

SCOPE OF WORK

Rehabilitation of HVAC and Smoke Control Systems

Main Office Building and Engineering & Operations Building
NJ Department of Transportation Headquarters Complex
Ewing, Mercer County, N.J.

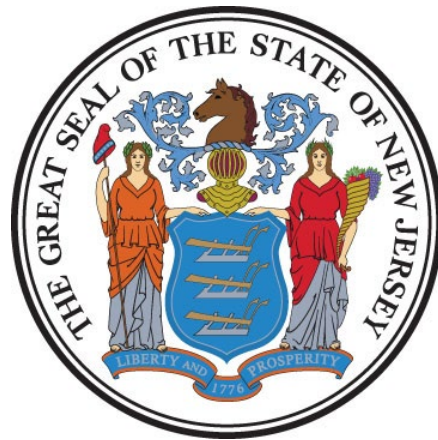
Project No. T0646-00

STATE OF NEW JERSEY

Honorable Philip D. Murphy, Governor
Honorable Sheila Y. Oliver, Lt. Governor

DEPARTMENT OF THE TREASURY

Elizabeth Maher Muoio, Treasurer



DIVISION OF PROPERTY MANAGEMENT AND CONSTRUCTION

Christopher Chianese, Director

Date: December 13, 2023

TABLE OF CONTENTS

SECTION	PAGE
I. OBJECTIVE	4
II. CONSULTANT QUALIFICATIONS	4
A. CONSULTANT & SUB-CONSULTANT PRE-QUALIFICATIONS.....	4
III. PROJECT BUDGET	4
A. CONSTRUCTION COST ESTIMATE (CCE)	4
B. CURRENT WORKING ESTIMATE (CWE)	5
C. CONSULTANT’S FEES	5
IV. PROJECT SCHEDULE	5
A. SCOPE OF WORK DESIGN & CONSTRUCTION SCHEDULE	5
B. CONSULTANT’S PROPOSED DESIGN & CONSTRUCTION SCHEDULE	6
V. PROJECT SITE LOCATION & TEAM MEMBERS.....	7
A. PROJECT SITE ADDRESS.....	7
B. PROJECT TEAM MEMBER DIRECTORY	7
VI. PROJECT DEFINITION	8
A. BACKGROUND	8
B. FUNCTIONAL DESCRIPTION	8
VII. CONSULTANT DESIGN RESPONSIBILITIES.....	9
A. DESIGN REQUIREMENTS	9
B. HAZARDOUS BUILDING MATERIALS.....	11
D. EXISTING DOCUMENTATION	12
VIII. PERMITS & APPROVALS.....	14
A. NJ UNIFORM CONSTRUCTION CODE PLAN REVIEW AND PERMIT.....	14
B. OTHER REGULATORY AGENCY PERMITS, CERTIFICATES AND APPROVALS.....	17
IX. ENERGY INCENTIVE PROGRAMS.....	18
X. ALLOWANCES	18
A. PLAN REVIEW AND PERMIT FEE ALLOWANCE.....	18
1. Permits:	18
2. Permit Costs:.....	18
3. Applications:	19

- 4. Consultant Fee: 19
- B. HAZARDOUS MATERIALS TESTING AND REPORT ALLOWANCE 19
- C. HAZARDOUS MATERIALS ABATEMENT DESIGN ALLOWANCE 19
- D. HAZARDOUS MATERIALS CONSTRUCTION ADMINISTRATION ALLOWANCE 20
- XI. SOW SIGNATURE APPROVAL SHEET 21**
- XII. CONTRACT DELIVERABLES 22**
- XIII. EXHIBITS..... 22**
- A. SAMPLE PROJECT SCHEDULE FORMAT
- B. PROJECT SITE LOCATION MAP
- C. SMOKE CONTROL EVALUATION

I. OBJECTIVE

The objective of this project is to make certain critical improvements with respect to fire protection, indoor air quality, and indoor thermal environment of the Main Office Building and Engineering & Operations building at the New Jersey Department of Transportation headquarters in Ewing, NJ.

II. CONSULTANT QUALIFICATIONS

A. CONSULTANT & SUB-CONSULTANT PRE-QUALIFICATIONS

The Consultant shall be a firm pre-qualified with the Division of Property Management & Construction (DPMC) in the following discipline(s):

- **P003 HVAC Engineering**
- **P010 Fire Protection Engineering**

The Consultant shall also have in-house capabilities or Sub-Consultants pre-qualified with DPMC in:

- **P025 Estimating/Cost Analysis**
- **P037 Asbestos Design**
- **P038 Asbestos Safety Control Monitoring**
- **P055 Energy Management Control Systems**
- **P065 Lead Paint Evaluation**

As well as **any and all** other Architectural, Engineering, and Specialty Disciplines necessary to complete the project as described in this Scope of Work (SOW).

III. PROJECT BUDGET

A. CONSTRUCTION COST ESTIMATE (CCE)

The initial Construction Cost Estimate (CCE) for this project is \$4,000,000.

The Consultant shall review this Scope of Work and provide a narrative evaluation and analysis of the accuracy of the proposed project CCE in its technical proposal based on its professional experience and opinion.

B. CURRENT WORKING ESTIMATE (CWE)

The Current Working Estimate (CWE) for this project is \$5,095,000.

The CWE includes the construction cost estimate and all consulting, permitting and administrative fees.

The CWE is the Client Agency’s financial budget based on this project Scope of Work and shall not be exceeded during the design and construction phases of the project unless DPMC approves the change in Scope of Work through a Contract amendment.

C. CONSULTANT’S FEES

The construction cost estimate for this project *shall not* be used as a basis for the Consultant’s design and construction administration fees. The Consultant’s fees shall be based on the information contained in this Scope of Work document and the observations made and/or the additional information received during the pre-proposal meeting.

IV. PROJECT SCHEDULE

A. SCOPE OF WORK DESIGN & CONSTRUCTION SCHEDULE

The following schedule identifies the estimated design and construction phases for this project and the estimated durations.

PROJECT PHASE	ESTIMATED DURATION (Calendar Days)
1. Site Access Approvals & Schedule Design Kick-off Meeting	14
2. Program Phase	21
• <i>Project Team & DPMC Plan/Code Unit Review & Comment</i>	14
3. Schematic Design Phase	42
• <i>Project Team & DPMC Plan/Code Unit Review & Comment</i>	14
4. Design Development Phase	42
• <i>Project Team & DPMC Plan/Code Unit Review & Comment</i>	14

5. Final Design Phase	42
• <i>Project Team & DPMC Plan/Code Unit Review & Approval</i>	14
6. Final Design Re-Submission to Address Comments	7
• <i>Project Team & DPMC Plan/Code Unit Review & Approval</i>	14
7. DCA Submission Plan Review	30
8. Permit Application Phase	7
• <i>Issue Plan Release</i>	
9. Bid Phase	42
10. Award Phase	28
11. Construction Phase	180
12. Project Close Out Phase	30

B. CONSULTANT’S PROPOSED DESIGN & CONSTRUCTION SCHEDULE

The Consultant shall submit a project design and construction schedule with its technical proposal that is similar in format and detail to the schedule depicted in **Exhibit ‘A’**. The schedule developed by the Consultant shall reflect its recommended project phases, phase activities, activity durations.

A written narrative shall also be included with the technical proposal explaining the schedule submitted and the reasons why and how it can be completed in the time frame proposed by the Consultant.

This schedule and narrative will be reviewed by the Consultant Selection Committee as part of the evaluation process and will be assigned a score commensurate with clarity and comprehensiveness of the submission.

V. PROJECT SITE LOCATION & TEAM MEMBERS

A. PROJECT SITE ADDRESS

The location of the project site is:

Main Office Building and Engineering & Operations Building
NJ Department of Transportation Headquarters Complex
1035 Parkway Avenue
Ewing, NJ 08618

See **Exhibit 'B'** for the project site location map.

B. PROJECT TEAM MEMBER DIRECTORY

The following are the names, addresses, and phone numbers of the Project Team members.

1. DPMC Representative:

Name: Joseph Polizzi, Design Project Manager
Address: Division of Property Management & Construction
20 West State Street, 3rd Floor
Trenton, NJ 08608-1206
Phone No: (609) 218-0260
E-Mail: Joseph.Polizzi@treas.nj.gov

2. Department of Transportation:

Name: Naveen Penmetcha, Support Services-FPEC
Address: Department of Transportation
1035 Parkway Avenue, 1st Floor E&O
Ewing, New Jersey 08618
Phone No: (609)-963-2188, cell (609) 503-1203
E-Mail: Naveen.Penmetcha@dot.nj.gov

VI. PROJECT DEFINITION

A. BACKGROUND

The New Jersey Department of Transportation (NJDOT) headquarters in Ewing is comprised of over 30 buildings and provides workspace for approximately 2,000 employees. The buildings vary with respect to age and usage. This project primarily involves two of the office-type buildings at the Headquarters campus: the Main Office Building (MOB) and the Engineering & Operations Building (E&O).

B. FUNCTIONAL DESCRIPTION

1. Building Descriptions:

The Main Office Building (MOB) is a 115,360 sqft. office building that consists of three occupied floors, some rooftop equipment spaces, and a basement. It was constructed several decades ago and has undergone multiple rehabilitation projects throughout its history. Main space types include office areas, conference rooms, restrooms, a main lobby, and various utility/equipment spaces.

The Engineering & Operations Building (E&O) is a 279,000 sqft. office building that consists of seven occupied floors, a rooftop equipment space, and a basement. It was constructed in the mid-1980s and has undergone multiple rehabilitation projects throughout its history. Main space types include office areas, conference rooms, restrooms, a main lobby, a kitchen, a cafeteria, and various utility/equipment spaces.

MOB and E&O are attached to each other by an enclosed single-story connector that also contains various types of spaces and has undergone prior rehabilitation projects. The MOB-E&O connector is mostly outside the scope of this project.

2. System Descriptions:

The indoor thermal environment and indoor air quality of MOB and E&O are maintained by heating, ventilation, and air-conditioning (HVAC) systems consisting of various equipment, devices, and distribution lines within the two buildings and a chilled water plant within the nearby Central Steam Plant building (CSP). The plant uses a single primary loop to provide chilled water for MOB, E&O, and another building known as Finance & Administration (F&A). A campus-wide building management system (BMS) allows for control, monitoring, and analysis of the mechanical systems that serve MOB, E&O, and various other buildings onsite.

E&O contains a smoke control system (SCS) as one element of its integrated fire/life safety systems. The SCS was installed during original construction and serves to control the products of

combustion during a smoke/fire condition. A main fire control panel works in conjunction with two controllers and a pneumatic air system in order to operate the SCS equipment (fans, dampers, etc.) which serve the stairwells and main atrium/lobby in E&O.

There is significant complexity and variation in the design, operation, age, and condition of the aforementioned systems that serve MOB and E&O. Relevant as-built documentation will be provided to the Consultant for informational purposes.

3. Related Projects:

Certain prior and ongoing projects are of particular relevance to this SOW, as noted within this section.

M&E Engineers, Inc. completed an evaluation of the Smoke Control System (SCS) in E&O 2020. Their report serves as the basis for a portion of this SOW and is included in **Exhibit ‘C’**. Further explanation is provided in Section VII.A.

Jarmel Kizel Architects and Engineers, Inc. completed an evaluation of the HVAC systems in MOB and E&O in 2022. Their report serves as the basis for a major portion of this SOW and will be provided to the Consultant at the preproposal meeting. Further explanation is provided in Section VII.A.

A project (T0620-00) is currently underway to renovate the lobbies in MOB and E&O. The lobby project impacts some of the areas and systems within this SOW. Therefore, the T0620-00 permit drawings will be made available to the Consultant.

An energy savings improvement program (ESIP) project (A1219) was completed for the Ewing Headquarters campus with a payback period of 15 years starting in 2019. The energy goals of the ESIP may impact this SOW and vice versa. Therefore, the initial ESIP energy savings plan and subsequent energy management & verification reports will be provided to the Consultant. Further explanation is provided in Section VII.A.

VII. CONSULTANT DESIGN RESPONSIBILITIES

A. DESIGN REQUIREMENTS

Existing deficiencies are present in the smoke control system (SCS) that serves E&O, as well as in the HVAC systems that serve MOB and E&O. Prior assessments were performed in order to properly identify, study, and document these deficiencies, and to provide recommendations for addressing them. The M&E and JK reports are the summary reports resulting from these prior assessments. Project T0646 shall address a portion of the deficiencies and recommendations

from each of these reports which are hereby referred to as the ‘scope items’. The Consultant shall provide evaluation, design, specification, bid/award and construction administration services for the Project T0646-00 scope items which are as follows:

- E&O Smoke Control System:
 - Recommendations #5 and #6 described in the M&E report (**Exhibit ‘C’**), pages 17-18. Include both recommendations. Additional details are provided in JK Report, pages 26 & 69.

- E&O HVAC:
 - “*Systems Serving the Occupied Non-Office Areas*”. Include all items within this category, as described in the JK report, pages 20-23 and pages 61-63.
 - “*Custom Non-Critical Areas*”. Include all items within this category, as described in the JK report, pages 23 & 64.
 - “*Systems Serving Equipment Areas*”. Include all items within this category, as described in the JK report, pages 24-25 and pages 66-68, but excluding the mechanical room recommendations on page 68.
 - “*Credit Union*”. This scope item was not covered within the M&E or JK assessments. As part of this project, identify and address the HVAC deficiencies of the Credit Union in E&O. Refer to DBC Project A313 drawing for details of the existing design.

- MOB HVAC:
 - “*Systems Serving Equipment Areas*”. Include all items within this category, as described in the JK report, pages 33-34 and pages 75-77, but excluding the mechanical room recommendations on page 75.

Evaluation Task

Within the Program Phase, the Consultant shall first review the M&E and JK reports in their entirety, with particular focus on the scope items listed above. The Consultant shall then perform their own complete evaluation of the scope items which will form the basis of a new design as specified in this SOW.

Design Task

General Overview:

Based on the results of the Program Phase, the Consultant shall provide a new design to address the scope items identified above. The overall design shall comply with all applicable codes and standards, and the HVAC portion of the design shall also incorporate measures from ASHRAE and other industry sources in order to meet the core objective of optimizing the thermal conditions, indoor air quality, energy efficiency, and system reliability. The following is a

general list of ASHRAE standards/guidelines that may be beneficial for meeting the aforementioned core objective:

- Guideline 0/0.2
- Guideline 36
- Standard 55
- Standard 62.1
- Standard 90.1
- Standard 100
- Standard 202

Demolition Work:

- Existing systems (or system elements) that are superseded by the new design shall be recommended by the Consultant for either demolition or abandonment, and these recommendations shall be reviewed by the Project Team. Finalized recommendations shall be reflected in the final design documents.

New Work:

- Any recommendations by the Consultant to reuse, refurbish, or retrofit existing systems (or system elements) as part of the new design shall be reviewed by the Project Team. Finalized recommendations shall be reflected in the design documents.

ESIP Impact:

- The new design shall align with the aforementioned ESIP energy goals to the extent possible while still meeting the core objective noted above. The Consultant shall perform an assessment to determine the energy impact of the new design in relation to the ESIP goals. This assessment shall be reviewed by the Project Team, and any necessary changes shall be incorporated into the final design.

Commissioning

Commissioning services for this project shall be procured under a separate project, T0646-01. The Consultant shall cooperate with the T0646-01 Commissioning Agent as needed throughout the duration of T0646-00 to ensure successful delivery of the project.

B. HAZARDOUS BUILDING MATERIALS

Consultant shall survey the building(s) and, if deemed necessary, collect samples of materials that will be impacted by the construction/demolition activities and analyze them for the presence of hazardous materials including:

1. Asbestos in accordance with N.J.A.C. 5:23-8, Asbestos Hazard Abatement Subcode.
2. Lead in accordance with N.J.A.C. 5:17, Lead Hazard Evaluation and Abatement Code.

3. PCB's in accordance with 40 CFR 761, Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions. Consultant shall engage a firm certified in the testing and analysis of materials containing PCB's.

Consultant shall document their procedure, process and findings and prepare a "Hazardous Materials Survey Report" identifying building components impacted by construction activities requiring hazardous materials abatement. Consultant shall provide three copies of the "Hazardous Materials Survey Report" to the Project Manager.

Consultant shall estimate the cost of hazardous materials sample collection, destructive testing as necessary, tests and analysis and preparation of the Hazardous Materials Survey Report and include that amount in their fee proposal line item entitled "**Hazardous Materials Testing and Report Allowance**", refer to paragraph X.C.

Based on the Hazardous Materials Survey Report, Consultant shall provide construction documents for abatement of the hazardous materials impacted by the work in accordance with the applicable code, subcode and Federal regulations.

Consultant shall estimate the cost to prepare construction documents for hazardous materials abatement and include that amount in their fee proposal line item entitled "**Hazardous Materials Abatement Design Allowance**", refer to paragraph X.D.

Consultant shall estimate the cost to provide "Construction Monitoring and Administration Services" for hazardous materials abatement activities and include that amount in their fee proposal line item entitled "**Hazardous Materials Construction Administration Allowance**", refer to paragraph X.E.

There shall be no "mark-up" of subconsultant or subcontractor fees if subconsultants or subcontractors are engaged to perform any of the work defined in paragraph VII.B "Hazardous Building Materials". All costs associated with managing, coordinating, observing and administrating subconsultants and subcontractors performing hazardous materials sampling, testing, analysis, report preparation, hazardous materials construction administration services shall be included in the consultant's lump sum fee proposal.

D. EXISTING DOCUMENTATION

Copies of the following documents will be provided to each Consulting firm at the pre-proposal meeting to assist in the bidding process.

- DPMC Project A1219: **Energy Savings Plan**, DCO Energy

- **DPMC Project A1219: Measurement & Verification Performance Year Summary Reports, 2020, 2021 and 2022, Gannett Fleming, Inc.**
- **DPMC Project A1219-02: NJDOT Headquarters Energy Savings Improvement Project, 7/2/2019, Concord Engineering**
- **DPMC Project A1219-02: NJDOT MOB (As-Built) Energy Savings Improvement Project Building Automation System, 5/20/2020, AME Inc.**
- **DPMC Project A1219-02: New Jersey Department of Transportation Headquarters Measurement & Verification Performance Year Summary Report, August 13, 2020, Gannett Fleming**
- **DPMC Project A1219-03: Campus Wide Energy Management System, 6/1/2020, Sustainable Engineering Services**
- **DPMC Project A1219-07: NJDOT ESIP Project BMS Integration and Upgrades, 12/11/2020, DCO Energy**
- **DBC Project A313: Department of Transportation Main Annex, 8/6/86, Johnson Controls**
- **DBC Project T0155: Cafeteria Renovations, 3/15/86, Scrimenti/Shive/Spinelli/Perantoni Architects**
- **Dunkin Donuts, 10/20/2014, KSD Architecture**
- **DBC Project T0184: Renovation of Main Office Building DOT Fernwood Complex, 22 Jan 88, Armstrong, Jordan, Pease Architects**
- **DPMC Project T0314-00: HVAC Air Quality Renovation DOT E&O Building, 6/25/2002, John C. Morris Associates, Inc.**
- **DPMC Project T0396-00: New Chiller Replacement, April 2002, Miller-Remick Corporation**
- **DPMC Project T0506-00: Variable Air Volume Box Retrofit at MOB Building, 8/31/2015, LAN Associates**
- **New Jersey Department of Transportation Headquarters Findings & Recommendations Report: Building Envelope Measures, March 21, 2018, B/E Retrofit**
- **Engineering and Operations Building Smoke Control Evaluation, 9/17/2020, M&E Engineers, Inc.**

- **New Jersey Department of Transportation Headquarters Infrared Study Report**, March 21, 2018, B/E Retrofit
- **DPMC Project T0612-00: Chilled and Condenser Water Piping Replacement Piping Replacement NJDOT Headquarters**, 01/08/20, Princeton Engineering Group
- **DPMC Project T0620-00: Alterations and Renovations to the NJ Department of Transportation Headquarters Complex: MOB, E&O, and F&A Lobbies**, 3/1/2022, Mott Macdonald Architects, P.C.
- **DPMC Project T0625-00: IT Room Cooling**, 12/10/20, M&E Engineers, Inc
- **DPMC Project T0645-00: HVAC Rehabilitation Report for Main Office Building and Engineering & Operations Building**, May 26, 2022
- **DPMC Project T0654-01: Smoke Control System Modifications**, 11/03/2022, M&E Engineers, Inc.
- **DPMC Project T0654-04: Advanced Controls Hardening**, 3/20/2023, AME, Inc.

Review these documents and any additional information that may be provided at a later date such as reports, studies, surveys, equipment manuals, as-built drawings, etc. The State does not attest to the accuracy of the information provided and accepts no responsibility for the consequences of errors by the use of any information and material contained in the documentation provided. It shall be the responsibility of the Consultant to verify the contents and assume full responsibility for any determination or conclusion drawn from the material used. If the information provided is insufficient, the Consultant shall take the appropriate actions necessary to obtain the additional information required.

All original documentation shall be returned to the provider at the completion of the project.

VIII. PERMITS & APPROVALS

A. NJ UNIFORM CONSTRUCTION CODE PLAN REVIEW AND PERMIT

The project construction documents must comply with the latest adopted edition of the NJ Uniform Construction Code (NJUCC).

The latest NJUCC Adopted Codes and Standards can be found at:

<http://www.state.nj.us/dca/divisions/codes/codreg/>

1. NJ Uniform Construction Code (NJUCC) Plan Review

Consultant shall estimate the cost of the NJUCC Plan Review by DCA and include that amount in their fee proposal line item entitled “**Plan Review and Permit Fee Allowance**”, refer to paragraph XI.A.

Upon approval of the Final Design Phase Submission by DPMC, the Consultant shall submit the construction documents to the Department of Community Affairs (DCA), Bureau of Construction Project Review to secure a complete plan release.

As of July 25, 2022, the Department of Community Affairs (DCA) is only accepting digital signatures and seals issued from a third party certificate authority. The DCA ePlans site can be found at:

<https://www.nj.gov/dca/divisions/codes/offices/ePlans.html>

Procedures for submission to the DCA Plan Review Unit can be found at:

https://www.state.nj.us/dca/divisions/codes/forms/pdf_bcpr/pr_app_guide.pdf

Consultant shall complete the “Project Review Application” and include the following on Block 5 as the “Owner’s Designated Agent Name”:

Joyce Spitale, DPMC
PO Box 235
Trenton, NJ 08625-0235
Joyce.Spitale@treas.nj.gov 609-943-5193

The Consultant shall complete the NJUCC “Plan Review Fee Schedule”, determine the fee due and pay the NJUCC Plan Review fees, refer to Paragraph X.A.
The NJUCC “Plan Review Fee Schedule” can be found at:

http://www.state.nj.us/dca/divisions/codes/forms/pdf_bcpr/pr_fees.pdf

2. NJ Uniform Construction Code Permit

Upon receipt of a complete plan release from the DCA Bureau of Construction Project Review, the Consultant shall complete the NJUCC permit application and all applicable technical sub-code sections. The “Agent Section” of the application and certification section of the building sub-code section shall be signed. These documents, with **six (6) sets of DCA approved, signed and sealed construction documents** shall be forwarded to the DPMC Project Manager.

The Consultant may obtain copies of all NJUCC permit applications at the following website:

<http://www.state.nj.us/dca/divisions/codes/forms/>

All other required project permits shall be obtained and paid for by the Consultant in accordance with the procedures described in Paragraph VIII.B.

3. Prior Approval Certification Letters:

The issuance of a construction permit for this project may be contingent upon acquiring various “prior approvals” as defined by N.J.A.C. 5:23-1.4. It is the Consultant’s responsibility to determine which prior approvals, if any, are required. The Consultant shall submit a general certification letter to the DPMC Plan & Code Review Unit Manager during the Permit Phase of this project that certifies all required prior approvals have been obtained.

In addition to the general certification letter discussed above, the following specific prior approval certification letters, where applicable, shall be submitted by the Consultant to the DPMC Plan & Code Review Unit Manager: Soil Erosion & Sediment Control, Water & Sewer Treatment Works Approval, Coastal Areas Facilities Review, Compliance of Underground Storage Tank Systems with N.J.A.C. 7:14B, Pinelands Commission, Highlands Council, Well Construction and Maintenance; Sealing of Abandoned Wells with N.J.A.C. 7:9D, Certification that all utilities have been disconnected from structures to be demolished, Board of Health Approval for Potable Water Wells, Health Department Approval for Septic Systems. It shall be noted that in accordance with N.J.A.C. 5:23-2.15(a)5, a permit cannot be issued until the letter(s) of certification is received.

4. Multi-building or Multi-site Permits:

A project that involves many buildings and/or sites requires that a separate permit shall be issued for each building or site. The Consultant must determine the construction cost estimate for *each* building and/or site location and submit that amount where indicated on the permit application.

5. Special Inspections:

In accordance with the requirements of the New Jersey Uniform Construction Code N.J.A.C. 5:23-2.20(b), Bulletin 03-5 and Chapter 17 of the International Building Code, the Consultant shall be responsible for the coordination of all special inspections during the construction phase of the project.

Bulletin 03-5 can be found at:

http://www.state.nj.us/dca/divisions/codes/publications/pdf_bulletins/b_03_5.pdf

a. Definition:

Special inspections are defined as an independent verification by a certified Special Inspector for **Class I buildings and smoke control systems in any class building**. The special inspector is to be independent from the Contractor and responsible to the Consultant so that there is no possible conflict of interest.

Special inspectors shall be certified in accordance with the requirements in the New Jersey Uniform Construction Code.

b. Responsibilities:

The Consultant shall submit with the permit application, a list of special inspections and the agencies or special inspectors that will be responsible to carry out the inspections required for the project. The list shall be a separate document, on letter head, signed and sealed.

B. OTHER REGULATORY AGENCY PERMITS, CERTIFICATES AND APPROVALS

The Consultant shall identify and obtain all other State Regulatory Agency permits, certificates, and approvals that will govern and affect the work described in this Scope of Work. An itemized list of these permits, certificates, and approvals shall be included with the Consultant’s Technical Proposal and the total amount of the application fees should be entered in the Fee Proposal line item entitled, **“Permit Fee Allowance.”**

The Consultant may refer to the Division of Property Management and Construction “Procedures for Architects and Engineers Manual”, Paragraph **“9. REGULATORY AGENCY APPROVALS”** which presents a compendium of State permits, certificates, and approvals that may be required for this project.

The Consultant shall determine the appropriate phase of the project to submit the permit application(s) in order to meet the approved project milestone dates.

Where reference to an established industry standard is made, it shall be understood to mean the most recent edition of the standard unless otherwise noted. If an industry standard is found to be revoked, or should the standard have undergone substantial change or revision from the time that the Scope of Work was developed, the Consultant shall comply with the most recent edition of the standard.

IX. ENERGY INCENTIVE PROGRAMS

The Consultant shall review any and all programs on the State and Federal level to determine if any proposed upgrades to the mechanical and/or electrical equipment and systems for this project qualify for approved rebates and incentives.

The Consultant shall review the programs available on the “New Jersey’s Clean Energy Program” website at: <http://www.njcleanenergy.com> as well as federal websites and New Jersey electric and gas utility websites to determine if and how they can be applied to this project.

The Consultant shall identify all applicable rebates and incentives in their technical proposal and throughout the design phase.

The Consultant shall be responsible to complete the appropriate registration forms and applications, provide any applicable worksheets, manufacturer’s specification sheets, calculations, attend meetings, and participate in all activities with designated representatives of the programs and utility companies to obtain the entitled financial incentives and rebates for this project.

All costs associated with this work shall be estimated by the Consultant and the amount included in the base bid of its fee proposal.

X. ALLOWANCES

A. PLAN REVIEW AND PERMIT FEE ALLOWANCE

The Consultant shall obtain and pay for all of the project permits in accordance with the guidelines identified below.

1. Permits:

The Consultant shall determine the various permits, certificates, and approvals required to complete this project.

2. Permit Costs:

The Consultant shall estimate the application fee costs for all of the required project permits, certificates, and approvals (excluding the NJ Uniform Construction Code permit) and include that amount in its fee proposal line item entitled “**Plan Review and Permit Fee Allowance**”,

refer to Paragraph IX.A. A breakdown of each permit and application fee shall be attached to the fee proposal for reference.

NOTE: The NJ Uniform Construction Code permit is excluded since it will be paid for by the State.

3. Applications:

The Consultant shall complete and submit all permit applications to the appropriate permitting authorities and the costs shall be paid from the Consultant’s permit fee allowance. A copy of the application(s) and the original permit(s) obtained by the Consultant shall be given to the DPMC Project Manager for distribution during construction.

4. Consultant Fee:

The Consultant shall determine what is required to complete and submit the permit applications, obtain supporting documentation, attend meetings, etc., and include the total cost in the base bid of its fee proposal under the “Permit Phase” column.

Any funds remaining in the permit allowance will be returned to the State at the close of the project.

B. HAZARDOUS MATERIALS TESTING AND REPORT ALLOWANCE

Consultant shall estimate the costs to complete the hazardous materials survey, sample collection, testing and analysis and preparation of a “Hazardous Materials Survey Report” noted in paragraph VII.C and enter that amount on their fee proposal line item entitled “**Hazardous Materials Testing and Report Allowance**”. Consultant shall attach a detailed cost breakdown sheet for use by DPMC during the proposal review and potential fee negotiations. The cost breakdown sheet shall include, but not be limited to, the following information:

- Description of tasks and estimated cost for the following:
 - Sample collection
 - Sample testing
 - Preparation of an Hazardous Materials Survey Report

Any funds remaining in the Hazardous Materials Testing and Report Allowance will be returned to the State at the close of the project.

C. HAZARDOUS MATERIALS ABATEMENT DESIGN ALLOWANCE

Consultant shall estimate the costs to prepare construction documents for hazardous materials abatement noted in paragraph VII.C and enter that amount on their fee proposal line item entitled “**Hazardous Materials Abatement Design Allowance**”. Consultant shall attach a detailed cost

breakdown sheet for use by DPMC during the proposal review and potential fee negotiations. The cost breakdown sheet shall include a description of the tasks to be performed and the estimated cost of each task.

Any funds remaining in the Hazardous Materials Abatement Design Allowance will be returned to the State at the close of the project.

D. HAZARDOUS MATERIALS CONSTRUCTION ADMINISTRATION ALLOWANCE

Consultant shall estimate the cost to provide Construction Monitoring and Administration Services for hazardous materials abatement as noted in paragraph VII.C and enter that amount on their fee proposal line item entitled “**Hazardous Materials Construction Administration Allowance**”. Consultant shall attach a detailed cost breakdown sheet for use by DPMC during the proposal review and potential fee negotiations. The cost breakdown sheet shall include a description of the tasks to be performed and the estimated cost of each task.

Any funds remaining in the Hazardous Materials Construction Administration Allowance will be returned to the State at the close of the project.

PROJECT NAME: Rehabilitation of HVAC and Smoke Control Systems
PROJECT LOCATION: Main Office Building and Engineering & Operations Building NJDOT HQ
PROJECT NO: T0646-00
DATE: December 13, 2023

XI. SOW SIGNATURE APPROVAL SHEET

This Scope of Work shall not be considered a valid document unless all signatures appear in each designated area below.

The Client Agency approval signature on this page indicates that they have reviewed the design criteria and construction schedule described in this project Scope of Work (including the subsequent contract deliverables and exhibits) and verifies that the work will not conflict with the existing or future construction activities of other projects at the site.

SOW APPROVED BY: James Wright 12/13/2023
JAMES WRIGHT, MANAGER DATE
DPMC PROJECT PLANNING & INITIATION

SOW APPROVED BY: Dennis W. Meszaros 12/14/2023
DENNIS W. MESZAROS, MANAGER DATE
NJ DEPARTMENT OF TRANSPORTATION

SOW APPROVED BY: Joseph J. Polizzi II 12/13/2023
JOSEPH POLIZZI, PROJECT MANAGER DATE
DPMC PROJECT MANAGEMENT GROUP

SOW APPROVED BY: Richard S. Flodmand 12/13/2023
RICHARD FLODMAND, DEPUTY DIRECTOR DATE
DIV PROPERTY MGT & CONSTRUCTION

XII. CONTRACT DELIVERABLES

The following are checklists listing the Contract Deliverables that are required at the completion of each phase of this project. The Consultant shall refer to the DPMC publication entitled “Procedures for Architects and Engineers,” 3.0 Edition, dated September 2022 available at <https://www.nj.gov/treasury/dPMC/Assets/Files/ProceduresforArchitectsandEngineers.pdf> for a detailed description of the deliverables required for each submission item listed. References to the applicable paragraphs of the “Procedures for Architects and Engineers” are provided.

Note that the Deliverables Checklist may include submission items that are “S.O.W. Specific Requirements”. These requirements will be defined in the project specific scope of work and included on the deliverables checklist.

This project includes the following phases with the deliverables noted as “Required by S.O.W” on the Deliverables Checklist:

- **PROGRAM PHASE**
- **SCHEMATIC DESIGN PHASE**
- **DESIGN DEVELOPMENT PHASE**
- **FINAL DESIGN PHASE**
- **PERMIT APPLICATION PHASE**
- **BIDDING AND CONTRACT AWARD**
- **CONSTRUCTION PHASE**
- **PROJECT CLOSE-OUT PHASE**

XIII. EXHIBITS

- A. **SAMPLE PROJECT SCHEDULE FORMAT**
- B. **PROJECT SITE LOCATION MAP**
- C. **SMOKE CONTROL EVALUATION**

END OF SCOPE OF WORK

Deliverables Checklist Program Phase

A/E Name: _____

A/E Manual Reference	Submission Item	Required by S.O.W.		Previously Submitted		Enclosed	
		Yes	No	Yes	No	Yes	No
12.3.1.	A/E Statement of Site Visit						
12.3.2.	Narrative Description of Project						
12.3.3.	Building Code Information Questionnaire						
12.3.4.	Space Analysis						
12.3.5.	Special Features						
12.3.6.	Catalog Cuts						
12.3.7.	Site Evaluation						
12.3.8.	Subsurface Investigation						
12.3.9.	Surveys						
12.3.10.	Fine Arts Inclusion						
12.3.11.	Design Rendering						
12.3.12.	Regulatory Approvals						
12.3.13.	Utility Availability						
12.3.14.	Diagrammatic Sketches/Drawings (6 Sets)						
12.3.15.	Outline Specifications (6 Sets)						
12.3.16.	Current Working Estimate/Cost Analysis						
12.3.17.	Project Schedule						
12.3.18.	Formal Presentation						
12.3.19.	Scope of Work Compliance Statement						
12.3.20.	Program Phase Deliverables Checklist						
S.O.W. Reference	S.O.W. Specific Requirements						

This checklist shall be completed by the Design Consultant and included as the cover sheet of this submission to document to the DPMC the status of all the deliverables required by the project specific Scope of Work.

Consultant Signature

Date

**Deliverables Checklist
Schematic Design Phase**

A/E Name: _____

A/E Manual Reference	Submission Item	Required by S.O.W.		Previously Submitted		Enclosed	
		Yes	No	Yes	No	Yes	No
13.4.1.	A/E Statement of Site Visit						
13.4.2.	Narrative Description of Project						
13.4.3.	Building Code Information Questionnaire						
13.4.4.	Space Analysis						
13.4.5.	Special Features						
13.4.6.	Catalog Cuts						
13.4.7.	Site Evaluation						
13.4.8.	Subsurface Investigation						
13.4.9.	Surveys						
13.4.10.	Arts Inclusion						
13.4.11.	Design Rendering						
13.4.12.	Regulatory Approvals						
13.4.13.	Utility Availability						
13.4.14.	Drawings (6 Sets)						
13.4.15.	Outline Specifications (6 Sets)						
13.4.16.	Current Working Estimate/Cost Analysis						
13.4.17.	Project Schedule						
13.4.18.	Formal Presentation						
13.4.19.	Scope of Work Compliance Statement						
13.4.20.	Schematic Design Phase Deliverables Checklist						
S.O.W. Reference	S.O.W. Specific Requirements						

This checklist shall be completed by the Design Consultant and included as the cover sheet of this submission to document to the DPMC the status of all the deliverables required by the project specific Scope of Work.

_____ Consultant Signature

_____ Date

Deliverables Checklist Design Development Phase

A/E Name: _____

A/E Manual Reference	Submission Item	Required by S.O.W.		Previously Submitted		Enclosed	
		Yes	No	Yes	No	Yes	No
14.4.1.	A/E Statement of Site Visit						
14.4.2.	Narrative Description of Project						
14.4.3.	Building Code Information Questionnaire						
14.4.4.	Space Analysis						
14.4.5.	Special Features						
14.4.6.	Catalog Cuts						
14.4.7.	Site Evaluation						
14.4.8.	Subsurface Investigation						
14.4.9.	Surveys						
14.4.10.	Arts Inclusion						
14.4.11.	Design Rendering						
14.4.12.	Regulatory Approvals						
14.4.13.	Utility Availability						
14.4.14.	Drawings (6 Sets)						
14.4.15.	Outline Specifications (6 Sets)						
14.4.16.	Current Working Estimate/Cost Analysis						
14.4.17.	Project Schedule						
14.4.18.	Formal Presentation						
14.4.19.	Plan Review/Scope of Work Compliance Statement						
14.4.20.	Design development Phase Deliverables Checklist						
S.O.W. Reference	S.O.W. Specific Requirements						

This checklist shall be completed by the Design Consultant and included as the cover sheet of this submission to document to the DPMC the status of all the deliverables required by the project specific Scope of Work.

Consultant Signature

Date

**Deliverables Checklist
Final Design Phase**

A/E Name: _____

A/E Manual Reference	Submission Item	Required by S.O.W.		Previously Submitted		Enclosed	
		Yes	No	Yes	No	Yes	No
15.4.1.	A/E Statement of Site Visit						
15.4.2.	Narrative Description of Project						
15.4.3.	Building Code Information Questionnaire						
15.4.4.	Space Analysis						
15.4.5.	Special Features						
15.4.6.	Catalog Cuts						
15.4.7.	Site Evaluation						
15.4.8.	Subsurface Investigation						
15.4.9.	Surveys						
15.4.10.	Arts Inclusion						
15.4.11.	Design Rendering						
15.4.12.	Regulatory Approvals						
15.4.13.	Utility Availability						
15.4.14.	Drawings (6 Sets)						
15.4.15.	Outline Specifications (6 Sets)						
15.4.16.	Current Working Estimate/Cost Analysis						
15.4.17.	Project Schedule						
15.4.18.	Formal Presentation						
15.4.19.	Plan Review/Scope of Work Compliance Statement						
15.4.20.	Final Design Phase Deliverables Checklist						
S.O.W. Reference	S.O.W. Specific Requirements						

This checklist shall be completed by the Design Consultant and included as the cover sheet of this submission to document to the DPMC the status of all the deliverables required by the project specific Scope of Work.

Consultant Signature Date

Deliverables Checklist Permit Application Phase

A/E Name: _____

A/E Manual Reference	Submission Item	Required by S.O.W.		Previously Submitted		Enclosed	
		Yes	No	Yes	No	Yes	No
16.1.	N.J. UCC Permit Application						
16.4.	Drawings, Signed and Sealed (6 Sets)						
16.5.	Specifications, Signed and Sealed (6 Sets)						
16.6.	Current Working Estimate/Cost Analysis						
16.7.	Project Schedule						
16.8.	Plan Review/Scope of Work Compliance Statement						
16.9.	Permit Application Phase Deliverables Checklist						
S.O.W. Reference	S.O.W. Specific Requirements						

This checklist shall be completed by the Design Consultant and included as the cover sheet of this submission to document to the DPMC Project Manager the status of all the deliverables required by the project specific Scope of Work.

Consultant Signature _____
Date

**Deliverables Checklist
Bidding and Contract Award Phase**

A/E Name: _____

A/E Manual Reference	Submission Item	Required by S.O.W.		Previously Submitted		Enclosed	
		Yes	No	Yes	No	Yes	No
17.1.1.	Notice of Advertising						
17.1.2.	Bid Proposal Form						
17.1.3.	Bid Clearance Form						
17.1.4.	Drawings (6 Sets)						
17.1.5.	Specifications (6 Sets)						
17.1.6.	Construction Schedule						
17.3	Pre-Bid Conference/Mandatory Site Visit						
17.3.1.	Meeting Minutes						
17.4	Bulletins						
17.5	Post Bid Meeting						
17.6.	Contract Award "Letter of Recommendation"						
17.8.	Bid Protests - Hearings						
17.9.	Bidding and Contract Award Phase Deliverables Checklist						
S.O.W. Reference	S.O.W. Specific Requirements						

This checklist shall be completed by the Design Consultant and included as the cover sheet of this submission to document to the DPMC the status of all the deliverables required by the project specific Scope of Work.

Consultant Signature

Date

**Deliverables Checklist
Construction Phase**

A/E Name: _____

A/E Manual Reference	Submission Item	Required by S.O.W.		Previously Submitted		Enclosed	
		Yes	No	Yes	No	Yes	No
18.2.	Pre-Construction Meeting						
18.3.	Submittal Log						
18.4.	Construction Schedule						
18.5.	Project Progress Meetings						
18.7.	Contractor's Invoicing and Payment Process						
18.8.	Contractor Submittals						
18.10.	Testing						
18.11.	Shop Drawings (6 Sets)						
18.12.	As-Built & Record Set Drawings (6 Sets)						
18.13.	Change Orders						
18.14.	Construction Photographs						
18.15.	Field Observations						
18.17.	Construction Phase Deliverables Checklist						
S.O.W. Reference	S.O.W. Specific Requirements						

This checklist shall be completed by the Design Consultant and included as the cover sheet of this submission to document to the DPMC the status of all the deliverables required by the project specific Scope of Work.

Consultant Signature

Date

**Deliverables Checklist
Project Close-Out Phase**

A/E Name: _____

A/E Manual Reference	Submission Item	Required by S.O.W.		Previously Submitted		Enclosed	
		Yes	No	Yes	No	Yes	No
19.3.	Development of Punch List and Inspection Reports						
19.5.	Determination of Substantial Completion						
19.6.	Correction/Completion of Punch List						
19.7.	Submission of Close-Out Documentation						
19.7.1.	As-Built and Record Sets of Drawing (6 Sets)						
19.8.	Final Payment						
19.9.1.	Contractors Final Payment						
19.9.2.	A/E's Final Payment						
19.10.	Project Close-Out Phase Deliverables Checklist						
S.O.W. Reference	S.O.W. Specific Requirements						

This checklist shall be completed by the Design Consultant and included as the cover sheet of this submission to document to the DPMC the status of all the deliverables required by the project specific Scope of Work.

Consultant Signature

Date

February 7, 1997
Rev.: January 29, 2002

Responsible Group Code Table

The codes below are used in the schedule field "GRP" that identifies the group responsible for the activity. The table consists of groups in the Division of Property Management & Construction (DPMC), as well as groups outside of the DPMC that have responsibility for specific activities on a project that could delay the project if not completed in the time specified. For reporting purposes, the groups within the DPMC have been defined to the supervisory level of management (i.e., third level of management, the level below the Associate Director) to identify the "functional group" responsible for the activity.

<u>CODE</u>	<u>DESCRIPTION</u>	<u>REPORTS TO ASSOCIATE DIRECTOR OF:</u>
CM	Contract Management Group	Contract Management
CA	Client Agency	N/A
CSP	Consultant Selection and Prequalification Group	Technical Services
A/E	Architect/Engineer	N/A
PR	Plan Review Group	Technical Services
CP	Construction Procurement	Planning & Administration
CON	Construction Contractor	N/A
FM	Financial Management Group	Planning & Administration
OEU	Office of Energy and Utility Management	N/A
PD	Project Development Group	Planning & Administration

EXHIBIT 'A'

Activity ID	Description	Respon	Weeks
<PROJ>			
Design			
CV3001	Schedule/Conduct Pre-design/Project Kick-Off Mtg.	CM	
CV3020	Prepare Program Phase Submittal	AE	
CV3021	Distribute Program Submittal for Review	CM	
CV3027	Prepare & Submit Project Cost Analysis (DPMC-38)	CM	
CV3022	Review & Approve Program Submittal	CA	
CV3023	Review & Approve Program Submittal	PR	
CV3024	Review & Approve Program Submittal	CM	
CV3025	Consolidate & Return Program Submittal Comments	CM	
CV3030	Prepare Schematic Phase Submittal	AE	
CV3031	Distribute Schematic Submittal for Review	CM	
CV3037	Prepare & Submit Project Cost Analysis (DPMC-38)	CM	
CV3032	Review & Approve Schematic Submittal	CA	
CV3033	Review & Approve Schematic Submittal	PR	
CV3034	Review & Approve Schematic Submittal	CM	
CV3035	Consolidate & Return Schematic Submittal Comment	CM	
CV3040	Prepare Design Development Phase Submittal	AE	
CV3041	Distribute D. D. Submittal for Review	CM	
CV3047	Prepare & Submit Project Cost Analysis (DPMC-38)	CM	
CV3042	Review & Approve Design Development Submittal	CA	
CV3043	Review & Approve Design Development Submittal	PR	
CV3044	Review & Approve Design Development Submittal	CM	
CV3045	Consolidate & Return D.D. Submittal Comments	CM	
CV3050	Prepare Final Design Phase Submittal	AE	
CV2001	Distribute Final Design Submittal for Review	CM	
CV2002	Review & Approve Final Design Submittal	CA	
CV3053	Review & Approve Final Design Submittal	PR	
CV3054	Review Final Design Submittal for Constructability	OCS	

Sheet 1 of 3

Bureau of Design & Construction Services

DBCA - TEST

NOTE:
Refer to section "IV Project Schedule" of the
Scope of Work for contract phase durations.

© Primavera Systems, Inc.

EXHIBIT 'A'

Activity ID	Description	Respn	Weeks			
CV2055	Review & Approve Final Design Submittal	CM				
CV2056	Consolidate & Return Final Design Comments	CM				
CV3060	Prepare & Submit Permit Application Documents	AE				
CV3068	Prepare & Submit Bidding Cost Analysis (DPMC-38)	CM				
Plan Review-Permit Acquisition						
CV4001	Review Constr. Documents & Secure UCC Permit	PR				
CV4010	Provide Funding for Construction Contracts	CA				
CV4020	Secure Bid Clearance	CM				
Advertise-Bid-Award						
CV5001	Advertise Project & Bid Construction Contracts	CP				
CV5010	Open Construction Bids	CP				
CV5011	Evaluate Bids & Prep. Recommendation for Award	CM				
CV5012	Evaluate Bids & Prep. Recommendation for Award	AE				
CV5014	Complete Recommendation for Award	CP				
CV5020	Award Construction Contracts/Issue NTP	CP				
Construction						
CV6000	Project Construction Start/Issue NTP	CM				
CV6001	Contract Start/Contract Work (25%) Complete	CON				
CV6002	Preconstruction Meeting	CM				
CV6003	Begin Preconstruction Submittals	CON				
CV6004	Longest Lead Procurement Item Ordered	CON				
CV6005	Lead Time for Longest Lead Procurement Item	CON				
CV6006	Prepare & Submit Shop Drawings	CON				
CV6007	Complete Construction Submittals	CON				
CV6011	Roughing Work Start	CON				
CV6012	Perform Roughing Work	CON				
CV6010	Contract Work (50%+) Complete	CON				
CV6013	Longest Lead Procurement Item Delivered	CON				
CV6020	Contract Work (75%) Complete	CON				

Sheet 2 of 3

Bureau of Design & Construction Services

EXHIBIT 'A'

DRCA - TEST

NOTE:
Refer to section "IV Project Schedule" of the
Scope of Work for contract phase durations.
© Primavera Systems, Inc.

Activity ID	Description	Respn	Weeks
CV6014	Roughing Work Complete	CON	
CV6021	Interior Finishes Start	CON	
CV6022	Install Interior Finishes	CON	
CV6030	Contract Work to Substantial Completion	CON	
CV6031	Substantial Completion Declared	CM	
CV6075	Complete Deferred Punch List/Seasonal Activities	CON	
CV6079	Project Construction Complete	CM	
CV6080	Close Out Construction Contracts	CM	
CV6089	Construction Contracts Complete	CM	
CV6090	Close Out A/E Contract	CM	
CV6092	Project Completion Declared	CM	

DBCA - TEST

Sheet 3 of 3

Bureau of Design & Construction Services

EXHIBIT 'A'

NOTE:
Refer to section "IV Project Schedule" of the
Scope of Work for contract phase durations.

© Primavera Systems, Inc.

**New Jersey
Department of Transportation
Ewing Complex**

1035 Parkway Avenue
Trenton, NJ 08625

*Created by the Division of IT
3/6/01*

FERNWOOD BUILDINGS

- Bldg. E Central Steam Plant
- Bldg. 1 Equipment Office/Car & Truck Shop
- Bldg. 1A Mower / Machine Shop
- Bldg. 2 Plow Shop
- Bldg. 4 Plant Maintenance Shops
- Bldg. 5 Storage
- Bldg. 6 Furniture Storage
- Bldg. 7 Equipment Receiving
- Bldg. 8 Pavement Management/Furniture Shop
- Bldg. 9 Vehicle Wash Building
- Bldg. 10 Vehicle (Gas & Natural Gas) Stations
- Bldg. 11 Inspection Shop
- Bldg. 13 Guard House
- Bldg. 16 Soils Building & Maintenance Storage
- Bldg. 17 Construction Shop
- Bldg. 18 Vacant Building
- Bldg. 19 Scale Prototype and Development
- Bldg. 20 Central Electrical Operations/Radio Shop
- Bldg. 21 Sign Shop
- Bldg. 22 Switch Gear
- Bldg. 23 Overhead Sign Crew
- Bldg. 24 DOT/DMV Warehouse/Stock Room
- Bldg. 25 Landscape Chemical Storage
- Bldg. 26 Body Shop
- Bldg. 28 Storage

- MOB** Main Office Building
- E&O** Engineering & Operations Building
- F&A** Finance and Administration Building

THIOKOL BUILDINGS

- Bldg. 1 Bureau of Materials Office
- Bldg. 2 Bituminous Lab & Chemistry Lab
- Bldg. 3 Materials Testing Lab
- Bldg. 4 Physical Testing Lab
- Bldg. 5 Storage
- Bldg. 6 Accident Records & Geodetic Survey Offices
& Sale of Plans/Triangle
- Bldg. 8 Print Shop
- Bldg. 9 Concrete Testing

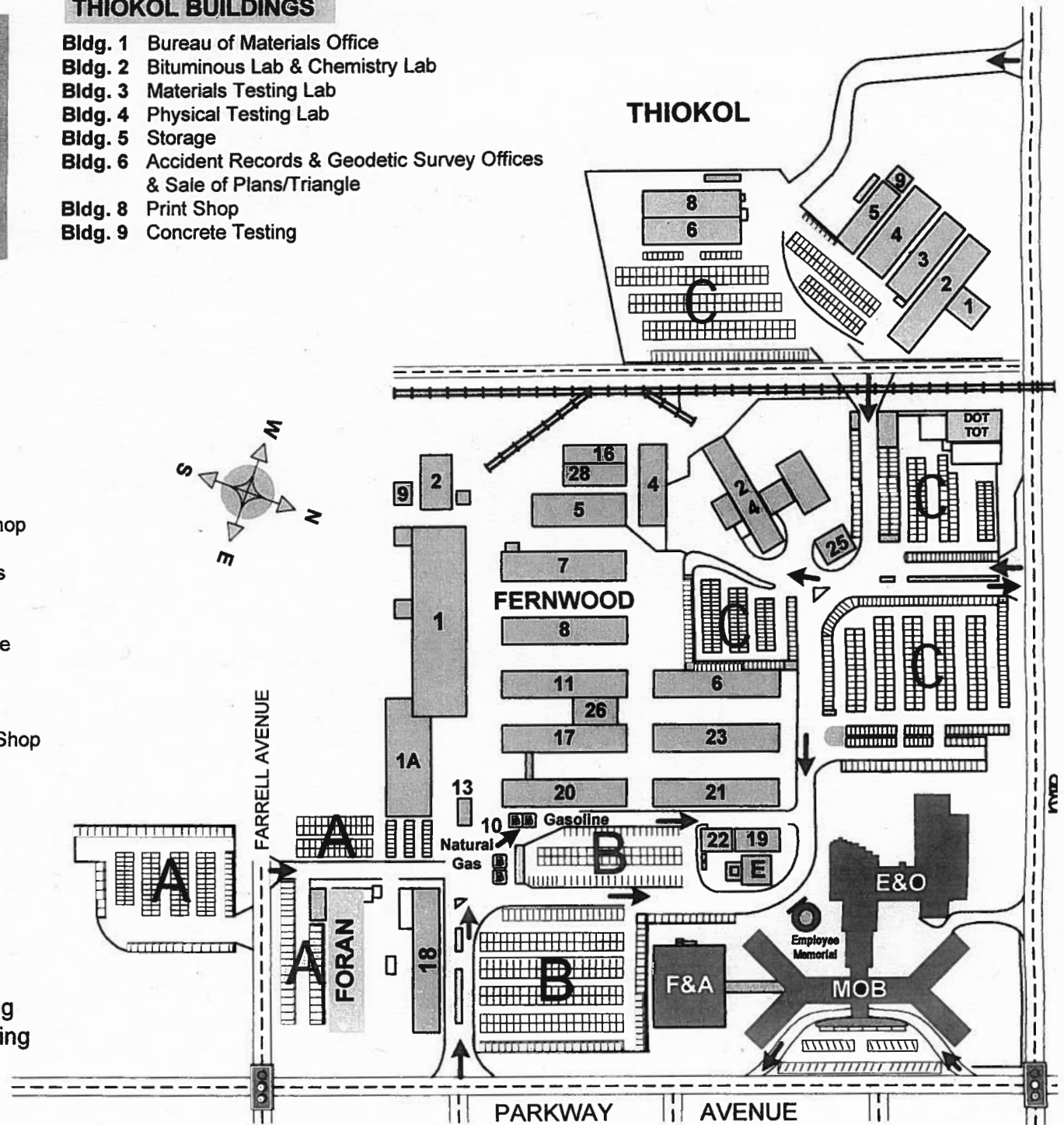
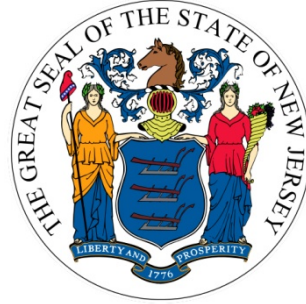


EXHIBIT 'B'



Engineering and Operations Building Smoke Control Evaluation

Contract No. Y0207-00,

Work Order No. 6

At the

NJDOT HQ

1035 Parkway Avenue

Ewing, NJ 08618

Prepared By:



**M&E Engineers, Inc
26 West High Street
Somerville, NJ**

Date: September 17, 2020

Revision 2

EXHIBIT 'C'

PURPOSE

The New Jersey Department of Transportation (NJDOT) has requested M&E Engineers, Inc. to evaluate the existing smoke control systems serving the Engineering and Operations (E&O) building at the NJDOT Headquarters located at 1035 Parkway Ave, Ewing, NJ. This study is intended to provide an analysis of the existing Smoke Control System (SCS) and documenting how it presently operates, determine if the system was designed in accordance with the original installation codes, and determine testing and maintenances procedures as required by code. The study also includes comparing how the system operates against current codes and what upgrades may be considered to bring the smoke control system up to current codes. Finally, this study has been updated to reflect an onsite meeting with the DPMC Fire Sub Code Official, Peter Buckley, on September 1, 2020 to clarify and interpret some of the original code requirements based on the building construction.

EXECUTIVE SUMMARY

M&E Engineers, Inc. performed an assessment of the existing smoke control systems. The building was built in 1983. Per the original construction drawings, the building was provided smoke control systems serving the main atrium and the four egress stairwells. These systems would have been required to meet the 1981 Building Officials and Code Administrators (1981 BOCA) code. Per the New Jersey Rehabilitation Subcode (NJAC 5:23-6), the building is not required to meet to the current building codes unless significant alterations are made to the atrium space itself. However at the request of the DOT, the systems will be evaluated in comparison to the 2018 International Building Code, NJ Edition, and 2018 International Fire Code which were adopted by NJ on September 3, 2019.

The main atrium exhaust systems and stairwell pressurization systems do not meet three critical requirements and one recommendation of the BOCA code and should be addressed as soon as possible. These requirements are as follows:

- The basement control panel which controls SF-2 and SF-3 is not on standby power as required per 1981 BOCA 631.1.1.4.
- The lobby doors no longer automatically open to allow supply air when the exhaust fan runs as originally designed and recommended in Section 631.2.1.1.
- The existing smoke detector layout does not cover the hallway and two story area extending from the atrium to the MOB building as required per 1981 BOCA 631.2.1.3.
- The smoke control systems serving the atrium are required to have a manual override for fire department use per 1981 BOCA 631.2.1.4.

We recommend these items be addressed as indicated in Recommendations #1, #2, #3 and #4 of this report. Our estimate of the probable cost to fix these items is \$40,000 if done during normal hours or \$59,500 if done during overtime hours.

The existing smoke control equipment is original to the building. We recommend the exhaust fan, supply fans and respective motorized dampers be replaced with equipment meeting the material requirements set forth in the 2018 International Building Code as indicated in recommendations #5 and #6 of this report. Our estimate of the probable cost for these items is \$200,000 if done during normal hours or \$250,000 if done during overtime hours.

If all equipment upgrade recommendations are incorporated (Recommendations #1-#6), our total estimate of probable cost is \$240,000 if done during normal hours or \$309,500 if done during overtime hours.

The system has not been routinely tested as required by all the codes previously referenced. The last test was by Fisher Balancing Company on March 23, 2019 where airflow and space differential pressure readings were taken (see Appendix C for a copy of this report). However, the testing report does not indicate the basis for how the differential pressure testing was done, nor whether supply and return fans were active on each floor during testing. As such, it is unclear if the differential pressure results provided are reliable. Prior to this test, there are no records on site of the system being tested. The system should also be tested for operation on a quarterly and semi-annual basis as noted in Recommendation #7. This includes recommended maintenance procedures as indicated in the 1981 BOCA and the 2018 NFPA 92 Standard for Smoke Control Systems. Additional pressurization testing for the atrium as listed in Recommendation #8 may also be done if desired to meet the current IBC-NJ. As these are maintenance costs and not capital expenses, an estimate of cost is not provided.

The smoke control systems also do not meet several 2018 International Building Code, NJ Edition, and 2018 International Fire Code requirements that are in addition to the items noted above. However, these requirements do not need to be addressed per the New Jersey Rehabilitation Code as they not feasible to be implemented. For further explanation on these items, please refer to the body of this report.

EXISTING CONDITIONS

The Engineering and Operations (E&O) building was built based on architectural and mechanical plans by CUH2A, dated February, 1983. The building consists of seven floors plus a partial basement and a mechanical penthouse. The building is a typical office building with various open and private offices, IT rooms, mechanical rooms, restrooms, etc. The building is fully sprinklered. A fire alarm system is provided with manual pull stations at exit doorways, sprinkler flow alarm and limited smoke detection serving the atrium spaces and egress stairwells.

The main building entry contains a two story atrium space approximately 131,800 ft³ in volume, with a security desk at the entry, an elevator lobby, an open stairwell (stairwell #4) connecting the ground floor to the second floor, and a long hallway connecting the atrium to the MOB building. At the end of the hallway to the MOB building, there is a set of automatic doors that are held open and close upon smoke detection or activation of the building fire alarm system.

The building also has three stairwells (stairwell #1, #2, and #3) that connect all seven floors for purposes of egress. Stairwell #2 also extends into the basement and the penthouse as the main point of egress. At the seventh floor landing, a separate single story stairwell (stairwell #6) is also connected to stairwell #2 which also extends up to the penthouse as a second means of egress.

Smoke control systems were provided in the original building plans to serve the atrium and the stairwells as part of the original construction in 1983. Based on field observations and additional as-builts provided, no significant changes were made to the smoke control mechanical systems since they were originally built.

The main atrium is provided with a 40,000 CFM of exhaust from the 2nd floor through a 120"x64" exhaust air opening immediately above stairwell #4 in the atrium, above the suspended ceiling within the plenum. The suspended ceiling consists of diagonal metal slats that have gaps between the slats to allow airflow to pass through the ceiling and into the plenum above. The air then enters the return opening and travels up through the building to exhaust fan, EF-P-11, which is located in the penthouse. There are smoke detectors located at the top of the atrium and at the elevator lobby. There were no detectors in the hallway extending to the MOB building. Upon activation of the building fire alarm, EF-P-11 will energize until the event is cleared. There is no system override presently installed for the fire department's use. Per the original specifications manual, the front entry lobby doors were also programmed to automatically open when EF-P-11 was energized. Per DOT, the lobby doors do not operate in that manner today. There is one dedicated HVAC system serving the atrium

space, AHU-2-3. Per the building staff, it is believed this unit shuts down upon activation of the atrium exhaust system but should be confirmed.

Each existing stairwell is positively pressurized by dedicated supply fan and has a relief vent installed on the roof at the top of each stairwell.

- Stairwell #1 is served by a roof mounted supply fan, SF-1, which was designed to provide 3,700 CFM of outside air ducted down to the first floor level of the stairwell.
- Stairwell #2 is served by an inline supply fan, SF-2, that is installed on the first floor in the northern mechanical room. The fan's intake is ducted from a common outside air intake louver also serving AHU-1-1. The supply fan was designed to provide 4,000 CFM of outside air at the first floor level of the stairwell
- Stairwell #3 is served by an inline supply fan, SF-3, that is installed on the second floor in the southern mechanical room. The fan's intake is ducted from a common outside air intake louver also serving AHU-2-2. The supply fan was designed to provide 3,700 CFM of outside air at the second floor level of the stairwell
- Stairwell #6 is served by an inline supply fan, SF-4, that is installed in the mechanical penthouse adjacent to stairwell #2. The fan's intake is ducted down from a gravity roof ventilator on the penthouse roof. The supply fan was designed to provide 2,740 CFM of outside air at the penthouse level of the stairwell.

EF-P-11, SF-1, and SF-4 are controlled by a Johnson Control panel located in the penthouse of the building. DOT personnel confirmed the control panel and respective fans are powered by the emergency generator. SF-2 and SF-3 are controlled by a Johnson Control panel located in the basement of the building. While SF-2 and SF-3 are powered by the emergency generator, the basement control panel is not (confirmed by DOT personnel through on site testing on September 28, 2019). The two control panels are not currently integrated into the recently installed Honeywell Niagara Controls system that operates the campus HVAC systems.

All of the systems appear to be original to the building, installed in 1983. Each fan has a pneumatically operated motorized damper that is held closed when not in operation to prevent unwanted outside air from infiltrating into the ductwork. The air compressor feeding the pneumatic controls is scheduled to be replaced before the in the near future. DOT noted the damper serving EF-P-11 has failed in the open position. This has led to dirt and debris to come through the rooftop outside air penetration and go into the fan housing.

BUILDING CODE REVIEW

Original Construction

The original construction drawings by CUH2A are dated for February 15, 1983. The drawings do not identify the building use, the building type, or building codes used when designing the building as is required today. Per the New Jersey Department of Community Affairs (NJ DCA), NJ would have been enforcing the 1981 Building Officials and Code Administrators (BOCA) National Building Code as of this date. As such, all smoke control systems designed for the Atrium and the Stairwells should have been required to meet or exceed this code. This code has specific design requirements for atriums and exit stairwells.

Atriums

Atriums were required to be designed and built per Section 631.0 for Open Wells of the 1981 BOCA National Building Code (1981 BOCA). Please see Appendix A for this section of the code. Per section 631.2, a smoke control system is not required for atriums two stories in height. However, one was provided in the original design drawings for an undetermined reason. This could have been done as a tradeoff for not meeting another portion of the BOCA code. Unfortunately, it is not possible to determine what the tradeoff may have been and exactly why it was included. However, since it was included in the design, the system is required to meet the code requirements' of the BOCA code.

The atrium smoke control system performance is outlined in Section 631.2.1.1 for atriums 55 feet or less in height and Section 631.2.1.2 for atriums in excess of 55 feet in height. As the E&O atrium is a maximum of 28 feet in height, Section 631.2.1.1 applies. The following important highlights of Section 631.0 as well as Section 631.2.1.1 relate to the E&O building.

- Per 1981 BOCA Section 631.1.1, an electrically supervised automatic fire suppression system throughout the building was required to be installed.
 - This system is presently installed and operating. A water flow switch is tied into the fire alarm system that when sensing flow activates the existing atrium smoke control systems
- Per 1981 BOCA Section 631.1.4, smoke control systems and equipment are also required to be provided with an emergency source of power.
 - The equipment and controls serving the atrium all appear to be fed by the emergency generator.
- Per 1981 BOCA Section 631.1.5 and 631.1.6, the smoke control system once built was required to be tested and accepted prior to building occupancy. The system was then to be inspected and tested every three months with a log kept for examination by the fire department. The system was also to be inspected and operated every six months as required by the fire prevention code.

- While this may have been done after the building was built, there are no recent records available to indicate the inspection and operation has been done in recent years until testing was done on March 29, 2019.
- Per 1981 BOCA Section 631.2, the volume of the atrium space shall include all spaces not separated by a one hour fire separation wall.
 - As such, the atrium space at the E&O building includes the first and second floor of the main entry as well as the elevator lobbies on the first and second floor and the connecting hallway on the first floor to the ramp towards the Main Office Building (MOB) that ends with normally held open fire doors that self-close upon smoke detection. This results in a total volume of 131,800 ft³ for the atrium space.
- Per 1981 BOCA Section 631.2.1, a smoke control system is required to control the migration of products of combustion in the atrium spaces. It also requires the system shut down all supply air fans on the floor a fire exists and shut down of the return air fans for non-fire floors. Per our meeting with the DPMC Fire Sub-Code Official, this portion of the code was interpreted as requiring the shut down of fans only serving floors *within* the atrium space itself, and not spaces or floor that are physically separated from the atrium by a fire wall or doorway that would normally be closed during a smoke event (i.e. the door is normally closed all the time, or electronically held open but released to close by the fire alarm system upon activation)
 - There is one existing air handler, AHU-2-3, that serves the atrium space that is believed to automatically shut off when the smoke control system is activated (this interlock should be confirmed at next testing opportunity).
 - All doors into the atrium space are either normally closed or have an electronic release to allow them to close.
 - This meets the intent of the code section.
- Per 1981 BOCA Section 631.2.1.1, the E&O atrium space must be provided with a minimum 40,000 CFM of exhaust at the ceiling of the atrium. The section also notes that supply air may be provided at the lowest area of the atrium, but does not explicitly require that supply air be provided.
 - The exhaust has been provided at the ceiling above the atrium stairwell with EF-P-11 providing 40,000 CFM of exhaust. Supply air flow has not been specifically provided by a mechanical system, but it also is not required per the code section. Instead, per the original building specification manual, section 1960 – Fire Alarm, the front lobby doors would open upon activation of the exhaust fan. This is no longer the case today and should be restored to the original operation.
 - It was noted that the system does not exhaust from the two story section of the corridor going to the MOB building. While this is not required by the BOCA code,

this does create a trap for smoke that could build up in the corridor. This could be addressed by extending an exhaust duct to the corridor, however the existing building layout does not allow for an easy pathway for this duct.

- Per 1981 BOCA Section 631.2.1.4, the smoke control system is required to be activated by the fire suppression system, smoke detectors located as per section 631.2.1.3 (in ceiling of atrium or neighboring floor areas projecting into the atrium), and through a manual controls provided for fire department use.
 - The existing fire alarm system is tied into the smoke control system. NJDOT confirmed this when the sprinkler system was mistakenly discharged and the smoke exhaust systems were activated.
 - Per NJDOT, activation of the smoke detectors in the atrium space caused the smoke exhaust systems to also be activated.
 - There are no smoke detectors in the hallway from the atrium to the MOB building with the exception of one detector on either side of the doors that are held open. There are also no detectors throughout the hallway or in the two story corridor area at the end of the corridor. As such, a fire in this area will not activate the atrium exhaust until enough smoke has generated to flood the hallway and get past the bulkheads at the atrium. This installation does not meet the requirement of Section 631.2.1.3. This hallway could be separated from the atrium through the provision of a new door assembly located at the main atrium side of the hallway. If this was installed, additional detection would not be required to be installed in the corridor.
 - There are presently no manual controls provided for the fire departments use. While the above two conditions are present, this must also be added as it is required to better aid first responders.

Exit Stairwells (Smoke Proof Enclosures)

The three exit stairwells (stairwell #1, #2 and #3) and penthouse stairwell #6 were all designed in accordance with Section 818.0 for Smokeproof Enclosures of the 1981 BOCA National Building Code (1981 BOCA). Please see Appendix B for this section of the code. The following represent important highlights of this section.

- Per 1981 BOCA Section 818.2, one of the stairwells were required to meet this section 818.0 as they all extend over 75 feet in height above the lowest level of fire department vehicle access. To meet the smoke proof enclosure requirement, stairwells are required to have a vestibule with specific sizing, location and ventilation requirements. Stairwells #1 and #3 do not have vestibules provided. Stairwell #2 has a vestibule on each floor. However, it is not ventilated per section 818 requirements.

- However, 1981 BOCA Section 818.2.1 identifies an alternative should the building be provided with an automatic fire suppression system throughout. Section 818.2.1 allows the smoke proof enclosure to be eliminated provided all interior exit stairways are pressurized to 0.15 inches of water column (37.33 Pa) as described in 1981 BOCA Section 818.7.3. However, Section 818.7.3 refers to vestibule ventilation which we do not believe was a correct reference. Instead, it is our judgment that the code was intended to reference Section 818.7.5 for stair shaft air movement systems.
- Per 1981 BOCA Section 818.7.5, the stairwell is required to have a dampered relief opening at the top, a minimum of 2,500 CFM of supply air and maintain a minimum positive pressure at all doors of 0.05 inches of water column (in. w.c.) with all doors closed. Per Section 818.2.1, the positive pressure requirement increases to 0.15 in. w.c. to meet the fire suppression system alternatives.
 - Stairwell #1, #2, #3, and #6 appear to meet the 818.7.5 requirements as each has a dedicated supply fan greater than 2,500 CFM and relief damper provided at the roof of each stairwell.
 - The original design does not identify a specific pressurization requirement to meet the section 818.2.1 requirement. However, the respective stairwell supply fans appear to have sufficient airflow to meet or exceed the 0.15 in. w.c. pressurization required based on our calculations for the overall leakage rate of the stairwells.
- Per 1981 BOCA Section 818.7.7, ventilation control systems and equipment are also required to be provided with an emergency source of power.
 - The controls and equipment serving SF-1 and SF-4 are on standby power
 - While supply fans SF-2 and SF-3 are on standby power, their basement control panel is not as noted above.

1981 BOCA Summary

The main atrium exhaust systems and stairwell pressurization systems do not meet three requirements of the 1981 BOCA code:

1. The basement control panel which controls SF-2 and SF-3 is not on standby power per Section 631.1.4.
2. The lobby doors no longer automatically open to allow supply air when the exhaust fan runs as originally designed and recommended in Section 631.2.1.1.
3. There is insufficient detection in the corridor from the main atrium to the MOB building as required in Section 631.2.1.3.
4. The atrium smoke exhaust system is not provided with a system override for the fire departments use per Section 631.2.1.4.

All other systems and components appear to meet the requirements of the 1981 BOCA code. The smoke control system, including shutdown of AC-2-3 should also be tested for operation on a quarterly basis. Lastly, the stairwell pressurization should be measured to ensure it meets the BOCA requirements of 0.15”.

Current Code Requirements (2018 IBC, NJ ED and 2018 IFC)

As the building was built in 1983, per the New Jersey Rehabilitation Code, it is not required to be built to the current building codes. However, at the request of the DOT, the systems will be evaluated in comparison to the 2018 International Building Code, NJ Edition (IBC, NJ Ed), and 2018 International Fire Code (IFC) which was adopted by NJ on September 3, 2019. The 2018 IFC and 2018 IBC requirements for smoke control systems are identical. In addition, there are not retroactive requirements set forth by the IFC for smoke control systems, as it limits its scope to new buildings or portions thereof by provisions of the IBC per paragraph 909.1. The following highlights the code requirements and possible deficiencies for the atrium and stairwell spaces in relation to 2018 IBC, NJ ed. and therefore also the 2018 IFC. (Please note that the 2018 IBC could not be added as an appendix due to its recent release. This code is only available online and not available in print at the time this report was written. The code can be accessed for free via the New Jersey Department of Community Affairs Division of Codes and Standards website at the following link: <https://www.nj.gov/dca/divisions/codes/codreg/index.html>)

Atriums

Atriums are classified in the 2018 International Building Code, NJ Edition (2018 IBC-NJ) as an opening connecting two or more stories that is closed at the top by a roof or horizontal assembly. The E&O building has a two story atrium space at its main entry point. Per 2018 IBC-NJ, atriums are required to be designed and built per Section 404.0 for Atriums. The following represent important highlights of Section 404.0 and its other references with the 2018 IBC-NJ Code.

- 2018 IBC-NJ Section 404.3 references that automatic sprinkler systems shall be provided through the entire building unless 2-hr fire barriers are provided to separate the atrium from the remainder of the building.
 - As the building is fully sprinklered, it meets this requirement. Note that the atrium is separated from the remainder of the building by 1 hr fire rated walls.
- 2018 IBC-NJ Section 404.4 notes a fire alarm system shall be provided in accordance with 2018 IBC-NJ Section 907.2.13. Section 907.2.13 required detectors be installed and spaced as per 2018 IBC-NJ Section 909.4, the system be operated as per 2018 IBC-NJ Section 909.17 and activation to occur as per section 2018 IBC-NJ 907.5

- Section 909.4 requires the system to be designed using a rational analysis for support and operation.
 - This appears to have been done based on the current fire alarm system layout.
- Section 909.17 requires the system to operate immediately on receipt of automatic or manual activation command.
 - The atrium systems are currently operating in this manner.
- Section 907.5 requires the fire alarm system to be activated by automatic fire detectors, sprinkler water flow devices, manual fire alarm boxes, and automatic fire extinguishing systems.
 - The atrium systems are currently operating in this manner.
- 2018 IBC-NJ Section 404.5 notes a smoke control system shall be installed in accordance with Section 909, however it also lists an exception that states, “In other than Group I-2, and I-1, Condition 2, smoke control is not required for *atriums* that connect only two *stories*.”
 - As the E&O building is considered Group B and the atrium space is only 2-stories, a smoke control system may not be required if it was built today provided it met all the other requirements in the IBC.
 - However, if the smoke control system were to be *newly* installed today, it would be designed to meet the requirements of Section 909.
- 2018 IBC-NJ Section 404.7 notes that all equipment required to provide smoke control shall be provided with standby power in accordance with Section 909.11.
 - As noted previously, the atrium equipment is provided with standby power and meets this requirement.
- 2018 IBC-NJ Section 909 established minimum requirements for smoke control systems.
 - Section 909.6 stipulates the design requirements for the pressurization method of the system. Per this section, the system shall maintain a minimum negative pressure difference of 0.05” inches W.C. and not exceed a maximum differential pressure that would require excess door opening or closing forces (typically about 0.30 inches W.C.)
 - Based on the balancing report done by Fisher Balancing Company on March 23, 2019, all doorways in the atrium maintained a differential pressure ranging from -0.010 to +0.103 when the AHUs were off and - 0.080 to -.008 when the AHUs were on. As the pressure difference vary from negative to positive and do not meet the 0.05” in w.c. minimum at all points, the system does not currently appear to meet the pressurization requirements.

- Section 909.7 allows for the airflow for smoke control to be designed by an airflow method when approved by the fire protection sub code official. This method allows smoke migration through openings fixed in a permanently open position, located between smoke control zones.
 - This is not an applicable method for this building atrium construction as there is no feasible way to allow smoke to migrate from the atrium via fixed openings without negatively impacting the surrounding spaces.
- Section 909.8 allows for the smoke control to be designed by the exhaust method. Where approved by the fire protection sub code official, mechanical exhaust systems may be used to mitigate the smoke. This method restricts the height of the smoke layer to not less than 6 feet above a walking surface within the smoke zone. The system must be designed in accordance with NFPA 92.
 - The geometry of the atrium does not allow for a pre-defined smoke layer to be controlled. The atrium has several long corridors on the first and second floor and barriers in the plenum of the second floor that would hinder a smoke layer from forming in a controlled manner. In addition, the connecting hallway from the main atrium to the Main Office Building (MOB) feeds into a 2 story corridor area that is technically part of the atrium volume. This 2-story corridor would also hinder the control for a smoke layer through the 1-story connecting hallway. It is possible that additional doorways could be added to separate the two spaces. However, a full egress analysis would need to be done by a licensed architect to confirm if this is possible. Because of these concerns, it does not appear to be practical to modify the architectural components at this time to meet the Section 909.8 requirements.
- NFPA 92 is the Standard for Smoke Control Systems. The NFPA Standard paragraph 1.3.1 specifically notes this standard is not intended to be applied to facilities, equipment, structure, or installations that were existing or approved for construction or installation prior to the effective date of this document. The E&O building was constructed prior to the creation of the NFPA 92 standard in 2012. However, at the request of the DOT, the systems will be evaluated in comparison to the 2018 NFPA 92 standard as it was referenced by IBC paragraph 909.8.
 - NFPA 92 lists several design methods for smoke management systems to be considered for large volume spaces (i.e. the atrium) that should be considered during the initial construction of the building. As the atrium is mechanically exhausted, the standard would require the exhaust system

maintain a pre-defined smoke layer under various conditions similar to 2018 IBC-NJ Section 909.8.

- As noted in the 2018 IBC-NJ Section 909.8 analysis, the geometry of the atrium does not allow for a pre-defined smoke layer to be controlled and it would not be practical to modify the architectural components at this time to meet the NFPA 92 requirements
- NFPA 92 also allows for smoke management calculations to be analyzed using computational fluid dynamic (CFD) modeling. This technique is typically used for large scale atriums with complicated geometries. The model would be used to determine the smoke layer height, assist in determining smoke production and migration within various points of the atrium.
 - As the existing atrium is complicated in its layout with multiple hallways extending away from the main atrium space, performing a smoke analysis through CFD would be prudent for any future major renovations to the atrium. We would not recommend this analysis be completed at this time based on the existing layout. As noted previously, the geometry of the atrium was not originally designed to allow for a pre-defined smoke layer to be controlled.
- 2018 IBC-NJ Section 909.10 identifies requirements for the equipment used in smoke control systems and is split into five separate requirements.
 - Section 909.10.1 states exhaust fans must be rated to and certified by the manufacturer for the probable temperature rise in which its components will be exposed.
 - It is unclear if the existing exhaust fan meets the requirement of 909.10.1 due to its age. There are also no labels on the exhaust fan to indicate its ratings. Any replacement fan will be required to meet this section.
 - The probable temperature rise calculation will also require further evaluation to determine the proper convective heat output of a design fire per equation 9-2 of this section.
 - Section 909.10.2 notes that ductwork must also be designed to meet the higher temperatures and leak tested to 1.5x the design pressure with leakage rates not exceeding 5%
 - It is unclear if the existing ductwork meets the requirement of 909.10.2 as it is inaccessible through the building until the penthouse and there are no indications in the building as-builts or

on the exposed ductwork in the fan room as to its materials of construction.

- Section 909.10.3 notes the location of equipment, inlets and outlets shall be located so as not to negatively impact other mechanical systems in the building.
 - This requirement appears to be met.
- Section 909.10.4 notes that all automatic dampers shall be listed and conform to requirements of approved, recognized standards.
 - It is unclear if the existing dampers meet the requirements of today's standards. There are no labels or markings on the installed dampers. As they are pneumatically controlled, we recommend they be replaced with electronically actuated dampers.
- Section 909.10.5 notes that belt driven fans shall be supplied 1.5 times the number of belts required for the design duty (minimum 2) as well as additional performance requirements.
 - The existing fan has two belts, but it is unclear if the fan meets the design duty requirement and performance requirements. During the March 23, 2019 balancing, the air balancer noted the operating electrical information was inaccessible.
- 2018 IBC-NJ Section 901.6.2.2 notes where a fire alarm system is integrated with a smoke control system as outlined in Section 909, integrated testing shall comply with NFPA 4, with an integrated test performed at intervals not exceeding 10 years.
 - This testing has not been completed with the exception of the recent accidental sprinkler discharge which activated the system.

Exit Stairwells (Smoke Proof Enclosures)

The three exit stairwells (stairwell #1, #2 and #3) and penthouse stairwell #6 if designed to the 2018 IBC-NJ are required to be "Smoke Proof Enclosures" per section 403.5.4 as the upper floors are more than 75 feet above the lowest level fire department vehicle access. As such, the stairwells would be required to meet the requirements for 2018 IBC-NJ Section 909.20 and Section 1023.11, both of which provide design requirements for Smoke Enclosures. In addition, as they are considered interior stairways, they would also be required to meet 2018 IBC-NJ Section 1023 – Interior Exit Stairways and Ramps. The following represent important excerpts of these sections in relation to the design of the stairwells at the E&O building.

- 2018 IBC-NJ Section 909.20.2 notes the smoke proof enclosure shall consist of an interior stair well per 2018 IBC-NJ Section 1023 and an open exterior balcony or ventilated vestibule. Similarly to the BOCA code, there is an exception in 2018 IBC-NJ

Section 909.20.5, that allows for the vestibule to be omitted if the stairwells are pressurized not less than 0.10 in. of w.c. and not more than 0.35 in. of w.c. in the shaft relative to the building when all interior doors are closed.

- As noted previously, Stairwells #1 and #3 do not have vestibules provided. Stairwell #2 has a vestibule on each floor. However, it is not ventilated. Therefore the exception to provide pressurization would need to apply which the supply fans appear to satisfy as discussed previously under the BOCA codes.
- 2018 IBC-NJ Section 909.20.6 notes that ventilation equipment, control wiring, power wiring and ductwork shall be located exterior to the building, located within the smoke enclosure or separated from the remainder of the building by a 2-hr fire barrier. The equipment must also be provided with standby power.
 - The existing installation deviates from this requirement.
 - Supply fan S-2 and S-3 serving Stairwell #2 and #3 respectively are located in neighboring mechanical rooms along with air handlers that serve the building. This type of installation does not meet the intent of this code section. It is not feasible to relocate or modify these fans as they are located directly over mechanical equipment and share the outside air intake with the building air handlers.
 - The control systems serving the supply fans are not in a dedicated room with a 2-hr fire rating.
 - As previously mentioned, the power serving the basement controls panel controlling S-2 and S-3 is not on standby power.
 - Supply fan, S-1 serving Stairwell #1 is located on the roof and its associated ductwork is located in a duct shaft. This equipment therefore meets the intent of this code section.
- 2018 IBC-NJ Section 1023.6 for ventilation is identical to the 2018 IBC-NJ Section 909.20.6 requirement for equipment and ductwork to be located exterior to the building, within the stairwell, or within the building but separated from other mechanical equipment by rated walls.
 - See deviations as noted under 2018 IBC-NJ Section 909.20.6 above.
- 2018 IBC-NJ Section 1023.11 requires the enclosures to terminate at an exit discharge or public way.
 - All stairwells have exit doorways to the outdoors at the ground floor satisfying this requirement.

2018 International Building Code – New Jersey Summary

The main atrium does not require an exhaust system per 2018 IBC-NJ Section 404.5. However, if it were to be *newly* installed today, it would be required to meet the remainder of the code

requirements in the 2018 IBC-NJ code. The atrium exhaust system does not meet two requirements of the 2018 IBC-NJ code:

1. The exhaust system did not maintain the required space differential as required per 2018 IBC-NJ Section 909.6 under the space pressurization method.
2. The exhaust system components (fan, ductwork, dampers) cannot be confirmed as meeting the material requirements of 2018 IBC-NJ Section 909.10

The stairwell pressurization systems do not meet two requirements of the 2018 IBC-NJ Section 909.20.6:

1. The basement control panel which controls SF-2 and SF-3 is not on standby power.
2. The respective supply fans, controls and electrical wiring are not separated from the remainder of the building by a minimum 2-hr rating.

Traditional Testing Considerations

It had been common practice to test smoke control systems using a “smoke bomb test”. This test would occur during unoccupied hours. The balancer would typically meet with the fire marshal or local inspector to discharge the smoke and activate the smoke control system. The system would need to purge or control the smoke within 60 seconds to be considered acceptable. It’s possible the authority having jurisdiction may still accept this type of test today provided the system is routinely maintained and tested as per the original 1981 BOCA requirements.

RECOMMENDATIONS

It is neither required nor practical to modify the existing atrium smoke control and stairwell pressurization systems to completely meet the current code requirements as set by the 2018 IBC-NJ code. However, there are modifications that should be made to meet the 1981 BOCA Code. It is also our understanding that DOT may require all of this work be done during overtime hours. As such, we have included probable cost estimates for both normal and overtime hours.

Recommendation #1 (Critical - BOCA and IBC Requirement)

Provide emergency power to basement control panel operating SF-2 and SF-3. This is a requirement in the original code and new code and should be completed as soon as possible. Should there be a power outage, Stairwell #2 and Stairwell #3 would not have pressurization creating potential smoke infiltration causing a life safety issue.

- Our estimate of the probable cost to provide a new power circuit is \$10,000 if done during normal hours or \$17,000 if done during overtime hours.

Recommendation #2 (Non-Critical - BOCA Recommendation)

The lobby doors no longer automatically open to allow supply air when the exhaust fan runs as originally designed and recommended in Section 631.2.1.1. While this is not required per the original building code, opening the doors allows the system to better maintain overall pressurization and smoke migration. We recommend the doors be modified or replaced to restore the automatic opening of the doors upon activation of the smoke control system.

- Our estimate of the probable cost to provide a new power circuit is \$5,000 if done during normal hours or \$7,500 if done during overtime hours.

Recommendation #3 (Critical - BOCA Requirement)

The existing corridor connecting to the main atrium space to the MOB building does not have adequate smoke detectors as required in BOCA section 631.2.1.3. Additional detection should be added or the space can be separated from the main atrium space by providing new doors at the start of the corridor near the main lobby. New doors would likely be the least expensive option and reduces the overall volume of the atrium making the system more effective. The doors could be installed so they are held normally open but automatically close when the exhaust fan is activated. A smoke detector on either side of the door would be installed to control the door along with an interlock into the existing fire alarm to close the doors upon activation. Alternatively, providing detection throughout the corridor would require a minimum of 4 detectors in the one story portion of the corridor and 4 more detectors in the two story section. These detectors would need to be tied into the smoke control system to activate upon detection by two or more detectors.

- Our estimate of the probable cost to provide a new doorway is \$10,000 if done during normal hours or \$15,000 if done during overtime hours.
- Alternatively, our estimate of the probable cost to provide additional detection throughout the hallway is \$18,000 if done during normal hours or \$27,000 if done during overtime hours.

Recommendation #4 (Critical - BOCA Requirement)

Provide a manual control station for the fire departments use to operate the atrium smoke control system and the stairwell pressurization fans as required per 1981 BOCA Section 631.2.1.4. The final location of the override should be confirmed with the local fire department. This would allow more control to the first responders to override the systems should the need arise.

- Our estimate of the probable cost to install the new manual override is \$15,000 if done during normal hours or \$20,000 if done during overtime hours.

Recommendation #5:

The atrium exhaust and four stairwell supply fans are original to the building and approximately 36 years old. We recommend these fans be replaced. The stair well pressurization fans can be replaced in kind as it is not practical to meet the installation requirements of 2018 IBC-NJ Section 909.20.6. The new exhaust fan would be required to meet the material requirements per 2018 IBC-NJ Section 909.10. These requirements include:

- 2018 IBC-NJ Section 909.10.1 – fan shall be rated and certified for probable temperature rise to which components will be exposed. The temperature rise must be calculated separately based on a proposed design fire.
- 2018 IBC-NJ Section 909.10.5 – fan shall be provided with minimum of 1.5 times the number of belts required for design duty (minimum 2 belts). Fans shall be selected for stable performance at normal and elevated temperatures. Motors shall be selected so they do not operate beyond their nameplate horse power based on actual current draw and have a minimum service factor of 1.15.
- Our estimate of the probable cost to replace the exhaust fan is \$160,000 if done during normal hours or \$200,000 if done during overtime hours. Note that the fan room and penthouse wall will likely need to be partially removed to accommodate the rigging of a new fan. The fan is also large in size and will require a complicate rigging plan.
- Our estimate of the probable cost to replace the three supply fans is \$24,000 if done during normal hours or \$30,000 if done during overtime hours.

Recommendation #6:

Each fan has a pneumatically operated motorized damper that is held closed when not in operation to prevent unwanted outside air from infiltrating into the ductwork. The dampers are original to the building and the pneumatic controls are not as reliable as electronic controls today. We recommend the dampers be replaced and new electronic actuators be provided that meets the material requirements of 2018 IBC-NJ Section 909.10.4. The damper for the EF-P-11 must also be rated for the same probable temperature rise as the exhaust fan.

- Our estimate of the probable cost to replace the motorized dampers is \$16,000 if done during normal hours or \$20,000 if done during overtime hours.

Recommendation #7

Per the 1981 BOCA Code Sections 631.1.6, the smoke control systems should be tested every 3 months. The code also references the inspection and operation be completed in accordance with the 1981 Basic Fire Prevention Code. However, this code is no longer available for viewing or purchase. Instead, we recommend following based on the requirements of NFPA 92 and the 2018 International Fire Code which recommends dedicated systems be tested quarterly and semi-annually to determine airflow quantities and pressure differences. We recommend the DOT set up a maintenance contract to have this testing regularly completed. The testing should confirm the following operating characteristics:

- Quarterly:
 - Physically inspect all operating parts of the smoke control systems (fans, dampers)
 - All results shall be included in a log for inspection by fire department.
- Semi-Annually (during normal and standby power):
 - Check operation of atrium smoke control exhaust fans upon activation of smoke detector or water flow switch.
 - Physically inspect ductwork & louvers
 - Verify the atrium smoke control system is interlocked with AHU-2-3 to shut down the supply fan of the air handler and either activate or shut down the return fan.
 - Verify stairwell pressurization fans operate upon activation of smoke detection system.
 - Verify respective motorized dampers for each exhaust fan are open during operation and power closed during off position.
 - (After Recommendation 4 is implemented) Verify operation of manual controls.
 - Measure airflow volume of atrium exhaust fan.
 - Measure differential pressure of stairwells with supply fans running while all doors are closed. Differential pressure is to be maintained between a minimum of 0.15 in. w.c. per 1981 BOCA Section 818.2.1 and a maximum of 0.35 in. w.c. per IBC-NJ Section 909.20.5.
 - Verify electrical characteristics of exhaust and supply fans do not exceed ratings of fan motors.
 - All results shall be included in a log for inspection by fire department.
- This cost would be considered a maintenance cost and not capital expenses, an estimate of cost is not provided.

Recommendation #8

While it's not required to meet the 2018 IBC-NJ code, the DOT at its option may elect to test the existing atrium exhaust system and stairwell pressurization systems to determine if they meet the differential pressure requirements per 2018 IBC-NJ Section 909.6 (atrium) and 2018 IBC-NJ Section 909.20.5 (stairwells). This would be accomplished by closing all doorways to each space and activating the respective smoke control systems.

- For the atrium, the differential pressure across all doorways would be required to be 0.05"-0.30" with the atrium being negative.
- For the stairwells, the differential pressure across all doorways would be required to be 0.10"-0.35" with the stairwells being positive.

Pending the results of this test, the respective exhaust fans and supply fans may need to be resized or provided with variable frequency drives to adjust their airflows to maintain the required differential pressures.

- This cost would be considered a maintenance cost and not capital expenses, an estimate of cost is not provided.

Additional options that were considered, but not recommended at this time:

It was noted that the atrium smoke control system does not exhaust from the two story section of the corridor going to the MOB building. While this is not required explicitly by the BOCA code, this does create a trap for smoke that could build up in the corridor. This could be addressed by extending an exhaust duct to the corridor, however the existing building layout does not allow for an easy pathway for this duct. This would be an expensive installation and cause significant disruption to the traffic flow through the corridors. We therefore do not recommend this be completed, but instead have the doorways installed to remove this corridor from the atrium space as per Recommendation #3.

CONCLUSIONS

Per the original construction drawings, the building was provided smoke control systems serving the main atrium and the four egress stairwells. These systems would have been required to meet the 1981 BOCA code. The main atrium exhaust systems and stairwell pressurization systems do not meet three critical requirements and one recommendation of the BOCA code and should be addressed as soon as possible as noted in Recommendations #1, #2, #3 and #4:

1. The basement control panel which controls SF-2 and SF-3 is not on standby power
2. The lobby doors no longer automatically open to allow supply air when the exhaust fan runs as originally designed and recommended in Section 631.2.1.1.
3. The existing smoke detector layout does not cover the hallway and two story area extending from the atrium to the MOB building as required per 1981 BOCA 631.2.1.3. This hallway should be separated from the atrium by providing new doorways where the hallways starts at the atrium.
4. The smoke control systems do not have a manual override for the smoke controls systems for the fire departments use as required in 1981 BOCA Section 631.2.1.4.
 - Our estimate of the probable cost for these items is \$40,000 if done during normal hours or \$59,500 if done during overtime hours.

The existing smoke control equipment is original to the building and is now past its expected useful lifetime. As such, we recommend the fans and motorized dampers be replaced as noted in Recommendations #5 and #6. Our estimate of the probable cost for both of these items is \$200,000 if done during normal hours or \$250,000 if done during overtime hours.

In total, if all equipment upgrade recommendations are incorporated (Recommendation #1-#6), our total estimate of probable cost is \$240,000 if done during normal hours or \$309,500 if done during overtime hours.

The system should also be tested for operation on a quarterly and semi-annual basis as noted above in Recommendation #7. Additional pressurization testing for the atrium as noted in Recommendation #8 may also be done if desired. As these are maintenance costs and not capital expenses, an estimate of cost is not provided.

Appendix A – 1981 BOCA National Building Code Excerpt – Section 631.0 Open Wells

631.1 General: Open wells are to be classified as either atriums (Section 631.2) or floor openings (Section 631 .3) and shall be permitted in all buildings in other than Use Group H when provided with the protection herein required.

631.1.1 Fire suppression: An approved electrically supervised automatic fire suppression system shall be installed throughout all floor areas connected by the open well in accordance with the provisions of Article 17, except those floor areas separated from the open well by fire separation assemblies conforming to Table 401.

631.1.2 Use: The floor of the open well shall not be used for other than low fire hazard uses and only approved materials and decorations may be used in the open well space.

Exception: The open well floor area may be used for any approved use when the individual space is provided with an automatic fire suppression system.

631.1.3 Exits: An open well connecting not more than three floor levels may contain an exit as permitted by Section 816.10.

631.1.4 Emergency power: All equipment required to provide smoke control shall be provided with an emergency source of power in compliance with Article 700 of NFPA 70 listed in Appendix A.

631.1.5 Acceptance of the smoke control system: Before the certificate of occupancy is issued, the smoke control system shall be tested in an approved manner to show compliance with the requirements of this section.

631.1.6 Inspections of the smoke control systems: All operating parts of the smoke control system (including dampers) shall be tested by the owner every three months and a log of the tests shall be kept for examination by the fire department. At six month intervals the system shall be inspected and operated in accordance with the fire prevention code listed in Appendix A.

631.2 Atriums: Atriums shall be constructed as herein required except atriums in buildings two stories in height shall not be required to be equipped with a smoke control system as indicated in Section 631.2.1. For purposes of this section, the volume of the atrium shall include all spaces not separated from the atrium in accordance with Section 631.2.2.

631.2.1 Smoke control: A smoke control system shall be designed to control the migration of products of combustion in the atrium spaces. Upon detection of a fire or smoke, the system shall shutdown the air supply to the fire floor and the return air from all non-fire floors.

631.2.1.1 Atriums 55 feet or less in height: In atriums 55 feet (16764 mm) or less in height with a volume of 600,000 cubic feet (16800 m³) or less, a smoke exhaust system shall be located at the ceiling of the atrium. Such system shall exhaust 40,000 cfm (18.88 m³ / s) or six air changes per hour, whichever is greater. When the volume of the atrium exceeds 600,000 cubic feet (16,800 m³), the exhaust system shall be sized to provide a minimum of four air changes per hour.

Supply air inlets may be provided at the lowest level of the atrium. These inlets shall be sized for 75 percent of the exhaust.

631.2.1.2 Atriums in excess of 55 feet in height: When the height of the atrium exceeds 55 feet (16764 mm) an exhaust system shall be provided as required by Section 631.2.1.1. However, supply air shall be introduced mechanically from the floor of the atrium and shall be directed vertically at the exhaust outlet above. The capacity of the supply shall be 75 percent of the exhaust.

631.2.1.3 Smoke detectors: Smoke detectors shall be provided at the ceiling of the atrium and on the underside of each floor area projecting into the atrium space. Detectors shall be located in accordance with their listing.

631.2.1.4 Smoke control activation: The smoke control system required for the atrium spaces shall be activated by the fire suppression system, by smoke detectors required by Section 631.2.1.3 and by manual controls provided for the fire department use. The system shall not be activated by a manual fire alarm system required by Section 1717.0. Manual controls shall be located in the central control station or other location approved by the fire department.

631.2.1.5 Other approved methods: Any other approved design which will achieve the same level of smoke control as described in this section may be used in lieu of these requirements.

631.2.2 Enclosure of atriums: Atrium spaces shall be separated from adjacent spaces by a one hour fire separation wall. A glass wall forming a smoke partition may be used in lieu of the required fire separation wall where automatic sprinklers are spaced 6 feet (1829 mm) or less along both sides of the separation wall, or on the room side only if there is not a walkway on the atrium side, and not more than 1 foot (305 mm) away from the glass and so designed that the entire surface of the glass will be wet upon activation of the sprinkler system.

Exception: The adjacent spaces of any three floors of the atrium shall not be required to be separated from the atrium; however, these spaces shall be included in the atrium volume according to Section 631.2.

631.2.3 Voice alarm: In Use Groups R-1, R-2 and I, a voice alarm system complying with the requirements of Section 629.5.1 shall be required on the floors communicating with the atrium.

The alarm shall be initiated by either the fire suppression system or the activation of two or more smoke detectors in the atrium.

631.2.4 Travel distance: In other than the lowest level of the atrium, when the required means of egress is through the atrium space, the exit access travel distance shall not exceed 150 feet (45720 mm).

631.3 Floor openings: Floor openings for unenclosed supplemental stairways, or escalators conforming to Section 2118.3 shall be permitted when protected on every floor pierced by the opening with an approved automatic exhaust system or by other approved smoke control method as herein required to prevent the passage of products of combustion to the story above.

Exception: Supplemental stairways conforming to Section 816.8.

631.3.1 Smoke control: The approved automatic exhaust system may be a separate unit or integrated with an approved air handling system and shall be thermostatically controlled to operate simultaneously with the detection of fire.

631.3.1.1 Capacity of exhaust system: The exhaust system shall be of adequate capacity to create a controlled draft in the floor opening with sufficient velocity of flow over the entire area of the floor opening under normal conditions of window and door openings in the building.

631.3.1.2 Operation of mechanical system: The exhaust system herein required shall be so arranged as to automatically stop the operation of the normal mechanical air handling and ventilating systems, and close the dampers of the return air duct connections, in the event of fire.

631.3.2 Draftstop: An approved draftstop shall be installed at each story of the floor opening. The draftstop shall enclose the perimeter of the opening and shall extend from the ceiling downward at least 18 inches (457 mm) on all sides. Automatic sprinklers shall be provided around the perimeter of the opening and within 2 feet (610 mm) of the draftstop. The distance between the sprinklers shall not exceed 6 feet (1829 mm) center to center.

Appendix B – 1981 BOCA National Building Code Excerpt – Section 818.0 Smokeproof Enclosures

818.1 General: A smokeproof enclosure shall consist of an interior exit stairway conforming to Section 816.0, enclosed from the highest point to the lowest point, and meeting the requirements of this section. When access is required to the roof by Section 817.0, such access shall be from the smokeproof enclosure where such is required.

818.2 Where required: At least one of the required exits shall be a smokeproof enclosure in buildings having floors used for human occupancy located more than 75 feet (22860 mm) above the lowest level of fire department vehicle access.

Exception: Buildings of Use Groups B, R-1 and R-2 complying with the area of refuge (compartmentation) option of Section 629.0.

818.2.1 Fire suppression system alternative: When the building is provided with an automatic fire suppression system throughout, the smokeproof enclosure may be eliminated provided all interior exit stairways are pressurized to 0.15 inches of water column (37.33 Pa) as described in Section 818.7.3.

818.3 Access: Access to the smokeproof enclosure shall be from every story and shall be by way of a vestibule or by way of an open exterior balcony.

818.4 Outlet: The smokeproof enclosure shall discharge onto a street, yard or open court with direct access to a public way, or into a grade passageway leading to a public way. The grade passageway shall be without other openings and shall be separated from the remainder of the building by two hour fire resistance rated construction.

818.5 Construction: The walls of the smoke proof enclosure and the vestibule shall provide a two hour fire resistance rating without openings other than the required doorways. The open exterior balcony shall be constructed in accordance with the fire resistance rating requirements for floor construction.

818.6 Smokeproof enclosure by natural ventilation: The provisions of Sections 818.6.1 through 818.6.4 shall apply to ventilation of smokeproof enclosures by natural means.

818.6.1 Balcony doors: Where access to the smoke proof enclosure is by way of an open exterior balcony, the door assembly into the enclosure shall have a one and one half hour fire resistance rating; and shall be maintained self closing, or shall be automatic closing by actuation of a smoke detector.

818.6.2 Vestibule doors: Where access to the smokeproof enclosure is by way of a vestibule, the door assembly into the vestibule shall have a one and one half hour fire resistance rating and the door assembly from the vestibule to the stairs shall have not less than a 20 minute fire resistance rating. Doors shall be maintained self closing or shall be automatic closing by actuation of a smoke detector.

818.6.3 Vestibule ventilation: Each vestibule shall have a minimum net area of 16 square feet (1.49 m²) of opening in a wall facing an outer court, yard, or public way at least 20 feet (6096 mm) in width.

818.6.4 Vestibule size: The minimum dimension of the vestibule shall be not less than the required width of the corridor leading to it.

818.7 Smokeproof enclosure by mechanical ventilation: The provisions of Sections 818.7.1 through 818.7.8 shall apply to ventilation of smokeproof enclosures by mechanical means.

818.7.1 Vestibule doors: The door assembly from the building into the vestibule shall have a one and one half hour fire resistance rating and the door assembly from the vestibule to the stairway shall have not less than a 20 minute fire resistance rating. The door to the stairway shall be provided with a drop sill or other provisions to minimize air leakage. The doors shall be self closing or automatic closing by smoke detection or in the event of a power failure.

818.7.2 Vestibule size: The vestibule shall have a minimum width of 44 inches (1118 mm) and a minimum length of 72 inches (1829 mm) in the direction of exit travel.

818.7.3 Vestibule ventilation: The vestibule shall be supplied with not less than one air change per minute, and exhausted at a rate sufficient to maintain an underpressure relative to the atmosphere of 0.05 inch of water column (12.44 Pa), and of 0.10 inch of water column (24.88 Pa) relative to the stair shaft. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose.

Supply air shall enter the vestibule within 6 inches (152 mm) of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but not more than 7 inches (152 mm) down from the top of the trap and shall be entirely within the smoke trap area. Doors, when in the open position, shall not obstruct duct openings. Duct openings may be provided with controlling dampers, if needed, to meet the design requirements, but such are not otherwise required.

818.7.3.1 Engineered ventilation system: A specially engineered system may be used. Such an engineered system shall provide 250 cubic feet per minute (18 m³/s) exhaust from a vestibule when in emergency operation and shall be sized to handle three vestibules simultaneously. The smoke detectors located outside each vestibule shall, upon release, open the supply and exhaust duct dampers in that affected vestibule.

818.7.4 Smoke trap: The vestibule ceiling shall be at least 20 inches (508 mm) higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward moving air column. The height may be decreased when justified by design and test.

818.7.5 Stair shaft air movement system: The stair shaft shall be provided with a dampered relief opening at the top and supplied with sufficient air to discharge a minimum of 2500 cubic feet per minute (1.18 m³/s) through the relief opening while maintaining a minimum positive pressure of 0.05 inch of water column (12.44 Pa) in the shaft relative to atmosphere with all doors closed .

818.7.6 Ventilating equipment: The activation of ventilating equipment shall be by a smoke detector installed outside the vestibule door in an approved location. When the closing device for the stair shaft and vestibule doors is, activated by smoke detection or power failure, the mechanical equipment shall operate at the levels specified in Sections 818.7.3 and 818.7.5.

18.7.7 Standby power: Mechanical vestibule and stair shaft ventilation systems and detector systems shall be powered by an approved self contained generator designed to operate whenever there is a loss of normal current. The generator if inside a building shall be located in a separate room of two hour fire resistance rated construction and shall have a minimum fuel supply to operate the equipment for two hours.

818.7.8 Acceptance and testing: Before the mechanical equipment is approved by the building official, it shall be tested in the building official's presence to confirm that the mechanical equipment is operating in compliance with these requirements.

NJDOT HQ – Ewing
E&O Smoke Control Evaluation

Appendix C – Fisher Balancing Company - Stair Tower Pressure Testing – March 23, 2019

***CERTIFIED TEST, ADJUST AND
BALANCE REPORT***

DATE : **March 23, 2019**

PROJECT : **State of New Jersey
Department of Transportation
Engineering and Operations Building
Stair Tower Pressure Testing**

ADDRESS : **1035 Parkway Avenue
Ewing, NJ**

ARCHITECT : **N/A**

ENGINEER : **N/A**

CONTRACTOR : **JCI/Tyco**



Certification Number 2911

1799 Glassboro – Cross Keys Road, Williamstown, New Jersey 08094

Phone: 856-740-9134

Fax: 856-740-9137

PROJECT NO.:

EXHIBIT 'C'



1799 Glassboro – Cross Keys Road, Williamstown, New Jersey 08094
Phone 856-740-9134 Fax 856-740-9137
E-Mail: fisherbalancing@comcast.net

Project Summary

PROJECT: State of NJ DOT: E & O Building Stair Tower Pressure Testing
DATE: March 23, 2019

All isolated zones involved in Fire/Smoke pressurization alarm sequence were tested. Due to uncertainty of current and/or future alarm sequencing, all systems were tested while AHUs were operating in both “Occupied” and “Unoccupied” modes.

Current pressurization standards require a pressurization range of +0.15” wg to +0.30” wg. None of the stair towers were able to meet the minimum pressure standard; however, all systems did energize and were able to develop intended pressurization, be it positive or negative.

While equipment was operating, total CFM and Total Static Pressure (TSP) of the fans was able to be measured. However due to location, age and condition of local fan electrical disconnects the decision was made not to attempt electrical readings.



Fisher Balancing Company
1799 Glassboro Cross Keys Road
Williamstown, New Jersey 08094
Phone: 856-740-9134
Fax: 856-740-9137

Table of Contents

PROJECT: State of NJ DOT: E & O Building Stair Tower Pressure Testing

DATE: March 23, 2019

Performed BY: Chris Weixler

Page Title

Project Summary

Page Number

1

EXHIBIT 'C'

COMMON ABBREVIATIONS

AC	Air Changes	FPS	Feet Per Second	RAT	Return Air Temperature
ACH	Air Changes Per Hour	FT	Foot, Feet	RCI	Return Ceiling Inlet
AHU	Air Handler Unit	FV	Face Velocity	RD	Round
AMB	Ambient	GA	Gauge	R/E	Return and Exhaust
AMP	Ampere	GAL	Gallons	RECOV	Recovery
ATM	Atmosphere	GPM	Gallons Per Minute	REF	Reference
AUTO	Automatic	GPS	Gallons Per Second	REQ / REQI	Required
AVG	Average	GRD's	Grilles, Registers, Diffusers	REQ NPSH	Required Net Positive Suction Head
AVG VEL	Average Velocity	HD	Head	REV	Revision
BAS	Building Automation System	HG	Inches Mercury	RG	Return Grille
BHP	Brake Horsepower	HMD	Humidity	RH	Relative Humidity
BP	Back Pressure	HP	Horsepower	RM	Room
C TO C	Center to Center	HW	Hot Water	RPM	Revolutions Per Minute
CAP	Capacity	HWH	Hot Water Heater	RR	Return Register
CD	Ceiling Diffuser	HWR	Hot Water Return, Hot Water Riser	RTN	Return
CFH	Cubic Feet Per Hour	HWS	Hot Water Supply	RTU	Roof Top Unit
CFH	Chemical Fume Hood	HZ	Hertz	RV	Relief Valve
CFLA	Corrected Full Load Amperage	IN	Inch	SAT	Supply Air Temperature
CFM	Cubic Feet Per Minute	IN HG	Inches of Mercury	SCH	Schedule
CL	Center Line	INWG	Inches Water Gauge	SCO	Supply Ceiling Outlet
CORR	Corridor	KW	Kilowatt	SD	Supply Diffuser
CS	Condenser Supply	LAT	Leaving Air Temperature	SENS	Sensible
CTR	Center	LB	Pound	SF	Service Factor
CU	Cubic	LD	Linear Diffuser	SG	Supply Grille
CU FT	Cubic Feet	LP	Low Pressure	SHT	Sheet
CU IN	Cubic Inches	LVG	Leaving	SP	Static Pressure
CV	Flow Coefficient	LWT	Leaving Water Temperature	SPEC	Specification
CW	Cold Water	MAT	Mixed Air Temperature	SQ	Square
DB	Dry Bulb	MAX	Maximum	SQ FT	Square Feet
DBT	Dry Bulb Temperature	MBH	Thousand British Thermal Units Per Hour	SR	Supply Register
DDC	Direct Digital Control	MER	Mechanical Electrical Room	SSH	Static Suction Head
DEG	Degree	MFR	Manufacturer	STD	Standard
DELTAT	Temperature Difference	MIN	Minimum	STH	Static Total Head
DIA	Diameter	MU	Make Up	SUCT	Suction
DIFF	Differential	MUA	Make Up Air	SPLY	Supply Air Temperature
DISC	Disconnect	N/A	Not Available	SWR	Side Wall Register
DP	Dew Point Temperature	NC	Normally Closed	TD	Temperature Difference
DSCH	Discharge	NEG	Negative	TDH	Total Dynamic Head
DWG	Drawing	NI	Not Installed	TEMP	Temperature
EA	Exhaust Air Each	NO	Normally Open	TH	Thermometer
EAT	Entering Air Temperature	NPSH	Net Positive Suction Head	TP	Total Pressure
ECI	Exhaust Ceiling Inlet	NS	Not Specified	TSP	Total Static Pressure
ECON	Economizer	OA	Outside Air	UF	Under Floor
EFF	Efficiency	OAT	Outside Air Temperature	UH	Unit Heater
EG	Exhaust Grille	OBD	Opposed Blade Damper	V	Vent, Volt, Volume
ELEC	Electrical	OED	Open Ended Duct	VAV	Variable Air Volume
ENT	Entering	OUT DIA	Outside Diameter	VEL	Velocity
ERU	Energy Recovery Unit	OD	Outside Diameter	VERT	Vertical
ESP	External Static Pressure	PD	Pressure Drop	VFD	Variable Frequency Drive
EVAP	Evaporator	PD	Pitch Diameter	VOL	Volume
EWT	Entering Water Temperature	PF	Power Factor	VSD	Variable Speed Drive
EXH	Exhaust Air Each	PRELIM	Preliminary	SP	Velocity Pressure
EXST	Existing	PG	Pressure Gauge	WB	Wet Bulb
° F	Degree Fahrenheit	PRESS	Pressure	WC	Inches of Water Column
F	Fahrenheit	PROP	Propeller	WG	Water Gauge
FCONN	Flexible Connection	PRV	Pressure Reducing Valve	WMS	Wire Mesh Screen
FC	Flow Coefficient	PSI	Pounds Per Square Inch		
FD	Floor Drain	PSIA	Pounds Per Square Inch Absolute		
FLA	Full Load Amps	PSIG	Pounds Per Square Inch Gauge		
FM	Flow Meter	QTY	Quantity		
FPM	Feet Per Minute	RA	Return Air		

EXHIBIT 'C'

FAN TEST REPORT

Fisher Balancing Company
 1799 Glassboro Cross Keys Road
 Williamstown, New Jersey 08094
 Phone: 856-740-9134
 Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

FAN DATA:	FAN NO: SF-1	
LOCATION	Roof	
SERVICE	North Stair Pressurization	
MANUFACTURER	N/A	
MODEL NUMBER	N/A	
SERIAL NUMBER	N/A	
TYPE / CLASS	Utility / 1	
MOTOR MAKE / STYLE	Dayton / Open	
MOTOR H.P. (Horsepower) / RPM (Revolutions Per Minute) / FRAME	1.0 / 1725	
VOLTS / PHASE / HERTZ	460 / 3 / 60	
FULL LOAD AMPS / SERVICE FACTOR	1.7 / 1.25	
MOTOR SHEAVE MAKE / MODEL	N/A	
MOTOR SHEAVE DIAMETER / BORE / OPERATING DIAMETER	3 1/2" / 5/8" / Max	
FAN SHEAVE MAKE	N/A	
FAN SHEAVE DIAMETER / BORE	N/A	
NUMBER OF BELTS / SIZE	1 / AX44	
SHEAVE CENTERLINE DISTANCE	N/A	
TEST DATA	DESIGN	ACTUAL
CFM (Cubic Feet Per Minute)	3,700	3,428
FAN RPM (Revolutions Per Minute)	N/A	N/A
S.P. (Static Pressure) IN / S.P. (Static Pressure) OUT	N/A / N/A	Atmosphere / N/A
TOTAL S.P. (Static Pressure)	N/A	N/A
VOLTAGE T1-T2 T2-T3	460	N/A
AMPERAGE T1 T2 T3	1.7	N/A
MOTOR RPM (Revolutions Per Minute)	1,725	1,721
MOTOR BHP (Brake Horsepower)	1.0	N/A

SUMMARY:

1) Total CFM measured at 36" x 24" outlet; Ak=5.1 sqft / 5.1 sqft x 672 fpm = 3428 cfm

2) No fan manufacturer information available on fan.

3) Operating electrical information not accessible.

N / A: Not Available / Not Known.

Readings Taken By: CW

EXHIBIT 'C'

**STAIR TOWER
PRESSURIZATION TEST**

FISHER BALANCING COMPANY
1799 Glassboro Cross Keys Road
Williamstown, New Jersey 08094
Phone: 856-740-9134
Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

SF-1 (North Stair)		
FLOOR	PRESSURE (AHU UNOCCUPIED)	PRESSURE (AHU OCCUPIED)
7	+0.090"	+0.075"
6	+0.086"	+0.074"
5	+0.075"	+0.076"
4	+0.101"	+0.070"
3	+0.097"	+0.072"
2	+0.086"	+0.094"
1	+0.101"	+0.104"
Street	+0.050"	+0.075"

SUMMARY:

Readings Taken By: CW

EXHIBIT 'C'

FAN TEST REPORT

Fisher Balancing Company
 1799 Glassboro Cross Keys Road
 Williamstown, New Jersey 08094
 Phone: 856-740-9134
 Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

FAN DATA:	FAN NO: SF-2	
LOCATION	Mechanical Room 1N	
SERVICE	Elevator Stair Pressurization	
MANUFACTURER	ILG Industries	
MODEL NUMBER	SOLB-2450	
SERIAL NUMBER	SOLB-024IA	
TYPE / CLASS	Cent. / 1	
MOTOR MAKE / STYLE	Westinghouse / Open	
MOTOR H.P. (Horsepower) / RPM (Revolutions Per Minute) / FRAME	1/2 / 1725 / 145T	
VOLTS / PHASE / HERTZ	460 / 3 / 60	
FULL LOAD AMPS / SERVICE FACTOR	3.0 / 1.15	
MOTOR SHEAVE MAKE / MODEL	N/A	
MOTOR SHEAVE DIAMETER / BORE / OPERATING DIAMETER	3 1/2" / 1" / Max	
FAN SHEAVE MAKE	N/A	
FAN SHEAVE DIAMETER / BORE	N/A	
NUMBER OF BELTS / SIZE	1 / AX66	
SHEAVE CENTERLINE DISTANCE	N/A	
TEST DATA	DESIGN	ACTUAL
CFM (Cubic Feet Per Minute)	4,000	3,213
FAN RPM (Revolutions Per Minute)	N/A	N/A
S.P. (Static Pressure) IN / S.P. (Static Pressure) OUT	N / A / N / A	-0.55" / +0.47"
TOTAL S.P. (Static Pressure)	N/A	1.02"
VOLTAGE T1-T2 T2-T3	460	N/A
AMPERAGE T1 T2 T3	3.0	N/A
MOTOR RPM (Revolutions Per Minute)	1,725	1,724
MOTOR BHP (Brake Horsepower)	0.50	N/A

SUMMARY:

1) Total CFM measured at 36" x 24" outlet; Ak=5.1 sqft / 5.1 sqft x 630 fpm = 3213 cfm

2) Fan sheave information not accessible.

3) Operating electrical information not accessible.

N / A: Not Available / Not Known.

Readings Taken By: CW

EXHIBIT 'C'

**STAIR TOWER PRESSURIZATION
TEST**

Fisher Balancing Company
1799 Glassboro Cross Keys Road
Williamstown, New Jersey 08094
Phone: 856-740-9134
Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

SF-2 (Elevator Stair)	
FLOOR	PRESSURE
Penthouse Stair	-1.01"
7	+0.077"
6	+0.075"
5	+0.073"
4	+0.074"
3	+0.081"
2	+0.078"
1	+0.094"

REMARKS:

READINGS TAKEN BY: _____

EXHIBIT 'C'

FAN TEST REPORT

Fisher Balancing Company
 1799 Glassboro Cross Keys Road
 Williamstown, New Jersey 08094
 Phone: 856-740-9134
 Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

FAN DATA:	FAN NO: SF-3	
LOCATION	Mechanical Room 2S	
SERVICE	South Stair Pressurization	
MANUFACTURER	ILG Industries	
MODEL NUMBER	SOLB-2450	
SERIAL NUMBER	SOLB-024IA	
TYPE / CLASS	Cent. / 1	
MOTOR MAKE / STYLE	Westinghouse / Open	
MOTOR H.P. (Horsepower) / RPM (Revolutions Per Minute) / FRAME	1.0 / 1725 / 145T	
VOLTS / PHASE / HERTZ	460 / 3 / 60	
FULL LOAD AMPS / SERVICE FACTOR	1.8 / 1.15	
MOTOR SHEAVE MAKE / MODEL	N/A	
MOTOR SHEAVE DIAMETER / BORE / OPERATING DIAMETER	3 1/2" / 1" / Max	
FAN SHEAVE MAKE	N/A	
FAN SHEAVE DIAMETER / BORE	N/A	
NUMBER OF BELTS / SIZE	1 / AX66	
SHEAVE CENTERLINE DISTANCE	N/A	
TEST DATA	DESIGN	ACTUAL
CFM (Cubic Feet Per Minute)	3,700	3,555
FAN RPM (Revolutions Per Minute)	N/A	N/A
S.P. (Static Pressure) IN / S.P. (Static Pressure) OUT	N/A / N/A	-0.32" / +0.56"
TOTAL S.P. (Static Pressure)	N/A	0.88"
VOLTAGE T1-T2 T2-T3	460	N/A
AMPERAGE T1 T2 T3	1.8	N/A
MOTOR RPM (Revolutions Per Minute)	1,725	1,720
MOTOR BHP (Brake Horsepower)	1.0	N/A

SUMMARY:

1) Total CFM measured at 36" x 24" outlet; Ak=5.1 sqft / 5.1 sqft x 697 fpm = 3555 cfm

2) Fan sheave information not accessible.

3) Operating electrical information not accessible.

N / A: Not Available / Not Known.

Readings Taken By: CW

EXHIBIT 'C'

**STAIR TOWER
PRESSURIZATION TEST**

FISHER BALANCING COMPANY
1799 Glassboro Cross Keys Road
Williamstown, New Jersey 08094
Phone: 856-740-9134
Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

SF-3 (South Stair)		
FLOOR	PRESSURE (AHU UNOCCUPIED)	PRESSURE (AHU OCCUPIED)
7	+0.073"	+0.075"
6	+0.071"	+0.056"
5	++0.068"	+0.049"
4	+0.082"	+0.041"
3	+0.088"	+0.049"
2	+0.117"	+0.133
1	+0.013"	+0.029"
Street	+0.090"	+0.088"

SUMMARY:

Readings Taken By: CW

EXHIBIT 'C'

FAN TEST REPORT

Fisher Balancing Company
 1799 Glassboro Cross Keys Road
 Williamstown, New Jersey 08094
 Phone: 856-740-9134
 Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

FAN DATA:	FAN NO: SF-4	
LOCATION	Penthouse Mechanical Room	
SERVICE	Penthouse Stair	
MANUFACTURER	ILG Industries	
MODEL NUMBER	SOLB-2450	
SERIAL NUMBER	SOLB-024IA	
TYPE / CLASS	Cent. / 1	
MOTOR MAKE / STYLE	Westinghouse / Open	
MOTOR H.P. (Horsepower) / RPM (Revolutions Per Minute) / FRAME	3/4 / 1725 / D56	
VOLTS / PHASE / HERTZ	460 / 3 / 60	
FULL LOAD AMPS / SERVICE FACTOR	1.55 / 1.15	
MOTOR SHEAVE MAKE / MODEL	N/A	
MOTOR SHEAVE DIAMETER / BORE / OPERATING DIAMETER	3" / 5/8" / Max	
FAN SHEAVE MAKE	N/A	
FAN SHEAVE DIAMETER / BORE	N/A	
NUMBER OF BELTS / SIZE	1 / AX51	
SHEAVE CENTERLINE DISTANCE	N/A	
TEST DATA	DESIGN	ACTUAL
CFM (Cubic Feet Per Minute)	N/A	1,931
FAN RPM (Revolutions Per Minute)	N/A	N/A
S.P. (Static Pressure) IN / S.P. (Static Pressure) OUT	N/A / N/A	-0.26" / +0.48"
TOTAL S.P. (Static Pressure)	N/A	0.74"
VOLTAGE T1-T2 T2-T3	460	N/A
AMPERAGE T1 T2 T3	1.8	N/A
MOTOR RPM (Revolutions Per Minute)	1,725	1,727
MOTOR BHP (Brake Horsepower)	0.75	N/A

SUMMARY:

- 1) Total CFM measured at 24" x 24" outlet; Ak=3.4 sqft / 3.4 sqft x 568 fpm = 1931 cfm
- 2) Fan sheave information not accessible.
- 3) Operating electrical information not accessible.

N / A: Not Available / Not Known.

Readings Taken By: CW

EXHIBIT 'C'

**STAIR TOWER PRESSURIZATION
TEST**

Fisher Balancing Company
1799 Glassboro Cross Keys Road
Williamstown, New Jersey 08094
Phone: 856-740-9134
Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

SF-4 (Penthouse Stair)	
FLOOR	PRESSURE
Penthouse Mechanical	+1.05"
Elevator Stair	+1.01"

REMARKS:

READINGS TAKEN BY:

FAN TEST REPORT

Fisher Balancing Company
 1799 Glassboro Cross Keys Road
 Williamstown, New Jersey 08094
 Phone: 856-740-9134
 Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

FAN DATA:	FAN NO: EF-P1	
LOCATION	Penthouse Mechanical Room	
SERVICE	Atrium Smoke Exhaust	
MANUFACTURER	Westinghouse	
MODEL NUMBER	PHY-8054-PHY-8944-11	
SERIAL NUMBER	N/A	
TYPE / CLASS	Utility	
MOTOR MAKE / STYLE	Westinghouse / Open	
MOTOR H.P. (Horsepower) / RPM (Revolutions Per Minute) / FRAME	15.0 / 1765 / N/A	
VOLTS / PHASE / HERTZ	460 / 3 / 60	
FULL LOAD AMPS / SERVICE FACTOR	18.6 / 1.15	
MOTOR SHEAVE MAKE / MODEL	Browning	
MOTOR SHEAVE DIAMETER / BORE / OPERATING DIAMETER	5" / 1 5/8" / Fixed	
FAN SHEAVE MAKE	Browning	
FAN SHEAVE DIAMETER / BORE	15" / 2 3/8"	
NUMBER OF BELTS / SIZE	2 / 5VX1800	
SHEAVE CENTERLINE DISTANCE	74"	
TEST DATA	DESIGN	ACTUAL
CFM (Cubic Feet Per Minute)	40,000	37,297
FAN RPM (Revolutions Per Minute)	N/A	603
S.P. (Static Pressure) IN / S.P. (Static Pressure) OUT	N/A / N/A	-0.85" / +1.12"
TOTAL S.P. (Static Pressure)	N/A	1.97"
VOLTAGE T1-T2 T2-T3	460	N/A
AMPERAGE T1 T2 T3	18.6	N/A
MOTOR RPM (Revolutions Per Minute)	1,765	1,771
MOTOR BHP (Brake Horsepower)	15.0	N/A

SUMMARY:

- 1) Total CFM measured at outlets.
- 2) Operating electrical information not accessible.

N / A: Not Available / Not Known.

Readings Taken By: CW

EXHIBIT 'C'

AIR OUTLET and/or INLET TEST REPORT

FISHER BALANCING CO.
 1799 Glassboro-Cross Keys Road
 Williamstown, New Jersey 08094
 Phone: 856-740-9134
 Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

SYSTEM: _____ EF-P1 _____

TEST APPARATUS: _____ Electronic Micromanometer _____

AREA SERVED	OUTLETS and/or INLETS				DESIGN		FINAL		
	NO.	TYPE	SIZE	AK	VELOCITY	CFM (Cubic Feet Per Minute)	VELOCITY	CFM (Cubic Feet Per Minute)	
Duct Discharge	1	WMS	70" x 32"	14.8 sqft	1,351	20,000	1,281	18,959	
Duct Discharge	2	WMS	70" x 32"	14.8 sqft	1,351	20,000	1,239	18,338	
					Total	40,000		37,297	

SUMMARY: _____ AK: Area Known - Expressed in Square Feet

Readings Taken By: CW

EXHIBIT 'C'

**STAIR TOWER
PRESSURIZATION TEST**

FISHER BALANCING COMPANY
1799 Glassboro Cross Keys Road
Williamstown, New Jersey 08094
Phone: 856-740-9134
Fax: 856-740-9137

PROJECT: State of NJ DOT: E&O Building Pressurization Testing

DATE: 3/23/2019

EF-P1 (Lobby Atrium)		
FLOOR	PRESSURE (AHU UNOCCUPIED)	PRESSURE (AHU OCCUPIED)
1st Flr Elev. Lobby	-0.140"	-0.024"
2nd Flr Elev Lobby	-0.012"	-0.020"
North Offices	-0.020"	-0.019"
Food Court	-0.011"	-0.013"
Food Court Kitchen	-0.012"	-0.008"
Connector Tunnel	0.103"	-0.080"
2nd Floor South	-0.010"	-0.011"

SUMMARY:

Readings Taken By: CW

EXHIBIT 'C'