ENTRY FORM

DVASE
2021 Excellence in Structural Engineering Awards Program

PROJECT CATEGORY (check one):

Buildings under $5M		Buildings Over $100M	
Buildings $5M - $15M		Other Structures Under $1M	
Buildings $15M - $40M		Other Structures Over $1M	
Buildings $40M - $100M	X	Single Family Home	

Approximate construction cost of facility submitted:	$53,000,000
Name of Project:	Confidential
Location of Project:	Confidential
Date construction was completed (M/Y):	November, 2020
Structural Design Firm:	Ballinger
Affiliation:	**All entries must be submitted by DVASE member firms or members.**
Architect:	Ballinger
General Contractor:	Confidential

Company Logo (insert .jpg in box below)

B A L L I N G E R

Important Notes:

- Please .pdf your completed entry form and email to bsagusti@barrhorstman.com.
- Please also email separately 2-3 of the best .jpg images of your project, for the slide presentation at the annual virtual presentation and for the DVASE website. Include a brief (approx. 4 sentences) summary of the project for the DVASE Awards Presentation with this separate email.

- Provide a concise project description in the following box (one page maximum). Include the significant aspects of the project and their relationship to the judging criteria.

Confidential Client Vertical Expansion - Urban Jenga 10 Stories Up, Without a Crane:

The Vertical Expansion project is a 52,000 SF two-story vertical connector addition occupying a plan footprint of 115'x45' and is elevated one story above the existing Level 10 roof of the original 1970s Main Hospital construction. Flanking the full length of both the east and west sides of the addition are two existing skylights and public space atria below. The north and south ends of the connector are bracketed by taller portions of a 2003 Hospital addition. Additionally, there was an existing concrete and steel framed helipad located within the footprint of the new connector addition that was partially removed and partially integrated into the new structure.

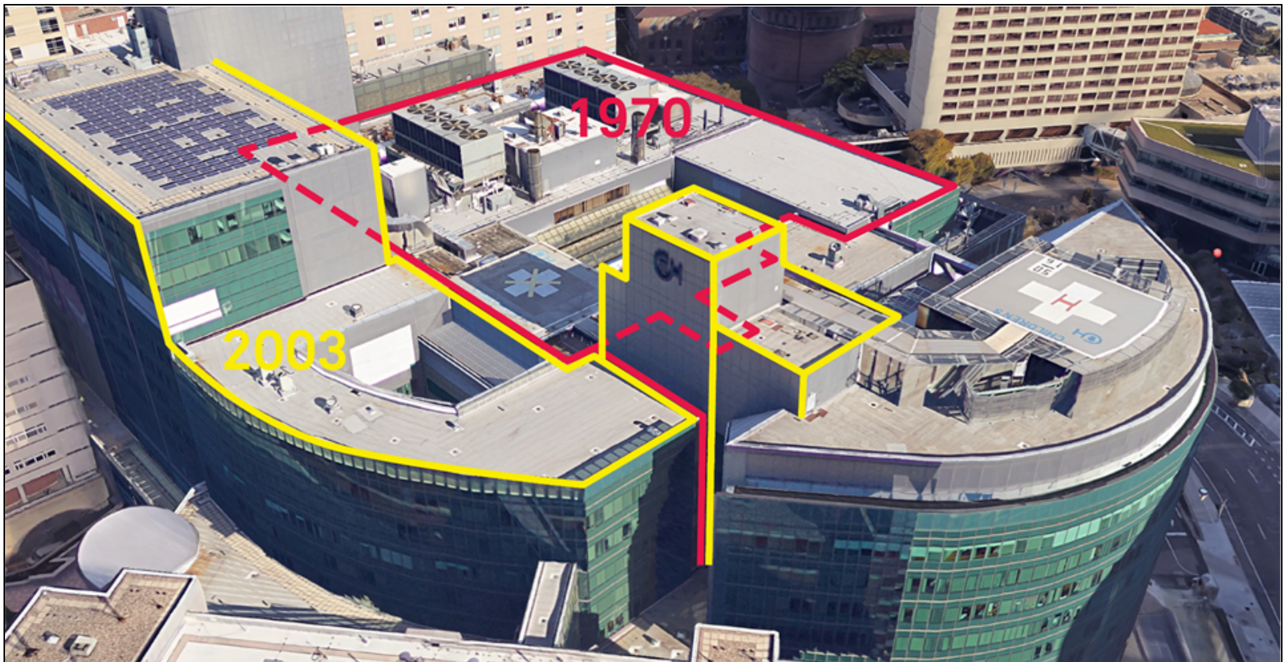
Reaching a crane from the closest adjacent street would have required lifting steel over a 175' width of occupied patient space and at least one skylight. To ensure patient and public safety, the Client elected not to build the addition using a street level crane. Instead, a mast-climbing hoist mounted to the side of the 2003 addition was the only means of moving workers and materials for the project. Further complicating the construction, the live load capacity of the existing roof structure is limited to the 1970 code minimum roof live load and not capable of supporting the construction loading of equipment, mini cranes, or materials. Ballinger provided structural engineering services during the design and construction phases to address these construction complications. The design team provided an integrated project-wide structural design not only for the new structure, but also helping the contractor develop safe and efficient methods for a phased construction that reduced the impact on the existing structure and patient floors below the connector addition. Specific construction challenges included:

- <u>Maximum material length of 17'-0":</u> Limitations on maximum material length that could fit in the hoist required much of the steel framing to be field spliced, in many cases more than once. The existing grid spacing of 24'x48' required the 48' long beams to be spliced twice, while girders where spliced once at the center and also cantilevered 12' on the west side and 8' on the east side.
- <u>Slab on Deck Design:</u> Every piece of steel that had to be moved on the material hoist cost money and time. During the pre-construction phase an effort to reduce piece count led to the removal of one infill beam in the 24' wide bay, resulting in a single infill beam and a 12' deck span. This required deck shoring when pouring the slabs on metal deck.
- <u>Construction Loads on Existing Structure:</u> The existing roof structures and columns supporting the roofs had limited live load capacities to support the construction loading and loads of the new connector as it was built. Ballinger worked with the contractors to evaluate the effects of all construction loads and sequences on both the 1970s and 2003 structures to ensure structural integrity of existing structures below, while also allowing construction activities to proceed in the most efficient manner.
- <u>Existing Helipad Demolition:</u> The existing helipad consisted of a 12" concrete slab supported by steel framing. Removal of the existing slab was the first phase of construction, to take advantage of the additional column capacity used by the dead load. However, the existing 1970s roof below the helipad was designed to support a minimum roof live load and could not support normal demolition loads. After confirming the limited roof capacity, a very structured and closely monitored demolition sequence was followed to remove small sections of concrete and to prevent overloading the existing roof with construction debris.
- <u>Steel Framed Work Platform:</u> The limited live load capacity of the existing 1970s roof, which is directly below the connector addition, necessitated a new steel framed work platform, supported by the existing columns, that could support the construction loading. The new temporary work platform was built a few feet above the existing roof and at the same elevation as the existing helipad. This allowed the new steel framing of the platform to be spliced together with the existing helipad steel framing to create one large working surface for material staging/handling and erection of the structure using Maeda mini-cranes. New connector columns were also used to support the working platform on the existing columns. Material staging and location of min-cranes on existing helipad steel framing was evaluated by Ballinger and crane locations were limited to avoid excessive loading on the existing helipad cantilevered framing of the east and west sides.
- <u>Connector North End Erection:</u> Erection of the north end of the new connector, which connects the new structure to the upper levels of the 2003 addition, could not be performed from the existing 1970s roof due to existing ductwork that could not be removed. Ballinger and the contractor investigated the design of window washing roof davits on the 2003 addition roof and determined that they could be used in combination with jib cranes to erect the north end.

In addition to the design of the new building structure adapting to these construction challenges, both the 1970s and 2003 existing structures required reinforcement to support the new connector loads. This reinforcement required phased installation sequences to allow construction of the new connector to proceed on schedule without interrupting continued occupancy of the floors below by patients and staff. Additionally, an alternate structural strategy was developed to eliminate significant column reinforcement which would have been required at the south end of the new connector if it was connected directly to the existing columns. These design challenges included:

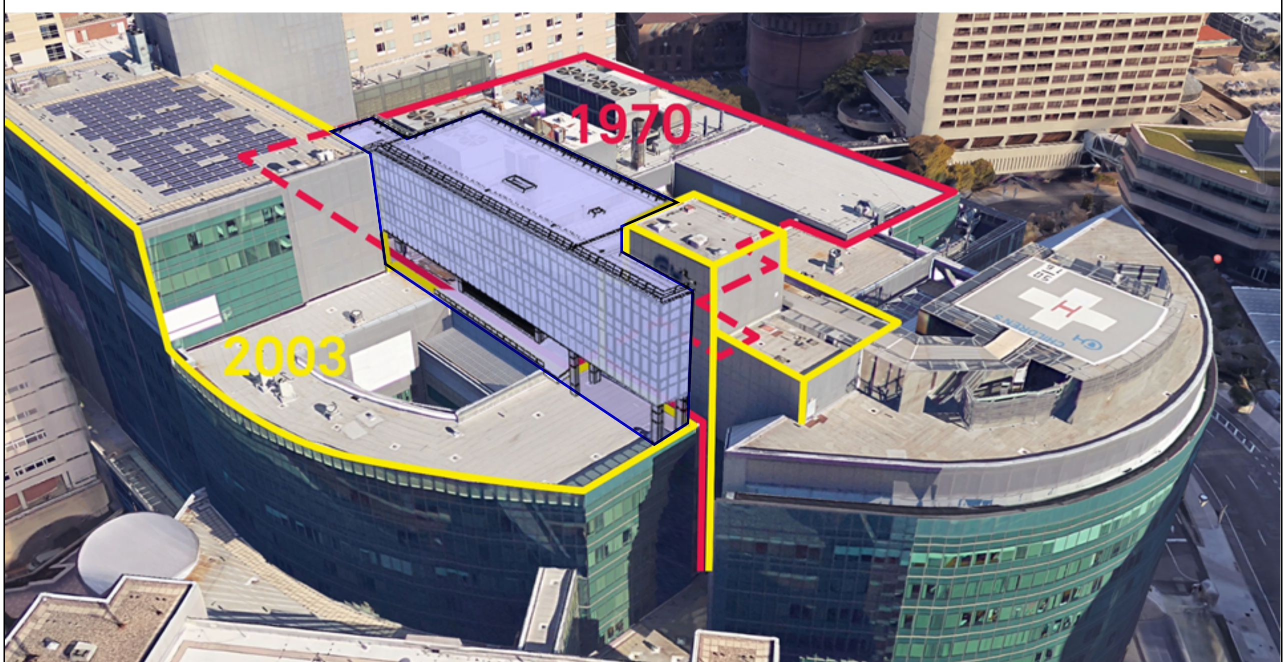
- <u>Existing Building Modeling:</u> Large portions of the existing 1970s and 2003 buildings between expansion joints were modeled to evaluate the effect of new connector and construction loads on existing structures. The structural model was made in RAM Structural System and originally used to determine the extents of required reinforcement of the existing structures due to the added load of the new connector. As the pre-construction and construction phases of the project progressed, the model was also used to evaluate several construction loading conditions in combination with different levels of completeness for the new structure. This allowed Ballinger and the contractor to balance the construction and new structure loads, such that construction could remain on schedule while the reinforcement of the existing structure below was coordinated and performed in overnight shifts to avoid interrupting hospital activities. The entire project would have been significantly delayed if the contractor had to wait until all reinforcement of the existing structure was completed before starting construction activities for the new connector.
- <u>1970s Building Existing Column Reinforcement:</u> The existing 1970s building columns that supported the new connector passed unbraced through a two-story mechanical room directly below the Level 10 roof. New steel column bracing was added to the columns in the mechanical room to reduce their unbraced length and utilize the existing column strength. Locations for bracing were determined in the field through coordination with contractor, steel fabricator/erector performing the work, and existing MEP equipment inside the mechanical room.
- <u>2003 Building Roof Framing Reinforcement:</u> A 10' wide two-story corridor, connecting the new addition to an elevator bank at south end of the addition, sits directly on the existing roof framing of the 2003 addition. Several existing beams and connections had to be reinforced to support the added loading.
- <u>Existing Helipad Steel Framing:</u> While reusing the existing helipad steel frame to create the working platform helped solve one challenge, it created another. It meant the existing helipad columns would also need to permanently support the new two-story connector and the new mechanical equipment located in the open story below the connector. The connection of the new columns to the existing structure were redesigned to incorporate and reinforce the existing helipad steel columns. Additionally, it was determined that the remaining helipad framing used to support the temporary work platform could also be reused to permanently support a new AHU and its associated service platform, saving valuable time and money for the project.
- <u>South End Sloped Columns:</u> The structural model of the existing 2003 building at south end of the connector showed it could not support additional loads from the new addition without extensive column strengthening below. To avoid the potential cost and disruption caused by such strengthening, the design team instead choose to support a 20'x45' section of the two-story connector at the south end with a combination of sloping columns and cantilevered transfer girders along the two main north/south column lines.

- The following 5 pages (maximum) can be used to portray your project to the awards committee through photos, renderings, sketches, plans, etc…



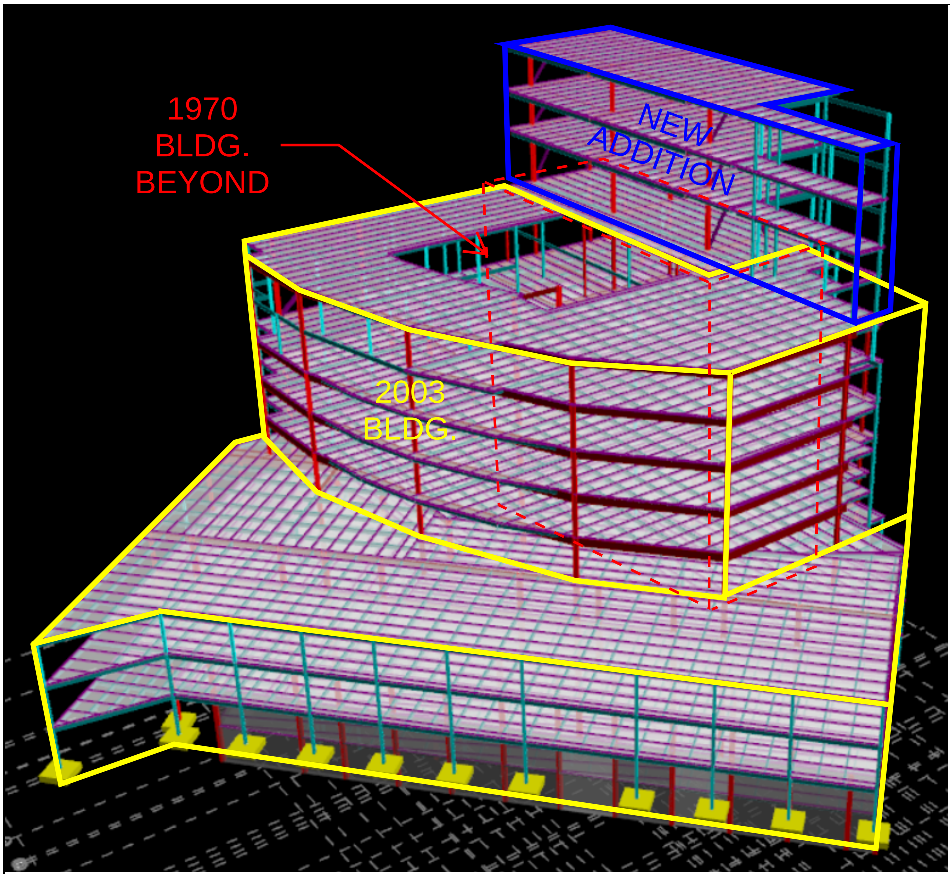
EXISTING MAIN HOSPITAL

(ORIGINAL 1970s MAIN HOSPITAL IN RED; 2003 ADDITION IN YELLOW)



EXISTING MAIN HOSPITAL WITH NEW ADDITION

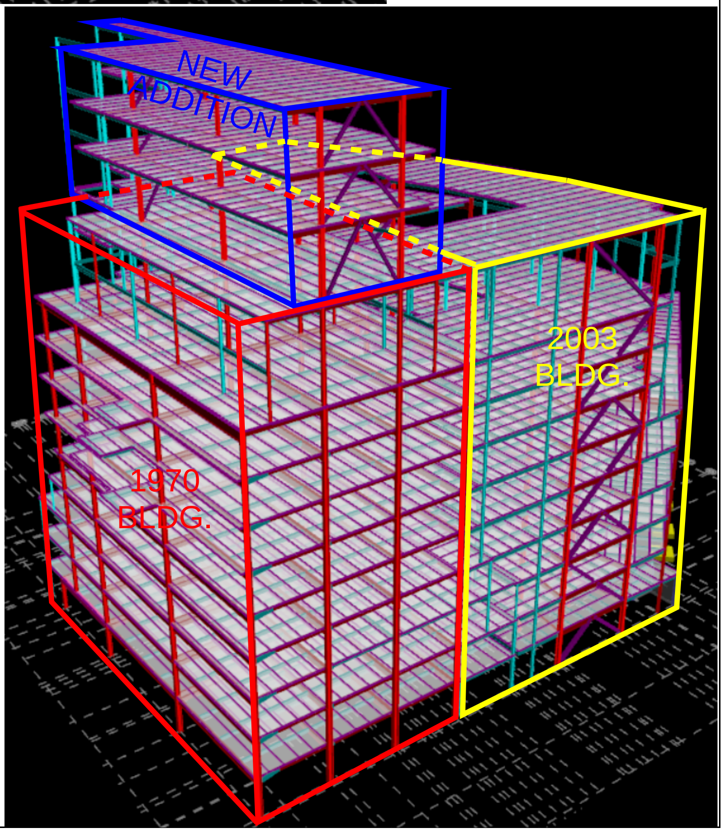
(NEW ADDITION HIGLIGHTED IN BLUE)

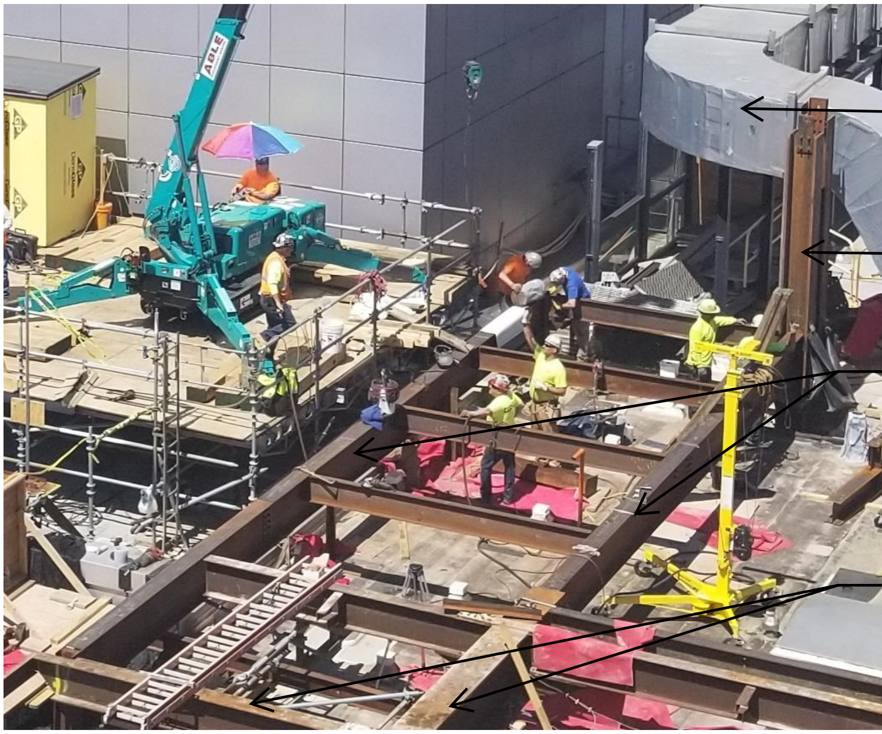


RAM STRUCTURAL SYSTEM
MODEL VIEWS:

TOP: VIEW FROM SOUTHWEST

RIGHT: VIEW FROM NORTHEAST





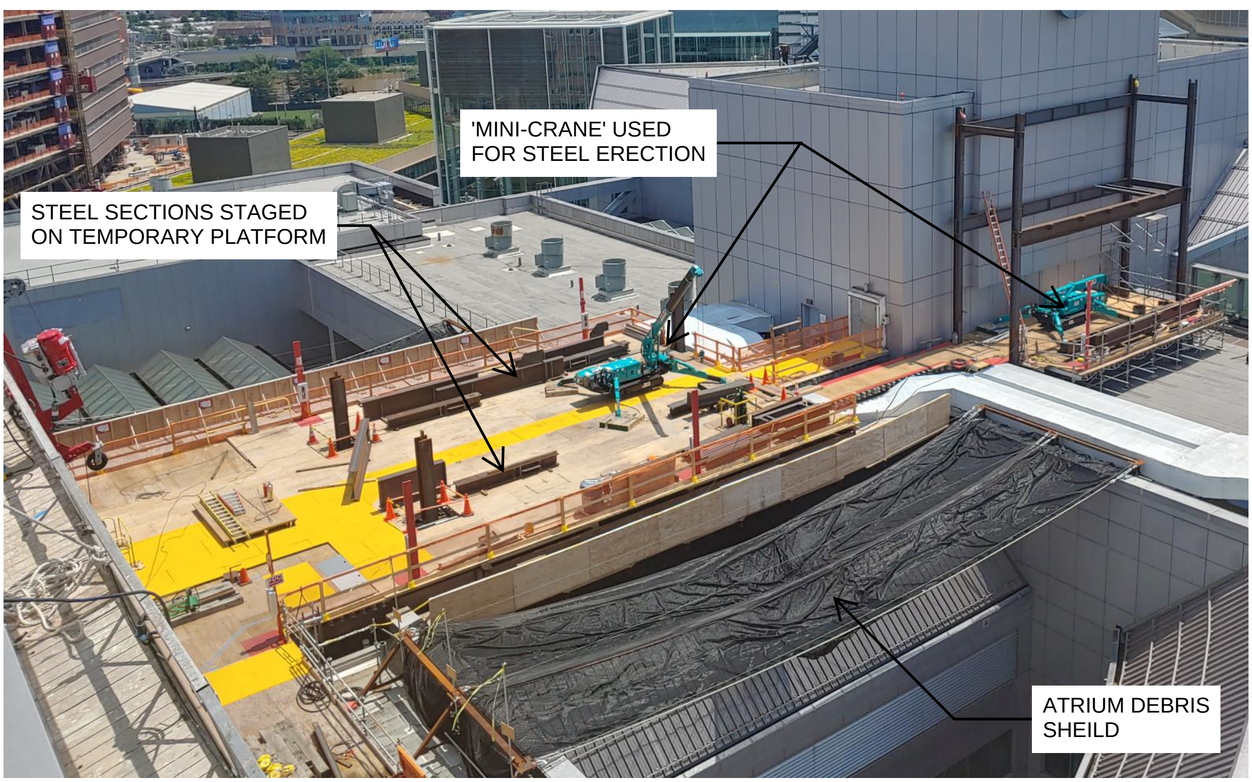
EXISTING DUCTWORK TO REMAIN UNDER NORTH END OF CONNECTOR THAT PREVENTED ERECTION FROM LOW ROOF - JIB CRANES FROM 2003 ADDITION USED IN THIS AREA

NEW BUILDING COLUMN SUPPORTING TEMPORARY WORK PLATFORM

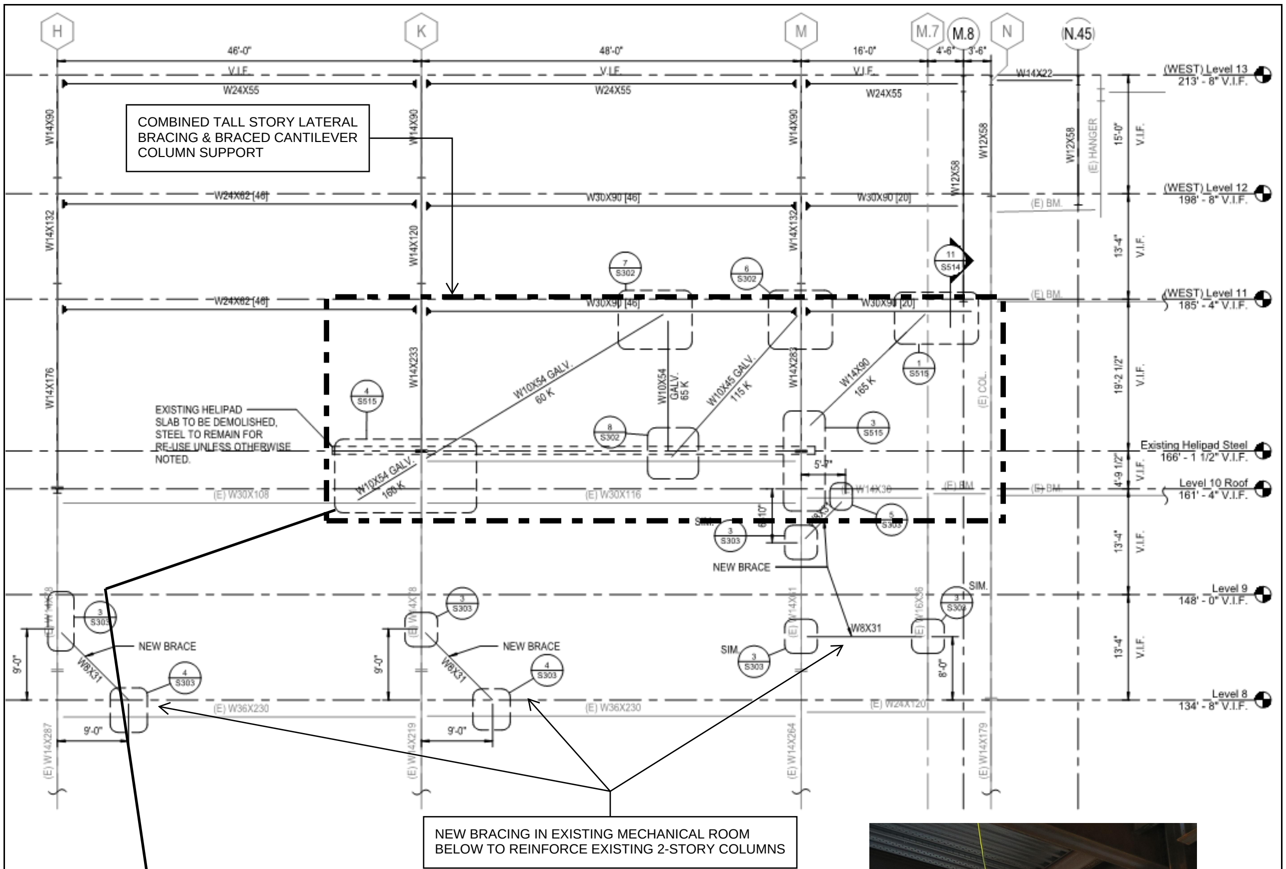
TEMPORARY STEEL FRAMING FOR WORK PLATFORM

EXISTING HELIPAD STEEL FRAMING REUSED AS WORK PLATFORM SUPPORT FRAMING

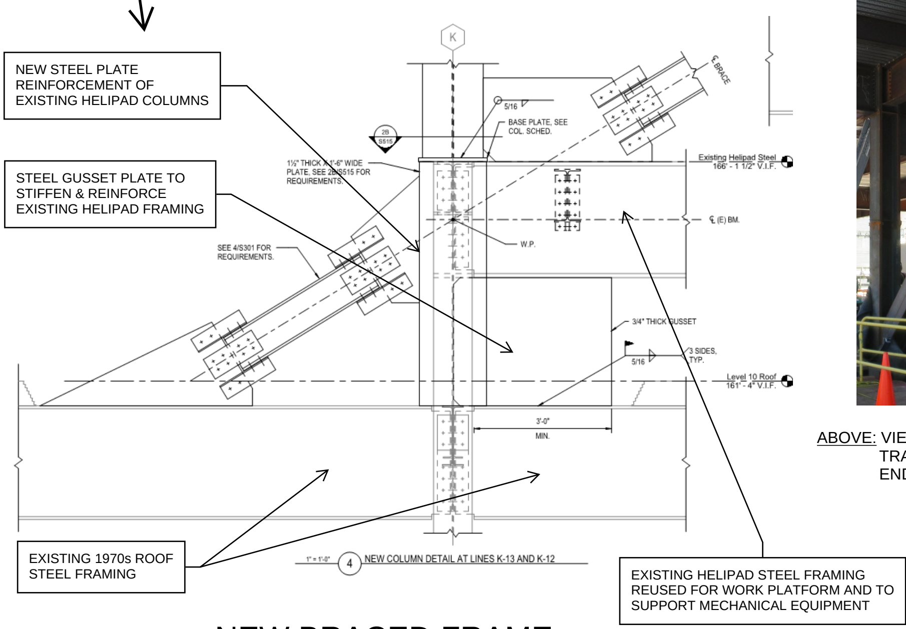
STEEL FRAMED WORK PLATFORM CONSTRUCTION



COMPLETED WORK PLATFORM @ START OF STEEL ERECTION

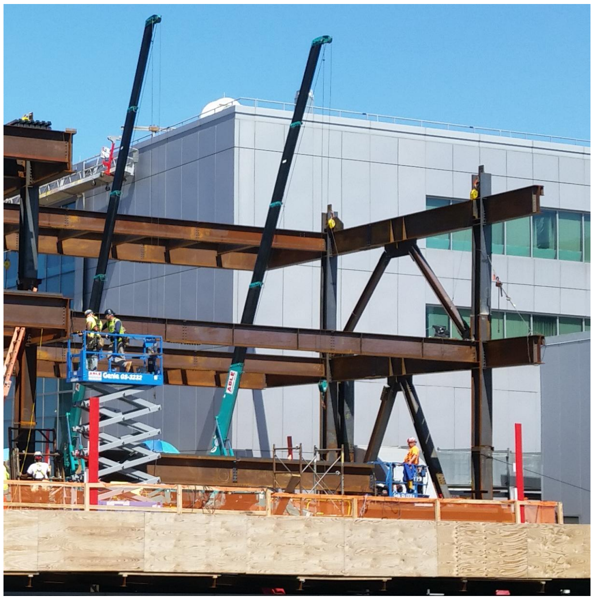


NORTH/SOUTH FRAMING ELEVATION:



NEW BRACED FRAME CONNECTION THROUGH EXISTING HELIPAD STEEL FRAMING:

ABOVE: VIEW OF SLOPED COLUMN COMBINED W/ TRANSFER GIRDER SUPPORTING SOUTH END OF CONNECTOR



STEP #2: 32'-0" SECTION SUPPORTED BY CONNECTION ON NORTH END & SHORING ON EAST END PRIOR TO FINAL 16'-0" SECTION BEING LIFTED INTO PLACE

STEP #1: TWO 16'-0" SECTION SPLICED TOGETHER ON WORK PLATFORM & HOISTED INTO PLACE W/ TWO MAEDA MINI CRANES

TYPICAL ERECTION SEQUENCE OF 48'-0" LONG BEAMS :

ABOVE: VIEW OF THE WEST SIDE OF THE COMPLETED FRAMING FOR 1ST AND 2ND SUPPORTED LEVELS SHOWING THIRD POINT SPLICES FOR THE 48'-0" LONG BEAMS.

ABOVE: VIEW OF THE WEST SIDE FROM ROOF OF 2003 BLDG. SHOWING PARTIAL COMPLETION OF ROOF FRAMING AND FLOOR DECKING.

LEFT: DECK SHORING IN PLACE FOR 1ST SLAB ON METAL DECK POUR. DECK SHORING WAS USED INSTEAD OF ADDING AN ADDITIONAL BEAM TO REDUCE NUMBER OF PIECES THAT NEEDED TO BE TRANSPORTED UP THE MATERIAL HOIST.

By signing, signatory agrees to the following and represents that he or she is authorized to sign for the structural design firm of record.

All entries become the property of DVASE and will not be returned. By entering, the entrant grants a royalty-free license to DVASE to use any copyrighted material submitted.

If selected as an award winner, you may be offered the opportunity to present your project at a DVASE breakfast seminar. Would you be willing to present to your colleagues? ☒ ***YES*** ☐ ***NO***

Submitted by:

<table>
<tr><td>Print name:
Angela Fante</td><td colspan="2">Signature:</td><td>Date:
4/2/2021</td></tr>
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