

CHESAPEAKE BAY BRIDGE and TUNNEL DISTRICT

REQUEST FOR QUALIFICATIONS

FOR

General Consulting Engineering Services

“GCES”

PROPOSAL NUMBER: M-25-001

ISSUED: July 11, 2024

**General Consulting Engineering Services
Request for Qualifications
Chesapeake Bay Bridge and Tunnel District**

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1. Introduction

The Chesapeake Bay Bridge and Tunnel District ("District") issues this request for qualifications for General Consulting Engineering Services for the Chesapeake Bay Bridge and Tunnel District. The District is inviting proposals from individual Consulting Engineering Firms or Corporations having a nationwide and favorable reputation for skill and experience to perform duties imposed on the Consulting Engineer (CE). General Description

The Chesapeake Bay Bridge-Tunnel (CBBT) is a 20-mile-long vehicular toll crossing of the lower Chesapeake Bay. The facility carries US 13, the main north-south highway on Virginia's Eastern Shore, and provides the only direct link between Virginia's Eastern Shore and south Hampton Roads, Virginia. The crossing consists of a series of parallel, two lane, low-level trestles and bridges that are connected by two approximately one-mile-long two-lane tunnels beneath Thimble Shoal and Chesapeake navigation channels. The manmade islands, each approximately 5.25 acres in size at the surface, are located at each end of the two tunnels. There are also high-level bridges over two other navigation channels: North Channel Bridge and Fisherman Inlet Bridge. Finally, between North Channel and Fisherman Inlet, the facility crosses at-grade over Fisherman Island, a barrier island that includes the Fisherman Island National Wildlife Refuge administered by the U. S. Fish and Wildlife Service. Toll collection facilities are located at each end of the facility.

2. Scope of Services

The District is required to maintain various inspections, maintenance programs and reporting instruments as further identified below. The various inspections and reports are intended for different uses; however, each has the same basic purpose, to verify the facility is being regularly inspected and maintained in a reasonable manner. The CE will be required to complete the inspections and reports and, to the greatest extent possible, minimize duplication of effort and leverage the various inspection requirements to create efficiencies in the execution of the work.

2.1. Annual Condition Assessment Report

The CE will perform all engineering services specified in the Chesapeake Bay Bridge and Tunnel District's Revenue Bond Resolution and other services as requested by the District and generally outlined as follows.

On or before the 1st day of January, the CE will submit to the Commission a Summary Report setting forth with respect to the Chesapeake Bay Bridge and Tunnel:

- a) Findings whether the Chesapeake Bay Bridge and Tunnel Crossing has been maintained in good repair, working order and condition, incorporating the National Bridge Inspection Standards (NBIS) and National Tunnel Inspection Standards (NTIS) condition assessment ratings from the current Fiscal Year, as well as the condition assessment rating of the non-bridge and non-trestle facility components to comply with Governmental Accounting Standards Board Statement No. 34 and the District's Infrastructure Preservation Policy from the current Fiscal Year.

- b) Recommendations for the proper maintenance, repair and operation of the Chesapeake Bay Bridge and Tunnel during the ensuing Fiscal Year. The CE will be required to provide the Director of Maintenance with a list of recommended repair items that can be used to facilitate planning and execution of repairs, retrofits, and rehabilitations in accordance with the findings of the Annual Condition Assessment Report.
- c) The CE’s recommendations as to the value of the facility, for insurance purposes, to be carried under Section 509 of said Resolution. [Jacobs letter dated February 9, 2024 – Appendix - B]

The bridges and tunnels will be inspected in accordance with current NBIS and NTIS requirements, respectively, including the inspection frequencies stated in NBIS and NTIS. The CE may rely upon the most recent NBIS and NTIS inspection reports to prepare the Annual Condition Assessment Report.

2.2. Modified Approach to Infrastructure Reporting

The Chesapeake Bay Bridge and Tunnel Commission (“Commission”) has adopted the Governmental Accounting Standards Board (GASB) modified approach to infrastructure reporting GASB 34. The Commission’s preservation policy is to maintain 90% of the bridge and tunnel assets at a maintenance rating program (MRP) condition level of “generally good” or better. The MRP Condition Scale used by the District is as follows:

Condition Rating	Definition
9	New Condition
8	Good condition; no repairs needed
7	Generally good condition; potential exists for minor maintenance
6	Fair condition; potential exists for major maintenance
5	Generally fair condition; potential exists for minor rehabilitation
4	Marginal condition; potential exists for major rehabilitation
3	Poor condition; repair or rehabilitation required immediately

2	Critical condition; need for repair or rehabilitation is urgent
1	Critical condition; facility is closed; study feasibility for repair
0	Critical condition; facility is closed and beyond repair

Table 1- Maintenance Rating Program

A copy of the most recent GASB 34 Report is included in the FY2024 Annual Inspection Report. The Annual Inspection Report can be found on the cbbt.com website at: <http://www.cbbt.com/investor-relations/annual-inspection-reports/>

2.3. Bridge Inspections

2.3.1. Bridge Inspections

The District complies with the National Bridge Inspection Standards (NBIS), Federal Highway Administration (FHWA) and Virginia Department of Transportation (VDOT) bridge inspection standards and frequency requirements. The CBBT facilities and inspection cycles are provided in Appendix A. The CE will be required to complete the inspections and reports to meet the requirements for submittal of reports to VDOT and FHWA. The CE will rely upon the most recent NBIS bridge inspection report(s) when completing the annual condition evaluation report described above.

2.3.2. Nonredundant Steel Tension Member Inspections

The consultant shall provide the engineering services required for a fracture critical inspection of the nonredundant steel tension member portions of the approach spans steel girders and of the nonredundant steel truss member of the main span of North Channel Bridge, northbound. Also included will be a routine cursory inspection of other components of the bridge.

This inspection shall be done in accordance with applicable Federal Guidelines as well as in accordance with NBIS and VDOT procedures.

2.3.3. Underwater Inspections

The CE shall provide the services required for Underwater Inspections of Substructure Units in accordance with the 60-month cycles, as required by NBIS and FHWA standards. All Inspections will be performed in accordance with applicable NBIS Guidelines, including Levels I, II, and III Underwater Inspections.

2.3.4. Scour Evaluations

District forces annually perform hydrographic surveys to monitor scour around the facility. The most recent completed surveys will be provided to the CE for use in conducting the Annual Condition Assessment, as well as for routine bridge inspections.

2.4. Tunnel Inspections

The FHWA now requires all roadway tunnels to be inspected on a two-year cycle and in accordance with the Tunnel Operations, Maintenance, Inspection, and Evaluation (TOMIE) Manual. The District will require the CE to complete the tunnel inspections in accordance with the current TOMIE Manual and to produce the reports to meet the submittal requirements of VDOT and FHWA. The existing tunnels will be inspected in alternating years. The CE will rely upon the most recent tunnel inspection report(s) when completing the annual condition evaluation report described above. See Appendix C, Tunnel Description and Inspection Procedures for Thimble Shoal Channel and Chesapeake Channel Tunnels, a Reference Document for NTIS Inspections, for more detailed information.

2.5. Reporting, Submittals and Emergency Response

Any deficiency deemed to be critical shall be reported immediately to the Director of Maintenance, via phone, followed by written correspondence.

The District may request that completed and signed drafts and/or final plans and other materials developed be submitted in both hard copy format and electronic format for reproduction and distribution. When plans or drawings are submitted for review, all submittals must be in formats as specified by the District. It shall be the responsibility of the CE to perform any and all necessary electronic file conversions before the District will accept any portion of the CE's work. Electronic file submissions shall be continuous throughout the project such that the District's files are representative of the current stage of work.

In the event of an emergency due to accident damage, hurricane, or similar, the CE shall be ready to mobilize within one hour of notification. The CE shall notify the Director of Maintenance of any defects found during the inspection immediately upon finding.

The CE shall furnish the District with two (2) copies of final, bound report(s), complete with captioned photographs. Report(s) shall include a description of the Inspection Findings, Inspection Report Forms and Conclusions/Recommendations, as appropriate. A draft report shall be forwarded to the District for review prior to the Final Report production. All hardcopy submittals shall be accompanied with electronic files in both pdf format, as well as the original document preparation format (Word, Excel, AutoCAD, etc.) The District is currently using AutoCAD 2022.

2.6. Safety

The CE shall be responsible for the safety of their employees, contractors and subcontractors and for ensuring compliance with all Federal, State and local laws (OSHA, VOSH, etc.) while working on the facility.

2.7. Maintenance of Traffic (MOT) and Bridge Inspection Vehicles

The District will provide an under bridge inspection vehicle (Snooper) and traffic control in accordance with the Virginia Work Area Protection Manual for above water bridge inspections. The CE will be responsible for any other specialized equipment deemed necessary for special inspections and for all equipment required for underwater bridge inspections. Toll-free passage is provided for all District Business.

2.8. Miscellaneous Services

The CE will provide the District with professional services for unusual or extraordinary maintenance or repair projects when requested by the District and approved as to the terms, costs and conditions. Professional services may include, but are not limited to, the following skill sets:

1. Bridge Design (New and Rehab)
2. Tunnel Design (include MEP, FLS, Structures, etc.)
3. Coastal Engineering (scour analysis, metocean analysis, etc.)
4. Building Rehabilitation and Design (Architectural, MEP, new and rehab)
5. Surveying (Utility location, topographic, hydrographic services)
6. SCADA / ITS
7. Civil and Roadway Design Services

The District may request services that include, but are not limited to, the following:

1. Concept Studies
2. Feasibility Studies
3. Cost Estimates
4. Detailed Design Reports
5. Construction Inspections
6. Environmental Planning and Permitting

The CE must be able to provide immediate services within three (3) days of notification if a project assignment so warrants. No overtime work shall be performed unless directed in writing by the District.

For all tasks, with the exception of an emergency assignment, the CE will respond in writing, with a proposal, within ten (10) working days after receipt of a verbal/written request by the District. This response shall include a proposed work plan, including work scope, staff, schedule, and price proposal.

In all cases, the CE shall be required to certify his work, which must contain the signature and seal of a Professional Engineer who is registered in the State of Virginia and is a permanent employee of the Consulting Engineer.

2.9. Contract Term

This Contract shall be an initial four (4) year term, with an additional four (4) year period upon mutual agreement of both parties.

3. Submittal and Evaluation Criteria

Responses to this Request for Qualifications will be evaluated based on the following:

3.1. Organizational Capability (10 Points)

Provide a description of the firm's, or the team's, organizational capability and the proposed use of sub-consultants. The CE is expected to provide a core team with the appropriate mix of management abilities, technical expertise, and experience. The following information will need to be provided in describing the firm's organizational capabilities.

- Prime Firm
 - Location of Office that will be responsible for the Contract
 - Year the office was opened
 - Number of employees firm-wide
 - Total years in business
 - Number of employees in Virginia
 - Number of employees in the CBBT region
 - Annual Gross Revenue (most recent year available)
 - Revenue attributed to Transportation

- Sub-Consultants (for each firm provide)
 - Years in business
 - Number of employees
 - Number of employees in Virginia
 - Number of employees in the CBBT region
 - Annual Gross Revenue (most recent year available)
 - Revenue attributed to Transportation

3.1.1. SCC Registration

Professional corporations must possess a Commonwealth of Virginia Certificate of Authority from the State Corporation Commission to render professional services. Any business entity other than a professional corporation must be registered in the Commonwealth of Virginia with the Department of Commerce, State Board of Architects, Professional Engineers, Land Surveyors and Certified Landscape Architects. All firms involved that are to provide professional services must meet these criteria prior to a contract being executed by the District.

Proof of this registration shall be submitted with the Statement of Qualification (SOQ), and will not count against the page limitations.

3.2. Firm/Team's Experience Providing Similar Types of Services (10 points)

Describe the firm/team's cumulative experience, technical expertise, and qualifications in providing comparable services to those identified in Section 3.0. Provide a minimum of five (5) and a maximum of ten (10) project examples. At a minimum, provide the following information:

- Project Name
- Project Owner/Client
- Year(s) of the contract
- Description of services provided by the firm
- Contract value
- Point of Contact
- Phone Number for Point of Contact

3.3. Personnel's Experience Providing Similar Type of Services (25 Points)

Give a description of the Key Personnel's expertise, experience, and qualifications in providing services as related to the Scope of Work. Key Personnel are defined as those to whom the project will be assigned and who will be performing the actual services. Emphasis should be focused on boots on ground personnel, not office managers. Provide a matrix, table or list of relevant project examples where the Key Personnel held leadership positions in providing the noted services and describe the member's involvement in the project.

Provide resumes for each Key Personnel and include a list of relevant projects focused on the Key Personnel's experience, as well as project history. Each Key Personnel should have performed leadership roles in at least one major bridge or tunnel project.

Key Personnel should, at a minimum, include the following:

- Bridge Inspector Team Leader
- Tunnel Inspector Team Leader
- Lead Bridge Designer
- Lead Tunnel Designer
- Tunnel Mechanical Designer
- Tunnel Electrical Designer

The CE is also expected to supply any additional positions to its staff for successful program delivery, including any Key Personnel that may not initially be anticipated. At all times, the CE will be required to show the necessary experience, expertise, technical and managerial ability and skill in the areas identified in the Scope of Work and any other areas necessary for successful program delivery.

3.4. Qualifications of Project Manager (25 Points)

Provide a description of the Project Manager's expertise, experience, and qualifications in providing services, as related to the services described in Section 3.0. Provide a matrix, table or list of relevant project examples where the Project Manager held leadership positions in providing the noted services and describe the involvement in the project.

3.5. Contract Scope, Project Understanding and Project Approach (30 Points)

Provide a Scope of Work for the following FY 2026 Facility Annual Inspection and Report, including the following:

- CE's overall lead who will plan, schedule, manage and communicate with the District throughout the multiple components of the inspection cycle.
- NBIS Team Lead
- NTIS Team Lead
 - Electrical Systems Inspector, if different than NTIS Team Lead
- Under Water Inspection (UWI) Team Lead.
- FY2026 Inspection Cycle consists of the following:
 - NBIS (NB Spans are 75'L, SB Spans are 100'L)
 - Hands On:
 - ANB 1-32
 - ASB 1-38
 - BNB 213-266
 - BSB 17-56
 - CNB 264-322
 - CSB 1-52
 - NCB-NB Fracture Critical Inspection
 - Visual Inspection: (Typically performed from underwater inspection vessel in between dive tide cycles)
 - ANB
 - BNB
 - CNB
 - NTIS
 - Thimble Channel Tunnel
 - UWI
 - CNB
 - Additional Facility Components to Support GASB 34 ratings:
 - Approach Roads
 - Fishermans Island Causeway
 - Administration Buildings, Maintenance Structures
 - Portal Islands 1 &2
 - South Toll Plaza, including overhead sign structures
 - North Toll Plaza including overhead sign structures and butterfly sign structure
 - Toll Plaza Infrastructure
 - Site Wide Utilities

- If any of the above roles will be filled with Sub-Consultants, provide the following information for each:
 - Years in Business
 - Number of Employees (in total, in VA and in Hampton Roads area)
 - Annual Gross Revenue
- For personnel filling the roles above, provide cumulative experience, technical expertise and qualifications.

For scheduling purposes, the CE can not start inspection processes that impact traffic until the first full week after the Labor Day Holiday, with the Final Facility Annual Inspection Report due to the District on or before December 31st of the same year.

4. Submittal Requirements

4.1. Pre-Proposal Conference

A **non-mandatory** pre-proposal conference will be held in the District's Commission Conference Room, located at 32386 Lankford Highway, Cape Charles, VA 23310, on July 23, 2024, starting promptly at 10:00 a.m.

4.2. Interpretation of Documents

Any comments or questions concerning this Request for Qualifications shall be directed to the Point of Contact, and be received at least ten (10) days prior to receipt of proposal. Answers will be provided at least five (5) days prior to the submittal date. The District is not responsible for any explanation, clarification or approval made or given in any manner except by addendum. A copy of each addendum will be posted on the CBBT website (www.cbbt.com) and it shall be the responsibility of each offeror to verify that all addendums have been received and incorporated into their respective SOQ. Any addenda so issued are to be considered part of the Request for Proposal.

4.3. Submittal Format and Limitations

Proposals shall be prepared simply and economically, providing a straightforward, concise description of the firm's (or the team's) capabilities to satisfy the requirements of the RFQ. Emphasis should be on completeness and clarity of content. Elaborate brochures and other representations beyond that sufficient to present a complete and effective proposal are neither required nor desired. Under no circumstances shall the proposal exceed a total of seventy (70) pages. FHWA training certification documentation, such as NBIS, NTIS, UWI, FC, etc. will not count towards the 70 pages.

All pages shall be 8 ½" X 11" and printed on one side, with single-spaced type no smaller than 12 pitch. Graphics, organizational charts and similar material may use 11" X 17" sheets folded to 8 ½" X 11".

4.4. Submittal Deadline

All information must be submitted with one (1) digital and five (5) paper copies and received no later than August 23, 2024, at 4:00 pm. Responses received after this time will not be considered.

All questions, correspondence and submittals shall be directed to:

Point of Contact: Michael T. Crist, P. E.
Deputy Executive Director, Infrastructure
Chesapeake Bay Bridge and Tunnel District
32386 Lankford Highway
Cape Charles, Virginia 23310
(757) 331-2960
mcrist@cbbt.com

5. Schedule

Item	Description	Date
1	Issue Request for Qualifications	July 11, 2024
2	Non-Mandatory Pre-proposal Conference	July 23, 2024
3	Submittal of Qualifications	August 23, 2024
4	Notification to Short-Listed Firms	September 6, 2024
5	Short-List Interviews	October 7-11, 2024
6	Recommendation to Commission	November 12, 2024

Table 2 – Schedule

6. Selection and Award of Contract

The District will evaluate SOQs in accordance with the criteria outlined in Section 4.0 and short-list the most qualified firms for interviews. At a minimum, short listed firms will be expected to have the proposed Project Manager present at the interview. The District will provide guidance to the interview requirements at the time of short-list notification. Interviews may be conducted remotely via Web-Ex. Based on the interviews, the District

will select the best firm (or team) to provide the services outlined in the RFQ and will conduct negotiations with that firm for award of a contract.

7. Payment for Services

Services under this contract will be paid for on a cost plus net fee basis. The net fee shall be limited to 10% for each supplemental agreement and shall be determined as follows:

The District strives to operate an efficient and cost effective entity. The CE will be held accountable to provide services under this contract that meet the objectives of the District. These services will be evaluated for each supplemental agreement and the net fee will be adjusted in accordance with the following scale:

Score	Fee
91% - 100%	10%
81% - 90%	9%
71% - 80%	8%
61% - 70%	7%
51% - 60%	6%
<50%	0%

Table 3 - Net Fee Calculation

Scoring criteria and allocation for each category will be developed prior to award of the supplemental agreement. The evaluation categories will be based on:

1. Scoping
2. Quality
3. Competence of Technical Personnel
4. Communication
5. Continuity of Project Personnel
6. Responsiveness
7. Project Management

8. Project Cost Control

8. Insurance Requirements

- a. The CE shall provide the District Certificates of Insurance providing the following:
- i. Certification of insurance for a general liability policy, including products liability on an occurrence basis:

-Combined Single Limit	\$1,000,000
-General Aggregate Limit	\$2,000,000
 - ii. Certification of insurance for a Worker's Compensation Insurance policy, meeting the requirements of the Worker's Compensation Laws of the Commonwealth of Virginia.
 - iii. Errors and Omissions liability policy

-Single Limit	\$5,000,000
- General Aggregate Limit	\$5,000,000
 - iv. Certification of Insurance for an automobile liability policy for vehicles used by the Contractor in connection with the said Contract.

-Combined Single Limit	\$1,000,000
-General Aggregate Limit	\$2,000,000

9. Miscellaneous Provisions**9.1. Non-Discrimination**

During the performance of this Contract, CE agrees as follows:

- a. CE will not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin, except when religion, sex, or national origin in a bona fide occupational qualification reasonably necessary to the normal operation of the CE. The CE agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provision of this non-discrimination clause.
- b. The CE, in all solicitations or advertisements for employees placed by or on behalf of the Firm, will state that such Firm is an equal opportunity employer.
- c. Notices, advertisements, and solicitations placed in accordance with Federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.
- d. The CE shall include the provisions of the foregoing Paragraphs a, b, and c in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each Subcontractor vendor.

9.2. Drug-Free Workplace

The following shall apply for every Contract over \$10,000 in value:

- a. During the performance of this Contract, CE agrees to (i) provide a drug-free workplace for the Firm's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Firm's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of CE that CE maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each Sub-consultant or Vendor.
- b. For the purposes of this section, "*drug-free workplace*" means a site for the performance of work done in connection with a specific Contract awarded to CE in accordance with these General Provisions, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the Contract.

9.3. Employee Identification

All employees that are required to access sensitive areas shall be required to sign a blanket release form provided by the District authorizing the District to conduct an in-depth background investigation on all personnel working on the project. Additionally, a photo ID and a social security card or proper immigration identification, as appropriate, shall be provided by all employees for examination upon request by the District.

9.4. Cost Proposals Not Accepted

The District will not consider for award any cost proposals submitted by any consultants and will not consent to subcontracting any portions of the contract to any sub-consultants in violation of the provisions of the Federal Immigration Reform and Control Act of 1986, which prohibits employment of illegal aliens.

9.5. Accounting Controls to Meet FAR Audit Requirements

All firm's proposals must reference internal accounting systems that meet any applicable Federal requirements, including a transparent overhead calculation and acceptance of any required Federal audit requests.

9.6. Civil Rights Acts Compliance

The District assures compliance with Title VI of the Civil Rights Act of 1964, as amended. The consultant and all sub-consultants selected for this project will be required to submit a Title VI Evaluation Report (EEO-D2) within ten (10) work days of notification of selection when requested by the District. This requirement applies to all consulting firms when the contract amount equals or exceeds \$10,000.

9.7. Discrimination Disclaimer

The District does not discriminate against an offeror because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment.

9.8. Lobbying

All firm's/team's proposals must acknowledge Federal lobbying restrictions in PL 101-121, Section 319, and associated laws and regulations.

9.9. Critical Infrastructure Information/Sensitive Security Information (CII/SSI):

1. Contract documents or project material containing CII/SSI in whole or in part are subject to the terms of this Section and comply with the requirements of CII/SSI Guide. This guide can be located at; <http://www.virginiadot.org/business/const/CII-CriticalStructureInformation.asp>.
2. CE shall be responsible for safeguarding Critical Infrastructure/Sensitive Security Information (CII/SSI) (as defined in the VDOT CII/SSI Policy) in their custody or under their control. Individuals are responsible for safeguarding CII/SSI entrusted to them. The extent of protection afforded CII/SSI shall be sufficient to reasonably foreclose the possibility of its loss or compromise.
3. CE shall ensure that all employees using this information are aware of the prohibition against disclosing CII/SSI in any manner (written, verbal, graphic, electronic, etc.) that permits interception by unauthorized persons.
4. CE shall protect CII/SSI at all times, either by appropriate storage or having it under the personal observation and control of a person authorized to receive it. Each person who works with protected CII/SSI is personally responsible for taking proper precautions to ensure that unauthorized persons do not gain access to it.
5. The use and storage of CII/SSI shall conform to the following guidelines: During working hours, reasonable steps shall be taken to minimize the risks of access to CII/SSI by unauthorized personnel. After working hours, CII/SSI shall be secured in a secure container, such as a locked desk, file cabinet or facility where contract security is provided.
6. The reproduction of CII/SSI documents or material containing CII/SSI shall be kept to the minimum extent necessary consistent with the need to carry out official duties. The reproduced CII/SSI material shall be marked and protected in the same manner as the original material.
7. Material containing CII/SSI shall be disposed of by any method that prevents unauthorized retrieval. (e.g. shredding, burning, returning to original source, etc.)
8. CII/SSI shall be transmitted only by US first class, express (US Postal, FedEx, UPS, etc.), certified or registered mail, or through secure electronic means.

9. The portions of the documents that are marked as CII/SSI are not subject to disclosure under Code of Virginia §2.2-3705.2, and may not be released except with written permission from the District. Unauthorized release or reproduction of these documents may result in civil penalty or other legal action.
10. By copying, downloading, or receiving a copy of any documentation containing CII/SSI, or any part thereof, the CM or any other recipient acknowledges and agrees to the terms of this Section and will advise any individual using these documents, or any part thereof, that they, too, shall be responsible for safeguarding the CII/SSI in their custody or under their control. All costs associated with performing these CII/SSI requirements are the responsibility of the prime CE.
11. In the event of loss, suspected loss or compromise of any District CII/SSI material, the CE having possession of the said CII/SSI material will immediately upon having knowledge of the loss, suspected loss or compromise of any District CII/SSI material, notify the District. If the loss is a result of a theft or suspected theft, of either the actual CII/SSI material or any device containing or storing CII/SSI material, the CE will immediately file a report with a law enforcement agency having jurisdiction and forward a copy of the report to the District.)
12. CE shall include the terms of this Section and comply with the CII/SSI Guide, in any further dissemination of any contract documents or project materials containing CII/SSI in whole or in part, and in all subcontracts awarded under this contract.

Appendix A
Bridge and Pier Facilities Inspection List

Facility Element	Inspection	Bents	Piles	UWI	Notes
A Trestle NB	2020	235	717	2013	Includes A' 1-10
A Trestle SB	2020	203	646	2013	
B Trestle NB	2019	262	805	81	243 ea. three pile bents, 19 four pile bents,
B Trestle SB	2020	201	634	2011	
C Trestle NB	2020	321	983	2015	
C Trestle SB	2020	245	753	2012	
NCB NB	2020	18	845	2011	18 Piers supported on 14 BP 89 Steel Bearing Piles of various numbers. 75.80' Clearance.
NCB SB	2019		220	2014	2 ten-pile piers, 3 thirteen-pile piers, 10 sixteen pile piers, 2 fender systems 187 54" OD Cylinder / 33 14" Square Precast
D Trestle NB	2019	18	54	2011	
D Trestle SB	2019	20	70	2014	
E Trestle NB	2019	10	30	2014	
E Trestle SB	2019	14	40	2011	
FIB NB	2019				2 four-pile piers, 2 six pile piers, 2 fender systems
FIB SB	2019				

F Trestle NB	2019	2	25	2014	
F Trestle SB	2019	5	15	2011	
Thimble Shoal	2020				5,552 feet in length, portal to portal/24 feet horizontal; 13 feet 6 inches
Chesapeake	2020				5,237 feet in length, portal to portal/24 feet horizontal; 13 feet 6 inches
Fishing Pier	2020	2	16	2014	
Little Creek Pier	2020	17	54		17 bents and one abutment

Note: North Bound spans are typically 75'L with 8 girders. South Bound spans are typically 100'L with 6 girders.

Appendix B
Bridge Insurance Limit Estimate



5701 Cleveland Street, Suite 200
Virginia Beach, Virginia 23462
United States
T +1.757.518.9666

www.jacobs.com

February 9, 2024

Attention: Mr. Michael T. Crist, P.E.
Deputy Executive Director, Infrastructure
Chesapeake Bay Bridge and Tunnel District
32386 Lankford Highway
Cape Charles, Virginia 23310

Project Name: General Consulting Engineering Services FY2024
Project Number: E5X80114

Subject: Bridge-Tunnel Insurance Recommendations for FY2024-2025 - FINAL

Dear Mr. Crist,

The replacement cost values for the bridges, trestles, tunnels, man-made portal islands and roadway sections most susceptible to damage have been reviewed and updated for your use and reference relative to the District's Special Risk Property policy. These values, updated to July 2024, are shown in Table 1: Special Risk Property Replacement Costs with \$2,713,511,585 as the total Actual Computed Replacement Cost (ACRC). This includes the Construction Replacement Cost and Engineering for Replacement Cost, both of which are presented in separate columns in the table. The replacement cost values of the buildings and contents for the General Business Coverage Policy have been updated to July 2024 and are shown in Table 2: Statement of Values – Buildings, Contents, and Property in the Open. The Total Blanket Limit for the insurance of buildings, contents, and property in the open was determined to be \$69,448,145. The "Property Damage and Use and Occupancy" value was determined to be \$204,046,866 when combining the maximum probable loss value determined in Section 3 of this letter and the estimated loss of revenue provided in the Steer Certificate of Use and Occupancy Insurance for FY2024-2025 letter.

The assumed 2.78% escalation rate used last year for the current year's replacement cost values was removed, and those cost values were then escalated by the actual escalation value of 2.58% from Engineering News-Record (ENR) Construction Cost Index History to take the cost values from December 2022 through December 2023. To estimate values forward through June 2024, that same 2.58% was carried forward for an additional six months (resulting in an escalation factor of 1.29%, half of aforementioned 2.58%) in keeping with the latest data available.

1. Replacement Costs for Bridge Tunnel Special Risk Property Policy

See Table 1 for Special Risk Property Replacement Costs updated to July 2024, for policy year 2024/2025 (FY2025) with \$2,713,511,585 as the ACRC for all the bridges, tunnels, and exposed



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roadway along the facility. The following sections provide an explanation on the derivation of the Replacement Costs from assessments performed in previous fiscal years.

1.1 Trestles, North Channel Bridge - Northbound (NCB-NB) and Southbound (NCB-SB), Fisherman Inlet Bridges - Northbound (FIB-SB) and Southbound (FIB-SB), and Exposed Roadway

These replacement costs were revisited and were found to be in line with current construction costs. Therefore, the process of escalating the costs from the previous year will be continued to arrive at the updated replacement costs.

1.2 Fishing Pier

The updated replacement cost for the Fishing Pier was determined by comparing the bids for the Parallel Thimble Shoal Tunnel (PTST) Project with the Conceptual Cost Estimate for the PTST Project that was completed in April 2015. The average bid price for the demo of the existing superstructure, rehabilitation of the existing substructure, and the replacement of the superstructure was \$2,576,947. The Jacobs PTST Conceptual Cost Estimate for a new Fishing Pier was \$2,412,000, which included all new superstructure and substructure. The bids carried demolition and replacement of the superstructure and rehabilitation of the substructure. It was decided that the best representative replacement cost was the Jacobs estimate and this cost was then escalated to July 2024 for an estimated replacement cost of \$3,300,985 (excluding engineering), which is shown in Table 1.

1.3 Portal Islands

The PTST Conceptual Cost Estimate had determined that the costs for armor stone and for stone dike material has greatly outpaced routine adjustments for inflation, etc.; therefore, Jacobs took another look at the costs to construct replacement islands. New portal islands would be constructed similar to the way the original islands were constructed. Quantities were calculated based on an island of similar size to what is currently in place.

Escalating the updated component costs determined for FY2023 equates to an updated Replacement Cost for all four of the Portal Islands of approximately \$757,637,334 excluding engineering fees.

1.4 Tunnels

The tunnel costs as presented in all three bids for the PTST Project were reviewed to best determine a basis for the replacement cost of the Thimble Shoal Channel Tunnel (TSCT) and Chesapeake Channel Tunnel (CCT) in FY2025. Escalating the updated component costs determined for FY2025 equates to an updated Replacement Cost of approximately \$616,044,005 for each of the tunnels, excluding engineering fees.



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Table 1: Special Risk Property Replacement Costs

Description	Construction Replacement Cost	Engineering for Replacement ¹	Actual Computed Replacement Cost (ACRC) ^{2,3}
Trestle ANB	\$48,360,074	2%	\$49,327,275
Trestle BNB	\$54,440,769	2%	\$55,529,585
Trestle CNB	\$66,309,023	2%	\$67,635,203
Trestle DNB	\$3,721,574	3%	\$3,833,222
Trestle ENB	\$2,889,318	3%	\$2,975,998
Trestle FNB	\$1,654,316	3%	\$1,703,946
Trestle ASB	\$70,113,440	2%	\$71,515,709
Trestle BSB	\$70,699,716	2%	\$72,113,710
Trestle CSB	\$86,035,916	2%	\$87,756,634
Trestle DSB	\$7,435,502	3%	\$7,658,567
Trestle ESB	\$3,868,143	3%	\$3,984,187
Trestle FSB	\$1,966,572	3%	\$2,025,569
Fishing Pier	\$3,300,985	3%	\$3,400,015
TSCT	\$616,044,005	6%	\$653,006,645
CCT	\$616,044,005	6%	\$653,006,645
NCB-NB	\$82,764,244	2%	\$84,419,529
FIB-SB	\$4,776,870	3%	\$4,920,176
NCB-SB	\$86,809,544	2%	\$88,545,735
FIB-NB	\$6,181,382	3%	\$6,366,823
Portal Islands ⁴	\$757,637,334	2%	\$772,790,080
Exposed Roadway	\$20,584,639	2%	\$20,996,332
TOTAL	\$2,611,637,371	TOTAL	\$2,713,511,585

1. Engineering for Replacement Estimate: Tunnels = 6%, Structures > \$15M = 2%, and Structures < \$15M = 3%.
2. ACRC for Parallel Crossing Project Structures (PCPS) based on Contractor's price; for original trestles, NCB, and FIB based on ratio considering similar PCPS, escalated⁵ to Dec. 2023 plus an additional assumed 1.29% through June 2024.
3. ACRC Tunnels are based on bid prices received for the PTST Project and projected to be acceptable for use as of June 2017 and were escalated⁵ to Dec. 2023 plus an assumed 1.29% through June 2024.
4. Portal Islands cost includes Island Construction, Open Approaches and the Parallel Crossing Portal Island Expansion.

2. Statement of Values – Buildings, Contents, and Property in the Open

The updated replacement cost values of the buildings and contents for the General Business Coverage Policy have also been determined. These values, updated to July 2024, are shown in Table 2 for policy year 2024/2025 (FY2025), with \$69,448,145 as the Total Blanket Limit for the insurance of buildings and contents. Escalation adjustments performed for the replacement costs previously discussed were used on the values that were provided for FY2024 to arrive at the replacement costs as listed in Table 2. The same format from policy year FY2024 is used to distinguish Property In The Open values and Contents from the Building values, presenting this information in separate columns.

Table 2: Statement of Values – Buildings, Contents, and Property in the Open

Item	Description ¹	Buildings ²	Contents	Property in the Open
<i>The following is situated in Northampton County, VA</i>				
<i>Administration Building and Maintenance Complex, West Side U.S. Highway 13:</i>				
1-1	Administration Building, one story, brick & concrete block, including all complex fencing: 17,300 SF	\$3,484,643	\$1,097,100	\$94,824
2-1	Vehicle Maintenance Building, shops, warehouse & office (2 sections) steel & concrete block: 14,800 SF	\$1,929,356	\$762,031	\$187,863
2-2	Water Pump Station	\$49,833	\$137,010	\$0
2-3	Water Storage Tank	\$62,451	\$0	\$0
3-1	Garage & Generator Equipment Building, steel & concrete block: 5,600 SF.	\$516,560	\$288,040	\$5,480
3-2	Salt Storage Building, timber-framed construction, asphalt pad: 3,100 SF	\$257,706	\$0	\$0
3-3	Electrical Storage Building, steel framed construction on concrete pad, with asphalt drive & pad: 5,000 SF	\$253,883	\$0	\$0
3-4	Equipment Storage Building, timber framed construction on stone pad: 2,000 SF	\$86,412	\$0	\$0
<i>The following is situated at the North Toll Plaza Complex, Northampton County, VA:</i>				
4-1	North Toll Plaza office building, brick & concrete block: 3,500 SF	\$671,285	\$433,589	\$17,716
4-2	Toll booths, canopies, steel, and concrete	\$677,913	\$110,500	\$0
5-1	Rest Stop - East parking area, steel, brick & concrete block: 2,500 SF	\$1,214,355	\$2,931	\$119,549



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Item	Description ¹	Buildings ²	Contents	Property in the Open
<i>The following is situated at the South Toll Plaza Complex, Virginia Beach, VA:</i>				
6-1	South Toll Plaza office building, brick & concrete block with all complex fencing; 3,500 SF	\$671,285	\$433,589	\$17,716
6-2	South Plaza Toll booths, canopies, steel, and concrete	\$677,913	\$110,500	\$0
6-3	Storage Garage, metal and concrete block with underground fuel tanks and pumps; 1,800 SF	\$203,030	\$51,235	\$76,726
<i>The following are located on the Bay Bridge and Tunnel Complex's Islands:</i>				
7-1	Ventilation Building, Island No. 1 wind resistive construction: 27,800 SF	\$7,646,051	\$5,122,900	\$0
8-1	Ventilation Building, Island No. 2 wind resistive construction: 27,200 SF	\$7,481,384	\$5,086,321	\$8,412
9-1	Ventilation Building, Island No. 3 wind resistive construction: 27,200 SF	\$7,646,051	\$5,122,900	\$8,412
10-1	Ventilation Building, Island No. 4 wind resistive construction: 27,200 SF	\$7,646,051	\$5,122,900	\$8,412
<i>"The following are located on the property in Little Creek Harbor:"</i>				
11-1	Warehouse, ICM; 28,600 SF	\$2,740,455	\$0	\$287,785
11-2	Office, CB Masonry; 8,300 SF	\$817,089	\$0	\$0
STATED VALUES LESS EXCLUSION		\$44,733,706	\$23,881,546	\$832,893
TOTAL BLANKET LIMIT		\$69,448,145		

1. All square footages (SF) are approximate.
2. The stated values listed have a 5% exclusion.

3. Maximum Probable Loss

The Maximum Probable Loss Computations have been updated using the same basic escalation methodology as used to determine the replacement cost values. As mentioned above, the costs for armor stone and for stone dike material has outpaced inflation. Therefore, the unit costs for these in the Maximum Probable Loss Computations have been updated and similar adjustments have been made for the unit cost for island surface repairs. The cost of the fender system replacement on NCB-NB from the 2013 RMF Project has been incorporated and that cost has been escalated since that time.



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The method of selecting the higher of two possible scenarios to determine a maximum probable loss as detailed in Jacobs letters to Bill Barnard dated February 25, 2004 and March 10, 2004, has continued to be used. The two scenarios are as follows:

1. Damage to two portal islands and various trestle spans from a catastrophic storm that exceeds the 100-year design storm event. This storm event is one of such magnitude that it would be highly improbable to find a ship at sea of a size sufficient to cause significant damage to either NCB-NB or NCB-SB.
2. A "lesser" storm, approaching the 100-year design event, causing an uncontrolled ship to collide with and cause damage to NCB-NB and NCB-SB. It is assumed that this "lesser" storm event will cause damage to two portal islands, but at approximately 1/3 of the magnitude of that presented in Scenario 1. No damage is assumed to the bridges and trestles due directly to the effects of this "lesser" storm, as it is a storm of magnitude not exceeding the 100-year design event for which the Parallel Crossing bridges and trestles were designed. This scenario could also include ship traffic of size sufficient to damage either or both NCB-NB and NCB-SB during a collision.

It is Jacobs' opinion that both scenarios represent probable loss occurrences, with the Scenario 2 presenting the governing Maximum Probable Loss.

The Maximum Probable Loss is estimated to be approximately \$78,495,000 for only the property damage portion of the Property Damage and Use and Occupancy Insurance. This loss figure is theoretical at best, and in no way can ensure that a catastrophe would not result in losses greater than those assumed herein.

For Scenario 2, which is the basis of the Maximum Probable Loss estimation, it would be quicker to replace the main piers and the main plate girder spans of NCB-SB, rather than the main pier, the truss span and a portion of the approach spans for NCB-NB. Considering delivery of the replacement plate girders is on the critical path and the replacement plate girders could be fabricated utilizing the existing shop drawings, NCB-SB materials could be ordered on the first day after assessing the damage. Reconstruction of NCB-NB would require additional lead time to design new piers and new superstructure units to fit within the existing clearance envelopes to ensure that they work with the remaining portions of the bridge.

Based on scheduling that utilizes accelerated construction, which is also included in the Maximum Probable Loss computations, it would take approximately 12 months to restore traffic flow across the facility following the level of damage experienced in Scenario 2. This would entail bi-directional traffic on NCB-SB and on Southbound Trestles C (CSB) and D (DSB), with crossovers located on Portal Island No. 4 and on Fisherman Island. The application of the final topcoat of paint on NCB-SB is assumed to occur after NCB-NB is reopened to traffic and lane closures could be utilized on NCB-SB. To be conservative and to account for additional weather delays and additional delays in material procurement, it could potentially take up to 18 months to get this portion of NCB-SB reconstructed. Therefore, it is recommended to assume a loss of revenue period of 18 months.

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4. Property Damage and Use and Occupancy

The "Property Damage and Use and Occupancy" value is the sum of the above maximum probable loss value and the "loss of revenue", which was provided in the SDG Certificate of Use and Occupancy Insurance for FY2024-2025 letter. SDG recommended using an 18-month total service interruption period, with the loss of revenue for that 18-month period estimated to be \$125,552,236 which will create a total value for Property Damage and Use and Occupancy equal to \$204,046,900 (rounded up to the nearest hundred).

Please call if you have any questions or need additional information.

Yours sincerely

JACOBS



Todd Eckhart, P.E.
Structural Engineer
410-419-0824
todd.eckhart@jacobs.com

Attachment: Steer Certificate of Use and Occupancy Insurance for FY2024-2025 letter, dated
January 26, 2024

Copies to: Mr. Jeffrey B. Holland, Mr. Thomas R. Anderson, III, Mr. Timothy R. Holloway, and
Mr. Todd Childress, P.E.

Appendix C

**Tunnel Description and Inspection Procedures for Thimble Shoal Channel and Chesapeake Channel
Tunnels, a Reference Document for NTIS Inspection**



CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT

Tunnel Description and Inspection Procedures for Thimble Shoal
Channel and Chesapeake Channel Tunnels, a Reference Document
for NTIS Inspections

Revision Number	Date	Notes	Author
0	6/14/2024	Initial Document	T. Holloway

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Appendix A – CBBT Policy Reporting Critical Findings

Appendix B – CBBT Tunnel Fire Fan Procedure

Appendix C – CBBT Tunnel Reference Drawings

Appendix D – CBBT Tunnel LED Light Fixture Drawings

Appendix E – CBBT Tunnel One Line Power Drawing, Typical

Appendix F - CBBT One Line Water Control System, Typical

Appendix G – Tunnel Construction, Maintenance, Repair and Inspection Methodology

Appendix H - CBBT NTIS Preventative Maintenance Schedule

Tunnel Description

The Chesapeake Bay Bridge and Tunnel Facility is a 23-mile-long combination bridge tunnel facility crossing the Chesapeake Bay and carries U.S. Route 13, which provides the only direct link between Virginia's Eastern Shore and Hampton Roads, Virginia. The crossing is approximately 19 miles in length from toll plaza to toll plaza and generally consists of parallel elevated structures, one carrying northbound traffic and the other one carrying southbound traffic.

The original crossing was constructed in the 1960's and carried one lane north and one lane south. Construction of the "Parallel Crossing" in the 1990's provided a similar adjacent structure to provide two northbound lanes, on the original structure, and two southbound lanes on the new structure. Overall the facility consists of two low level steel structures, two high level steel structures, approximately 17 miles of parallel low level concrete trestles and two and one-mile long tunnels traveling beneath the Thimble Shoal and Chesapeake Channels. The elevated structures approaching each tunnel are striped and transition down to one lane, with the Thimble Shoal and Chesapeake Channel Tunnels each carrying one northbound and one southbound lane of traffic.

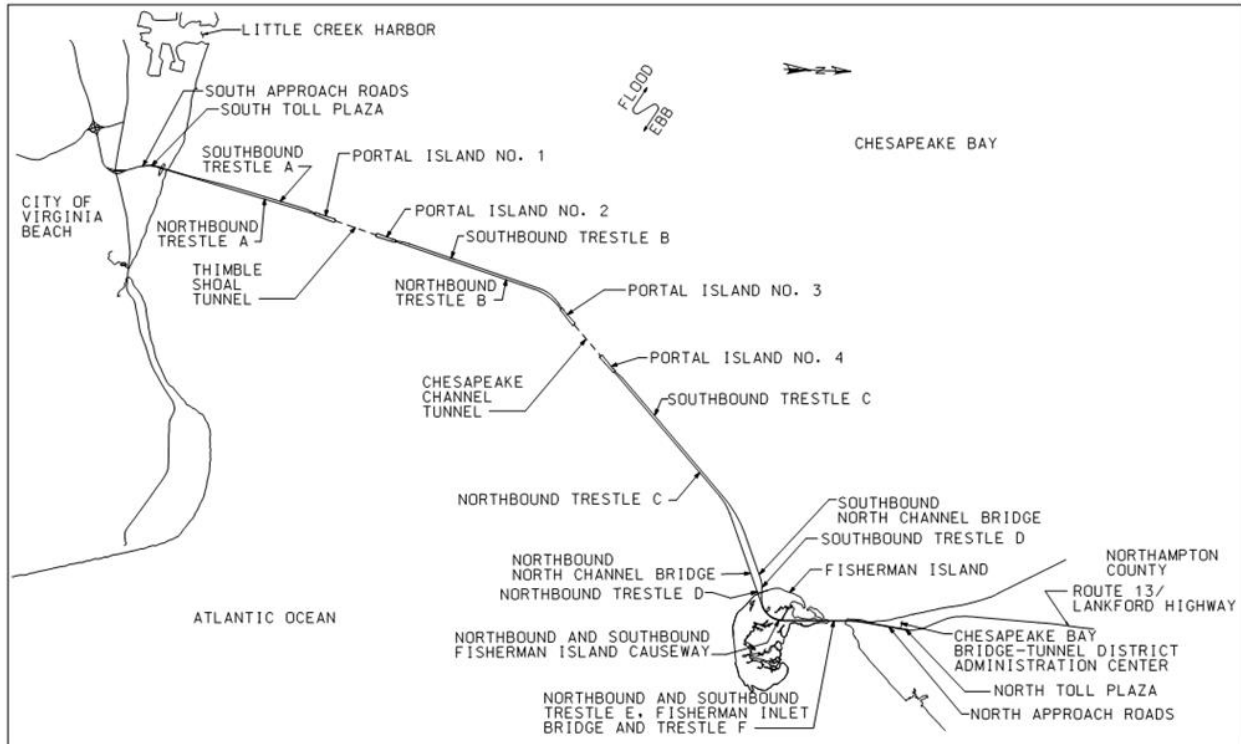


Figure 1 - Plan View of CBBT Facility

The Thimble Shoal and Chesapeake Channel Tunnels were constructed during the early 1960's using Immersed Tube Tunnel (ITT) construction methods and were opened to the public in April of 1964. Connecting the low-level trestles and the tunnels are four (4) man-made portal islands approximately five (5) acres each. Each of these islands contain the approach roadway to the tunnel portal and also a ventilation building, which houses the bulk of the operational support systems for the tunnels. The Thimble Shoal Tunnel is the southernmost tunnel connecting Portal Island Nos. 1 and 2. The Chesapeake Channel Tunnel is the northernmost tunnel connecting Portal Island Nos. 3 and 4.



Figure 2 – Portal Island No. 4 and Trestle CSB (l) and Trestle CNB (r)

The Thimble Shoal Tunnel was constructed using the ITT method and consists of nineteen (19) tube segments, each approximately 300 feet in length. When combined with the portions of the tunnel constructed with the ventilation buildings, the overall length of the Thimble Shoal Tunnel is approximately 5,738 feet long from portal to portal.

The Chesapeake Channel Tunnel was constructed using the ITT method and consists of eighteen (18) tube segments, each approximately 300 feet in length. When combined with the portions of the tunnel constructed with the ventilation buildings, the overall length of the Chesapeake Channel Tunnel is approximately 5,424 feet long from portal to portal.

All tunnels have:

A roadway width of 24 feet, (2) 11-ft lanes with 1-ft shoulders

- Road way vertical clearance of 13 feet 6 inches
- Tunnel lighting runs down both sides of the ceiling
- A sidewalk, also referred to as a catwalk, runs along the west wall for the full length of each tunnel providing emergency egress and also providing access to the Low Point Pumping Station (LPPS) for maintenance personnel
- Emergency telephones are located in niches in the West tunnel wall of the tunnel at 300-ft intervals
- Standpipes for fire emergencies are located in niches in the East tunnel wall, at approximately 300-foot intervals
- Fire extinguishers are located in niches in both tunnel walls at 150-ft intervals
- CCTV cameras are mounted on the West wall throughout the length of the tunnel in an overlapping area pattern to monitor tunnel conditions.

Ventilation buildings are located on each of the Portal Islands at the north and south portals of each Tunnel and consist of five levels with the bottom floor at approximate Elev. -30.0 ft and rising to an approx. roof Elev. 60.75 ft. In addition to ventilation, each building contains electrical switchgear, transformers, and controllers associated with the tunnel. Most tunnel systems can be operated from HMI screens through a SCADA system. This occurs from Control Rooms on Portal Island No. 1 and 3, which are actively manned 24/7/365.

The two tunnels utilize a fully transverse ventilation system. Mid-channel bulkheads in the exhaust duct and the low point pump station in the supply air duct separate the tunnel ventilation system into north and south halves.

Each ventilation building houses three (3) exhaust fans and three (3) supply fans providing ventilation to half of the tunnel. These ventilation buildings provide fresh supply air in the tunnel by pulling in outside air and pushing the air into the supply duct beneath the roadway slab. The fresh air exits the supply duct through a series of flues that run from the supply duct to just above the curb the roadway level. These fresh air flues have openings of varying sizes to allow proper amounts of fresh air to reach the roadway based on the variable pressure along the length of the fresh air duct. Variable-sized transverse openings in the roadway ceiling provides extraction of exhaust gases from the roadway into the exhaust duct above the ceiling. Exhaust is expelled through large ventilation shafts that penetrate the roof of each ventilation building.

The Thimble Shoal and Chesapeake Channel Tunnels are scheduled for a rotating 24-month inspection cycle with the Thimble Shoal Tunnel being inspected during odd years (i.e. 2017, 2019, etc.) and the Chesapeake Channel being inspected during even years

(i.e. 2016, 2018, etc.).

District Approach to Facility Management

The District's approach to maintaining the facility can be seen in a separate document entitled, Tunnel Construction, Maintenance, Repair and Inspection Methodology, found here in Appendix G. In addition, the Electrical Mechanical Division follows a CBBT NTIS Preventative Maintenance Schedule, see Appendix H.

Inspection Requirements

It is important to understand that the District performs an Annual Inspection of the entire facility as required by the District's Revenue Bond covenants. The bond covenants require that the District have a 3rd party conduct the inspection and provide a report documenting the condition of the facility.

In addition to the requirement for an annual inspection, the District follows the Modified Approach to Infrastructure Reporting as described in the Government Accounting Standards Board (GASB) Statement No. 34. "Basic Financial Statements – and Management's Discussion and Analysis – for State and Local Governments." As is required by GASB No. 34, the Chesapeake Bay Bridge and Tunnel Commission's (the "Commission") preservation policy is to maintain 90% of the bridge and tunnel assets at a Maintenance Rating Program condition level of "good" or better.

The numeric scaled rating below is based on a condition index as follows, whereby "0" is a failed condition level and "9" is an excellent condition level. The National Bridge Inspection Standards (NBIS) and the National Tunnel Inspection Standards (NTIS) implemented an element rating system in 2014, changing the previous 0 to 9 scale with a condition state (CS) rating system of 1 to 4. The rating system was not only condensed, but also inverted, with CS1 being good, CS2 being fair, CS3 being poor and CS4 being severe. Definitions of each CS state are no longer general, but specific to the bridge or tunnel element being inspected. A conversion from the CS ratings to the prior numeric scaled rating is used to appropriately fill out the GASB 34 rating tables and maintain the original intent of the bond covenants. The GASB rating tables are a group of six main categories of the District's facility, labeled A thru F. Each of the six main categories has multiple sub-category components, each receiving ratings. The sub-category ratings then roll up into the overall group rating.

Rating	Condition Category	Description
9	Excellent	Component/Element has been recently put into service or remains in new condition
8	Very Good	No problems noted, potential exists for minor preventative maintenance
7	Good	Potential exists for minor maintenance
6	Satisfactory	Potential exists for major maintenance
5	Fair	Potential exists for minor repair or rehabilitation.
4	Poor	Potential exists for major repair or rehabilitation.
3	Serious	Major repair or rehabilitation is required.
2	Critical	The need for repair or rehabilitation is urgent, Component/Element should be taken out of service until indicated repair is complete.
1	Imminent Failure	Component/ Element is out of service; study feasibility for repair or rehabilitation.
0	Failed	Component/ Element is out of service and beyond repair; replacement is required.

Table 1 – Numeric Scaled Rating used for GASB 34

Every other year, each tunnel is inspected in accordance with the NTIS requirements and as further detailed in this document. The tunnel inspection is completed during the Facility Annual Inspection Report.

The third-party inspector will rate the elements (identified later in this document) based on the condition of the elements on the day of the inspection. Preventative maintenance schedules and records will be provided to the inspectors for their review and consideration when developing element ratings.

The third-party inspector will also rely on the tunnel inspection information to develop the GASB 34 Condition Ratings described above, and included in the Annual Report.

Report to FHWA, through VDOT

The third-party inspector will, as part of the Annual Facility Inspection Report, report all their findings at the element level, as dictated by NTIS. This report, once reviewed and approved by the District, is forward to VDOT, who in turn reports the required data to FHWA.



Figure 5 – Typical Ventilation Building



Figure 6– Thimble Shoal Tunnel Portal



Figure 7 - Chesapeake Tunnel Southern Portal



Figure 8 - Typical Tunnel Roadway with Catwalk



Figure 9 - Typical Open Cut, Leading to Tunnel Portal



Figure 10 - Typical Lower Air Plenum



Figure 11 - Typical Upper Air Plenum



Figure 12 - Typical Intake Fan Room



Figure 13 - Typical Exhaust Fan Room



Figure 14 - Typical Fan MCC and Motor



Figure 15 - Typical Pump Room



Figure 16 - Low Point Pump Station



Figure 17 - Typical Switchgear



Figure 18 - Typical 500kW Emergency Backup Generator



Figure 19 - Typical Control Room

Overview of Routine Inspections

Routine inspections of the Thimble Shoals Channel Tunnel (TSCT) and Chesapeake Channel Tunnel (CCT) located on the Chesapeake Bay Bridge and Tunnel Facility (CBBT) are performed by qualified third party inspectors as required by the National Tunnel Inspection Standards (NTIS). The tunnel's previous inspection data is used during the inspection, with notable changes in defects documented. Change of condition for prior documented defects and new defects shall be documented, with appropriate condition state rating. Below is a brief discussion of inspection activities performed during those inspections.

Civil/Structural Inspection of a Tunnel is performed over three days. The inspection consists of the following locations and elements:

- Supply Duct - Concrete Tunnel Liner, Tunnel Ceiling Slab, Stainless Steel Hangers and Connections
- Roadway Level - Tunnel Ceiling Slab, Tunnel Walls, Elevated Sidewalk, Metal Railing, Roadway Barriers, Asphalt Wearing Surface, Tunnel Roadway Manholes, Emergency Telephones, Fire Extinguishers, Fire Suppression Standpipes, CCTV Cameras, Signage, Tunnel Lighting, and Tunnel Lighting Fixtures
- Exhaust Duct – Concrete Tunnel Liner, Fresh Air Supply Flues, Exhaust Duct Lighting, Tunnel Roadway Slab

- Ventilation Buildings - Rooftop Structures and Systems, Building Structural Members, Stairway Structures, Exhaust and Supply Fan Housings and Attachments, Man Doors, Overhead Doors, Attached Garage Structures, Exterior Coping and Brick
- Open Approaches - Walls, Roadway, Sidewalk, Signage, Lighting, Portal Face Compression Joints, Portal Drains
- Portal Islands - General Island Surface, Guardrail, Island Protective Rip Rap and Armor Stone, Splash Walls

Inspections at the roadway level of each tunnel are performed during overnight lane closures, typically between the hours of 9PM to 6AM. Open cuts walls are inspected in early morning daylight hours, with traffic d-filed around inspectors. All other inspections are performed during the day under normal operating conditions. The upper portions of the tunnel walls, the underside of the tunnel ceiling and tunnel lighting fixtures are inspected both from the roadway and from the platform of the District's tunnel flush truck. This platform allows the inspector to sound an area or check an anchor, should the visual inspection dictate the need.

Electrical/mechanical inspection of the tunnels are performed over a period of three days each. The electrical/mechanical inspection of the Tunnels include all functional systems such as electrical, lighting, ventilation, drainage and pumping, emergency lighting and distribution, and emergency communications. The majority of these components are inspected under normal daytime conditions, but the emergency power, including uninterruptable power supply (UPS), automatic transfer switches (ATS), generators and emergency tunnel lighting are tested during an overnight lane closure, generally between 9PM and 6AM.

In addition to the onsite inspection, the CBBTD provides the third-party inspectors a digital spreadsheet, entitled FY 20XX Completed PM Form for Chesapeake Tunnel (or Thimble Tunnel). This document contains the more significant tunnel maintenance records that are collected from the time of the previous inspection to the present inspection. Tunnel Operator logs are also available for review, which note hourly readings for CO, fan run time and speed ran, pump run time, exercising of generators, etc. These documents will be made available to the inspector.

Reporting of Recommendations

After the Annual Inspection has been completed, the District expects deficiencies to be grouped and reported by structure or tunnel. Repair recommendations fall into two categories, Priority and Routine Repairs. Priority Repairs are defined as defects that will become problematic or repair costs could escalate significantly if not addressed in the next 24 months. Routine Repairs are defined as defects that that will likely not become problematic or see a significant increase in repair costs if not addressed in the next 60 months and should be completed as opportunities present themselves.

A third more immediate deficiency category exists, entitled Critical Findings. Should a potential Critical Finding occur during inspection, defined as requiring immediately action to ensure public safety, an immediate phone call shall be made to the Director of Maintenance at (757) 642-6883, or the Deputy Executive Director of Infrastructure at (757) 350-0975. The

CBBT Policy for Reporting Critical Findings, dated September 18, 2023 will be followed to make this determination and take appropriate action.

Critical Findings

As defined by CFR 650.305, "A structural or safety related deficiency that requires immediate action to ensure public safety."

As it related to the District, critical findings may be found as follows:

Structural deficiency: is a defect or condition that presents an immediate danger to the motoring public. Such condition would, by itself, present the potential for the next vehicle to be in danger.

- A hanging light fixture or conduit in the tunnel that encroaches on the travel envelope
- A concrete deficiency (such as a spall and/or deteriorated reinforcing) that impacts the structural integrity of the major structural element, such as the invert slab, tunnel ceiling, or tunnel liner

Safety deficiency: is a condition or defect that presents an immediate danger to the motoring public. Such condition would, by itself, present the potential for the next vehicle to be in danger. The District has multiple redundant systems. In general, the failure of a single system would not present a critical finding. For example,

- A failure of the power generator would not be a critical finding if the redundant power feeders were working. Failure of all of the power distribution systems would be necessary to be a critical finding.
- Failure of SCADA systems are not critical findings because all critical systems have local controls that can be accessed in the event of a SCADA outage.

- Failure of CCTV are not critical findings. CCTV cameras are not required for the motoring public to cross the facility.
- Failure of a single fan or fire pump would not be a critical finding because the District has redundant systems. Failure of more than one fan or pump motor in a system should be brought to the attention of the Director of Maintenance immediately for further evaluation.

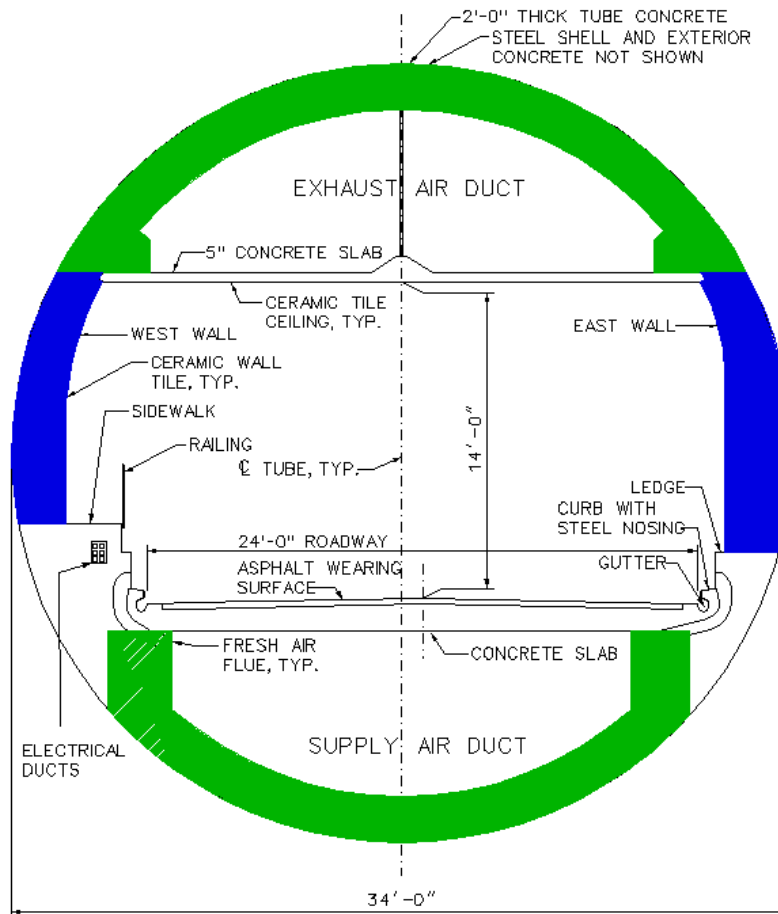
In general, for the condition to be an imminent danger to the motoring public, it exists and could lead to major issue from a single event, such as a hanging light fixture that could be struck by the next vehicle.

If more than one event is required, then it is not an imminent threat and not a critical finding. For example, if an emergency generator does not start. Multiple redundant systems are in place, such that a life threatening event would require multiple failures, first power outage on both redundant feeders, then an emergency generator failure AND an event that would impact motoring public.

The third-party inspector will not determine if a condition is a critical finding. Conditions that may warrant a critical finding shall be documented and immediately brought to the attention of the Director of Maintenance or the Deputy Executive Director, Infrastructure in accordance with the CBBT Policy for Reporting Critical Findings (see Appendix A).

General Description of Routine Inspection Elements

Precast Concrete Tunnel Liner (Element Number 10002)



TYPICAL TUNNEL CROSS SECTION

Figure 20 – Typical Tunnel Liner Portions in Cross Section

The concrete liner consists of the two side walls, the curved ceiling visible from the exhaust air duct, and the curved floor visible from the fresh air duct. The concrete is directly exposed on the ceiling of the exhaust air duct and the floor of the fresh air duct, but the concrete walls on each side of the tunnel roadway are not visible due to the tile finish and the three coats of mortar beneath the tile.

Inspection Procedures

Defects are located by approximate station as found on the West wall inside each tunnel. New defects in tile, such as cracking or bulging are sounded to see if tiles are loose or if the concrete liner behind them is delaminated.

The upper and lower sections of the tunnel liner are inspected during the exhaust and supply air duct inspections (indicated above in green). The upper and lower air ducts are to be walked and inspected by the appropriate team inspector with the prior inspection defects in hand, listed by approximate station.

The bottom of the **Concrete Invert Slab (Element Number 10101)** will be included in the supply air duct inspection process. Defects in the Concrete Invert Slab include delamination, spalls, exposed rebar, efflorescence, rust staining and cracking. District personnel will accompany the inspector in both the supply and exhaust air duct and utilize a portable multi gas detector to monitor the air quality.

The top of the **Concrete Ceiling Slab (Element Number 10061)** and the **Steel Anchors (Element Number 10080)** will be included in the exhaust air duct inspection process. Defects in the Concrete Ceiling Slab include delamination, spalls, exposed rebar, efflorescence, rust staining, cracking and/or distortion. Defects in the Steel Anchors include corrosion, bowing and elongation. Change in condition for prior defects and new defects shall be documented. All defects are to be documented per approximate station location.

Defects noted in the wall sections (indicated above in blue), are found in the tile surface. The condition of the tile is assumed to be reflective of the tunnel liner. These are to be inspected during the night time lane closure detail, generally from 9PM to 6AM. The top of the invert slab, covered in an asphalt wearing surface, and the bottom of the concrete ceiling slab, covered in tile, will also be inspected as part of this night time lane closure. The condition of the covered surfaces of both these concrete elements are considered to be reflective of the concrete element.

Critical Finding Guidance

Structural conditions that represent an immediate threat to the motoring public shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Concrete Portal (Element Number 10051)

The concrete portal consists of the area above the roadway, which for this tunnel includes the exterior face of the ventilation building located on the portal island at each end of each tunnel.

Inspection Procedures

Brick, mortar, limestone coping and stone parapets above the portal are inspected as part of this element. Defects are noted by the North or South Portal for the respective inspected tunnel. Defects are documented for delamination, spalls, condition of repairs, exposed reinforcing steel, efflorescence, rust staining, and cracking. Change of condition of prior documented defects and new defects shall be documented.

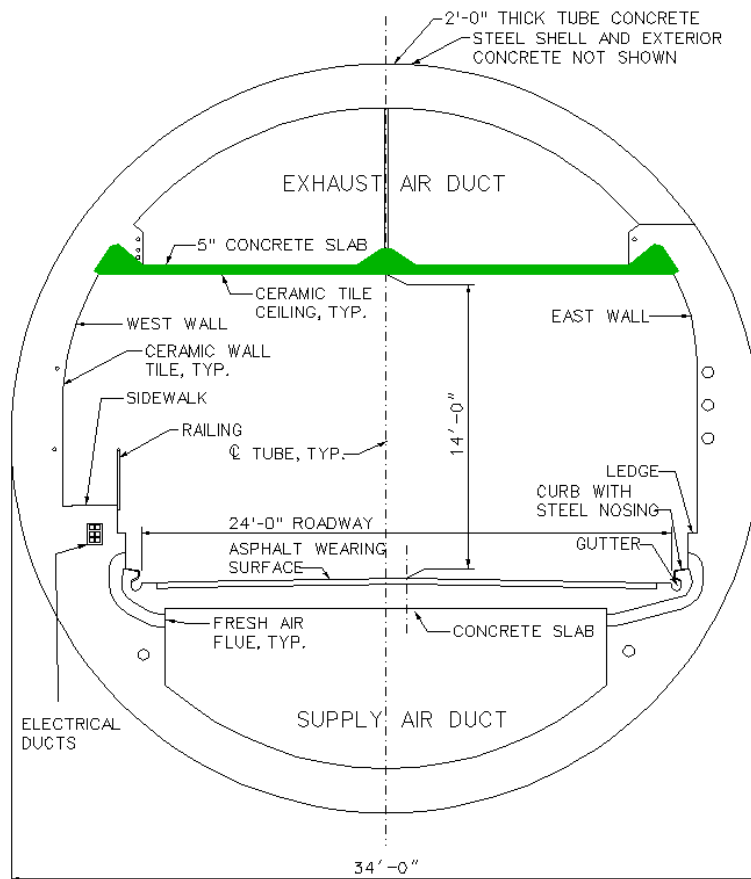
This inspection happens as part of the night time lane closure, in the roadway of the tunnel being inspected, between 9PM and 6AM. Portions of the Concrete Portal can also be viewed from the Island surface, from behind the open cut wall at the Portal. While the majority of this inspection typically occurs from the roadway, a District bucket truck is available, upon request, should a noted defect dictate a closer look.

Critical Finding Guidance

Structural conditions that represent an immediate threat to the motoring public shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Structural Elements

Concrete Ceiling Slab (Element Number 10061)



TYPICAL TUNNEL CROSS SECTION

Figure 21 – Typical Tunnel Ceiling Slab in Cross Section

The concrete ceiling slab is suspended over the roadway and forms the bottom of the exhaust air duct. Stainless steel hangers help support the ceiling slab through the use of embedded anchorages in the ceiling slab and in the concrete liner (exhaust duct ceiling), with the stainless-steel hanger spanning between the anchorages.

Inspection processes for this element are listed above, under the Precast Tunnel Liner section.

Critical Finding Guidance

Structural conditions that represent an immediate threat to the motoring public, such as a piece of the tunnel ceiling protruding into the travel way envelope, shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Steel Hangers and Anchorages (Element Number 10080)

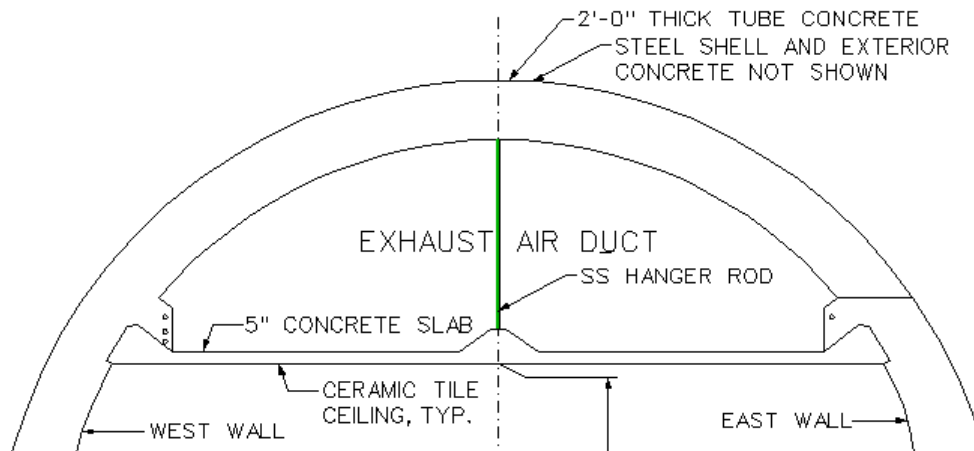


Figure 22 – Typical Ceiling Hangers in Cross Section

This element consists of the stainless-steel hangers and the anchorages embedded in the haunch beam in the center of the ceiling slab. Also included is the anchorage at the top of the hanger embedded into the tunnel liner. Inspection processes for this element are listed above, under the Precast Tunnel Liner section.

Critical Inspection Guidance

Structural conditions that represent an immediate threat to the motoring public shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

District forces. Inspectors shall look for leakage, seal adhesion, seal damage of any kind, seal cracking, debris impact to the seal and any spalling of adjacent edges to the seal. Both change of condition from previous defects and new defects shall be documented. A District bucket truck can be provided, upon request, should a noted defect dictate a closer look.

Critical Finding Guidance

Seal conditions that represent an immediate threat to the motoring public shall be reported per the CBBT Policy for Reporting Critical Findings. Short of an imminent flooding condition, it is unlikely that a critical finding would be issued for conditions of the seal/joints.

Asphalt Wearing Surface (Element Number 10158)

The asphalt wearing surface covers the concrete slab-on-grade from curb to curb in each tunnel. Defects are located by approximate project station as defined in the tunnel plans. The asphalt wearing surface of the Tunnels was last replaced in FY 2016.

Inspection Procedure

The Asphalt wearing surface is inspected during the night lane closure in the tunnel between 9PM and 6AM. The inspector shall look at the general condition of the wearing surface and document if any isolated or widespread deterioration is occurring. Since it is a wearing surface, the effectiveness of it to protect the element it is covering shall also be documented. Change of condition from prior documented defects and new defects shall be documented.

Critical Finding Guidance

Typical deterioration of asphalt (alligatoring, potholes and raveling) would not normally result in a critical finding. Unusual conditions that directly impact the safety of the motoring public shall be reported per the CBBT Policy for Reporting Critical Findings.

Concrete Traffic Barrier (Element Number 10161)

Concrete traffic barriers run along both sides of the roadway for the full length of each tunnel with tile covering the surface. Defects are located by approximate stations, which are located on the West tunnel wall. This element is covered in tile. Defects noted in the tile, are assumed to be reflective of the concrete traffic barrier condition.

Inspection Procedure

The inspector shall document delamination, spalls, exposed rebar, efflorescence, rust staining, and cracking. Change of condition of prior defects and new defects shall be documented. New

defects in tile, such as bulging shall be sounded to see if tiles are loose or if the concrete liner behind them is delaminated.

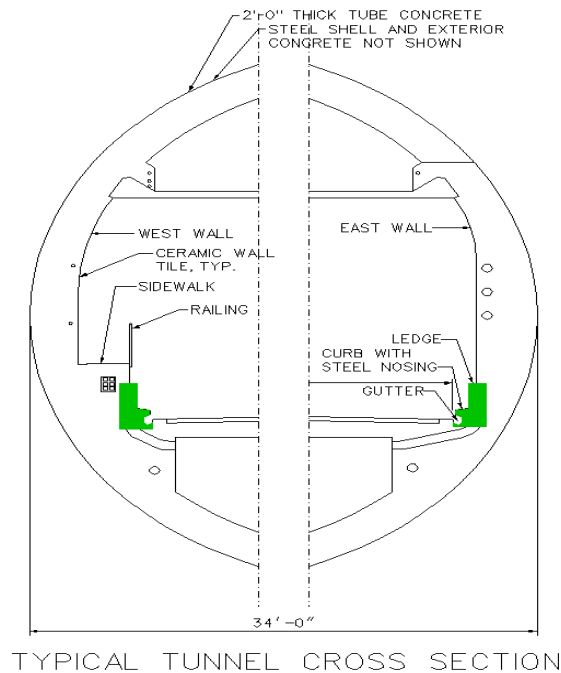


Figure 24 – Typical Tunnel Concrete Barrier in Cross Section

Critical Finding Guidance

Deteriorated conditions that significantly alter the effectiveness of the concrete barrier, such as missing sections that create blunt ends, or weaken the structural effectiveness of the barrier, may be critical findings. Such conditions shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Steel Pedestrian Railing (Element Number 10179)

Steel pedestrian railing runs along the sidewalk for the full length of the tunnel with openings at approximately every 300-ft. Openings in the railings are provided to allow access from the roadway to the fire extinguishers and telephones in the niches along the West wall above the sidewalk. The railing consists of a top rail, a mid-rail and a toe-board that are connected to vertical members, which are anchored into the Concrete Traffic Barrier on the West side of each tunnel.

Inspection Procedure

The inspector shall document the condition of the railing for corrosion/breakdown that may reduce load capacity, lose or missing railing anchors, cracks or spalling stemming from the anchorages, separated connections of horizontal to vertical rail members and corrosion. Defects are located by approximate station, found on the west wall. Change of condition from prior defects and new defects shall be documented.

Critical Finding Guidance

If the railing is found to be out of alignment, and potentially impeding on the normal vehicle travel envelope, the condition shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Mechanical Systems

Ventilation System (Element 10200)

Each tunnel has two ventilation systems which consist of fans, fan motor control centers, dampers, damper motors, air quality monitors, conduits and the ventilation control system. Ventilation is provided by six supply fans and six exhaust fans per tunnel, with 3 supply fans and 3 exhaust fans providing and extracting air to half of each tunnel due to the bulkheads in the supply and exhaust ducts at mid-channel. Each fan has a motor controller and motorized damper. All steel components associated with the fans, except for the motors themselves, were cleaned and repainted in 2015. Reconditioning of the fan motors were performed from 2012 to 2020. Replacement of the fan Motor Control Cabinets (MCC) were completed in 2022.

Inspection Procedure

In addition to inspecting the above listed pieces of the system, during operation of the fans, the fan chains and sprocket drive housings are checked for abnormal noises such as chatter on the fan start up. Fan controls, including emergency stops, both local and remote, are also tested.

The CO monitoring system located in each half of the exhaust duct is also checked for functionality. Typical readings, reported in ppm, range from the teens to the twenties, which is well below harmful levels that begin around 70 ppm. 150 to 200 ppm are considered toxic with the potential to cause unconsciousness, disorientation and death over extended exposure times. The Tunnel Operators record the CO levels on the hour in the Operators log in Control Rooms on #1 and #3 Island. These records shall be made available to the inspector.

As part of the Ventilation System the District developed Tunnel Fire Fan Procedures for each tunnel in 2017. A copy of these procedures hangs on the wall in the respective Control Room for each tunnel. When the Island Operator determines a fire is occurring in the tunnel in a specific fire zone, utilizing the Tunnel Cameras and signage mounted on the East wall of each tunnel, they are to utilize the fan scenario provided for number of exhaust and or blowers turned on and at what speed they are to be ran.

Note that the Tunnel design is 1964 and each fan must be brought up to speed with normal control features utilized by the Tunnel Operator. The inspector shall choose a fire zone and allow the Tunnel Operator to walk each fan up to the required speed for each of the designated

fans per the District's Tunnel Fire Fan Procedure. The inspector shall verify that the system allowed the fans to operate simultaneously under the designated speeds for the fire scenario being tested. In the event that a fan does not ramp up to the intended fan speed during the test, an alternate fan will be utilized. Having 3 intake and 3 exhaust fans per Island provides the redundancy to be able to overcome unexpected electrical/mechanical failures. The Tunnel Fire Fan Procedures for each tunnel are attached as Appendix B.

A successful test will result in all associated equipment operating per the Tunnel Fire Procedure Zone chosen. Should a portion of the equipment fail, or not ramp up to the appropriate speed, the defect will be noted and provided to the Electrical Mechanical Superintendent for trouble shooting.

The inspector shall rate the overall system condition for this element and whether or not the operational condition impacts the serviceability function for the element. Change of condition for prior documented defects and new defects shall be documented.

Critical Finding Guidance

The ventilation system and associated electrical distribution systems have multiple redundancies. The failure of any one piece of equipment is not a critical finding (any such failures shall be reported for priority repairs). A complete failure of the system, no active ventilation systems would be a critical finding and shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Fans (Element Number 10201)

There are 6 exhaust fans and 6 supply fans associated with each of the two tunnels. A total of six fans separated into 3 exhaust air and 3 supply air fans are located in each of the ventilation buildings located at the north and south portals of the tunnel. Each fan consists of the fan wheel and housing as well as the motor, bearings, and drive assembly.

Inspection Procedure

Third party inspectors randomly choose 3 fans per vent building. The exterior of the fans, fan shafts, fan housings and safety screens are inspected for failed paint, corrosion and section loss.

Each spot-checked fan is tested in all four (4) speeds. In addition, the following items are tested: local and remote fan controls, E-stops, interior components of the motor control centers, fan shaft bearings are examined for oil leaks and grease accumulation, during operation the shaft bearings are checked for abnormal sounds and/or excessive vibrations, and the fan chains and sprocket drive housings are checked for abnormal noises such as chatter on the fan start up. Change of condition from previous defects and new defects shall be document.

Critical Finding Guidance

The ventilation fans are designed with redundancy for routine maintenance purposes and in the event of a failure. In addition, in the event of a fire event, or similar conditions, the blower fans are typically shut off and the exhaust fans are increased to evacuate smoke or unsuitable conditions. The failure of three exhaust fans in a single vent building may be a critical finding and shall be reported per the CBBT Policy for Reporting Critical Findings.

Drainage and Pumping System (Element Number 10300)

Each tunnel has three Drainage and Pumping Systems which consists of one at the south portal, one at the north portal and one at the Low Point Pumping Station (LPPS) at mid-channel, all of which shall be inspected. The drainage systems at the portals include the portal drainage troughs, pumps, valves, piping, conduit, stormwater tanks and tank floats. The drainage system at mid-channel consists of the roadway gutters, pumps, valves, piping, conduit, stormwater tanks and tank floats.

Each portal island stormwater tank holds 20,000 gallons. Each portal pump room contains one 200 gpm and two 1500 gpm pumps.

The facility does *NOT* have flood gates at its portal islands, as the island surfaces are approximately 30 feet above sea level.

Each LPPS stormwater tank holds 17,000 gallons. Each LPPS room contains two 300 gpm pumps.

Inspection Procedure

Portal drains and roadway gutters are inspected when performing night time roadway inspections, with a lane closure from 9PM to 6 AM. Portal pump rooms and the LPPS can be inspected during normal day hours.

The inspector will document the overall system condition of the various parts listed above, based on functionality and the system's ability to operate without impacting the serviceability of the elements. Change of condition for prior defects and new defects shall be documented.

Critical Finding Guidance

The pumping system has multiple redundancies (pumps and power systems). Failure of the entire pumping system may represent a critical finding and such condition shall be reported per the CBBT Policy for Reporting Critical Findings.

Pumps (Element Number 10301)

All of the pumps for the Portal Pump Rooms and LPPS at Mid-Channel were replaced in 2008.

Each portal pump room contains one 200 gpm and two 1500 gpm pumps. Each LPPS contains two 300 gpm pumps.

There are two sump pumps in each Tunnel; one in each portal pump room, but no sump pump in the LPPS at mid-channel. LPPS uses a valve in the sump pit to drain into the invert of the adjacent lower air duct. CBBT maintenance has stated that the life cycle of the typical sump pump is a little less than five years. Spare sump pumps are kept in inventory to replace these as needed.

Inspection Procedure

The Portal and LPPS pumps are typically not operated at the time of inspection as the District performs this testing on a regular basis. The District's maintenance personnel will report how the pumps are running and when the pumps last ran. Pumps are ran as needed, depending on rainfall. Pump run times are documented by the Tunnel Operator in their logs on #1 and #3 Island control rooms. These records will be made available to the inspectors at their request. The pump disconnects are tested quarterly. The valves and gauges are also exercised and checked bi-monthly. The valves are lubricated annually. The District utilizes the common practice of placing buckets to collect any water possibly leaking through pump packing/seals. This helps to reduce humidity in the room.

If enough water is present in the stormwater tanks, pump operation can be spot checked upon request. Otherwise, the inspector can view the Operator logs, current or any time over the previous two-year period. These will be made available to the inspector. Pump number and run time are documented on these sheets each time a pump is run. Shutoff valves may be exercised by the inspector to assure that they move freely without binding.

The inspector shall rate the pumps based on the capacity of the pump to operate, through testing or documentation, the capacity of the pump controls to function properly, any leaking of fluids from the pumps, as well as non-typical noise, vibration and temperature, such that motor operation is negatively influenced.

Critical Finding Guidance

The failure of any single pump to operate is not a critical finding. As noted above, larger systematic failures may be considered critical findings and shall be reported per the CBBT Policy for Reporting Critical Findings.

Emergency Generator System (Element 10400)

There are four emergency generator systems, one in each ventilation building, two per tunnel, associated with the Thimble Shoal Channel Tunnel and Chesapeake Channel Tunnel, with each consisting of an engine-generator set, a main fuel tank, a day fuel tank, a fuel pump, supply air louvers and damper actuators in the roof, an exhaust manifold, electrical controls, conduits and an automatic transfer switch (ATS) located in each ventilation building that provides emergency power for the components within the ventilation building and for the emergency tunnel lighting for that half of the tunnel.

The main fuel oil storage tank for each emergency generator is located to the immediate west of each ventilation building and are buried underground. This fuel is also used in the Ventilation Building heating system. Therefore, the fuel is turned over on a regular basis.

Inspection Procedure

The emergency generators are tested separately by simulating a loss of power during a night lane closure from 9PM to 6AM, with each ATS transferring over power when a loss of utility power to the building is detected. A visual inspection is done on the equipment. The supply air louvers, actuators and generator exhaust system are also inspected during this process.

The fuel oil day storage tank for each generator, as well as the fuel level indicator, are visually inspected for leaks/defects. Each fuel oil transfer pump, located on the fan floor, is also visually inspected. District's maintenance personnel can report on the running of the fuel oil transfer pumps, which receive regular exercise.

The electrical controls for the generators were replaced as part of the District's Supervisory Control and Data Acquisition (SCADA) replacement project in 2012. Generators functionality can be monitored from an HMI screen at the #1 and #3 Island Control Rooms.

The inspector shall rate the overall system condition for this element and whether or not the condition impacts the serviceability function for the element. Change of condition for prior documented defects and new defects shall be documented for each generator system associated with the tunnel being inspected.

Critical Finding Guidance

Multiple redundancies exist on the power distribution side, and as such the failure of any of the generator components or systems are not likely to generate a critical finding. The failure of any components of the generator system shall be reported as priority repair recommendations.

Electrical and Lighting Systems

Electrical Distribution System (Element Number 10500)

There is one electrical distribution system for the entire facility which provides and distributes power from the utility services on the South end of the facility to the tunnel systems and equipment. This system contains numerous subcomponents, such as electrical services, medium and low voltage switchgear, circuit breakers, switches, cables, raceways, transformers, panelboards, relays, metering equipment, etc. The 15kV distribution system is highly redundant consisting of redundant main switchgear, redundant feeders, and redundant switchgear at each portal island.

Redundancy for this system begins with Dominion Power feeding the facility with two independent feeders originating from different sub-stations. Those two feeders come into the District's sub-station at South Plaza and are sent out on two independent 15kV feeders across the facility. Each Ventilation Building receives the two independent feeders with double ended 15kV switchgear. The facility has the ability to run independently on one of these feeders.

Circuit breakers for the 15kV switchgear located on each portal island are vacuum breakers and controlled from a 125 Volt direct current (DC) source. The DC source is provided by a rectifier and battery backup on each Portal Island. The intent of this type of DC source with battery backup is to provide control of the circuit breakers for selection of a backup source when a power outage or the loss of a feeder occurs. This type of system eliminates the need for manual operation and uses pushbutton control to minimize the efforts and time required for opening and closing a circuit breaker during an outage.

Inspection Procedure

The overall condition of this equipment shall be checked with each inspection. Voltage and amperage readings taken from the digital meter on the 15kV switchgear will be viewed and documented to make sure they are in the normal operating range.

The 600V switchgear is the distribution portion of the double-ended substations located in each ventilation building at each of the portal islands. The overall condition of this equipment shall be checked with each inspection as well as viewing the enclosures for corrosion.

Each active and spare 600V circuit breaker is equipped with new solid-state tripping devices. The 600V breakers are inspected and cleaned annually by the District Maintenance Staff.

The 600V circuit breakers for the supply and exhaust fans were tested as part of the Fan MCC replacement project in FY 2022. Each fan was brought on line and run through its paces from both the local and remote controls, as each fan MCC was complete.

Appropriate maintenance of the switchgear consists of cleaning the bus and structural insulation to remove any contamination, as well as thermal image testing to detect any sign of overheating typically caused by loose connections. CBBT maintenance isolates all sources of power from the bus when an outage is needed to perform this work or when any kind of preventative maintenance is required on the electrical distribution system. During the inspection, voltage and amperage readings are gathered from the equipment gauges and digital meters. The equipment is also inspected for paint failure and corrosion. The wiring for the various pieces of electrical equipment is spot checked for damage and/or corrosion during the inspection.

Visual inspection of electrical equipment disconnects are conducted. CBBT maintenance verifies annually that all equipment is properly disconnected utilizing the respective disconnect switch for each particular piece of equipment.

Distribution transformers are visually inspected. Substation transformers are oil filled with the fluid level, pressure and temperature being observed as part of the inspection.

All of the power distribution panels are inspected. CBBT maintenance check all electrical outlets quarterly and test the GFCI outlets monthly; any faulty outlets are replaced upon discovery. Maintenance check conduit clamps annually to ensure conduits are secure in place.

See tunnel drawings and one-line diagram in Appendix C for configuration and labeling of electrical equipment.

The inspector shall rate the overall system condition for this element and whether or not the condition impacts the serviceability function for the element. Change of condition for prior documented defects and new defects shall be documented for the system.

Critical Finding Guidance

As noted above, the power distribution system has multiple redundancies. The failure of any single piece of equipment is not a critical finding, but shall be recorded as a priority repair recommendation. The failure of multiple components of the power distribution system shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Emergency Distribution System (Element Number 10550)

There is an emergency power distribution system for each portal island, which supplies power to critical systems only. The emergency distribution system includes numerous subcomponents such as emergency generators, Uninterruptable Power Supplies (UPS), batteries, battery charging equipment, emergency power distribution panels, fire rated circuit systems, automatic transfer switches, wiring, conduit and cable.

Inspection Procedure

All of the above subcomponents will be inspected for condition and function as part of the inspection.

Defects are noted for individual pieces of equipment based on location. See tunnel drawings in Appendix C and one-line power drawings in Appendix E for configuration and labeling of electrical equipment.

The emergency power distribution system is evaluated by removing the normal power and observing the ATS transfer power to the UPS in the Ventilation Building in question. The UPS is checked and verified that the tunnel lighting is being powered by the UPS in each building.

It should be noted that when under emergency power, the fan motor controls currently only allow for operation of one supply fan and one exhaust fan on low speed in each ventilation building. In FY 2024, CBBT awarded an Emergency Power Upgrades project for the four Ventilation Buildings to maximize the use of the existing generator capacity and provide more redundancy for emergency backup equipment.

The switchgear batteries are replaced every 10 years, last being replaced in 2019. The batteries and charging system shall be inspected for functionality and condition with each tunnel inspection.

The emergency power distribution panels will be observed for functionality during the testing of the emergency generators.

The inspector shall rate the overall system condition for this element and whether or not the operational condition impacts the serviceability function for the element. Change of condition for prior documented defects and new defects shall be documented for each of the two systems associated with the tunnel being inspected.

Critical Finding Guidance

As noted above, the power distribution system has multiple redundancies. The failure of any single piece of equipment in the emergency power system is not a critical finding, but shall be recorded as a priority repair recommendation. The failure of multiple components of the emergency power system shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Tunnel Lighting System (Element Number 10600)

There is one tunnel lighting system for each half of the tunnel resulting in a total of two systems per tunnel. This element only refers to the roadway lighting for the tunnel, and includes light fixtures, raceways, wiring, sensors, conduits and control equipment.

Inspection Procedure

All of the lighting components including lighting programmable logic controllers (PLCs) and associated lighting sensors, output contactors, lighting transformers, the raceways adjacent to the tunnel lighting fixtures and the tunnel lighting conduit that runs the length of the exhaust duct will be inspected for condition and functionality. With the exception of conduits and control equipment, the components will need to be inspected from the roadway inspection detail during a night time closure, generally between 9PM and 6AM.

The lighting in the tunnel is measured in foot-candles using an LM-50 illumination testing device. The tunnel lighting is measured at night during a lane closure in three locations across the width of the roadway at each camera location of the tunnel. The three locations are taken by laying the measuring device on the roadway surface at the center of the northbound lane, center of southbound lane and on the centerline. The typical range of illuminance measure is between 10.9 and 193 foot-candles for the locations tested. The brightest measurements are typically found at the entrance of the tunnel, and the lowest level of lighting in the interior zone. The measurements are compared to readings taken during prior inspections for evaluation of system degradation.

All of the lighting components including lighting programmable logic controller (PLC) and associated lighting sensors, output contactors, lighting transformers, the raceways adjacent to the tunnel lighting fixtures and the tunnel lighting conduit that runs the length of the exhaust duct will be inspected.

The inspector shall rate the overall system condition for this element and whether or not the operational condition impacts the serviceability function for the element. Change of condition for prior documented defects and new defects shall be documented for each of the two systems associated with the tunnel being inspected.

Critical Finding Guidance

The failure of the entire tunnel lighting system may be a critical finding and shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Tunnel Lighting Fixture (Element Number 10601)

Tunnel lighting fixtures are mounted on the underside of the ceiling slab along both sides of the roadway providing motorists with lighting to safely navigate within the tunnel. There are

significantly more fixtures at the tunnel portal areas to help eliminate the black hole effect that drivers sometime experience when approaching the tunnel, as well as to help transition from a dark location to much brighter areas during daylight hours.

This element includes only components related to the physical housing of the lighting fixture and the connection of it to the tunnel ceiling.

In a project that was completed in FY 2022, these fixtures were replaced with new 316 stainless steel housing LED fixtures. See the Tunnel Lighting Replacement Project drawings in Appendix D for current lighting configurations and associated equipment.

A total of 722 light fixtures are located throughout the Chesapeake Channel Tunnel, while 757 fixtures are located throughout the Thimble Shoal Channel Tunnel.

During the normal relamping process of the District, personnel will perform a slow roll by on all the fixtures in a lane, looking at anchorages, lens clips, etc. Since LED fixtures were installed this process has moved from every 4 to 6 weeks to every 4 to 6 months.

Inspection Procedure

Inspection for this element shall entail the condition of the fixture, for both damage and or corrosion, as well as component supports, missing or loose. This inspection shall occur from the roadway, the catwalk and the platform of the District's flush truck, allowing the inspector to physically touch the fixture and its components as spot checks and visual conditions dictate. This process occurs from the platform on top of the flush truck where an inspector will view a location, including tunnel ceiling and lighting, the flush truck will roll forward approximately 50' to 100' and the process will be reiterated for the length of the tunnel.

Critical Finding Guidance

If the fixture is hanging or sticking into the travel way envelope, report per the CBBT Policy for Reporting Critical Findings.

Emergency Lighting System (Element Number 10620)

There is one emergency lighting system for each half of the tunnel, resulting in two systems per tunnel. A system covers the emergency tunnel lighting fixtures, supports, raceways, wiring, sensors, conduits and control equipment.

Under emergency power, approximately every seventh tunnel lighting fixture provides the emergency lighting along the main portions of the tunnel from a UPS located in the respective ventilation building. One third of the tunnel lighting fixtures in each portal also provide lighting under emergency power.

Inspection Procedure

The functionality of this system is tested while the Emergency Power testing is underway. Inspectors must be in the tunnel roadway, as well as on the 5th floor of the Ventilation Building, to fully witness the Emergency Power start up and the subsequent switch over to Emergency Lighting in the Tunnel roadway.

There are no Emergency Exit Signs located in the ventilation buildings or in the tunnel. The East wall of each tunnel roadway does have signage containing distances to each portal that glow in the dark in case of an emergency. These signs are spaced every 80 feet.

The inspector shall rate the overall system condition for this element and whether or not the operational condition impacts the serviceability function for the element. Change of condition for prior documented defects and new defects shall be documented for each of the two systems associated with the tunnel being inspected.

Critical Finding Guidance

The failure of the entire emergency tunnel lighting system may be a critical finding and shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Emergency Lighting Fixture (Element Number 10621)

The fixtures of this component, which only includes roadway lighting for the tunnel, serve dual purpose as general lighting fixtures and emergency lighting fixtures. Per SNTI, fixtures that serve this dual purpose are only to be accounted for under the tunnel lighting fixture element above. Resultantly, this element consists of zero (0) fixtures.

Fire/Life Safety/Security Systems

Fire Detection System (Element Number 10650)

No automated fire detection system or sensors exists at either of the two tunnels.

Fire Protection System (Element Number 10700)

There are no automated fire protection systems in either of the two tunnels. There are two fire protection systems in each tunnel. One system consists of the fire extinguishers located in niches on the West and East walls throughout each tunnel, spaced at approximately 150-ft intervals. The other fire protection system consists of the fire suppression water standpipes in niches on the East wall also located at approximately 150-foot intervals along the tunnel bore.

These wet standpipes allow for direct hookup of fire hoses and opening of the hose valves in each niche. The hydrostatic tanks and booster pumps in #1 and #3 Island pump rooms are an integral part of this standpipe system.

Inspection Procedure

The District exercises the standpipe valves annually. Visual inspection for condition, corrosion and/or section loss shall be done as part of the roadway inspection occurring at night between 9PM and 6AM. Hydrostatic tanks and booster pumps in the #1 and #3 Island pumps rooms, shall be viewed for condition. Operator records can be viewed for runtime of these pumps.

During this night time lane closure, fire extinguishers will be spot checked to assure there is a positive charge and that the inspection tag is current. Fire extinguishers are also located on each floor in the ventilation buildings.

The inspector shall rate the overall system condition for this element and whether or not the operational condition impacts the serviceability function for the element. Change of condition for prior documented defects and new defects shall be documented for the system associated with the tunnel being inspected.

Critical Finding Guidance

The fire protection system has multiple redundancies; therefore, the failure of any single component is not a critical finding, but shall be reported as a priority repair recommendation. The failure of the complete fire protection system shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Emergency Communications System (Element Number 10750)

There are no components within the existing Thimble Channel or Chesapeake Channel Tunnels that serve to broadcast information as part of an Emergency Communication System. However, there are emergency telephones on the West wall of each tunnel at the sidewalk level, spaced at 300-ft intervals and also in the ventilation buildings. These connect directly to the CBBT South Plaza Control and allow for 2-way communication.

Inspection Procedure

Phones will be randomly spot checked for condition and functionality during the inspection. In the age of cell phones, these are rarely if ever utilized, however they are maintained in case cell phone coverage is disrupted during an incident.

Inspection shall entail spot checking the emergency telephones to verify functionality. The inspector shall rate the overall system condition for this element and whether or not the operational condition impacts the serviceability function for the element. Change of condition

for prior documented defects and new defects shall be documented for the system associated with the tunnel being inspected.

Critical Finding Guidance

There are no critical findings associated with this element.

Tunnel Operations and Security System (Element Number 10800)

There is one Tunnel Operations and Security System for each tunnel and associated components. This system consists of the CCTV cameras, telephones and radios. Cameras are located throughout the facility, located in the tunnel roadways, pump rooms, and on the ventilation buildings. Telephones and radios are located in all Control Rooms and District Offices. In addition, radios are installed in the majority of Maintenance Vehicles and all Police and Emergency Crew Member Vehicles. The SCADA system is also included under this system. The doors at the sidewalk level in the tunnel that lead to the ventilation buildings utilize keyed locks and the doors to the ventilation building at the portal island surface utilize swipe card access controls. Access to the areas near the ventilation buildings are controlled by security gates with swipe card access. These gates are viewed by CCTV cameras on top of the Ventilation Buildings.

The bulk of the cameras at CBBT are monitored real time 24/7. The remainder of the cameras are verified weekly by the Management Information Systems (MIS) Division. Radios are utilized daily with issues handled in real time. Traffic signals are monitored via the SCADA system and visually every week.

Inspection Procedure

The SCADA System, CCTV cameras, telephones, radios and other communication devices will be spot checked as part of the inspection for condition and functionality. The majority of these systems can be checked from the manned Control Room for the tunnel being inspected.

The inspector shall rate the overall system condition for this element and whether or not the operational condition impacts the serviceability function for the element. Change of condition for prior documented defects and new defects shall be documented.

Critical Finding

There are no critical findings associated with this element.

Signs

Traffic Signs (Element Number 10850)

Within each tunnel, there are lighted signs stating “Maintain Speed Up Grade” and “Keep Up Speed” on the opposite side of each sign. Flexible conduit is run to the lighted signs. There is also a sign indicating the mile marker. These signs are located on the West wall of each tunnel, over the cat walk.

Each open approach contains several signs. Proceeding downward in each open approach toward the tunnel, there is a sign indicating “Lane Use Signal”, which is mounted to the arm of a signal pole. Still in the direction towards the tunnel, there are also signs mounted to the adjacent open approach walls, indicating “Two Way Traffic” in the tunnel, “Do Not Pass In Tunnel” and a “Speed Limit 55”. Travelling up each open approach out of each tunnel, there is a “Keep Right” sign.

Flashing caution lights are mounted to the upper West wall at four locations within each tunnel and operate on a wig-wag lighting pattern when needed in the tunnels. This is included for reference only and not included in the count for Traffic Signs.

Inspection Procedure

Inspection for this element will focus on component supports. Missing or loose anchorage shall be documented. Failed anchorage resulting in an unstable traffic sign shall be immediately reported to the Director of Maintenance for assessment, repair and or removal. Change of condition from prior documented defects and new defects shall be recorded.

Critical Finding Guidance

Missing, deteriorated or broken connections that could imminently lead to a sign encroaching in the normal vehicle travel envelope may be a critical finding and shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Lane Signals (Element Number 10910)

There are 3 sets of lane signals facing in each direction over each lane within each open approach to Chesapeake Tunnel and 2 sets each direction for Thimble Tunnel. They indicate that traffic is one lane in each direction in the open approaches and in the tunnel.

These signals are mounted on main support arms and signal post arms.

Inspection Procedure

Inspection for this element will focus on component supports and operability of the signal. Missing or loose anchorage shall be documented. Failed connection hardware resulting in an unstable signal fixture and/or a nonfunctioning signal, shall be immediately reported to the Director of Maintenance for assessment, repair and/or removal. Change of condition from prior documented defects and new defects shall be recorded.

Critical Finding Guidance

Missing, deteriorated or broken connections that could imminently lead to a sign encroaching on the normal vehicle travel envelope may be a critical finding and should be immediately reported per the CBBT Policy for Reporting Critical Findings.

Lane Signal Fixtures (Element Number 10911)

The lane signal fixtures mentioned above, total 20 between the two tunnels. The fixture connection to the main support arm is considered part of this element and will be inspected.

Inspection Procedure

Inspection for this element will focus on component supports, corrosion of the fixture and condition of the enclosure housing. Missing or loose anchorage shall be documented. Failed connection hardware resulting in an unstable signal fixture and/or an enclosure housing that contains holes, shall be immediately reported to the Director of Maintenance for assessment, repair and/or removal. Change of condition from prior documented defects and new defects shall be recorded.

Critical Finding Guidance

Missing, deteriorated or broken connections that could imminently lead to a sign encroaching on the normal vehicle travel envelope may be a critical finding and shall be immediately reported per the CBBT Policy for Reporting Critical Findings.

Protective Systems

Steel Corrosion Protective Coating (Element Number 10950)

Steel pedestrian railing throughout the length of each tunnel is protected by a steel protective coating. This is the only steel coating currently associated with the District's tunnels.

Inspection Procedure

This element shall be visibly inspected for failure such as peeling bubbling and cracking, as well as the overall effectiveness for protecting the pedestrian railing. Change of condition from prior documented defects and new defects shall be documented.

Critical Finding Guidance

There are no critical findings associated with this element.

APPENDIX A

CBBT Policy for Reporting Critical Findings

CBBT Policy for Reporting Critical Findings 9/18/2023

The purpose of this policy is to meet the following requirements:

- The National Tunnel Inspection Standards (NTIS), Page 41350, states, “Owners are required to notify FHWA within 24 hours of identifying a critical finding and the actions taken to resolve the matter.”
- The Tunnel Operations, Maintenance, Inspection, and Evaluation (TOMIE) Manual, Chapter 4, Page 95, states, “The owner is required to establish a procedure to ensure that critical findings are addressed in a timely manner.”

A Critical Finding, as defined in Federal Code, 23 CFR 650.305, is a structural or safety related deficiency that requires immediate action to ensure public safety.

When a potential Critical Finding is discovered, whether during an inspection process by third party inspectors or by internal personnel performing day to day duties, it will be reported immediately via phone call to:

- The Director of Maintenance, cell (757) 642-6883, or
- The Deputy Executive Director of Infrastructure, cell (757) 350-0975

The Deputy Executive Director of Infrastructure will be responsible for determining if the reported finding is critical. Once the determination has been made, the finding will be immediately reported to the Executive Director. The Director of Maintenance shall report the finding to the following entities within 24 hours:

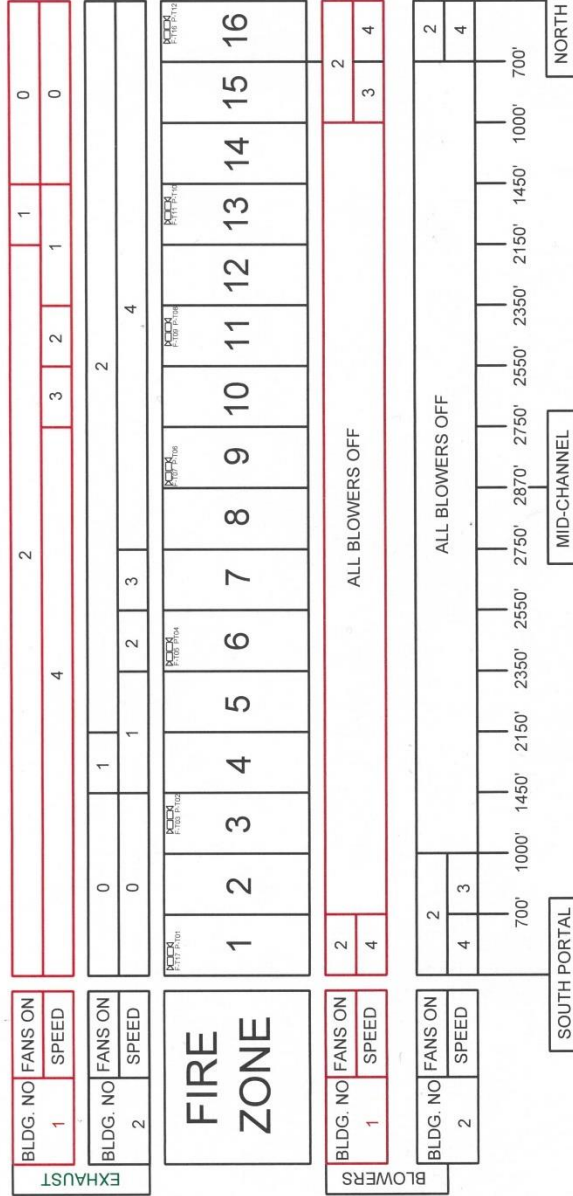
- Virginia Department of Transportation
 - Program Manager, Ancillary Structure & Tunnel Inspection
Structure & Bridge Division
804-786-6172 Office
804-338-0332 Mobile
lee.godsey@vdot.virginia.gov
- Federal Highway Administration
 - Division Bridge Engineer
Federal Highway Administration Virginia Division
400 North 8th Street, Suite 750
Richmond, VA 23219
VAdivisionStructures@dot.gov

Communication will include how the finding will be mitigated, what steps are being taken until the mitigation can be performed, when the mitigation is planned and reporting after the mitigation has been successfully completed.

APPENDIX B

CBBT Tunnel Fire Fan Procedure

TUNNEL FIRE FAN PROCEDURE



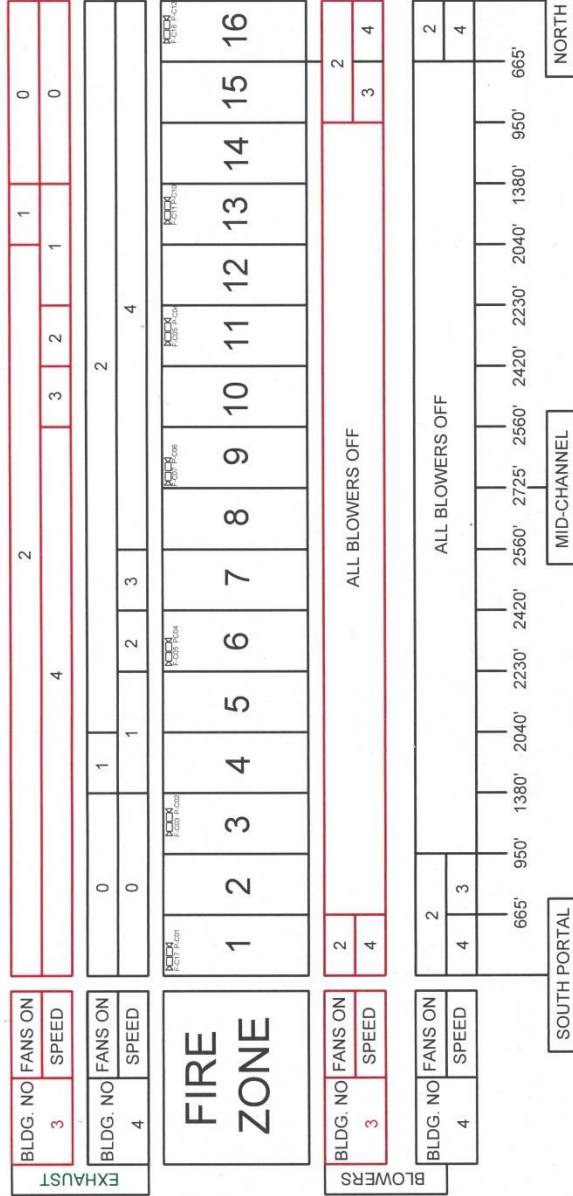
COMMONWEALTH OF VIRGINIA
 DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE
 DIVISION OF HIGHWAYS
 CHECKED BY: DATE: 12-1-18
 APPROVED BY: DATE: 12-1-18
 SECTION NO. 1 of 2

150' SPACING 39 LOCATIONS ON WEST WALL / EAST WALL
 300' SPACING 20 LOCATIONS ON WEST WALL
 150' SPACING 39 LOCATIONS ON EAST WALL

NO.	DATE	BY	DESCRIPTION

FIRE FAN PROCEDURE
 THIMBLE TUNNEL
 APPROVED: _____
 SECTION NO. _____

TUNNEL FIRE FAN PROCEDURE



- 150' SPACING 37 LOCATIONS ON WEST WALL / EAST WALL
- 300' SPACING 19 LOCATIONS ON WEST WALL
- 150' SPACING 37 LOCATIONS ON EAST WALL

COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
CAPE CHARLES, VIRGINIA 23010-5111

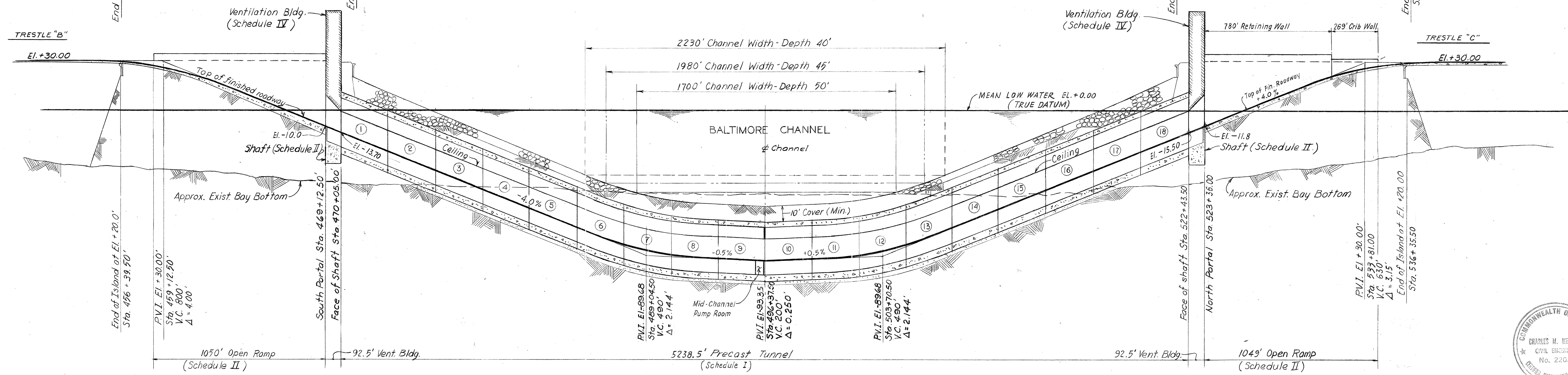
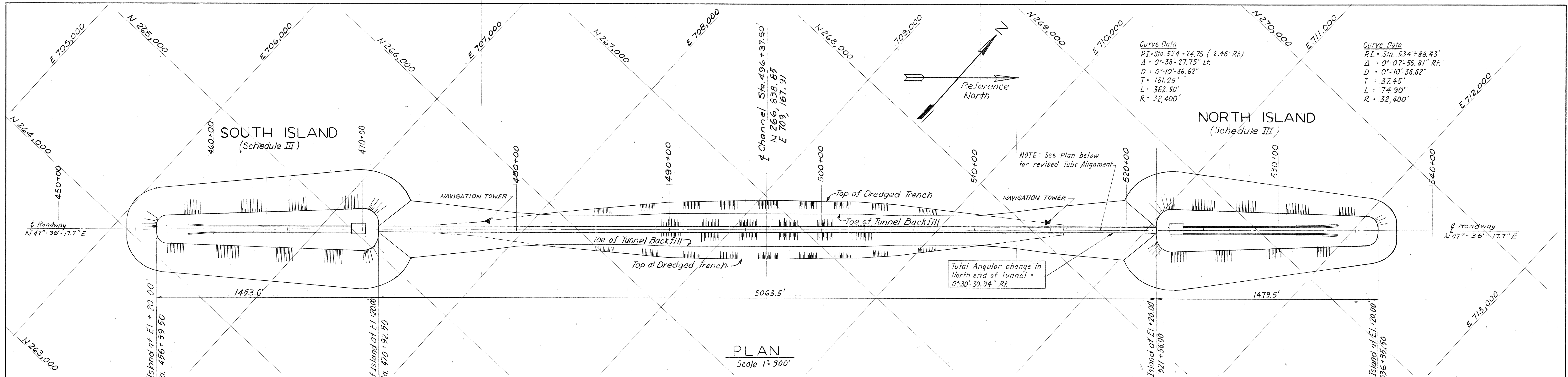
FIRE FAN PROCEDURE
CHESAPEAKE TUNNEL

OWNER: VTS SCALE: NTS
CHECKED BY: MTC DATE: 01-23-17
DWG. NO. 2 of 2
SECTION NO.

NO. DATE BY APP. DESCRIPTION

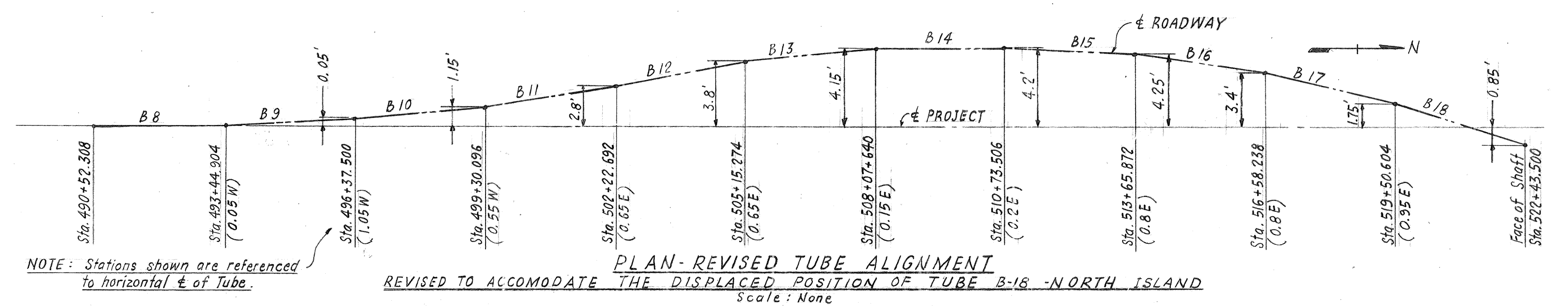
APPENDIX C

CBBT Tunnel Reference Drawings



- REFERENCES**
- For Low Level Trestle Plan and Profile, see Dwg. #3, Section LT-1.

- NOTES:**
- Coordinates and bearings shown are based on a plane rectangular coordinate system, which coincides with the Virginia State Coordinate System (South Zone) at one point only, that point being at Station 217+75.00 along a project with the bearing at that point being N16°-51'-17.7"E.
 - All elevations are referred to Mean Low Water Elevation 0.00 which is 1.40' below Mean Sea Level.
 - The Baltimore Channel Tunnel-North Island has been revised to accommodate the displaced position of Tube B-18.



MSL	DATE	REVISION
6	9-22-64	AS BUILT
G.C.	5	27 JULY 64 - AS BUILT
1/ST	4	3-15-63 REV. NORTH ISLAND PLAN & NOTE NO. 2
1/ST	3	3-1-63 REVISED NORTH ISLAND PLAN & PROFILE
FR	2	Feb 15, 1962 General Revision
1	Nov. 22, 1960	
APPR. NO.		REVISION

COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
NORFOLK 1, VIRGINIA

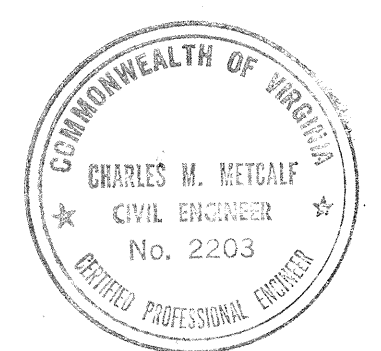
SVERDRUP & PARCEL, CONSULTING ENGINEERS
NEW YORK, N. Y. - ST. LOUIS, MO. - NORFOLK, VA.

CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING
BALTIMORE CHANNEL TUNNEL
PLAN AND PROFILE

RECOMMENDED: *F. C. Lowry*

APPROVED: *C. M. [Signature]*

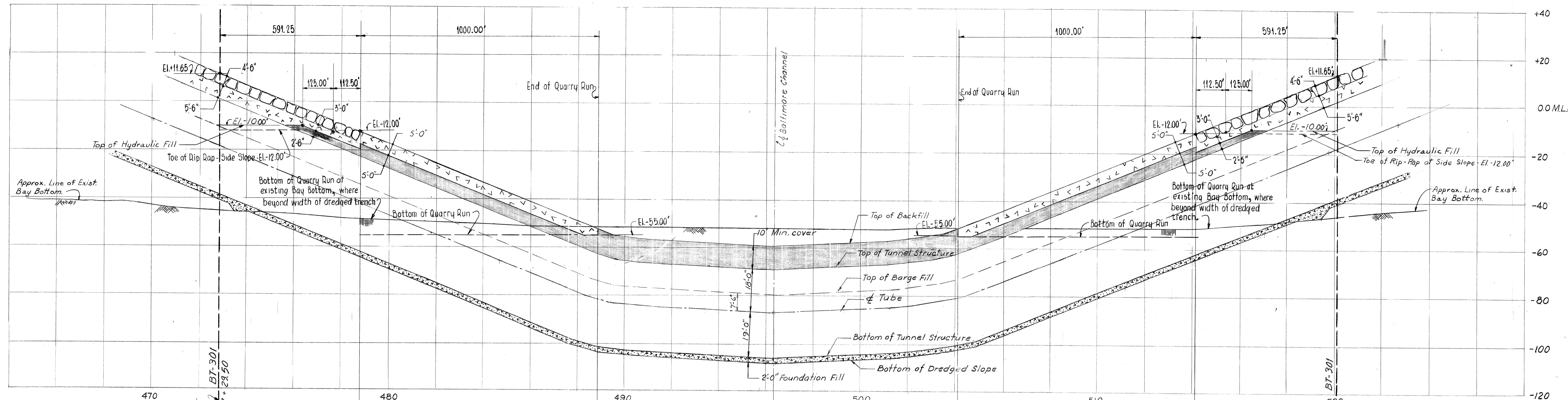
DRAWN BY: JAR SCALE: AS SHOWN
CHECKED BY: [Signature] DATE: 10-18-60
DWG. NO. B-2
SECTION NO. BC-1



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GON27

DO NOT SCALE THIS DRAWING. FOLLOW DIMENSIONS.

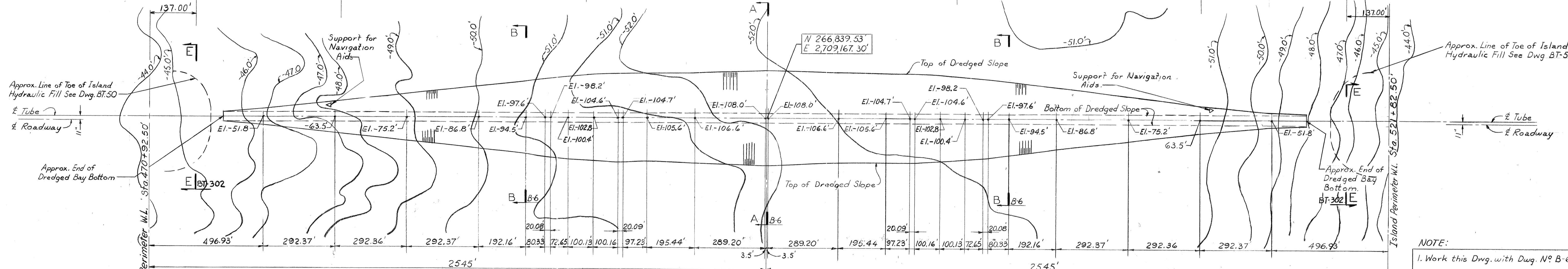
AS BUILT



DREDGING & BACKFILL PROFILE
 SCALE: 1" = 200'-0" HORIZ.
 1" = 20'-0" VERT.

LEGEND	
HEAVY RIP RAP	
QUARRY RUN ROCK TYPE A	
FOUNDATION FILL	
HYDRAULIC FILL	

For Tunnel Protection at Island See Dwg. N° BT-301 & BT-302
 See Drawing BT-30
 Limits of Section B-B
 Limits of Section A-A
 Limits of Section B-B
 See Drawing BT-30
 For Tunnel Protection at Island See Dwg. N° BT-301 & BT-302



REFERENCE DRAWINGS

1. HYDROGRAPHIC SURVEYS - SOUTH HALF BALTIMORE TUNNEL (DATE 1-25-61) SH. N° 1 of 2
2. " " " " NORTH " " (DATE 3-1-61) SH. N° 2 of 2
3. ARTIFICIAL PORTAL ISLANDS - TYPICAL PROTECT DETAILS BT-300
4. " " " " " " - PROTECT. DET. OVER TUBES - PLAN - BT-301
5. " " " " " " - SECT. - BT-302
6. TUBE PROTECTION ADJOINING ISLANDS BT-30

COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
 NORFOLK 1, VIRGINIA

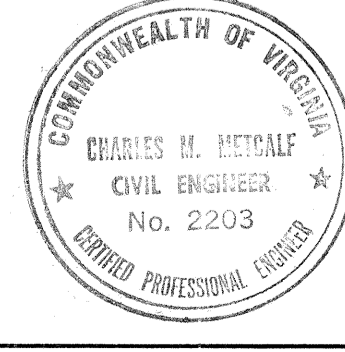
SVERDRUP & PARCEL, CONSULTING ENGINEERS
 NEW YORK, N. Y. - ST. LOUIS, MO. - NORFOLK, VA.

CHESAPEAKE BAY BRIDGE - TUNNEL CROSSING
 BALTIMORE CHANNEL - TUNNEL
 DREDGING & BACKFILL PLAN & PROFILE
 SHEET NO 1

RECOMMENDED:	DRAWN BY: A.F.P.	SCALE: As shown
7c Lowy	CHECKED BY: G.C.	DATE: 3-14-61
APPROVED:	DWG. NO. B-5	
C. M. Metcalf	SECTION NO. BC-1	

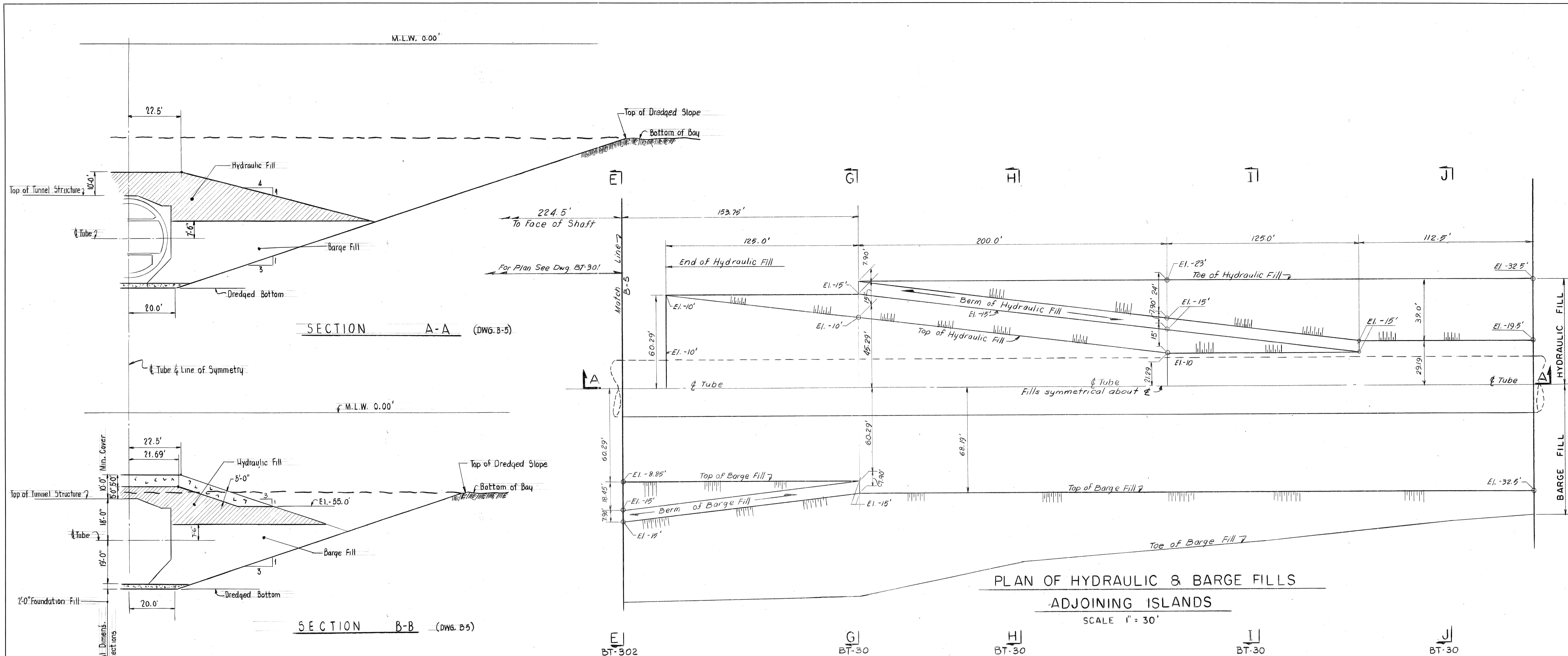
DREDGING PLAN
 SCALE: 1" = 200'-0"

ALL ELEVATIONS ARE REFERRED TO MEAN LOW WATER (EL. 0.00) WHICH IS 1.4 BELOW U.S.C. & G.S. SEA LEVEL DATUM

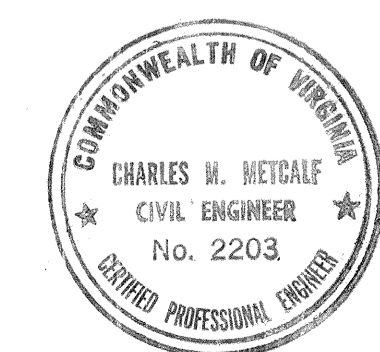


APPR. NO.	REVISION
7c	Jun 18, 62

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 GIN 30



1555
GIN 31

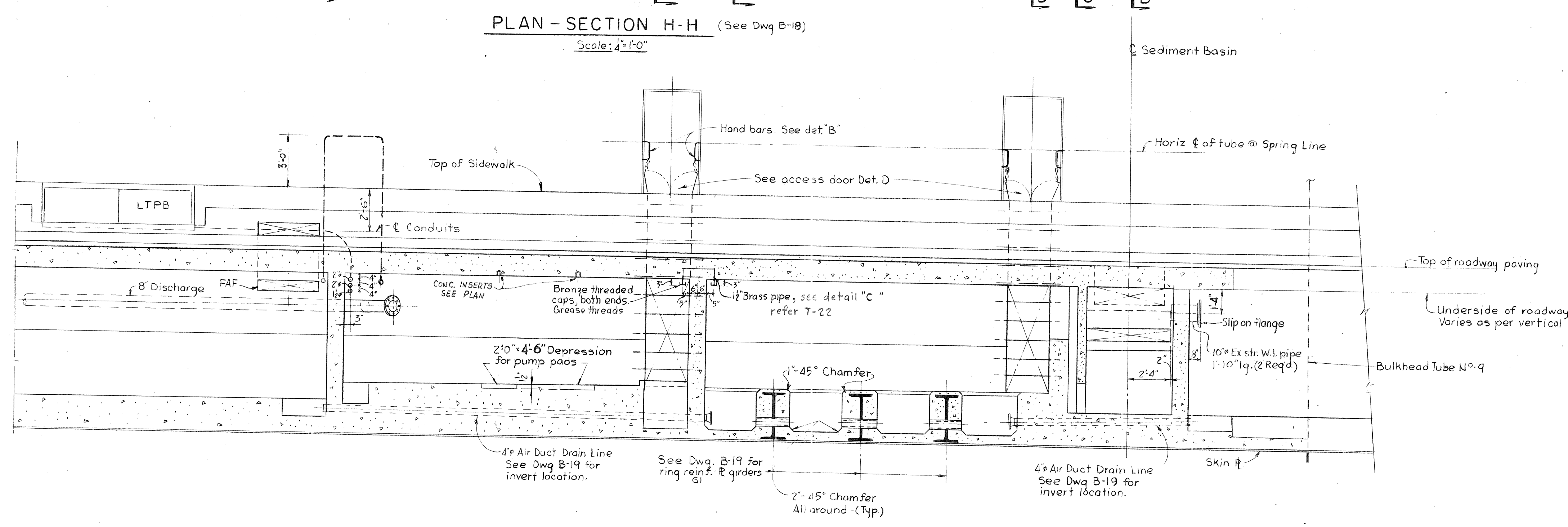
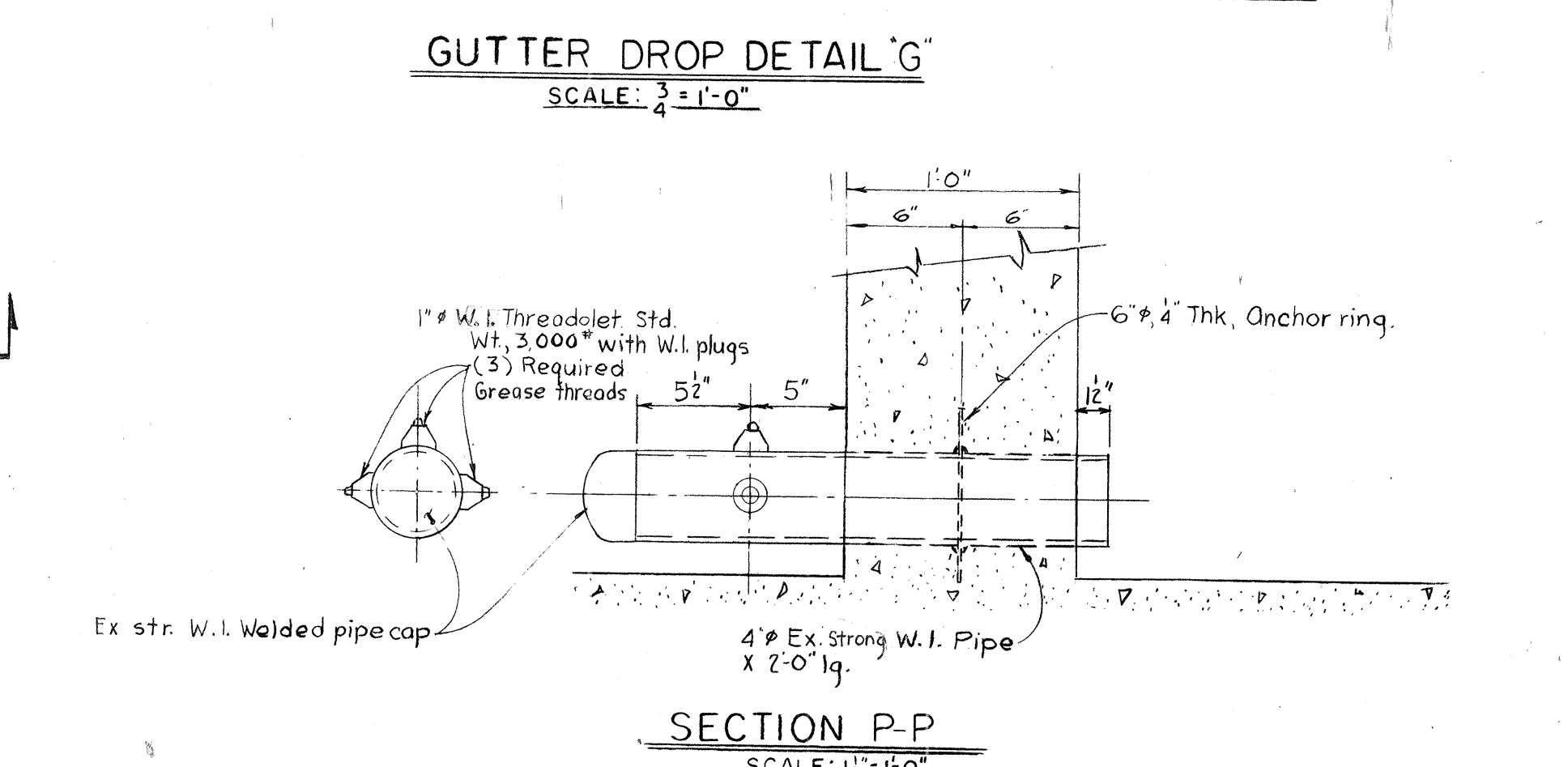
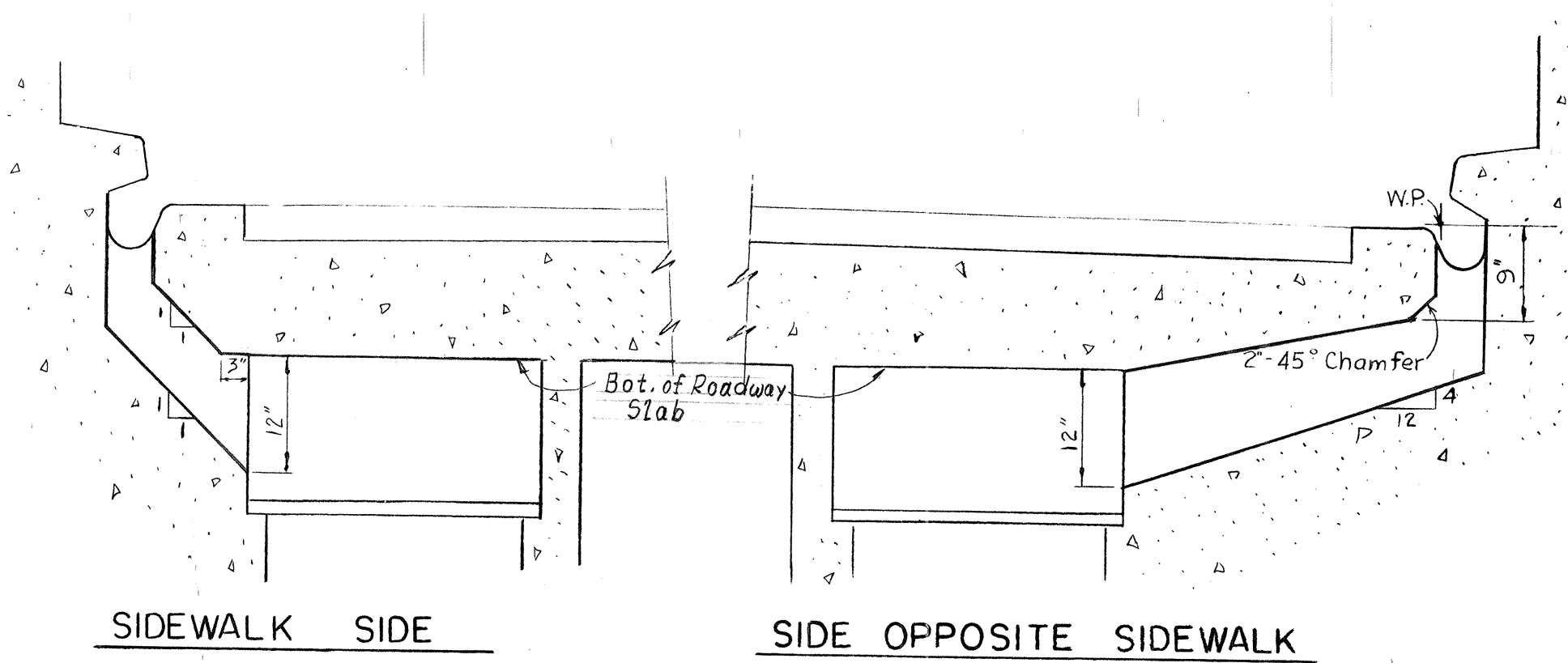
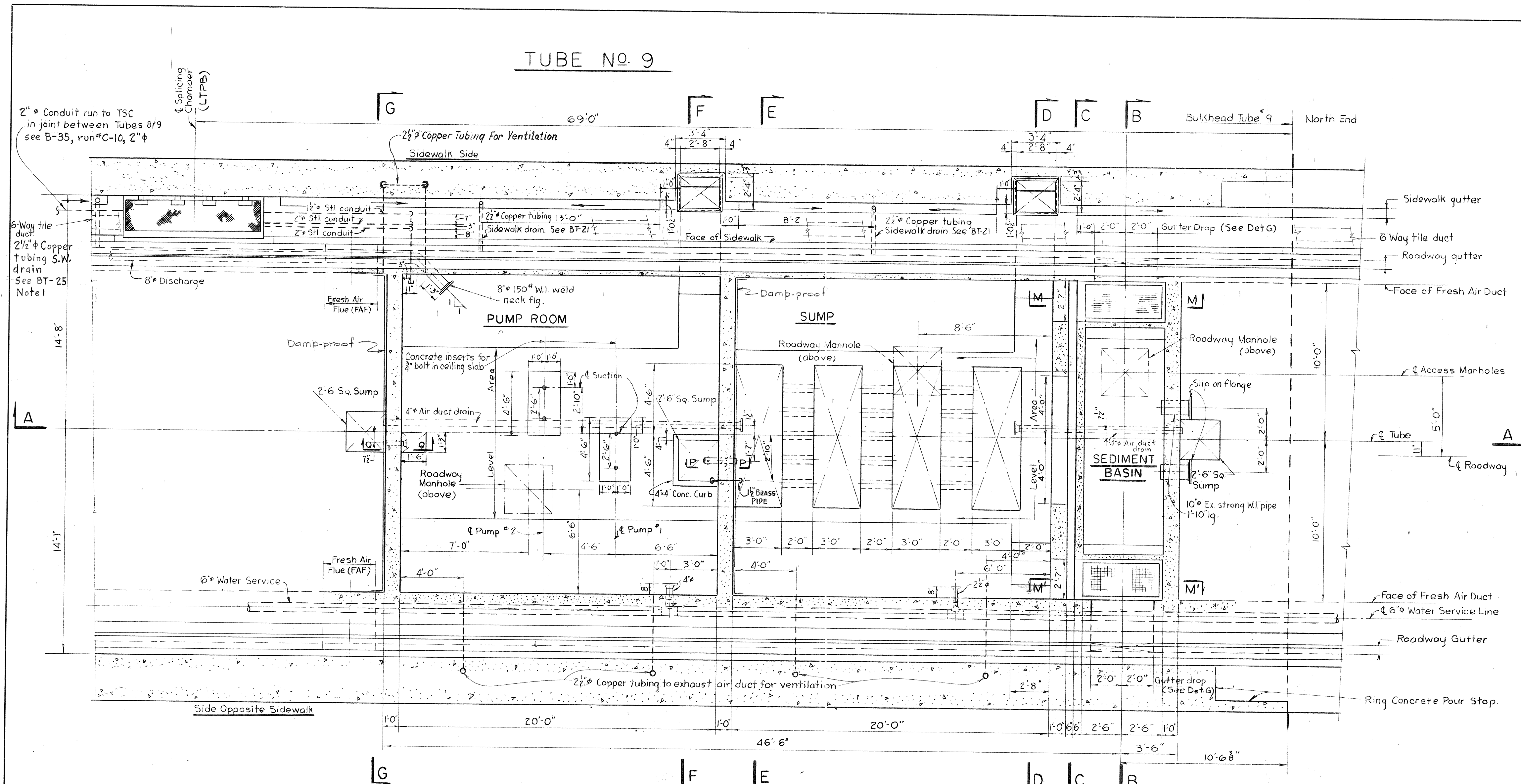


APPR. NO.	REVISION
1	Jun 18 '62 (Added Plan)

RECOMMENDED:
F. C. Long

APPROVED:
John H. ...

DRAWN BY: G.C.
CHECKED BY: L.F.D.
DWG. NO. B-6
SCALE: 1" = 20'-0"
DATE: 3-14-61
SECTION NO. BC-1



- REFERENCE DRAWINGS
1. INTERIOR DETAILS-PLANS & SECTS. - TUBES #9 & 10 --- B-12
 2. MID-CHANNEL SUMP & PUMP CHAMBERS SECTIONS & DETAILS SH#2 --- B-18.
 3. MID-CHANNEL SUMP & PUMP CHAMBERS TUBE REINFORCING SH#3 --- B-19
 4. MID-CHANNEL SUMP & PUMP CHAMBERS TUBE REINFORCING SH#4 --- B-20
 5. MECHANICAL INSTALLATION PUMPING AT MID-CHANNEL --- BT-454
 6. CONCRETE RING REINFORCEMENT --- BT-455
 7. TYPICAL CROSS-SECTION-LOWER HALF --- BT-12
 8. TYPICAL CROSS-SECTION-UPPER HALF --- BT-21



COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
 NORFOLK 1, VIRGINIA

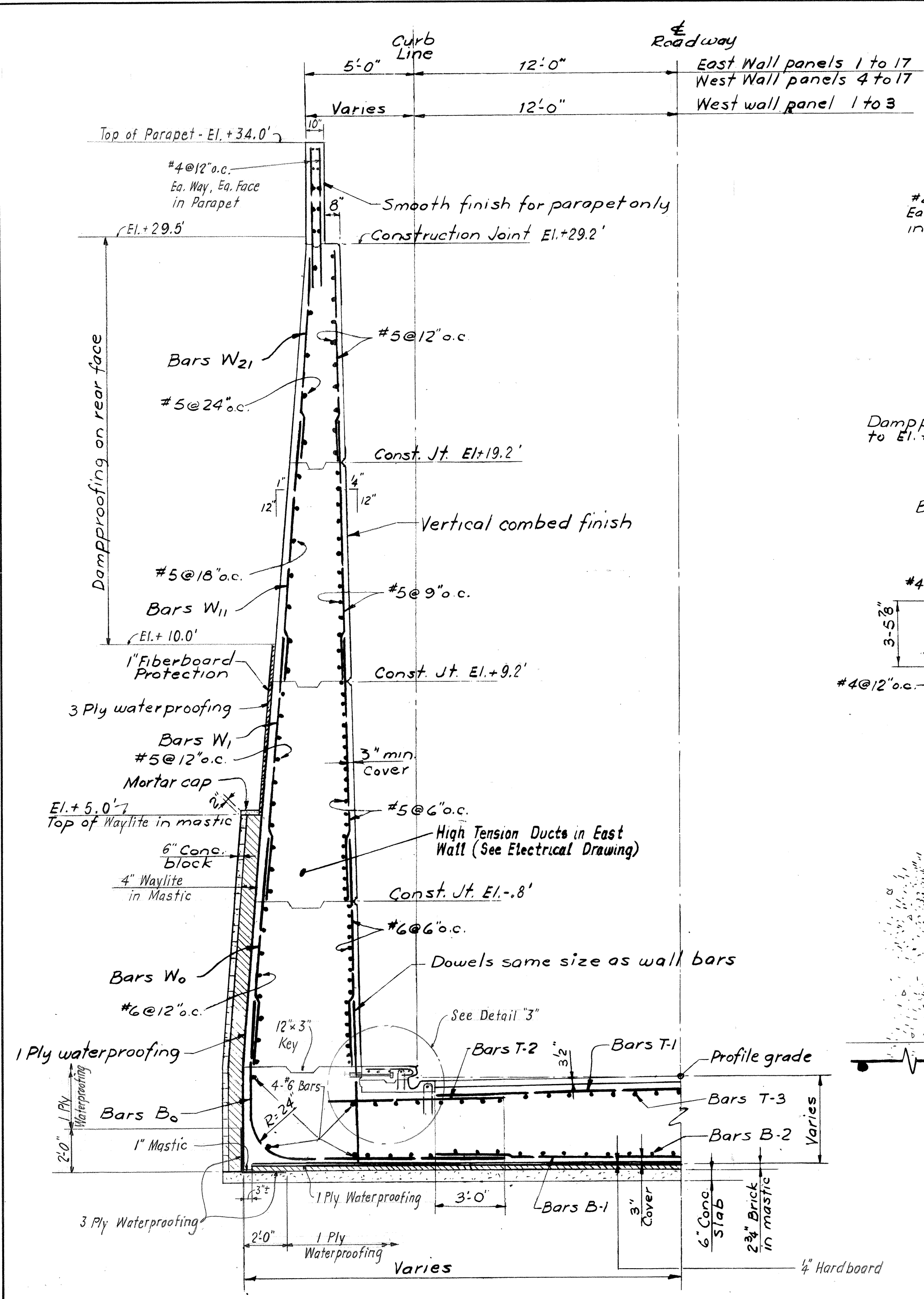
SVERDRUP & PARCEL, CONSULTING ENGINEERS
 NEW YORK, N. Y. - ST. LOUIS, MO. - NORFOLK, VA.

CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING
 BALTIMORE CHANNEL TUNNEL
 MID CHANNEL SUMP & PUMP CHAMBERS
 PLAN, SECTIONS & DETAILS. SH.#1

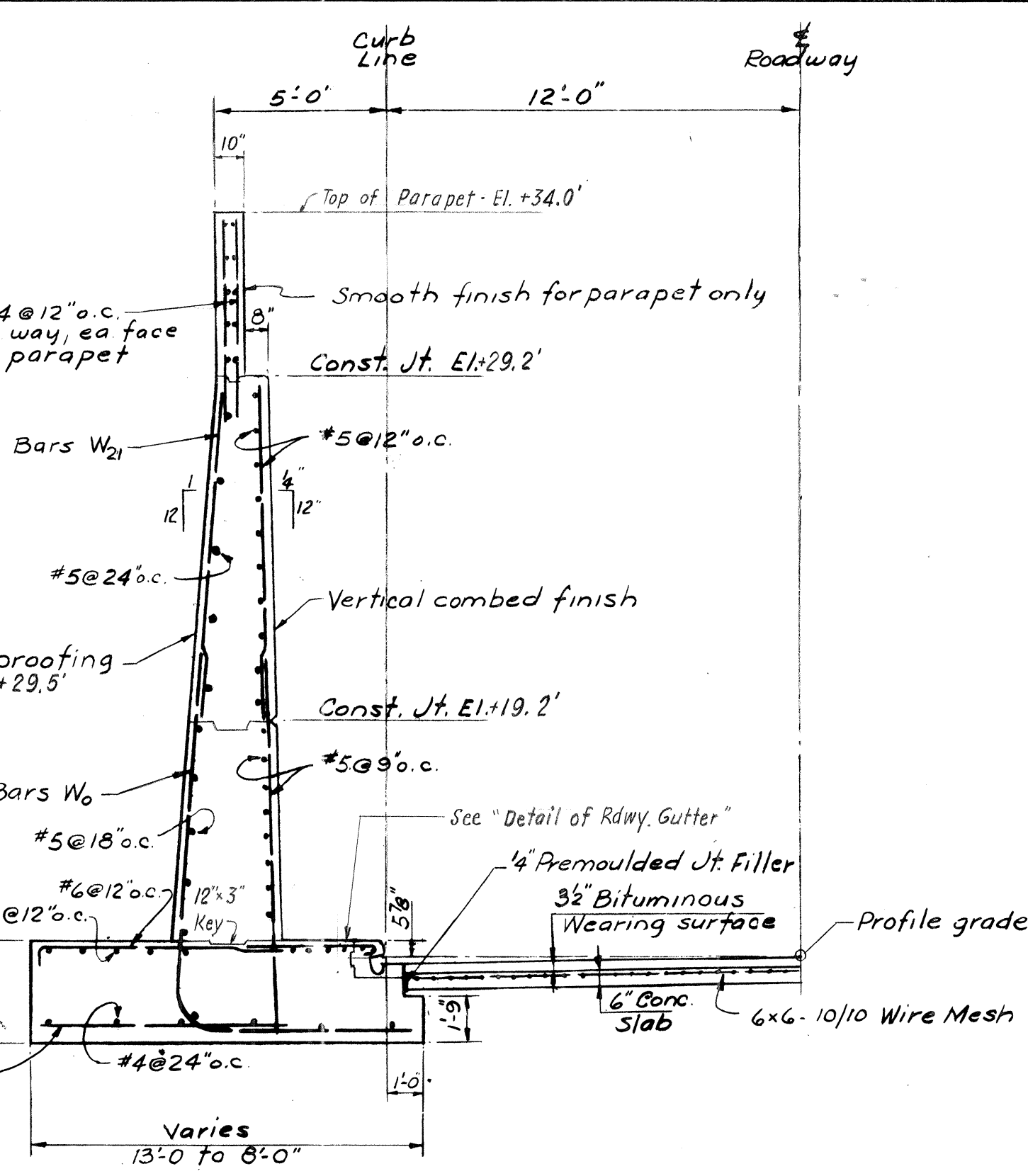
RECOMMENDED:	<i>F. C. Lowry</i>	DRAWN BY: JAR	SCALE: AS NOTED
APPROVED:	<i>Ch. Metzels</i>	CHECKED BY: G.C.	DATE: 2-17-61
B.O. 3	27 JULY 64-AS BUILT	DWG. NO. B-17	
REV. 2	3-25-63 REV. REL. DWGS. BALTIM. TUNNEL SECT. H-H		
REV. 1	MAY 4, 1961		
APPR. NO.	REVISION		

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G.N.41

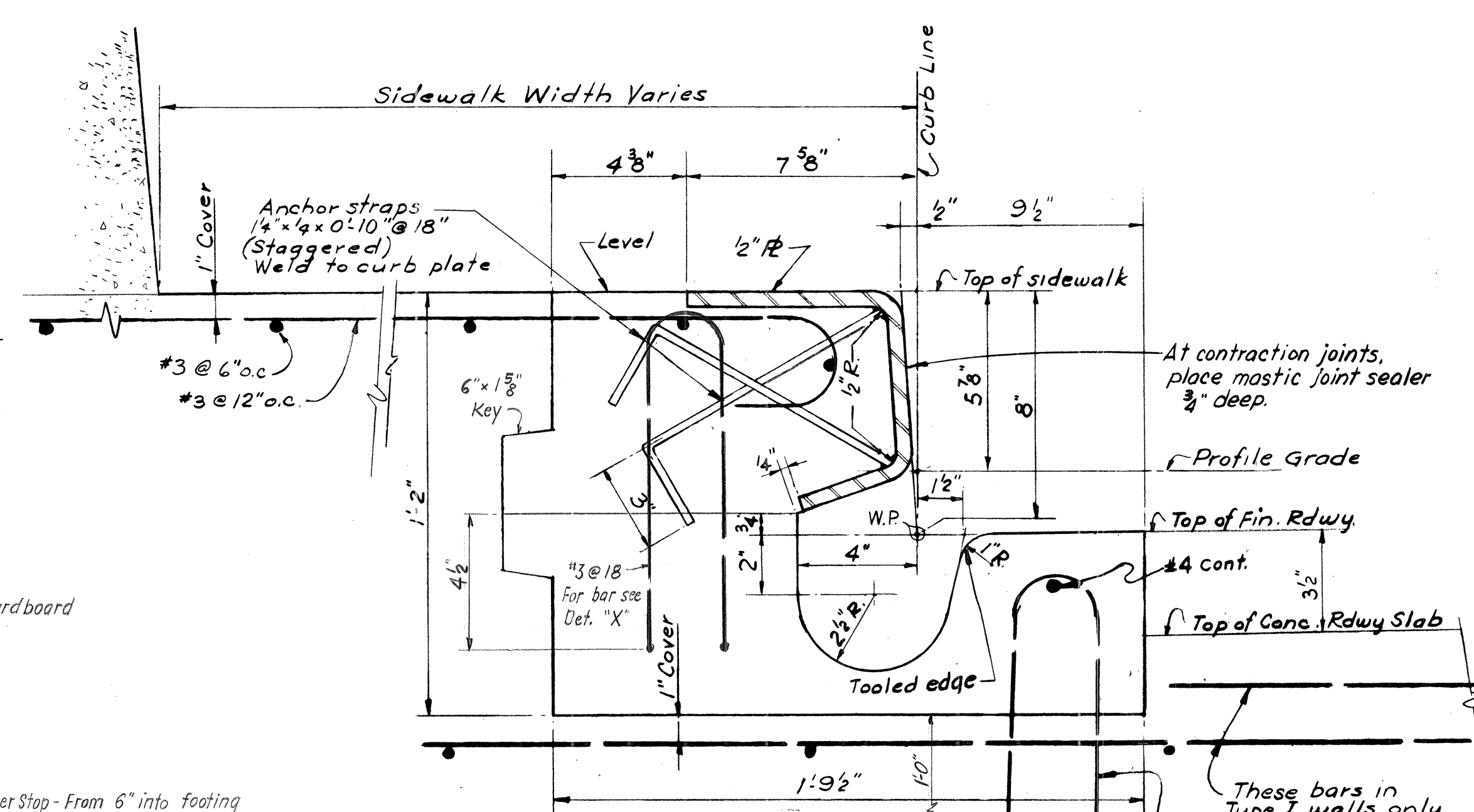
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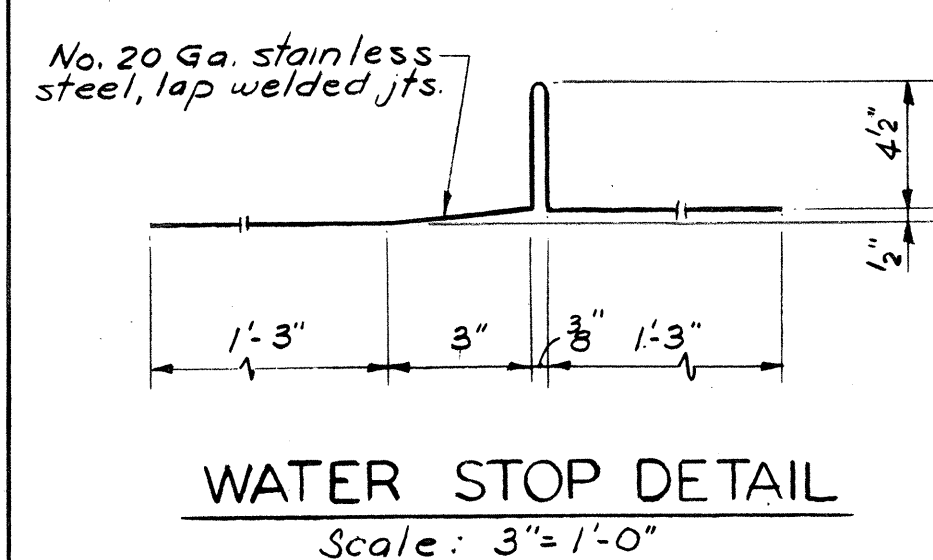
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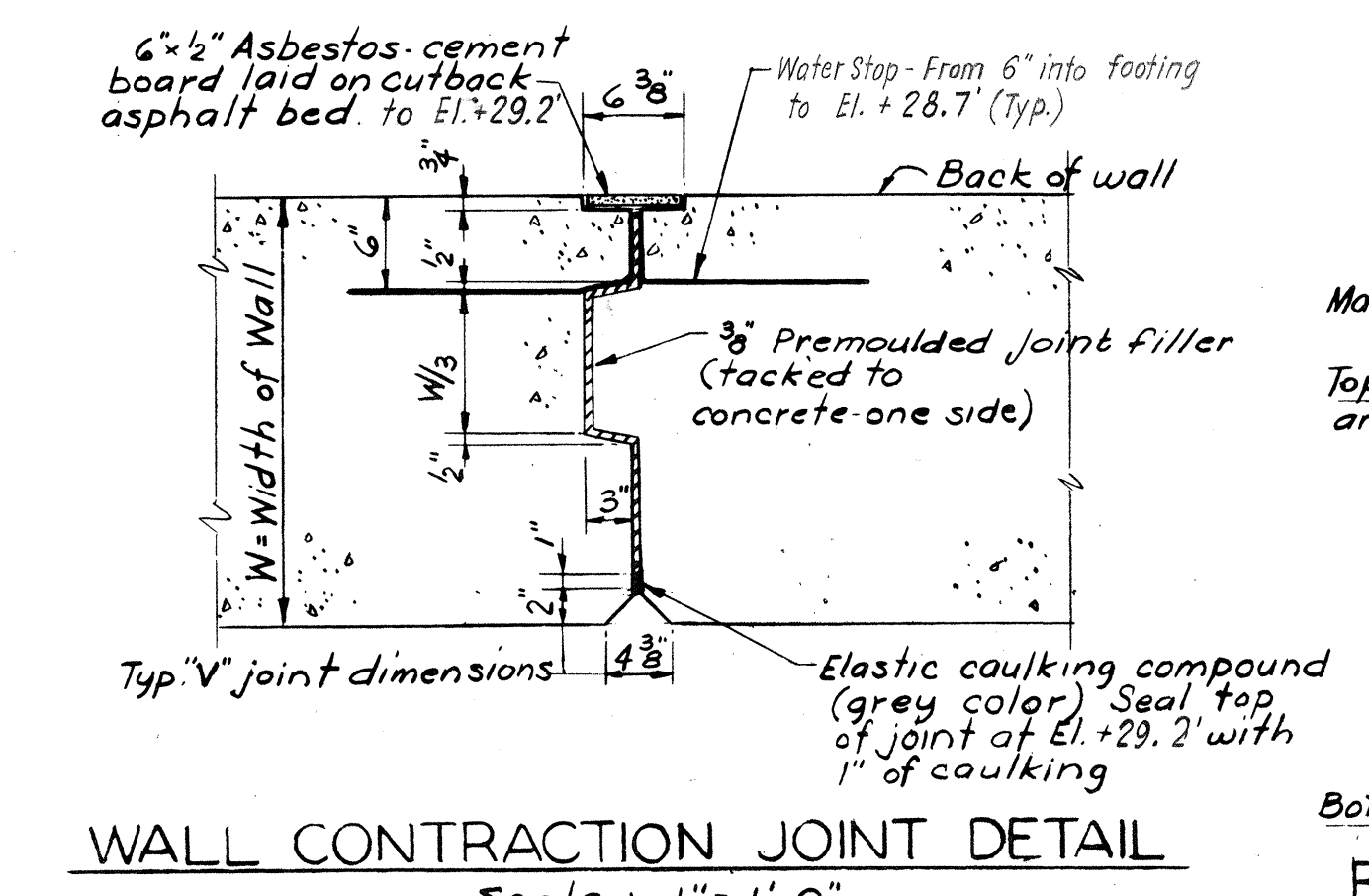
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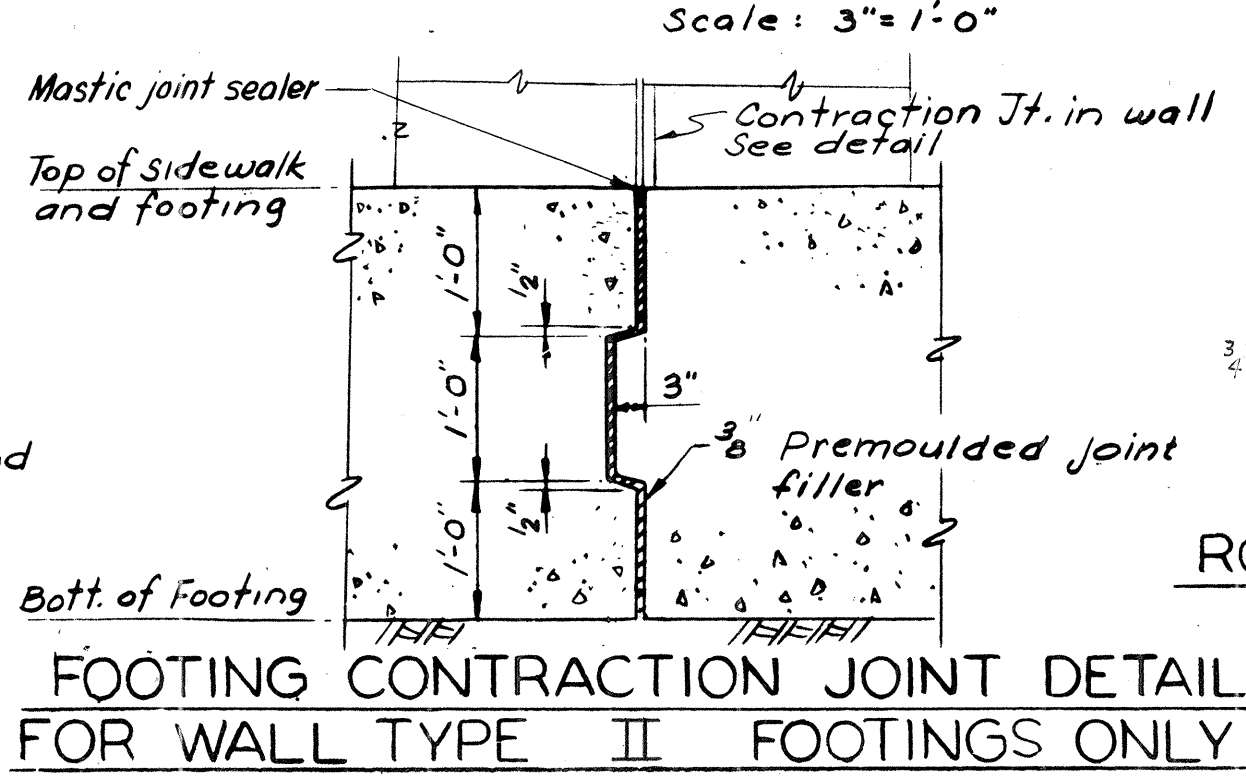
DETAIL OF ROADWAY GUTTER
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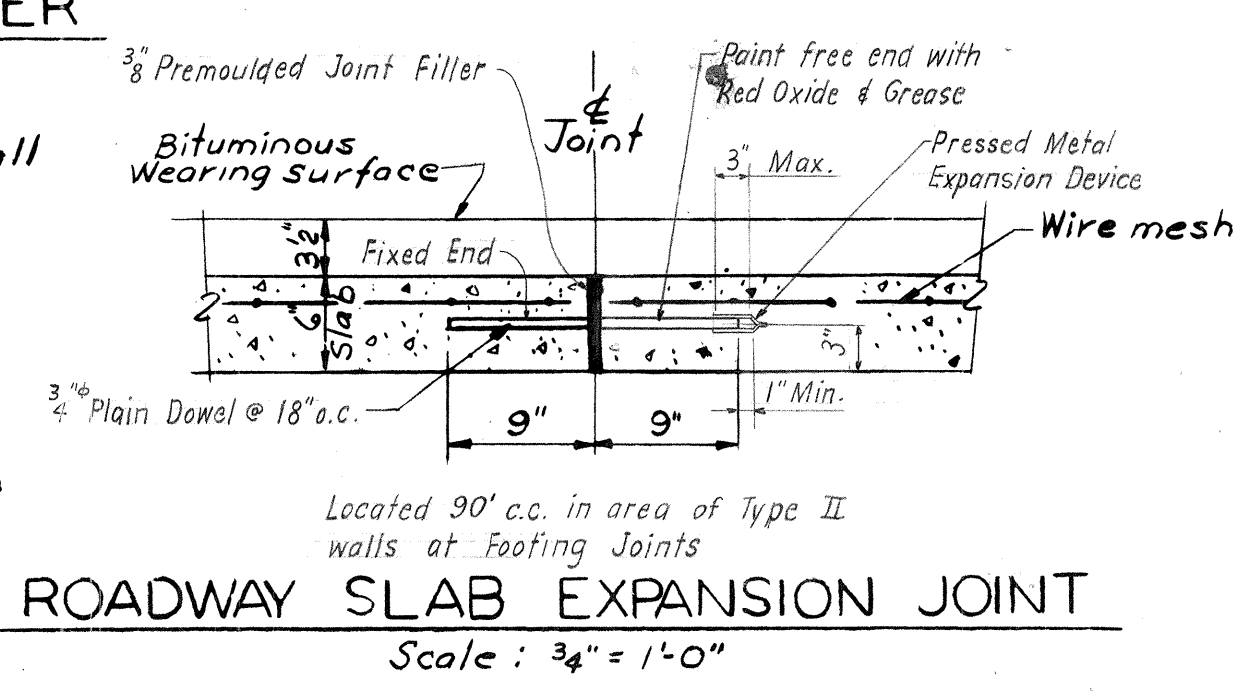
WATER STOP DETAIL
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WALL CONTRACTION JOINT DETAIL
Scale: 1"=1'-0"



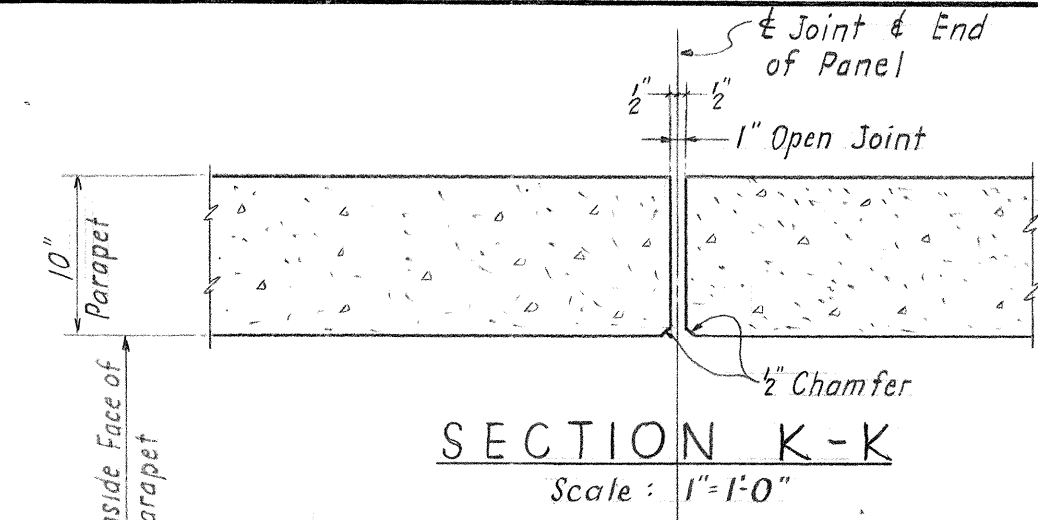
FOOTING CONTRACTION JOINT DETAIL
FOR WALL TYPE II FOOTINGS ONLY
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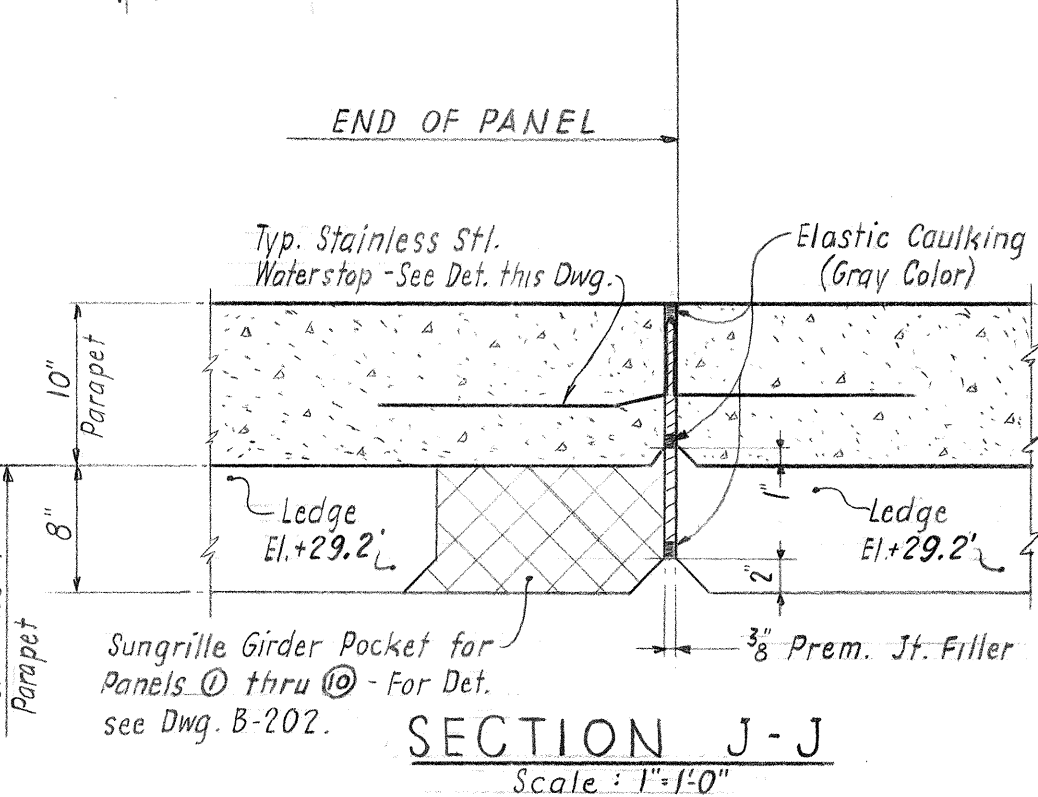
ROADWAY SLAB EXPANSION JOINT
Scale: 3/4"=1'-0"

WALL TYPE II		
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19	#5@12"	#8@12"
20	#5@12"	#8@12"
21	#5@12"	#7@12"
22	#5@12"	#7@12"
23	#5@12"	#6@12"
24	#5@12"	#6@12"
25	#5@12"	#6@12"
26	#5@12"	#6@12"

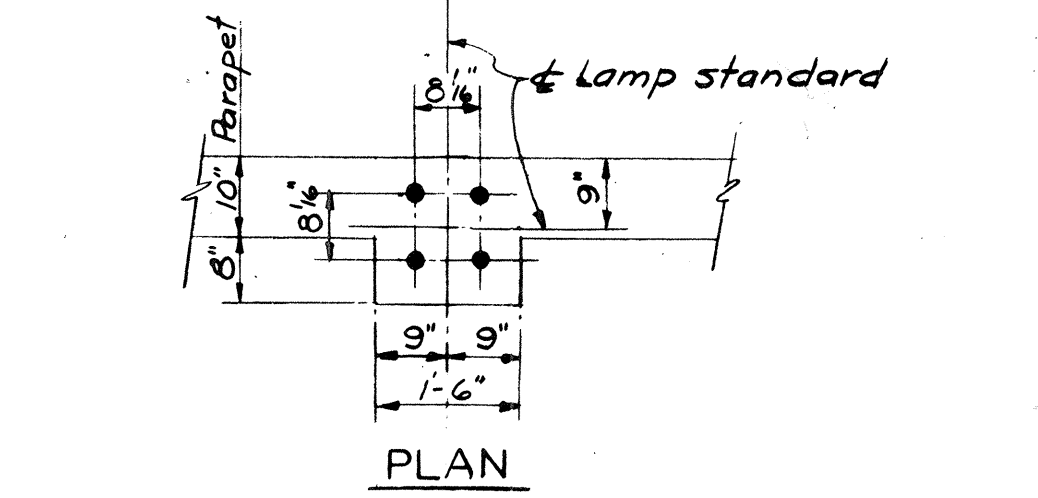
NOTE
For Bar Schedule Type I
Wall see Dwg. B-203



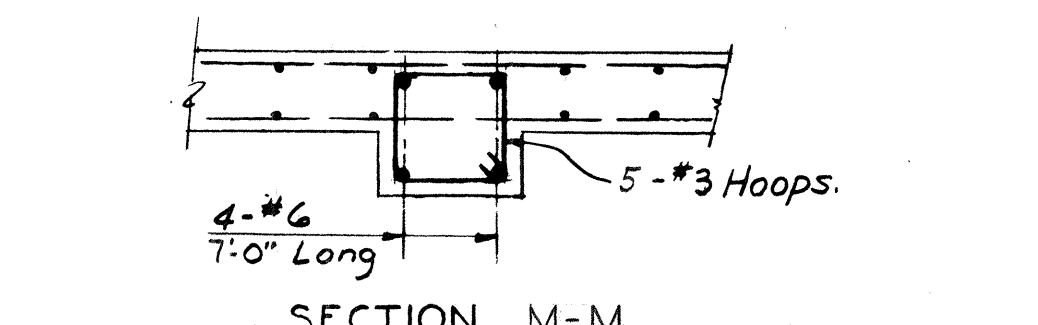
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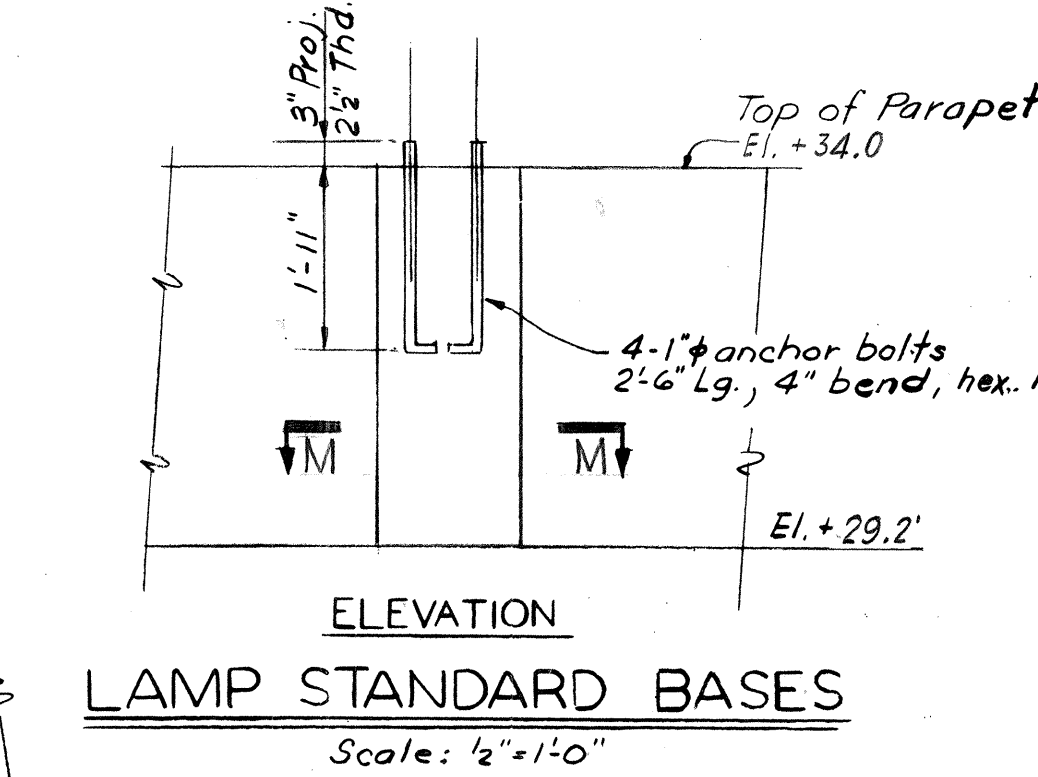
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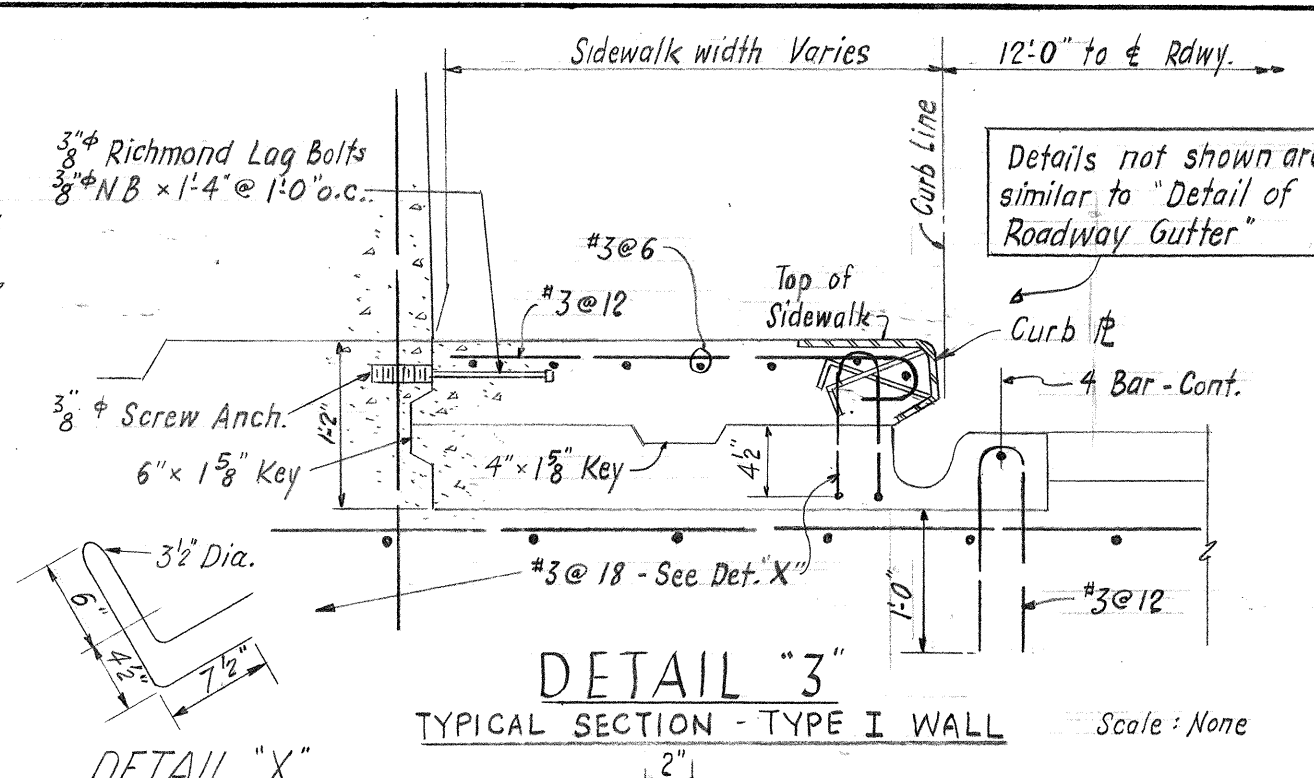
PLAN



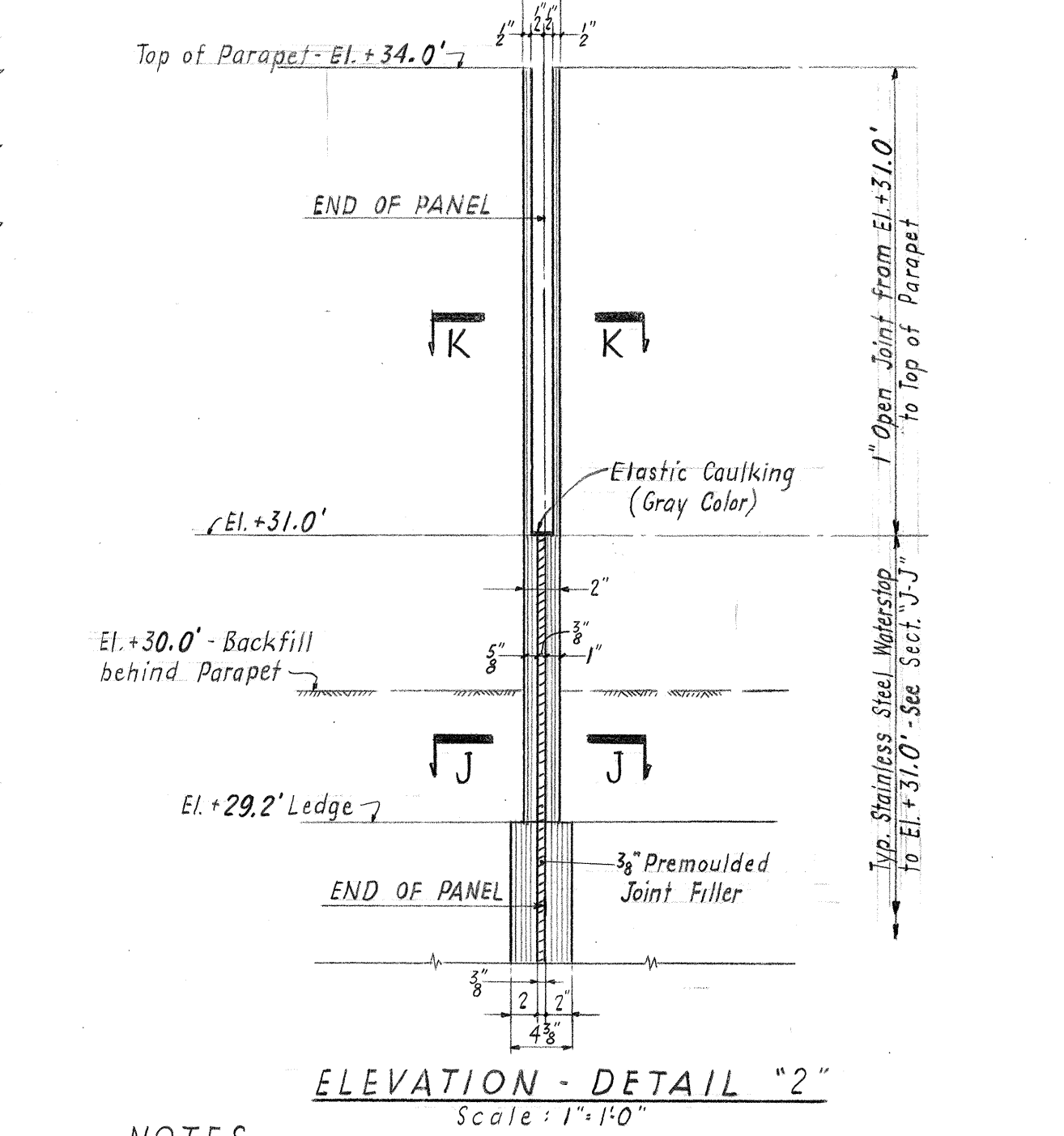
SECTION M-M



ELEVATION
LAMP STANDARD BASES
Scale: 1/2"=1'-0"



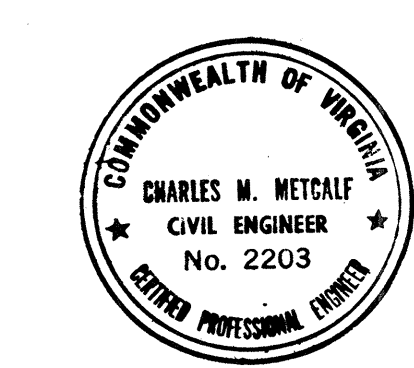
DETAIL "3"
TYPICAL SECTION - TYPE I WALL
Scale: None



ELEVATION - DETAIL "2"
Scale: 1"=1'-0"

- NOTES
- For extent of wall types see Dwg. B-202, B-203, B-204.
 - For Bar schedule Type I Wall see Dwg. B-203.
 - Elevations shown refer to revised datum Elevation for North Island - Baltimore Channel.
 - The Baltimore Channel Tunnel North Ramp has been revised to accommodate the displaced position of Tube B-18.
 - For Baltimore Channel Tunnel - North Island use Dwg. B-306 thru B-308.
 - For Roadway Alignment see Dwg. B-306.

WORK THIS DWG. WITH DWGS. B-200
B-202, B-203, B-204 & B-306



COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
NORFOLK 1, VIRGINIA

SVERDRUP & PARCEL, CONSULTING ENGINEERS
NEW YORK, N. Y. - ST. LOUIS, MO. - NORFOLK, VA.

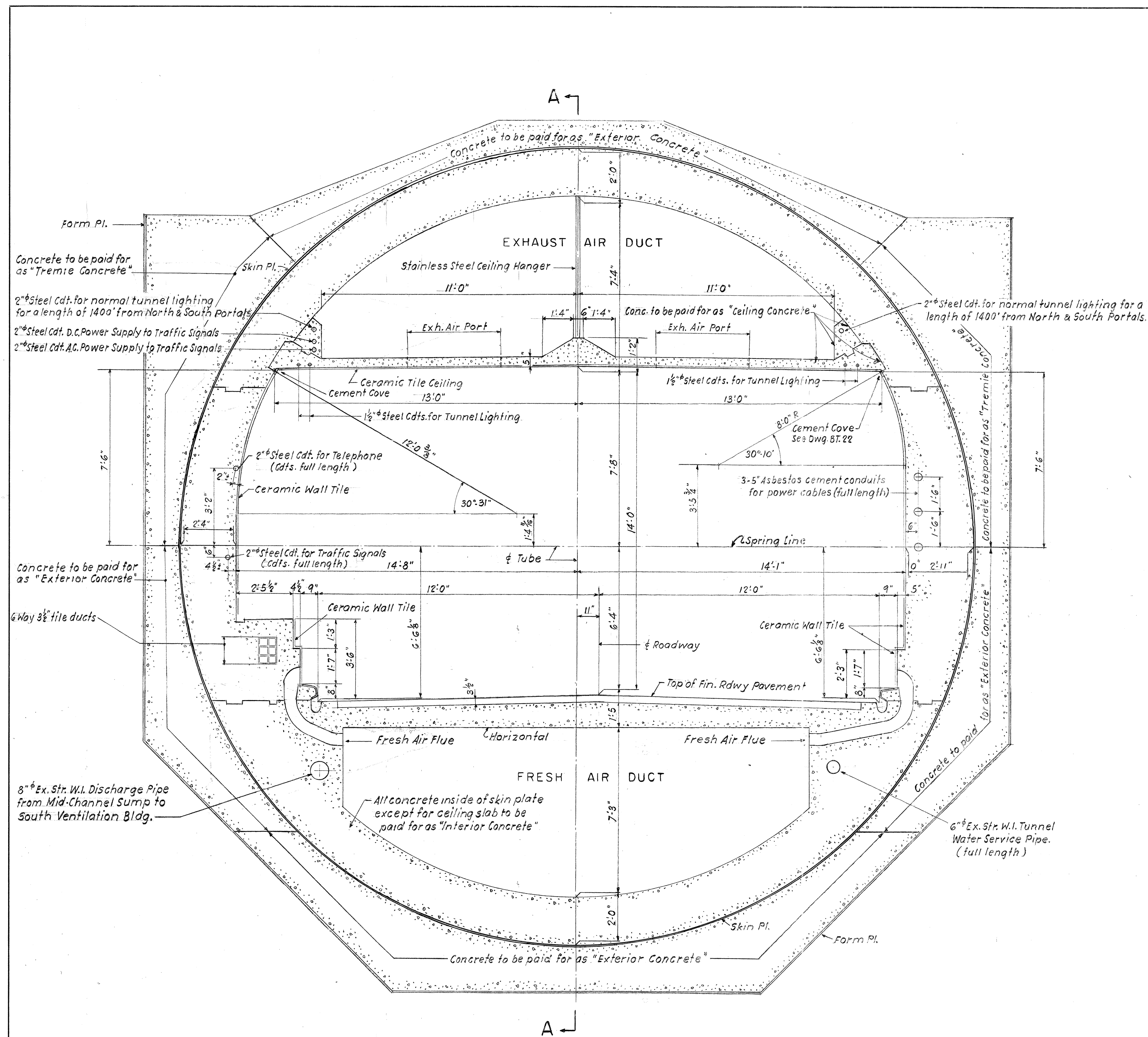
CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING
BALTIMORE CHANNEL TUNNEL
NORTH APPROACH RAMP
DETAILS

RECOMMENDED:	FC Ruy	DRAWN BY: J. Miller	SCALE: AS SHOWN
CHECKED BY: J. Miller	DATE: 3-15-63	DWG. NO.:	B-205
APPROVED:	C. M. Metcalf	SECTION NO.:	BC-1
APR. NO.:	REVISION:		

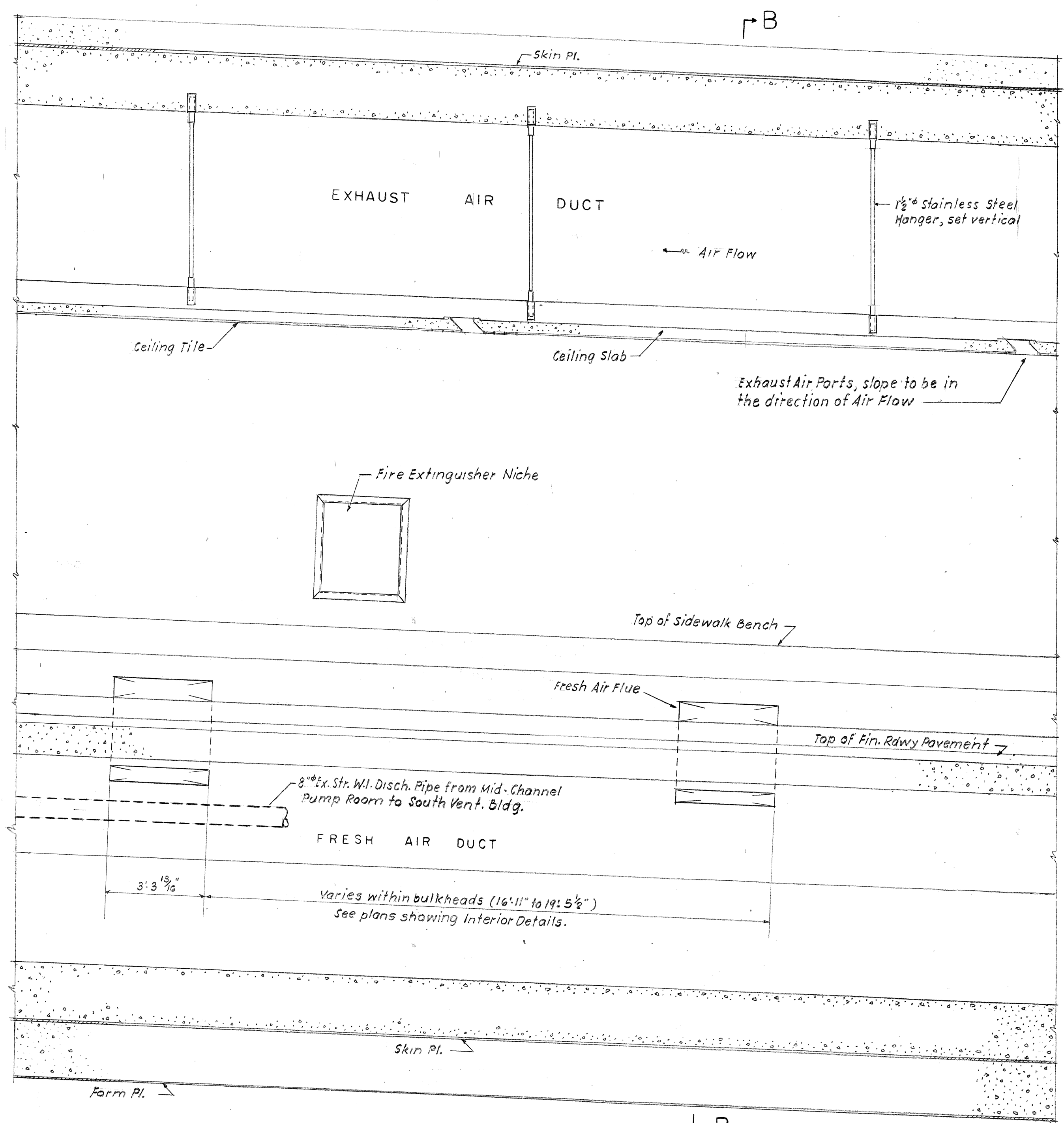
1555
63 M 24

DO NOT SCALE THIS DRAWING. FOLLOW DIMENSIONS.

AS BUILT



SECTION B-B
LOOKING NORTH



SECTION A-A

REFERENCE DRAWINGS.
 Typical Cross Sections-Interior Details Lower Half See Dwg. BT. 21
 Typical Cross Sections-Interior Details Upper Half See Dwg. BT. 22

COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
 NORFOLK 1, VIRGINIA

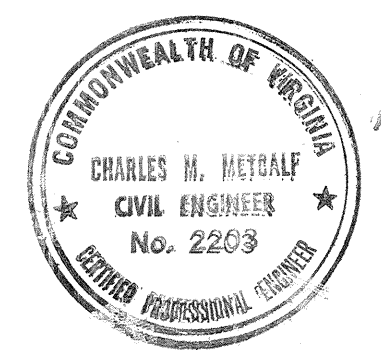
SVERDRUP & PARCEL, CONSULTING ENGINEERS
 NEW YORK, N. Y.—ST. LOUIS, MO.—NORFOLK, VA.

CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING
 TYPICAL CROSS SECTION

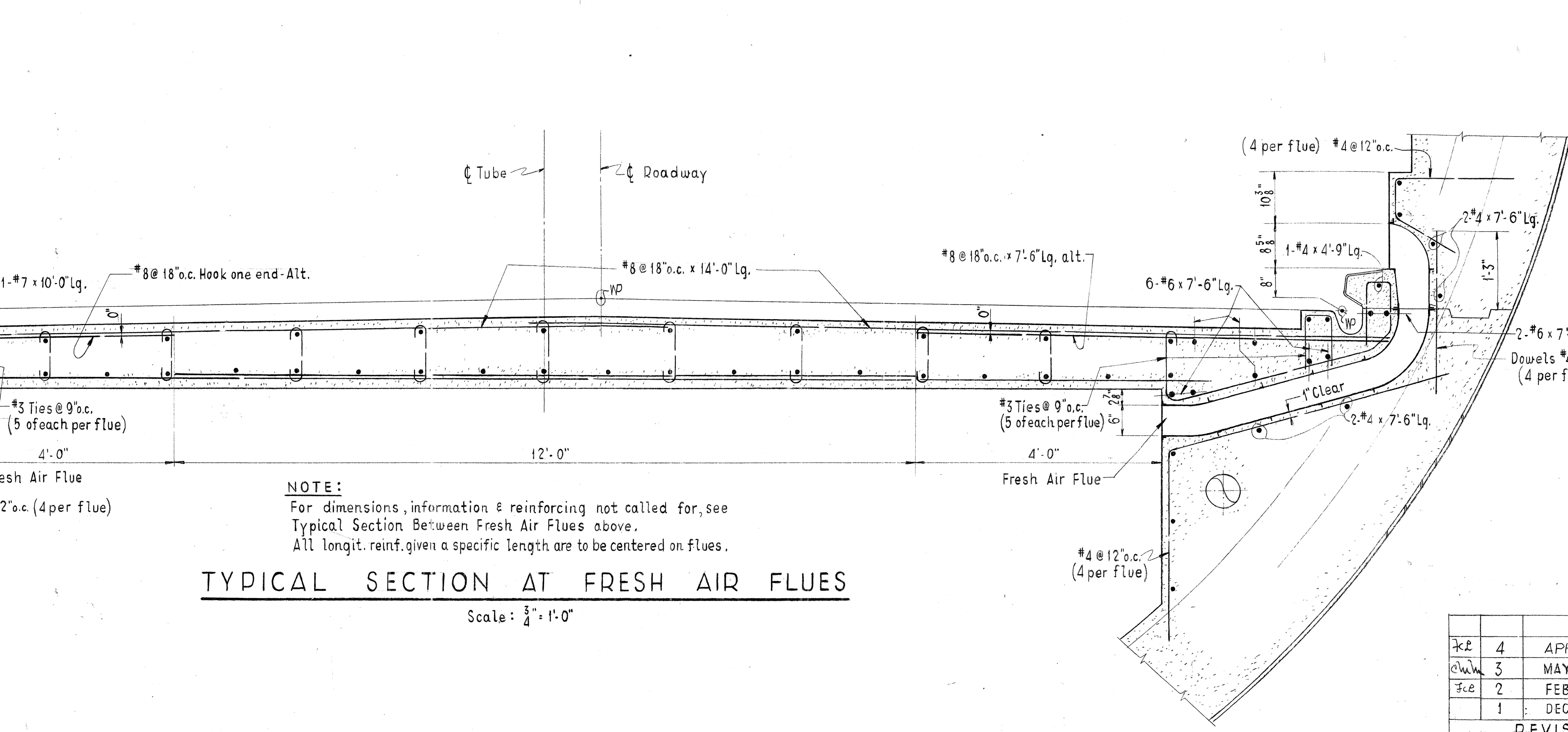
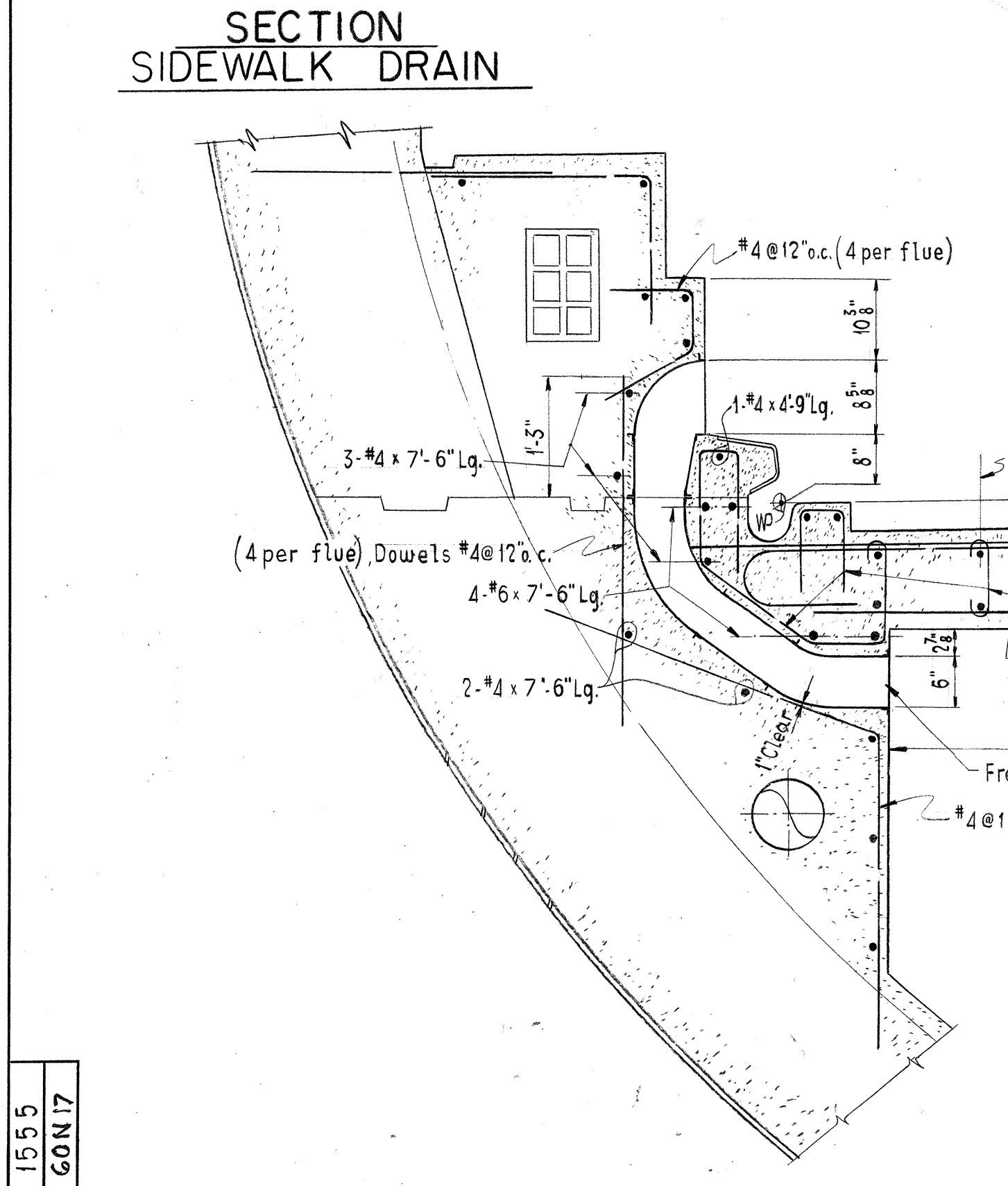
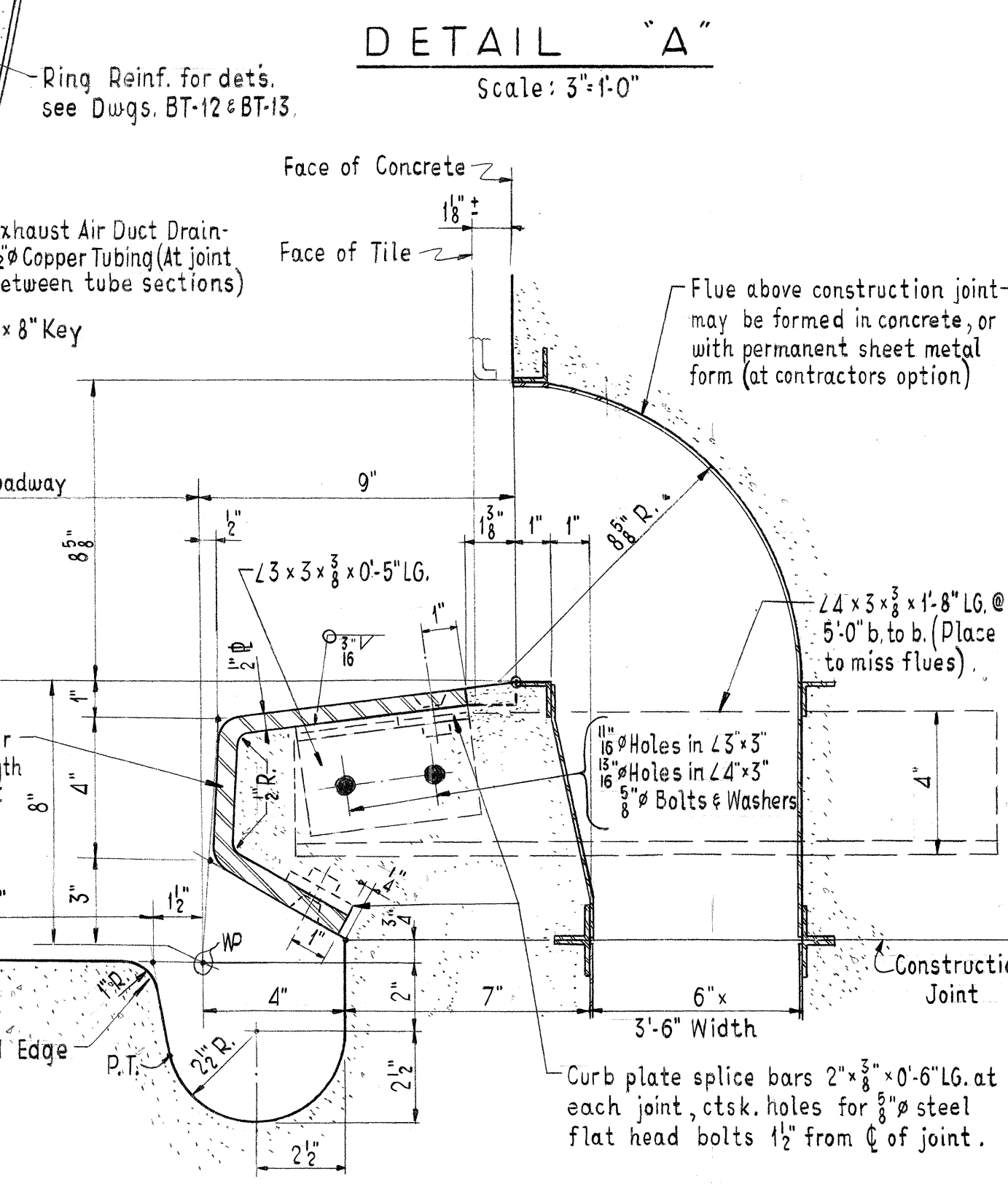
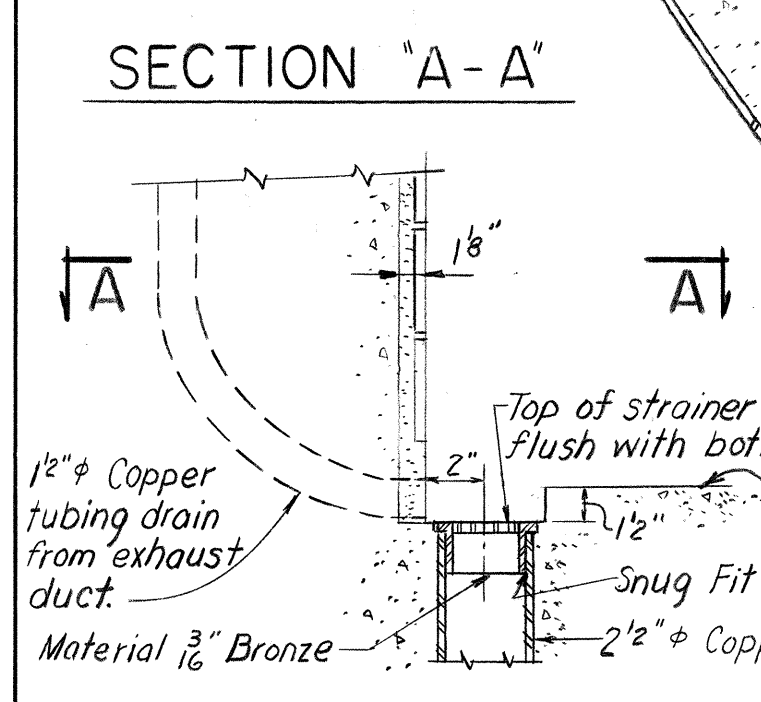
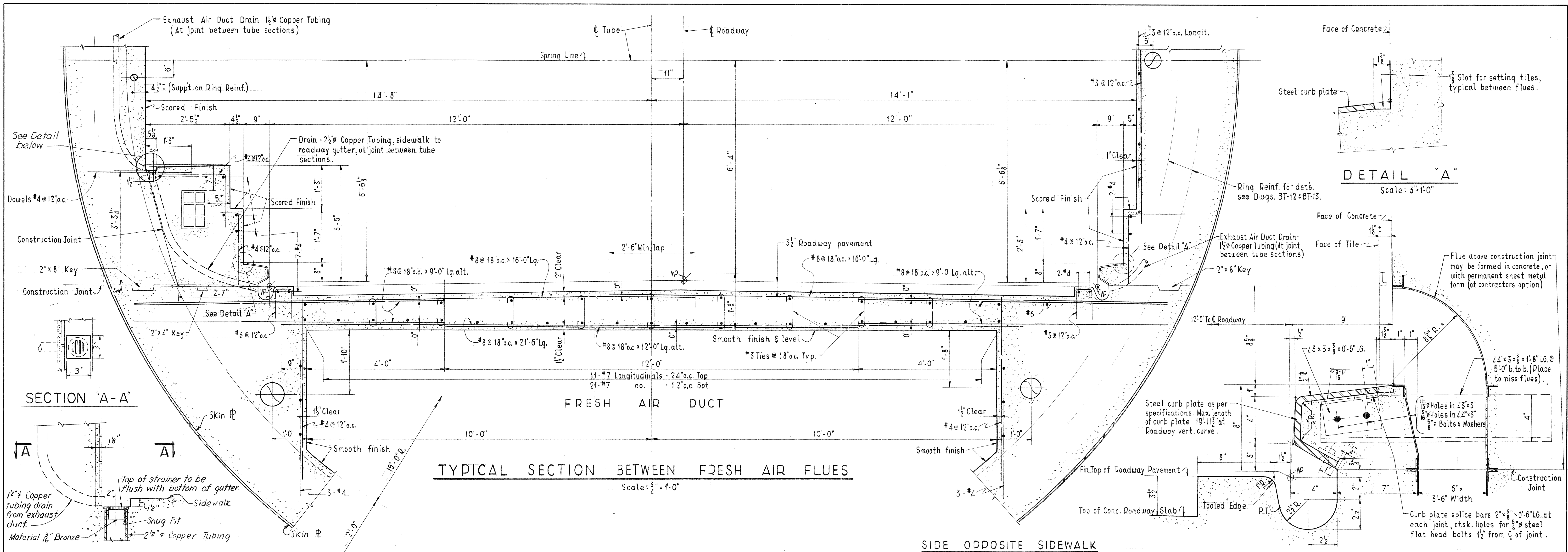
RECOMMENDED BY:	CHARLES H. HITCHCOCK CIVIL ENGINEER No. 2203	SCALE: 3/8" = 1'-0"
CHECKED BY:	F. C. L.	DATE: JAN. 16, 1961
DWG. NO.	BT. 20	
SECTION NO.	TS-1 BC-1	

APPROVED: *C. W. Tuttle*

DATE	FEB. 13, 1961
APPR. NO.	REVISION



1555
GIN 1



GENERAL NOTES

1. For piping & conduits located but not identified see dwg. BT-20.

COMMONWEALTH OF VIRGINIA
 CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
 NORFOLK 1, VIRGINIA

SVERDRUP & PARCEL, CONSULTING ENGINEERS
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CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING
 TYPICAL CROSS-SECTIONS
 INTERIOR DETAILS - LOWER HALF

RECOMMENDED: *F. C. Lowry*

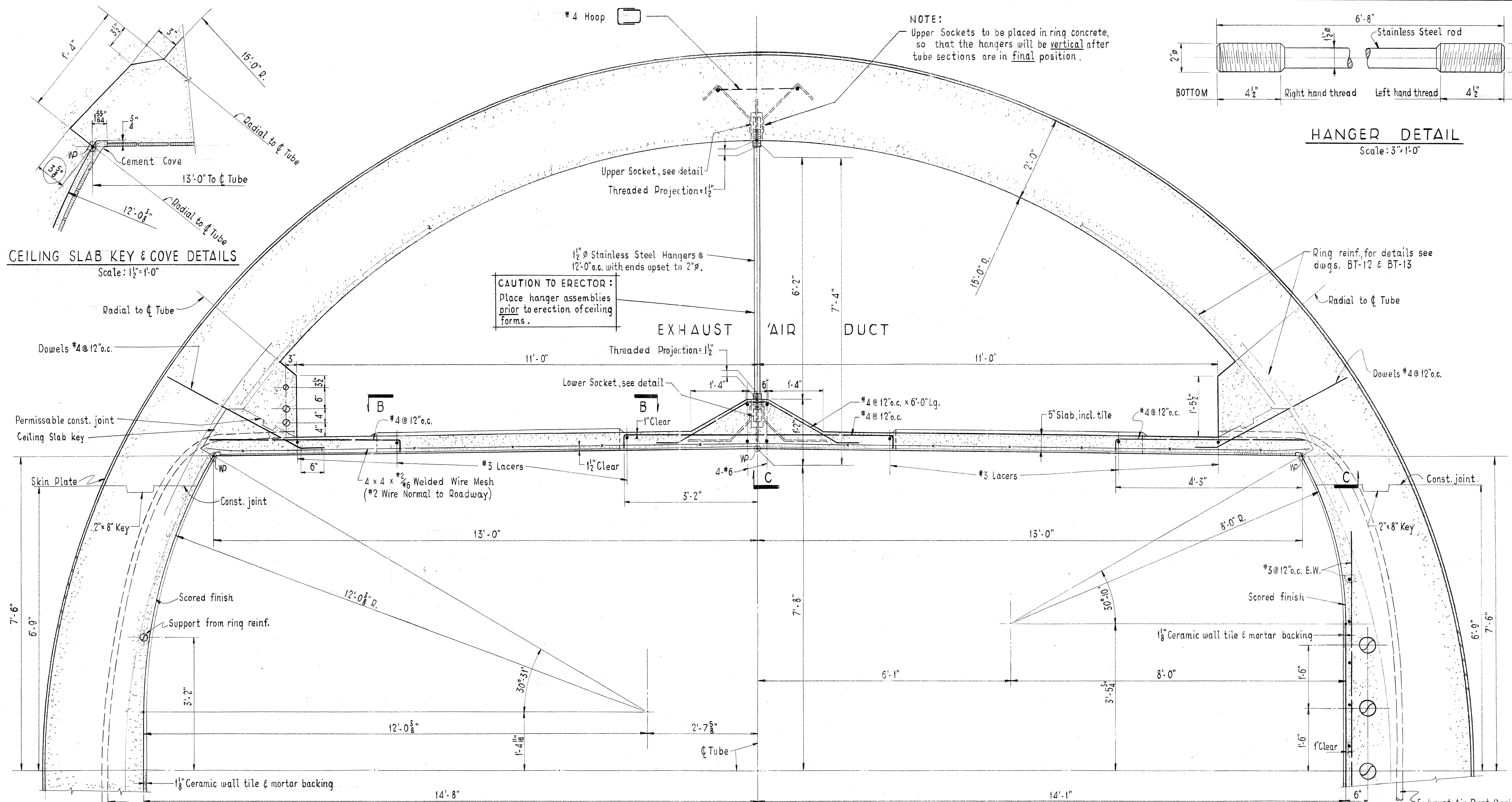
APPROVED: *C. M. Heston*

REVISED	DATE	BY
4	APR. 17, 1962	G.C.
3	MAY 4, 1961	I.S.T.
2	FEB. 13, 1961	
1	DEC. 8, 1960	

REVISIONS

DRAWN BY: G.C.	SCALE: As Noted
CHECKED BY: I.S.T.	DATE: 12-5-60
DWG. NO. BT-21	
SECTION NO. TS-1	
BC-1	

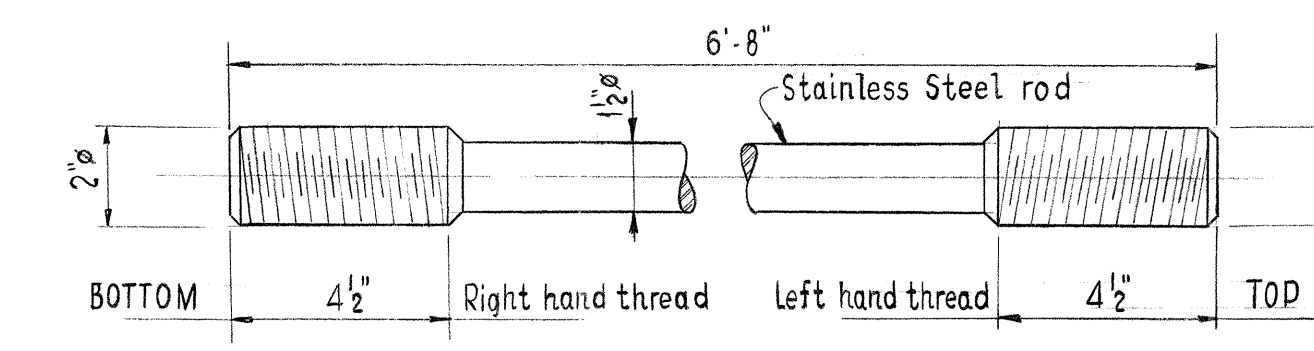
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GON 17



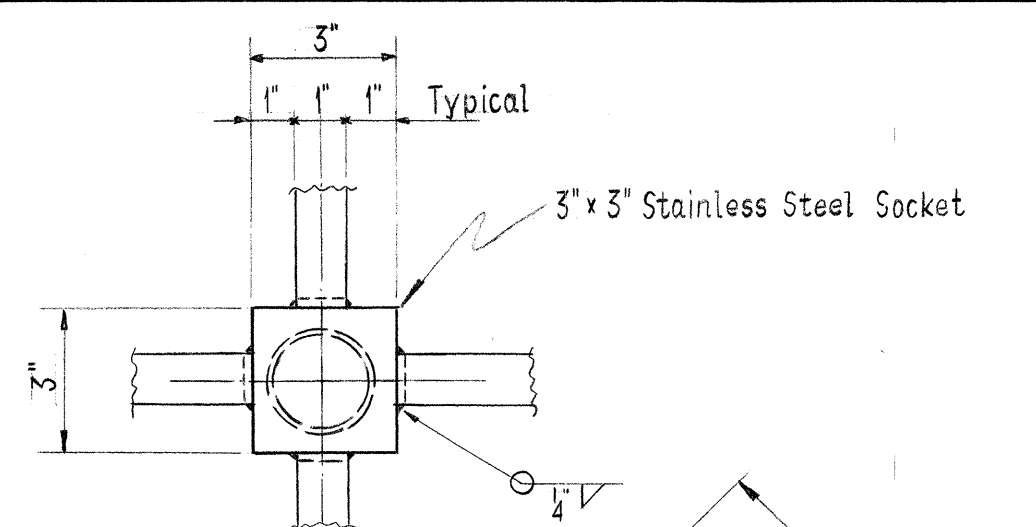
CEILING SLAB KEY & COVE DETAILS
Scale: 1/2" = 1'-0"

CAUTION TO ERECTOR:
Place hanger assemblies prior to erection of ceiling forms.

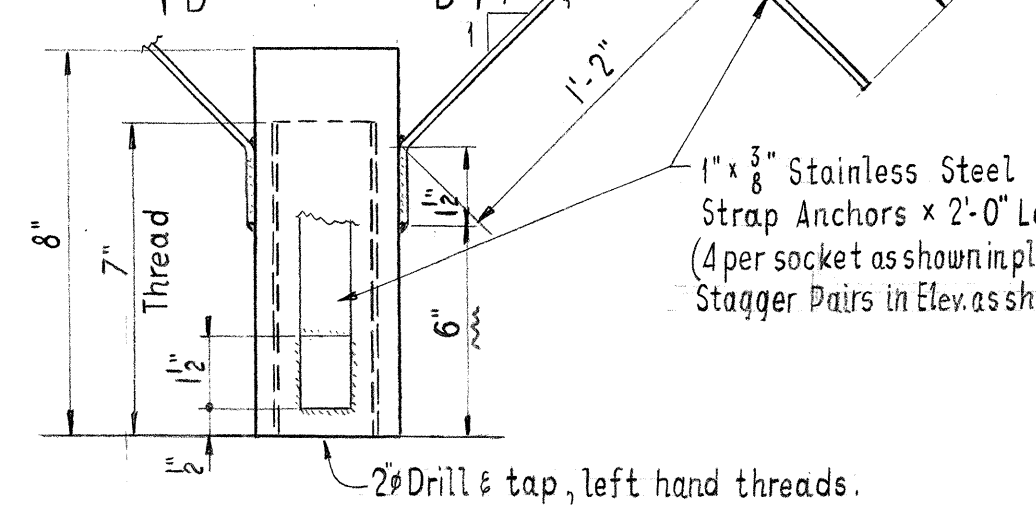
NOTE:
Upper Sockets to be placed in ring concrete, so that the hangers will be vertical after tube sections are in final position.



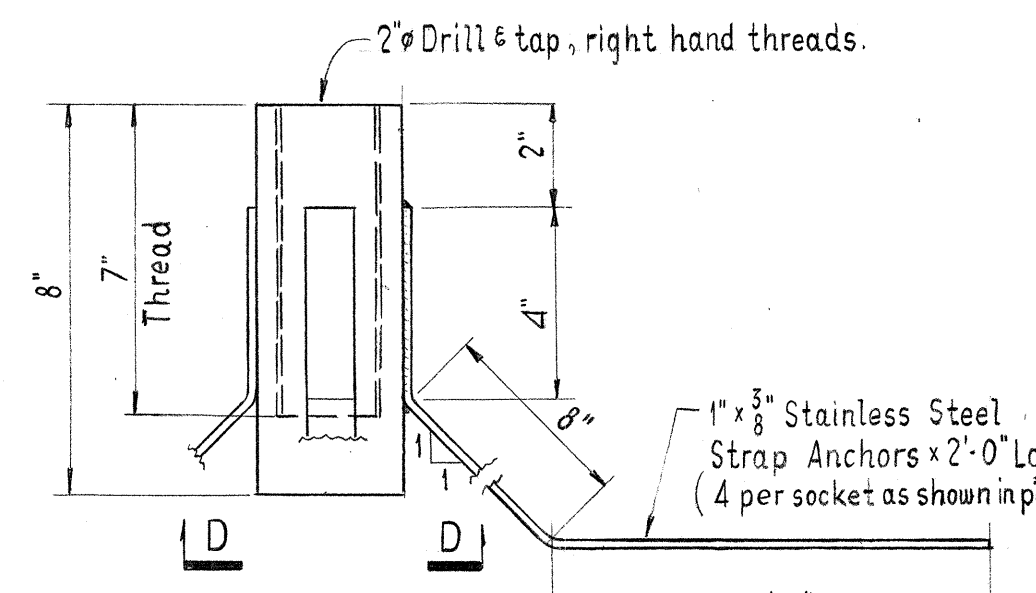
HANGER DETAIL
Scale: 3/8" = 1'-0"



PLAN-VIEW D-D
Scale: 3/8" = 1'-0"



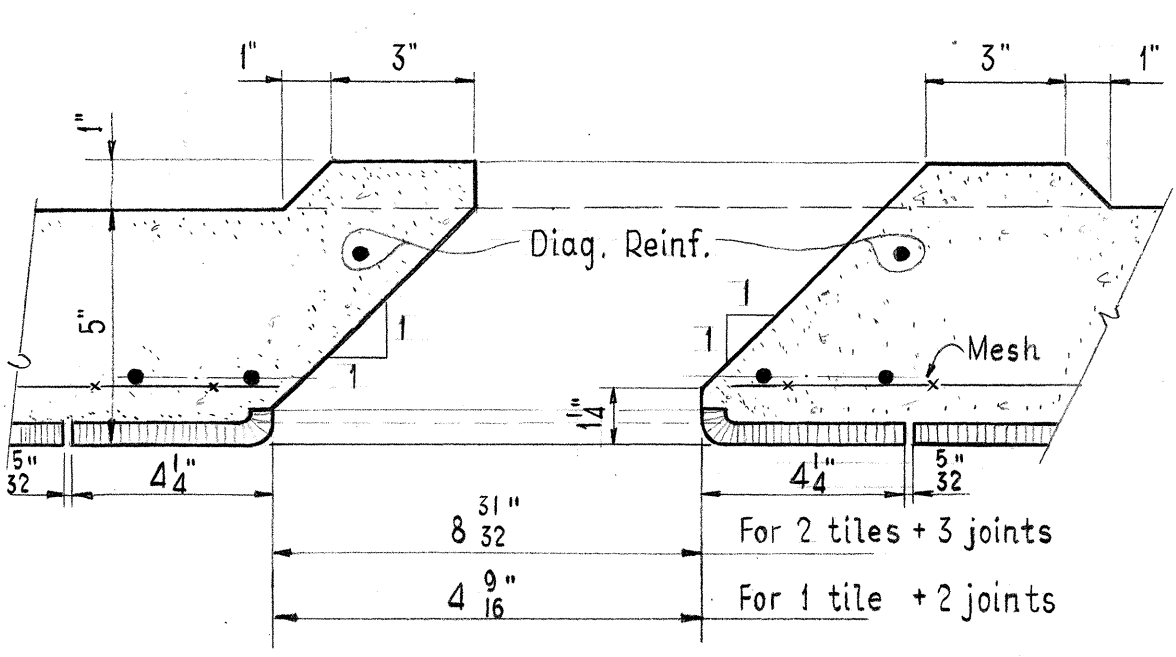
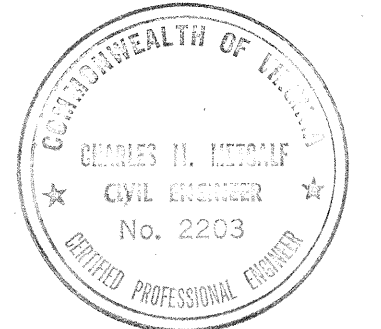
UPPER SOCKET DETAIL
Scale: 3/8" = 1'-0"



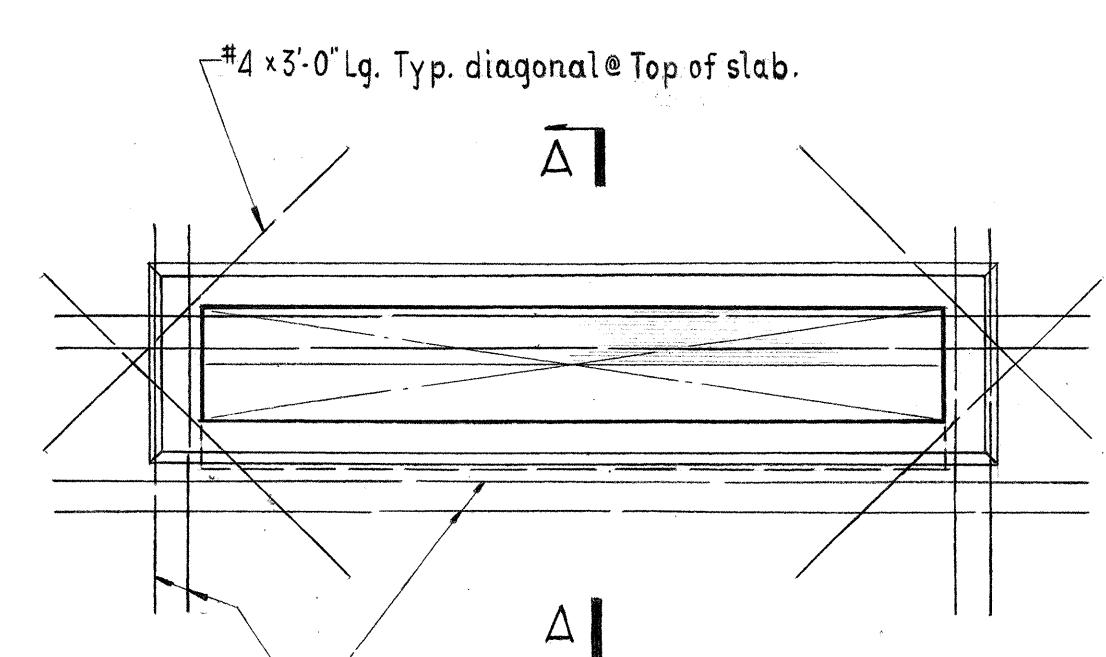
LOWER SOCKET DETAIL
Scale: 3/8" = 1'-0"

TYPICAL SECTION
Scale: 3/8" = 1'-0"

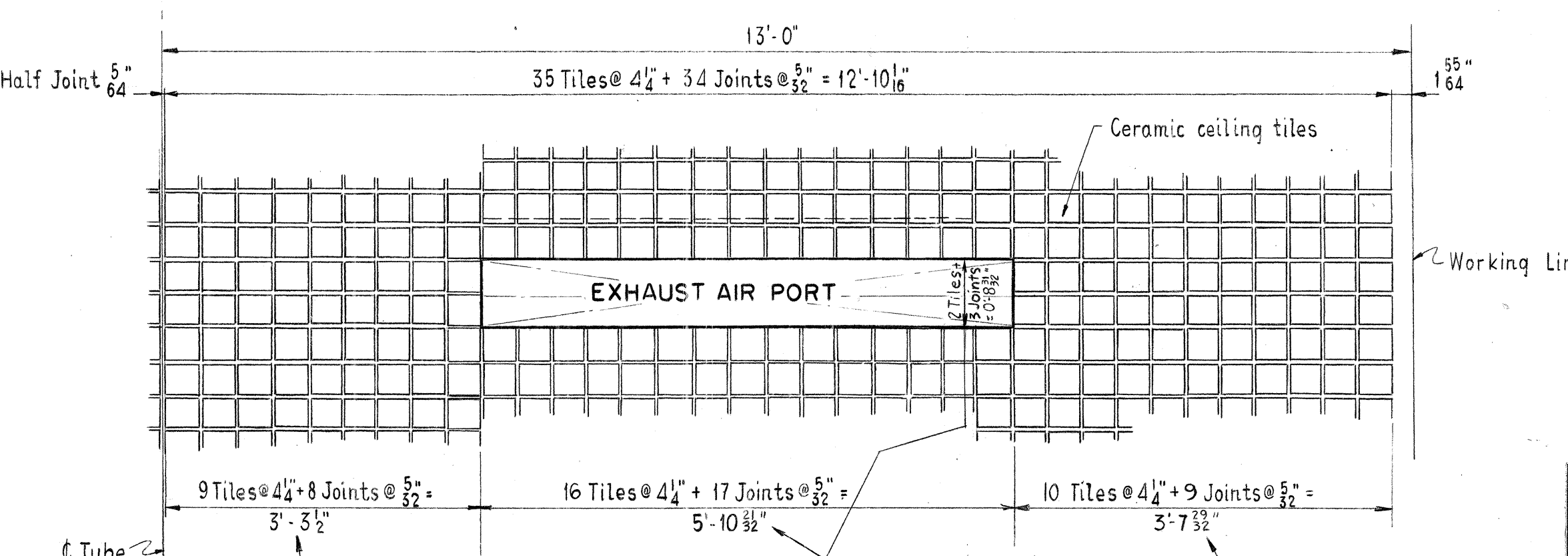
GENERAL NOTES
1. For conduits located but not identified see dwg. BT-20.
2. For Lower Half Interior Details below ϕ tube see dwg. BT-21.



SECTION A - A
Scale: 3/8" = 1'-0"



PLAN-SECTION B - B
Scale: 3/8" = 1'-0"



PLAN-SECTION C - C
Scale: 3/8" = 1'-0"

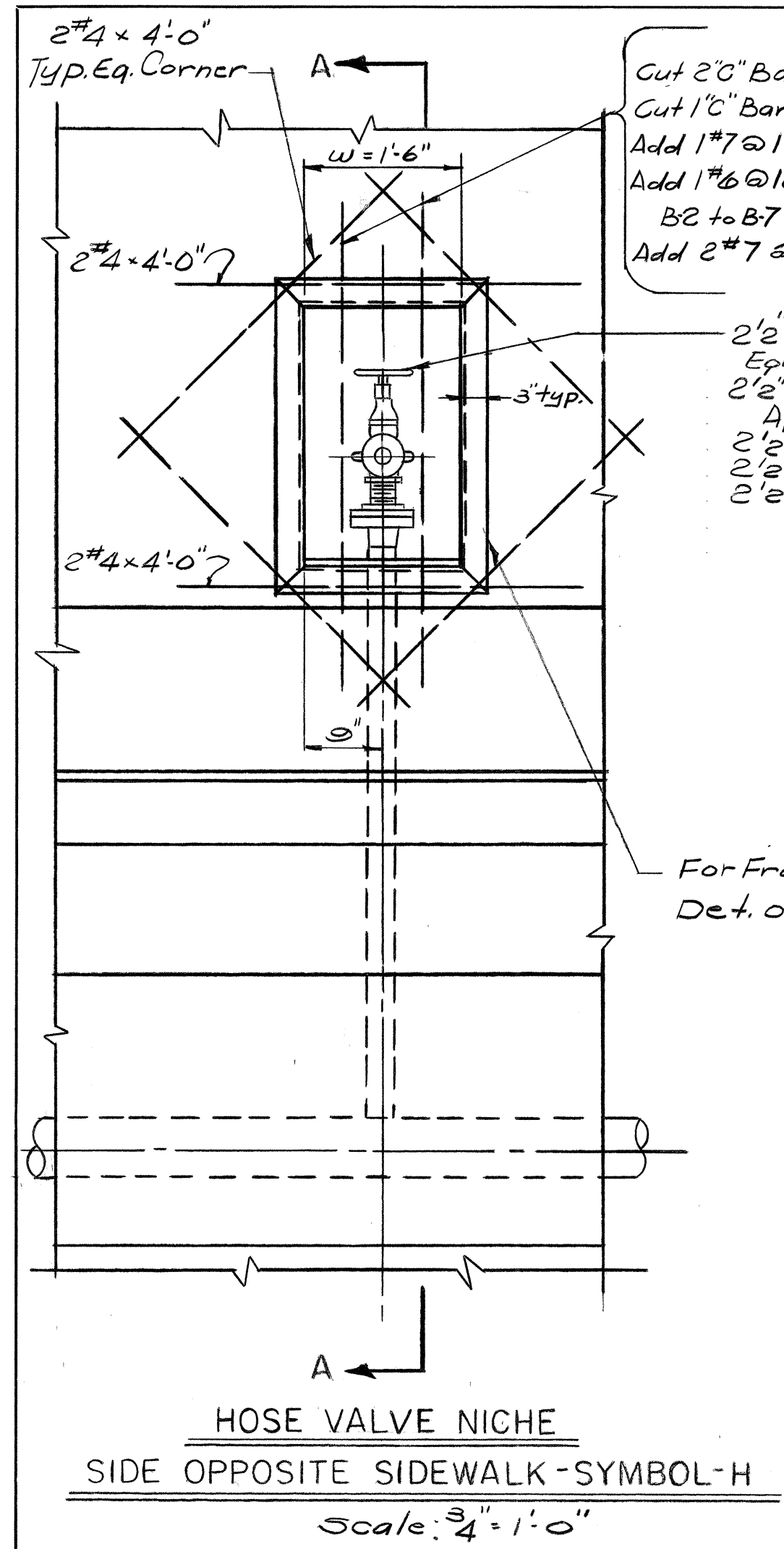
NO.	DATE	REVISION
3	JAN 16, 1962	
2	MAY 4, 1961	
1	FEB. 17, 1961	

COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
NORFOLK 1, VIRGINIA

SVERDRUP & PARCEL, CONSULTING ENGINEERS
NEW YORK, N. Y. - ST. LOUIS, MO. - NORFOLK, VA.

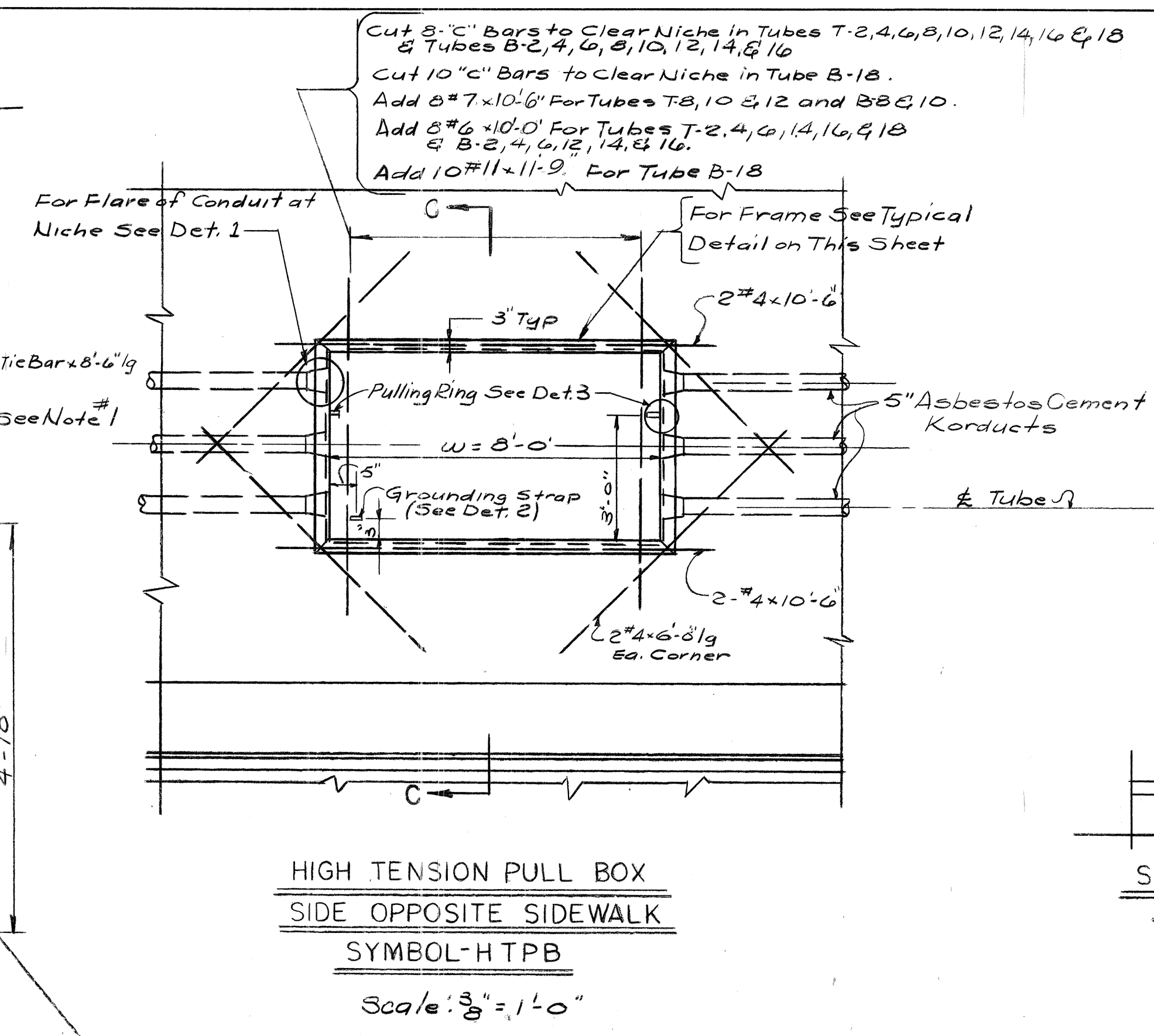
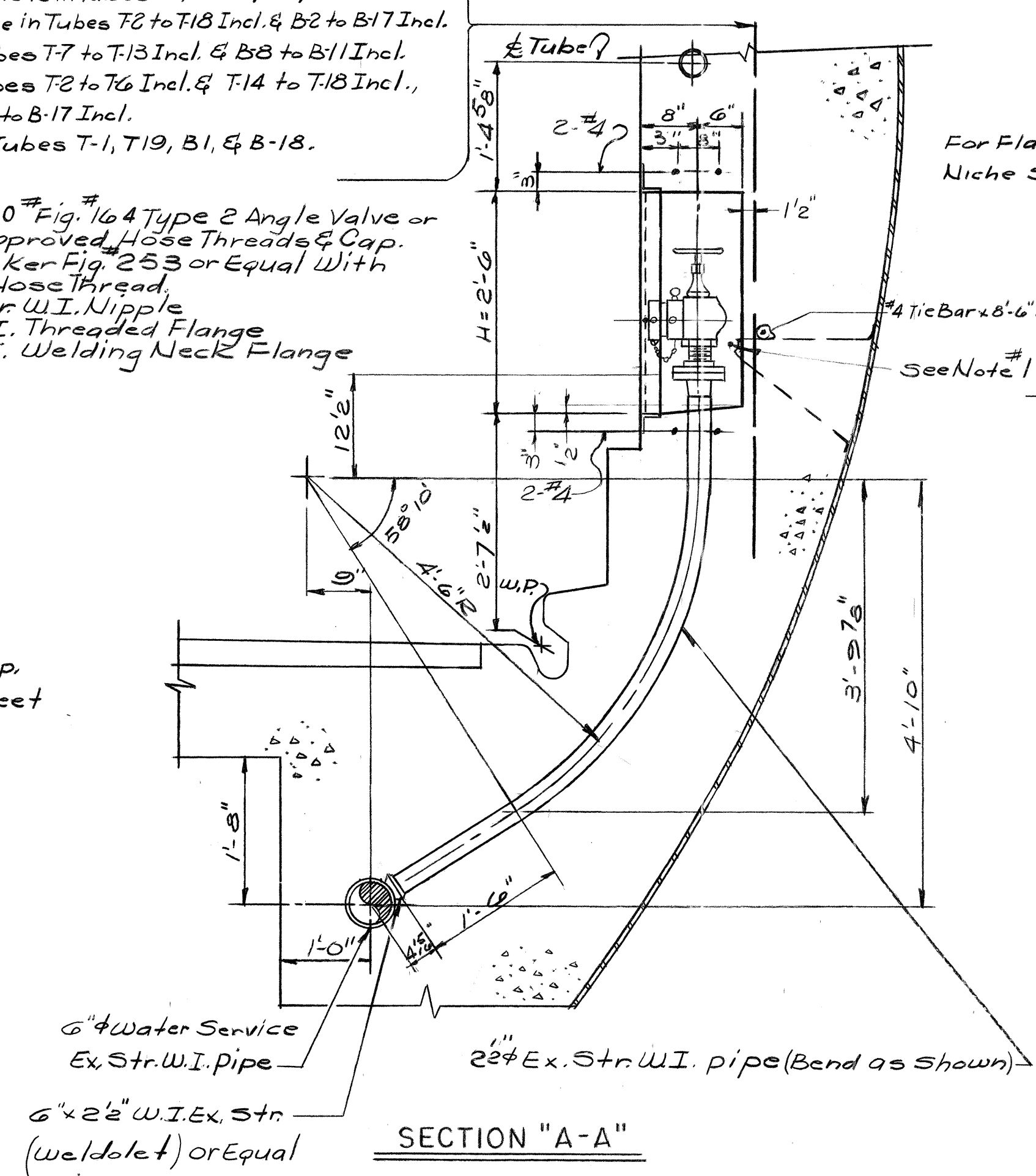
CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING
TYPICAL CROSS-SECTION
INTERIOR DETAILS-UPPER HALF

RECOMMENDED: *F. C. Lowry*
DRAWN BY: G. C. SCALE: As Noted
CHECKED BY: A. R. B. DATE: DEC. 9, 1960
DWG. NO. **BT-22**
SECTION NO. TS-1 BC-1

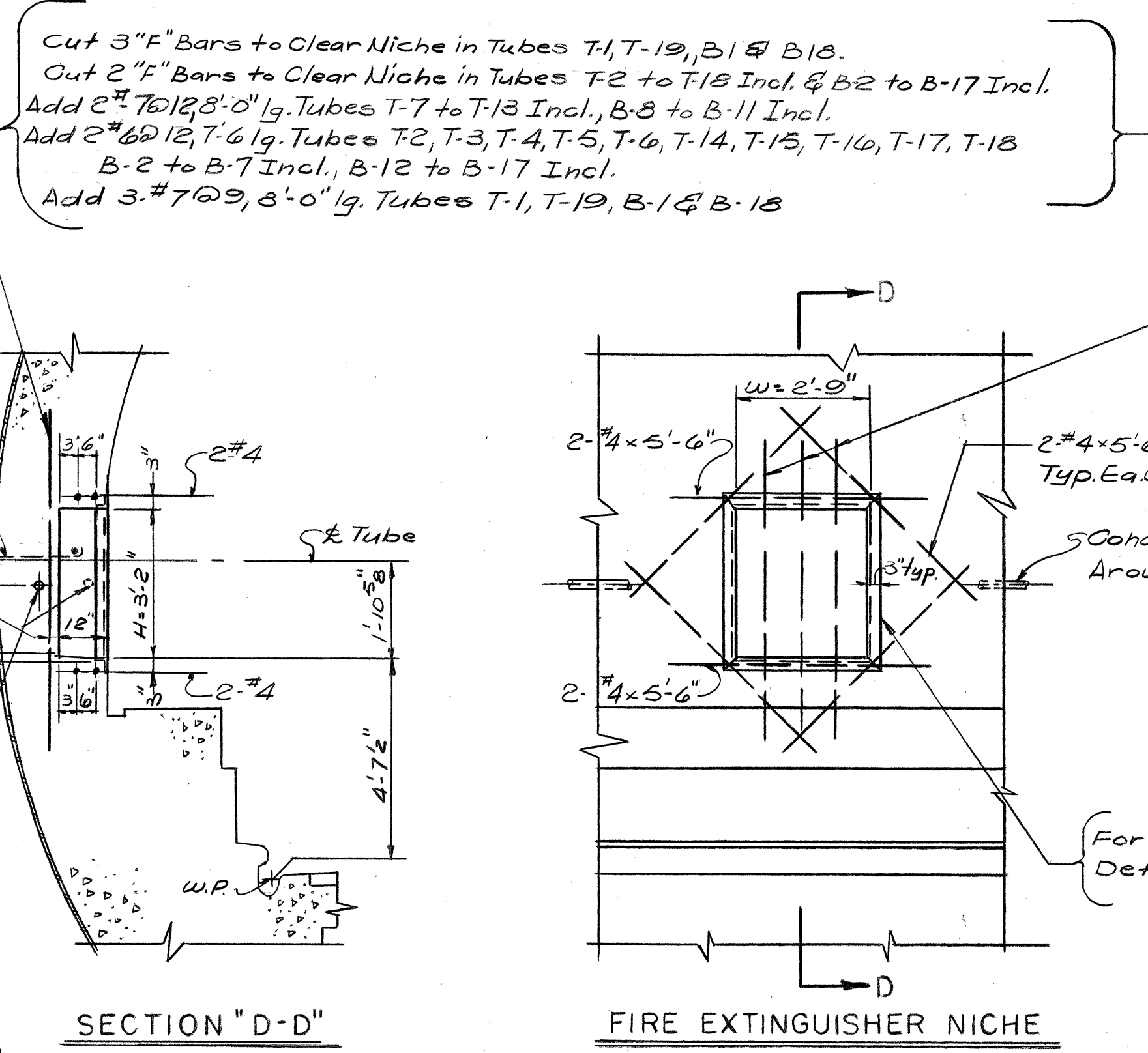
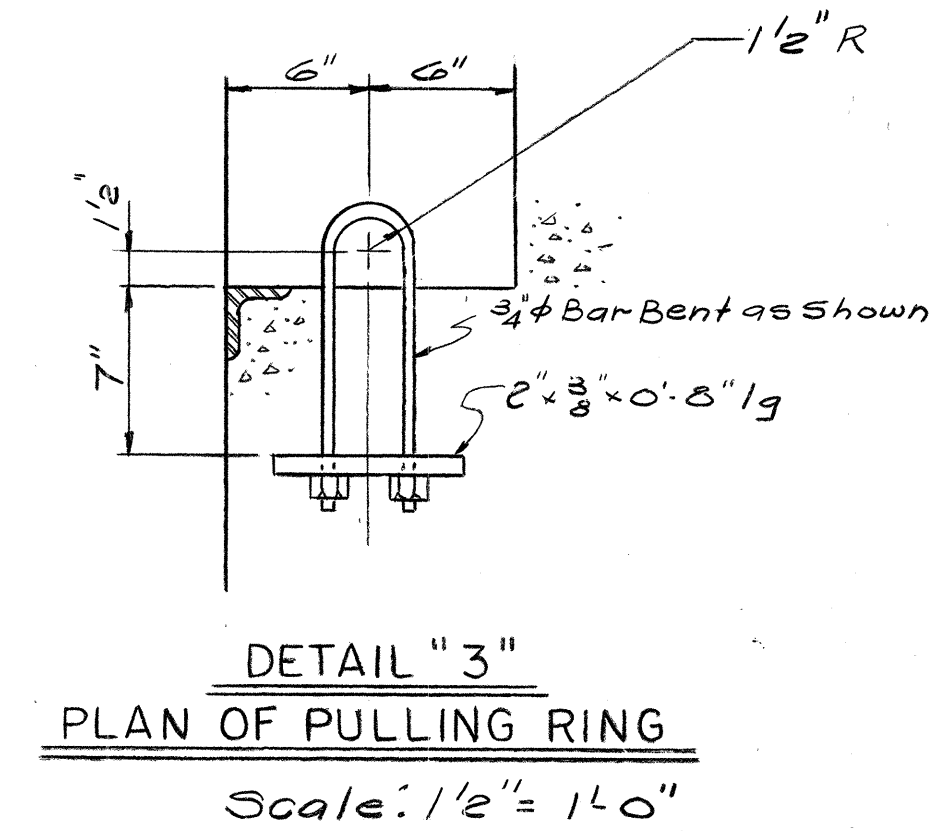
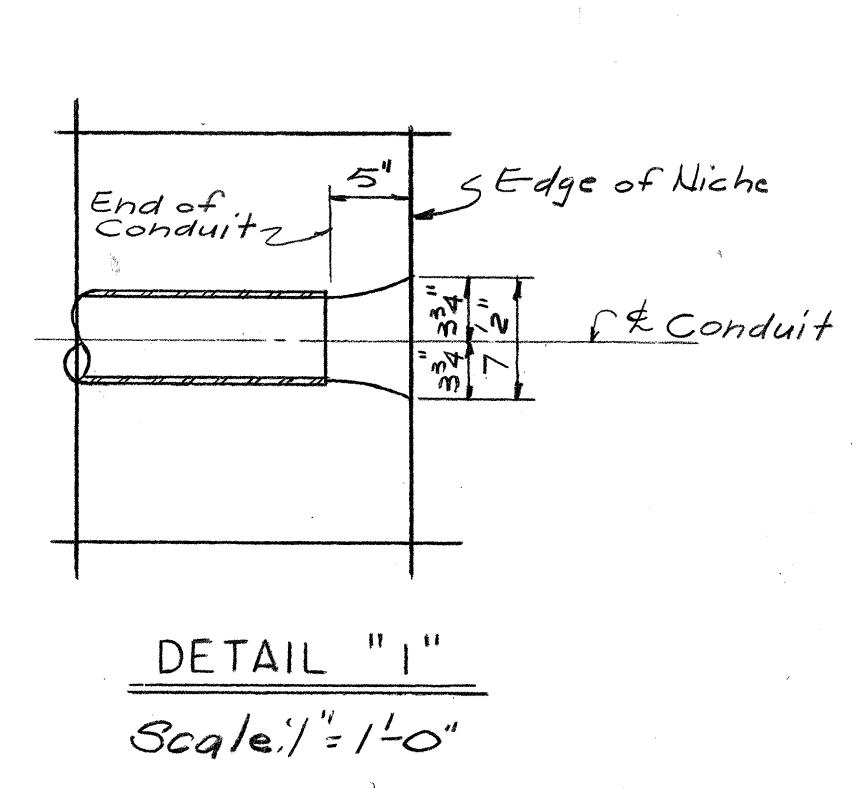
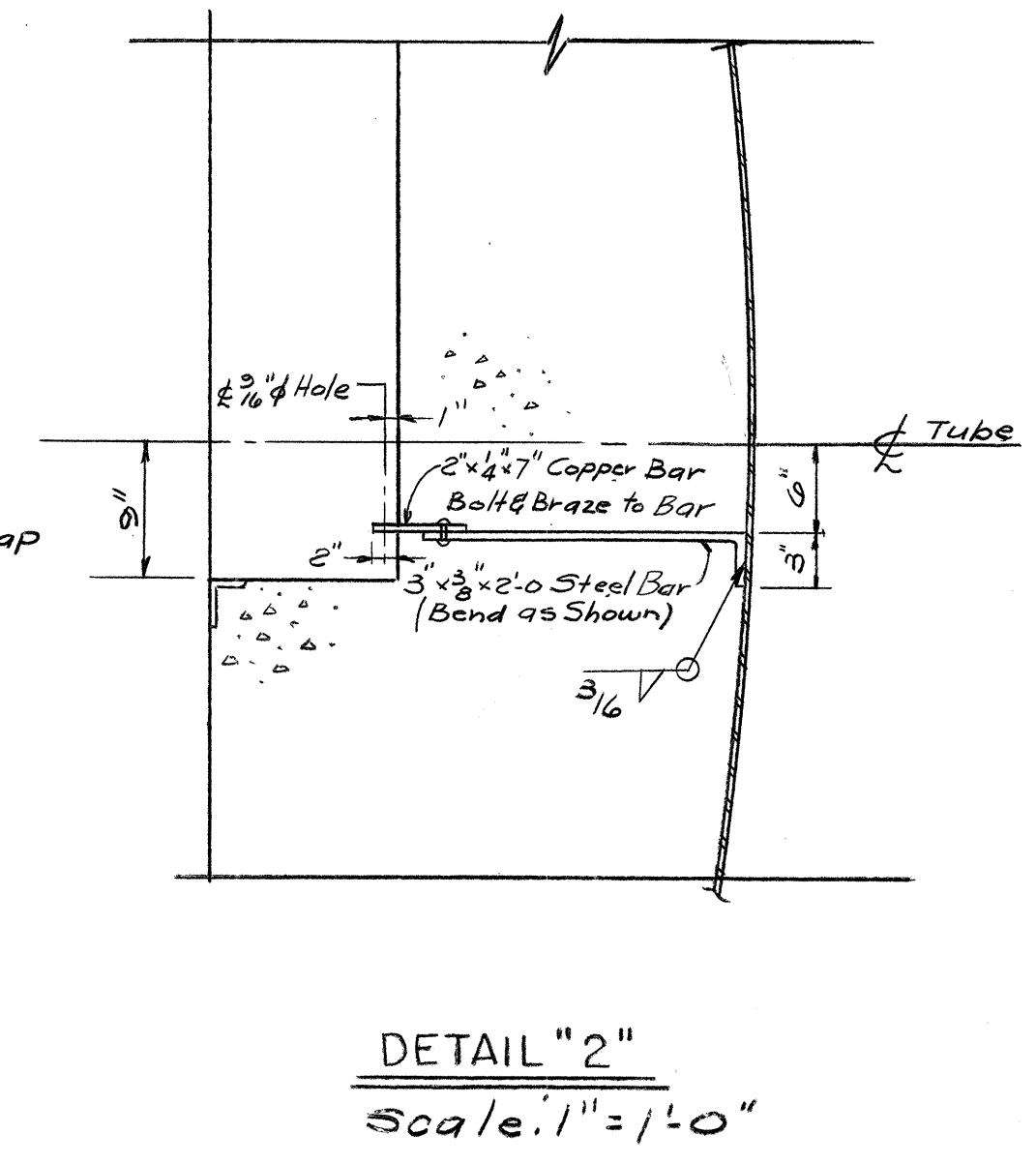
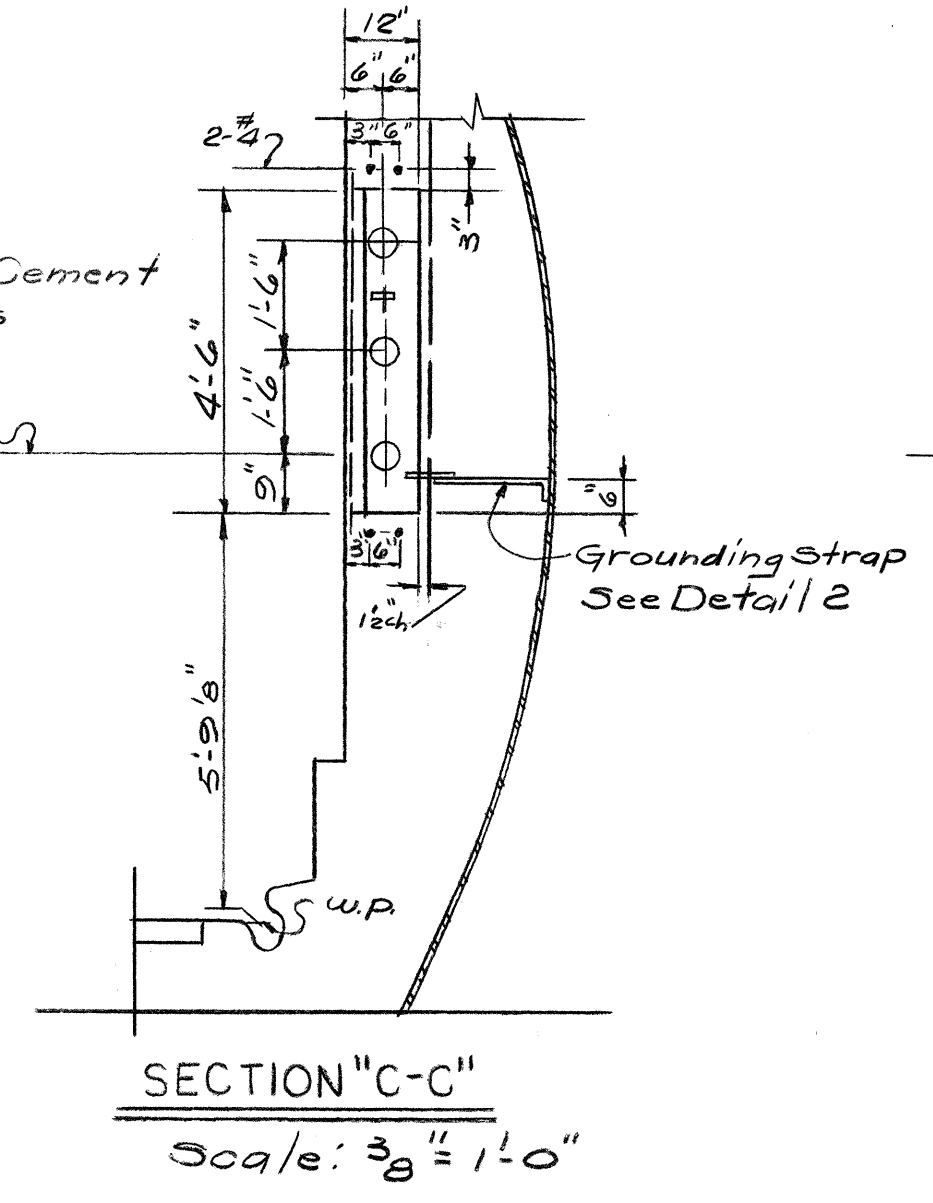


Cut 2" C Bars to Clear Niche in Tubes T-1, T-19 & B-1, B-18
Cut 1" C Bar to Clear Niche in Tubes T-2 to T-13 Incl. & B-2 to B-17 Incl.
Add 1" #7 @ 12, 6" lg. Tubes T-7 to T-13 Incl. & B-8 to B-11 Incl.
Add 1" #6 @ 12, 6" lg. Tubes T-2 to T-6 Incl. & T-14 to T-18 Incl., B-2 to B-7 Incl., & B-12 to B-17 Incl.
Add 2" #7 @ 9, 6" lg. Tubes T-1, T-19, B-1, & B-18.

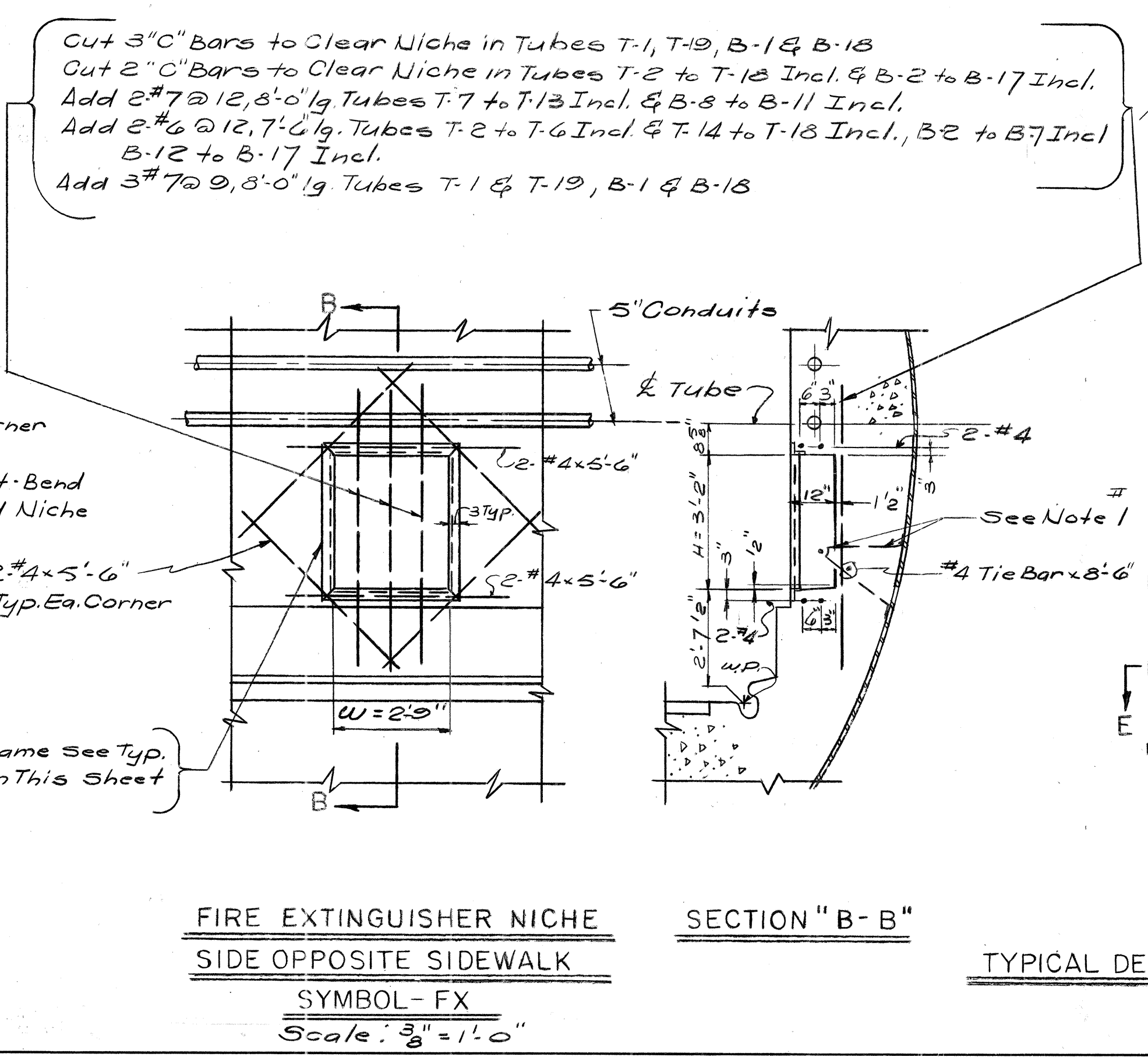
2" Croker 300 # Fig. 164 Type 2 Angle Valve or Equal With Approved Hose Threads & Cap.
2" P.R.V. Croker Fig. 253 or Equal With Approved Hose Thread.
2" x 4" Ex. Str. W.I. Nipple
2" x 300 # W.I. Threaded Flange
2" x 150 # W.I. Welding Neck Flange



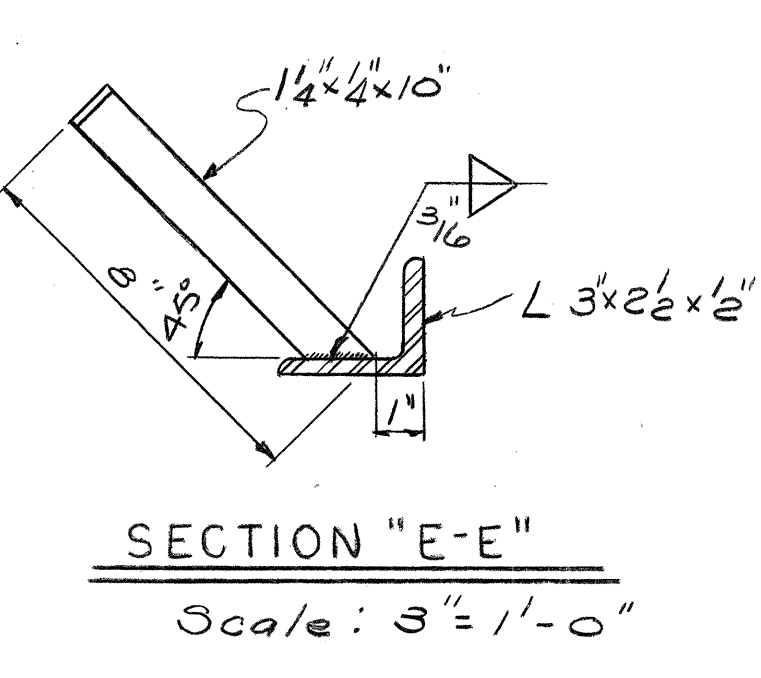
Cut 3" C Bars to Clear Niche in Tubes T-2, 4, 6, 8, 10, 12, 14, 16 & 18 & Tubes B-2, 4, 6, 8, 10, 12, 14, & 16
Cut 10" C Bars to Clear Niche in Tube B-18.
Add 2" #7 @ 10, 6" For Tubes T-8, 10 & 12 and B-8, 10.
Add 2" #6 @ 10, 6" For Tubes T-2, 4, 6, 14, 16, & 18 & B-2, 4, 6, 12, 14, & 16.
Add 10" #11 @ 11, 9" For Tube B-18



Cut 3" F Bars to Clear Niche in Tubes T-1, T-19, B-1 & B-18.
Cut 2" F Bars to Clear Niche in Tubes T-2 to T-13 Incl. & B-2 to B-17 Incl.
Add 2" #7 @ 12, 8" lg. Tubes T-7 to T-13 Incl. & B-8 to B-11 Incl.
Add 2" #6 @ 12, 7" lg. Tubes T-2, T-3, T-4, T-5, T-6, T-14, T-15, T-16, T-17, T-18 B-2 to B-7 Incl., B-12 to B-17 Incl.
Add 3" #7 @ 9, 8" lg. Tubes T-1, T-19, B-1 & B-18



Cut 3" C Bars to Clear Niche in Tubes T-1, T-19, B-1 & B-18
Cut 2" C Bars to Clear Niche in Tubes T-2 to T-13 Incl. & B-2 to B-17 Incl.
Add 2" #7 @ 12, 8" lg. Tubes T-7 to T-13 Incl. & B-8 to B-11 Incl.
Add 2" #6 @ 12, 7" lg. Tubes T-2 to T-6 Incl. & T-14 to T-18 Incl., B-2 to B-7 Incl. B-12 to B-17 Incl.
Add 3" #7 @ 9, 8" lg. Tubes T-1 & T-19, B-1 & B-18



NOTES
1. Longitudinal Bars Interfering With Niches Are to Be Cut. Stirrups Interfering With Niches Are to Be Bent to Clear Niche.



This Drawing Supersedes The Following Sketches: SK-7, 8, 9 Dated 11-23-60

COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
NORFOLK 1, VIRGINIA

SVERDRUP & PARCEL, CONSULTING ENGINEERS
NEW YORK, N. Y.-ST. LOUIS, MO.-NORFOLK, VA.

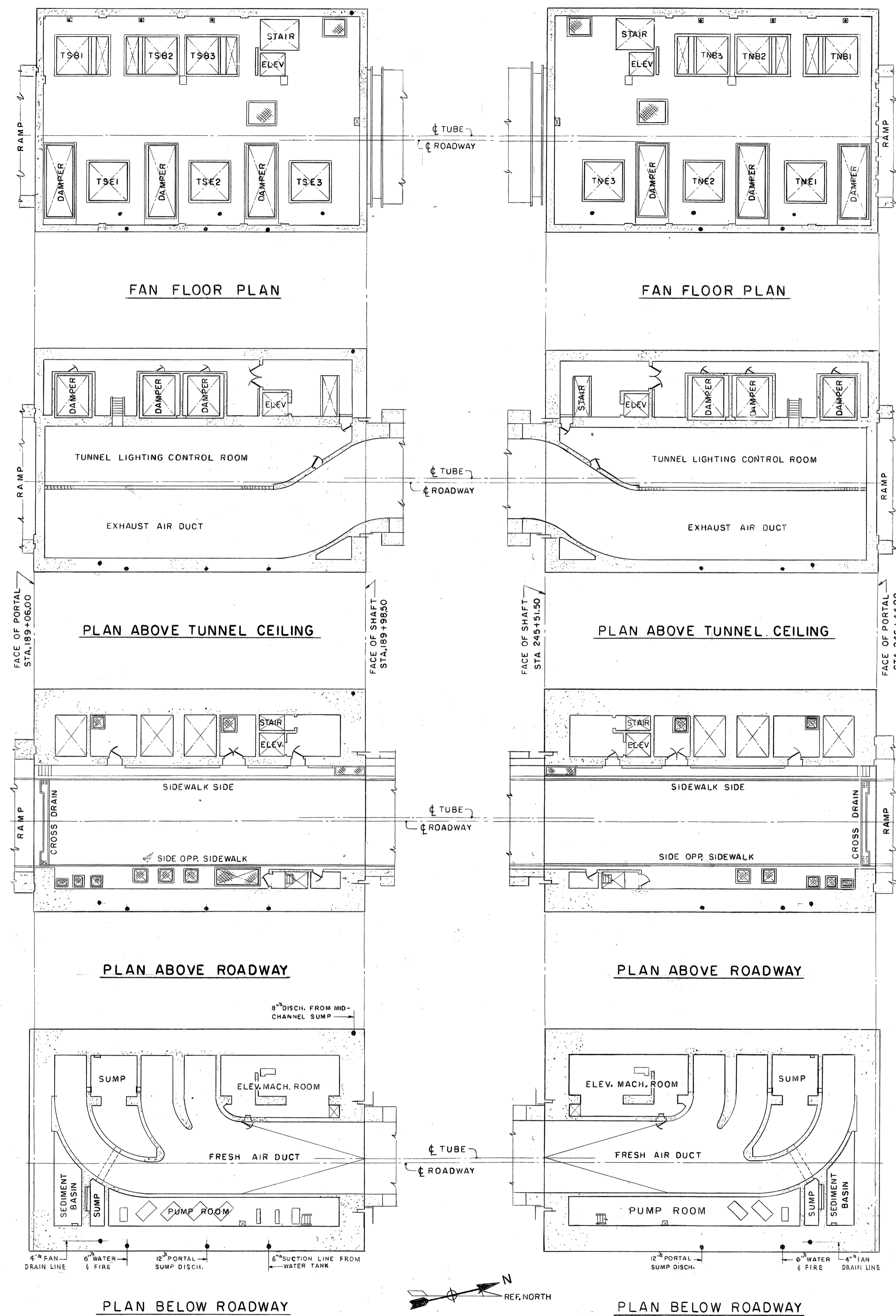
CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING

NICHES IN PRECAST TUBES

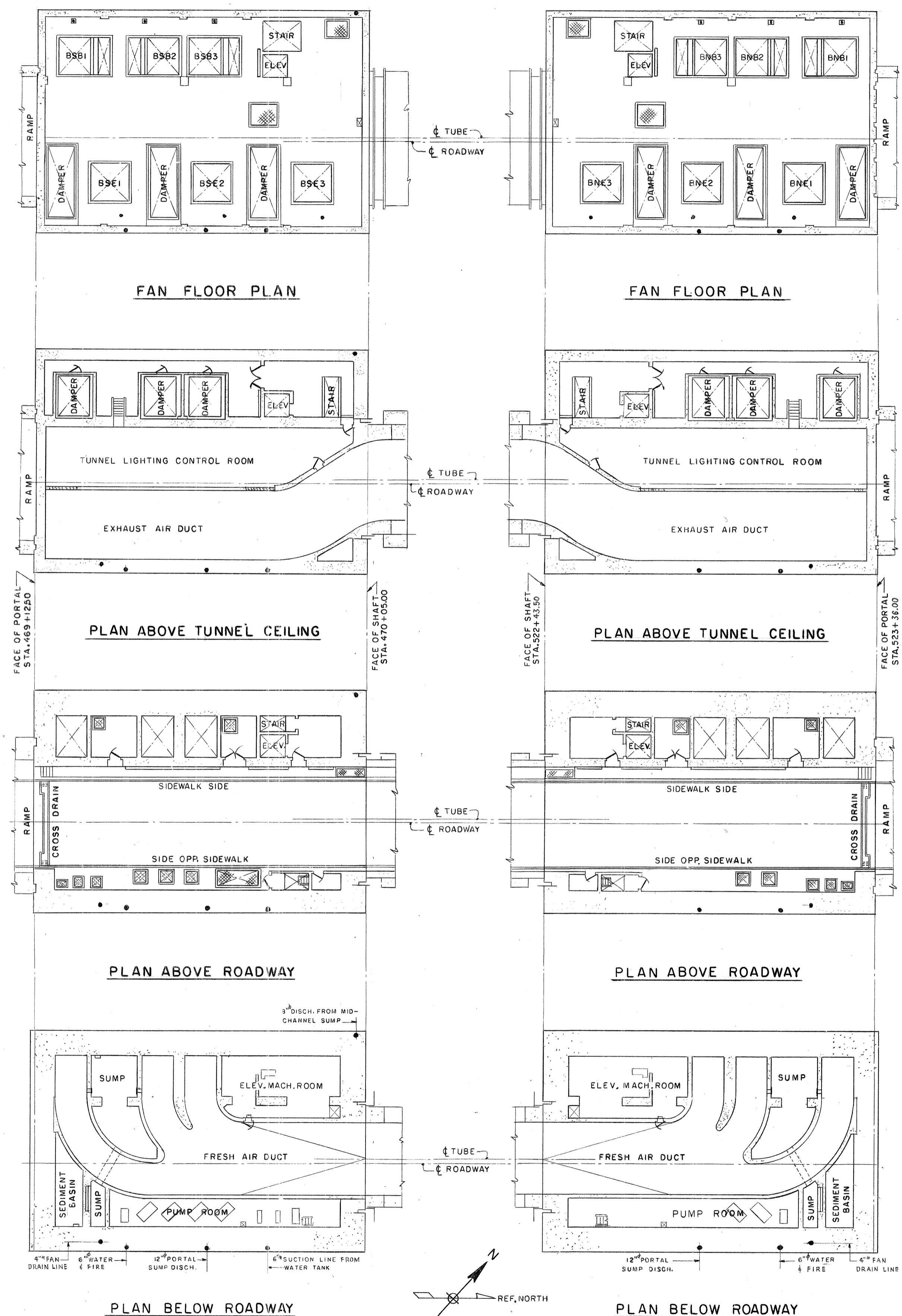
RECOMMENDED:	FC Roy
CHECKED BY:	I ST
APPROVED:	Ch Metcalf
DATE:	JUNE 1, 1961
REVISION:	

DRAWN BY:	J.L.W.	SCALE:	AS NOTED
CHECKED BY:	I ST	DATE:	1-18-61
DWG. NO.:	BT-23		
SECTION NO.:	TS-1		
	BC-1		

1555
GIN2



THIMBLE SHOAL TUNNEL
SOUTH SHAFT NORTH SHAFT



BALTIMORE CHANNEL TUNNEL
SOUTH SHAFT NORTH SHAFT

GENERAL NOTES

1. IN GENERAL, PLANS DRAWN APPLY TO THE SOUTH SHAFTS OF THE BALTIMORE CHANNEL AND THIMBLE SHOAL TUNNELS.
2. PLANS FOR THE NORTH SHAFTS ARE, IN GENERAL, "OPPOSITE HAND" TO THE PLANS FOR THE SOUTH SHAFTS ABOUT AN IMAGINARY AXIS LOCATED MIDWAY BETWEEN NORTH AND SOUTH SHAFTS, AND ARE PICTORIALLY INDICATED ON THIS DRAWING.
3. CERTAIN DEVIATIONS FROM THE "OPPOSITE HAND" RULE ARE REQUIRED IN THE INSTALLATION OF PIPING IN THE SHAFT WALLS FOR WATER SUPPLY AND DISCHARGE LINES FROM THE MID-CHANNEL AND PORTAL SUMPS, AND THE ACCESS HATCHES FOR INSTALLATION AND REMOVAL OF PUMPING EQUIPMENT. SUCH DEVIATIONS ARE PICTORIALLY INDICATED ON THIS DRAWING FOR THE PURPOSE OF ORIENTATION.
4. ELEVATIONS REFER TO "REVISED" DATUM FOR THE BALTIMORE CHANNEL NORTH SHAFT AND "TRUE" DATUM FOR THE BALTIMORE CHANNEL SOUTH SHAFT AND BOTH THIMBLE SHOAL SHAFTS.
5. FOR THE BALTIMORE CHANNEL NORTH SHAFT THE TYPICAL "BRICK IN MASTIC" WATERPROOFING AND THE TYPICAL "3 PLY MEMBRANE" WATERPROOFING ARE TO BE CARRIED TO EL. +0.80 AND EL. +11.80, RESPECTIVELY.
6. ELEVATIONS REFER TO TRUE DATUM FOR ALL SHAFTS.

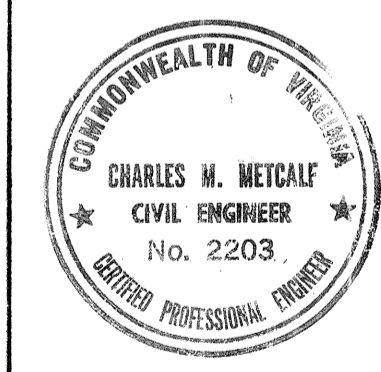
GENERAL NOTES ON STRUCTURES

1. THE CONTRACTOR MAY CONSTRUCT THE EXTERIOR WALLS OF THE SHAFT FROM THE TOP OF THE MAT TO THE CONSTRUCTION JOINT BELOW THE FAN FLOOR FRAMING WITHOUT INTERIOR WALLS AND SLABS, PROVIDED THAT:
 - A) BACKFILL LEVEL DOES NOT EXCEED ELEVATION +5.00' TYP DO. NORTH SHAFT B.C. ONLY DO. DO. +3.20 FOR
 - B) ALL REQUIRED KEYS, SEATS, RECESSES, WATERSTOPS AND DOWELS ARE PLACED IN PREPARATION FOR THE PLACEMENT OF THE INTERIOR WORK.
2. CONSTRUCTION JOINTS INDICATED ON THE DRAWINGS REFLECT DESIGN REQUIREMENTS. ADDITIONAL JOINTS OR MODIFICATION OF JOINTS, IF DESIRED BY CONTRACTOR, REQUIRE APPROVAL BY THE ENGINEER.
3. MINIMUM COVER OVER REINFORCING BARS SHALL BE AS FOLLOWS:

BASE SLAB	3"
BEAMS AND WALLS	1-1/2"
SLABS	1"
4. ALL REINF. PROJECTIONS, LAPS AND EMBEDMENTS TO BE 30 DIA. UNLESS NOTED.

REFERENCE DRAWINGS

Structural	BT-201 to BT-220, inclusive.
Mechanical	BT-450 to BT-453, inclusive.
Electrical	BT-248 to BT-253, inclusive.
STRUCTURAL	B-210 to B-229, inclusive



GC	6	27 JULY 64	AS BUILT
IS	5	3-15-63	REVISION PER P&E CHANGES
CM	4	11-2-62	DELETED L POST IN ELEVATOR MACH. ROOM
FL	3	6-19-62	
FL	2	FEBRUARY 1962	REVISION TO SHOW Door Swing
FL	1	JAN. 29, 1962	
APPR. NO.			REVISION

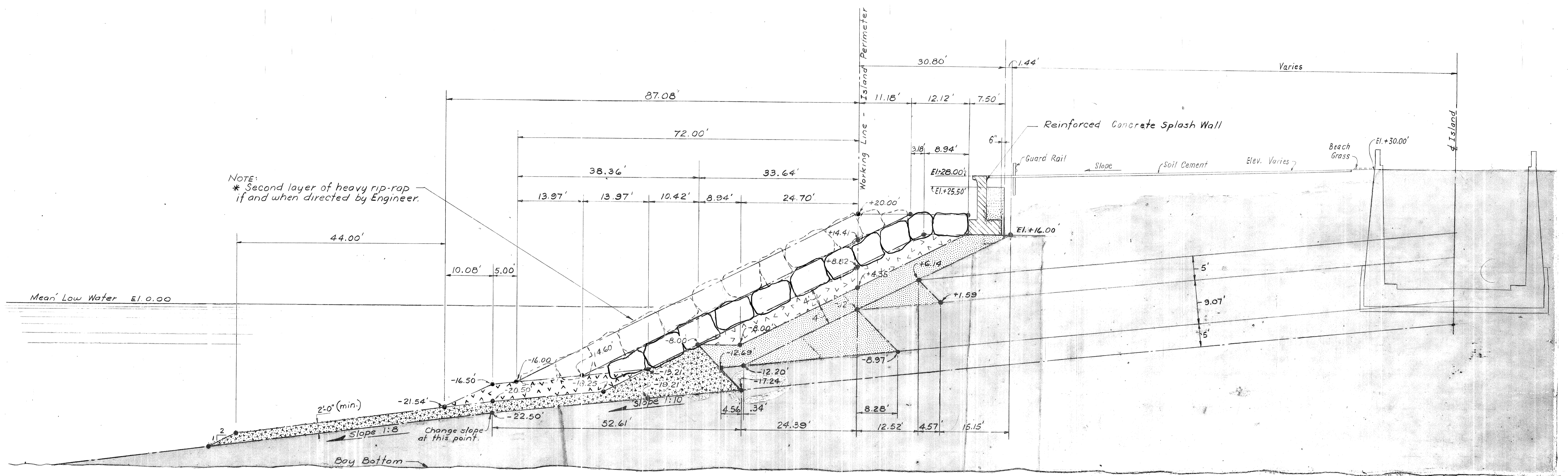
COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
NORFOLK 1, VIRGINIA

SVERDRUP & PARCEL, CONSULTING ENGINEERS
NEW YORK, N. Y. - ST. LOUIS, MO. - NORFOLK, VA.

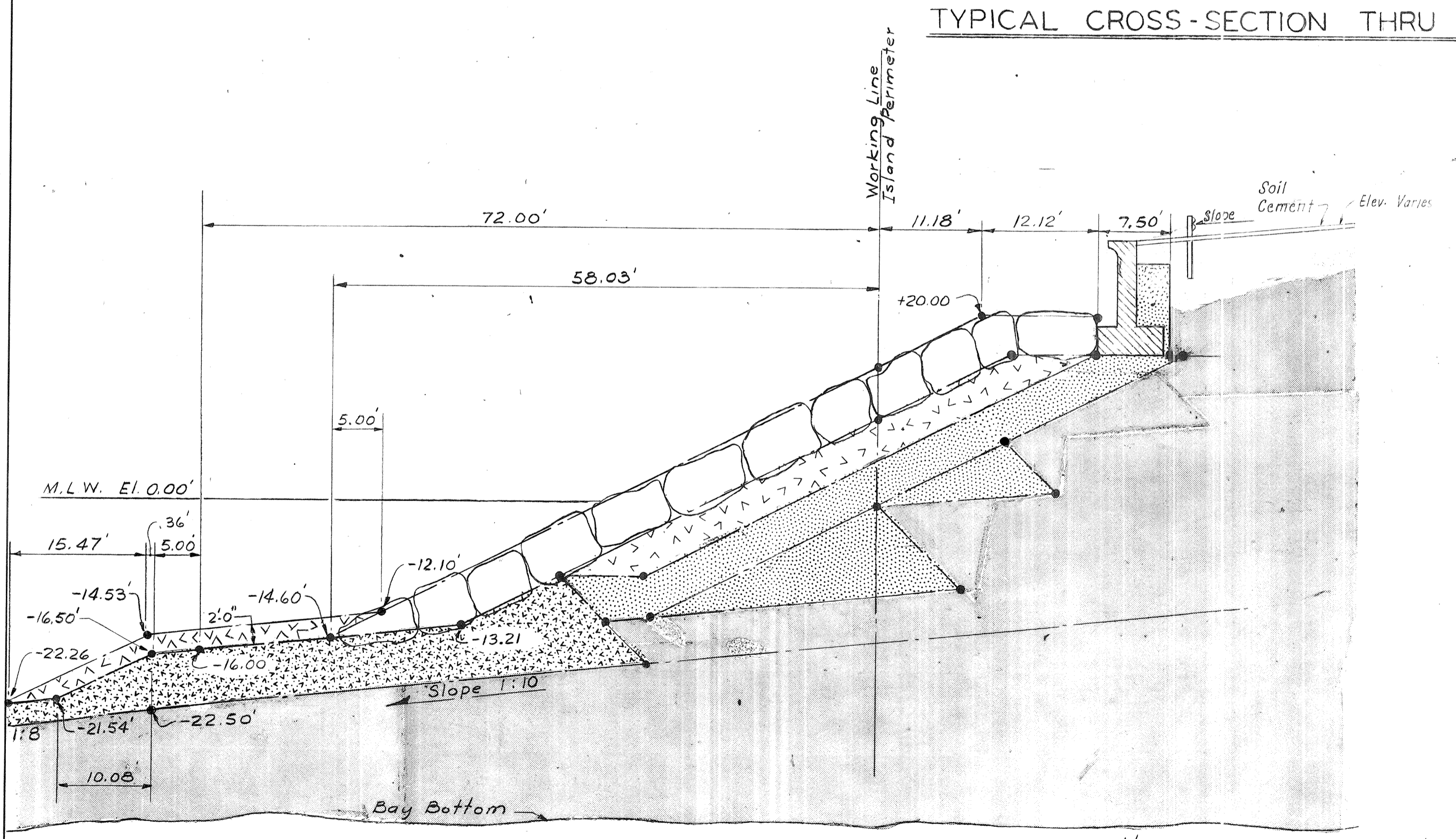
CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING
SHAFTS
KEY PLANS

RECOMMENDED:	DRAWN BY: J.L. S0950	SCALE: 1" = 20'-0"
APPROVED:	CHECKED BY: Chavetta	DATE: 11-24-61
	DWG. NO. BT-200	
	SECTION NO. TS-1 BC-1	

AS BUILT

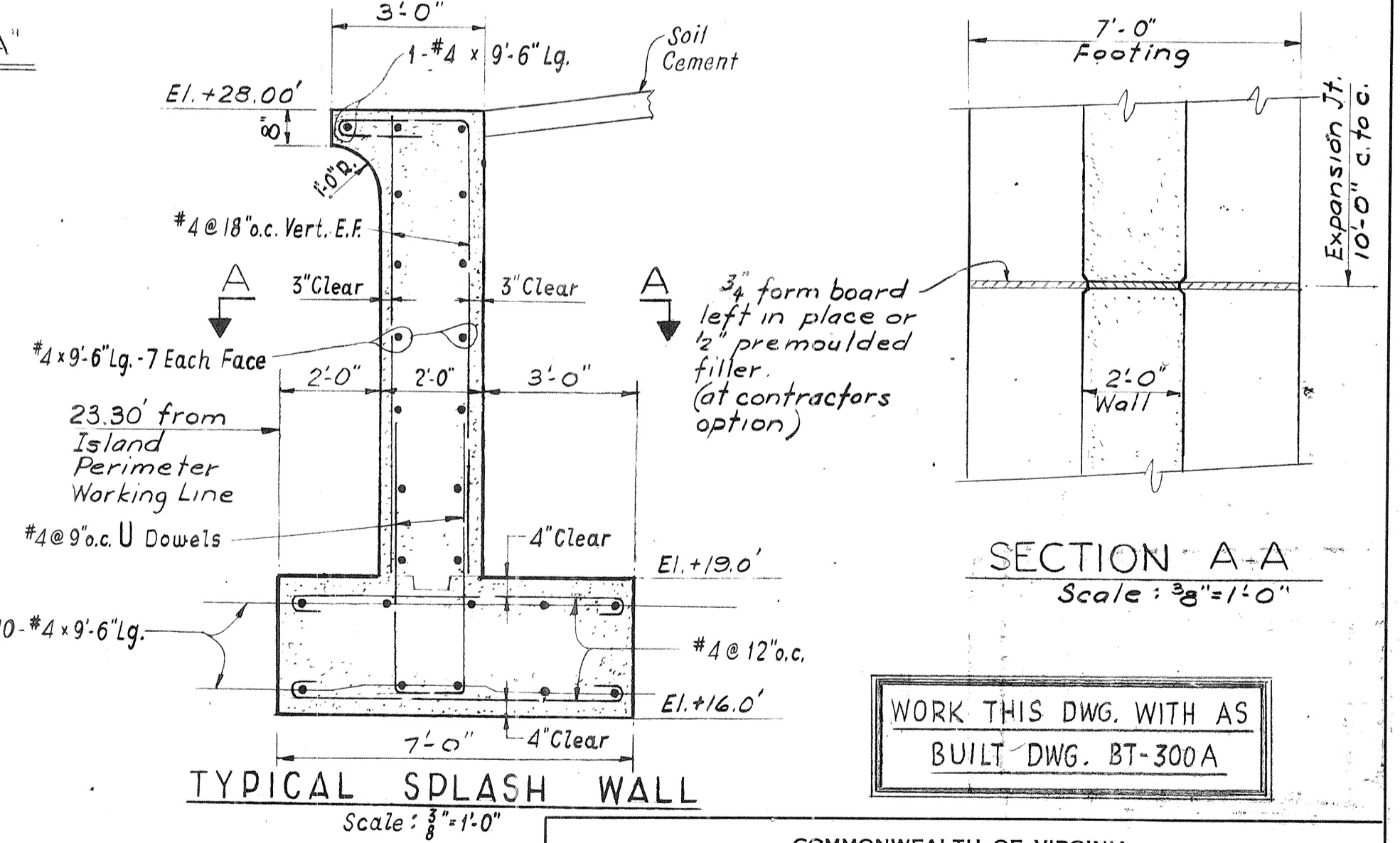
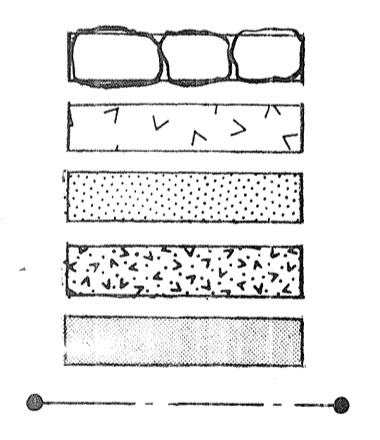


TYPICAL CROSS-SECTION THRU ISLAND - TOE OF SLOPE PROTECTION - SCHEME "A"
Scale: 1" = 10'



TYPICAL CROSS-SECTION THRU ISLAND
TOE OF SLOPE PROTECTION - SCHEME "B"
Scale: 1" = 10'-0"

- LEGEND**
- Heavy Rip Rap Type "A"
 - Quarry Run Rock Type "B"
 - Gravel Type "A"
 - Gravel Type "B"
 - Hydraulic Fill
 - Payment Lines or Limit Lines



WORK THIS DWG. WITH AS
BUILT DWG. BT-300A

NOTE:
TYPICAL CROSS-SECTION THRU ISLAND -
TOE OF SLOPE PROTECTION - SCHEMES
"A" & "B" ARE VOID. FOR REVISED
ISLAND SEE AS BUILT DWG.
BT-300A.



COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
NORFOLK 1, VIRGINIA
SVERDRUP & PARCEL, CONSULTING ENGINEERS
NEW YORK, N. Y. - ST. LOUIS, MO. - NORFOLK, VA.
CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING
ARTIFICIAL PORTAL ISLANDS
TYPICAL PROTECTION DETAILS

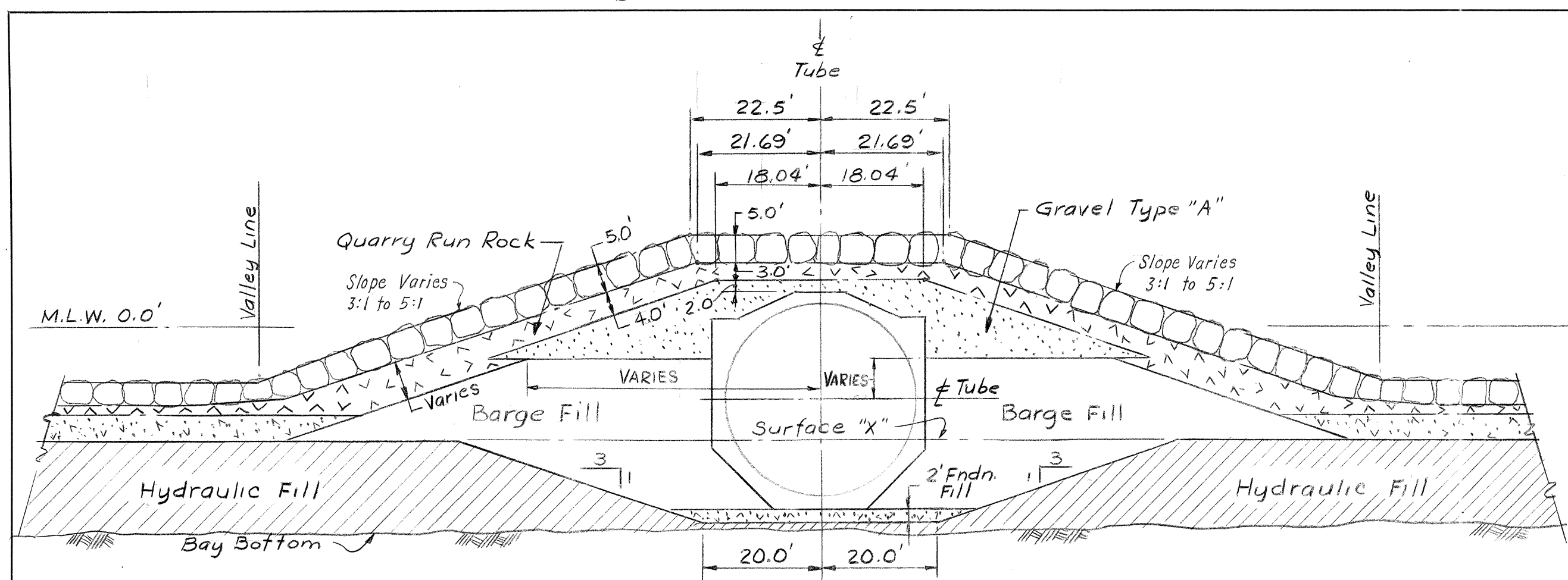
M.S.L.	DATE	REVISION
6	9-22-64	AS BUILT
5	JUL 27 1964	AS BUILT
4	APR 3, 1961	
3	JAN 30, 1961	
2	DEC. 16, 1960	
1	NOV. 14, 1960	

RECOMMENDED:
F. C. Lowry
APPROVED:
C. M. [Signature]

DRAWN BY: A.F.P. SCALE: AS SHOWN
CHECKED BY: FCB DATE: 10-25-60
DWG. NO. BT-300 BT-50
SECTION NO. TS-1 BC-1

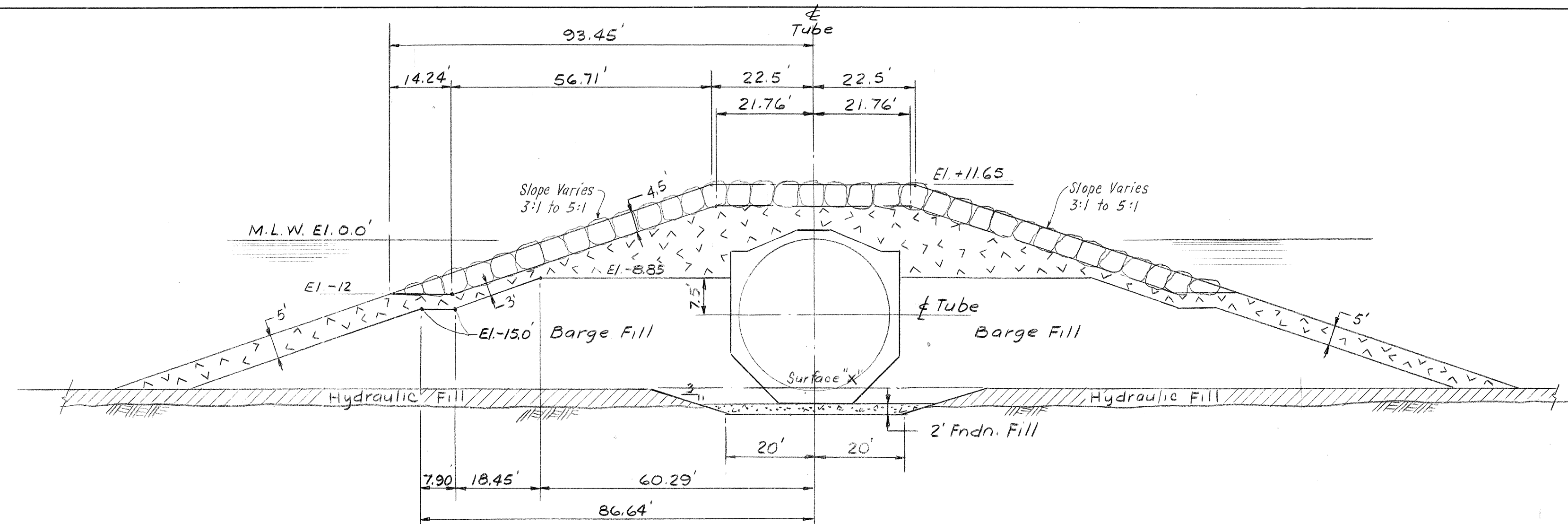
Nov. 2, 1960

AS BUILT

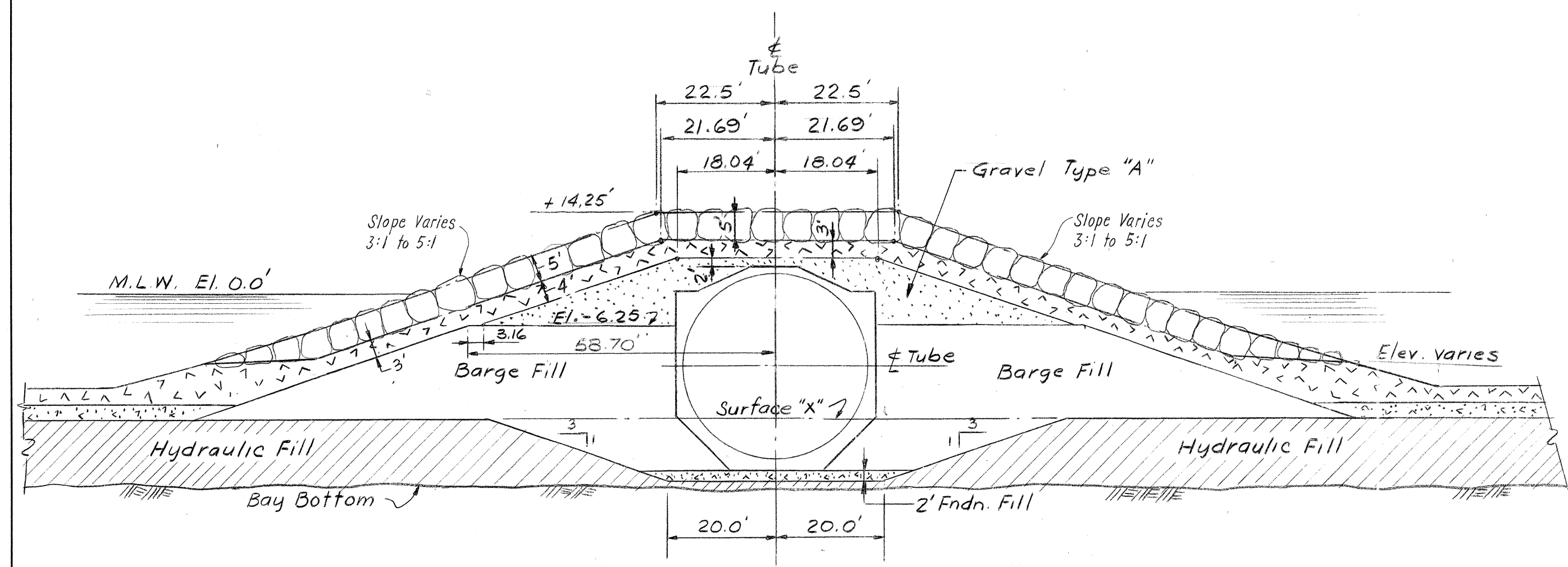


SECTION B-B

As shown for all islands except North Island Thimble Shoal

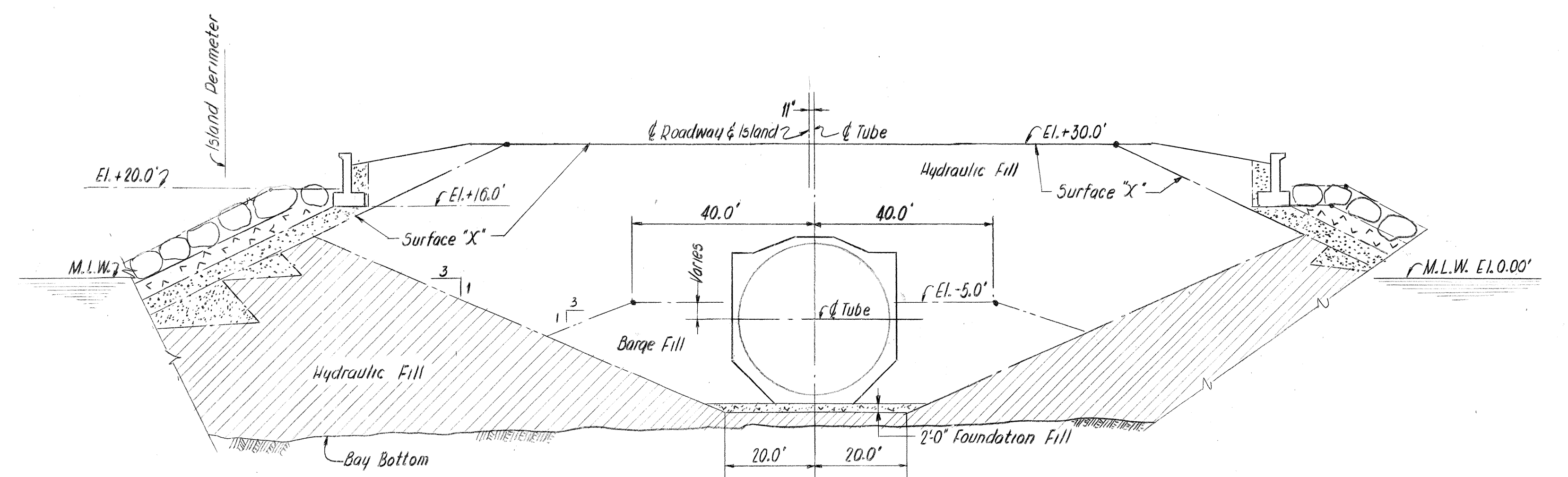


SECTION E-E

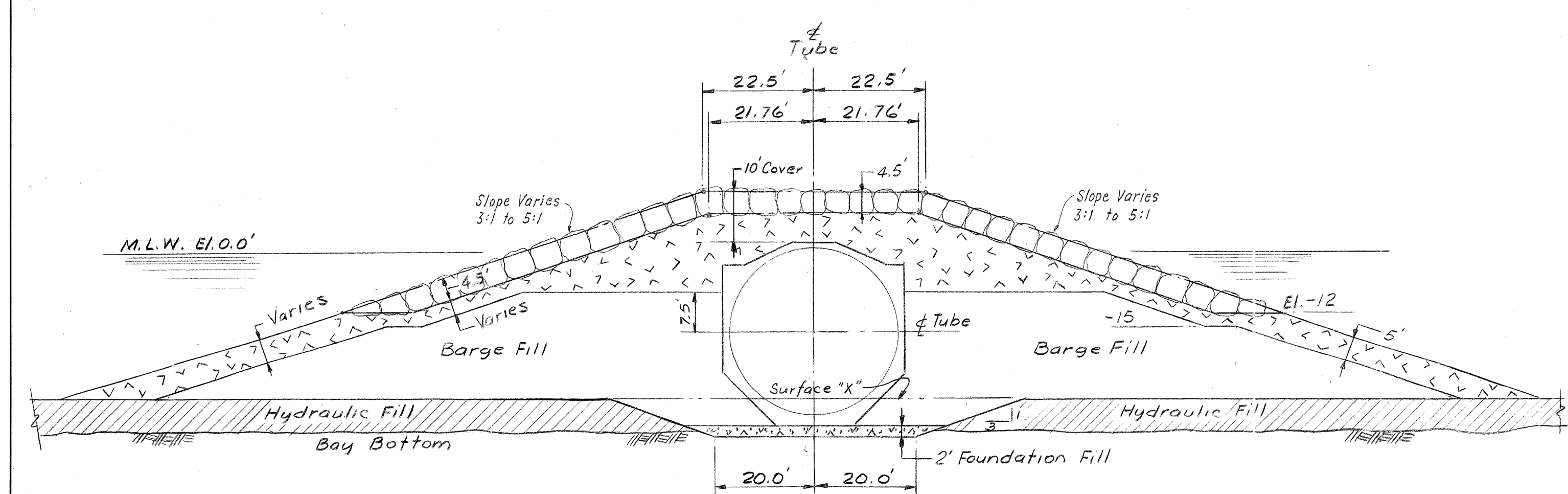


SECTION C-C

As shown for all islands except North Island Thimble Shoal



SECTION F-F



SECTION D-D

FOR LOCATION OF SECTIONS INDICATED SEE DWG. BT-301

COMMONWEALTH OF VIRGINIA
CHESAPEAKE BAY BRIDGE AND TUNNEL DISTRICT
 NORFOLK 1, VIRGINIA

SVERDRUP & PARCEL, CONSULTING ENGINEERS
 NEW YORK, N. Y.-ST. LOUIS, MO.-NORFOLK, VA.

CHESAPEAKE BAY BRIDGE-TUNNEL CROSSING
ARTIFICIAL PORTAL ISLANDS
PROTECTION DETAILS OVER TUBES
SECTIONS

RECOMMENDED:	DRAWN BY: A.F.P.	SCALE: 1"=20'
<i>F.C. Lowry</i>	CHECKED BY: <i>Fee</i>	DATE: 1-30-61
APPROVED:	DWG. NO. BT-302	SECTION NO. TS-1 BC-1
<i>C. W. Mitchell</i>		



T.N.	3	JUL 27 1961 AS BUILT
REV.	2	GENERAL JUNE 18, 1962
REV.	1	AUGUST 31, 1961
APPR. NO.		REVISION

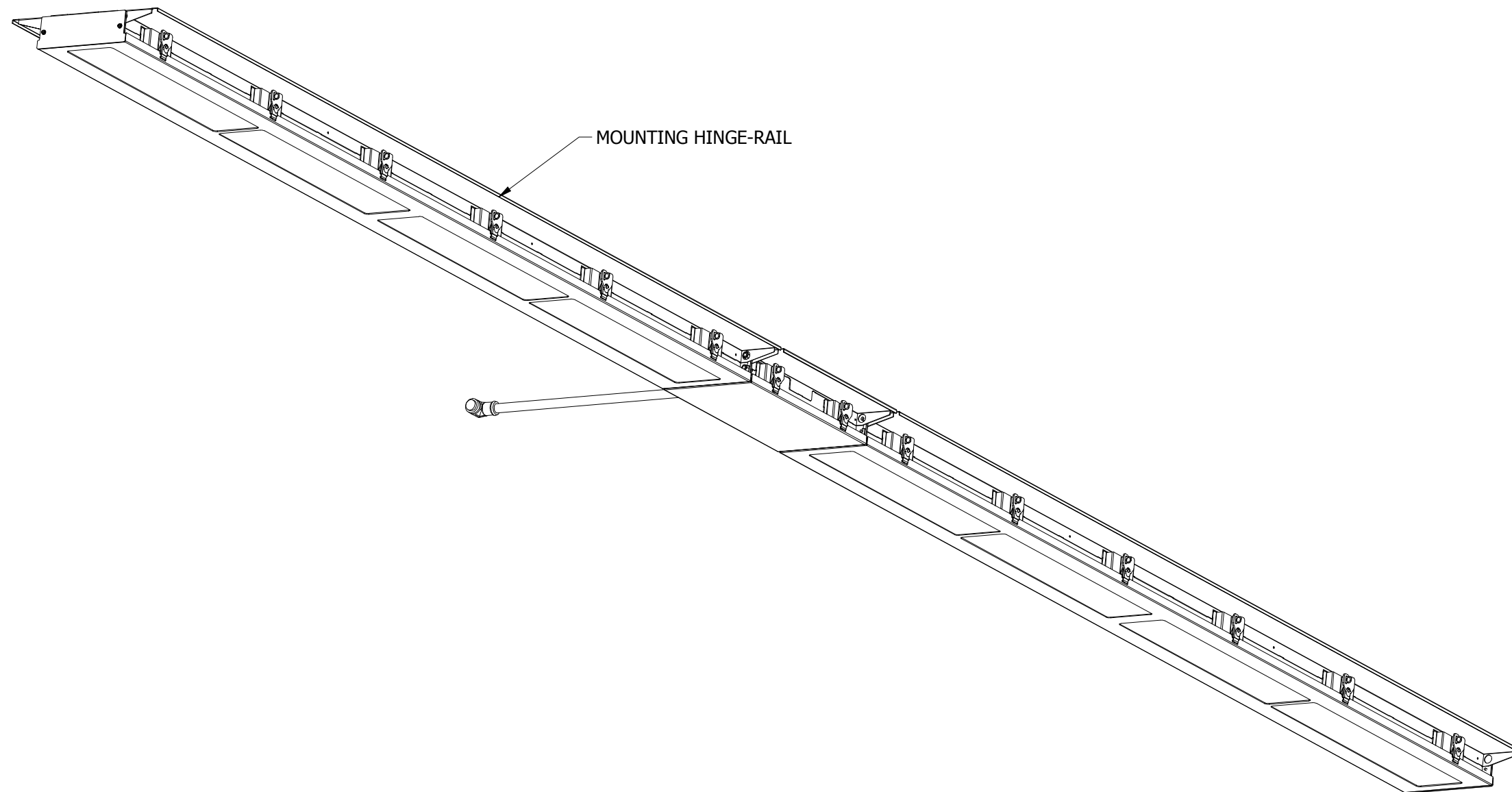
AS BUILT

APPENDIX D


CBBT Tunnel LED Light Fixture Drawings

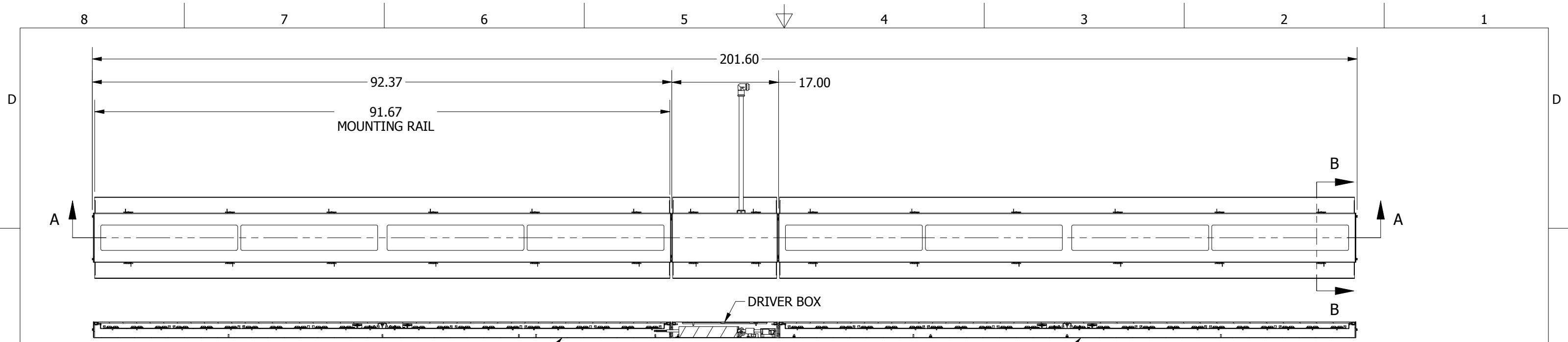
Tunnel LED Fixture Summary

	Designation	Description	Mfg. Part Number	Final Dwg Rev
1	CT1	Threshold Zone Portal Entrance, East and Middle Rows on 1 & 3 Isl, West and Middle Rows on 2 & 4 Isl.	N-3383	1
2	CT1	Threshold Zone Inside Row	N-3371	2
3	CT1	Threshold Zone Outside Row, nearest wall	N-3372	2
4	CT2	Transition Zone	N-2894	5
5	CT3	Interior	N-2893	6
6	Threshold Gap	Threshold area (CT1) short fixture to make spacing work, inside row	N-3466	0
7	Threshold Gap	Threshold area (CT1) short fixture to make spacing work, outside row nearest wall	N-3467	0
8	Portal Gap	Portal area (CT1) short fixture to make spacing work, West row on 1 & 3 Isl, East Row on 2 & 4 Isl	N-3468	0
9	Transition Gap	Transition area (CT2) short fixture to make spacing work	N-3389	0
10	Interior Gap	Interior area (CT3) short fixture to make spacing work	N-3388	0



MOUNTING HINGE-RAIL

DRAWN: fsalas	DATE: 10/18/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-5S-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE PORTAL ENTRANCE			
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		SCALE: --- DO NOT SCALE DRAWING			



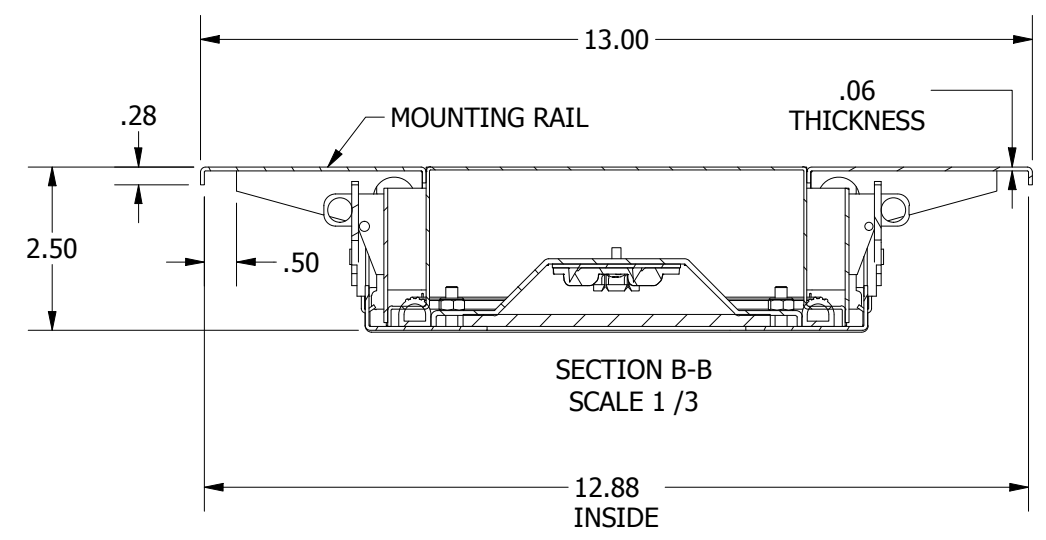
FIXTURE 2

SECTION A-A
SCALE 1 / 15


FIXTURE 1

SPECIFICATIONS

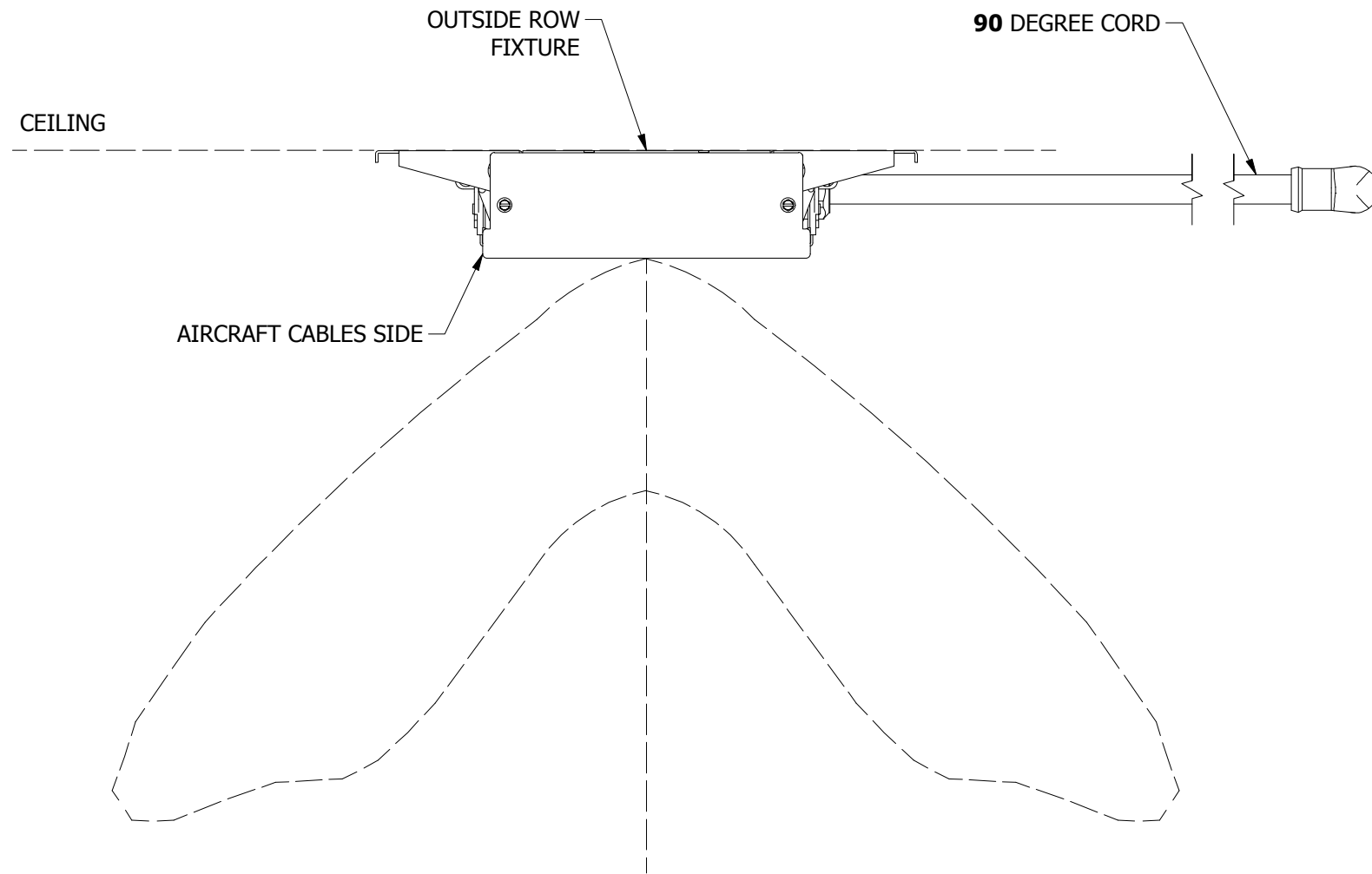
1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE II DISTRIBUTION OPTICS.
6. **ELECTRICAL:**
 - ONE (1) 277-480VAC MEANWELL **DRIVER** (#HVGC-480-H-AB).
 - ONE (1) **CORD** (208003A01F0201).
 - ONE (1) 3-POLE **QUICK DISCONNECT** FOR THE DRIVER.
 - TWO (2) 2-POLE **QUICK DISCONNECTS** FOR LED MODULES.
 - EIGHT (8) 12-LED **MODULES** PER FIXTURE.
 - 192 **LEDS** @700mA DRIVE CURRENT (96 LEDES PER FIXTURE).
 - 400L50K **OPTICAL** PACKAGE WITH TYPE **5S OPTICS**.
 - 21,680 LUMENS PER 8 FOOT SECTION.
 - L70 150,000 HRS.
 - **DIMMING LEVELS:** ONE (1) LIGHTING CONTROL SWITCH AND ONE (1) DIMMING RELAY.
 - * Level 1 - Full intensity 100% (21,680 lumens per 8 foot section).
 - * Level 2 - Dimmed at 75% (16,260 lumens per 8 foot section).
 - * Level 3 - Dimmed at 25% (5,440 lumens per 8 foot section).




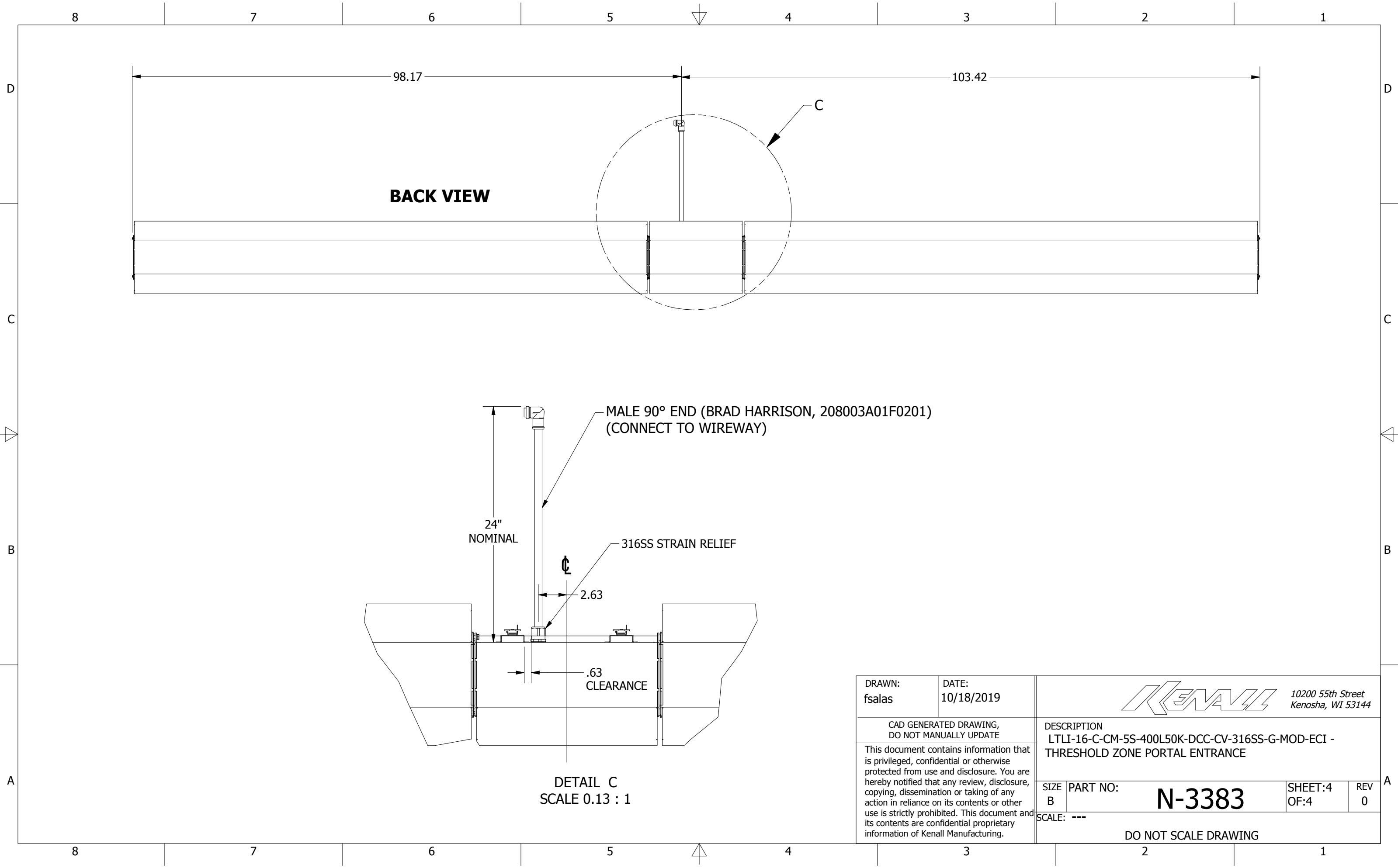
SECTION B-B
SCALE 1 / 3


DRAWN: fsalas	DATE: 10/18/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-5S-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE PORTAL ENTRANCE			
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		DO NOT SCALE DRAWING			

PORTAL ENTRANCE

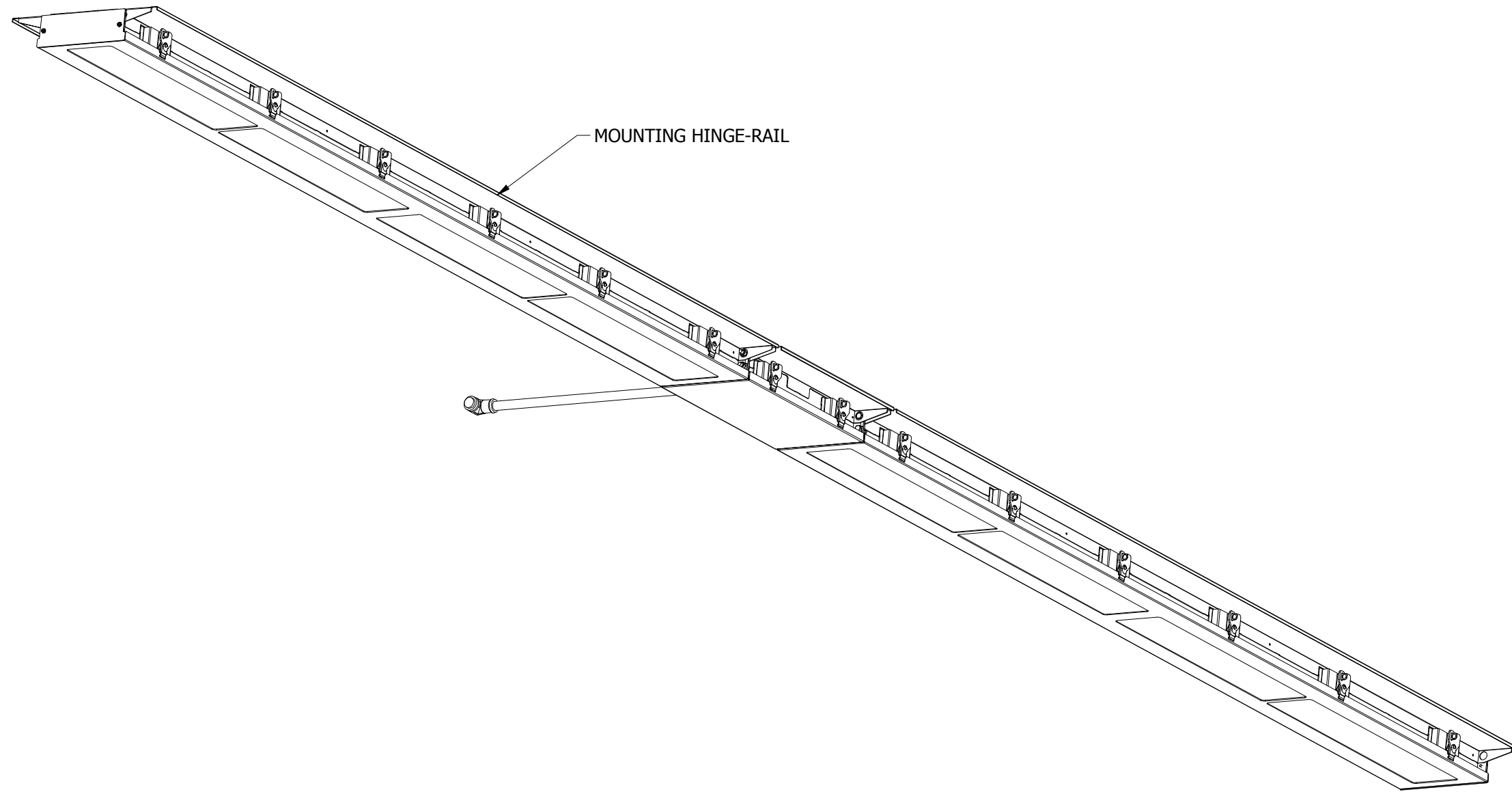


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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-5S-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE PORTAL ENTRANCE			
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		SCALE: --- DO NOT SCALE DRAWING			




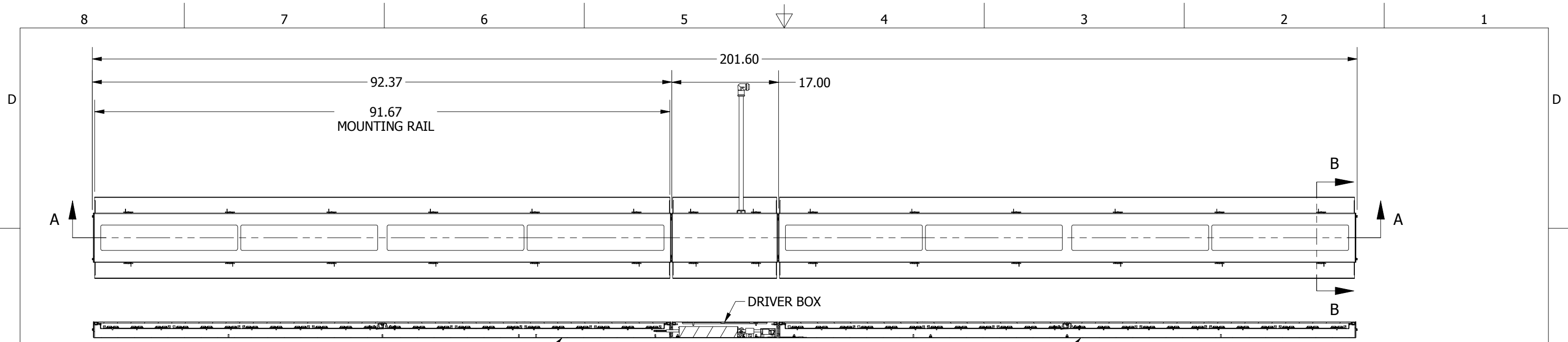
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SIZE B	PART NO: N-3383	SHEET:4 OF:4	REV 0	A
SCALE: ---		DO NOT SCALE DRAWING		

REVISIONS				
REV	ECN NO.	DESCRIPTION	APPROVED	DATE
1	XXXX	Removed the fourth (OFF) dimming level per customer request. It should be in the Outside Row fixture instead.	FS	09/30/2019
2	XXXX	L70 changed from 150,000 hrs. to 125,000 hrs.	FS	11/13/2019



MOUNTING HINGE-RAIL

DRAWN: fsalas	DATE: 9/20/2019	 10200 55th Street Kenosha, WI 53144		
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-2-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE INSIDE ROW		
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		SCALE: ---		
DO NOT SCALE DRAWING				



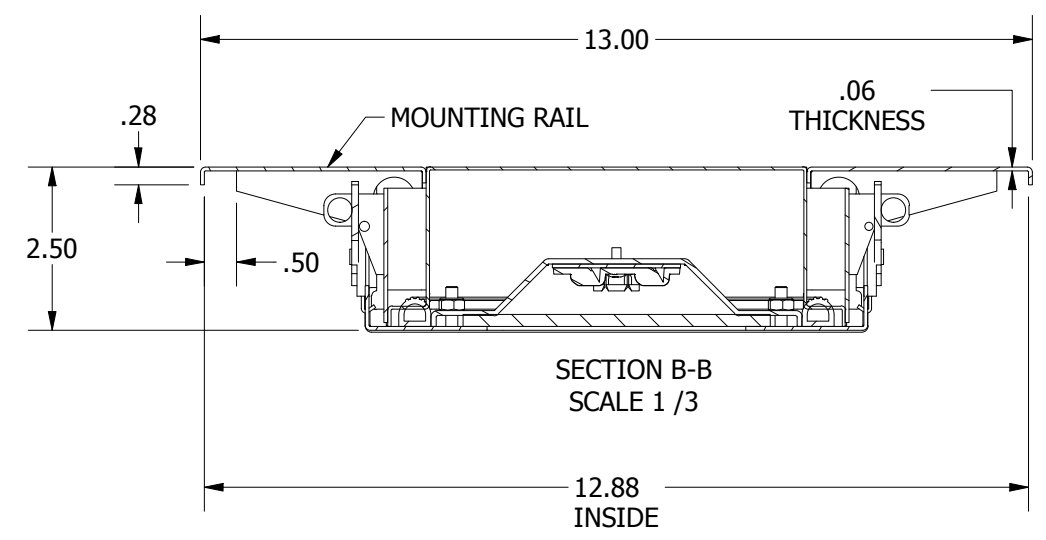
FIXTURE 2

SECTION A-A
SCALE 1 / 15


FIXTURE 1

SPECIFICATIONS

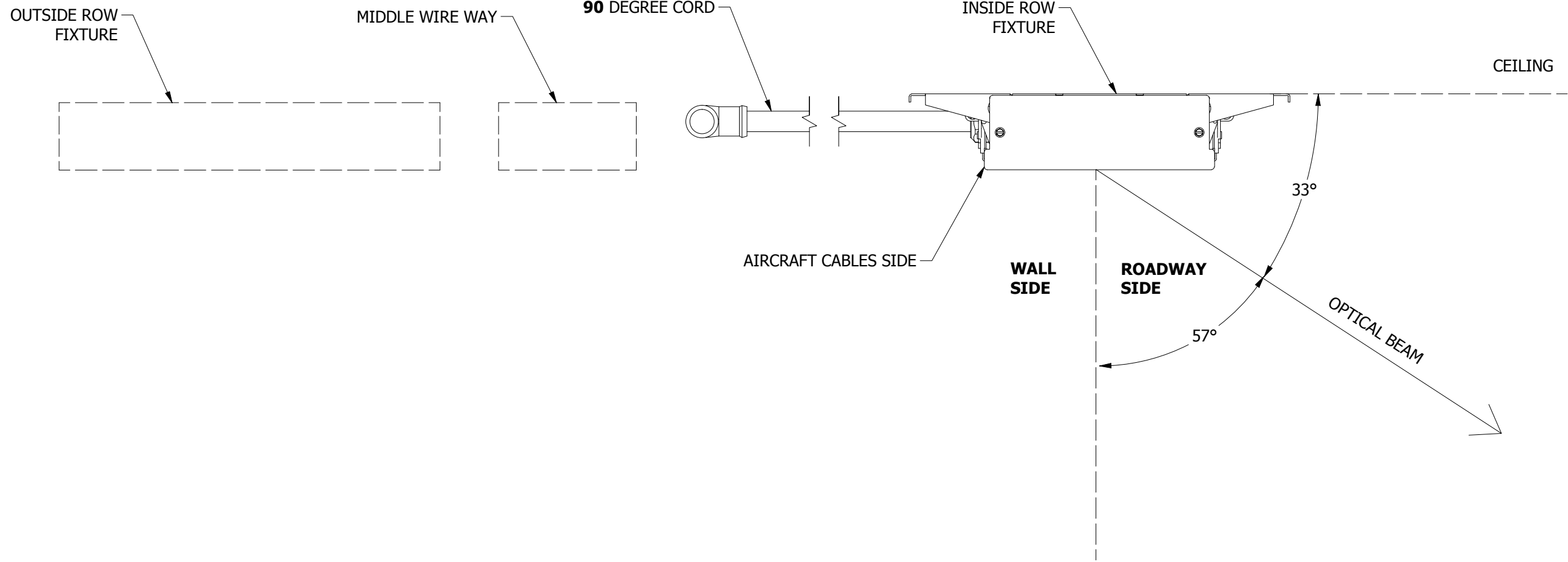
1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE II DISTRIBUTION OPTICS.
6. **ELECTRICAL:**
 - ONE (1) 277-480VAC MEANWELL **DRIVER** (#HVGC-480-H-AB).
 - ONE (1) **CORD** (208003A01F0201).
 - ONE (1) 3-POLE **QUICK DISCONNECT** FOR THE DRIVER.
 - TWO (2) 2-POLE **QUICK DISCONNECTS** FOR LED MODULES.
 - EIGHT (8) 12-LED **MODULES** PER FIXTURE.
 - 192 **LEDS** @700mA DRIVE CURRENT (96 LEDES PER FIXTURE).
 - 400L50K **OPTICAL** PACKAGE WITH TYPE 2 OPTICS.
 - 21,680 LUMENS PER 8 FOOT SECTION.
 - L70 125,000 HRS.
 - **DIMMING LEVELS:** ONE (1) LIGHTING CONTROL SWITCH AND ONE (1) DIMMING RELAY.
 - * Level 1 - Full intensity (21,680 lumens per 8 foot section).
 - * Level 2 - Dimmed at 75% to match the CT2 daytime settings (16,260 lumens per 8 foot section).
 - * Level 3 - Dimmed at 25% to match the CT2 Nighttime settings (5,440 lumens per 8 foot section).




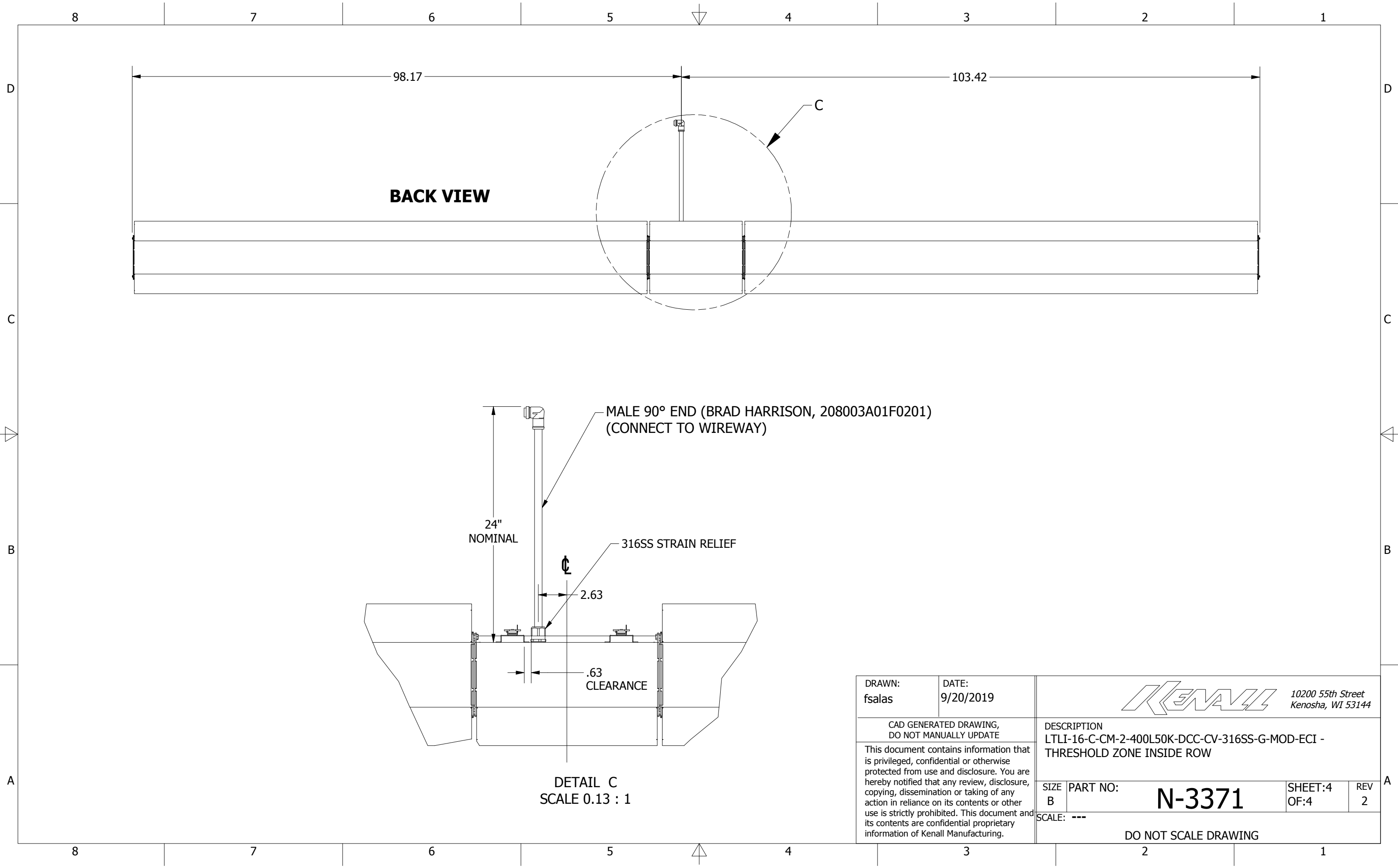
SECTION B-B
SCALE 1 / 3


DRAWN: fsalas	DATE: 9/20/2019	 10200 55th Street Kenosha, WI 53144		
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-2-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE INSIDE ROW		
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		SCALE: ---		
DO NOT SCALE DRAWING				

INSIDE ROW CONFIGURATION

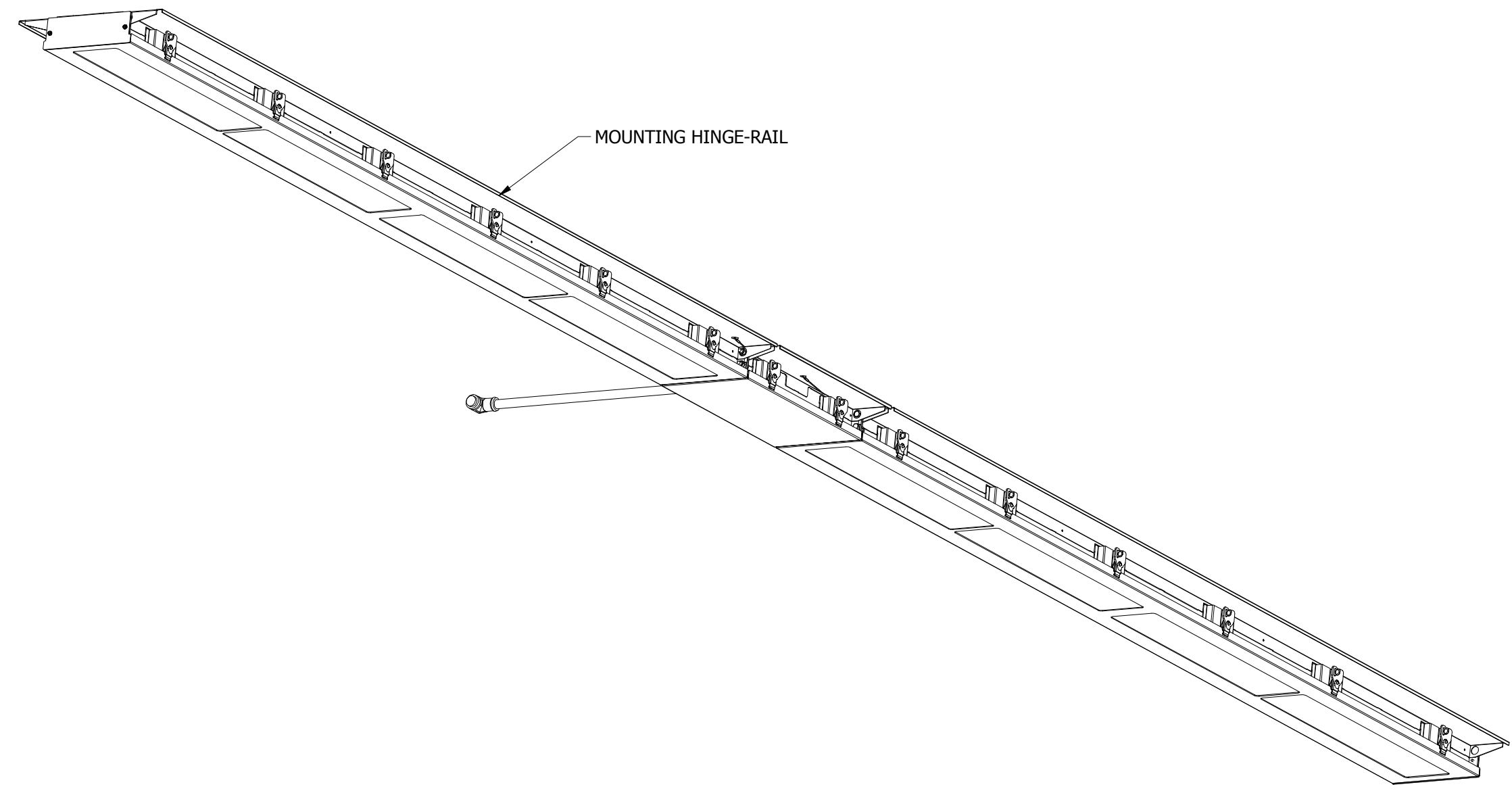


DRAWN: fsalas	DATE: 9/20/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-2-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE INSIDE ROW			
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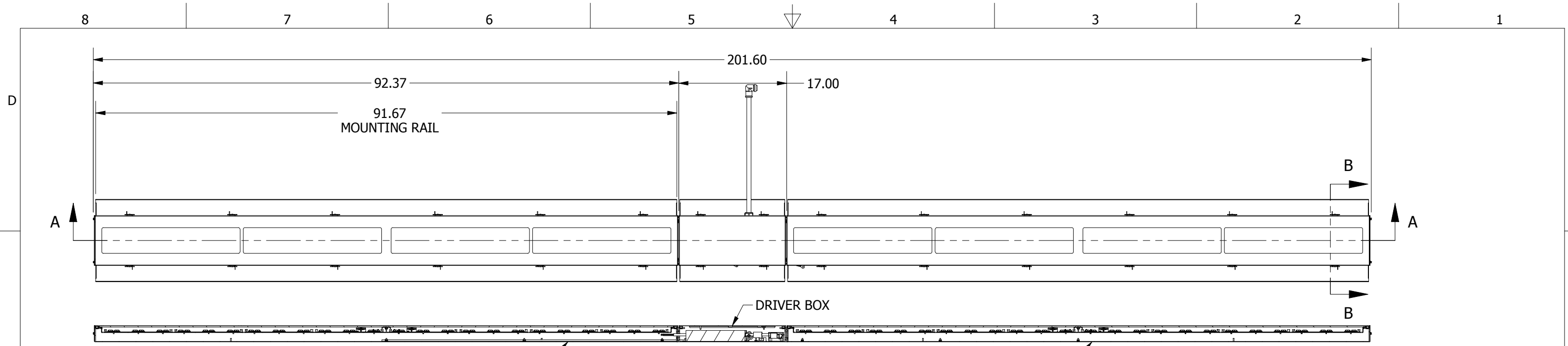
DRAWN: fsalas	DATE: 9/20/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-2-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE INSIDE ROW			
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		SCALE: ---			
DO NOT SCALE DRAWING					

REVISIONS				
REV	ECN NO.	DESCRIPTION	APPROVED	DATE
1	XXXX	Added the fourth (OFF) dimming level, per customer request.	FS	09/30/2019
2	XXXX	L70 changed from 150,000 hrs. to 125,000 hrs.	FS	11/13/2019



MOUNTING HINGE-RAIL

DRAWN: fsalas	DATE: 9/26/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-2-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE OUTSIDE ROW			
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		SCALE: ---			
DO NOT SCALE DRAWING					



FIXTURE 2

SECTION A-A
SCALE 1 / 15

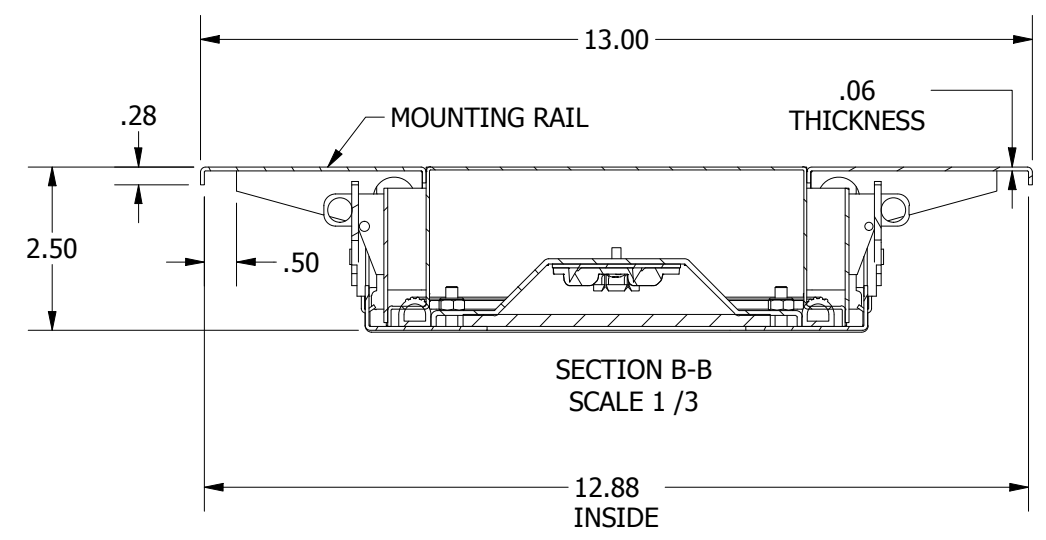
FIXTURE 1

SPECIFICATIONS


1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE II DISTRIBUTION OPTICS.

6. ELECTRICAL:

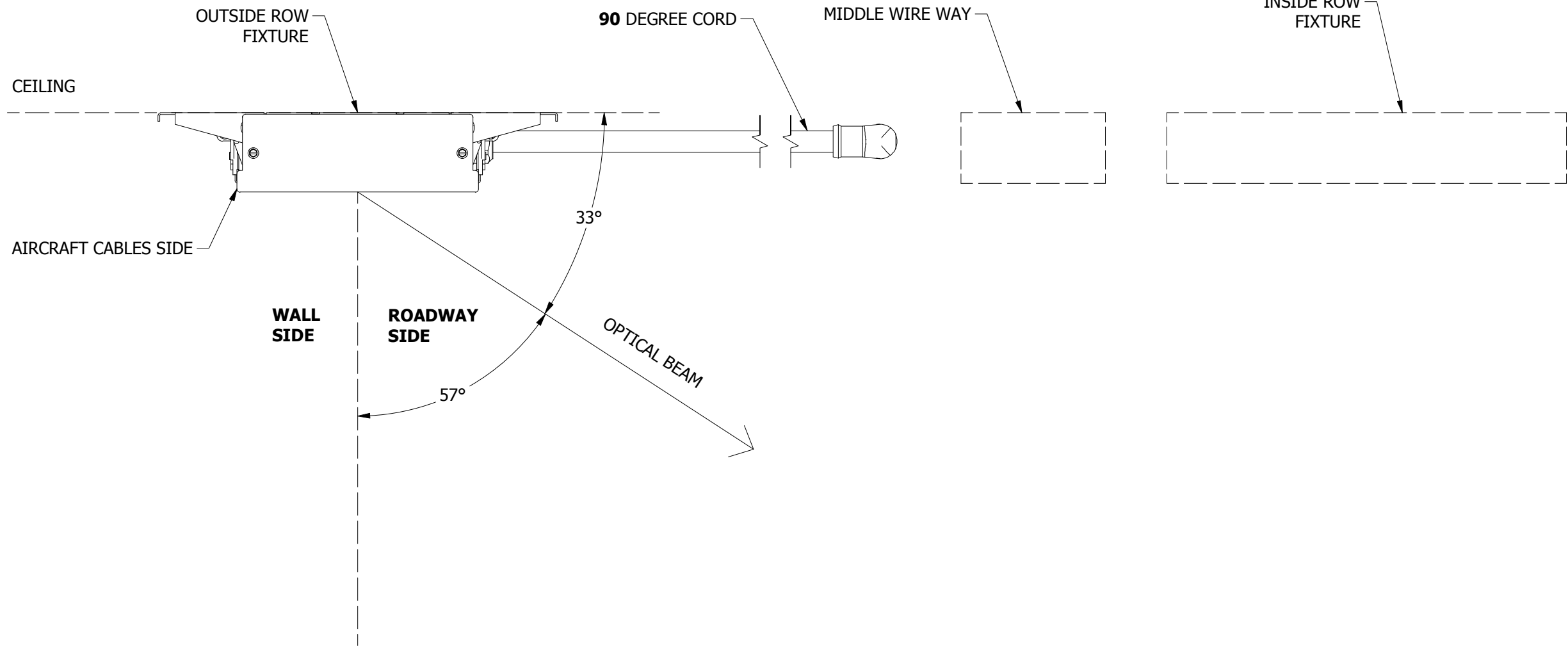
- ONE (1) 277-480VAC MEANWELL **DRIVER** (#HVGC-480-H-AB).
- ONE (1) **CORD** (208003A01F0201).
- ONE (1) 3-POLE **QUICK DISCONNECT** FOR THE DRIVER.
- TWO (2) 2-POLE **QUICK DISCONNECTS** FOR LED MODULES.
- EIGHT (8) 12-LED **MODULES** PER FIXTURE.
- 192 **LEDS** @700mA DRIVE CURRENT (96 LEDES PER FIXTURE).
- 400L50K **OPTICAL** PACKAGE WITH TYPE 2 OPTICS.
- 21,680 LUMENS PER 8 FOOT SECTION.
- L70 125,000 HRS.
- **DIMMING LEVELS:** ONE (1) LIGHTING CONTROL SWITCH AND ONE (1) DIMMING RELAY.
 - * Level 1 - Full intensity (21,680 lumens per 8 foot section).
 - * Level 2 - Dimmed at 75% to match the CT2 daytime settings (16,260 lumens per 8 foot section).
 - * Level 3 - Dimmed at 25% to match the CT2 Nighttime settings (5,440 lumens per 8 foot section).
 - * Level 4 - OFF.




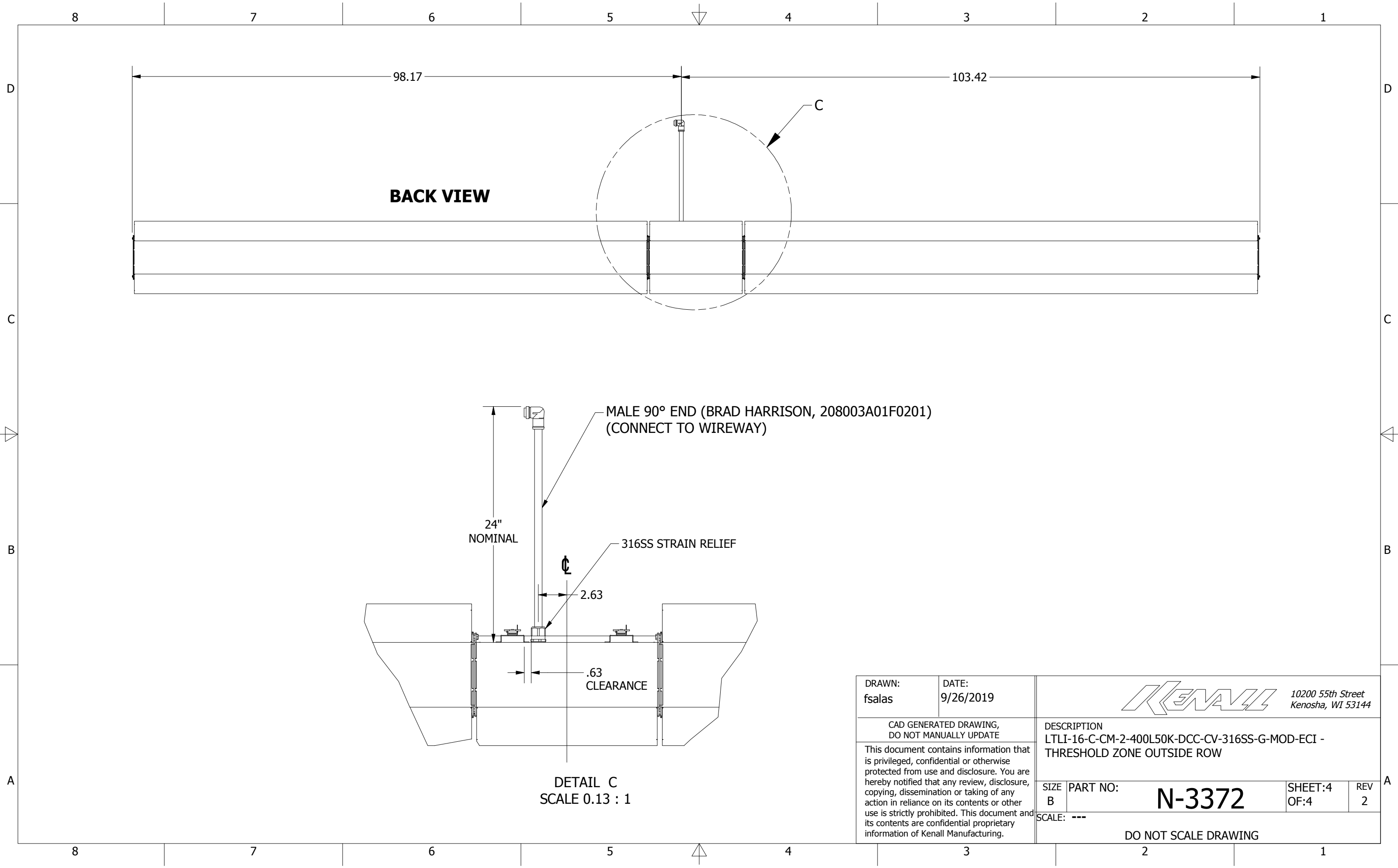
SECTION B-B
SCALE 1 / 3


DRAWN: fsalas	DATE: 9/26/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-2-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE OUTSIDE ROW			
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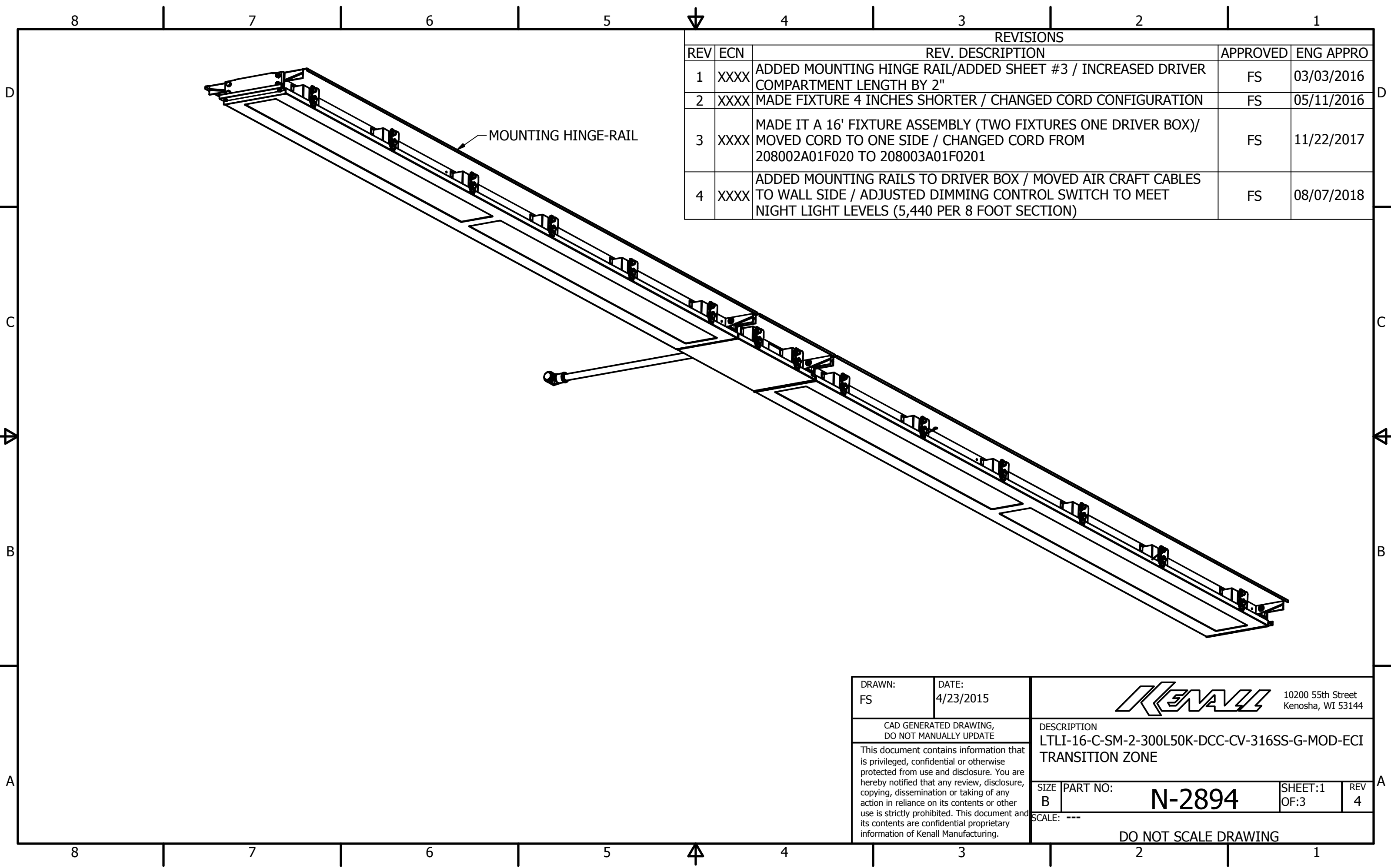
OUTSIDE ROW CONFIGURATION




DRAWN: fsalas	DATE: 9/26/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-2-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE OUTSIDE ROW			
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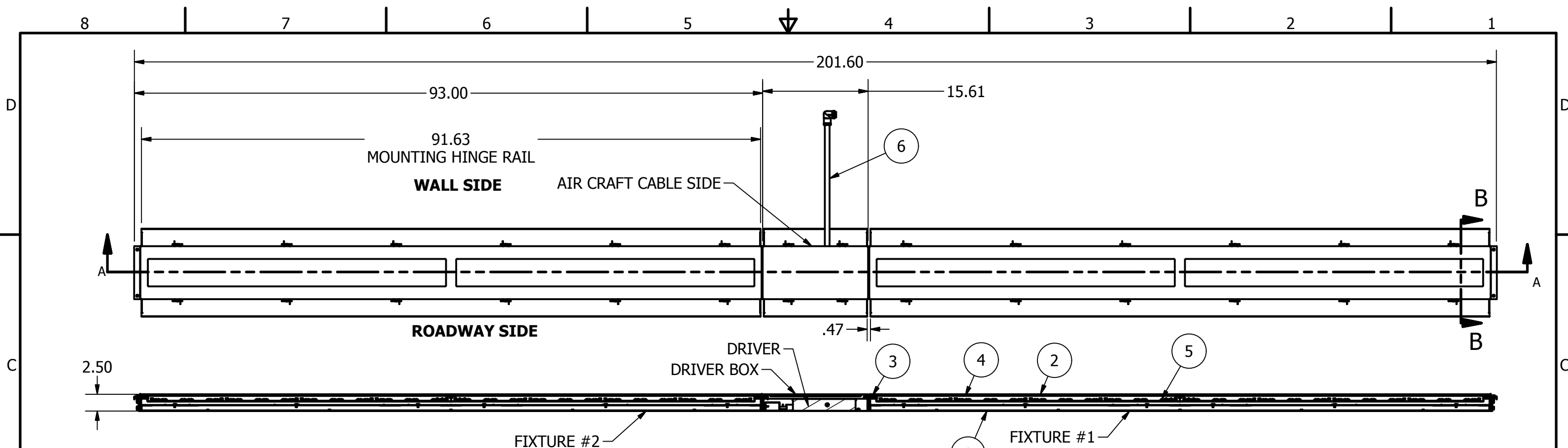


DRAWN: fsalas	DATE: 9/26/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-CM-2-400L50K-DCC-CV-316SS-G-MOD-ECI - THRESHOLD ZONE OUTSIDE ROW			
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		SCALE: ---			
DO NOT SCALE DRAWING					



REVISIONS				
REV	ECN	REV. DESCRIPTION	APPROVED	ENG APPRO
1	XXXX	ADDED MOUNTING HINGE RAIL/ADDED SHEET #3 / INCREASED DRIVER COMPARTMENT LENGTH BY 2"	FS	03/03/2016
2	XXXX	MADE FIXTURE 4 INCHES SHORTER / CHANGED CORD CONFIGURATION	FS	05/11/2016
3	XXXX	MADE IT A 16' FIXTURE ASSEMBLY (TWO FIXTURES ONE DRIVER BOX)/ MOVED CORD TO ONE SIDE / CHANGED CORD FROM 208002A01F020 TO 208003A01F0201	FS	11/22/2017
4	XXXX	ADDED MOUNTING RAILS TO DRIVER BOX / MOVED AIR CRAFT CABLES TO WALL SIDE / ADJUSTED DIMMING CONTROL SWITCH TO MEET NIGHT LIGHT LEVELS (5,440 PER 8 FOOT SECTION)	FS	08/07/2018

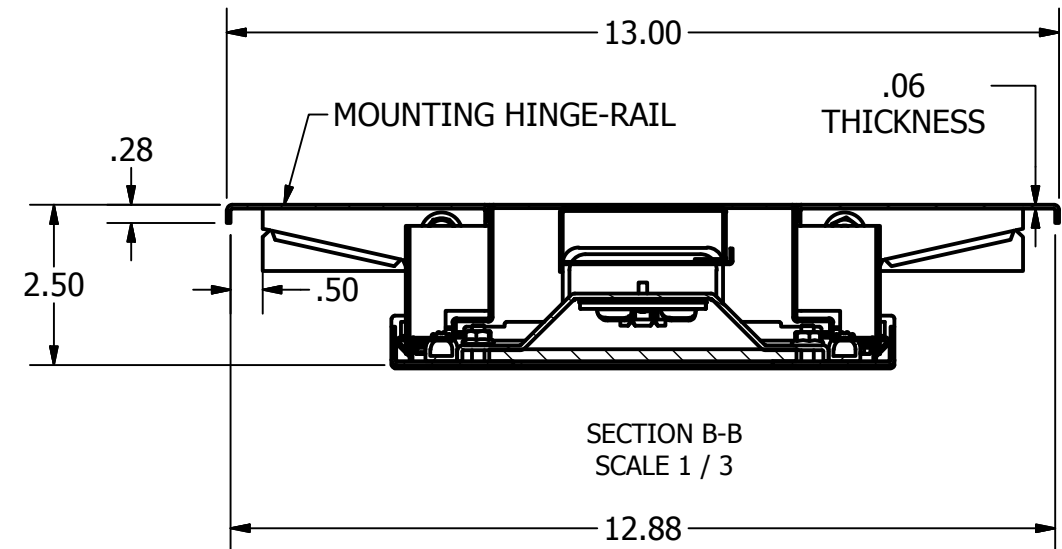
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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE This document contains information that is privileged, confidential or otherwise protected from use and disclosure. You are hereby notified that any review, disclosure, copying, dissemination or taking of any action in reliance on its contents or other use is strictly prohibited. This document and its contents are confidential proprietary information of Kenall Manufacturing.		DESCRIPTION LTLI-16-C-SM-2-300L50K-DCC-CV-316SS-G-MOD-ECI TRANSITION ZONE		
SIZE B	PART NO: N-2894	SHEET:1 OF:3	REV 4	
SCALE: ---				
DO NOT SCALE DRAWING				




SPECIFICATIONS

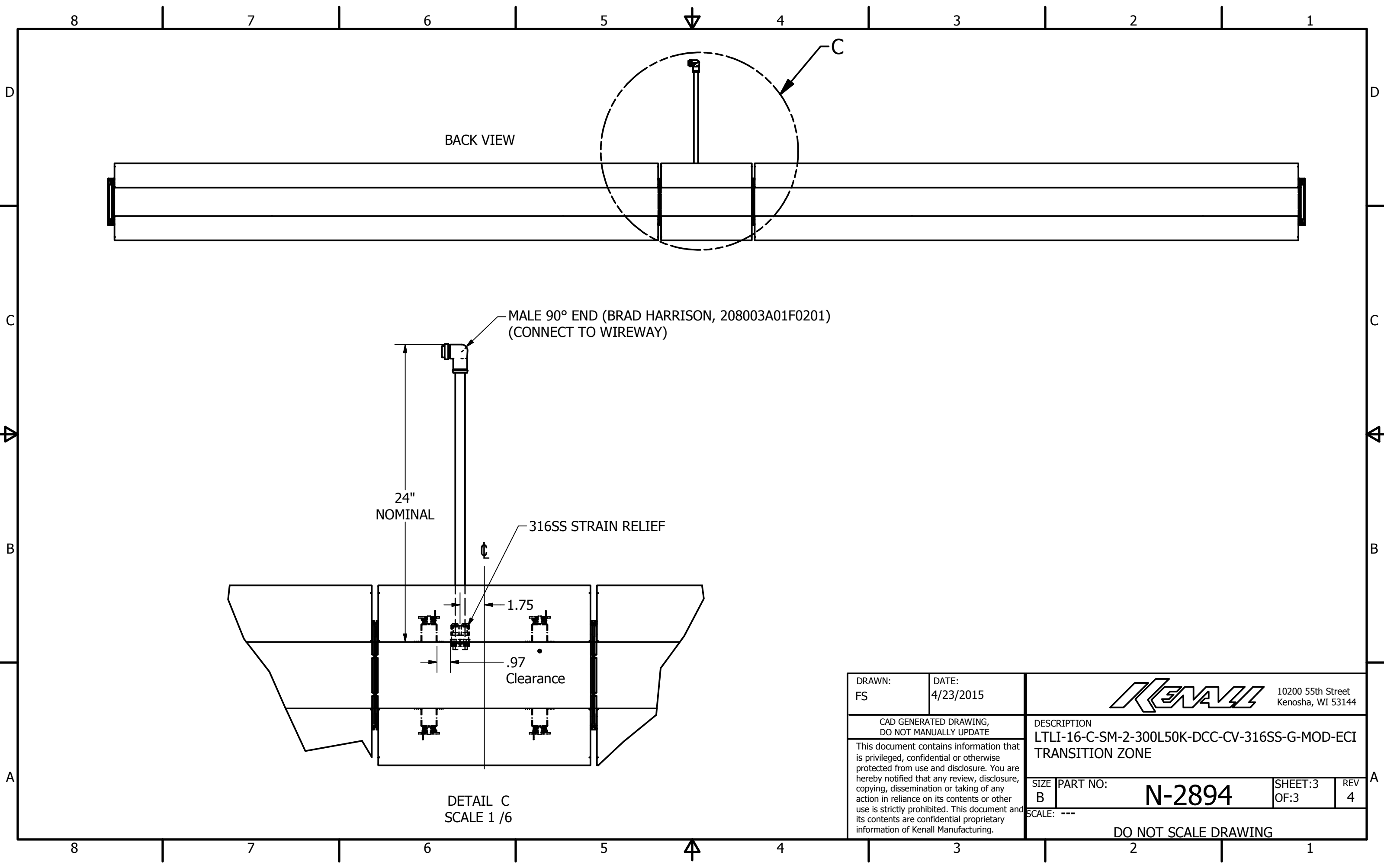
1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE II DISTRIBUTION OPTICS.
6. **ELECTRICAL:**
 - ONE (1) 277-480VAC MEANWELL **DRIVER** (#HVGC-320-2100B).
 - ONE (1) **CORD** (208003A01F0201).
 - ONE (1) 3-POLE **QUICK DISCONNECT** FOR THE DRIVER.
 - TWO (2) 2-POLE **QUICK DISCONNECTS** FOR LED MODULES.
 - EIGHT (8) 12-LED **MODULES** PER FIXTURE.
 - 192 **LEDS** @525mA DRIVE CURRENT (96 LEDES PER FIXTURE).
 - 300L50K **OPTICAL** PACKAGE WITH TYPE 2 OPTICS.
 - 16,260 LUMENS PER 8 FOOT SECTION.
 - L70 100,000 HRS.
 - ONE (1) LIGHTING **CONTROL SWITCH**, DIMS THE FIXTURE DOWN TO 33% LIGHT OUTPUT (5,440 LUMENS PER 8 FOOT SECTION).


SECTION A-A
SCALE 1 / 14



SECTION B-B
SCALE 1 / 3

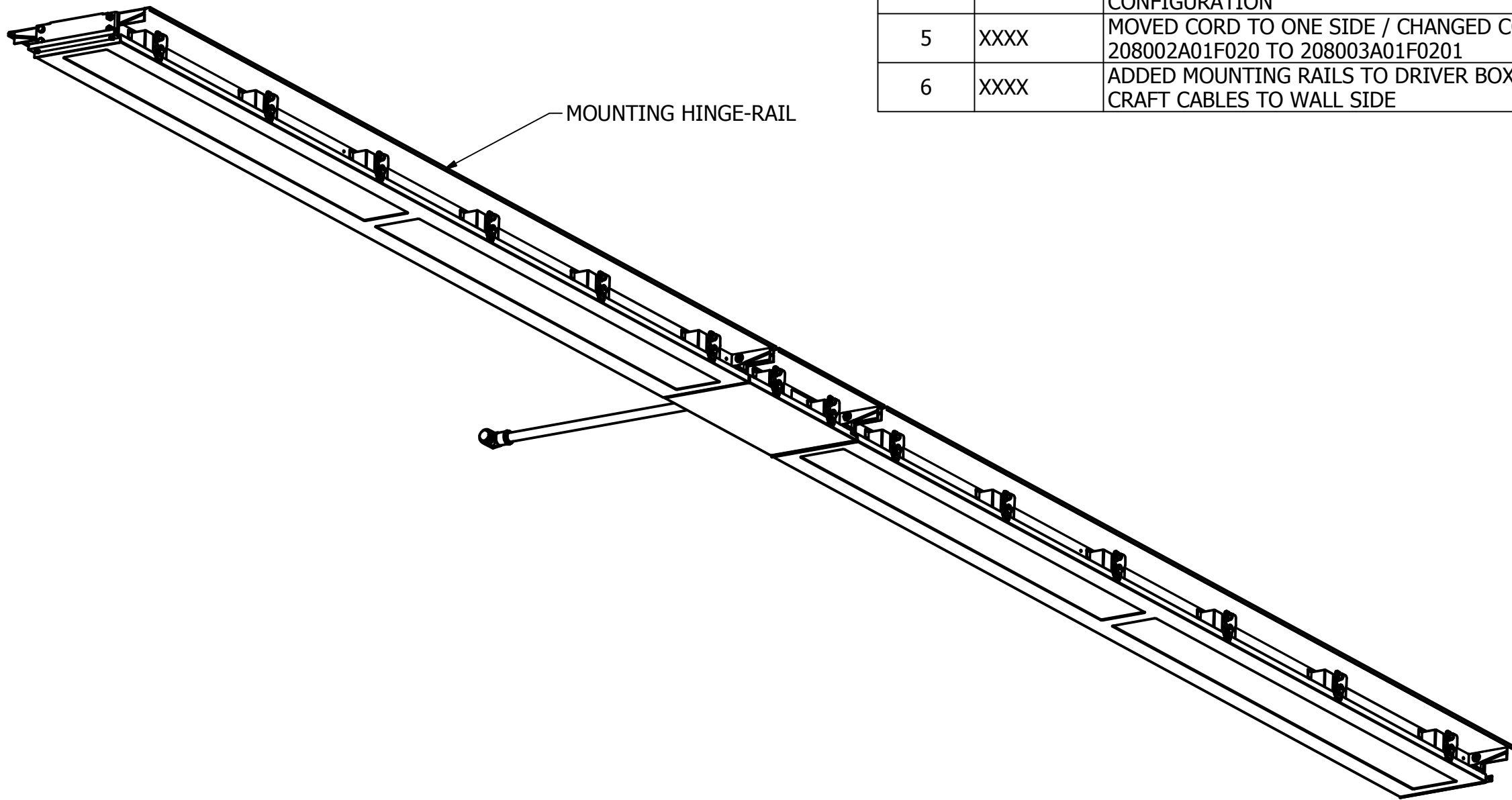
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DO NOT SCALE DRAWING				




DRAWN: FS	DATE: 4/23/2015	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-SM-2-300L50K-DCC-CV-316SS-G-MOD-ECI TRANSITION ZONE			
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		SCALE: ---			
DO NOT SCALE DRAWING					

8 7 6 5 4 3 2 1

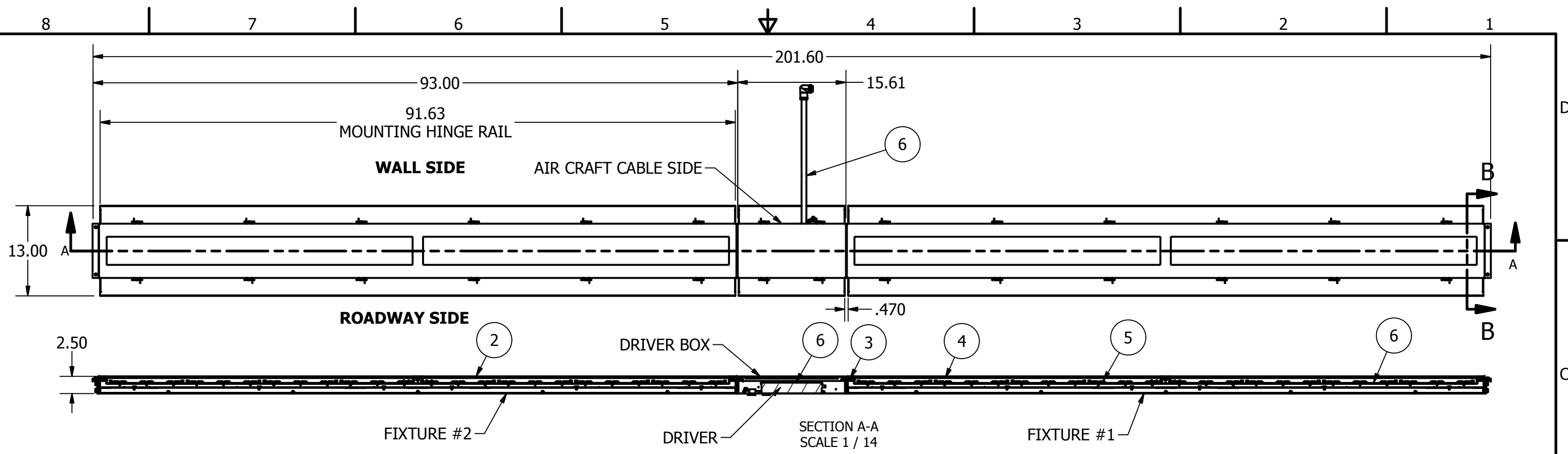
REVISIONS				
REV	ECN NO.	REV. DESCRIPTION	APPROVED	DATE
1	XXXX	CHANGED LENS FROM .188" TGL TO .125" CLEAR POLY	FS	03/31/2015
2	XXXX	ADDED NOTES "WALL SIDE" AND "ROADWAY SIDE"	FS	
3	XXXX	ADDED MOUNTING HINGE RAILS / ADDED SHEET # 3	FS	03/01/2016
4	XXXX	REDUCED TOTAL LENGTH BY 8 INCHES / CHANGED CORD CONFIGURATION	FS	05/23/2016
5	XXXX	MOVED CORD TO ONE SIDE / CHANGED CORD FROM 208002A01F020 TO 208003A01F0201	FS	01/17/2017
6	XXXX	ADDED MOUNTING RAILS TO DRIVER BOX / MOVED AIR CRAFT CABLES TO WALL SIDE	FS	08/08/2018



MOUNTING HINGE-RAIL

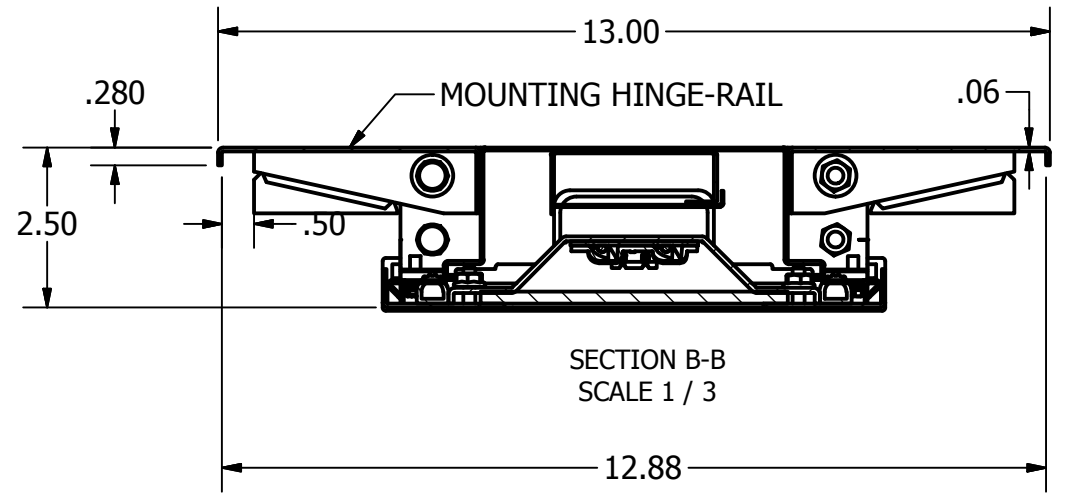
DRAWN: fsalas	DATE: 3/20/2015	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-SM-2-100L50K-DCC-CV-316SS-G-MOD-ECI INTERIOR ZONE			
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		SCALE: --- DO NOT SCALE DRAWING			


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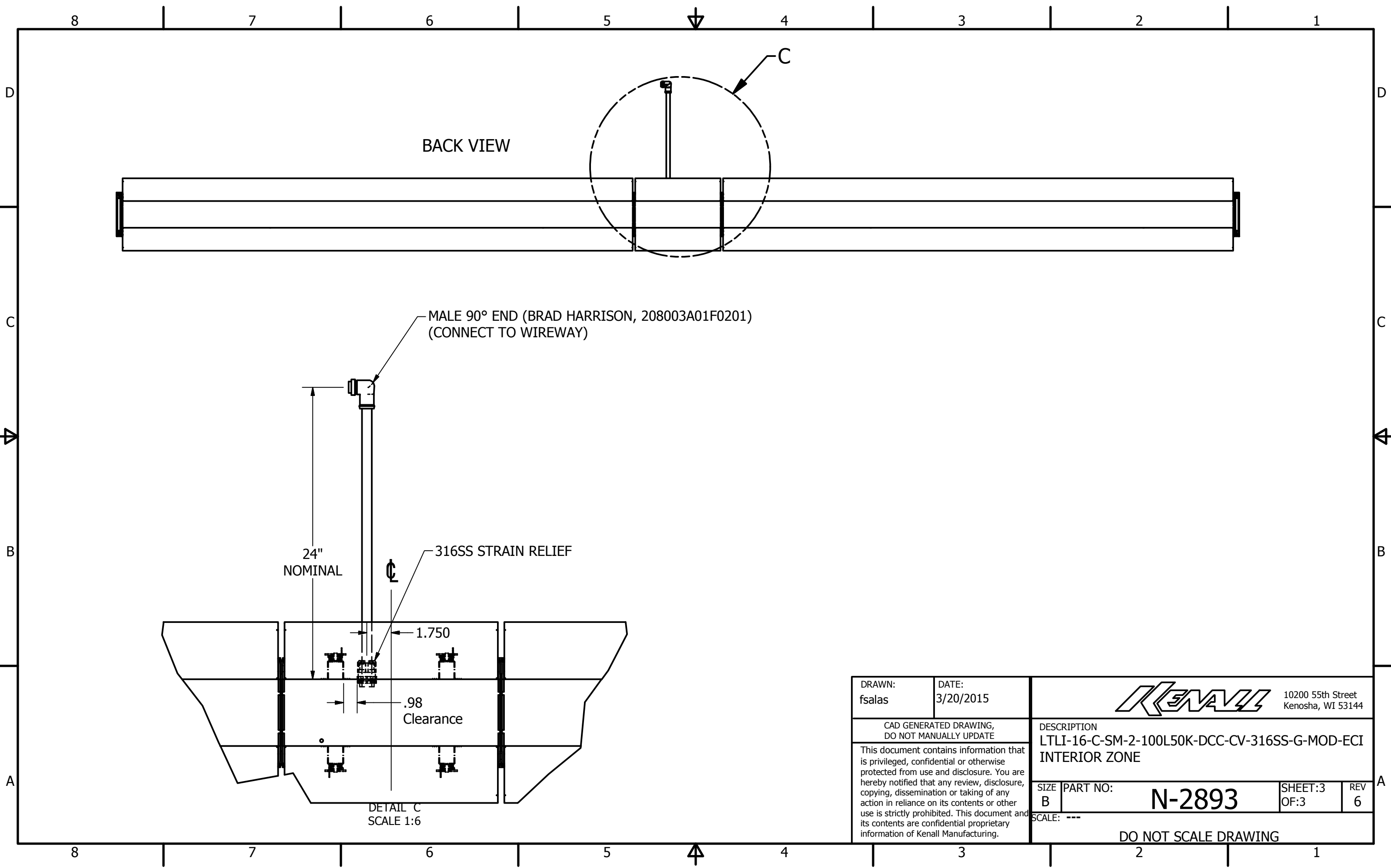



SPECIFICATIONS

1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** ONE .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE II DISTRIBUTION OPTICS.
6. **ELECTRICAL:**
 ONE (1) 277-480VAC DRIVER, 50-60 Hz, 0.6 A.
 ONE (1) CORD (208003A01F0201).
 ONE (1) 3-POLE QUICK DISCONNECT FOR THE DRIVER.
 TWO (2) 2-POLE QUICK DISCONNECTS FOR LED MODULES.
 EIGHT (8) 12-LED MODULES PER FIXTURE.
 192 LEDS @175mA DRIVE CURRENT (96 LEDS PER FIXTURE).
 100L50K OPTICAL PACKAGE WITH TYPE 2 OPTICS.
 5,440 LUMENS PER 8 FOOT SECTION.
 L70 200,000 HRS.



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		SCALE: --- DO NOT SCALE DRAWING			



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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-16-C-SM-2-100L50K-DCC-CV-316SS-G-MOD-ECI INTERIOR ZONE			
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		SCALE: --- DO NOT SCALE DRAWING			

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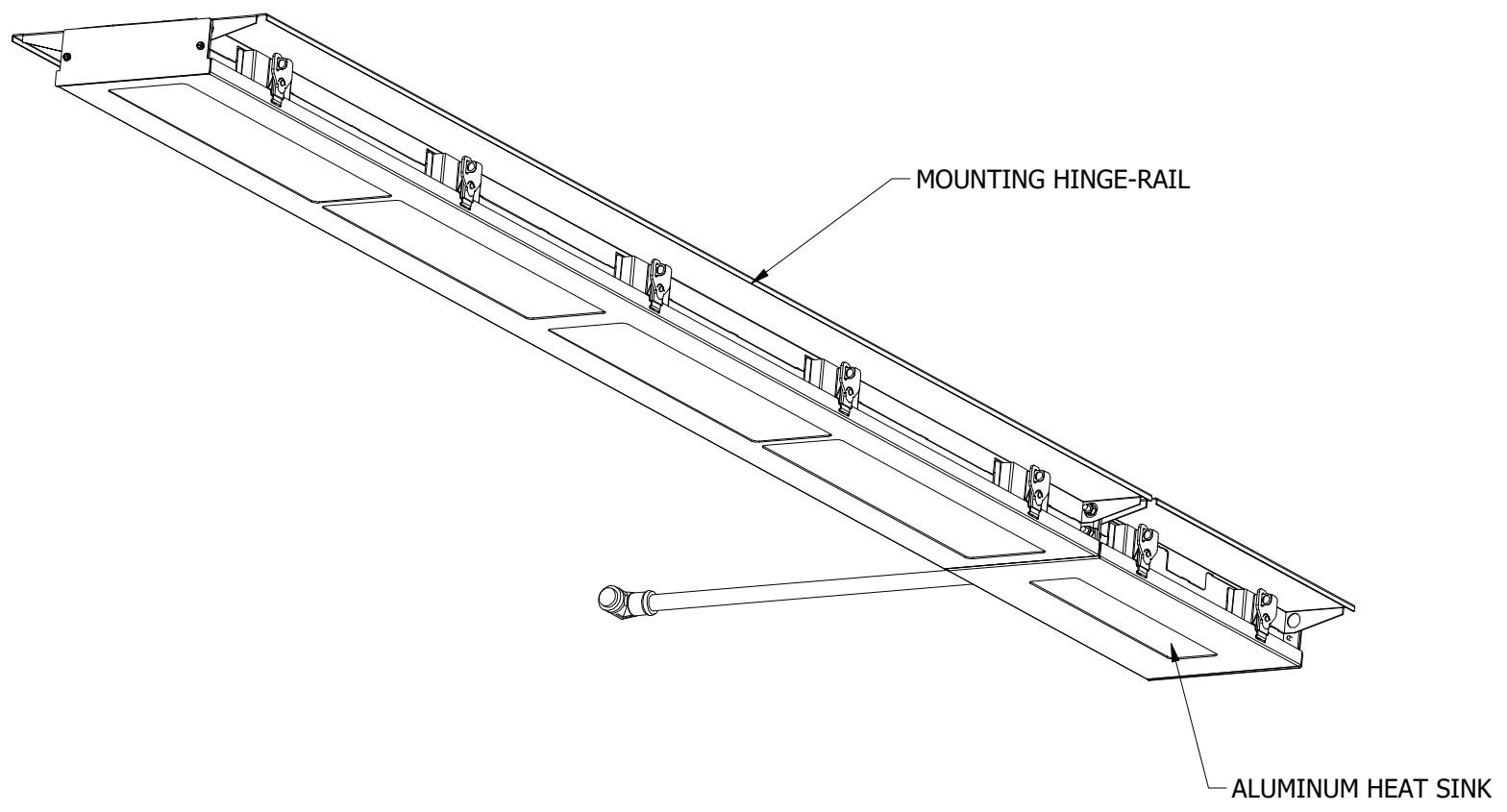
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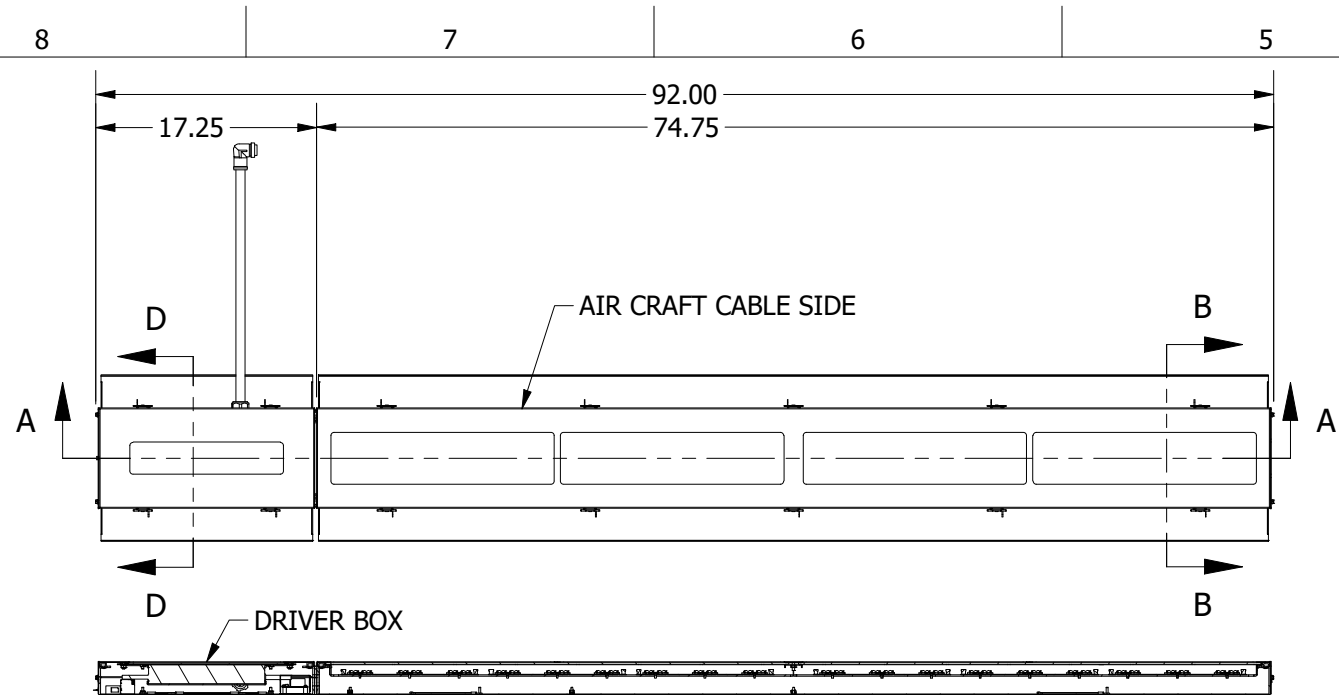


MOUNTING HINGE-RAIL

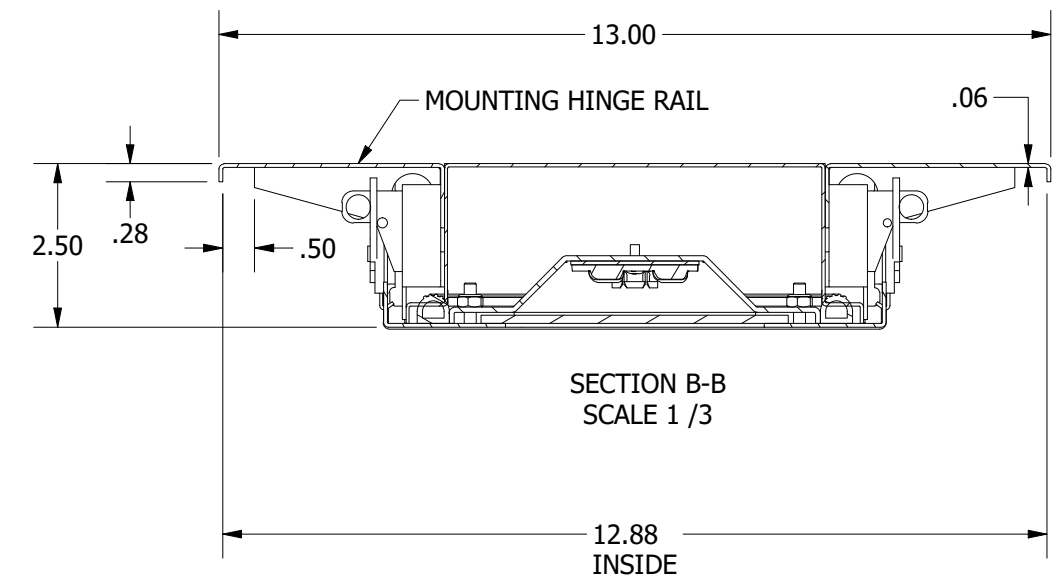
ALUMINUM HEAT SINK

DRAWN: fsalas	DATE: 8/25/2020	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-2-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP INSIDE ROW			
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		SCALE: --- DO NOT SCALE DRAWING			

8 7 6 5 4 3 2 1



SECTION A-A
SCALE 1 / 15



SECTION B-B
SCALE 1 / 3

SPECIFICATIONS

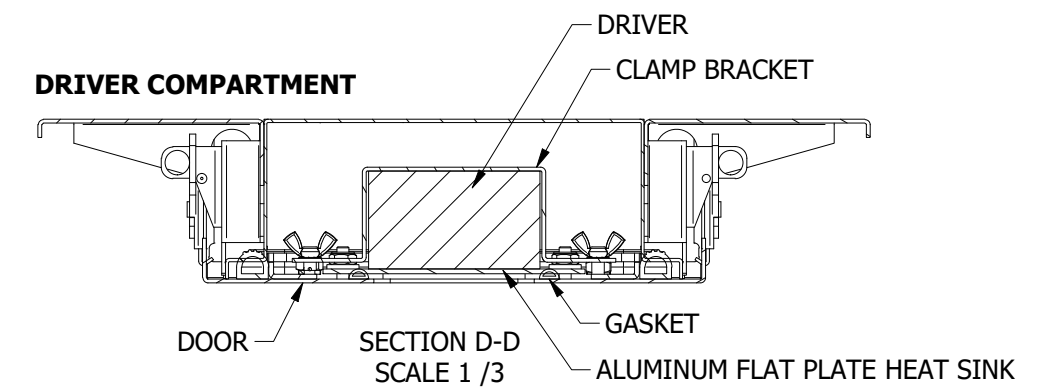
1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES. ALUMINUM-FLAT HEAT SINK ATTACHED TO DOOR, SEALED WITH CLOSED CELL SPONGE SILICONE GASKET. ELECTRICALLY INSULATED FROM STAINLESS STEEL DOOR. ALUMINUM, 5,000 HOUR FINISH.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE II DISTRIBUTION OPTICS.


6. ELECTRICAL:

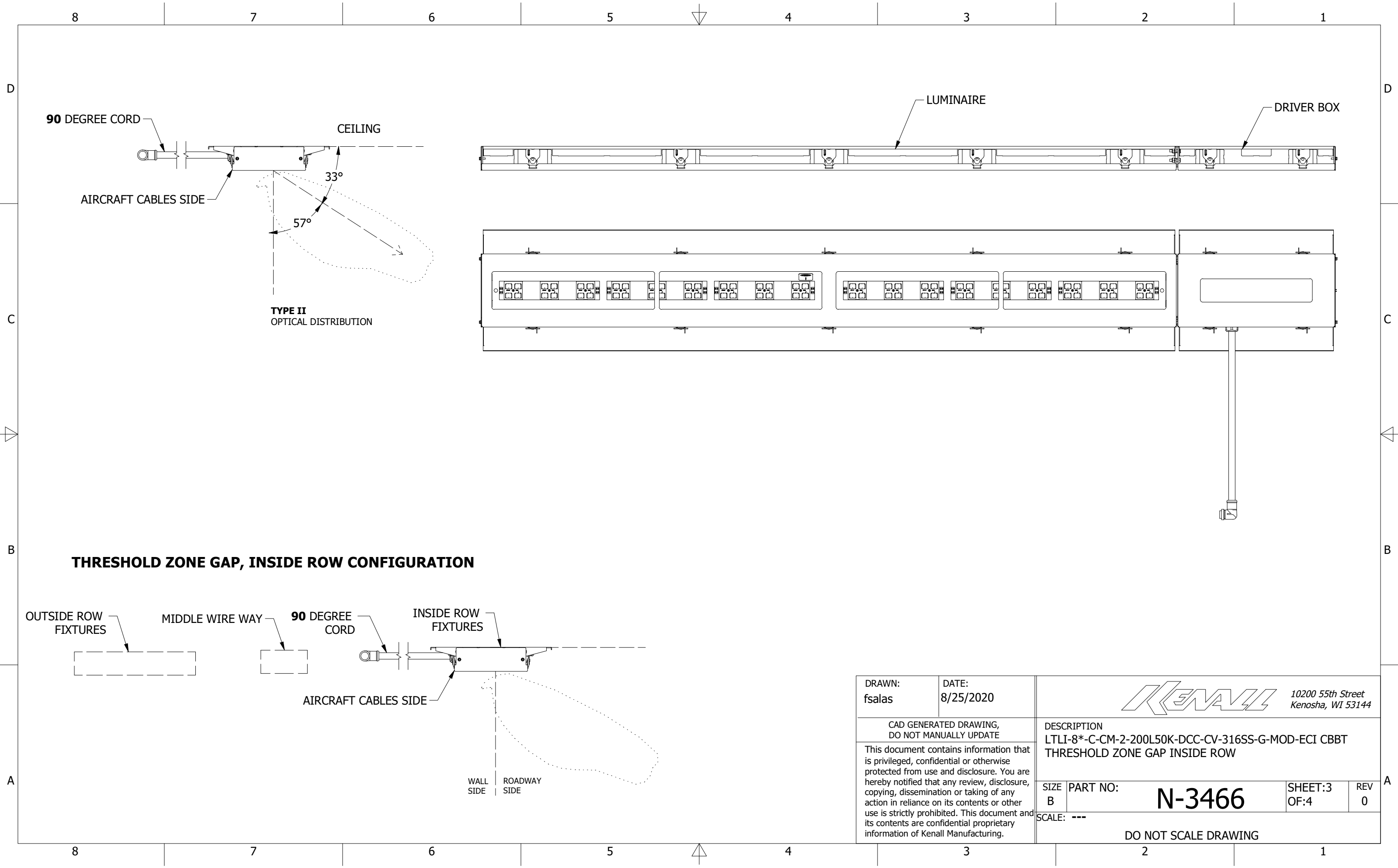
- ONE (1) 277-480VAC MEAN WELL **DRIVER** (#HVGC-240-1050AB).
- ONE (1) **CORD** (208003A01F0201).
- ONE (1) 3-POLE **QUICK DISCONNECT** FOR THE DRIVER.
- TWO (2) 2-POLE **QUICK DISCONNECTS** FOR LED MODULES.
- SIX (6) 12-LED **MODULES**.
- 72 **LEDS** @925mA DRIVE CURRENT.
- 200L50K **OPTICAL** PACKAGE WITH TYPE II OPTICS.
- 21,680 LUMENS.
- L70 100,000 HRS.

DIMMING LEVELS:


- * Level 1 - Full intensity (21,680 lumens).
- * Level 2 - Dimmed at 75% to match the CT-2 daytime settings (16,260 lumens).
- * Level 3 - Dimmed at 25% to match the CT-2 nighttime settings (5,440 lumens).

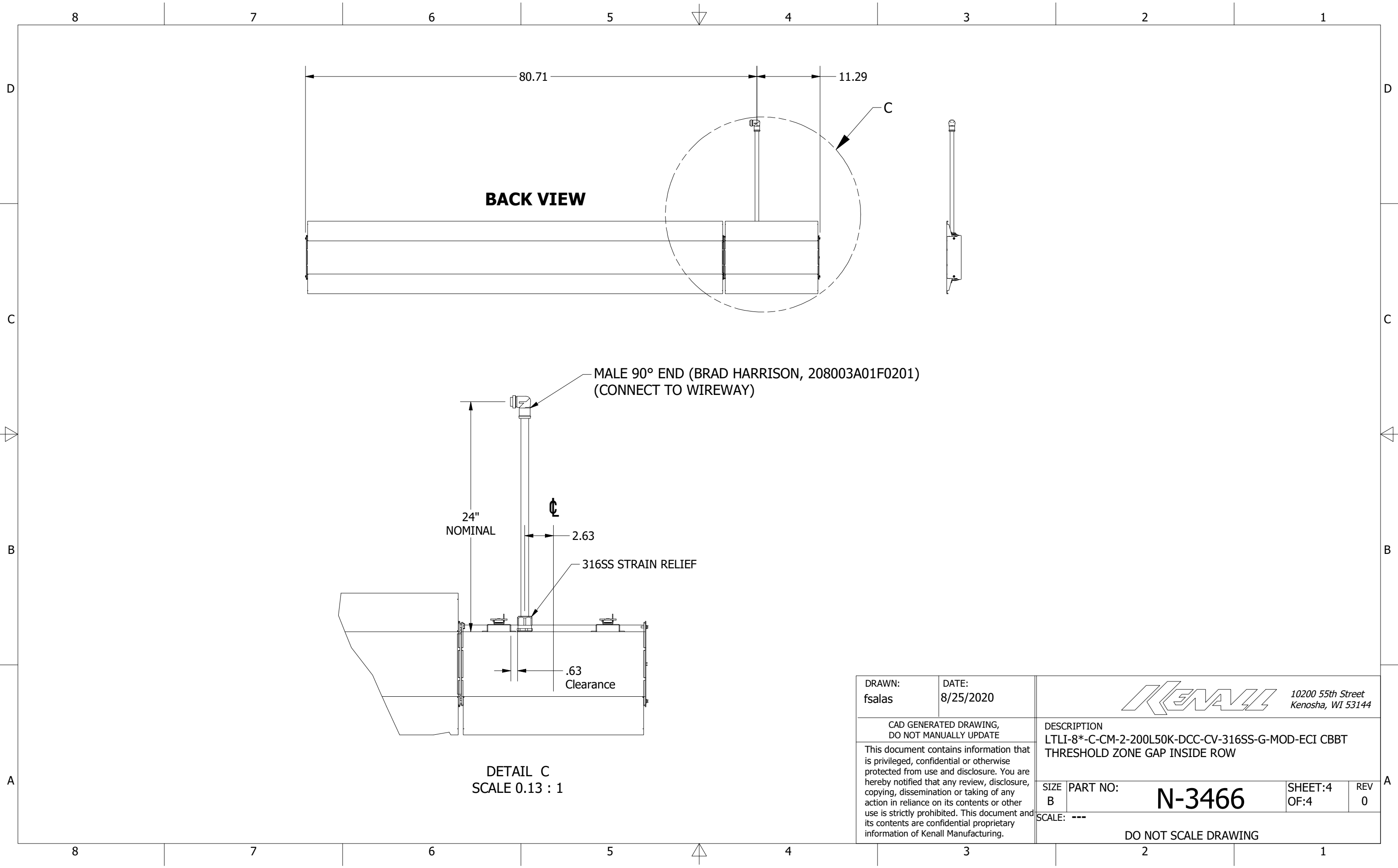


DRAWN: fsalas	DATE: 8/25/2020	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-2-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP INSIDE ROW			
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		SCALE: --- DO NOT SCALE DRAWING			




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 DATE: 8/25/2020
 CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE
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 10200 55th Street Kenosha, WI 53144			
DESCRIPTION LTLI-8*-C-CM-2-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP INSIDE ROW			
SIZE B	PART NO: N-3466	SHEET:3 OF:4	REV 0
SCALE: ---			
DO NOT SCALE DRAWING			



DETAIL C
SCALE 0.13 : 1

DRAWN: fsalas	DATE: 8/25/2020	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-2-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP INSIDE ROW			
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SCALE: ---		DO NOT SCALE DRAWING			

8 7 6 5 4 3 2 1

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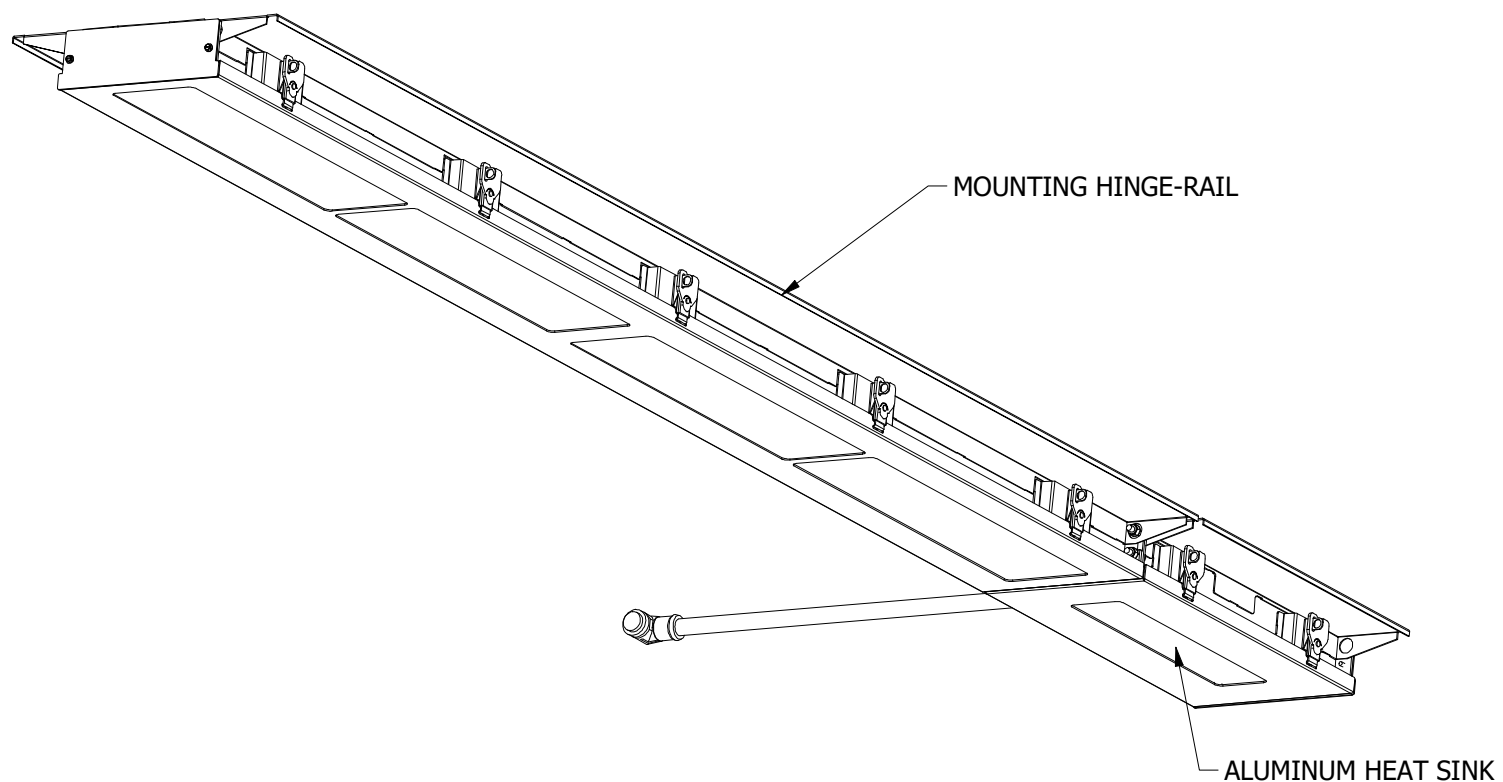
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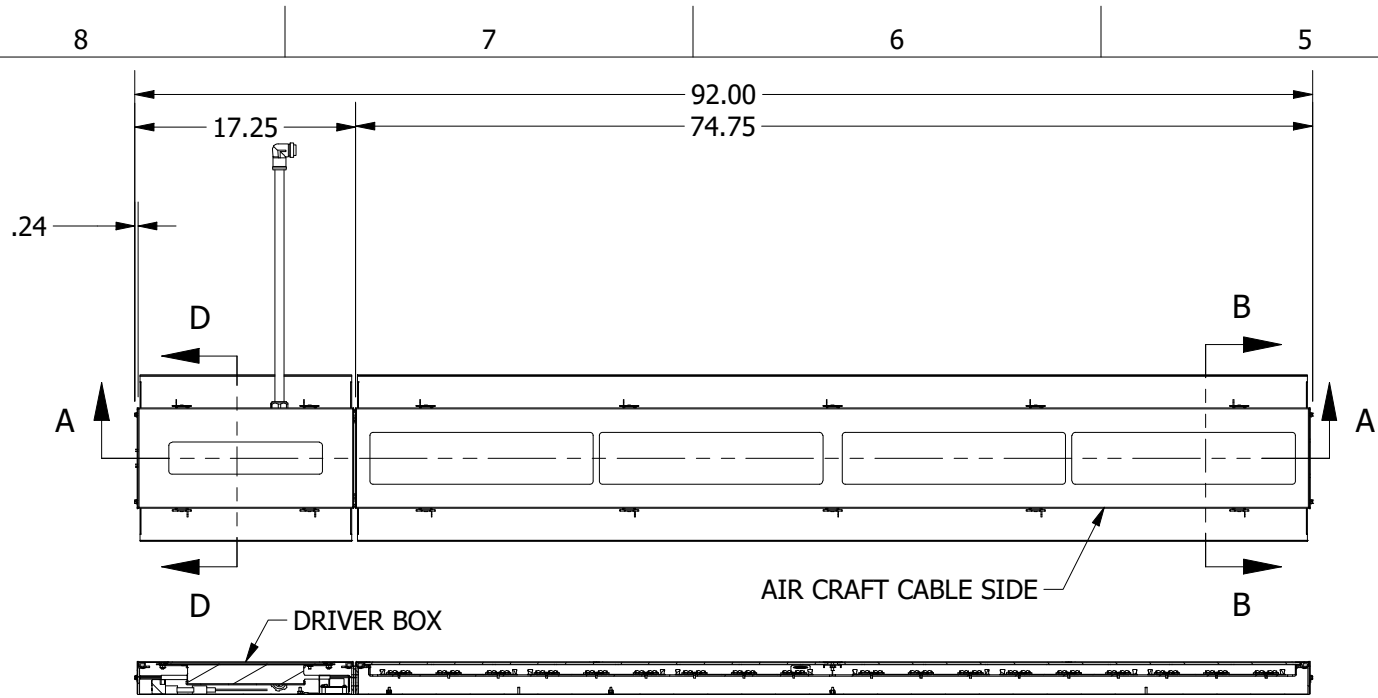
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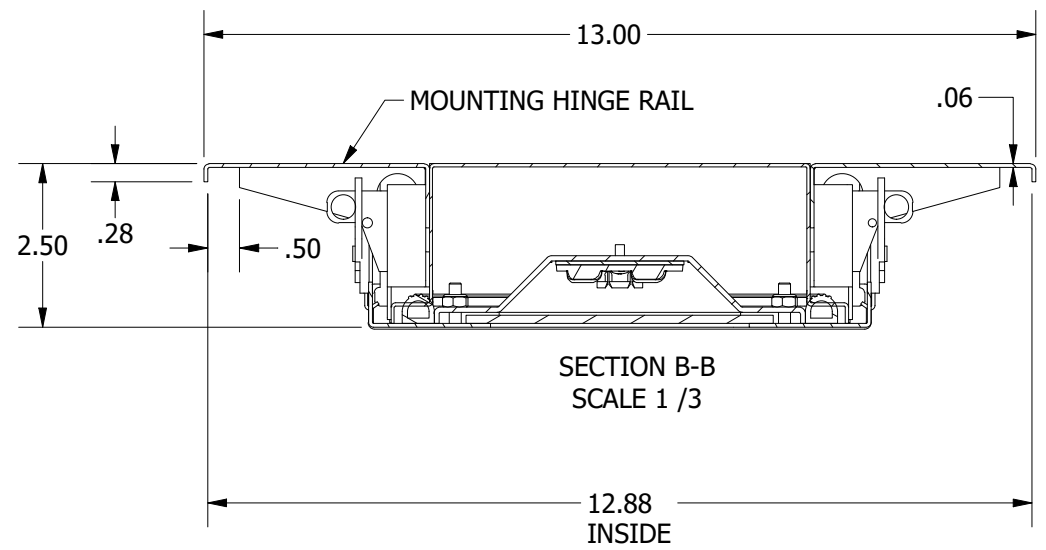


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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-2-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP OUTSIDE ROW			
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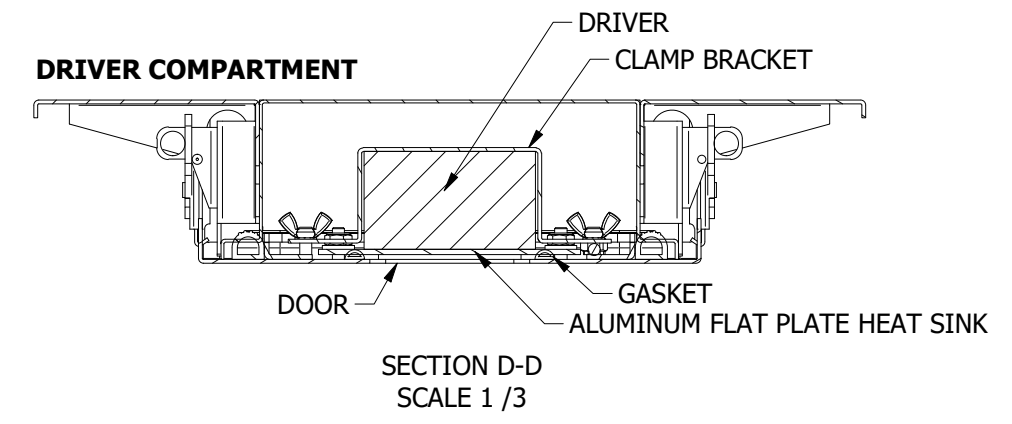
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SECTION A-A
SCALE 1 / 15




SECTION B-B
SCALE 1 / 3



SECTION D-D
SCALE 1 / 3

SPECIFICATIONS

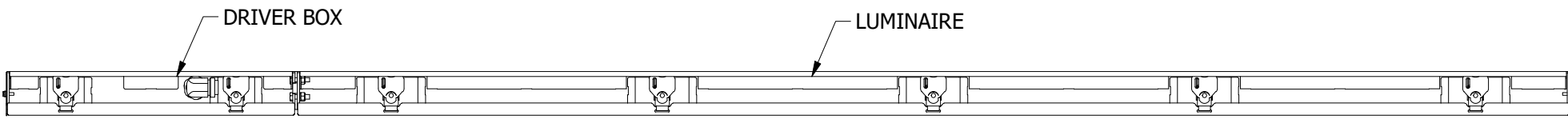
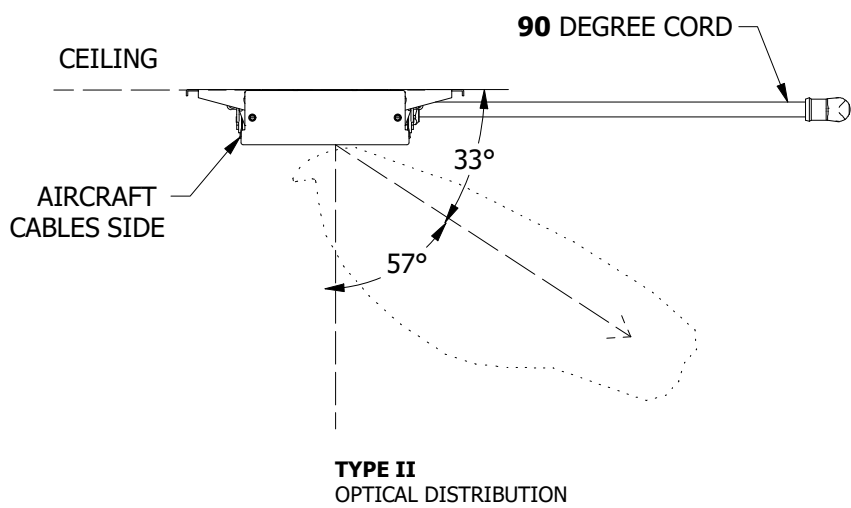
1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR ASSY:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES. ALUMINUM-FLAT HEAT SINK ATTACHED TO DOOR, SEALED WITH CLOSED CELL SPONGE SILICONE GASKET. ELECTRICALLY INSULATED FROM STAINLESS STEEL DOOR. ALUMINUM, 5,000 HOUR FINISH.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE II DISTRIBUTION OPTICS.
6. **ELECTRICAL:**
 - ONE (1) 277-480VAC MEAN WELL **DRIVER** (#HVGC-240-1050AB).
 - ONE (1) **CORD** (208003A01F0201).
 - ONE (1) 3-POLE **QUICK DISCONNECT** FOR THE DRIVER.
 - TWO (2) 2-POLE **QUICK DISCONNECTS** FOR LED MODULES.
 - SIX (6) 12-LED **MODULES**.
 - 72 **LEDS** @925mA DRIVE CURRENT.
 - 200L50K **OPTICAL** PACKAGE WITH TYPE II OPTICS.
 - 21,680 LUMENS.
 - L70 100,000 HRS.
- DIMMING LEVELS:**
 - * Level 1 - Full intensity (21,680 lumens).
 - * Level 2 - Dimmed at 75% to match the CT-2 daytime settings (16,260 lumens).
 - * Level 3 - Dimmed at 25% to match the CT-2 nighttime settings (5,440 lumens).
 - * Level 4 - OFF

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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-2-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP OUTSIDE ROW		
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SCALE: ---		DO NOT SCALE DRAWING		

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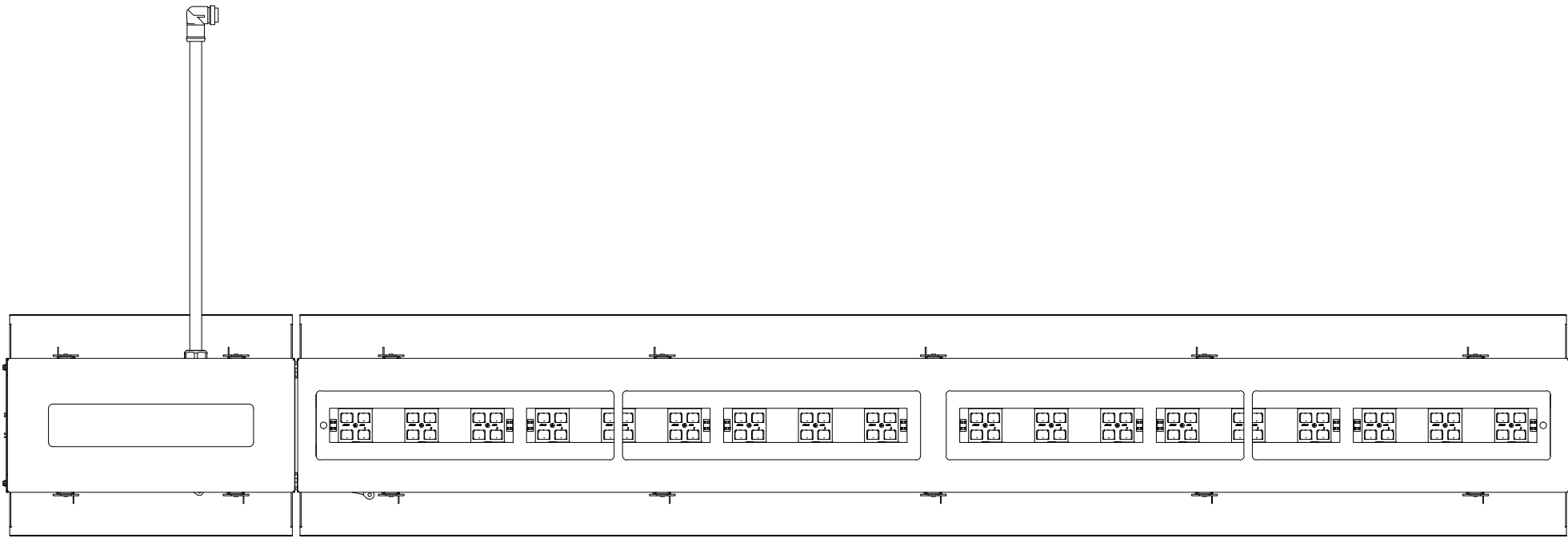
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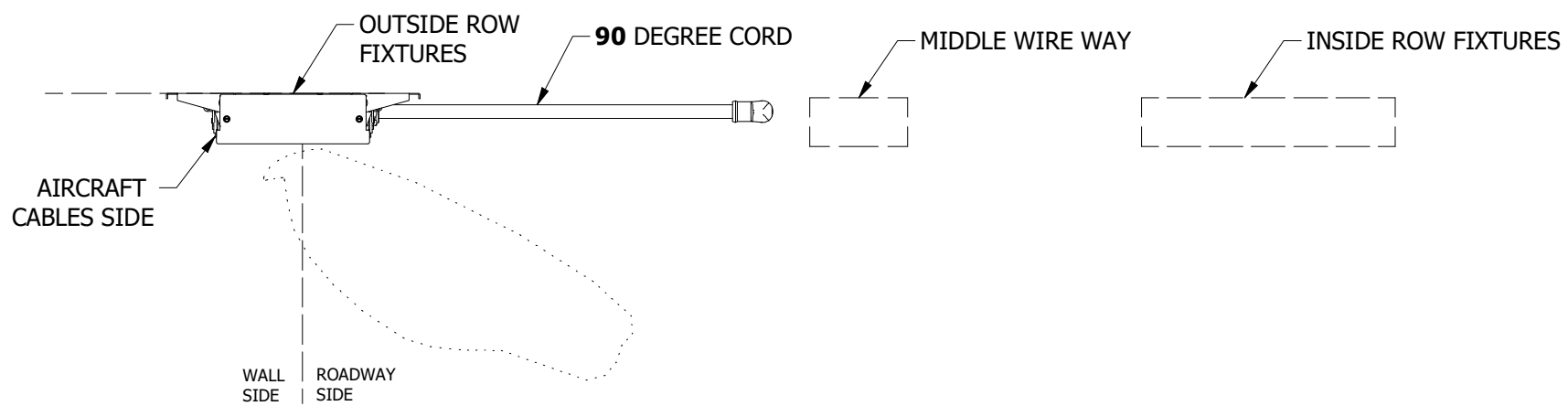
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THRESHOLD ZONE GAP, OUTSIDE ROW CONFIGURATION

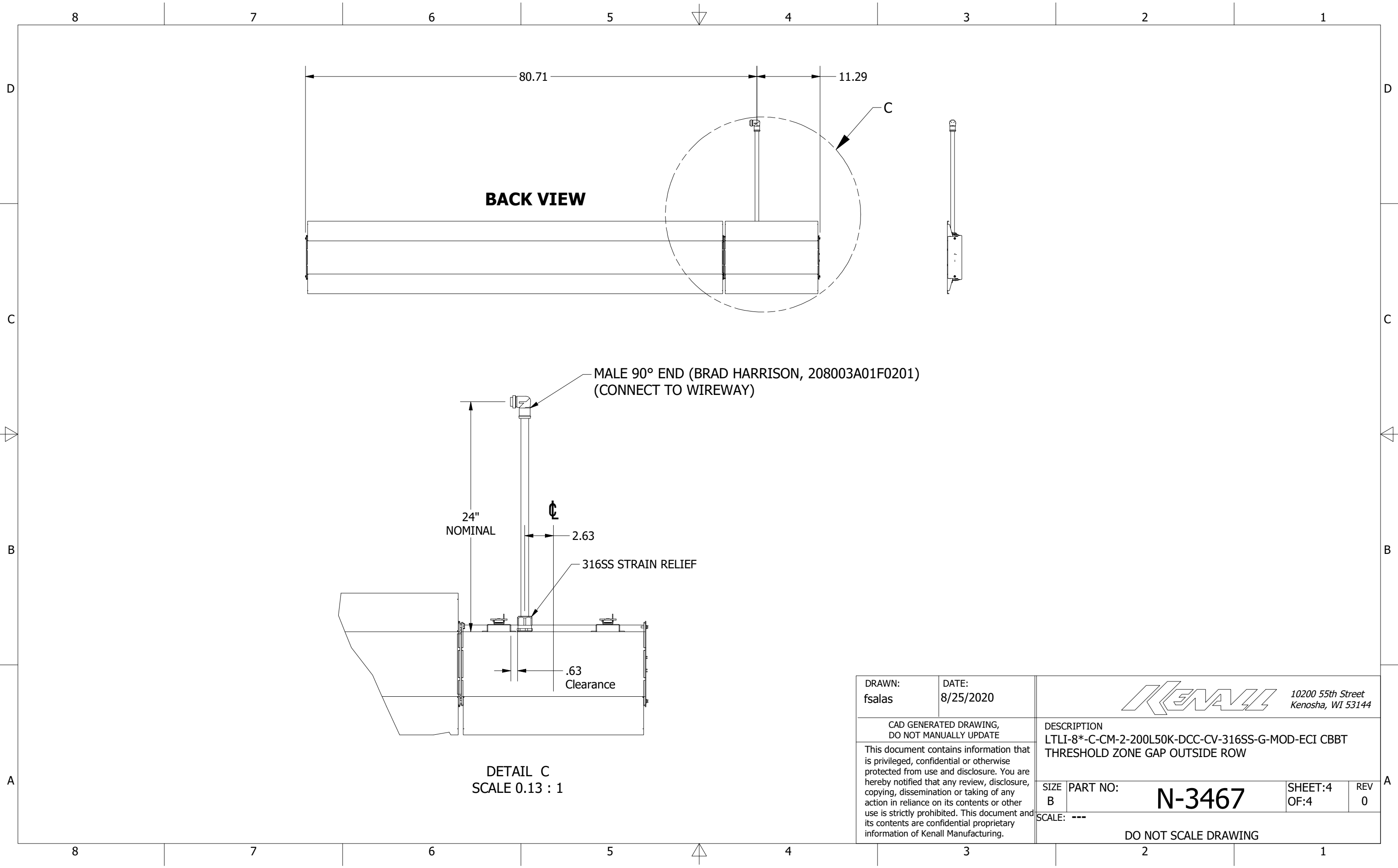


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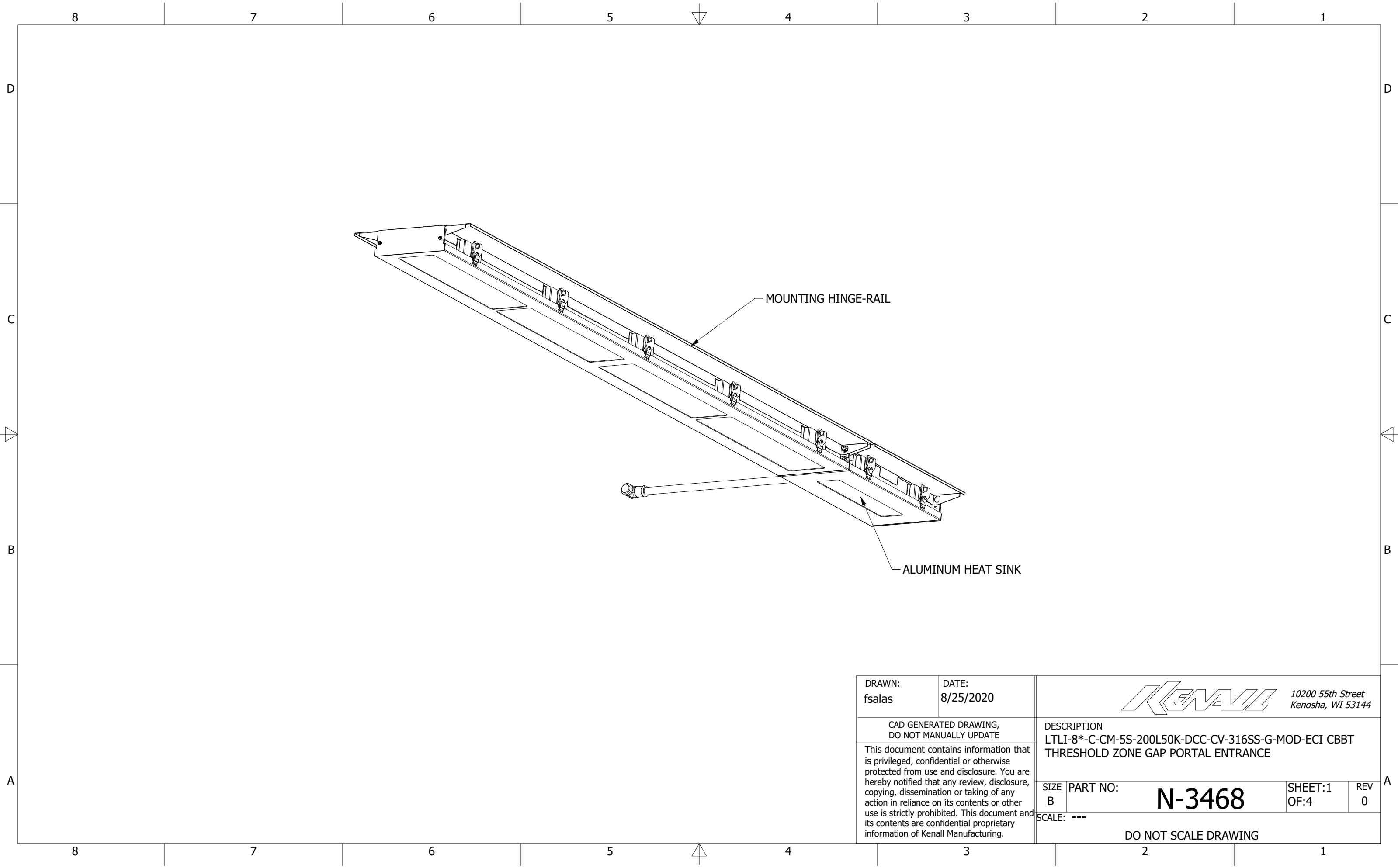
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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-2-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP OUTSIDE ROW			
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		SCALE: --- DO NOT SCALE DRAWING			

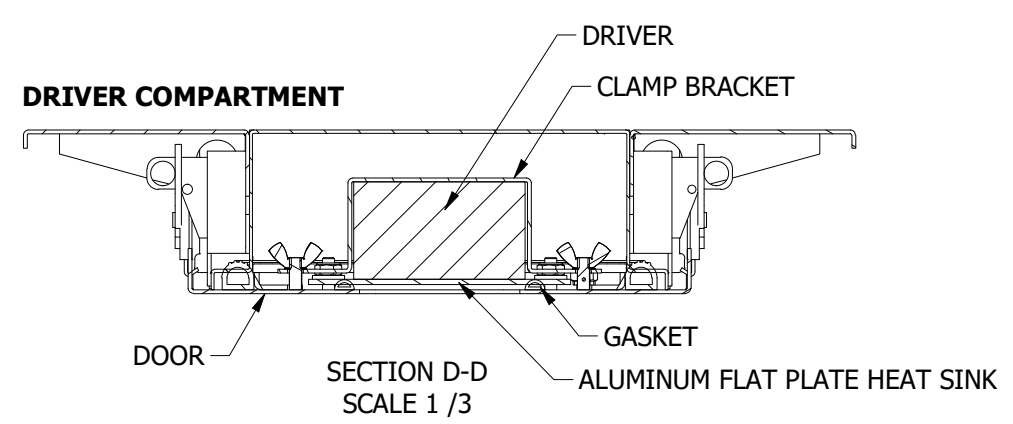
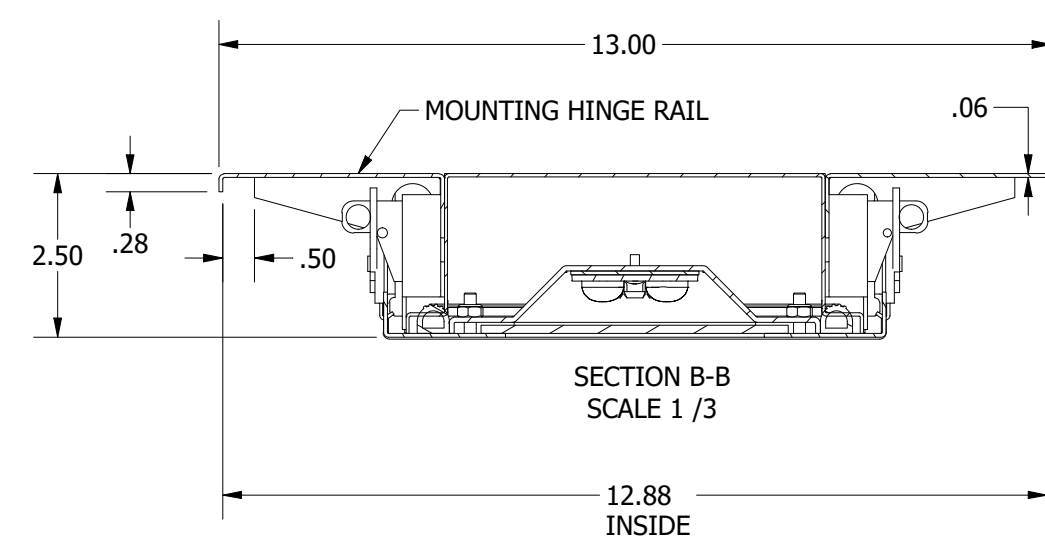
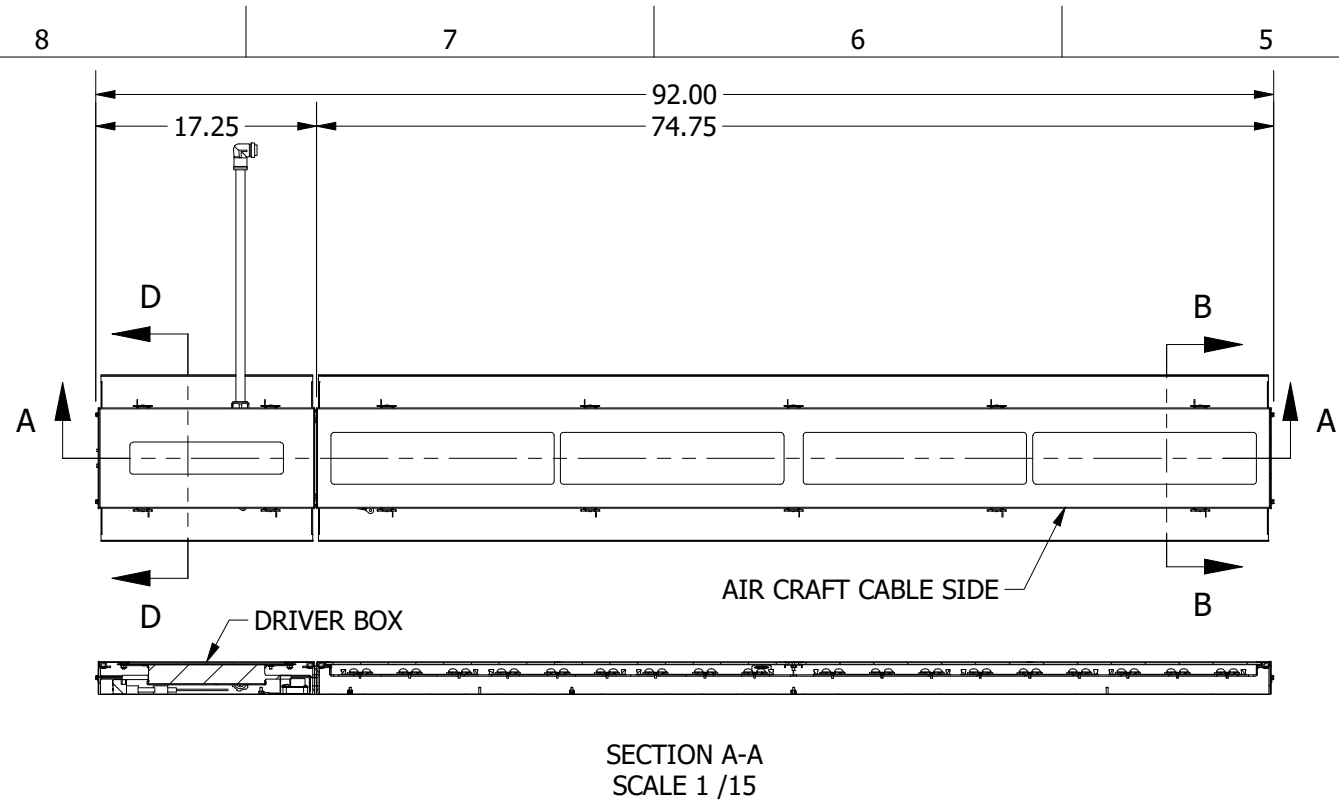


DETAIL C
SCALE 0.13 : 1

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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-2-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP OUTSIDE ROW			
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SCALE: ---		DO NOT SCALE DRAWING			



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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-5S-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP PORTAL ENTRANCE			
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		SCALE: --- DO NOT SCALE DRAWING			



SPECIFICATIONS


1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES. ALUMINUM-FLAT HEAT SINK ATTACHED TO DOOR, SEALED WITH CLOSED CELL SPONGE SILICONE GASKET. ELECTRICALLY INSULATED FROM STAINLESS STEEL DOOR. ALUMINUM, 5,000 HOUR FINISH.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE 5S DISTRIBUTION OPTICS.

6. ELECTRICAL:

- ONE (1) 277-480VAC MEAN WELL **DRIVER** (#HVGC-240-1050AB).
- ONE (1) **CORD** (208003A01F0201).
- ONE (1) 3-POLE **QUICK DISCONNECT** FOR THE DRIVER.
- TWO (2) 2-POLE **QUICK DISCONNECTS** FOR LED MODULES.
- SIX (6) 12-LED **MODULES**.
- 72 **LEDS** @925mA DRIVE CURRENT.
- 200L50K **OPTICAL** PACKAGE WITH **5S OPTICS**.
- 21,680 LUMENS.
- L70 100,000 HRS.

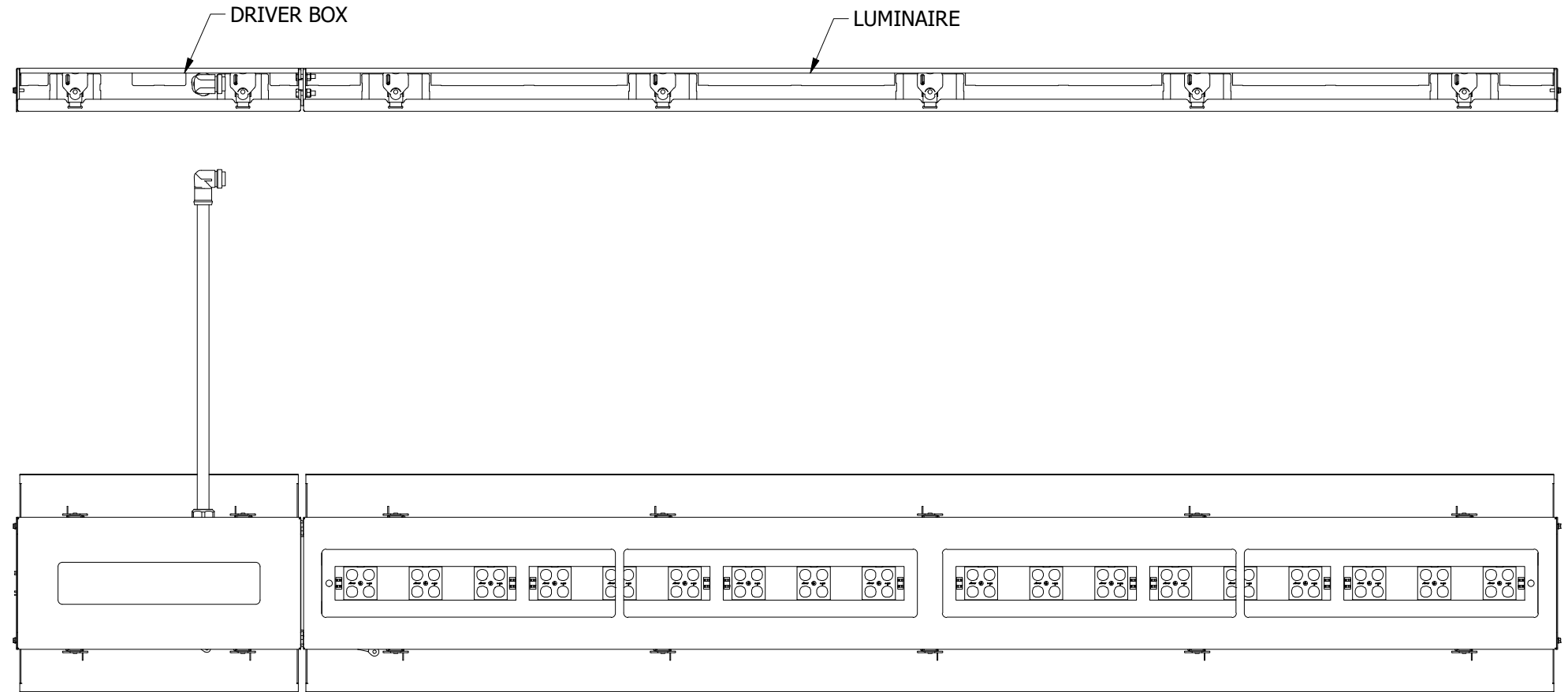
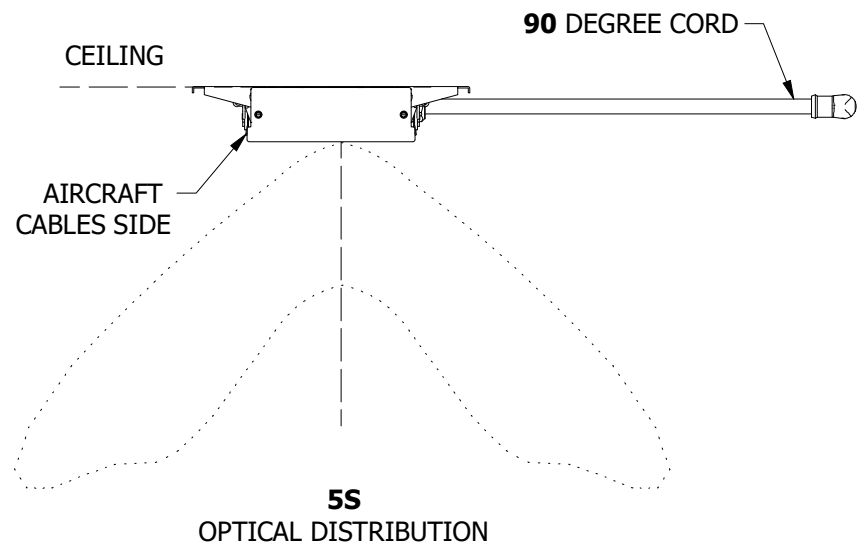
DIMMING LEVELS:

- * Level 1 - Full intensity (21,680 lumens).
- * Level 2 - Dimmed at 75% to match the CT-2 daytime settings (16,260 lumens).
- * Level 3 - Dimmed at 25% to match the CT-2 nighttime settings (5,440 lumens).

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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-5S-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP PORTAL ENTRANCE			
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		SCALE: --- DO NOT SCALE DRAWING			

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THRESHOLD ZONE GAP, PORTAL ENTRANCE



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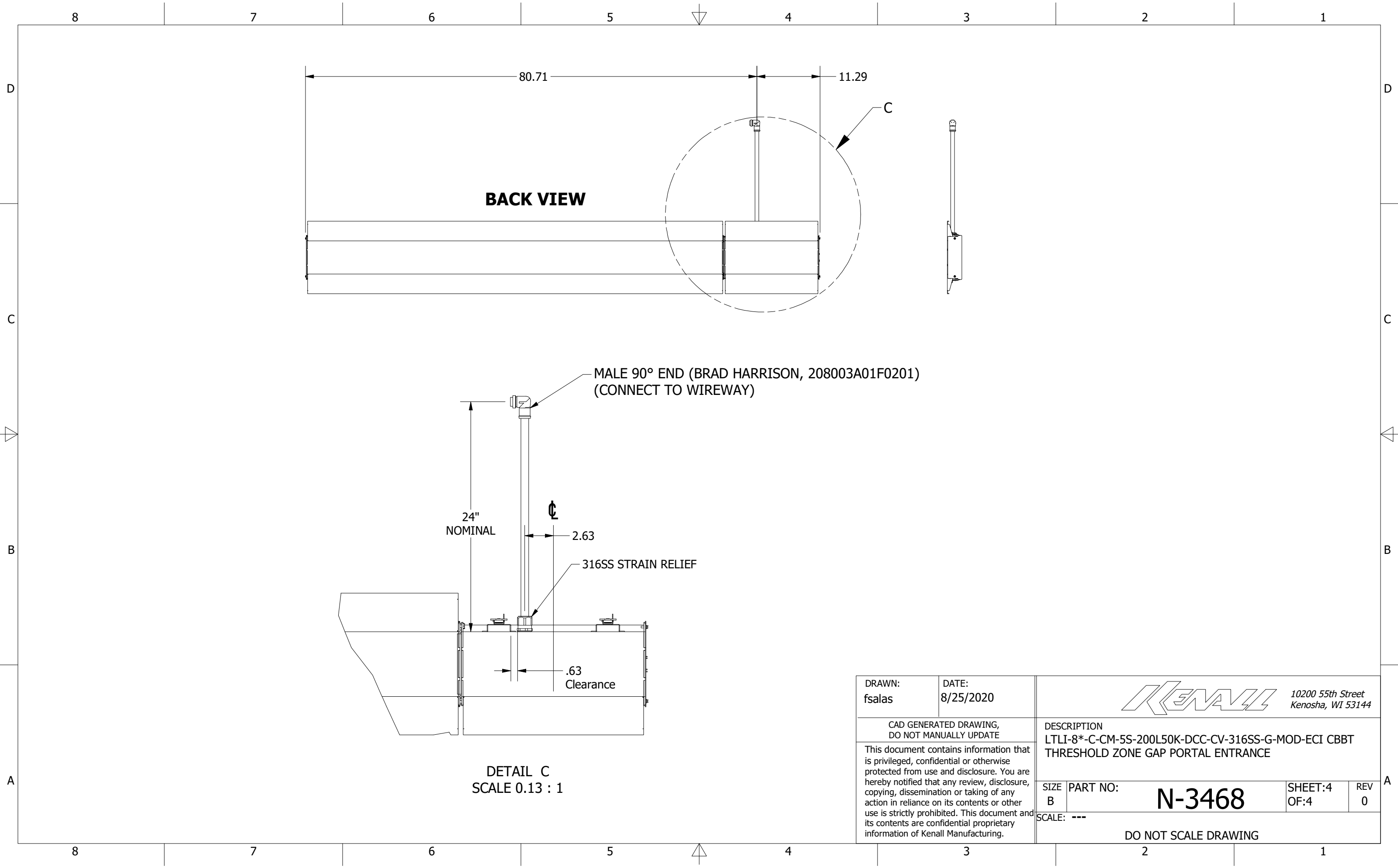
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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-5S-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP PORTAL ENTRANCE			
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DETAIL C
SCALE 0.13 : 1

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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8*-C-CM-5S-200L50K-DCC-CV-316SS-G-MOD-ECI CBBT THRESHOLD ZONE GAP PORTAL ENTRANCE			
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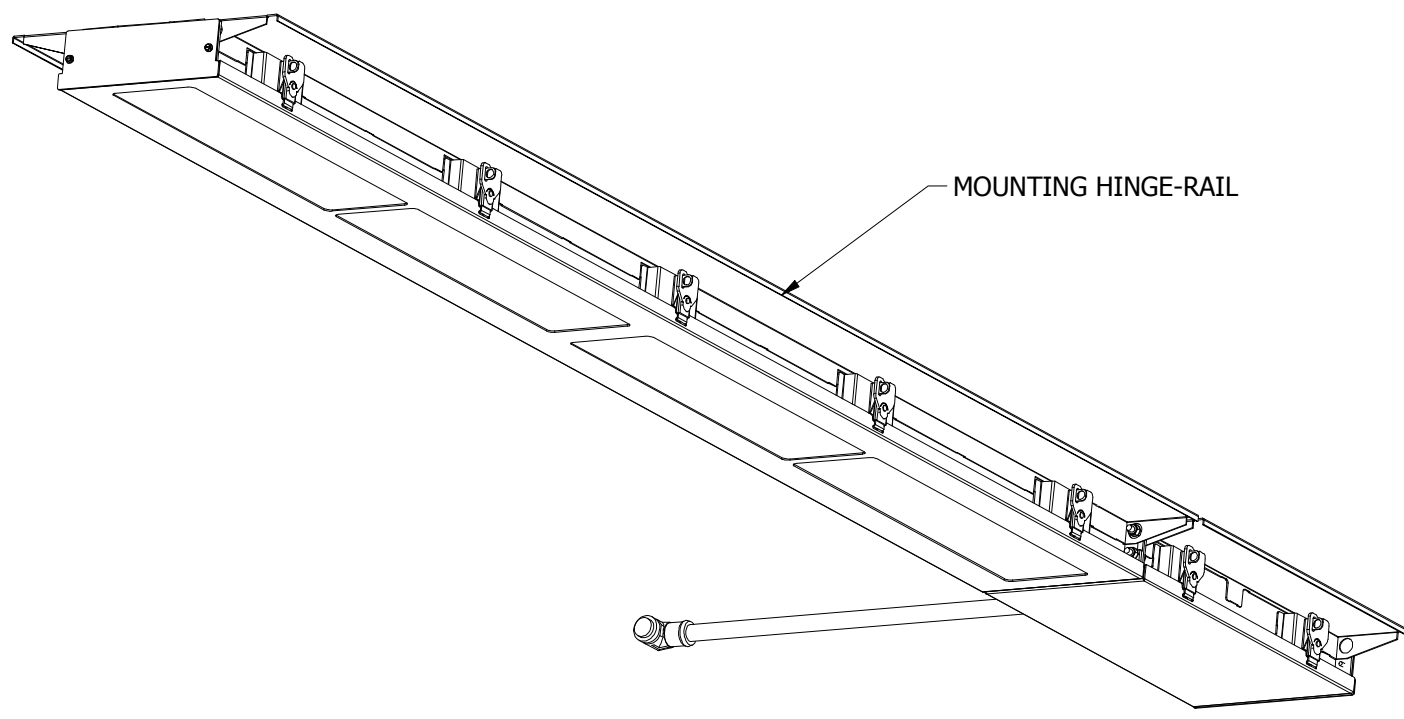
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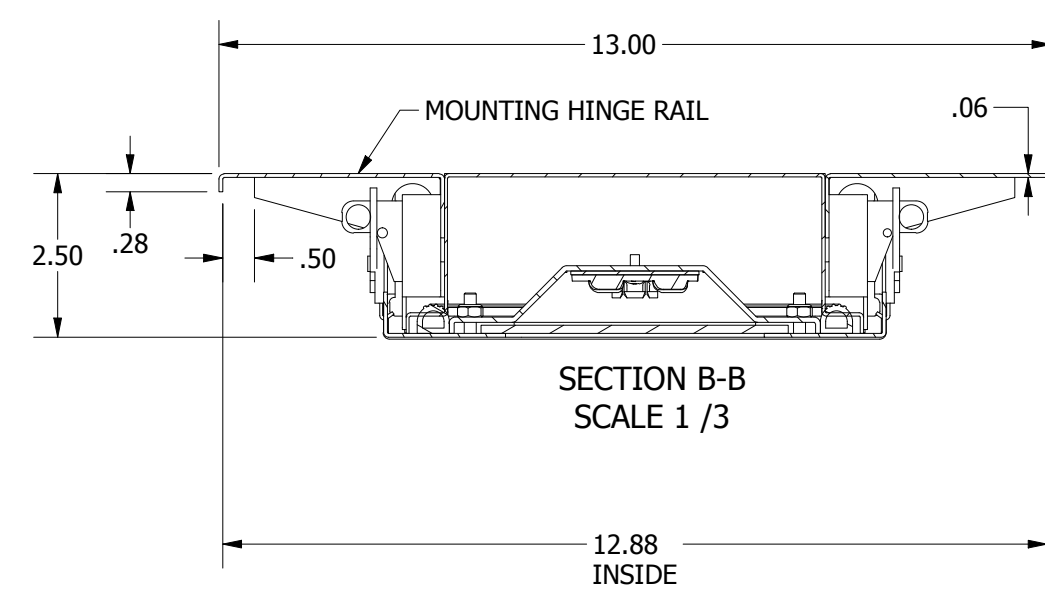
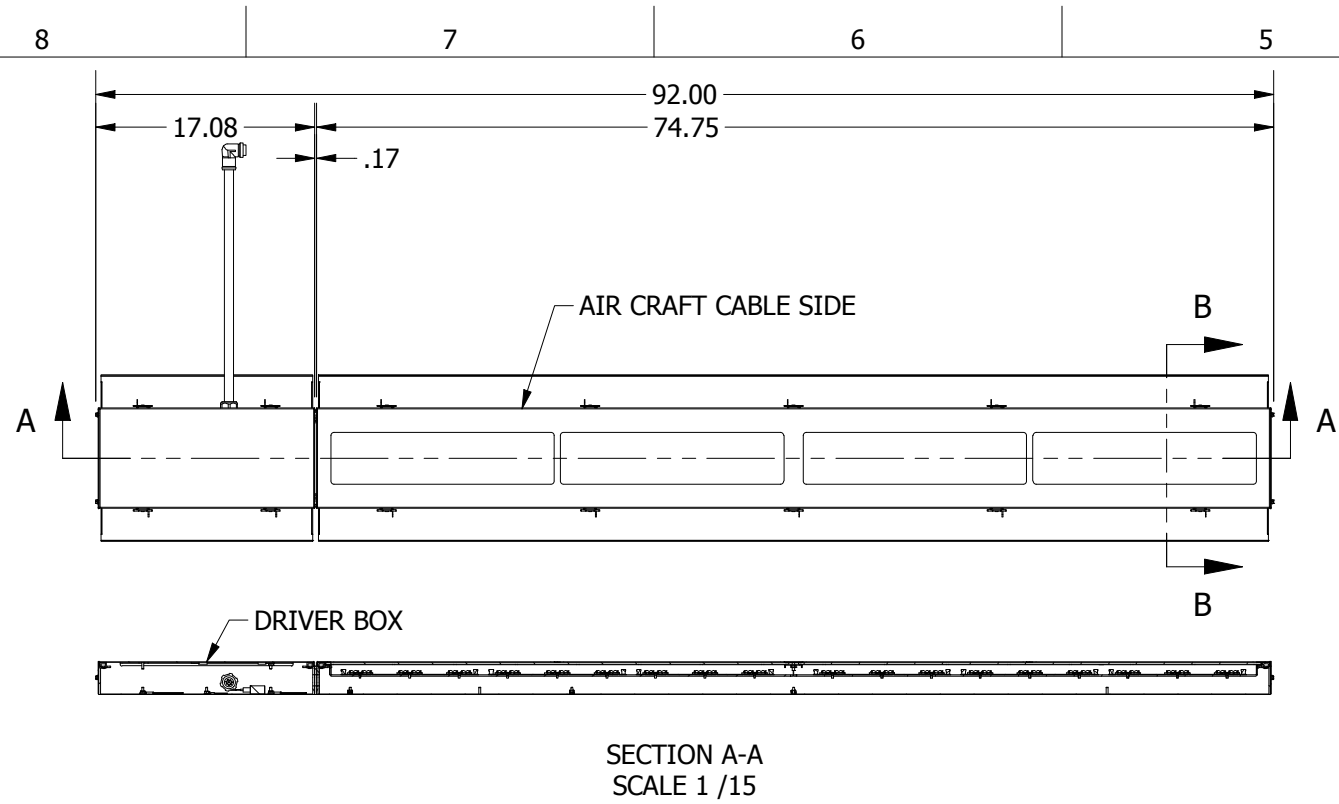
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MOUNTING HINGE-RAIL


DRAWN: fsalas	DATE: 2/26/2020	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8-C-SM-2-150L50K-DCC-CV-316SS-G-MOD-ECI - TRANSITION ZONE GAP			
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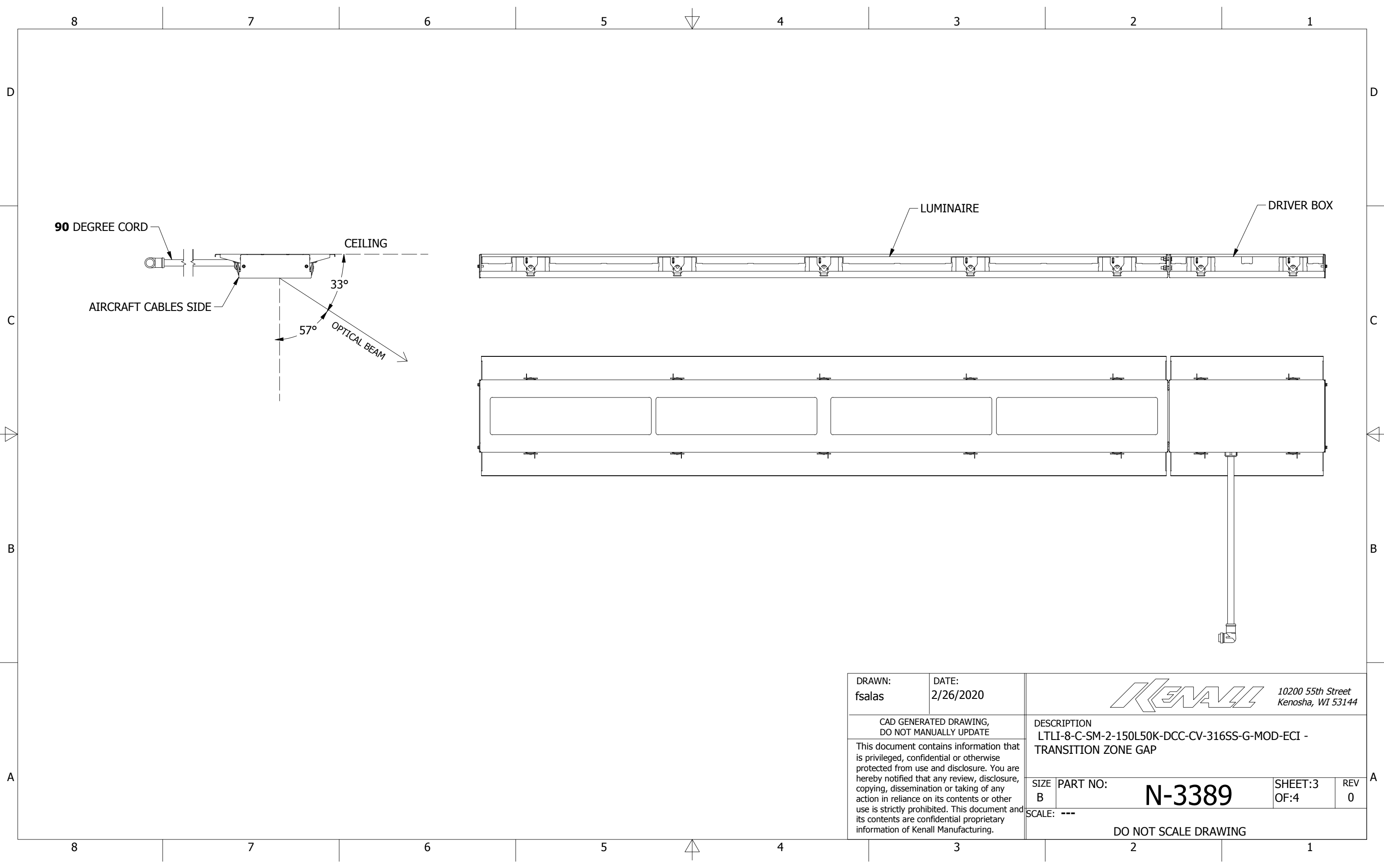
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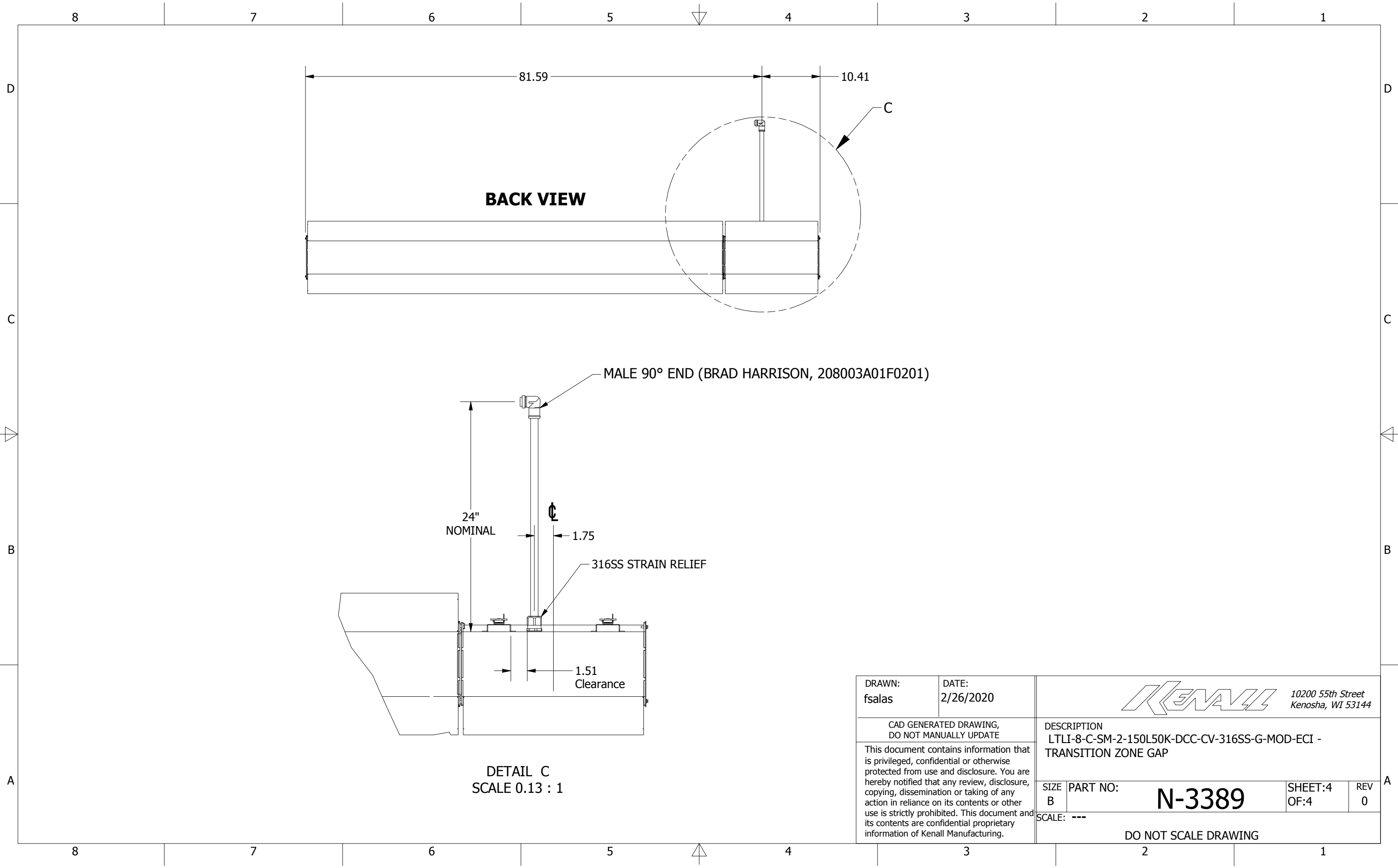
SPECIFICATIONS

1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE II DISTRIBUTION OPTICS.
6. **ELECTRICAL:**
 - ONE (1) 277-480VAC MEAN WELL **DRIVER** (#HVGC-240-1400).
 - ONE (1) **CORD** (208003A01F0201).
 - ONE (1) 3-POLE **QUICK DISCONNECT** FOR THE DRIVER.
 - TWO (2) 2-POLE **QUICK DISCONNECTS** FOR LED MODULES.
 - SIX (6) 12-LED **MODULES**.
 - 72 **LEDS** @700mA DRIVE CURRENT.
 - 150L50K **OPTICAL** PACKAGE WITH TYPE 2 OPTICS.
 - 16,260 LUMENS.
 - L70 125,000 HRS.
- DIMMING LEVELS:**
 - * Level 1 - Full intensity (16,260 lumens).
 - * Level 2 - Dimmed at 33% to match the CT3 fixtures (5,440 lumens).


DRAWN: fsalas	DATE: 2/26/2020	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8-C-SM-2-150L50K-DCC-CV-316SS-G-MOD-ECI - TRANSITION ZONE GAP			
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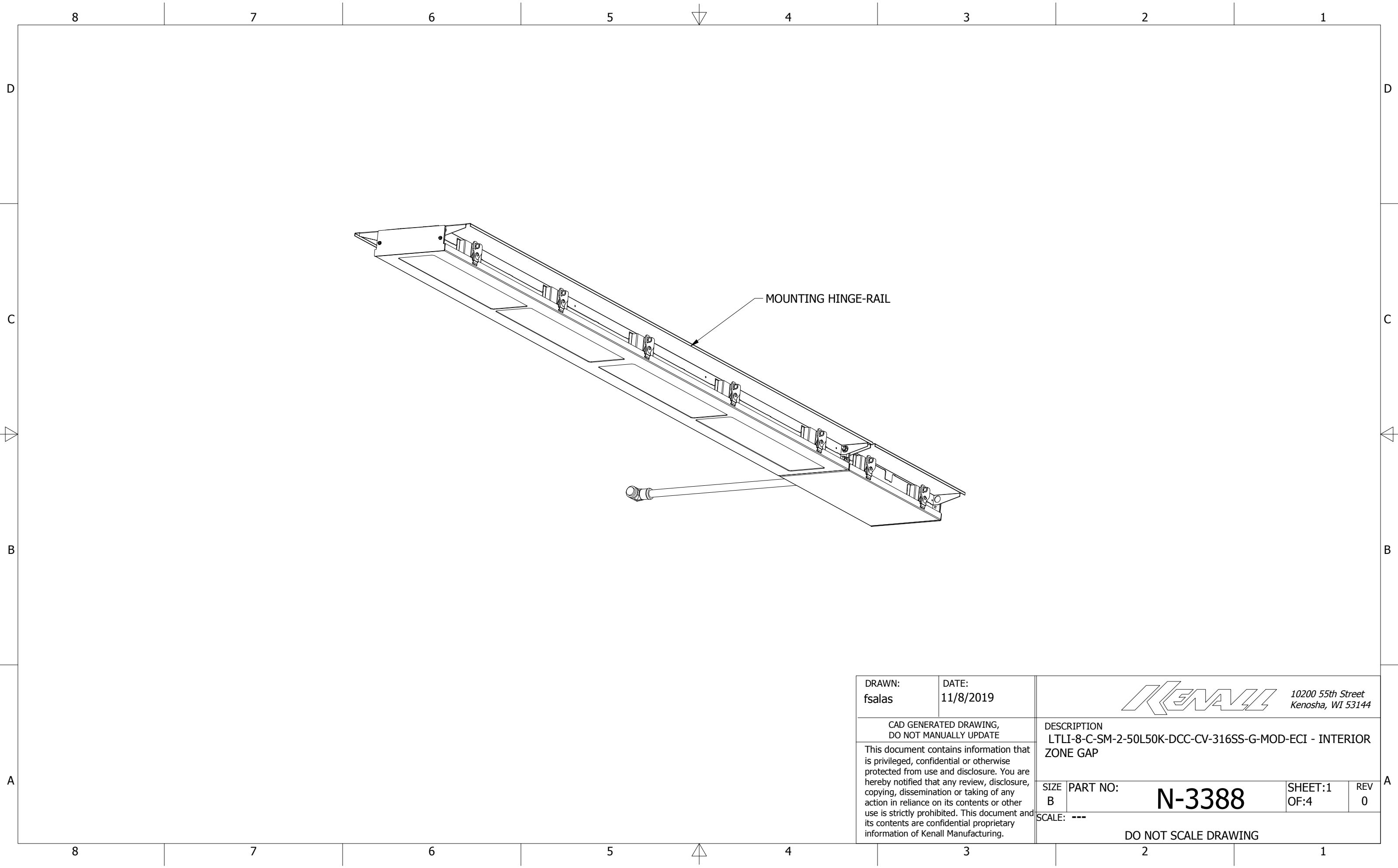


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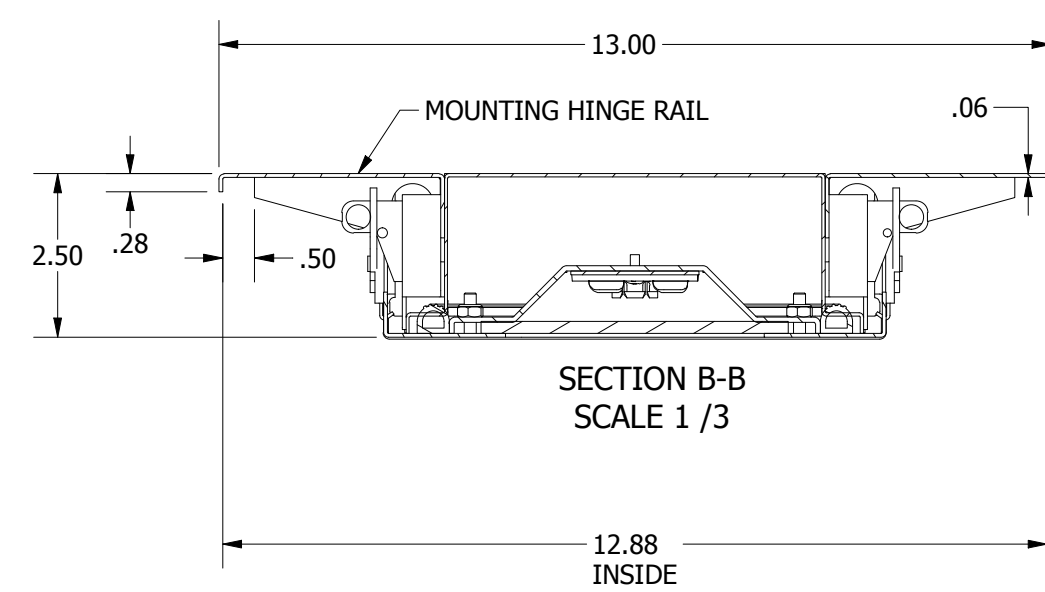
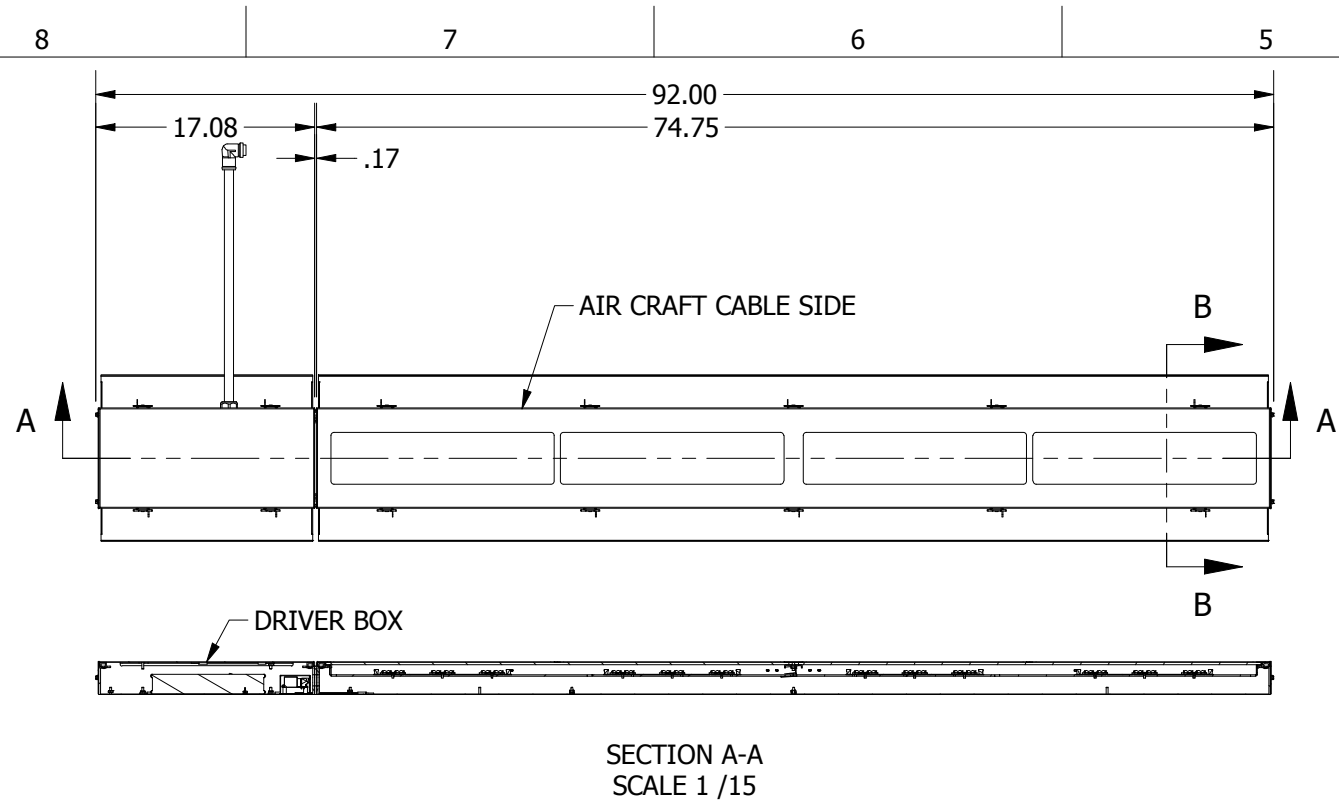
DETAIL C
SCALE 0.13 : 1

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CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8-C-SM-2-150L50K-DCC-CV-316SS-G-MOD-ECI - TRANSITION ZONE GAP			
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		SCALE: --- DO NOT SCALE DRAWING			




MOUNTING HINGE-RAIL

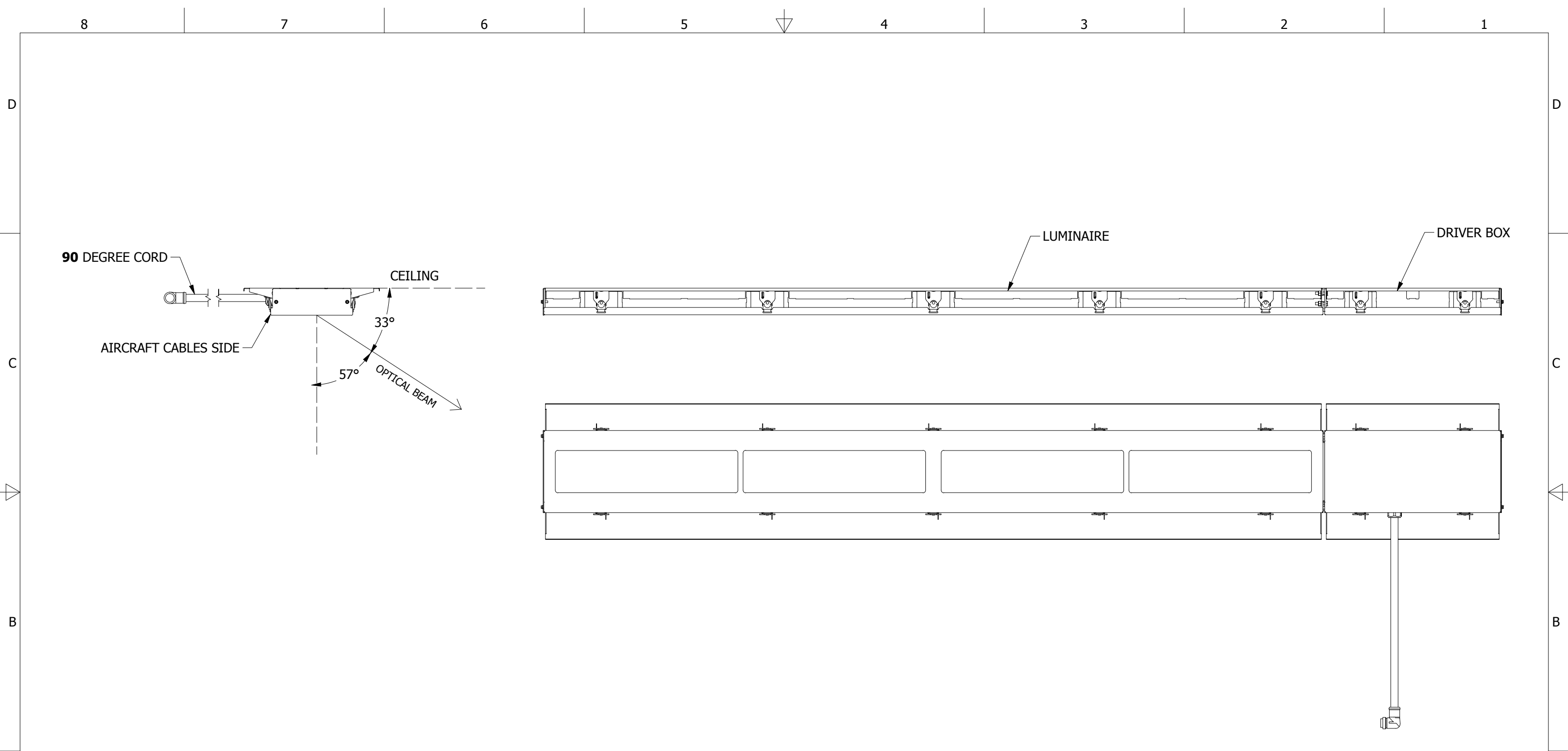
DRAWN: fsalas	DATE: 11/8/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8-C-SM-2-50L50K-DCC-CV-316SS-G-MOD-ECI - INTERIOR ZONE GAP			
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		SCALE: --- DO NOT SCALE DRAWING			




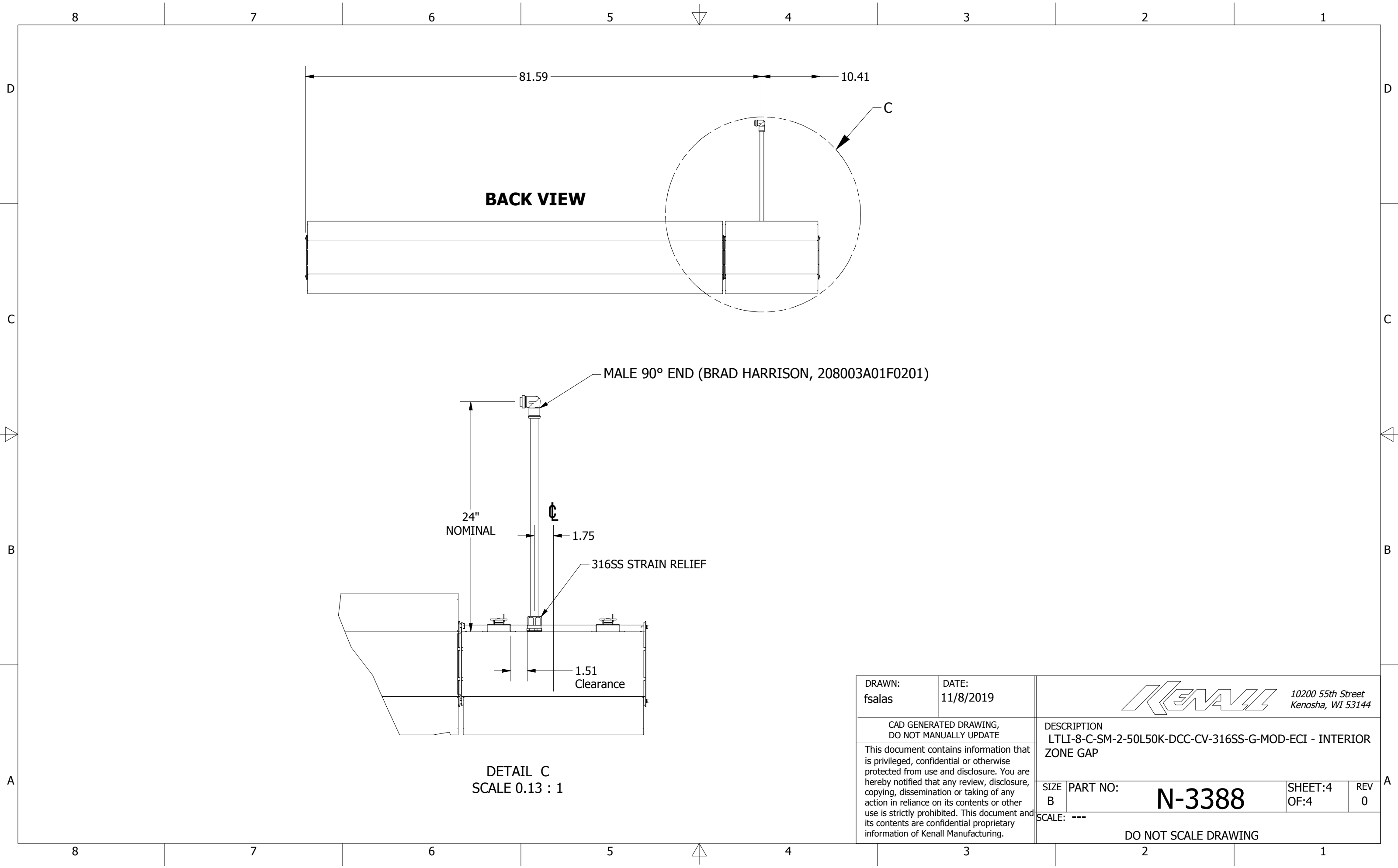
SPECIFICATIONS

1. **HOUSING:** 18-GAUGE, TYPE 316 STAINLESS STEEL. ONE PIECE SEAM WELDED CONSTRUCTION WITH 16-GAUGE 316 STAINLESS STEEL WELDED MOUNTING HINGE-RAILS.
2. **DOOR:** 16-GAUGE, TYPE 316 STAINLESS STEEL, SUPPORTED TO HOUSING WITH AIRCRAFT CABLES AND 316 STAINLESS STEEL CAM LATCHES.
3. **GASKET:** ONE PIECE EXTRUDED SILICONE WITH MOLDED CORNERS.
4. **DOOR LENS:** .125" CLEAR POLYCARBONATE LENS.
5. **OPTICS:** TYPE II DISTRIBUTION OPTICS.
6. **ELECTRICAL:**
 - ONE (1) 277-480VAC MEAN WELL **DRIVER** (#HVGC-65-700-B).
 - ONE (1) **CORD** (208003A01F0201).
 - ONE (1) 3-POLE **QUICK DISCONNECT** FOR THE DRIVER.
 - TWO (2) 2-POLE **QUICK DISCONNECTS** FOR LED MODULES.
 - FOUR (4) 12-LED **MODULES**.
 - 48 **LEDS** @350mA DRIVE CURRENT.
 - 50L50K **OPTICAL** PACKAGE WITH TYPE 2 OPTICS.
 - 5,440 LUMENS.
 - L70 TBD.

DRAWN: fsalas	DATE: 11/8/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8-C-SM-2-50L50K-DCC-CV-316SS-G-MOD-ECI - INTERIOR ZONE GAP			
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		SCALE: --- DO NOT SCALE DRAWING			



DRAWN: fsalas	DATE: 11/8/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8-C-SM-2-50L50K-DCC-CV-316SS-G-MOD-ECI - INTERIOR ZONE GAP			
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		SCALE: ---			
DO NOT SCALE DRAWING					



BACK VIEW

MALE 90° END (BRAD HARRISON, 208003A01F0201)

24"
NOMINAL


Ø

1.75

316SS STRAIN RELIEF

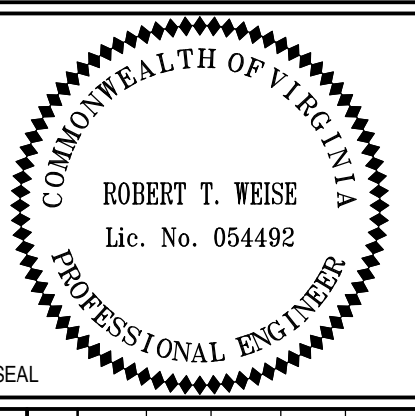
1.51
Clearance

DETAIL C
SCALE 0.13 : 1

DRAWN: fsalas	DATE: 11/8/2019	 10200 55th Street Kenosha, WI 53144			
CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE		DESCRIPTION LTLI-8-C-SM-2-50L50K-DCC-CV-316SS-G-MOD-ECI - INTERIOR ZONE GAP			
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		SCALE: --- DO NOT SCALE DRAWING			

APPENDIX E

CBBT Tunnel One Line Power Drawing, typ.



NO.	DATE	DESCRIPTION

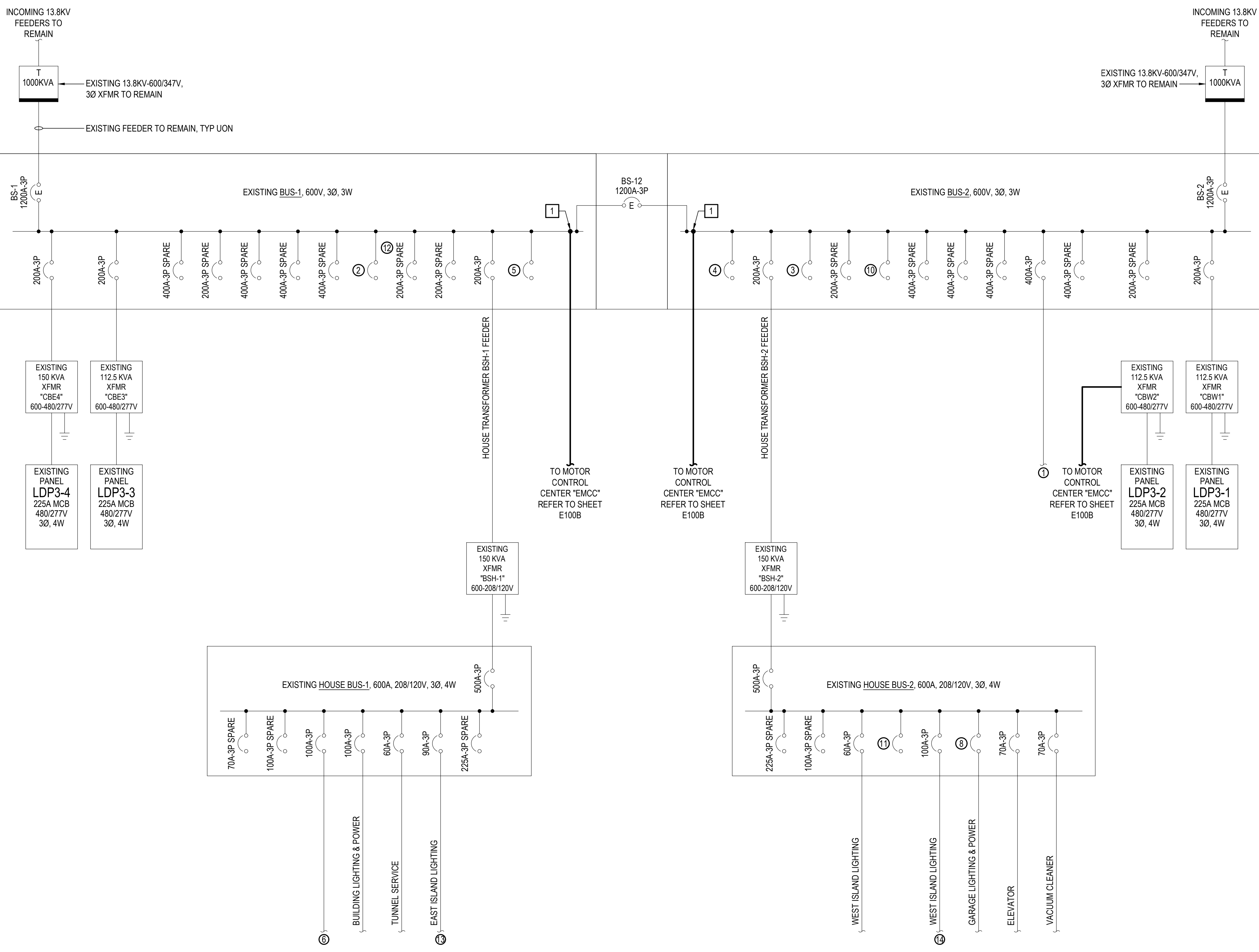
CHESAPEAKE BAY BRIDGE TUNNEL
SUPPORT BUILDINGS EMERGENCY POWER SYSTEM UPGRADES
CAPE CHARLES VIRGINIA
PARTIAL ONE-LINE DIAGRAM - BUILDING #3 - NEW WORK

NOTES THIS SHEET

- 1 DRILL AND TAP EXISTING BUSSING DOWNSTREAM OF MAIN 1200A-3P CIRCUIT BREAKER. PROVIDE LUGS AS REQUIRED TO ACCOMMODATE QUANTITY AND SIZE OF CONDUCTORS INDICATED. ENGAGE A UL FIELD ENGINEERING SERVICES STAFF MEMBER TO EVALUATE BUSSING MODIFICATIONS AND OBTAIN APPROVAL FROM THE AHJ PRIOR TO COMMENCING WORK. MAKE ALL NECESSARY MODIFICATIONS AS DIRECTED BY THE UL FILED ENGINEERING STAFF AND THE AHJ.

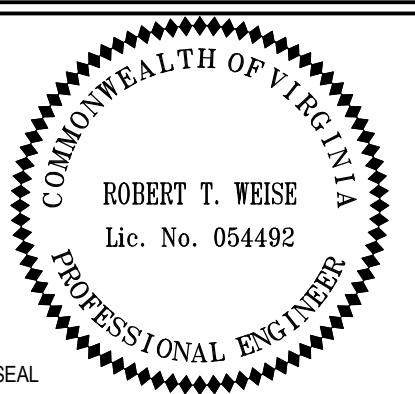
BUILDING SPECIFIC NOTES

- 1 BUILDING #1: TO FISHING PIER, SNACK BAR
BUILDING #2: SPACE ONLY
BUILDING #3: TO VERIZON EQUIPMENT
BUILDING #4: SPARE
- 2 BUILDING #1: 400A-3P SPARE
BUILDING #2: 200A-3P SPARE
BUILDING #3: 200A-3P SPARE
BUILDING #4: 200A-3P SPARE
- 3 BUILDING #1: 200A-3P SPARE
BUILDING #2: 200A-3P (*25HP MID-CHANNEL PUMP)
BUILDING #3: 400A-3P SPARE
BUILDING #4: 400A-3P SPARE
- 4 BUILDING #1: 200A-3P SPARE
BUILDING #2: SPACE ONLY
BUILDING #3: SPACE ONLY
BUILDING #4: 200A-3P (*25HP MID-CHANNEL PUMP)
- 5 BUILDING #1: SPACE ONLY
BUILDING #2 ONLY: SPARE (UNKNOWN RATING) LABELED "DO NOT OPERATE"
- 6 BUILDING #1: SPARE
BUILDING #2: SPARE
BUILDING #3: SUNCOM
BUILDING #4: SPARE
- 7 NOTE NOT USED.
- 8 BUILDING #1: 90A-3P
BUILDING #2: 100A-3P
BUILDING #3: 100A-3P
BUILDING #4: 100A-3P
- 9 NOTE NOT USED.
- 10 BUILDING #1: 200A-3P SPARE
BUILDING #2: 400A-3P SPARE
BUILDING #3: 400A-3P SPARE
BUILDING #4: 400A-3P SPARE
- 11 BUILDING #1: 100A-3P
BUILDING #2: 90A-3P
BUILDING #3: 100A-3P
BUILDING #4: 90A-3P
- 12 BUILDING #4 ONLY: 400A-3P.
- 13 BUILDING #4 ONLY: SPARE.
- 14 BUILDING #4 ONLY: EAST/WEST LIGHTING.



PARTIAL ONE-LINE DIAGRAM - BUILDING #3 - NEW WORK
NO SCALE

GENERAL NOTE:
WORK SHOWN IN THIS SET OF CONTRACT DOCUMENTS IS BASED ON PORTAL ISLAND BUILDING #3. THIS WORK IS TYPICAL FOR PORTAL ISLAND BUILDINGS #1, #2, AND #4.



NO.	DATE	DESCRIPTION

CHESAPEAKE BAY BRIDGE TUNNEL
SUPPORT BUILDINGS EMERGENCY POWER SYSTEM UPGRADES
CAPE CHARLES VIRGINIA
PARTIAL ONE-LINE DIAGRAM - BUILDING #3 - NEW WORK

PROJECT No: 21161

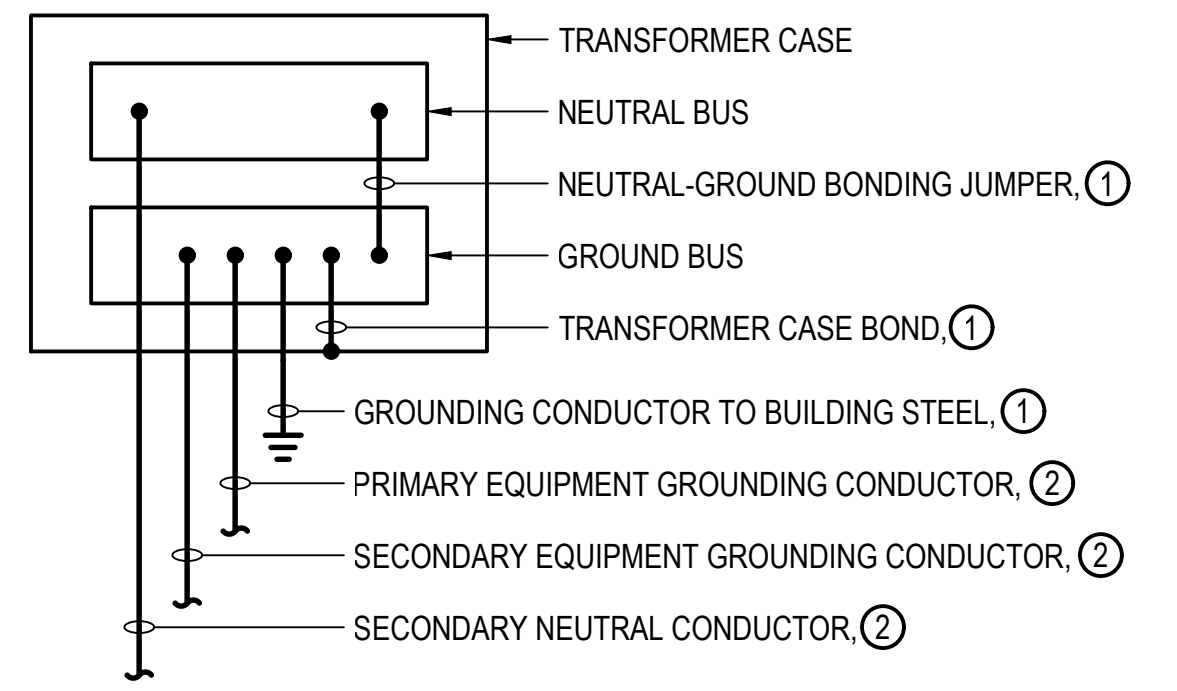
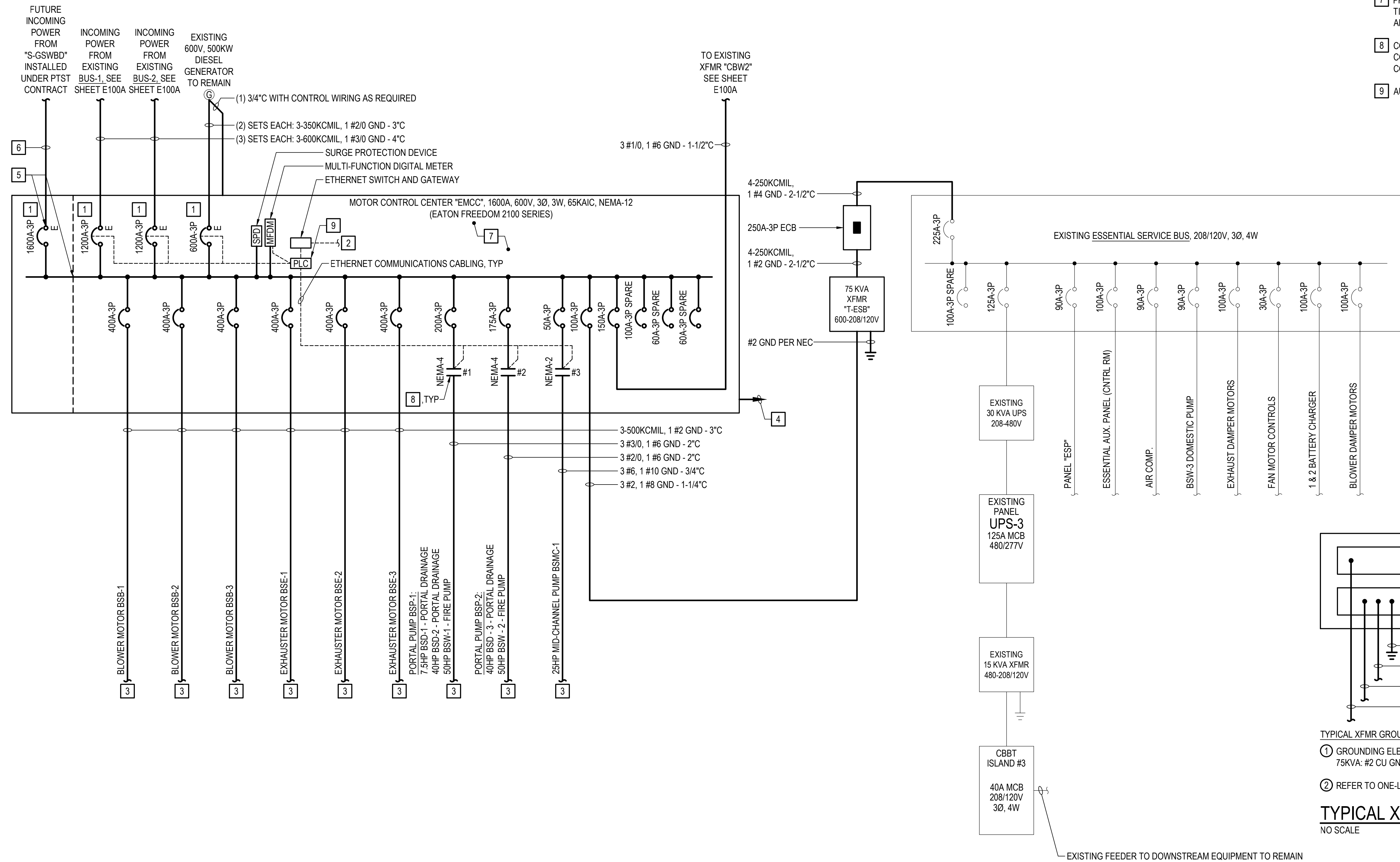
E100B

GENERAL PROGRAMMING NOTES:

- BUS-1 IS THE PREFERRED SOURCE OF UTILITY POWER TO "EMCC".
- UPON LOSS OF UTILITY POWER FROM BUS-1 AS SENSED BY THE PLC, THE PLC SHALL AUTOMATICALLY TRANSFER TO THE BUS-2 UTILITY SOURCE BY OPENING THE BUS-1 INPUT BREAKER AND CLOSING THE BUS-2 INPUT BREAKER.
- UPON LOSS OF BOTH UTILITY POWER SOURCES FROM BUS-1 AND BUS-2 AS SENSED BY THE PLC, THE PLC SHALL AUTOMATICALLY START THE EXISTING GENERATOR AND TRANSFER TO EMERGENCY POWER BY OPENING THE BUS-1 AND BUS-2 INPUT BREAKERS AND CLOSING THE GENERATOR INPUT BREAKER WITHIN 10-SECONDS.
- UPON RESTORATION OF POWER FROM BUS-1 OR BUS-2 UTILITY SOURCES AS SENSED BY THE PLC, THE PLC SHALL AUTOMATICALLY RETRANSFER BACK TO UTILITY POWER BY OPENING THE GENERATOR INPUT BREAKER AND CLOSING THE AVAILABLE UTILITY SOURCE INPUT BREAKER. PLC SHALL HAVE AN ADJUSTABLE TIME DELAY FOR RETRANSFER TO UTILITY POWER (0-30 MINUTES MINIMUM).
- PLC SHALL INCLUDE AN ADJUSTABLE GENERATOR COOL DOWN TIMER. COOL DOWN TIME SHALL BE PROGRAMMED AS DIRECTED BY THE DISTRICT.
- PLC SHALL BE PROGRAMMED TO EXERCISE THE GENERATOR AS DIRECTED BY THE DISTRICT. PROGRAMMING SHALL INCLUDE OPTIONS FOR EXERCISING WITH OR WITHOUT LOAD AND ADJUSTABLE INTERVALS FOR EXERCISING FREQUENCY AND TIME DURATION.
- WHEN "EMCC" IS POWERED BY THE EMERGENCY GENERATOR, THE SCADA SYSTEM SHALL BE PROGRAMMED TO INHIBIT ANY OF THE BLOWER MOTORS OR EXHAUSTER MOTORS FROM OPERATING AT ANY SPEED OTHER THAN SPEED-1. ONLY (1) BLOWER MOTOR AND (1) EXHAUSTER MOTOR MAY OPERATE SIMULTANEOUSLY WHEN "EMCC" IS POWERED BY THE GENERATOR. AN ADJUSTABLE TIME DELAY SHALL BE PROGRAMMED BETWEEN STARTING THESE LOADS (30 SECONDS MINIMUM).
- UPON LOSS OF POWER AS SENSED BY "EMCC" AUTO TRANSFER PLC, NETWORKED CONTACTORS SHALL OPEN. ADJUSTABLE TIME DELAYS SHALL BE PROGRAMMED BETWEEN CLOSING THESE CONTACTORS. CONTACTORS SHALL CLOSE SEQUENTIALLY AS NUMBERED ON ONE-LINE DIAGRAM WITH 30 SECOND MINIMUM TIME DELAYS BETWEEN EACH.
- UPON LOSS OF COMMUNICATIONS SIGNAL BETWEEN "EMCC" PLC AND SCADA SYSTEM AND IN ORDER TO PREVENT OVERLOADING THE STANDBY GENERATOR, THE SCADA SYSTEM SHALL BE PROGRAMMED TO DEFAULT TO OPERATING (1) BLOWER MOTOR AND (1) EXHAUSTER MOTOR AT SPEED-1 ONLY UNTIL COMMUNICATIONS IS RESTORED.

NOTES THIS SHEET

- INSULATED CASE, ELECTRICALLY OPERATED BREAKER.
- CAT-5E CABLE IN 3/4" TO EXISTING SCADA SYSTEM (AT EXISTING CNC CABINET LOCATED IN TUNNEL LIGHTING CONTROL ROOM).
- CONNECT TO EXISTING FEEDERS SAVED DURING DEMOLITION.
- 2 #12 - 3/4" TO EXISTING DC LIGHTING PANEL LOCATED IN CONTROL ROOM, SEE E201. CONNECT TO SPARE CIRCUIT BREAKER IN EXISTING PANEL.
- PROVIDE 1600A INPUT BREAKER AS INDICATED IN MCCs LOCATED IN PORTAL ISLAND BUILDINGS #1 AND #2 ONLY. FOR MCCs LOCATED IN PORTAL ISLAND BUILDINGS #3 AND #4 ONLY, PROVIDE PROVISIONS FOR FUTURE 1600A BUS EXTENSION AND FUTURE 1600A BREAKER.
- FUTURE (4) SETS EACH 3-600KCMIL, 1 #4/0 GND - 4" TO BE INSTALLED UNDER A SEPARATE CONTRACT.
- PROVIDE ELECTRONIC TRIP UNITS WITH ADJUSTABLE LONG TIME, SHORT TIME, AND INSTANTANEOUS TRIP SETTINGS FOR ALL CIRCUIT BREAKERS.
- CONTACTOR WITH COMMUNICATIONS CARD/DEVICE TO ALLOW CONTACTOR COIL TO ENERGIZE/DE-ENERGIZE VIA NETWORK COMMUNICATIONS.
- AUTO-TRANSFER AND INHIBIT PLC.



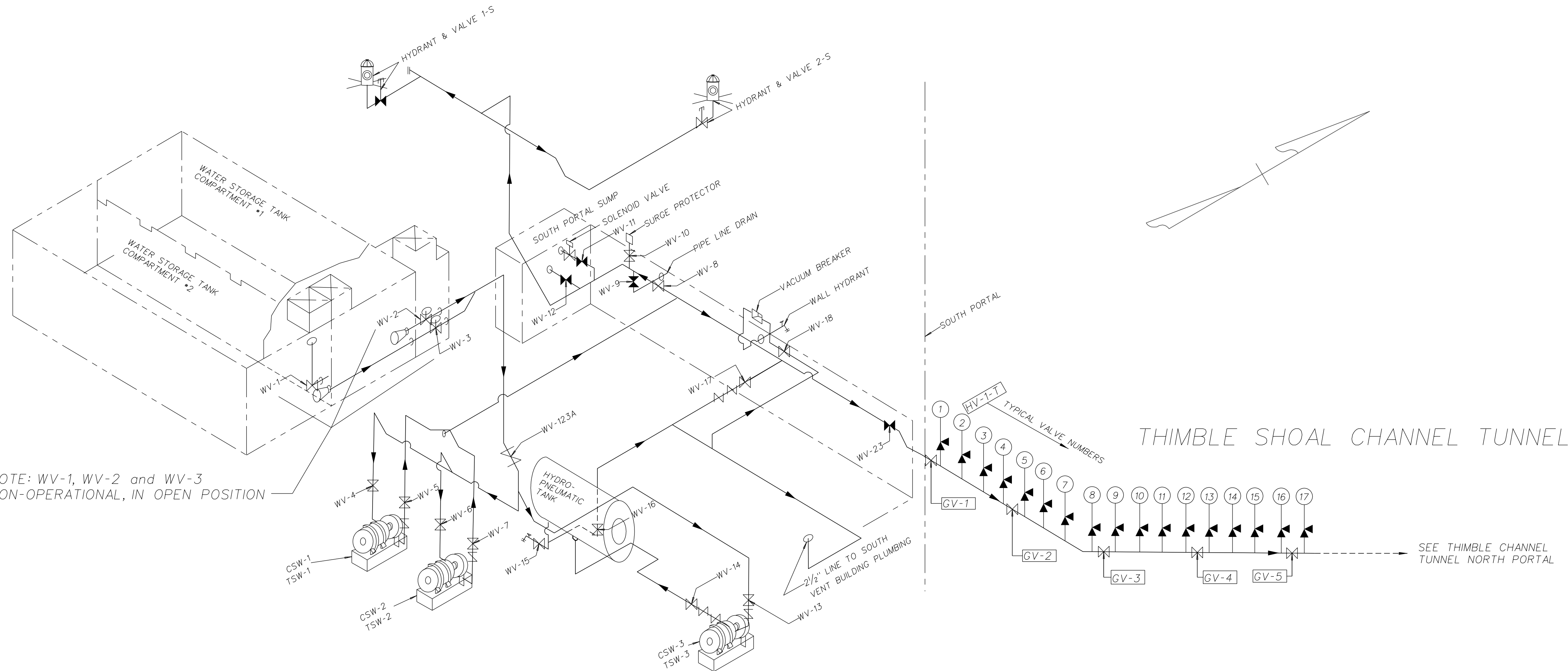
TYPICAL XFMR GROUNDING DETAIL
NO SCALE

PARTIAL ONE-LINE DIAGRAM - BUILDING #3 - NEW WORK
NO SCALE

GENERAL NOTE:
WORK SHOWN IN THIS SET OF CONTRACT DOCUMENTS IS BASED ON PORTAL ISLAND BUILDING #3. THIS WORK IS TYPICAL FOR PORTAL ISLAND BUILDINGS #1, #2, AND #4.

APPENDIX F

CBBT One Line Water Control System, typ.



NOTE: WV-1, WV-2 and WV-3
NON-OPERATIONAL, IN OPEN POSITION

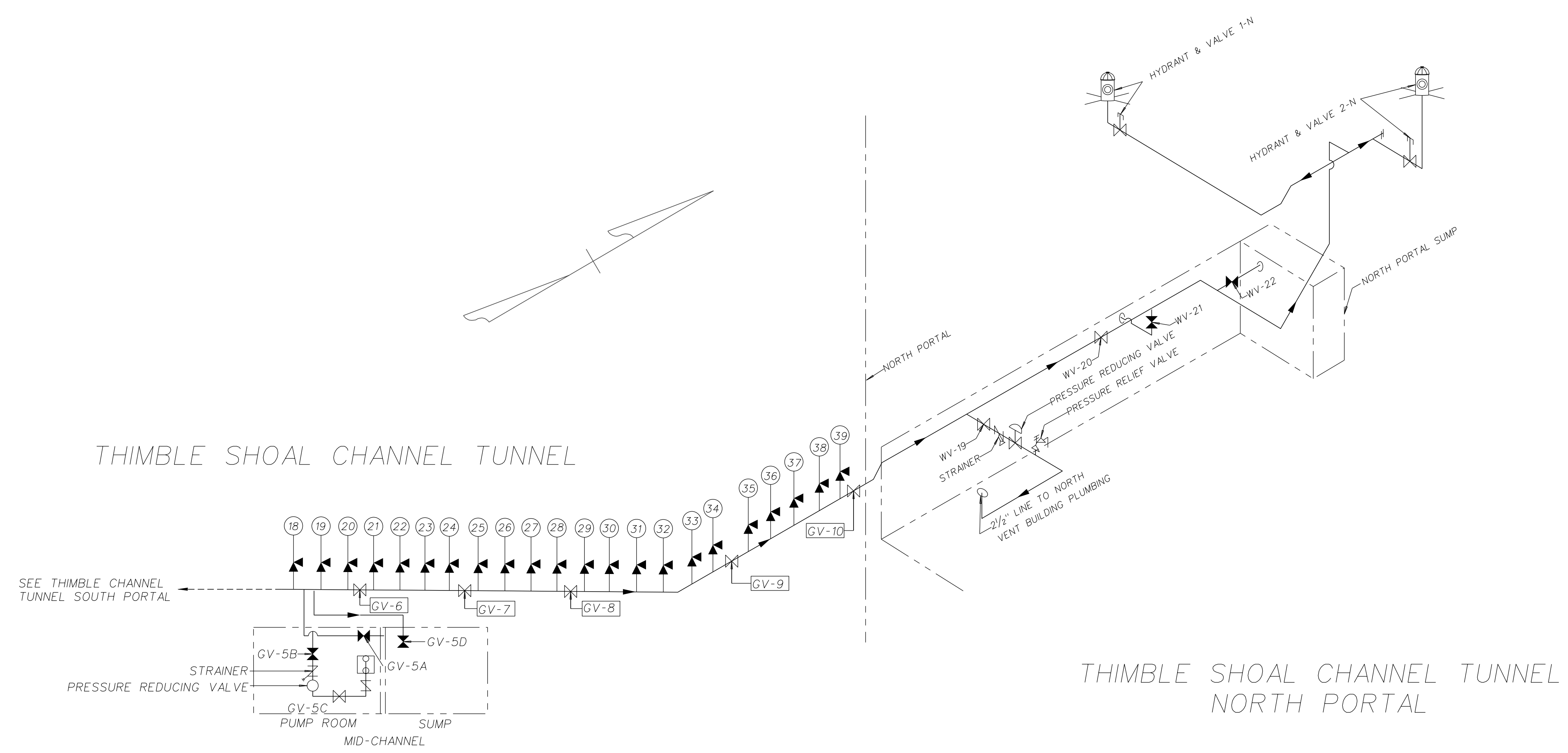
THIMBLE SHOAL CHANNEL TUNNEL
SOUTH PORTAL

LEGEND

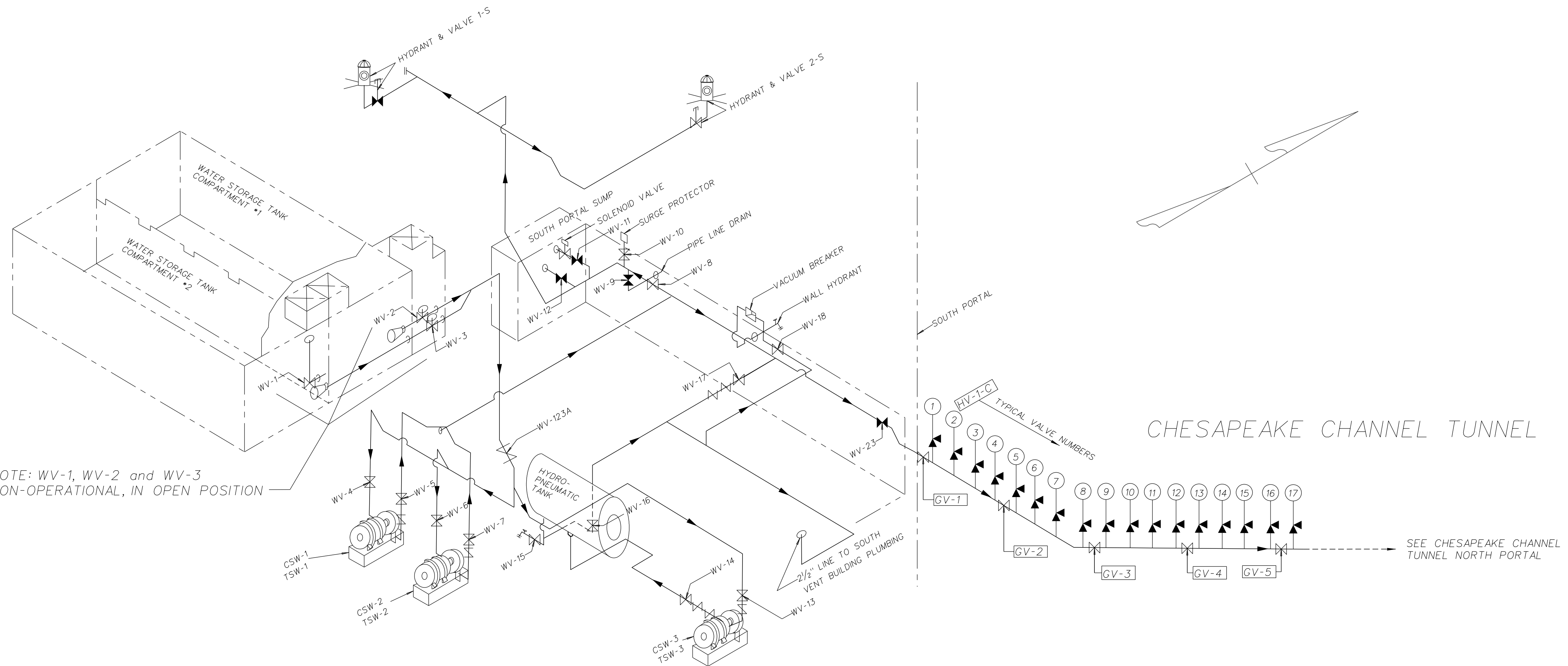
WV	WATER VALVE
GV	GATE VALVE (TUNNEL SECTION)
HV	HOSE VALVE (TUNNEL SECTION)
CSW	CHESAPEAKE SOUTH WATER
TSW	THIMBLE SOUTH WATER
▲▲▲	NORMALLY CLOSED VALVES

CHESAPEAKE BAY BRIDGE - TUNNEL
FRESH WATER SYSTEM

Scale: Not To Scale



THIMBLE SHOAL CHANNEL TUNNEL
NORTH PORTAL



NOTE: WV-1, WV-2 and WV-3
NON-OPERATIONAL, IN OPEN POSITION

CHESAPEAKE CHANNEL TUNNEL
SOUTH PORTAL

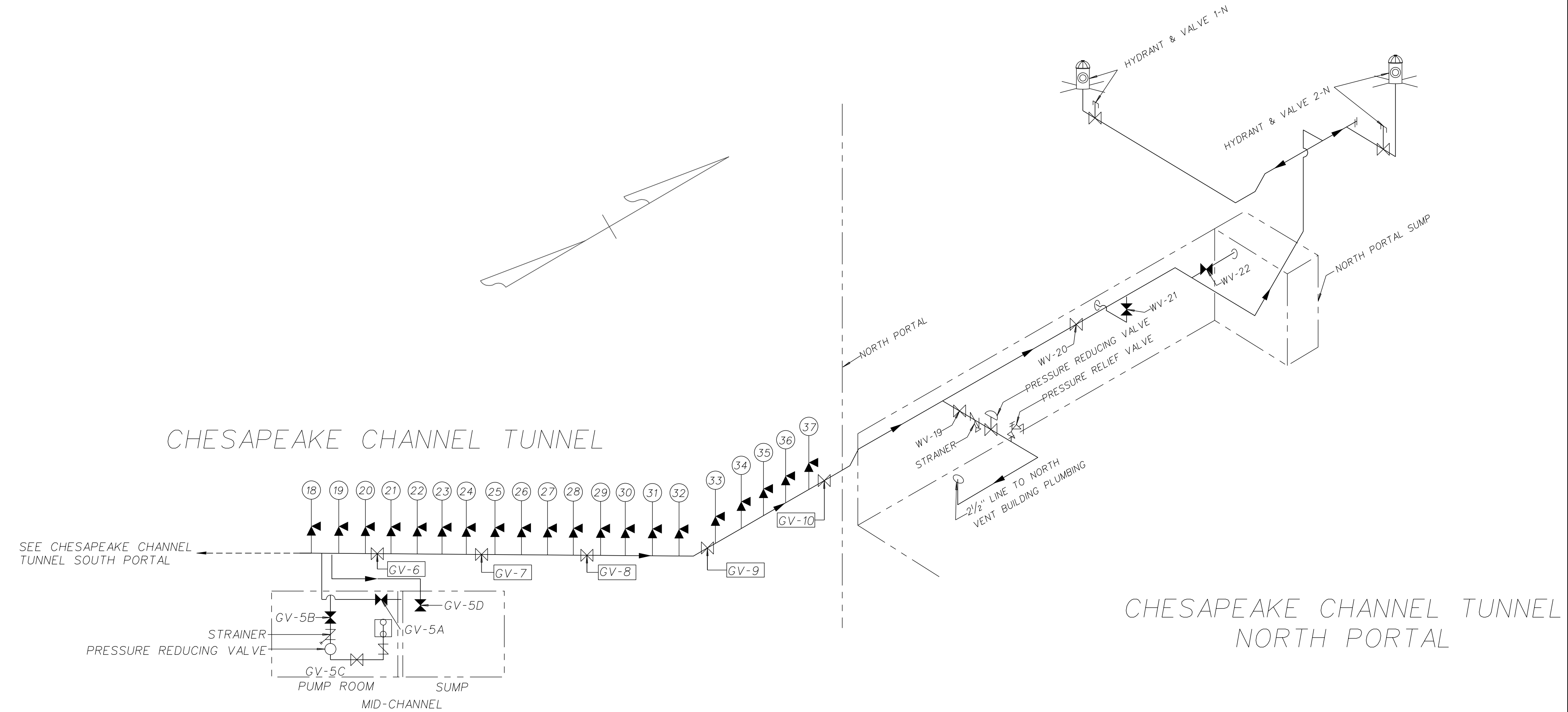
LEGEND

WV	WATER VALVE
GV	GATE VALVE (TUNNEL SECTION)
HV	HOSE VALVE (TUNNEL SECTION)
CSW	CHESAPEAKE SOUTH WATER
TSW	THIMBLE SOUTH WATER
▲▲	NORMALLY CLOSED VALVES

CHESAPEAKE BAY BRIDGE - TUNNEL
FRESH WATER SYSTEM

NOTE: CHESAPEAKE CHANNEL TUNNEL
PREVIOUSLY KNOWN AS BALTIMORE
CHANNEL TUNNEL.

Scale: Not To Scale



CHESAPEAKE CHANNEL TUNNEL

CHESAPEAKE CHANNEL TUNNEL
NORTH PORTAL

APPENDIX G

Tunnel Construction, Maintenance, Repair and Inspection **Methodology**

Tunnel Construction, Maintenance, Repair and Inspection Methodology

Chesapeake Bay Bridge and Tunnel District



September 26, 2022

Revision Number	Date	Notes
0	9/26/2022	Initial Report
1	9/13/2023	edits, mostly grammatical
2	7/2/2024	Update District PM docs, Appendix D & E

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Appendix A- Literary Review of Tunnel Inspection Governing Documents

Appendix B – Applicable Elements from the Specifications for the National Tunnel Inventory

Appendix C – Required Maintenance Standards vs. Guidance and Recommendations

Appendix D – District Preventative Maintenance (PM) Schedule

Appendix E – Sample District PM Data Sheets

Appendix F – Codes and Standards

Introduction

The purpose of this document is to describe how the Chesapeake Bay Bridge and Tunnel District (“District”) complies with the various codes and standards that apply to the construction, maintenance, repair and inspection of tunnels.

The need to document the District’s approach to tunnel construction, maintenance, repair and inspection stems from conflicting information that is often presented in industry standards, practices and codes.

In 2022, the District undertook a review of the codes and standards identified below, to verify and document the District follows statutory requirements. This report also documents District maintenance practices that are not otherwise prescribed in codes or standards.

Tunnel Standards

Over the last 58 years, standards for the construction and inspection of tunnels have been created, modified and evolved. The following paragraphs highlight the most relevant standards, or codes, that govern tunnels.

Maintenance and Inspection Since 1964

The Chesapeake Bay Bridge and Tunnel opened to the public in April of 1964. Since its inception, the District has charged its Maintenance Division with keeping the facility in good condition or better, as determined by a third-party inspection process. This charge stems from the original bond covenants and has continued to be stipulated in subsequent bonding processes as an assurance to the bond holders that the District will maintain the facility in good operating condition. The original need to maintain the facility in “good” condition or better, was required to be verified by an independent third-party consulting engineer. This requirement has been maintained to present day.

Federal Highway Administration (FHWA) Inspection Requirements

In 1971, the Federal Highway Administration implemented the National Bridge Inspection Standards (NBIS) and in 2015 the National Tunnel Inspection Standards (NTIS).

The District employs a General Consulting Engineer (GCE) to conduct the independent thirdparty inspection, to include the NTIS inspection. For the purposes of the inspection, the GCE is employed to report on the condition of the items inspected. The Consultant is not required to evaluate code compliance of the various items being inspected. The item being inspected is evaluated based on its original installation, not against codes that may, or may not, have changed since the item was installed. This philosophy is consistent with bridge inspection standards used by FHWA and VDOT.

A review of tunnel inspection governing documents was performed so that the District could verify current practices are in compliance with standards. The work is attached as Appendix A. This review pointed to the Specifications for the National Tunnel Inventory (SNTI), with broken out tunnel inspection elements as the main inspection focus. The applicable elements from the SNTI, for our facility, are captured in Appendix B.

Design and Construction

The primary codes and standards used for the design and construction of new tunnel facilities are provided in Appendix F. Generally, existing facilities are not required to meet new codes that are developed, or changed, after the initial construction. When major rehabilitation occurs systems and components will meet new standards where practical.

Maintenance

There are currently no statutory standards that govern the maintenance requirements for tunnels. As will be discussed in later sections, there are recommended practices for maintenance and many electrical and mechanical elements have preventative maintenance programs recommended by the manufacturer. The District has a robust preventive maintenance program which is described in the following sections of this report.

The District reviewed codes and standards for our tunnel elements, with regards to maintenance, and sorted through each to determine what was required to verify District compliance. The full results are in Appendix C. In summary, of the eight documents reviewed, made up of seven NFPA standards and the NETA Maintenance Testing Specifications, only three contained elements required for our existing facility. These were all NFPA documents or a specific portion of a NFPA document, relating to inspection and testing of water-based fire systems, maintenance and testing for backup generators and emergency response plans.

Tunnel Maintenance

The design, construction and inspection of tunnel facilities is well codified and documented. However, preventative maintenance and testing is not a statutory requirement. The next section(s) will identify the District's philosophy with regard to maintenance and document how maintenance is handled.

Philosophy

The goal of the District is to maintain the facility with a very high level of performance, or reliability. This is achieved by:

1. Properly maintaining the various systems and components of the tunnel
 - a. Preventative maintenance
 - b. Repairs when necessary
 - c. Replacement of items that exceed their service life
2. Providing redundancy for critical systems

- a. Tunnel ventilation fans
 - b. Drainage pumps
 - c. Power feeds
 - d. MIS HVAC units
3. Providing back-ups for critical systems
 - a. Uninterruptable power supply (UPS)
 - b. Generators
 4. Maintaining spare parts
 - a. Common items
 - b. Long-lead items

In-House Capabilities

The District's maintenance approach begins with an electrical/mechanical group of people that have in-depth institutional knowledge of the facilities and systems as well as technical skills required for maintenance and repairs.

The District was first a ferry system, prior to the fixed crossing that opened in 1964. The mentality of the ferry system was brought into the District's tunnel systems, as many of the District ferry employees became District tunnel personnel.

- **Tunnel Maintainers** were originally deck hands who made checks and kept the ferries clean.
 - Tunnel Maintainers make checks throughout each Ventilation Building and the Tunnel, ○ make sure equipment is operating as intended, and ○ keep their assigned stations clean.
- **Tunnel Mechanics and Electricians** were originally Ferry Engineers who kept the boats in good running order, performing preventative maintenance, making repairs and replacing parts as needed.
 - Tunnel Mechanics and Electricians perform preventative maintenance on drainage pumps, ventilations fans, generators and the electrical systems that feed them.
- **Tunnel Equipment Operators** were originally Ferry Captains who were in charge of the boat.
 - Tunnel Operators keep overall care of the ventilation buildings and tunnel, ○ receive information and give guidance to the Tunnel Maintainers, who are performing checks, and relay what repairs are needed to Mechanics and Electricians, ○ keep watch over pending weather, and ○ keep a log of conditions and events on the hour

The District hires from within, whenever possible. Typically, the Maintainer is an entry level position that transitions to Operators, Electricians or Mechanics depending on the abilities, work ethic and desired career path. On the job training is supplemented by formal coursework to gain

the needed skills as the employee advances. This method of developing employees provides a wealth of internal institutional knowledge and ownership of the maintenance program.

Hands-On Approach

While duties have changed slightly over the years as additional and updated equipment has been added, this ferry system maintenance culture still remains, utilizing a daily hands on approach, with in-house skilled personnel.

Daily Checks

The hands-on approach builds its foundation on 24/7/365 coverage by Tunnel Maintainers, working a three-shift cycle.

- On each shift, these employees walk each Ventilation Building from bottom to top, putting hands on equipment to make sure they are warm but not hot to the touch, listening for unusual sounds, checking fluid levels and basically looking for anything that is not the typical sights and sounds.
- Each Maintainer, four in total, has their own Island Vent Building for which they are solely responsible for cleanliness.
- Knowing their working peers will be making checks through their building, inspires a competitive nature.
- If issues or problems are found by the tunnel Maintainer, they report it to their Tunnel Operator, located in the Control Rooms on #1 and #3 Islands.
- Tunnel Operators are also a 24/7/365 three shift position, with the #1 Island Operator having seniority over the #3 Island Operator.
- Operators have an in-depth working knowledge of the tunnel systems.
- Depending on the nature of the issue, the Tunnel Operator will either give direction to the Maintainer to rectify the issue on the spot, log the issue to be reported to the Superintendent the following work day for repair, or make the call to bring in the appropriate personnel to fix an issue deemed unable to wait.
- In addition to overseeing these processes, the Tunnel Operators keep watch over the facility utilizing the multiple CCTV cameras in the tunnels and on the islands.
- The #3 Island Operator is responsible for the duty of turning on and off various blank out signs, variable message boards and lighting across the facility through a SCADA system.
- The Operator makes these changes based on radio and/or phone call requests from the field.
- Having an in-depth knowledge of the Tunnel Systems, the Operators have the ability to re-route power using different feed configurations available through SCADA as the need may arise, such as a dropped feeder from Dominion Power.
- They will also rotate the Tunnel Ventilation Fans through SCADA and monitor CO levels in the tunnel.
- All weather conditions and any events are logged on the hour at a minimum.

Preventative Maintenance

The electrical and mechanical items that require routine preventative maintenance are included in Appendix D. Only the applicable elements pertaining to our facility are listed.

Third Party Maintenance, Testing and Inspection

Not all cyclical maintenance, testing and inspection can be performed in house. Examples of these services would be load testing the medium voltage switchgear, hydrostatic testing of the tunnel stand pipes, rebuilding medium switchgear breakers, and reconditioning fan motors. Outside service required tasks are listed as such, under the Position Responsible column, in Appendix D.

Maintenance and Repairs

Minor Repairs

Operators record reported deficiencies on a punch list pad. A picture of that list is text to the Superintendent and Supervisor every morning. In the early morning meeting of the Day Gang, comprised of the Superintendent, Supervisor, Electricians, HVAC Mechanics, Mechanics and Technicians, appropriate personnel are assigned the deficiencies to address. As items are addressed they are removed from the list. Typical daily items would include things such as light out on the 5th floor #3 Island or Booster Pump #2 leaking #1 Island. These types of items would typically be fixed next working day after reported. Other items that are somewhat out of the norm would be UPS in Alarm State #4 Island. Items such as this would receive trouble shooting and, even if fixed right away, would be left on the Operators list in the Control Room, so that it receives attention over the next several days to verify that no issues arise.

Major Repairs

Major repairs typically require budgeting for a capital project. Once a project is budgeted, a bid package with design and specifications is prepared and advertised to industry. Projects are awarded to the lowest bidder, who will then be provided a contract to complete the repairs.

As noted previously, when major repairs are required, items are designed and constructed to current codes and standards, where practical.

Documentation

Daily Checks

The Tunnel Maintainers report items that need repair. They do not report items that are in good condition. Having multiple personnel performing the same daily checks, coupled with 3rd party inspectors on an annual basis, provides double and triple checks of equipment.

- Maintainers follow a shift check/walk through in each of the four ventilation buildings.
- These checks can be found in Appendix D.

- Operators often document the start and stop time for the ventilation building checks on the daily logs they keep.
- Each of the four Maintainers is responsible for cleaning stations in one of the four ventilation buildings.
- The maintainers document what they have cleaned in a log book located in each of the control rooms.
- Once full, the log books are kept by the Electrical Mechanical Superintendent.
- Each cleaning log book holds about two years of cleaning records for that ventilation building.
- Any item found to be in disrepair, or not operating normally, will be reported and documented in the Operator's log book.

Preventative Maintenance

The major annual preventative maintenance work activities, listed in Appendix D, such as oil changes on the Island 500kV generators, greasing damper door chains and exercising/lubricating pumps are documented, by Tunnel Mechanics and/or Electricians, on legal pads and handed up to the Electrical Mechanical Superintendent.

In preparation for annual inspection processes, the Superintendent will compile a report from the legal pads mentioned above. This report documents preventative maintenance performed per tunnel element system and their major components per the tunnel being inspected in a given year. This report is provided to the third-party annual inspectors for the tunnel being inspected that year, prior to the annual inspection commencing. See the most recent example of Chesapeake Tunnel that was completed for the FY 2023 Annual Inspection, attached as Appendix E.

Third Party Maintenance, Testing and Inspection

For District third-party activities, the work is performed, a report is generated by the vendor with the report placed in the District's file system for documentation. Files for third party testing reports are maintained in the filing systems of both the Department's Superintendent and the Director of Maintenance.

Minor Repairs

Technicians, Mechanics and Electricians, keep track of their repairs and testing on legal pads. These legal pads are given to the Superintendent on a monthly basis. This is what the Superintendent uses to put the monthly report items together from the Electrical Mechanical Division. The Superintendent keeps these legal pads in his filing system for an extended time period, approximately 5 years, and then discards them.

Major Repairs

Major repairs require specifications and drawings that document the repairs. These records are maintained by the Director of Maintenance. In addition, a construction summary report is generated for major repair projects.

APPENDIX A - Literary Review of Tunnel Inspection Governing Documents

* 3 documents were searched for trigger words: TOMIE, SNTI, NTIS * Trigger words included: shall, required, requirement, mandate, mandatory, will, must, obligated, and obliged. * Did not include standard safety practices (i.e. a lanyard must not be used after deployed in fall or after date has expired) * Did not include items that do not pertain to our facility (i.e. Must inspect tunnel ceiling panels.) * Did not include standard practices (i.e. All load calculations must be checked by a qualified Engineer.)

Red Text means this applies to our facility. District needs to integrate into our processes, if it is not already incorporated.

Trigger word	Document	Chapter	pg	Verbiage	Notes
Must	TOMIE	1	1	Many tunnels have complicated functional systems such as lighting, ventilation, drainage, fire detection and alarms, fire suppression, communication and traffic control; these systems must be kept in good working order to minimize death and injury during an emergency such as a collision, fire, flood, earthquake, or criminal act.	
Will	TOMIE	1	1	The data produced in accordance with these documents will be maintained in the National Tunnel Inventory (NTI) database.	
Required	TOMIE	1	3	Key inspection personnel, including program manager and team leaders, are required to become nationally certified tunnel inspectors.	
Will	TOMIE	1	3	The inventory and inspection data will be available in the annual report to Congress.	
Must	TOMIE	1	4	The data submitted to the FHWA must be formatted in accordance with the instructions contained in the SNTI instructions.	
Must	TOMIE	2	1	Functional systems within the tunnels must be integrated with operational procedures to include the mechanical equipment, electrical components, lighting fixtures, fire and life safety systems, signs and security equipment installed within the tunnel.	
Must	TOMIE	2	8	The functional systems must be checked to ensure that they are working as intended.	
Must	TOMIE	3	24	All gauges, sight glasses, indicator lights, and safety equipment must be cleaned and checked.	Make sure this is incorporated into our PM docs.
Required	TOMIE	3	30	Equipment and system certifications should be posted at the equipment locations as required.	Boilers, switchgear, etc.
Required	TOMIE	3	35	Manufacturer's literature or inspect on an interval required by the local authority having jurisdiction (AHJ).	Need to look at items such as Emergency Generators, Air Compressors, Pumps, etc. for Mfg. recommendations on PMs
Required	TOMIE	4	2	Required to establish a tunnel inspection organization.	
Must	TOMIE	4	4	The inspection program must be developed sufficiently to be capable of evaluating the tunnel elements and identifying any safety or structural concerns.	
Mandated	TOMIE	4	6	The Program Manager overall in charge of the inspection program. The Team Leader leads and coordinates inspections in the field.	
Will	TOMIE	4	40	When taken as a whole, the element level data collected during the tunnel inspection will provide information on the overall safety and reliability of the structural, civil, and functional systems. The structural elements contained in the NTI database include tunnel liners, roof girders, columns and piles, cross passageways, interior walls, portals, ceiling slabs, ceiling girders, hangers and anchorages, ceiling panels, invert slabs, slabs on grade, invert girders, joints, and gaskets. The civil elements included in the NTI database are roadway wearing surfaces, traffic barriers, and pedestrian railings. The functional systems contained in the NTI database include the mechanical, electrical and lighting, fire and life safety, sign, and protective systems. The written inspection procedures should cover all of these systems as appropriate for the particular tunnel.	
Required	TOMIE	4	55	If the passageway is pressurized, an operational check of this system is required.	This will be needed for New Thimble Tunnel

Trigger word	Document	Chapter	pg	Verbiage	Notes
Required	TOMIE	4	81	The SNTI defines the elements required for the NTI including the electrical distribution system, the emergency distribution system, tunnel lighting system and fixtures, and the emergency lighting system and fixtures.	
Required	TOMIE	4	95	The owner is required to establish a procedure to ensure that critical findings are addressed in a timely manner.	Verify we have a written statement to cover this.
Must	TOMIE	5	1	A load rating must be performed in accordance with the National Tunnel Inspection Standards (NTIS).	Done
Required	TOMIE	5	21	A load rating is required for all tunnels that have a structurally supported roadway system to carry vehicles (not at grade).	Done
Shall	TOMIE	5	22	The load rating of tunnels shall follow the provisions from the AASHTO Manual for Bridge Evaluation (MBE). In cases where the AASHTO criteria are silent or do not apply, criteria should be agreed upon between the tunnel owner and engineer performing the evaluation and a record of these decisions shall be documented in the tunnel file.	

Trigger word	Document	Chapter	pg	Verbiage	Notes
Required	SNTI	Section 1	2	The coded items in these specifications are considered to be an integral part of the database that can be used to meet several Federal reporting requirements, as well as part of the States' needs. These requirements are set forth in the National Bridge and Tunnel Inventory and Inspection Standards (Section 144 of Title 23, United States Code).	The Element section pertaining to the Electrical/ Mechanical PM schedule entails Section 3 of the SNTI, entitled Elements. More specifically, it is Sections 3.4 Mechanical System Section, 3.5 Electrical and Lighting Systems, 3.6 Fire/Life Safety/Security System. Go to Sheet entitled SNTI Required Element Data in this workbook for applicable information. The remainder items are structural and civil element data, not involved in the PMs
Required	SNTI	Section 2	4	The Specifications and Commentary portions provide the detailed description of each inventory item and some explanation or additional clarification to consider for coding each item. The Specification portion is the required information to be recorded and shall be followed. Where there is ambiguity in the Specification, the FHWA Division office should be consulted for clarification and/or additional guidance. The Commentary portion is intended to provide clarifying information and general guidance for recommended methods to meet the Specification.	

Trigger word	Document	Chapter	pg	Verbiage	Notes
Mandate	Federal NTIS		41350	Routine and thorough inspections of our Nation's tunnels are necessary to maintain safe operation and prevent structural, geotechnical, and functional failures. Data on the condition and operation of our Nation's tunnels is necessary in order for tunnel owners to make informed investment decisions a part of an asset management program for maintenance and repair of their tunnels. Recognizing that the safety and security of our Nation's tunnels are of paramount importance, Congress declared in MAP-21 that it is in the vital interest of the U.S. to inventory, inspect, and improve the condition of the Nation's highway tunnels. As a result of this declaration and the MAP-21 mandate found in 23 U.S.C 144, FHWA establishes the NTIS.	
Required	Federal NTIS		41350	The inspection organizations are required to develop and maintain inspection policies and procedures, ensure that inspections are conducted in accordance with the proposed standards, collect and maintain inspection data, and maintain a registry of nationally certified tunnel inspection staff.	

Trigger word	Document	Chapter	pg	Verbiage	Notes
Shall	Federal NTIS		41350	A program Manager shall be a registered Professional Engineer (P.E.) or have 10 years of tunnel or bridge inspection experience, and be a nationally certified tunnel inspector. The Team Leader shall be a nationally certified tunnel inspector and either be registered P.E. with 6 months of tunnel or bridge inspection experience, or have 5 years of tunnel or bridge inspection experience or an appropriate combination of education and experience as detailed in the referenced section.	
Required	Federal NTIS		41350	Owners are required to notify FHWA within 24 hours of identifying a critical finding and the actions taken to resolve or monitor the finding.	Work this into our written statement for critical findings.
Shall	Federal NTIS		41355	<i>Complex Tunnel-</i> The current definition clearly states that a structure shall be inspected and reported only once under either the NBIS or the NTIS, but not both.	
Shall	Federal NTIS		41357	A program Manager shall, at a minimum, be a registered Professional Engineer or have 10 years of tunnel or bridge inspection experience, be a national certified tunnel inspector, and be able to determine the minimum qualifications for a Team Leader.	
Required	Federal NTIS		41367	Tunnel owners are required to report to the Secretary on the results of tunnel inspections and notations of any action taken pursuant to the findings of the inspections. For all inspections, tunnel owners will be required to enter the appropriate inspection data into the State DOT, Federal Agency, or tribal government inventory within 3 months of the completion of the inspection.	
Shall	Federal NTIS		41370	Each State DOT shall inspect , or cause to be inspected, all highway tunnels located on public roads, on and off Federal-aid highways, that are fully or partially located within the State's boundaries, except for tunnels that are owned by Federal agencies or tribal governments.	
Shall	Federal NTIS		41370	A Team Leader shall at least at minimum: (1) Meet at least one of the four qualifications listed in paragraph (b)(1)(i) through (iv) of this section: (i) Be a registered professional engineer and have six months of tunnel or bridge inspection experience. (ii) Have 5 years of tunnel or bridge inspection experience. (iii) Have all of the following: (A) A bachelor's degree in engineering or engineering technology from a college or university accredited or determined as substantially equivalent by the Accreditation Board for Engineering and Technology. (B)Successfully passed the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination. (C) Two (2) years of tunnel or bridge inspection experience.	
Shall	Federal NTIS		41370	Load ratings shall be performed by, or under the direct supervision of, a registered Professional Engineer.	
Shall	Federal NTIS		41370-71	A nationally certified tunnel inspector shall: (1) Complete an FHWA-approved comprehensive tunnel inspection training course and score 70 percent or greater on an end-of-course assessment; (2) Complete a cumulative total of 18 hours of FHWA-approved tunnel inspection refresher training over each 60 month period; and (3) Maintain documentation supporting the satisfaction of paragraphs (e) (1) and (2) of this section, and, upon request, provide documentation of their training status and current contact information to the Tunnel Inspection Organization of each State DOT, Federal agency, or tribal government for which they will performing tunnel inspections.	
Shall	Federal NTIS		41371	The initial routine inspection shall be conducted after all construction is completed and prior to opening to traffic, according to the inspection guidance provided in the Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual (incorporated by reference, see 650.517)	

Trigger word	Document	Chapter	pg	Verbiage	Notes
Shall	Federal NTIS		41371	Routine Inspections shall be as follows: (1) Establish for each tunnel the NTIS routine Inspection Date in a month and year (MM/DD/YYYY) format. This date should only be modified by the Program Manager in rare circumstances. (2) Inspect each tunnel at regular 24 month intervals.	
Shall	Federal NTIS		41371	Damage, in-depth, and special inspections. The Program Manager shall establish criteria to determine the level and frequency of damage, in-depth, and special inspections.	
Shall	Federal NTIS		41371	CBBT shall (a) inspect tunnel structural elements and functional systems in accordance with the inspection guidance provided in the Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual. (b) Provide at least one Team Leader, who meets the minimum qualifications stated in 650.509, at the tunnel at all times during each initial, routine, and in-depth inspection. The State DOT, Federal agency, or tribal government shall report the nationally certified tunnel inspector identification for each Team Leader that is wholly or partly responsible for a tunnel inspection must be reported to the National Tunnel Inventory. (c) Prepare and document tunnel specific inspection procedures for each tunnel inspected and inventoried that shall: (1) Take into account the design assumptions and the tunnel complexity; and (2) Identify the - (i) Tunnel structural elements and functional systems to be inspected; (ii) Methods of inspection to be used; (iii) Frequency of inspection for each method; and (iv) Inspection equipment, access equipment, and traffic coordination needed. (d) Establish requirements for functional system testing, direct observation of critical system checks, and testing documentation. (e) For complex tunnels, identify specialized inspection procedures and additional inspector training and experience required to inspect complex tunnels. Inspect complex tunnels according to the specialized inspection procedures. (f) Conduct tunnel inspections with qualified staff not associated with the operation or maintenance of the tunnel structure or functional systems. (g) Rate each tunnel's safe vehicular load-carrying capacity in accordance with the Sections 6 or 8, AASHTO Manual for Bridge Evaluation (incorporated by reference, see 650.517).	

APPENDIX B - Applicable Elements from the Specifications for the National Tunnel Inventory (SNTI)

The SNTI represents coded items that must be recorded and or inspected. This was developed to meet the requirements of the National Tunnel Inventory Inspection Standards (Section 144 of Title 23 Part 650, United States Code). Two main sections make up these requirements; 1) Inventory Items - which were established and recorded at the commencement of NTIS for our existing tunnels. These will not change unless a major retrofit changes current configuration or a new tunnel is brought on line. 2.) Elements - These are made up of structural, civil, mechanical, electrical, lighting, fire/life, safety/security, signs and protective systems. Typically, we do not incorporate Civil and Structural Elements into our regular Preventative Maintenance Schedule (PMS) unless obvious sign of deterioration in concrete and/or steel members are noticed that may lead to an internal or outside service project. An example of this on our facility would be the internal Girder Repair Project. In like manner, the Protective Systems Section only applies to Civil and Structural Elements, mostly coatings. The remaining items below, should be part of our routine PMS for the District's existing tunnels. Only the elements pertaining to our facility are listed. Nonapplicable elements, such as flood gates & variable message signs were not included.

Section Name	Element Number	Element Name	Specification Requirement	Defect	Condition State 1	Condition State 2	Condition State 3	Condition State 4
3.4 Mechanical Systems	10200	Ventilation System	This element describes the components that provide the supply of fresh air to the tunnel while removing stale air & contaminants	System Condition	Good Condition - No notable Stress.	Fair Condition - Isolated breakdowns and deterioration.	Poor Condition - widespread deterioration/breakdowns reducing operational capacity, without impacting serviceability of element or tunnel.	condition warrants evaluation to determine effect on serviceability on element or tunnel/ or eval has determined there is an impact on element/tunnel.
	10201	Fans	This element describes the components that produce a current of air which provides the supply of fresh to the tunnel while removing stale air and contaminants.	Fan Operation	Operates on all speeds and in all modes with no noticeable temperature rise.	Operates on all speeds and in all modes. Requires manual restart or manual control to achieve this.	Fan operates on at least one speed or only operates in manual mode. Drive(s) require major adjustment. Severe play and/or belt/chain noise is observed. (If belt – moderate wear/deterioration to belt.) Between 40 degree F and 80 degree F temperature rise form ambient temperatures during operation.	Fan will not operate on any speed. Over 80 degree F temperature rise for ambient temperatures during operation.
				Fan Condition	Good Condition - No notable Stress.	Fair Condition - Isolated breakdowns and deterioration.	Fan will not operate on any speed. Over 80 degree F temperature rise for ambient temperatures during operation.	Condition warrants evaluation to determine effect on serviceability on element or tunnel/ or eval has determined there is an impact on element/tunnel
	10300	Drainage and Pump Systems	This element includes storm drains, piping, pumps and water treatment equipment for the removal of water that may enter the tunnel from the portals, vent shafts, and cracks in the tunnel lining. Drainage at the tunnel facility also handles the drippings from vehicles traversing the tunnel and potential spills from trucks hauling liquid materials.	System Condition	Good Condition - No notable distress.	Fair Condition - Isolated breakdowns and deterioration.	Poor Condition - widespread deterioration/breakdowns reducing operational capacity, without impacting serviceability of element or tunnel.	Condition warrants evaluation to determine effect on serviceability on element or tunnel/ or eval has determined there is an impact on element/tunnel.
10301	Pumps	This element includes the component that moves water that may enter the tunnel from the portals, vent shafts, and crack in the tunnel lining.	Pump Operation (Includes Sump Pump, Pump Motor, Pump Controller, Pump Control Panel, Oil Leakage, Pump Leakage, Noise and Vibration and Temperature)	Operates in all speeds and modes. Shut off valves operate freely and without binding. Fair amount of noise and vibration velocity of 100 in./s or less. No oil leakage observed at pump seal. No water leakage noted in immediate piping and valves. Motor temp is within expected limits.	Operates in all speeds and modes in a reduced capacity. Shut-off valves operate with some resistance and binding but do not appear to fully open/seal. Slightly rough noise and vibration velocity between 100 & 300 in./s. Limited exterior staining from oil seepage at seals. Limited exterior water seepage from seals with seals appearing wet. Motor temp is slightly increased during motor operation.	Operates intermittently or haltingly. Shut-off valves difficult or impossible to operate. Rough noise and vibration velocity in excess of 300 in./s. extensive exterior staining from oil seepage around seals. Measurable water seepage around seals that can be quantified in drips/min. Motor temp is moderately above what is expected and/or hot spots of temperature exist.	Pump will not operate. Pooling of oil on exterior surfaces of seals or significant reduction of interior lubricant level. A visible stream of water on exterior surfaces of seals or significant reduction of pump performance. Motor temp is drastically increased and motor function is influenced.	
10400	Emergency Generator System	These elements are the mechanical components of an emergency generator and power system which consist of fuel delivery, fuel storage, an engine cooling and exhaust systems. The emergency generator provides a back-up power source in the event of utility service failure to the tunnel. The mechanical systems support the proper operation of the generator to provide back-up power.	System Condition	Good Condition - No notable distress.	Fair condition – isolated breakdowns or deterioration.	poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.	Condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.	
3.5 Electrical and Lighting Systems	10500	Electrical Distribution System	The electrical distribution system consists of the electrical equipment, wiring, conduit, and cable used for distributing electrical energy from the utility supply (service entrance) to the line terminals of utilization equipment.	System Condition	Good Condition - No notable distress.	Fair condition – isolated breakdowns or deterioration.	poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.	Condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

Section Name	Element Number	Element Name	Specification Requirement	Defect	Condition State 1	Condition State 2	Condition State 3	Condition State 4
	10550	Emergency Distribution System	This system consists of the electrical equipment, wiring, conduit, and cable used for providing electrical power in case of utility service failure. Equipment included in this system consists of emergency generators and/or uninterruptible power supply (UPS) systems, transfer switches, and other equipment supplying emergency power.	System Condition	Good Condition - No notable distress	Fair condition – isolated breakdowns or deterioration.	Poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.	Condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.
	10600	Tunnel Lighting System	These systems consist of the light fixtures, supports, bulb housings, lenses, light switches, junction boxes, wiring, conduit, cable, sensors, and controllers used to provide lighting for the tunnel.	System Condition	Good Condition - No notable distress.	Fair condition – isolated breakdowns or deterioration.	Poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.	Condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.
	10601	Tunnel Lighting Fixture	This element includes the physical housing of the tunnel lights and their connections to the tunnel.	Component Supports	No deficient support conditions.	Loose anchorage or component housing connection hardware.	Missing anchorage or component housing connection hardware which does not result in an unstable condition.	Failed anchorage or component connection hardware which results in an unstable situation.
Corrosion				None	Freckled Rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.	
Component Housing or Enclosure				No damages.	Single Crack.	Multiple Cracks.	Holes are present.	
	10620	Emergency Lighting System	These systems consist of the light fixtures, supports, bulb housings, lenses, light switches, junction boxes, wiring, conduit, cable, sensors, and controllers used to provide emergency lighting for the facility	System Condition	Good Condition - No notable distress.	Fair condition – isolated breakdowns or deterioration.	Poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.	Condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.
	10621	Emergency Lighting Fixture	This element includes the physical housing of the emergency lights and their connections to the tunnel.	Component Supports	No deficient support conditions.	Loose anchorage or component housing connection hardware.	Missing Anchorage or component housing connection hardware which does not result in an unstable situation.	Failed anchorage or component connection hardware which results in an unstable situation.
Corrosion				None.	Freckled Rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.	
Component Housing or Enclosure				No Damages	Single Crack	Multiple Cracks	Holes are present	
3.6 Fire/Life Safety/Security Systems	10650	Fire Detection System	These systems consist of control panels, initiating devices (heat and smoke detectors, pull-stations, etc.), notification appliances (strobes, horns, etc.), wiring, conduit, and cable used to detect a fire in the tunnel.	System Condition	Good Condition - No notable distress.	Fair condition – isolated breakdowns or deterioration.	Poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.	Condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.
				Detection Sensor Operations (heat or smoke detectors)	All detector sensors are operational.		Detection sensors are not operational in one zone.	Detection sensors are not operational in multiple zones.
	10700	Fire Protection System	These systems consist of fire extinguishers, hose connections, storage tanks, fire hydrants, building sprinklers, pumping systems, piping, circulating pumps, and hose reels used as fire protection in the tunnel.	System Condition	Good Condition - No notable distress.	Fair condition – isolated breakdowns or deterioration.	Poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.	Condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

Section Name	Element Number	Element Name	Specification Requirement	Defect	Condition State 1	Condition State 2	Condition State 3	Condition State 4
	10750	Emergency Communication System	The components of the emergency communication system include the communication device itself (i.e. intercom, radios, cell-phone), receivers, wiring, exchange devices, etc.	System Condition	Good Condition - No notable distress.	Fair condition – isolated breakdowns or deterioration.	Poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.	Condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.
	10800	Tunnel Operations & Security System	These systems consist of the communication equipment (CCTV cameras, telephones, radios, etc.) used to provide communication within and from the tunnel.	System Condition	Good Condition - No notable distress.	Fair condition – isolated breakdowns or deterioration.	Poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.	Condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.
3.7 Signs	10850	Traffic Signs	These elements consist of the traffic sign and supports. Signs for pedestrians, variable message signs and lane signals are not covered under this element.	Component Supports	No deficient conditions.	Loose anchorage or component housing connection hardware.	Missing anchorage or component housing connection hardware which does not result in an unstable situation.	Failed Anchorage or component connection hardware which results in an unstable situation.
	10870	Egress Signs	This element consists of egress signs and their supports that are not related to the emergency lighting system.	Component Supports	No deficient conditions.	Loose anchorage or component housing connection hardware.	Missing anchorage or component housing connection hardware which does not result in an unstable situation.	Failed Anchorage or component connection hardware which results in an unstable situation.
	10910	Lane Signal	The components of the tunnel lane signal system include the lane signals themselves, their supports and the control system.	Component Supports	No deficient conditions.	Loose anchorage or component housing connection hardware.	Missing anchorage or component housing connection hardware which does not result in an unstable situation.	Failed Anchorage or component connection hardware which results in an unstable situation.
				Sign Operation	Sign is functional and operates when tested.	Sign operates with minor decrease in light output, flicker, or reduced display area.	Sign operates with significant decrease in light output, flicker, and/or reduced display area.	Sign is not operational.

APPENDIX C - Required Maintenance Standards							
Organization	Standard	Year	Standard Title	Application to Existing Facility	Required for Maintenance and Testing	Required Specifically for	Notes
NFPA	25	2017	Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems	Minimum requirements for periodic inspection, testing and maintenance of water based fire protection systems .	Yes	All water equipment on the front end of the water stand pipes in the tunnel and the fire hydrants on the Islands.	No Grandfather Clause for existing systems
NFPA	110	2022	Standard for Emergency and Standby Power Systems	1.3 Application - This document applies to new installations of ESPS, except the requirement of Chapter 8 shall apply to new and existing systems. Existing systems shall not be required to be modified to conform, except where the authority having jurisdiction determines that nonconformity presents a distinct hazard to life.	Yes	Ch 8. Routine Maintenance and Operational Testing for Generators	Also refers to Mfg. Recommendations
NFPA	502	2017	Standard for Road Tunnels, Bridges and Other Limited Highways	1.3.3 The portion of this standard that covers emergency procedures applies to both new and existing facilities. 1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.	Yes	Chapter 13. Emergency Reponse	Mainly referring to Emergency Response Plans, types of incident to consider, coordination of participating agencies with POCs and training, exercises, drills and critiques.
Guidance and Recommendations							
NFPA	70	2020	National Electric Code (NEC)	This document focuses on the installation and removal of electrical conductors, equipment, and raceways; signaling and communications conductors, equipment and raceways; and optical fiber cables. It does not pertain to maintenance and testing	No		
NFPA	70B	2019	Recommended Practice for Electrical Equipment Maintenance	Recommended practices applying to preventative maintenance for electrical, electronic, and communication systems and equipment and is not intended to duplicate or supersede instructions that manufacturers normally provide.	No		
NFPA	72	2019	National Fire Alarm and Signaling Code	1.4.1 Unless otherwise noted, it is not intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the document.	No	This will come into play for the fire detection and deluge systems in the new tunnel.	

NFPA	111	2022	Standard on Stored Electrical Energy Emergency and Standby Power Systems	1.3 Application - 1.3.1 This document shall apply to new installations of stored-energy emergency power supply systems (SEPSS). 1.3.2 Existing systems shall not be required to be modified to conform except where the authority having jurisdiction determines that non-conformity presents a distinct hazard to life.	No		
NETA	-	2019	Standard for Maintenance Testing Specifications	This standard contains no requirement language for new or existing facilities. Under General Scope of document, it states, "These specifications incorporate comprehensive field tests and inspections to assess the suitability for continued service, condition of maintenance, and reliability of electrical distribution equipment and systems. The purpose of these specifications is to assure tested electrical equipment and systems are operational, are within applicable standards and manufacturer's tolerances, and are suitable for continued service.	No		

Appendix D - District Preventative Maintenance (PM) Schedule

DEPT.	Service Frequency	Position Responsible	SNTI Element #	
D -	Daily	S-	Semiannually	5/500 ^a Every 5 years or 500 hours
W-	Weekly	A-	Annually	3/500 ^b Every 3 years or 500 hours
M-	Monthly	No's.	Indicate Hours	3/4 ^c Every 3 years or 4 hours
Q-	Quarterly	U	Prior to Use	
DEPT.				
Electrical/Mechanical	GENERATOR SYSTEM		10400	
	Fuel			
	Main supply tank level (Seasonal Stick Tank during heating)	M	HVAC Mechanic	
	Day Tank level	D	Maintainer	
	Fuel Pump (3rd floor) (Seasonal during heating)	M	Maintainer	
	Day tank float switch	D	Maintainer	
	Supply or transfer pump operation	D	Maintainer	
	Strainer, filter, dirt leg or combination	Q	HVAC Mechanic	
	Water in system	W	Tunnel Mechanic	
	Flexible hose and connectors	A	Tunnel Mechanic	
	Tank vents and overflow piping unobstructed	A	HVAC Mechanic/Tunnel Mechanic	
	Piping	A	HVAC Mechanic/Tunnel Mechanic	
	Lubrication System			
	Oil level	M	Tunnel Mechanic/Electrician	
	Oil Change	50 or A	Tunnel Mechanic	
	Oil Filter(s) (Dates written on Filter)	50 or A	Tunnel Mechanic	
	Cooling System			
	Level	A	Tunnel Mechanic	
	Antifreeze protection level	A	Tunnel Mechanic	
	Antifreeze	A	Tunnel Mechanic	
	Fan and alternator belt	A	Tunnel Mechanic	
	Water pump(s)	A	Tunnel Mechanic	
	Condition of flexible hoses and connection	A	Tunnel Mechanic	
	Jacket water heater	D	Maintainer	
	Inspect duct work, clean louvers	A	Tunnel Mechanic	
	Louver motors and controls	A	Tunnel Mechanic/Electrician	
	Exhaust System			
	Leakage	M	Monthly inspection when tested/Tunnel Electrician	
	Exhaust system hangers and supports	A	Tunnel Mechanic	
	Flexible exhaust section	A	Tunnel Mechanic	
	Battery System			
	Electrolyte level	W	Maintainer	
	Terminals clean and tight	A	Annual/Electrician	
	Remove corrosion, case exterior clean and dry	A	Annual/Electrician	
	Specific gravity or state of charge	W	Maintainer	
	Charger and charge rate	D	Maintainer	
	Electrical System			
	General Inspection	M	Electrician	
	Tighten control and power wiring connections	A	Electrician	
	Wire chafing where subject to movement	A	Electrician	
	Operation of safeties and alarms (constant SCADA)	S	Continuously Monitored via SCADA/ by Operator when running	

Appendix D - District Preventative Maintenance (PM) Schedule

Prime Mover		
General Inspection	M	Maintainer
Service air cleaner	A	Tunnel Mechanic
EPS at minimum of 30% nameplate rating		Use all current load available. Run 30 min at Operating Temps.

Generator		
General condition of EPSS, any unusual condition of vibration, leakage, noise, temperature, or deterioration	M	Monthly when testing
Service room or housing	D	Maintainer
Restore system to automatic operation condition	N/A	System remain in Auto, Alarms when it is not

Electrical/Mechanical	VENTILATION SYSTEM	10200
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Fans		
Bearings	W	Maintainer
Listen for pitch	W	Maintainer
Oil Level (site glass)	W	Maintainer
Test run on all speeds	A	Electrician
Fans Motors		
Bearings	W	Maintainer
Chain Casing	W	Maintainer
Grease Electric Motor	S	Tunnel Mechanic
Motor Control Cabinets (replaced in 2022)		
Clean inside of MCCs	A	Electrician
Test during semi annual Fan Testing	A	Electrician
Damper Doors		
Damper Door Motors	W	Maintainer
Damper Door Chains	W	Maintainer
Grease Damper Motor	S	Tunnel Mechanic
Grease all Damper Door Chains and Gears	A	Tunnel Mechanic
CO Detectors (constantly monitored at Control Room)		
Replace Air Filters	A	Electricians

Electrical/Mechanical Shops/Services	DRAINAGE and PUMP SYSTEM	10300
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Portal Drains	D/W	Maintainers/Mechanic
Gutters (visual from roadway)	Q	Shops and Services
Pumps (Operational)		
Alarm functionality (pump running alarm)	W	Tunnel Mechanic
Packing (check for leaking, repack as needed)	D	Maintainer
Gate Valves in Pump Room (Exercise)	A	Tunnel Mechanic
Hydropneumatic Tank		

Appendix D - District Preventative Maintenance (PM) Schedule

Water Level (site glass/SCADA screen)	D	Maintainer/Operator
Pressure Gages for Domestic System (SCADA)	D/W	Operator/Mechanic
Portal End Strainers (cleaned during tunnel scrub)	Q	Shops and Sevices
LPPS sumps and strainers (check functionaility, clean out)	M	Tunnel Mechanic
Pump Out LPPS Sumps and Scrub (last done Spring 2024)	3 yr	Tunnel Mechanic

Electrical/Mechanical	ELECTRICAL DISTRIBUTION SYSTEM	10500
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South Substation		
Incoming Feeders, ATS, Transformers, Insulators		
Air Filters	A	Electrician
Filter Press/ Test Transformer Oil (last tested summer/fall 2023)	5 yr	Outside Services
Conveyance System		
Cable Tray, Pull Boxes, Hand Holes, Conduit, etc. (visual/hands on)	A	MEP/Electrician
Switchgear (Double Ended 13.8kV to 600V)		
13.8 Voltage Readings (monitored by SCADA)	D	Maintainer/Tunnel Operator
600 V Transformers (loud,hot to touch)	D	Maintainer
Clean Switchgear Cabinets	A	Electrician
Replace Air Filters	A	Electrician
Service/Test Medium Voltage (once all breakers are recoditioned)	5 yr	Outside Services

Electrical/Mechanical	EMERGENCY DISTRIBUTION SYSTEM	10550
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ATS (when generator is run)	M	Tunnel Electrician
UPS (when generator is run)	M	Tunnel Electrician
Essential Bus (when generator is run)	M	Tunnel Electrician
Transformer (when generator is run)	M	Tunnel Electrician

Electrical/Mechanical	Tunnel Lighting Systems	10600
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Fixtures (Visual/Hands On)	W/A	Electrician
Supports (Visual/Hands On)	W/A	Electrician
Housing (Visual/Hands On)	W/A	Electrician
Lenses (Visual/Hands On)	W/A	Electrician
Lighting Control Cabinet	D	Maintainer
Tunnel Lighting Transformers (hot to touch/loud)	D	Maintainer

Appendix D - District Preventative Maintenance (PM) Schedule

Junction Boxes	A	Electrician
Wiring/ Conduit	A	Electrician
Portal Sensors	A	Electrician

Electrical/Mechanical	Emergency Lighting System	10620
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Emergency Light System utilizes approximately every 7th fixture in the tunnel Lighting System. The checks for Tunnel Lighting Systems will also cover Emergency Lighting Systems.

Electrical/Mechanical	Fire Protection System	10700
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Air Compressor (bleed off)	D	Maintainer
Air Compressor Oil (clarity, change if needed)	W	Tunnel Mechanic
Grease Motor	A	Tunnel Mechanic
Booster Pumps (Visual/Hands On)	D/W	Maintainer/Tunnel Mechanic
Control Gate Valves (exercise and grease)	A	Tunnel Mechanic
Hydropneumatic Tank	D/W	Maintainer/Tunnel Mechanic
water level (Site Glass/SCADA)	D	Maintainer/Tunnel Operator via SCADA
Standpipe Valves in Lower Air Duct (Exercised & Greased)	A	Tunnel Mechanic
Standpipe Valves in Tunnel (Exercised)	A	Tunnel Mechanic

Management	Emergency Communications Systems	10750
Information Systems	Tunnel Operations and Security	10800

CBBT Radio System	D	Multiple Daily Users Report Outage
Control Room Receivers and Mics	D	Multiple Daily Users Report Outage
Vehicle Radio Checks (CBBT Radio System)	D	Multiple Daily Users Report Outage
Handheld Units (Cbbt Radio System - E/Cs & Maintenance)	D	Multiple Daily Users Report Outage
Tunnel Antennas (drive through/upper plenum walk through)	D/A	MIS Field Tech
Off Hook Indicator	A	System Test/Report Run/MIS Field Tech follow up
Phone Jacks	A	System Test/Report Run/MIS Field Tech follow up
Phone Set	A	System Test/Report Run/MIS Field Tech follow up
System Performance	A	System Test/Report Run/MIS Field Tech follow up
Records	A	File of system test saved and sent to Director for file
Telephones (Emergency Phone Boxes)	S	Program Reports to MIS
Telephone (Operators Desk Phone)	D	Daily Users Report Outage

Appendix D - District Preventative Maintenance (PM) Schedule

Camera System		
Cameras	D	MIS
Network Video Recorders	D	MIS
Pelco Video Export	D	MIS

Management Informatrion Systems	Lane Signals		10910
	X's & O's in Open Approaches (visual/hands on)	A	MIS Field Techs
	Housings and Support Connections to mast arms (visual/hands on)	A	MIS Field Techs

Line Item	SNTI Element	Component	Item Name, Description or Location	Preventative Maintenance and/or Repair Performed	Date of Maintenance MM/DD/YYYY
1	10200 Ventilation System	Damper BSB1, BSB2 and BSB3, BSE1, BSE 2, BSE3	Service Damper Door, Chains, Motors, Drive Rods and Bearings, by Mechanics		
2	10200 Ventilation System	Damper BNB1, BNB2, BNB3, BNE1, BNE 2, BNE 3	Service Damper Door, Chains, Motors, Drive Rods and Bearings, by Mechanics		
3	10200 Ventilation System	CO Monitor	North Exhaust Duct, South Exhaust Duct		

Line Item	SNTI Element	Component	Item Name, Description or Location	Preventative Maintenance and/or Repair Performed	Date of Maintenance MM/DD/YYYY
4	10201 Fans	Fan BSB 1, BSB2, BSB3, BSE 1, BSE 2, BSE 3	Fan Motor, Motor Controller, MC E-Stop		
5	10201 Fans	Fan BSB 1, BSB2, BSB3, BSE 1, BSE 2, BSE 3	Fan Shaft, Bearing Pedestals Bearings, Drive Chains, Fan Housing, Fan Wheel		

Drainage and Pumps - Chesapeake Tunnel

Line Item	SNTI Element	Locaion	Item Name, Description or Location	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY

Emergency Generators - Chesapeake Tunnel

Line Item	SNTI Element	Component	Item Name, Description or Location	Output Voltage Acceptable (Y/N)	Thermal Reading °F	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY

Power Distribution - Chesapeake Tunnel

Line Item	SNTI Element	Component/ Label	Item Name, Description or Location	Last Serviced DD/MM/YY	Service Due DD/MM/YY	Temp (F)	Volts	Current	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY				
NORTH VENTILATION BUILDING #4 - CHESAPEAKE TUNNEL														
1	10500 Electrical Distribution System	MB FDR NB23	Medium Voltage Switchgear											
2		FB SB14	Medium Voltage Switchgear											
3		FB XFMR #2	Medium Voltage Switchgear											
4	10500 Electrical Distribution System	TIE BREAKER	Medium Voltage Switchgear											
5		MB FDR NB13	Medium Voltage Switchgear											
6		FB NB14	Medium Voltage Switchgear											
7		FB XFMR #1	Medium Voltage Switchgear											
8		TIE BREAKER	Medium Voltage Switchgear											
9	10500 Electrical Distribution System	LVSG Enclosure	600 V Switchboard											
10	10500 Electrical Distribution System	Trans #1	1000KVA Transformer #1											
11		Trans #2	1000KVA Transformer #2											
12	10500 Electrical Distribution System	House Bus PB 1	Distribution Panel											
13		House Bus PB 2	Distribution Panel											
14		Essential Service PB	Distribution Panel											
15		Emergency Systems	Diesel Generator Switchboard											
16		HT1	House Transformer #1 - 150KVA 3PH 60HZ											
17		HT2	House Transformer #2 - 150KVA 3PH 60HZ											
18		Outlets/ Receptacles	Control Room/Bathroom No. 1/Locker Room No. 1											
19	10500 Electrical Distribution System	Outlets/ Receptacles	Kitchen/Bathroom No. 2/Locker Room No. 2											
20		Raceways/ Overhead Wiring	General Overhead Raceways and Wiring Chases within Electrical Floor											
21	10500 Electrical Distribution System	Disconnect Switches	Main Power Transformer											
SOUTH VENTILATION BUILDING #3 - CHESAPEAKE TUNNEL														
22	10500 Electrical Distribution System	MB FDR NB12	Medium Voltage Switchgear											
23		FB NB23	Medium Voltage Switchgear											
24		FB XFMR #2	Medium Voltage Switchgear											
25	10500 Electrical Distribution System	MB M1 FDR NB22	Medium Voltage Switchgear											
26		MB M1 FDR NB12	Medium Voltage Switchgear											
27		FB NB13	Medium Voltage Switchgear											
28		FB XFMR #1	Medium Voltage Switchgear											

Power Distribution - Chesapeake Tunnel

Line Item	SNTI Element	Component/ Label	Item Name, Description or Location	Last Serviced DD/MM/YY	Service Due DD/MM/YY	Temp (F)	Volts	Current	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY				
29		MB M2 FDR SB12	Medium Voltage Switchgear											
30	10500 Electrical Distribution System	LVSG Enclosure	600 V Switchboard											
31	10500 Electrical Distribution System	Trans #1	1000KVA Transformer #1											
32		Trans #2	1000KVA Transformer #2											
33	10500 Electrical Distribution System	House Bus PB 1	Distribution Panel											
34		House Bus PB 2	Distribution Panel											
35		Essential Service PB	Distribution Panel											
36		Emergency Systems	Diesel Generator Switchboard											
37		HT1	House Transformer #1 - 150KVA 3PH 60HZ											
38		HT2	House Transformer #2 - 150KVA 3PH 60HZ											
39	10500 Electrical Distribution System	Outlets/ Receptacles	Control Room/Bathroom No. 1/Locker Room No. 1											
40		Outlets/ Receptacles	Kitchen/Bathroom No. 2/Locker Room No. 2											
41	10500 Electrical Distribution System	Damper BSE3	General Overhead Raceways and Wiring Chases within Electrical Floor											
42	10500 Electrical Distribution System	Disconnect Switches	Main Power Transformer											

Tunnel Lighting - Chesapeake Tunnel

Line Item	SNTI Element	Component	Item Name, Description or Location	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY
1	10600 Tunnel Lighting System	Lights	LED		
2					
3	10600 Tunnel Lighting System	Lenses	Light Fixture Cover/Lenses		
4	10600 Tunnel Lighting System	Conduit	Conduits connecting Fixtures		
5	10600 Tunnel Lighting System	Wireways	Lighting wireways powering fixtures		
6	10600 Tunnel Lighting System	PLC	Programmable Logic Controllers for Tunnel Lighting Sensors		
7					
8	10600 Tunnel Lighting System	Luminance Meter	Lumiance Meter Located near the top of the open approach directed at the portal opening		
9	10600 Tunnel Lighting System	LDP3-1	Lighting Distribution Panel - Substation 3 (Chesapeake Tunnel)		
10					
11		LDP3-2	Lighting Distribution Panel - Substation 3 (Chesapeake Tunnel)		
12					
13		LDP3-3	Lighting Distribution Panel - Substation 3 (Chesapeake Tunnel)		
14					
15		LDP3-4	Lighting Distribution Panel - Substation 3 (Chesapeake Tunnel)		
16					

Tunnel Lighting - Chesapeake Tunnel

Line Item	SNTI Element	Component	Item Name, Description or Location	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY
17	10600 Tunnel Lighting System	LDP4-1	Lighting Distribution Panel - Substation 3 (Chesapeake Tunnel)		
18					
19		LDP4-2	Lighting Distribution Panel - Substation 3 (Chesapeake Tunnel)		
20					
21		LDP4-3	Lighting Distribution Panel - Substation 3 (Chesapeake Tunnel)		
22					
23		LDP4-4	Lighting Distribution Panel - Substation 3 (Chesapeake Tunnel)		
24					
25	10600 Tunnel Lighting System	CBW-1	112.5KVA Dry Type Transformer for LDP1 (Thimble Shoals Tunnel) - Substation 3		
26					
27		CBW-2	112.5KVA Dry Type Transformer for LDP2 (Chesapeake Tunnel) - Substation 3		
28					
29		CBE-3	112.5KVA Dry Type Transformer for LDP3 (Thimble Shoals Tunnel) - Substation 3		
30					
31		CBE-4	150KVA Dry Type Transformer for LDP4 (Chesapeake Tunnel) - Substation 3		
32					

Tunnel Lighting - Chesapeake Tunnel

Line Item	SNTI Element	Component	Item Name, Description or Location	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY
33	10600 Tunnel Lighting System	CBW-1	112.5KVA Dry Type Transformer for LDP1 (Thimble Shoals Tunnel) - Substation 4		
34					
35		CBW-2	112.5KVA Dry Type Transformer for LDP2 (Chesapeake Tunnel) - Substation 4		
36					
37		CBE-3	112.5KVA Dry Type Transformer for LDP3 (Chesapeake Tunnel) - Substation 4		
38					
39		CBE-4	150KVA Dry Type Transformer for LDP4 (Chesapeake Tunnel) - Substation 4		
40					
41	10601 Tunnel Lighting Fixture	Housing	Lighting Fixture Housing		
42	10601 Tunnel Lighting Fixture	Connections	Connection to the Tunnel Lining		

Fire and Life Safety - Chesapeake Tunnel

Line Item	SNTI Element	Component	Item Name, Description or Location	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY
1	10700 Fire Protection System	Hose Valve	470+05		
2			471+54		
3			473+00		
4			474+50		
5			475+93		
6			477+39		
7			478+85		
8			480+31		
9	10700 Fire Protection System	Hose Valve	481+77		
10			483+24		
11			484+70		
12			486+16		
13			487+62		
14			489+08		
15			490+55		
16			492+01		

Fire and Life Safety - Chesapeake Tunnel

Line Item	SNTI Element	Component	Item Name, Description or Location	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY
17			493+47		
18			494+94		
19			496+40		
20	10700 Fire Protection System	Hose Valve	497+86		
21			499+32		
22			500+79		
23			502+25		
24			503+72		
25			505+18		
26			506+63		
27			508+10		
28			509+43		
29			510+76		
30			512+23		
31	10700 Fire Protection System	Hose Valve	513+68		
32			515+15		

Fire and Life Safety - Chesapeake Tunnel

Line Item	SNTI Element	Component	Item Name, Description or Location	Preventative Maintenance and/or Repair Performed	Date Inspected MM/DD/YY
33			516+61		
34			518+07		
35			519+53		
36			521+00		
37			522+41		
38					
39					
40	10700 Fire Protection System	Tunnel Niche Fire Extiguisher	See Operations Inspection Sheets		
79	10800 Tunnel Operations and Security System	Door Access Security	VB 3 Exterior Doors		
80			3 Island Portal - Sidewalk Side		
81			3 Island Portal - Side Opp. Sidewalk		
82			VB 4 Exterior Doors		
83			4 Island Portal - Sidewalk Side		
84			4 Island Portal - Side Opp. Sidewalk		
85					

APPENDIX H

CBBT NTIS Preventative Maintenance Schedule

Appendix H - CBBT NTIS Preventive Maintenance Schedule

D -	Daily	S-	Semiannually	5/500 ^a	Every 5 years or 500 hours
W-	Weekly	A-	Annually	3/500 ^b	Every 3 years or 500 hours
M-	Monthly	No's.	Indicate Hours	3/4 ^c	Every 3 years or 4 hours
Q-	Quarterly	U	Prior to Use		

DEPT.		Service Frequency	Position Responsible	SNTI Element #
Electrical/Mechanical	GENERATOR SYSTEM			10400

Fuel			
Main supply tank level (Seasonal Stick Tank during heating)	M		HVAC Mechanic
Day Tank level	D		Maintainer
Fuel Pump (3rd floor) (Seasonal during heating)	M		Maintainer
Day tank float switch	D		Maintainer
Supply or transfer pump operation	D		Maintainer
Strainer, filter, dirt leg or combination	Q		HVAC Mechanic
Water in system	W		Tunnel Mechanic
Flexible hose and connectors	A		Tunnel Mechanic
Tank vents and overflow piping unobstructed	A		HVAC Mechanic/Tunnel Mechanic
Piping	A		HVAC Mechanic/Tunnel Mechanic

Lubrication System			
Oil level	M		Tunnel Mechanic/Electrician
Oil Change	50 or A		Tunnel Mechanic
Oil Filter(s) (Dates written on Filter)	50 or A		Tunnel Mechanic

Cooling System			
Level	A		Tunnel Mechanic
Antifreeze protection level	A		Tunnel Mechanic
Antifreeze	A		Tunnel Mechanic
Fan and alternator belt	A		Tunnel Mechanic
Water pump(s)	A		Tunnel Mechanic
Condition of flexible hoses and connection	A		Tunnel Mechanic
Jacket water heater	D		Maintainer
Inspect duct work, clean louvers	A		Tunnel Mechanic
Louver motors and controls	A		Tunnel Mechanic/Electrician

Exhaust System			
Leakage	M		Monthly inspection when tested/Tunnel Electrician
Exhaust system hangers and supports	A		Tunnel Mechanic
Flexible exhaust section	A		Tunnel Mechanic

Battery System	
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Electrolyte level	W	Maintainer
Terminals clean and tight	A	Annual/Electrician
Remove corrosion, case exterior clean and dry	A	Annual/Electrician
Specific gravity or state of charge	W	Maintainer
Charger and charge rate	D	Maintainer

Electrical System

General Inspection	M	Electrician
Tighten control and power wiring connections	A	Electrician
Wire chafing where subject to movement	A	Electrician
Operation of safeties and alarms (constant SCADA)	S	Continuously Monitored via SCADA/ by Operator when running

Prime Mover

General Inspection	M	Maintainer
Service air cleaner	A	Tunnel Mechanic
EPS at minimum of 30% nameplate rating		Use all current load available. Run 30 min at Operating Temps.

Generator

General condition of EPSS, any unusual condition of vibration, leakage, noise, temperature, or deterioration	M	Monthly when testing
Service room or housing	D	Maintainer
Restore system to automatic operation condition	N/A	System remain in Auto, Alarms when it is not

Electrical/Mechanical	VENTILATION SYSTEM	10200
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Fans		
Bearings	W	Maintainer
Listen for pitch	W	Maintainer
Oil Level (site glass)	W	Maintainer
Test run on all speeds	A	Electrician

Fans Motors		
Bearings	W	Maintainer
Chain Casing	W	Maintainer
Grease Electric Motor	S	Tunnel Mechanic

Motor Control Cabinets (replaced in 2022)		
Clean inside of MCCs	A	Electrician
Test during semi annual Fan Testing	A	Electrician

Damper Doors		
Damper Door Motors	W	Maintainer
Damper Door Chains	W	Maintainer
Grease Damper Motor	S	Tunnel Mechanic
Grease all Damper Door Chains and Gears	A	Tunnel Mechanic

CO Detectors (constantly monitored at Control Room)		Tunnel Operator
Replace Air Filters	A	Electricians

Electrical/Mechanical Shops/Services	DRAINAGE and PUMP SYSTEM	10300
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Portal Drains	D/W	Maintainers/Mechanic
Gutters (visual from roadway)	Q	Shops and Services
Pumps (Operational)	W	Tunnel Mechanic
Alarm functionality (pump running alarm)	W	Tunnel Mechanic
Packing (check for leaking, repack as needed)	D	Maintainer
Gate Valves in Pump Room (Exercise)	A	Tunnel Mechanic
Hydropneumatic Tank		
Water Level (site glass/SCADA screen)	D	Maintainer/Operator
Pressure Gages for Domestic System (SCADA)	D/W	Operator/Mechanic
Portal End Strainers (cleaned during tunnel scrub)	Q	Shops and Services
LPPS sumps and strainers (check functionality, clean out)	M	Tunnel Mechanic
Pump Out LPPS Sumps and Scrub (last done Spring 2024)	3 yr	Tunnel Mechanic

Electrical/Mechanical	ELECTRICAL DISTRIBUTION SYSTEM	10500
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South Substation		
Incoming Feeders, ATS, Transformers, Insulators		
Air Filters	A	Electrician
Filter Press/ Test Transformer Oil (last tested summer/fall 2023)	5 yr	Outside Services
Conveyance System		
Cable Tray, Pull Boxes, Hand Holes, Conduit, etc. (visual/hands on)	A	MEP/Electrician
Switchgear (Double Ended 13.8KvA to 600V)		
13.8 Voltage Readings (monitored by SCADA)	D	Maintainer/Tunnel Operator
600 V Transformers (loud, hot to touch)	D	Maintainer
Clean Switchgear Cabinets	A	Electrician
Replace Air Filters	A	Electrician

Service/Test Medium Voltage (once all breakers are recoditioned)	5 yr	Outside Services
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Electrical/Mechanical	EMERGENCY DISTRIBUTION SYSTEM	10550
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ATS (when generator is run)	M	Tunnel Electrician
UPS (when generator is run)	M	Tunnel Electrician
Essential Bus (when generator is run)	M	Tunnel Electrician
Transformer (when generator is run)	M	Tunnel Electrician

Electrical/Mechanical	Tunnel Lighting Systems	10600
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Fixtures (Visual/Hands On)	W/A	Electrician
Supports (Visual/Hands On)	W/A	Electrician
Housing (Visual/Hands On)	W/A	Electrician
Lenses (Visual/Hands On)	W/A	Electrician
Lighting Control Cabinet	D	Maintainer
Tunnel Lighting Transformers (hot to touch/loud)	D	Maintainer
Junction Boxes	A	Electrician
Wiring/ Conduit	A	Electrician
Portal Sensors	A	Electrician

Electrical/Mechanical	Emergency Lighting System	10620
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Emergency Light System utilizes approximately every 7th fixture in the tunnel Lighting System. The checks for Tunnel Lighting Systems will also cover Emergency Lighting Systems.

Electrical/Mechanical	Fire Protection System	10700
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Air Compressor (bleed off)	D	Maintainer
Air Compressor Oil (clarity, change if needed)	W	Tunnel Mechanic
Grease Motor	A	Tunnel Mechanic
Booster Pumps (Visual/Hands On)	D/W	Maintainer/Tunnel Mechanic
Control Gate Valves (exercise and grease)	A	Tunnel Mechanic
Hydropneumatic Tank	D/W	Maintainer/Tunnel Mechanic
water level (Site Glass/SCADA)	D	Maintainer/Tunnel Operator via SCADA
Standpipe Valves in Lower Air Duct (Exercised & Greased)	A	Tunnel Mechanic
Standpipe Valves in Tunnel (Exercised)	A	Tunnel Mechanic

Management Informatrion Systems	Emergency Communications Systems	10750
	Tunnel Operations and Security	10800

CBBT Radio System	D	Muliple Daily Users Report Outage
Control Room Receivers and Mics	D	Muliple Daily Users Report Outage
Vehicle Radio Checks (CBBT Radio System)	D	Muliple Daily Users Report Outage
Handheld Units (Cbbt Radio System - E/Cs & Maintenance)	D	Muliple Daily Users Report Outage
Tunnel Antennas (drive through/upper plenum walk through)	D/A	MIS Field Tech
Off Hook Indicator	A	System Test/Report Run/MIS Field Tech follow up
Phone Jacks	A	System Test/Report Run/MIS Field Tech follow up
Phone Set	A	System Test/Report Run/MIS Field Tech follow up
System Performance	A	System Test/Report Run/MIS Field Tech follow up
Records	A	File of system test saved and sent to Director for file

Telephones (Emergency Phone Boxes)	S	Program Reports to MIS
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Telephone (Operators Desk Phone)	D	Daily Users Report Outage
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Camera System		
Cameras	D	MIS
Network Video Recorders	D	MIS
Pelco Video Export	D	MIS

Management Informatrion Systems	Lane Signals	10910
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X's & O's in Open Approaches (visual/hands on)	A	MIS Field Techs
Housings and Support Connections to mast arms (visual/hands on)	A	MIS Field Techs

