to 165+92 (5 locs.) 166+26 to 166+63 (5 locs.) 167+30 to 167+60 (3 locs.) 168+82 169+04 to 169+92 (7 locs.) 170+53 172+24 to 172+76 (13 locs.) 178+24 178+56 188+44	Seeps and drips. (52 locs.)	Clean and seal leaks.

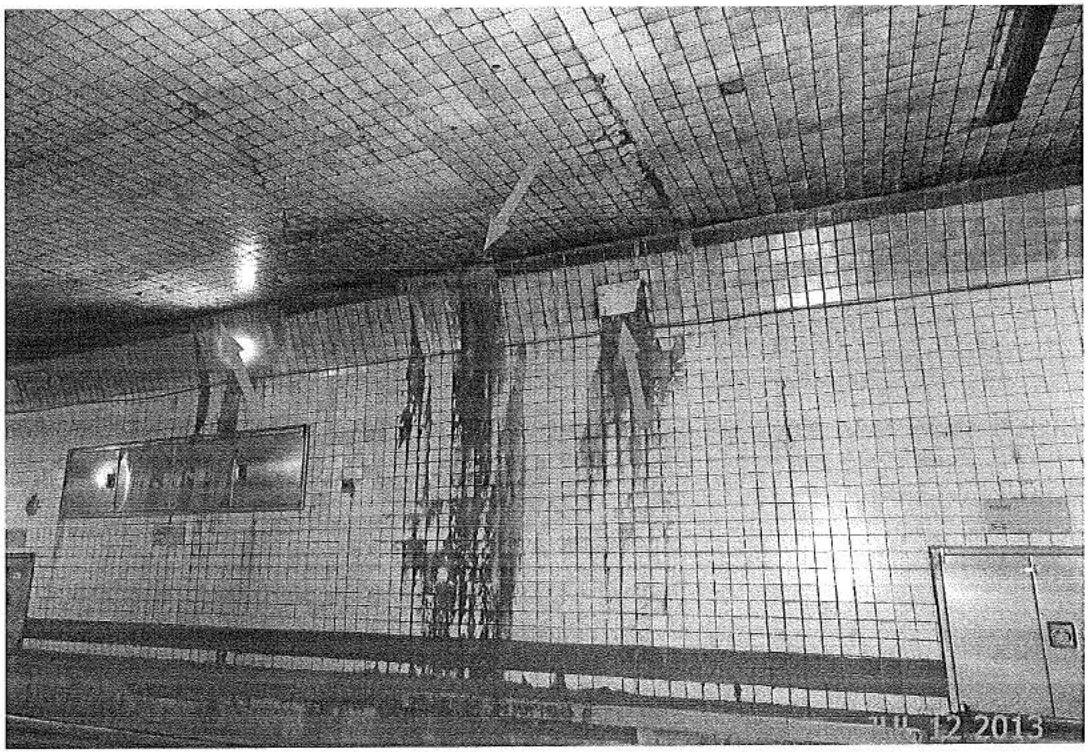
TABLE C2 (Continued) SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS BLOWER AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R3 (Cont'd)	Drum Ring & Steel Bent	204+26 209+40 213+14 222+35 to 222+53 (6 locs.) 224+68 226+37 to 226+88 (5 locs) 227+50 to 227+98 (8 locs.) 228+02 to 229+78 (17 locs.) 230+04 to 230+66 (3 locs.) 231+86 232+04 to 233+98 (12 locs.) 234+18 234+69 235+06 236+62 237+95 238+40 to 238+58 (4 locs.)	Seeps and drips. (65 locs.)	Clean and seal leaks.
R4	Drum Ring	170+06 to 170+94 (5 locs.) 171+16 to 171+82 (22 locs.) 172+03 175+40 175+52	Medium spalls with exposed ring joints. (30 locs.)	Clean and patch spalls.
R5	Steel Bent	224+34 to 224+56 (1 loc.) 231+83 to 231+90 (1 loc.) 237+31 237+61 237+71 238+66 239+34 to 239+57 (3 locs.)	Medium spalls with exposed steel at invert. (9 locs.)	Clean and patch.

TABLE C3 SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS EXHAUST AIR DUCT				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R6	Drum Ring & Steel Bent	160+68 to 160+76 (2 locs.) 161+16 166+20 to 166+71 (8 locs.) 167+90 168+23 to 168+54 (7 locs.) 172+75 to 172+77 (2 locs.) 225+00 234+71 to 234+95 (5 locs.) 235+18 235+21 235+55 235+78 236+26 237+50 238+43 239+80	Seeps and drips. (35 locs.)	Clean and seal leaks.
R7	Steel Bent	234+71 to 236+64 (18 locs.) 237+06 to 238+27 (12 locs.) 238+58 to 239+18 (7 locs.) 239+59 to 240+20 (6 locs.)	Concentration of fine to wide cracks along exhaust duct perimeter and adjacent hollow concrete in south wall. (43 locs.)	Clean and seal cracks. Remove hollow concrete. Clean and patch.

TABLE C4 SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R8	Drum Ring & Steel Bent	160+95 161+02 161+15 166+98 222+90	Seeps and drips. (5 locs.)	Clean and seal leaks.
R9	Drum Ring	176+40 181+20 185+85 190+50 195+10 199+84 199+98 209+98 219+25 223+15	Oil/asphalt seeps from splicing chambers. (10 locs.)	Locate source of leaks and seal.
R10	Steel Bent	234+30	Asphalt seep from construction joint. (1 loc.)	Locate source of leak and seal.

TABLE C4 (Continued) SOUTH TUNNEL ROUTINE REPAIR RECOMMENDATIONS ROADWAY				
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**
R11	Drum Ring & Steel Bent	165+00 to 165+11 (1 loc.) 224+10 to 224+18 (1 loc.) 234+28 to 234+32 (1 loc.) 234+80 to 234+84 (1 loc.)	Areas of missing tiles. (4 locs.)	Replace missing tiles.
R12	Drum Ring & Steel Bent	182+35 to 182+37 (1 loc.) 189+38 to 189+41 (1 loc.) 190+20 to 190+26 (1 loc.) 191+46 to 191+54 (1 loc.) 191+90 to 191+94 (1 loc.) 192+19 to 192+24 (1 loc.) 192+40 to 192+62 (3 locs.) 194+75 to 194+77 (1 loc.) 195+00 to 195+50 (1 loc.) 195+81 to 195+85 (1 loc.) 197+10 to 197+31 (1 loc.) 197+49 to 197+54 (1 loc.) 217+58 to 218+26 (1 loc.) 219+66 to 219+70 (1 loc.) 219+85 to 219+92 (1 loc.) 229+61 to 229+71 (1 loc.) 229+90 to 230+12 (1 loc.) 231+00 to 231+15 (1 loc.) 231+65 to 231+83 (1 loc.) 235+50 to 235+74 (1 loc.) 236+16 to 236+21 (1 loc.) 236+50 to 236+80 (1 loc.) 239+05 to 239+19 (1 loc.) 239+50 to 239+88 (1 loc.) 240+00 to 240+23 (1 loc.)	Crack/split in steel curb plate caused by pack rust. (27 locs.)	Repair curb plates.

TABLE C5 SOUTH TUNNEL FINDINGS WITH NO RECOMMENDATIONS					
Finding #	**Tunnel Type**	**Location**		**Description**	**Figure #**
1	Drum Ring	Exhaust Duct	161+55 to 161+68 (1 loc.) 164+12 165+32 to 165+40 (1 loc.) 166+16 to 166+30 (3 locs.) 166+90 to 167+17 (3 locs.) 167+84 172+70 175+10 175+35 176+42 204+22 to 204+38 (1 loc.) 221+80 222+85	Medium spalls in tunnel lining and adjacent hollow concrete. (17 locs.)	C1



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D. 41st STREET UNDERPASS

[redacted]

2. Inspection Findings and Repair Recommendations

The overall condition of the underpass is good.

Priority Repairs:

There were no priority repairs noted during the previous or current inspection.

Safety Repairs:

There were no safety repairs noted during the current inspection.

Routine Repairs:

There were 10 routine repairs at 49 locations noted during the current inspection.
Routine repairs are presented in Tables D1, D2, D3 and D4 and their locations are shown in Figures D1 and D2.

TABLE D1 41ST STREET UNDERPASS ROUTINE REPAIR RECOMMENDATIONS SUPPLY AIR (BLOWER) CHAMBER					
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R1	Steel Bent	4+73 4+86 6+98 7+42 7+75 8+48	Seeps. (6 locs.)	Clean and seal leaks.	D1

TABLE D2
41ST STREET UNDERPASS
ROUTINE REPAIR RECOMMENDATIONS
EXHAUST AIR CHAMBER

Routine Repair #	Tunnel Type	Station	Description	Repair Recommendation	Figure #
R2	Steel Bent	4+00 4+32 5+05 to 5+20 (5 locs.) 5+28 5+45 5+77 5+99 6+30 to 6+65 (4 locs.) 7+37 7+43 7+73 7+78 7+84 8+08	Seeps. (21 locs.)	Clean and seal leaks.	D1

TABLE D3
41ST STREET UNDERPASS
ROUTINE REPAIR RECOMMENDATIONS
BUS TERMINAL EXHAUST CHAMBER

Routine Repair #	Tunnel Type	Station	Description	Repair Recommendation	Figure #
R3	Steel Bent	5+00 5+88	Seeps and drips. (2 locs.)	Clean and seal leaks.	D2
R4	Steel Bent	4+62 5+98 (Exhaust fan #3)	Vertical medium crack w/ loose block in CMU. (2 locs.)	Re-point block and seal crack.	D2
R5	Steel Bent	4+76 (Exhaust fan #3)	Vertical full height wide crack in CMU wall of duct to exhaust fan #3. (1 loc.)	Seal crack.	D2
R6	Steel Bent	5+09 to 5+15 5+16 to 5+26	Large spalls. (2 locs.)	Clean and patch spalls.	D2
R7	Steel Bent	5+65 5+98 6+30 7+30 7+98 8+26	Deteriorated construction joints w/ large areas of adjacent delaminated concrete. (6 locs.)	Clean and patch construction joints.	D2
R8	Steel Bent	5+55	20 sq. ft. of hollow patch in ceiling. (1 loc.)	Repair patch.	D2

TABLE D4 41ST STREET UNDERPASS ROUTINE REPAIR RECOMMENDATIONS ROADWAY					
Routine Repair #	**Tunnel Type**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R9	Steel bent	3+38 3+90 3+95 4+00 4+10 4+20 4+28	Wide cracks in roadway pavement. (7 locs.)	Seal cracks.	D1
R10	Steel bent	4+28	Seeps in ceiling. (1 loc.)	Clean and seal leaks.	D1

E. MISCELLANEOUS CHAMBERS

[redacted]

2. Inspection Findings and Repair Recommendations

The overall condition of the New York Portal Tunnel Sump Rooms, the Lincoln Tunnel Expressway Sump Rooms and the New Jersey Portal Gallery is good.

Priority Repairs:

There were no priority repairs noted during the previous or current inspection.

Safety Repairs:

Four non-structural safety repairs were noted during the current inspection. The safety repairs consist of missing manhole rungs in the 33rd St. Sump Room, a severely corroded access ladder in the 36th St. Sump Room, railing posts around the sump pit area are completely rusted through and the railings are not attached to the walls in the NJ Portal Sump Room, and a missing sign for active roadway on the exit door leading to the roadway from the 33rd St. Pump Room. The location and description of safety repairs are furnished in Table E1 and their locations are also shown on Figures E2 and E4.

Routine Repairs:

There were 18 routine repairs at 58 locations noted during the current inspection.
Routine repairs are presented in Tables E2, E3 and E4 and their locations are shown in Figures E1, E2, E3 and E4.

TABLE E1 MISCELLANEOUS CHAMBERS SAFETY REPAIR RECOMMENDATIONS					
Safety Repair #	**Location**	**Station**	**Description**	**Repair Recommendation**	**Figure # / Photo #**
S1	NJ Portal Sump Chamber #2	--	Railing posts around sump pit are completely rusted through and the railing is not attached to the wall. (1 loc.)	Replace railing.	E4/E1
S2	Expressway Sump Room at 33rd St.	--	Manhole rungs missing. (1 loc.)	Replace manhole rungs.	E2/E2
S3	Expressway Pump Room at 33rd St.	--	Exit door leading to roadway without sign for active roadway. (1 loc.)	Install sign.	E2/E3
S4	Expressway Sump Room at 36th St.	--	Bottom rungs of the access ladder are severely corroded with 75% section loss. (1 loc.)	Repair or replace ladder.	E2/E4

TABLE E2 MISCELLANEOUS CHAMBERS ROUTINE REPAIR RECOMMENDATIONS NEW YORK PORTAL SUMP ROOMS					
Routine Repair #	**Location**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R1	North Tunnel NY Portal Sump Room	--	Seeps. (15 locs.)	Clean and seal leaks.	E1
R2	North Tunnel NY Portal Sump Room	--	Deteriorated concrete and medium spalls with exposed, severely corroded beam. Up to ¼" section loss of the bottom flange of beams around manhole. (2 locs.).	Repair spalls and corroded beam.	E1
R3	Center Tunnel NY Portal Sump Room	--	Joints between precast concrete panels seeping. (1 loc.)	Seal joints.	E1

TABLE E3 MISCELLANEOUS CHAMBERS ROUTINE REPAIR RECOMMENDATIONS LINCOLN TUNNEL EXPRESSWAY SUMP ROOMS					
Routine Repair #	**Location**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R4	36th St. Sump Room	--	Seeps. (5 locs.)	Clean and seal leaks.	E2
R5	39th St. Sump Room	--	Seeps. (2 locs.)	Clean and seal leak.	E3

TABLE E4
MISCELLANEOUS CHAMBERS
ROUTINE REPAIR RECOMMENDATIONS
NEW JERSEY PORTAL GALLERY AND SUMP CHAMBERS

Routine Repair #	Location	Station	Description	Repair Recommendation	Figure #
R6	Gallery Passageway	0+02	Dripping water around manhole with ponding water above manhole in duct bank. (1 loc.)	Clean, seal leak and repair.	E4
R7	Gallery Passageway	0+08 0+13 0+73 1+15	Seeps in ceiling. (4 locs.)	Clean and seal leaks.	E4
R8	Gallery Passageway	1+22 to 1+45	Fine crack seeping in wall. (4 locs.)	Seal leak and crack.	E4
	Gallery East Stairway	East & West Walls			
R9	Gallery Passageway	0+70	Severe corrosion of cable support. (1 loc.)	Repair cable support.	E4
R10	Gallery Passageway	0+19 1+10 2+20 to 2+25 (4 locs.)	Small to medium spall and adjacent hollow concrete. (6 locs.)	Repair spall.	E4
R11	South Tunnel Valve Chamber	–	Seeping around pipe. (1 loc.)	Seal leak.	E4
R12	Sump Chamber # 1	–	Steel beam in ceiling with severely corroded bottom flange. (1 loc.)	Repair bottom flange.	E4
R13	Sump Chamber # 1	–	Medium spall (2 sq. ft. x 2" deep) with delaminated concrete and severely corroded reinforcement adjacent to steel beam. (1 loc.)	Repair spall.	E4
R14	Sump Chamber # 1	–	Small to medium spalls around manhole and adjacent hollow concrete. (2 locs.)	Repair spalls.	E4

TABLE E4 (Continued) MISCELLANEOUS CHAMBERS ROUTINE REPAIR RECOMMENDATIONS NEW JERSEY PORTAL GALLERY AND SUMP CHAMBERS					
Routine Repair #	**Location**	**Station**	**Description**	**Repair Recommendation**	**Figure #**
R15	Sump Chamber # 1	--	Construction joint seeping. (1 loc.)	Seal leak and repair joint.	E4
R16	Sump Chamber # 1 Sump Chamber # 2	--	Fine to medium crack seeping in ceiling. (9 locs.)	Seal leak and repair crack.	E4
R17	Sump Chamber # 2	--	Seep in ceiling around pipe block out. (1 loc.)	Seal leak.	E4
R18	Sump Chamber # 2	--	Wide crack in ceiling slab with adjacent hollow concrete. (1 loc.)	Repair crack.	E4

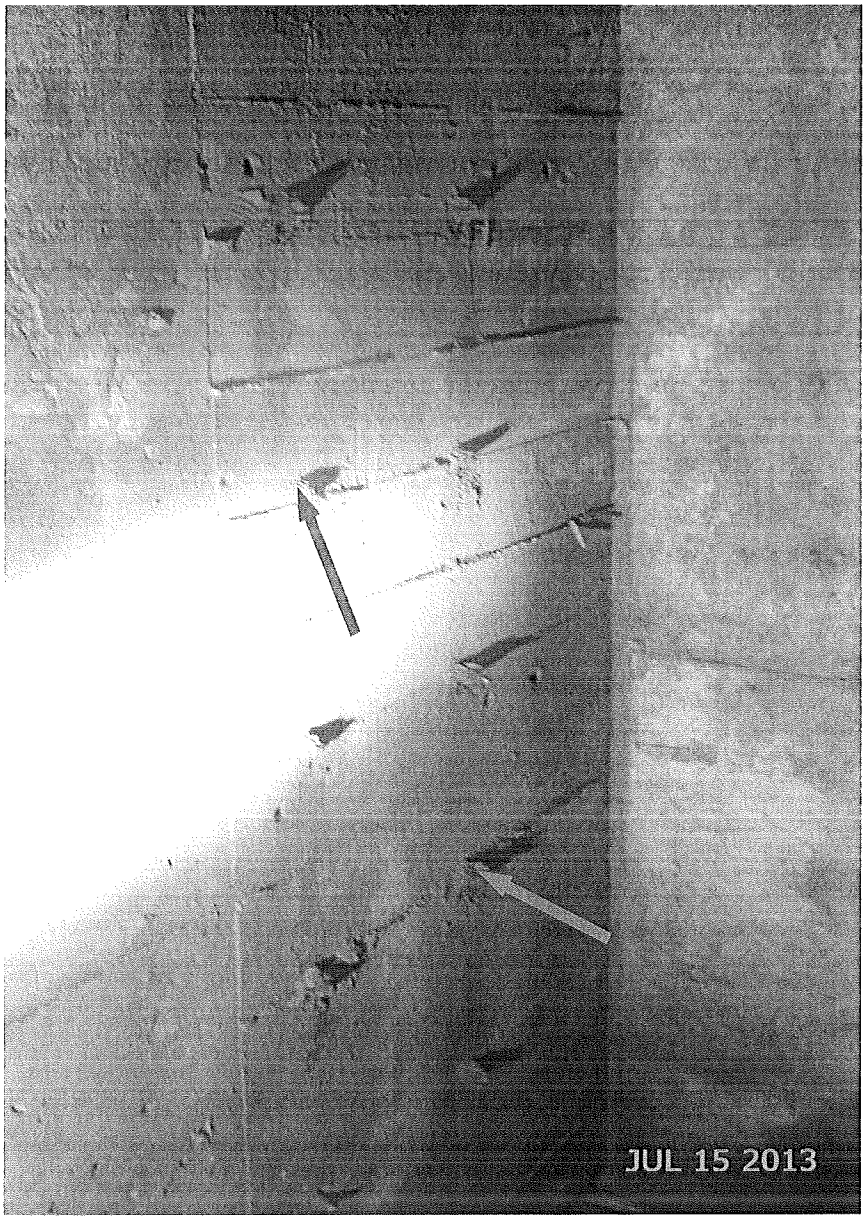

Photo E2 Expressway Sump Room at 33rd St. Manhole rungs missing. **Safety Repair S2.**

APPENDIX A

AVAILABLE DOCUMENTS

AVAILABLE DOCUMENTS

1. Port Authority Facility Condition Survey Program; Guidelines for Condition Survey of Tunnels, March 2002.

2. Port Authority Facility Condition Survey Program; Lincoln Tunnel Air Ducts and Drum Rings, September 2011.

3. Lincoln Tunnel Contract Numbers:
   MH-F – 10
   MH-F – 20
   MH-F – 21
   MHT – 1
   MHT – 1A
   MHT – 4
   MHT – 5
   MHT – 5B
   MHT – 6
   MHT – 14
   MHT – 51
   MHT – 55
   MHT – 56
   MHT – 319
   LT – 160.007
   LT – 160.008
   LT – 160.009
   LT – 160.036
   LT – 160.038

APPENDIX B

IMMEDIATE ACTION CORRESPONDENCE

JENNY
ENGINEERING
CORPORATION
CONSULTING ENGINEERS

2 EDISON PLACE • SPRINGFIELD, NEW JERSEY 07081
973 379-6699 FAX: 973 379-6774

July 1, 2013

Mr. C. John Lin, P.E.
Deputy Director, Quality Assurance
The Port Authority of New York & New Jersey
3 Gateway Center, 3rd Floor
Newark, N.J. 07102

Attention: Mr. Camille Dagher, P.E.
Project Manager
Quality Assurance

Reference: **Agreement No. 405-13-020 P.O. 4900009160**
Condition Survey of the Lincoln Tunnel Roadway -
South Tube, Recommended Immediate Action

During the inspection of the North Tube of the Lincoln Tunnel Roadway on July 1, 2013, an Immediate Action item was observed by Jenny Engineering Corporation (JEC). Our staff observed approximately 20 sq. ft. area of the wall tiles between Station 165+75 and 165+80 bulging outwards up to 1½"(refer to attached Photo 1). It is our recommendation that the protruding wall tiles in this area be removed on an immediate basis.

If you have any questions or comments, please do not hesitate to contact us.

Very truly yours,
JENNY ENGINEERING CORPORATION

Keith J. Gaspar

Keith J. Gaspar, P.E.
Project Manager

Attachments

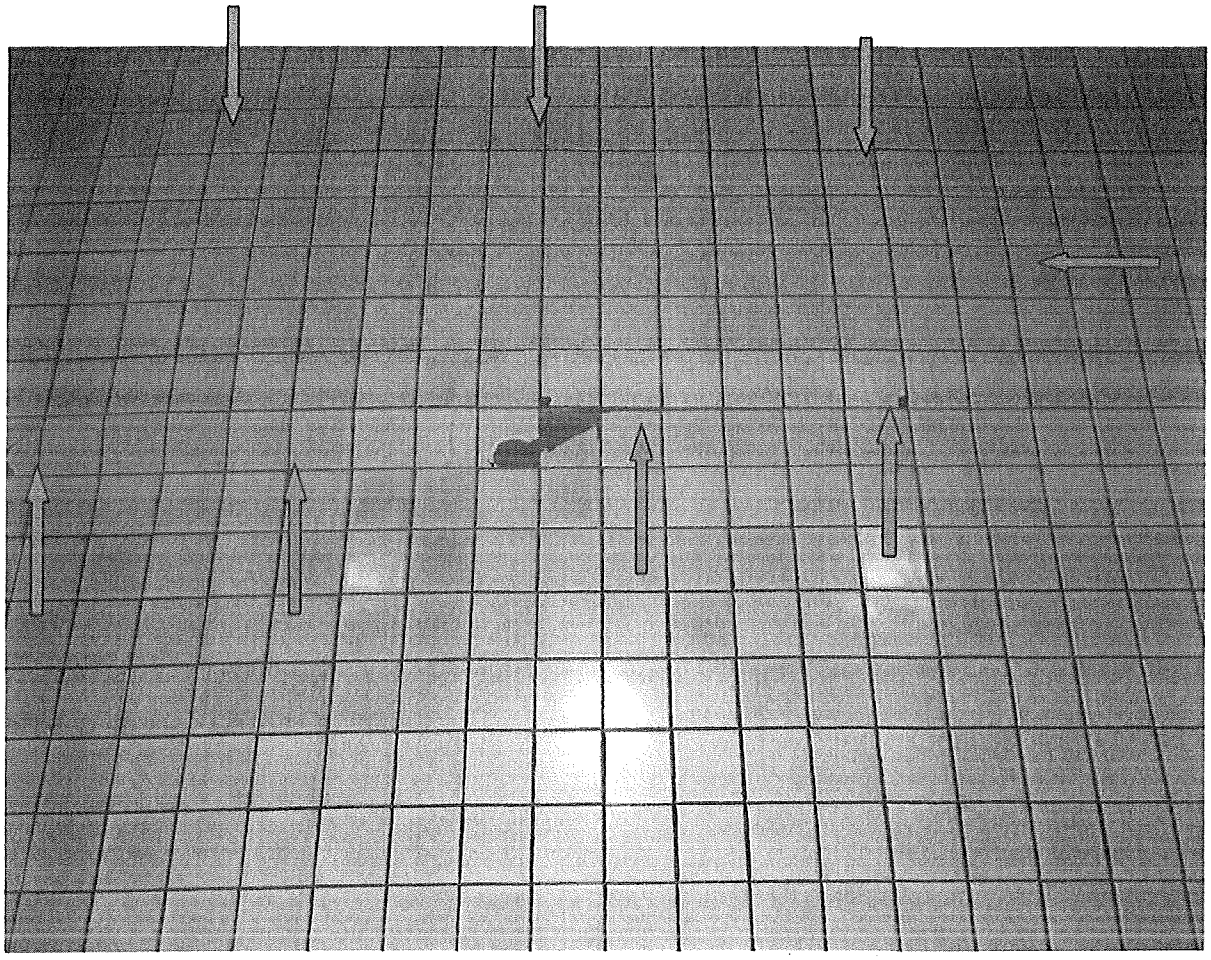

Photo 1 North Tunnel – Roadway – Station 165+75 to 165+80 – Approximately 20 sq. ft. area of the wall tiles bulging outwards up to 1½".