HEAVY MOVABLE STRUCTURES, INC.

EIGHTH BIENNIAL SYMPOSIUM

NOVEMBER 8 – 10, 2000

Grosvenor Resort
Walt Disney World Village
Lake Buena Visa, Florida

"East Washington Avenue Bridge"

by Nicholas Altebrando, P.E.
Hardesty & Hanover, LLP

EAST WASHINGTON AVENUE BRIDGE
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BRIDGEPORT, CONNECTICUT
HARDESTY & HANOVER
FALL 2000

Bridgeport, Connecticut, 1916, the year the East Washington Avenue Bridge was built, is one of the country's most heavily industrialized and economically successful cities. From the mouth of the Pequonnock on the north shore of the Long Island Sound upriver 5 miles until the river makes a sudden unnavigable narrowing, the river is lined with foundries, mills and factories of all types. Also known for being the home of PT Barnum, the City of Bridgeport was doing very well. To cross the Pequonnock and keep both marine and vehicular transportation 4 movable bridges crossed the river, two Scherzer rolling lift type bascules and two underdeck Strauss patented bascule bridges. The City suffered from serious decline during the mid and later parts of the last century, and today, Bridgeport is a city experiencing a comeback from the departure of heavy industry from the northeast. The southerly most bridge was replaced in 1975 with a tower drive lift span designed by Hardesty & Hanover (H&H). The next bridge to the north is closed and being replaced by the City. The northerly most bridge has been removed completely within the last several years. The last of the four movable crossing is East Washington Avenue Bridge and this paper will discuss the bridges rehabilitation and some of the unusual features of the Strauss patent.

As the city declined and industries left, first the city stopped manning the span. There was no need for any ships to move up river any longer. Then, as regular maintenance became less and less frequent, the bridge deck, particularly the movable span grating, became unsafe for vehicular traffic as well. At some point in the 1980's the city closed the bridge to all but pedestrians. This was the condition which H&H found the bridge when we first started our project with the State of Connecticut, Department of Transportation (ConnDOT), in 1994. At a public hearing held in late 1995, it was apparent that the loss of this crossing, combined the loss of the adjacent upriver bridge crossing, was a significant burden to an already stressed community. The department made the decision to replace or rehabilitate the crossing as soon as possible. Both the design and the construction were to be on a fast track schedule. This paper will discuss the original Strauss Bascule Bridge and the process through construction.

We should acknowledge the enormous support we received from the Connecticut Department of Transportation staff from the initial scoping of the project through the end of construction. In addition, H&H was assisted by United International Corporation on the project design as well as the construction support. Lastly, Cianbro Construction Corporation Pittsfield, Maine, did an extraordinary job both in terms of project support, and actual construction on this very complex fast track project.

The East Washington Avenue Bridge was constructed in 1916 and the movable span was a patented Strauss Underdeck Articulated Counterweight Bascule Bridge. While not as famous or as visibly impressive as the Strauss Overhead Counterweighted Heel Trunnion type bascule, this patented structure by the famous bridge engineer Joseph B. Strauss was very common in the first third of the last century. This bridge, one of the earliest of these designs, was built by the

City, with the Strauss portions covering the bascule span superstructure, the machinery and the electrical portions of the bridge. The substructure, the operator's house and the approach spans, in their entirety, were supplied by the City. This was the typical contract package for the patented designs common through the late 1800's into the early 1900's.

The original bridge as we noted above, was one of Strauss earlier patents using this design. The bridge was a single leaf span, 89'-8" from center of trunnion to end bearing on the rest pier. The bridge had two 55 '- 0" long simply supported approach spans and was a total of 226'-11" from backwall of bascule pier to backwall of the east abutment. The bridge is oriented almost exactly east-west. The roadway is 44 feet wide with 2′ - 10′ sidewalks. The movable span provides an unrestricted horizontal clear channel of 67 feet when the span is open. In the span closed position the original bridge supplied only 3'-6" vertical clear at mean high water. This required the span to open for almost all marine craft.

Due to the size of the span and the proximity of the water the bascule pier was of the closed pit type. The closed pier was claimed to be the deepest and largest of its kind when built. The pier was founded on timber piles directly on rock as were the two approach piers and the abutments. The mass and size of the substructures were large by the standards of the time and this fact played into the decisions made during the project design.

H&H was selected by ConnDOT to provide engineering services for the rehabilitation or replacement of the bridge in 1993.The Department had decided that the structure needed an inspection and evaluation but was pretty much determined to replace the structure. As a result, we spent little time on the superstructure elements. The basis of our inspection was to check the substructure to see what could be retained. Our Report on the East Washington Avenue Bridge, delivered to the state in April 1994, studied replacement of the existing superstructure, more or less in-kind, as well as other options both retaining portions of the existing substructure as well as complete replacement. After ConnDOT review it was agreed that the entire superstructure would be replaced and the piers retained, however, more investigation was required on the bascule pier and other substructure units. This investigation was carried on in the late fall of 1994 and our supplemental report submitted in January 1995. The Department asked if we could deliver the final plans by the fall and we said it was possible and the project began. The design started in earnest in February 1995 and was completed in September 1995.

To meet the needs of the project it was decided that an in-kind replica of the bascule span superstructure would be required. The historic guidelines that were developed as part of the Memorandum of Understanding were that the bridge use modern construction methods and materials but replace the essential operational features in kind. Along with other architectural amenities and certain requests for relocating equipment to local museums, the design was considered a rehabilitation project by all reviewing agencies. The substructure units would be repaired and upgraded as required and the entire superstructure would be replaced. This met both SHPO and other permitting requirements necessary to move the design and construction forward.

The rehabilitation of the approach spans involved changing from simple spans to a two span continuous structure, keeping the fascia appearance essentially the same. This was done using welded floorbeams and rolled parallel stringers on the existing approach piers and east abutment. The narrow structural profile was easy to keep within. The finished structure had a concrete deck with a 2-1/2" thick bituminous concrete wearing surface, per ConnDOT requirements.

For the bascule span, the design was much more complicated. To start, we go back to the original Strauss patent and how the original design worked. The underdeck articulated counterweight bascule was a conventional simple or Chicago trunnion arrangement. That is, the trunnion shaft passed through the center of gravity (CG) of the moving mass of the entire span and was rigidly fixed to the bascule girder. Both ends of the trunnion shaft rotate in journal bearings supported on steel trunnion towers which carried the entire dead load and a portion of the live load of the span as well as wind loads with the span open and closed. The towers also supported the low speed end of the open gearing with the main pinion driving the rack attached to the bottom flange of the bascule girder. The forward leaf CG was determined in a straight forward method and typically fell close to half way out from the trunnion and slightly above the center of trunnion. The typical bascule span with a fixed counterweight has the rear CG in line with the forward CG. This location is typically at the approximate center of the mass of the counterweight, well below and behind the trunnion. The Strauss patent sought to move the rear CG closer making a more compact rear end. To accomplish this the counterweight was freed from the actual bascule girder and hung by a link arm off the rear of the girder. As long as there was room for the rear counterweight trunnion shaft and casting, the back portion of the girder could be made much shorter. By introducing this rear trunnion and link and allowing the counterweight to hand, the span could obtain more rotation with a smaller pier. What Strauss accomplished at East Washington Avenue was a bascule pier, probably 25% smaller than that with a fixed counterweight.

The advantage of the Strauss counterweight was obvious. In many locations, fixed counterweight bridges, which would have required expensive closed pit bascule piers, were replaced by articulated counterweights with open bascule piers. Closed pit piers were made significantly smaller, both in length and depth of the pit. The cost savings were immediately realized. However Strauss either overlooked or as a result of the fierce competition of the time from other movable bridge designer choose to disregard the friction lag in the counterweight linkage. By the early 1930's Strauss' underdeck counterweights were falling into the pit or water below the span. The linkages were failing at an alarming rate and by the around 1935 the calls for use of this type structure were over. A similar problem was developing with the Strauss overhead counterweight heel trunnion bascules which suffer from classic stress reversal fatigue failures of the counterweight truss. Through the course of inspecting, maintaining and rehabilitating many Strauss bascule bridges and Strauss copies, it is apparent that the earlier models were much more robust. The trunnion and linkage members of the East Washington Avenue Bridge were as large or larger than spans which were 20% heavier designed not even 10 years later. However, for whatever reason, the Strauss counterweight linkages were failing and the cause was clear. The linkage was too light to handle both the impact from starting and stopping the span as well as the friction induced bending when the span began to move. Strain gage readings at other bridges confirmed the high bending stresses on the link. Investigating failures by collecting data on the number of openings show fatigue values exceeded to alarming levels. When combined with slight misalignments during erection or poor fabrication the failures were almost a given. Cracks propagated from the outer corners of abrupt section changes in the linkage and quickly cracked the linkage in half.

When we accepted the fact we would be designing the first new underdeck articulated counterweight bascule in as long as 60 years addressing the counterweight linkage problems were our first concern. On the original bridge, the deck was timber with asphalt planks overtop as a wearing surface. In the 1950's the timber deck was removed along with the old trolley tracks and a 3 " deep steel grating was placed over the existing stringers. The Department wanted a closed deck to protect the steel beneath as well as provide better skid and friction resistance. The deck selected was a partially filled grating with a monolithic overfill. The material that the Department selected was a standard weight microsilica concrete. The weight of the new bridge was 2.35 million pounds. The weight of the existing bridge was 1.6 million pounds. This enormous weight difference had to be accommodated with the same pier and the bascule span geometry had to remain essentially unchanged.

There were two primary considerations which we placed on the counterweight trunnion and rear linkage. That was they had to be sized to accept whatever friction lag inducted bending would occur and they had to account for dead load deflection of the counterweight during erection. Each bearing had to carry approximately 900 kips vertical load plus impact. We initially checked whether a roller bearing could be used for the rear counterweight. With no live load on the rear trunnion, a roller bearing becomes ideal. A frictionless bearing would have eliminated any bending problem resulting from the starting and stopping time lag in a journal bearing. A spherical roller bearing would address our concerns about dead load deflections. The problem is that the overall size of a roller bearing is much larger than a journal bearing for any given load and none of the suppliers we contacted could fit a roller bearing in the tight confines available on the new bridge. We then looked into plain spherical bearings. At the time of design there were no domestic suppliers who could meet the load and space requirements. However, SKF, stated that without the use of friction reducing inserts, a plain bronze bearing could meet both size and load requirements on this bridge. We prohibited the use of inserts due to problems uncovered with these bearings at other movable bridges where the low frequency of operation is below the bearing's typical design criteria. To meet the requirements of the 'Buy-America' funding requirements of the Federal Highway Authority the state had to petition for approval for the use of this non-domestic bearing. That was accomplished simultaneous to the development of the design plans. H&H prepared a short report outlining the design criteria and design restrictions placed on the bearing size. We described the contact we had with the various domestic manufacturers and reasons for selecting the bearing. Within several weeks the state was given approval for the bearing.

To meet the weight requirements while keeping the original dimensions of the counterweight, we used solid steel plates within a steel shell box for the counterweight. The lower two thirds of the counterweight was made up of plate stock with a 2'-6" cap pour of standard weight non air-entrained concrete. The remaining space within the counterweight box was left empty to provide for balance adjustments. Four hatches were provided for access to the voids. Since all the weight of this counterweight is transferred through the rear trunnion, the need for vertical adjustment of the counterweight is unnecessary. Unlike fixed counterweights which require both horizontal and vertical adjustment pockets to insure that balance is maintained, the articulated underdeck bascule always has the counterweight CG act through the trunnion shaft.

While this feature simplifies the design of the counterweight box to some small degree, it makes the balance calculations and the location of the rear counterweight trunnion exceptionally critical. For that reason it is customary, and was defined in the special provisions, for the rear trunnion to be left rough bored until the final balance is accepted. Cianbro combined their shop drawing weight spreadsheet program with a balance program of their own to take actual shop weights and get actual balance calculations. The checking was straight forward knowing that these weights were as accurate as could be, down to the weld fillet and the washers. Once the submitted balance calculations were approved the final machining of the rear counterweight trunnion was completed. By that time the main trunnion was already installed.

Some additional comments are appropriate concerning the balance. The original Strauss bridges and many of the copies found throughout the country have very little room between the fixed and moving members. While this may sound obvious since all movable bridges work with small tolerances, on these type bridges the tolerances are very tight. In fact, it is not uncommon to see towers shaped by years of counterweight strikes and counterweight or stabilizer links worn. Again, while common on movable bridges as a whole, there is an order of magnitude difference in the clearances and the susceptibility of the clearances to be eliminated. On this bridge the location of the rear trunnion could not vary more than ½ inch from the design plans without the counterweight fouling the rear tower legs. Great care was taken during the design and small errors found during the contractors balance could not be overlooked on this structure. There were issues that arose on this bridge during the balance calculations but the need for care by all parties was clear from the design plans and the preconstruction meetings.

The East Washington Avenue Bridge bascule piers needed substantial modifications to accommodate the new bridge. First the old sump pit had to be reconstructed to accommodate a new larger capacity submersible pump. Since the bridge is so low to the waterline, and has flooded repeatedly in the past, the sump pump had to be large. The City preferred a submersible model and this was provided. The outlet pipe is still below the 100 year flood level but it is as high as possible and the front wall of the pier was reshaped to reduce the openings as much as possible. The rear wall of the pier was completely reconstructed to facilitate the new deck over counterweight span. The front wall and the forward base portion of the bascule pier was partially removed so that the new trunnion tower steel could fit and so that more room for access could be provided. The new front wall was also used to assist in the prevention of uplift forces from wind and machinery loads so that the new tower members were detailed to engage as much new concrete as possible. New bumper block concrete was added to the bottom of the front wall as well.

The trunnion tower was designed similar to the original bridge in that the entire weight of the bascule span is on the rear leg. The forward leg of the trunnion tower is primarily resisting uplift from wind as well as machinery loads. Typically on new pier construction, there will be details which insure that sufficient mass is engaged to resist the calculated uplift loads. For the rehabilitation we had to incorporate portions of the original anchorage to accomplish the same function. To do this the original forward tower leg was first analyzed to see what capacity it had.

After we were assured it could carry the new loads, the details required that the majority of the leg be cut and the tension transferred from new upper leg to existing lower leg. The details allowed for maximum field adjustment so that both the forward and rear legs of the trunnion towers could be made truly vertical. All diagonal members were shop assembled and then field erected. The trunnion towers support the deck over counterweight steel as well as support all machinery and all access platforms. There was a significant amount of ancillary steel framing into the trunnion towers, the trunnion cross girder and the front wall. As typical the trunnion tower outboard rear legs were braced directly to the pier walls.

One of the features of the articulated underdeck counterweight design are the stabilizer linkages. These are struts which frame between the counterweight and the trunnion tower. The purpose of the strut is to insure that the counterweight remains vertical in all positions of travel. The link bearings must form a parallelogram with the main and counterweight trunnion shafts as the span opens and closes. On the original design the stabilizer links were framed directly from the counterweight links to the trunnion tower rear leg. This detail was changed to move the links where there was more room. The location selected was the quarter point of the counterweight. The link framed in between the counterweight and trunnion cross girder. The link assembly on the girder was backed by some of the machinery framing which was connected directly into the front wall. Like the location of the counterweight trunnion, the final position of the rear bearing support could not be determined until the balance was completed and accepted.

The machinery for this bridge is only slightly less complex an installation than the original. The Strauss bridges were noted for their integrated support framing for the reduction gear sets. Typically, the original bridges had the motor drive a series of open gear reduction sets, which were framed in a combination with pier and trunnion tower steel. The original bridge had 5 sets of open reduction gears. These gears had various sets of combined pinion spur gears on common shafts supported on the same structural members with the gears themselves inaccessible for inspection and in some cases maintenance. The intent of the rehabilitation was to use enclosed reducers to the fullest extent possible. We were able to replace the open gear sets with one special vertical reducer and one open reduction gear set just in front of the main pinion and rack. This simplified the machinery installation greatly. Another aspect to the project which was special was that the motor and auxiliary motor were mounted with the motor brakes, directly to the reducer enclosure. Also, the span drive instrumentation package was installed directly off the reducer enclosure. This compact design made a much simpler installation on what is normally a very complicated machinery installation. Unlike the original bridge there were no large shafts installed with bearings upside down, no gears aligned without direct access and no collared shafts. The new design used spherical roller type bearings and floating shafts were used between the main reducer and the one set of open gearing. By using these bearings and flexible couplings more flexibility was possible for the installation.

The East Washington Avenue Bridge does have lock machinery even though it is a single leaf bascule. The lock machinery is basically used to insure that the bridge will not open and is an interlocking device in the system operation. The lock system is comprised of two independent drive units placed underneath the approach span sidewalks. The bascule leaf has the receiving socket located in the front floorbeam. Power and control circuitry to the locks as well as the gates is via submarine cables.

We have not discussed the structural aspects of the span to any degree. Basically the bridge was designed with similar framing as the original. The leaf floorsystem was a girder floorbeam stringer arrangement. Only one plane of lateral bracing was used on this bridge due to the problems with the bracing clearing the front wall of the closed pit bascule pier. The structural steel was all ASTM A709 Grade 50 and while we researched bolting and even riveting to meet the historic concerns it was agreed that the members would be fabricated using welding. The structure used rolled stringers with welded floorbeams and the bascule girders were also welded. The fascia appearance was detailed to look similar to the original bridge and to accomplish this brackets and an open bridge railing were used. In addition, on the approach spans, we used poles and luminaires which closely matched the old photographs found of the original bridge.

The bascule span has a closed deck and the selected deck was a half-filled steel grating with an overfill of 1 inch. The grating is a 5 inch deep RB type also fabricated from ASTM 709, Grade 50 steel. The main bars are perpendicular to the direction of traffic. The connection plate was welded to the main bearing bars which was then bolted to the stringers. This detail permitted the connections to be shop welded and then field installed by drilling through the plates into the blank stringer flange. There was no field welding permitted because this project was the Departments first attempt at metallizing as a steel protection system. The cost of field touch up was considered too high to permit wholesale field welding which is the typical method of grating installation. The protection system, in general, was very successful, and was followed by a third and final colored coat meeting the architectural requirements of the project.

One of the more interesting aspects of the project was the control house and pier modifications necessary to construct it. The original house was very small and could not contain all the required electrical equipment. The equipment could not be placed in the lower portion of the pier due to space restrictions and high water levels. The only place possible was the sidewalk level house. Old photographs of the original house, as it appeared after construction were used as a basis to supply the basic lines and shape of the reconstructed house. New concrete cantilever brackets were constructed on the north face of the pier and a new concrete floor was placed along the entire width of the pier. The house was made of steel framing with precast colorized concrete panels. The roof was slate, as the original was and the colors were selected which matched the original architecture. The new house has a control desk and open control area on the far east end with the electrical equipment located to the west. A small bathroom is also provided. Special panel coatings were used to protect against vandalism. The house also provides access to the lower portions of the pier and the fender. All areas are totally screened in to protect against trespassers.

The electrical system for the East Washington Avenue Bridge was developed in conjunction with the City who would take over operation and maintenance when the project was completed. The decision was made to use a hard wired relay control system for the bridge. The motor control was a primary thyristor (SCR) drive of the 100 HP wound rotor motor. The auxiliary motor was a 10 HP squirrel cage motor operated through reversing push button starters. A portable back up generator was supplied with receptacles on the bridge. The system was developed to be as simple as possible with simple back-up options to provide the necessary redundancy given the future service the bridge may see.

In general the fabrication and erection of the bridge went very well. There were some issues which came up which were unusual. The original trunnion towers were not positioned exactly where the plans and original as-built drawings showed. While not far off, only about 1 inch, the plans had to be modified due to the very tight clearances of all the moving parts, the pier walls and the span joints. The fast track nature of the construction required that the some of the concrete be placed prior to the final survey of the existing towers which resulted in some reworking of the joints. The approach piers were significantly different from the as-built shape on the original drawings and many changes to the pier were required in the field to meet the actual shape of the pier. This was discovered even after a thorough diving inspection during the design phase. In general the construction went very well. The bridge was open to vehicular traffic 10 months after the project was awarded and the bridge was operational complete 2 months after that.

The East Washington Avenue Bridge was a very complex project both in terms of technical challenges as well as limited time frames. The State, the Contractor and the consultant formed a very cohesive team which meet the problems as they came up. When all the participants are in direct communication, when problems are discussed openly and timely completion is the goal, the project moves and becomes successful. We list the following people for special consideration on this project:

ConnDoT

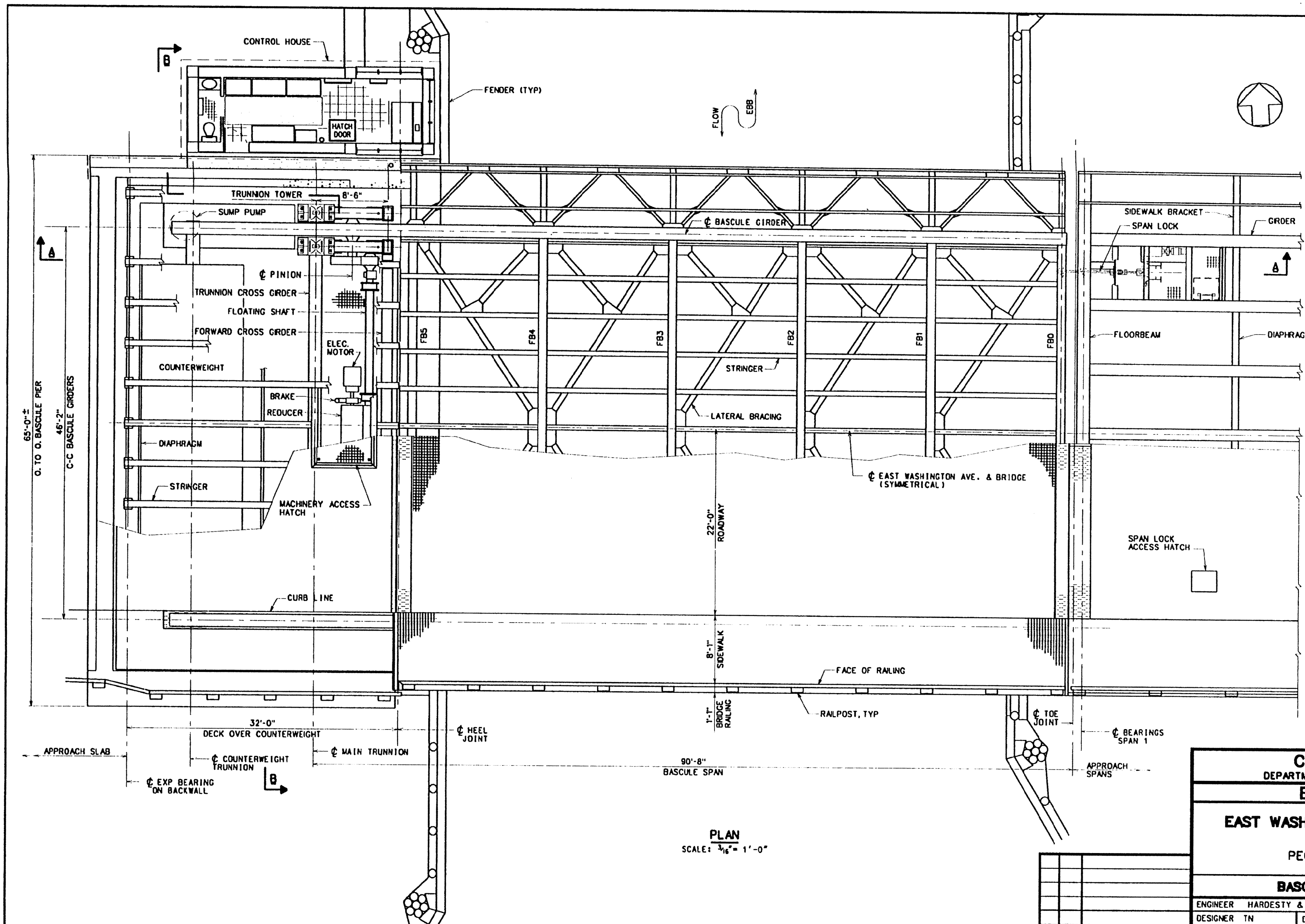
Mr. William R. Stark
Mr. Gary Abramowicz
Mr. Joseph DeMarco
Mr. Richard DeSantis
Mr. Keith Robinson

Cianbro

Mr. Ed Walsh
Mr. Brian Waston
Mr. Larry Doyan

Hardesty & Hanover, LLP

Mr. Richard W. Christie
Mr. Michael D. Hawkins



PLAN

SCALE: 3/16" = 1'-0"

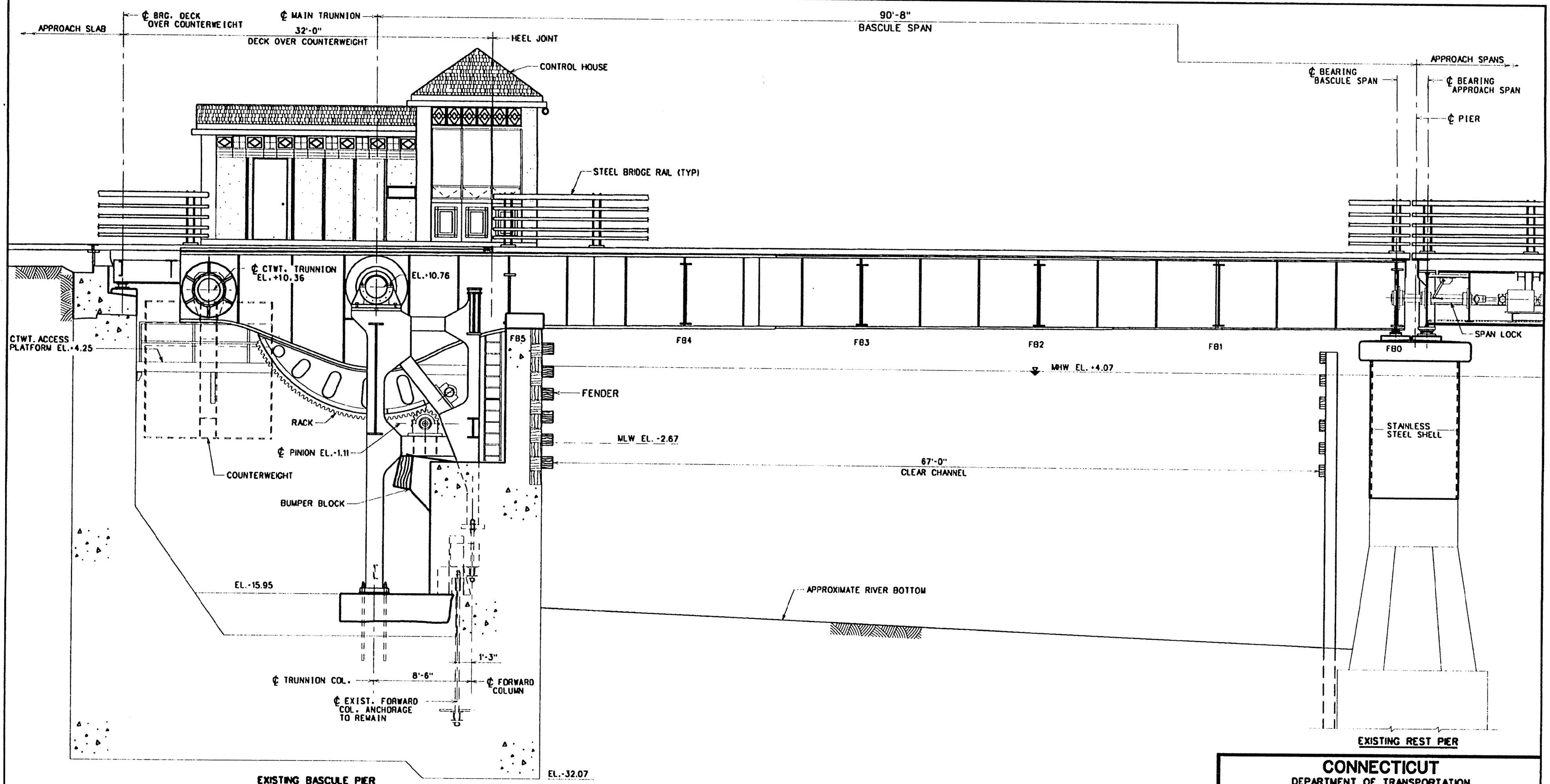
NO.	DATE	DESCRIPTION
		REVISIONS

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BRIDGEPORT

EAST WASHINGTON AVENUE BRIDGE
OVER THE
PEQUONNOCK RIVER

BASCULE SPAN - PLAN

ENGINEER HARDESTY & HANOVER, LLP		
DESIGNER TN	DRAFTER AES	CHECKER MDH
APPROVED		DATE SEPTEMBER 29, 1995
STRUCTURE NO. 15-212-1	BRIDGE LOG NO. 04252	STRUCTURE SHEET NO. S21 OF 82



SECTION A-A
SCALE: 1/4" = 1'-0"

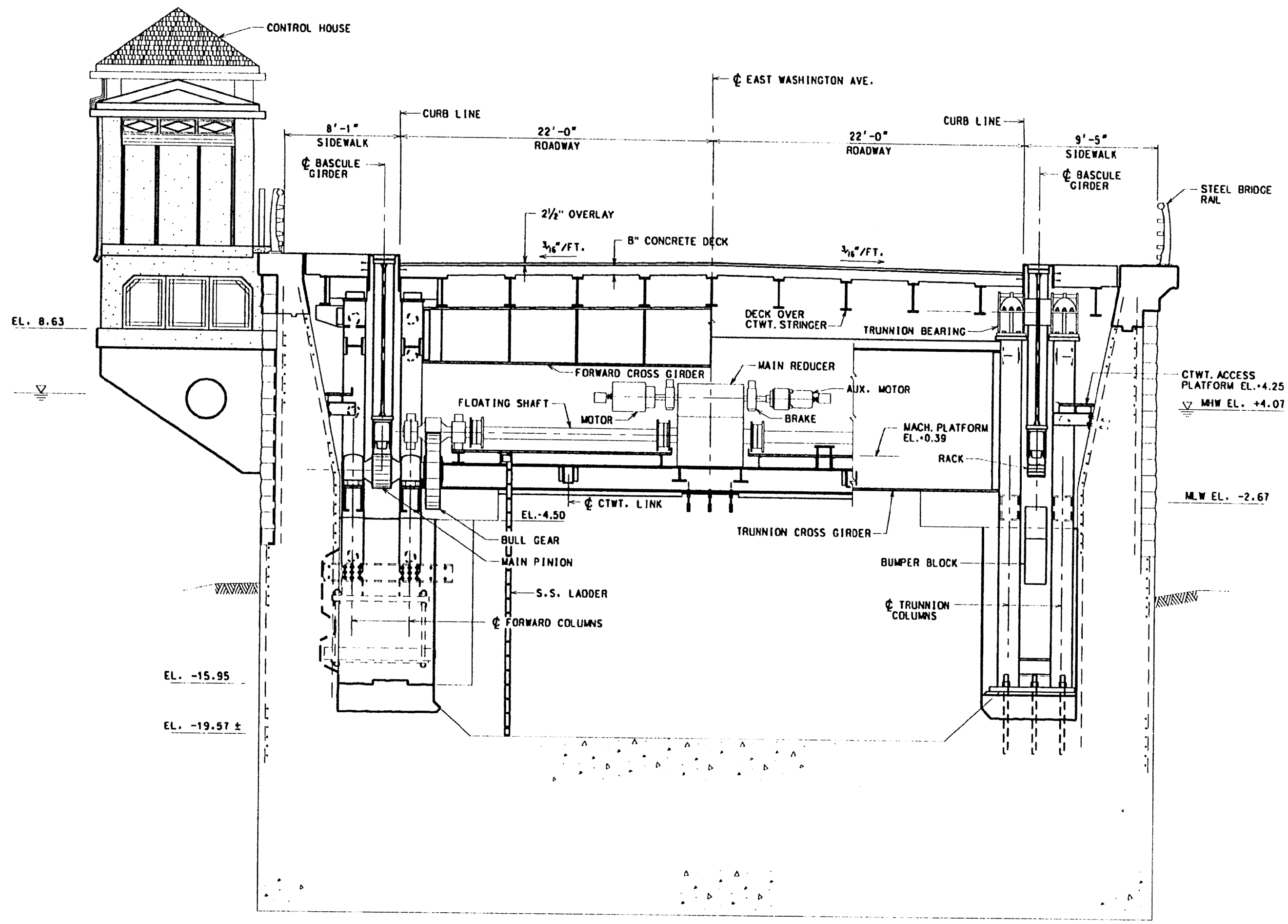
NO.	DATE	DESCRIPTION
REVISIONS		

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BRIDGEPORT

EAST WASHINGTON AVENUE BRIDGE
OVER THE
PEQUONNOCK RIVER

BASCULE SPAN - LONGITUDINAL SECTION

ENGINEER HARDESTY & HANOVER, LLP			
DESIGNER TN	DRAFTER AES		CHECKER MDH
APPROVED			DATE SEPTEMBER 29, 1995
STRUCTURE NO. 15-212-1		BRIDGE LOG NO. 04252	STRUCTURE SHEET NO. S22 of 62



SECTION AT FORWARD CROSS GIRDER

SECTION AT TRUNNION CROSS GIRDER

SECTION B-B
SCALE: 1/4" = 1'-0"

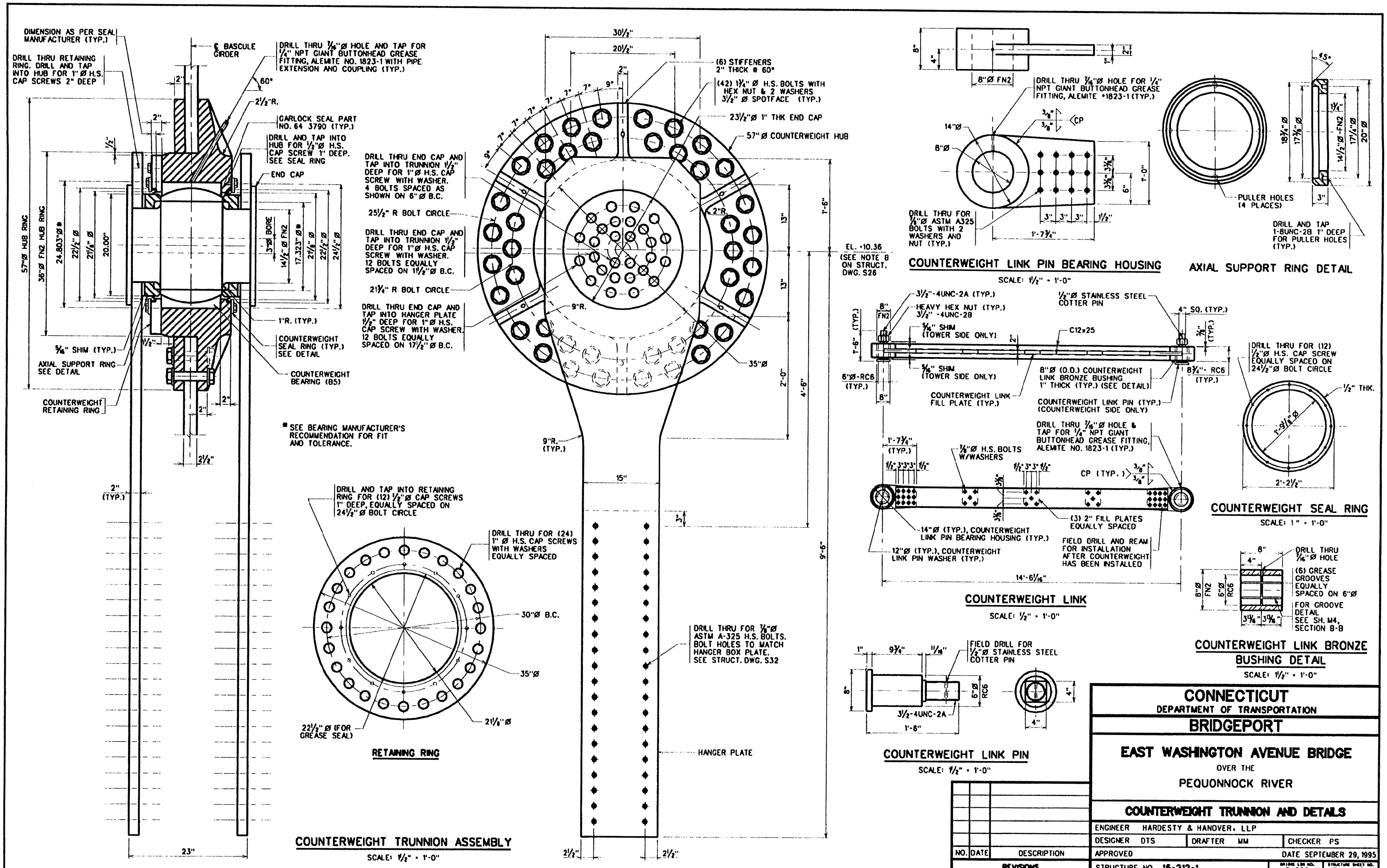
NO.	DATE	DESCRIPTION
		REVISIONS

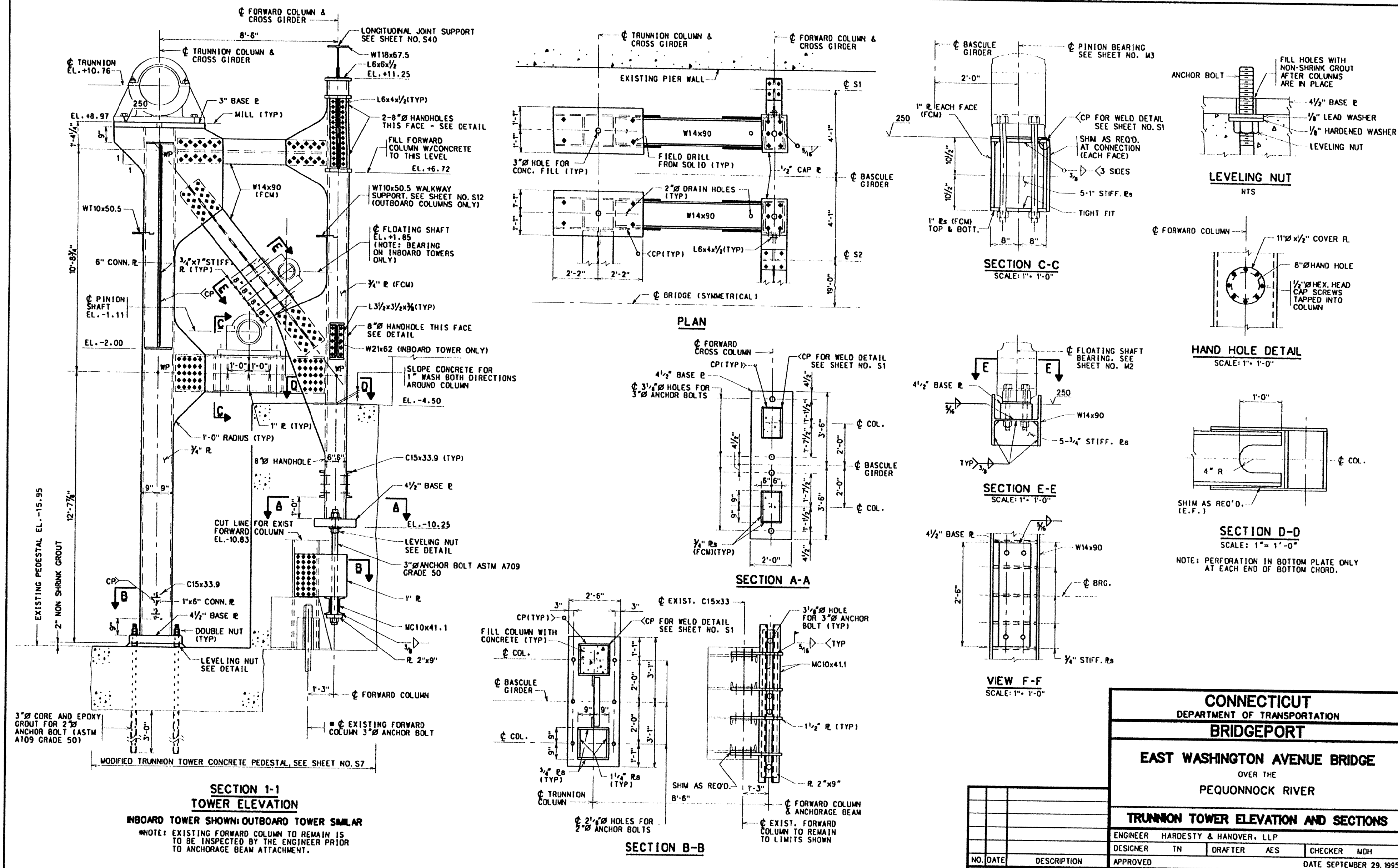
CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BRIDGEPORT

EAST WASHINGTON AVENUE BRIDGE
OVER THE
PEQUONNOCK RIVER

BASCULE SPAN - TRANSVERSE SECTION

ENGINEER HARDESTY & HANOVER, LLP
DESIGNER TN | DRAFTER AES | CHECKER MDH
APPROVED | DATE SEPTEMBER 29, 1995
STRUCTURE NO. 15-212-1 | BRIDGE LOG NO. 04252 | STRUCTURE SHEET NO. S23 of 62


COUNTERWEIGHT TRUNNION ASSEMBLY
SCALE: 1/2" = 1'-0"
RETAINING RING
* SEE BEARING MANUFACTURER'S RECOMMENDATION FOR FIT AND TOLERANCE.
HANGER PLATE
COUNTERWEIGHT LINK PIN BEARING HOUSING
SCALE: 1/2" = 1'-0"
AXIAL SUPPORT RING DETAIL
COUNTERWEIGHT LINK
SCALE: 1/2" = 1'-0"
COUNTERWEIGHT SEAL RING
SCALE: 1" = 1'-0"
COUNTERWEIGHT LINK BRONZE BUSHING DETAIL
SCALE: 1/2" = 1'-0"
COUNTERWEIGHT LINK PIN
SCALE: 1/2" = 1'-0"
CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BRIDGEPORT
EAST WASHINGTON AVENUE BRIDGE
OVER THE
PEQUONNOCK RIVER
COUNTERWEIGHT TRUNNION AND DETAILS
ENGINEER HARDESTY & HANOVER, LLP
DESIGNER DTS
DRAFTER MM
CHECKER PS
APPROVED
DATE SEPTEMBER 29, 1995
STRUCTURE NO. 15-212-1
04252
M5 of 9
NO. DATE DESCRIPTION
REVISIONS



NO.	DATE	DESCRIPTION

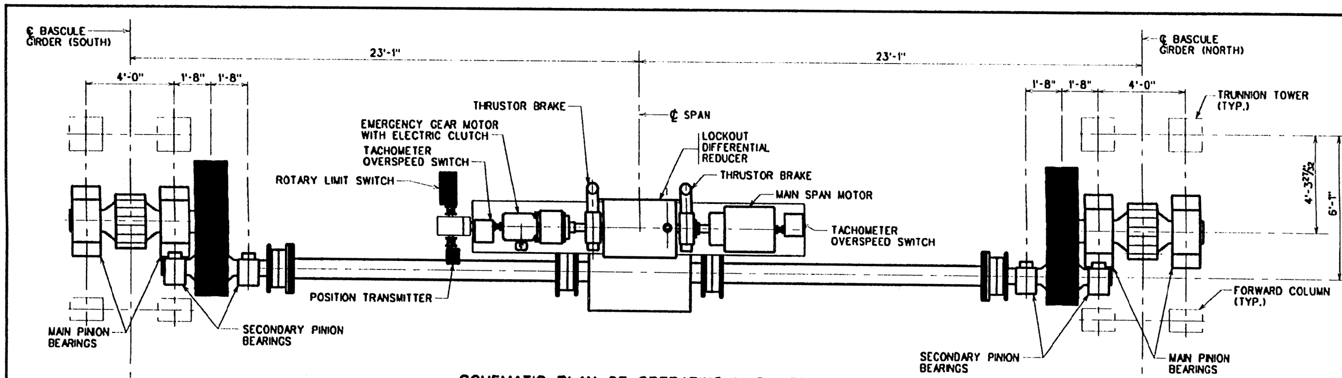
REVISIONS

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BRIDGEPORT

EAST WASHINGTON AVENUE BRIDGE
OVER THE
PEQUONNOCK RIVER

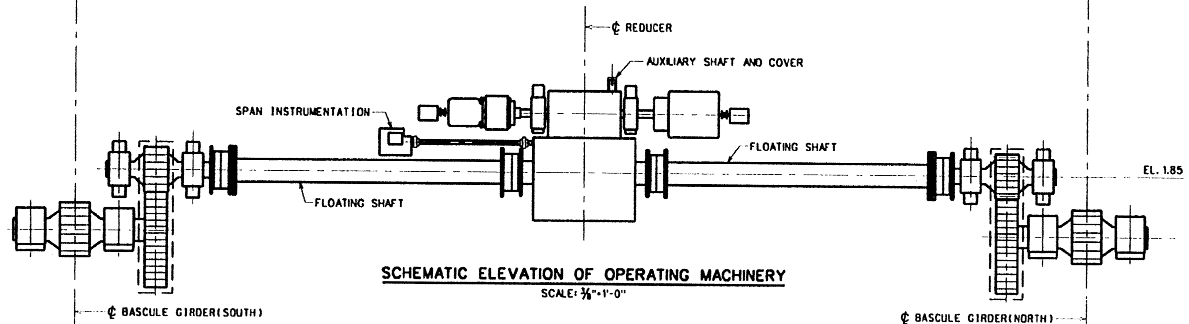
TRUNNION TOWER ELEVATION AND SECTIONS

ENGINEER	HARDESTY & HANOVER, LLP		
DESIGNER	TN	DRAFTER AES	CHECKER MDH
APPROVED			DATE SEPTEMBER 29, 1995
STRUCTURE NO. 15-212-1		BRIDGE LOG NO. 04252	STRUCTURE SHEET NO. S35 of 62



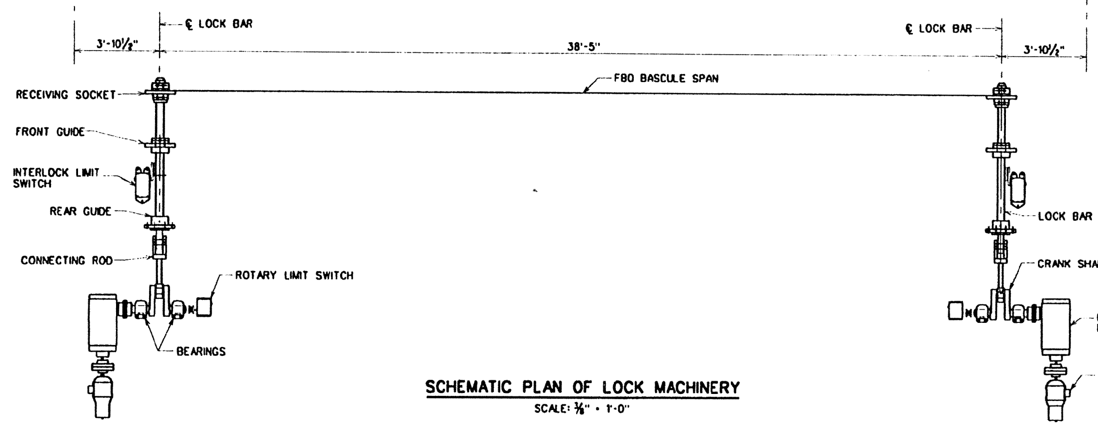
SCHEMATIC PLAN OF OPERATING MACHINERY

SCALE: 3/8" = 1'-0"



SCHEMATIC ELEVATION OF OPERATING MACHINERY

SCALE: 3/8" = 1'-0"



SCHEMATIC PLAN OF LOCK MACHINERY

SCALE: 3/8" = 1'-0"

NO.	DATE	DESCRIPTION

REVISIONS

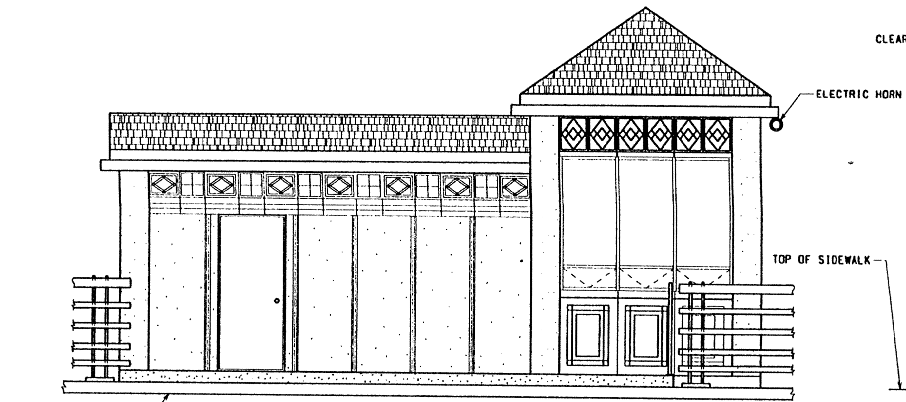
CONNECTICUT
DEPARTMENT OF TRANSPORTATION

BRIDGEPORT

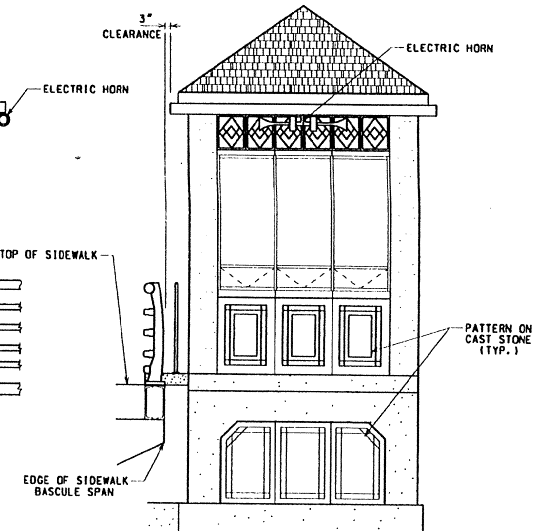
EAST WASHINGTON AVENUE BRIDGE
OVER THE
PEQUONNOCK RIVER

MACHINERY LAYOUT AND GENERAL NOTES

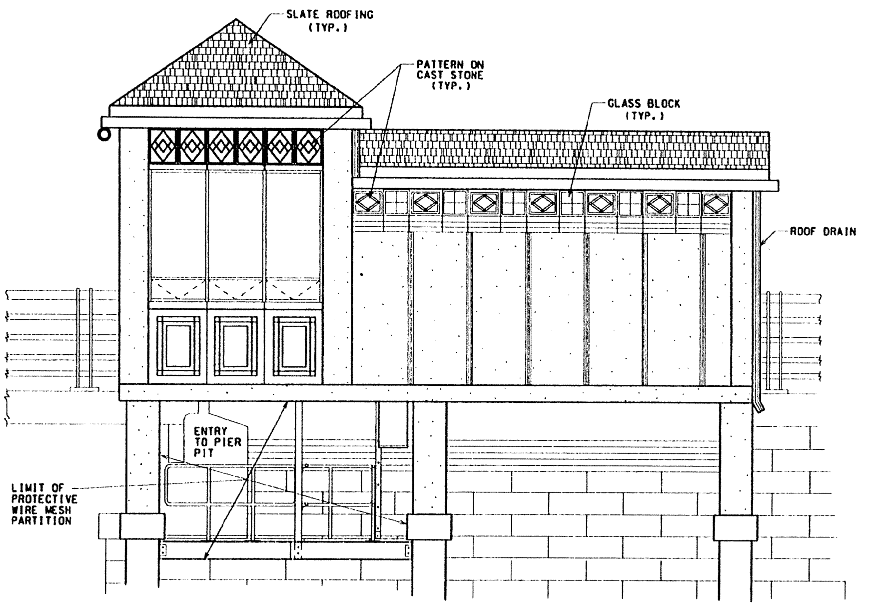
ENGINEER HARDESTY & HANOVER, LLP
DESIGNER DTS/PJJ | DRAFTER MM | CHECKER PS
APPROVED | DATE SEPTEMBER 29, 1995
STRUCTURE NO. 15-212-1 | BRIDGE LOG NO. 04252 | STRUCTURE SHEET NO. M1 of 9



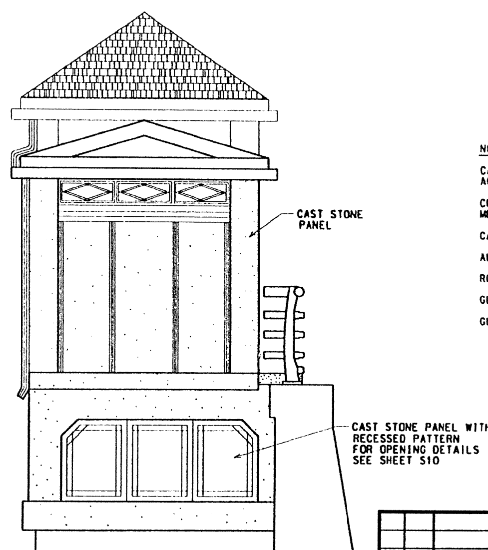
SOUTH ELEVATION
SCALE: 3/8" = 1'-0"



EAST ELEVATION
SCALE: 3/8" = 1'-0"



NORTH ELEVATION
SCALE: 3/8" = 1'-0"



WEST ELEVATION
SCALE: 3/8" = 1'-0"

NOTES:

CAST STONE SHALL BE MADE FROM PORTLAND CEMENT MEETING ASTM C150 AND AGGREGATE WHICH SHALL BE CAREFULLY GRADED AND WASHED MEETING ASTM C33.

COLOR ADDED TO CEMENT SHALL BE INORGANIC IRON OXIDE PIGMENTS MEETING ASTM C979

CAST STONE FINISHED SHALL BE IN "TOWER PINK"

ALL EXPOSED CAST STONE SHALL BE COATED WITH GRAFFITI RESISTANT COATING

ROOFING SHALL BE NATURAL SLATE - COLOR "UNFADING GREEN"

GLASS BLOCK SHALL BE LIGHT OF GREEN

GLASS AT FIXED/PROJECTED WINDOWS SHALL BE LIGHT OF GREEN TINTED

NO.	DATE	DESCRIPTION

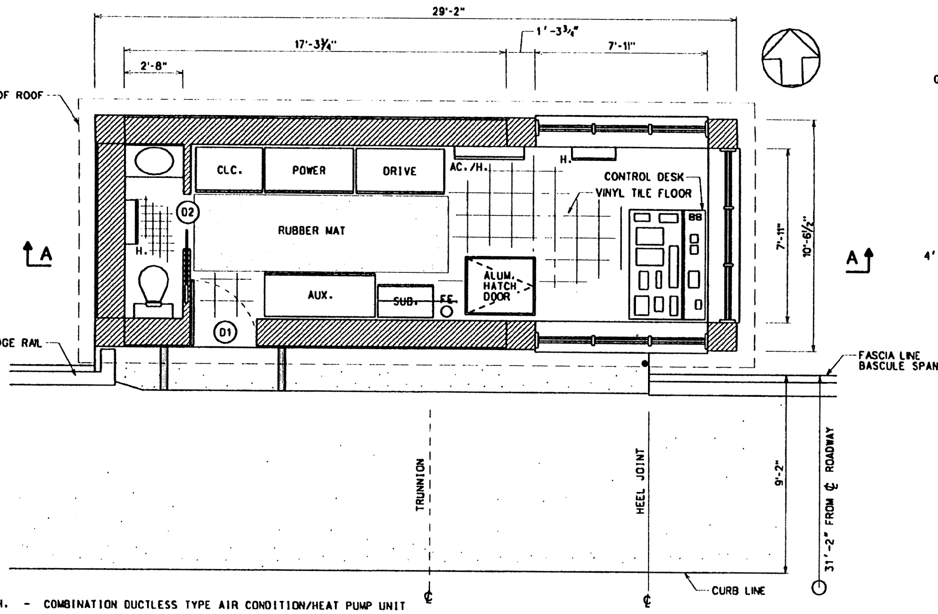
REVISIONS

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BRIDGEPORT

EAST WASHINGTON AVENUE BRIDGE
OVER THE
PEQUONNOCK RIVER

CONTROL HOUSE - ELEVATIONS

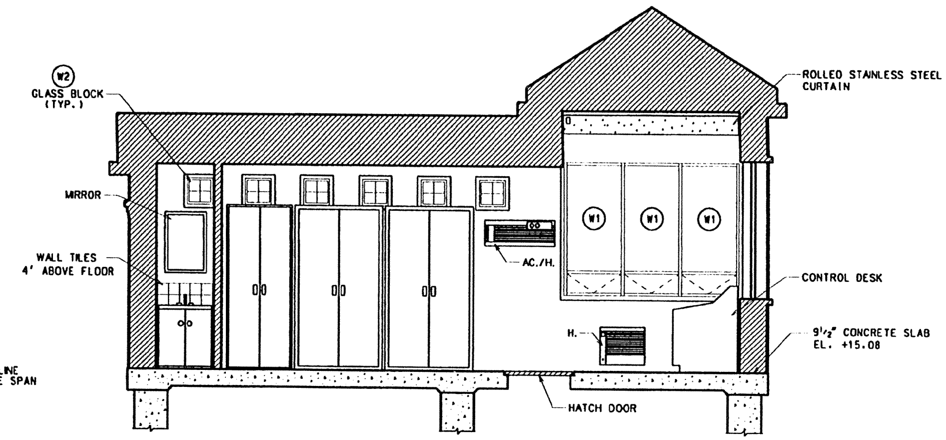
ENGINEER HARDESTY & HANOVER, LLP
DESIGNER TP | DRAFTER TP | CHECKER BS
APPROVED | DATE SEPTEMBER 29, 1995
STRUCTURE NO. 15-212-1 | BRIDGE LOG NO. 04252 | STRUCTURE SHEET NO. S52 of 62



PLAN - CONTROL HOUSE

SCALE: ⅜" = 1'-0"

AC./H. - COMBINATION DUCTLESS TYPE AIR CONDITION/HEAT PUMP UNIT
AUX. - AUXILIARY CABINET
CLC. - CENTRAL LIGHTING CABINET
C.O. - CLEANOUT
FE. - FIRE EXTINGUISHER
H. - HEATING UNIT
SUB. - SUBMARINE CABLE TERMINAL CABINET
LAV. - LAVATORY
WC. - WATER CLOSET



SECTION A-A

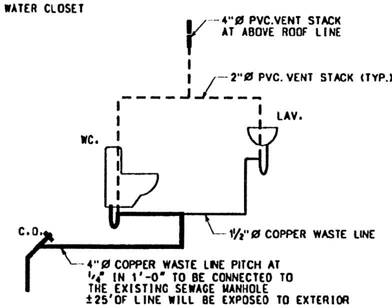
SCALE: ⅜" = 1'-0"

WINDOW SCHEDULE

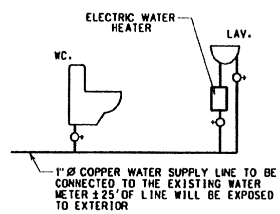
MARK	TYPE	SIZE (WXH)	QUANTITY	DESCRIPTION
W1	COMBINATION FIX/PROJECTED-IN	2'-6"x 5'-10"	9	ANODIZED ALUMINUM - GREEN TINTED LAMINATED TEMPERED GLASS
W2	FIX	1'-0"x 1'-0"	12	ANODIZED ALUMINUM - GREEN TINTED GLASS BLOCK

DOOR SCHEDULE

MARK	SIZE	QUANTITY	SADDLE	DESCRIPTION
D1	2'-8"X 6'-10"X 1¾"	1	STAINLESS STEEL	FLUSH ALUMINUM IN-SWING
D2	2'-6"X 6'-8"X 1¾"	1	STAINLESS STEEL	FLUSH ALUMINUM POCKET DOOR



WASTE WATER DIAGRAM



WATER SUPPLY DIAGRAM

NOTES:

FOR DETAILS OF CONTROL HOUSE CONCRETE SLAB SEE SHEET S11

PROJECTED-IN WINDOWS SHALL BE EQUIPPED WITH SCREENS.

ALL PIPES EXPOSED TO EXTERIOR SHALL BE EQUIPED WITH HEAT TRACE TAPE AND COVERED WITH 2" URETHANE INSULATION WITH ALUMINUM WEATHERPROOF JACKET. THE DISTANCE OF PIPE EXPOSED TO THE WEATHER SHALL BE FIELD VERIFIED TO SIZE HEATER CABLE. SEE SHEET 21 FOR WATER SUPPLY LINE AND SEWAGE LINE LAYOUT.

ALL FIXTURES MUST BE TRAPPED.

TOP SURFACE OF HATCH DOOR SHALL BE COVERED WITH THE SAME ADJACENT VINYL FLOOR TILE.

OUTDOOR AC./H. UNIT IS LOCATED UNDER THE CONTROL HOUSE AS SHOWN ON SHEET S58

NO.	DATE	DESCRIPTION

REVISIONS

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BRIDGEPORT

EAST WASHINGTON AVENUE BRIDGE
OVER THE
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CONTROL HOUSE - PLAN AND UTILITIES

ENGINEER HARDESTY & HANOVER, LLP
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