Stanley D. Lindsey and Associates, Ltd. 1966 SDL

McGough

DEVELOP | BUILD | OPERATE

MNSEA – Gateway Presentation

May 10, 2022

RBC Gateway Project Team

Structural Engineer of Record: Stanley D. Lindsey and Associates, Ltd. Atlanta, Georgia

Steve Hamvas

- **Principal-in-Charge. Lead team of structural engineers and modelers from start to finish and coordinated work with Owner, Architect, Contractor, and other consultants.**

General Contractor:
McGough Construction LLC St. Paul, MN

G.C. – Core and shell
SPW - Concrete, Masonry, General Carpentry

Mike Martin

- **Helped lead preconstruction efforts from a self-perform lens including; estimating, constructability, visualization, and equipment selection**

General Contractor:
McGough Construction LLC St. Paul, MN

G.C. – Core and shell
SPW - Concrete, Masonry, General Carpentry

Nick Fernstrom

- **Helped lead the execution of the concrete and masonry scopes including; manpower, constructability, sequencing, change management.**

RBC Gateway Project Overview

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Project Metrics

- 65,000cy concrete
- 12.7mil pounds of rebar
- 1.0mil pounds of PT
- 75,000 units of CMU
- 2025 pieces of exterior stone
- 700 pieces of interior stone
- Stone came from four countries

- Concrete value approx. = $66mil
- Masonry value approx. = $5mil
- Project value approx. = $300mil

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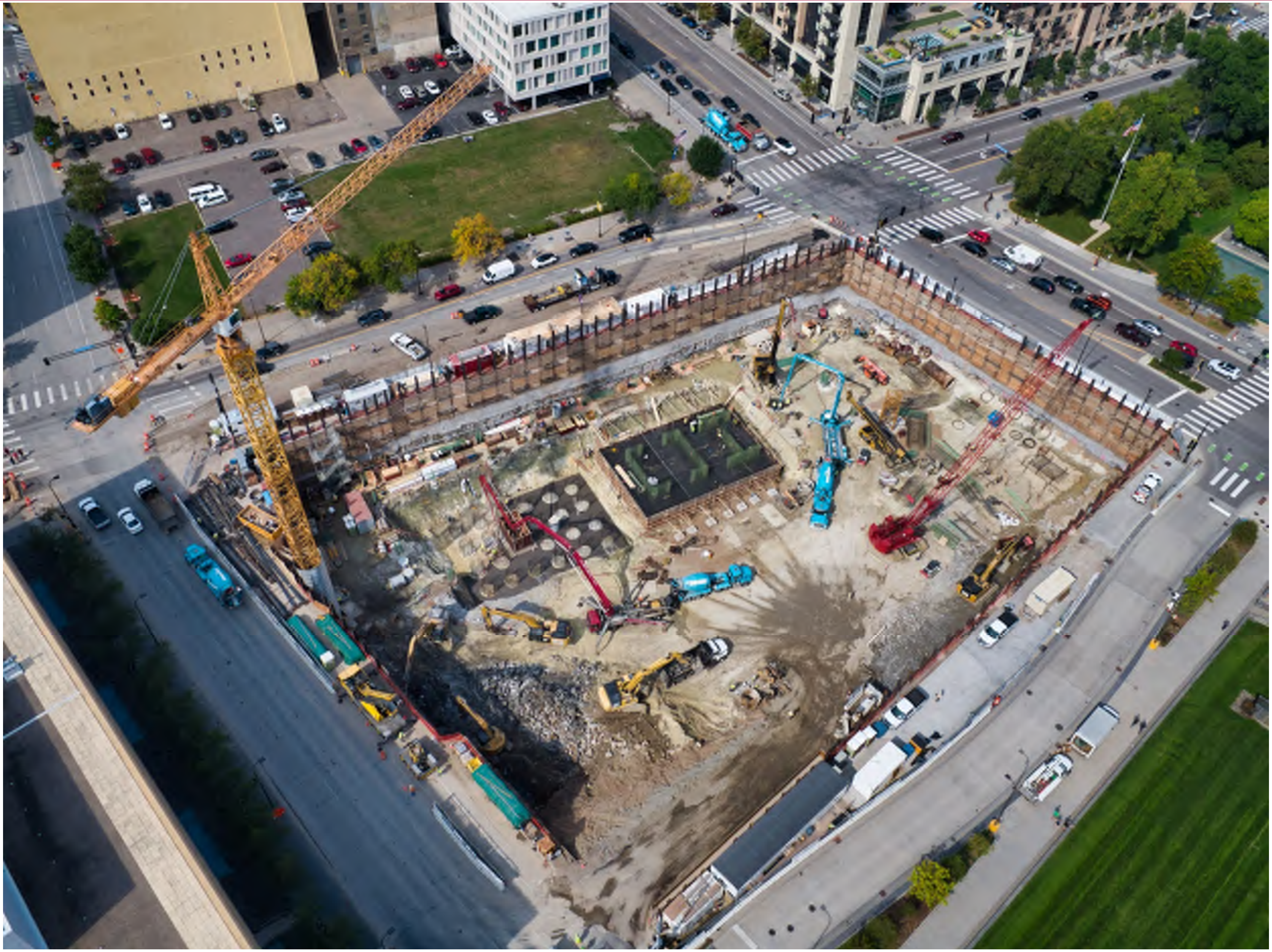

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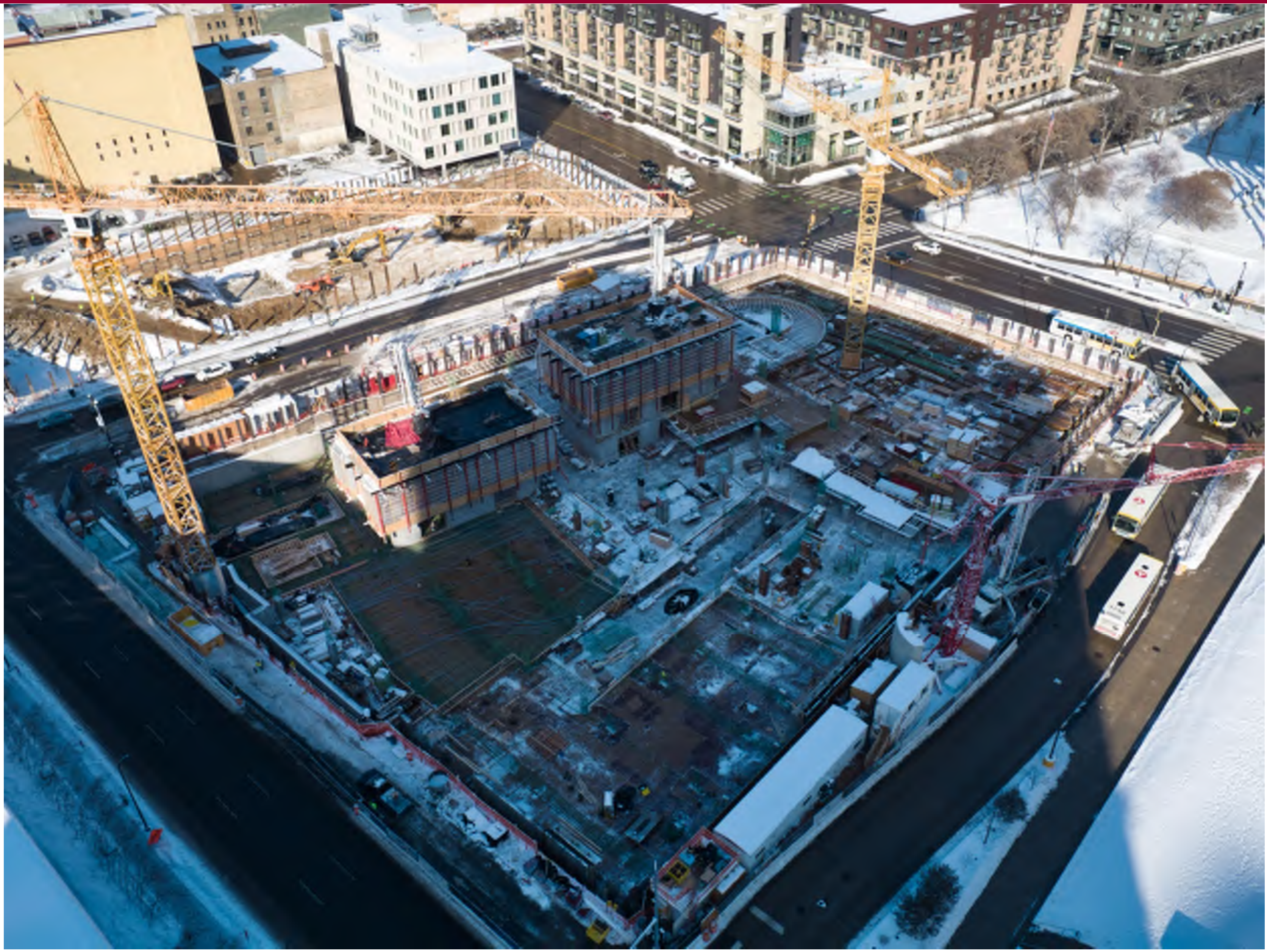

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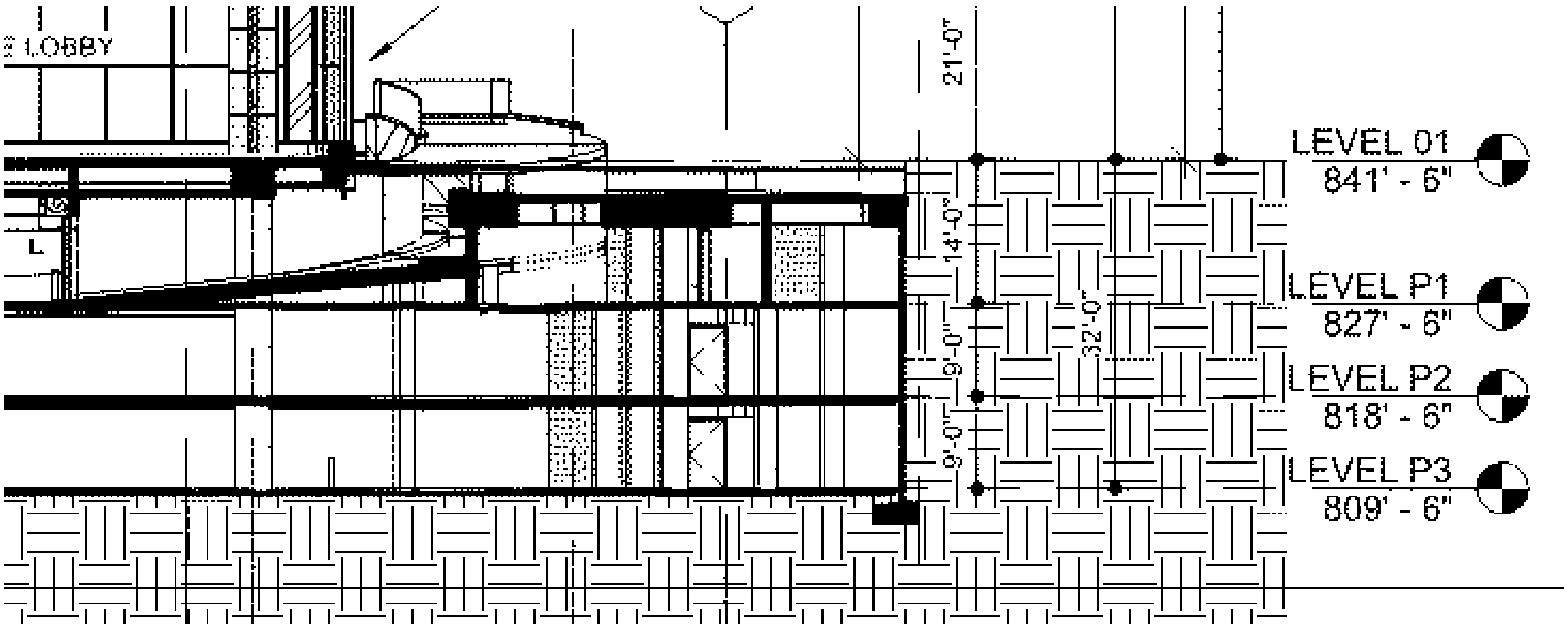
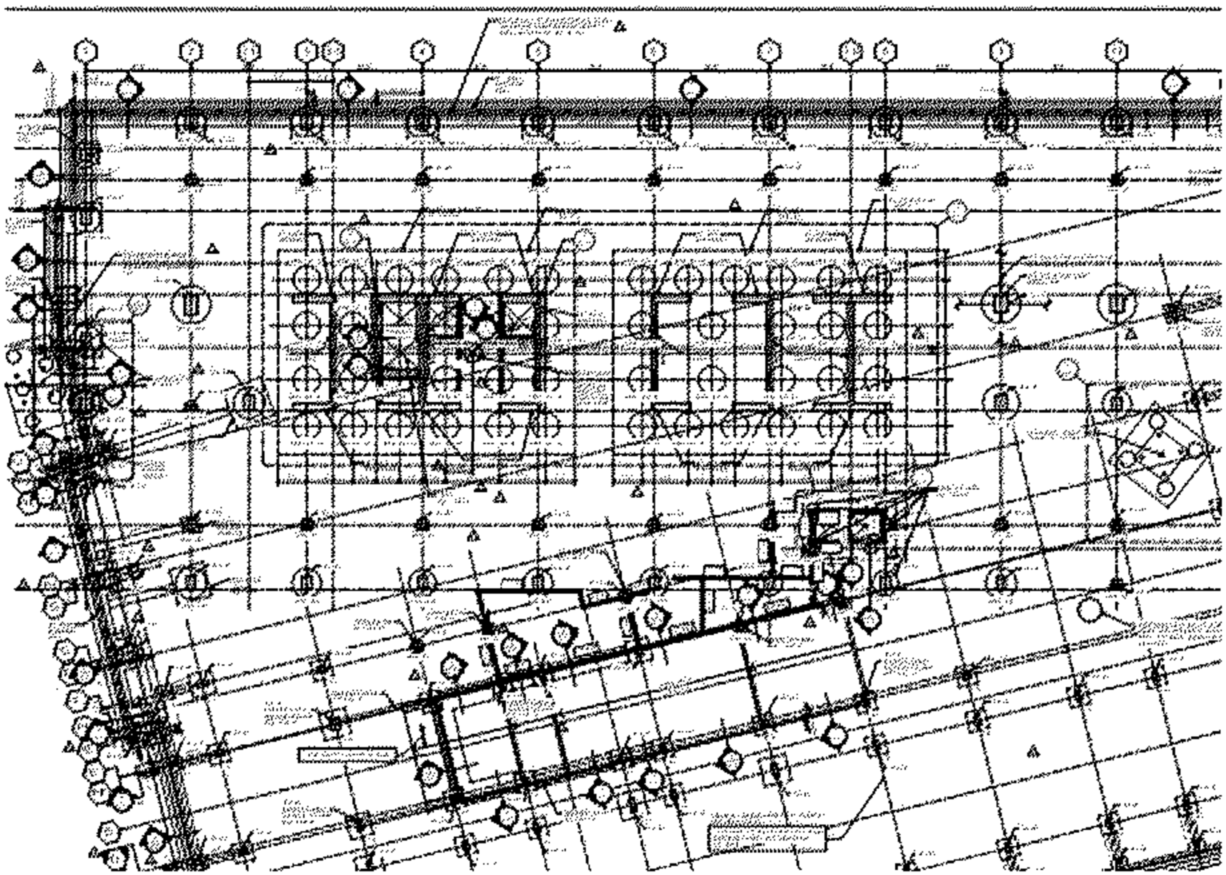
Engineering Overview

What are the responsibilities of structural engineers?

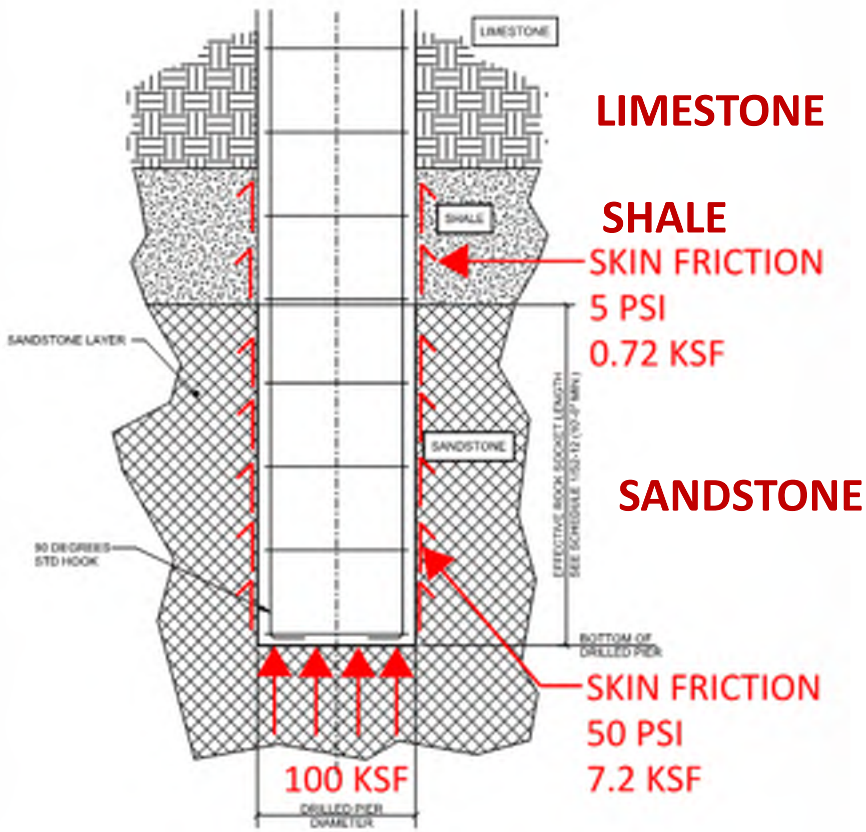
To design structures to withstand stresses and pressures imposed through environmental conditions and human use.



THREE LEVELS OF BELOW GRADE PARKING



FOUNDATION PLAN



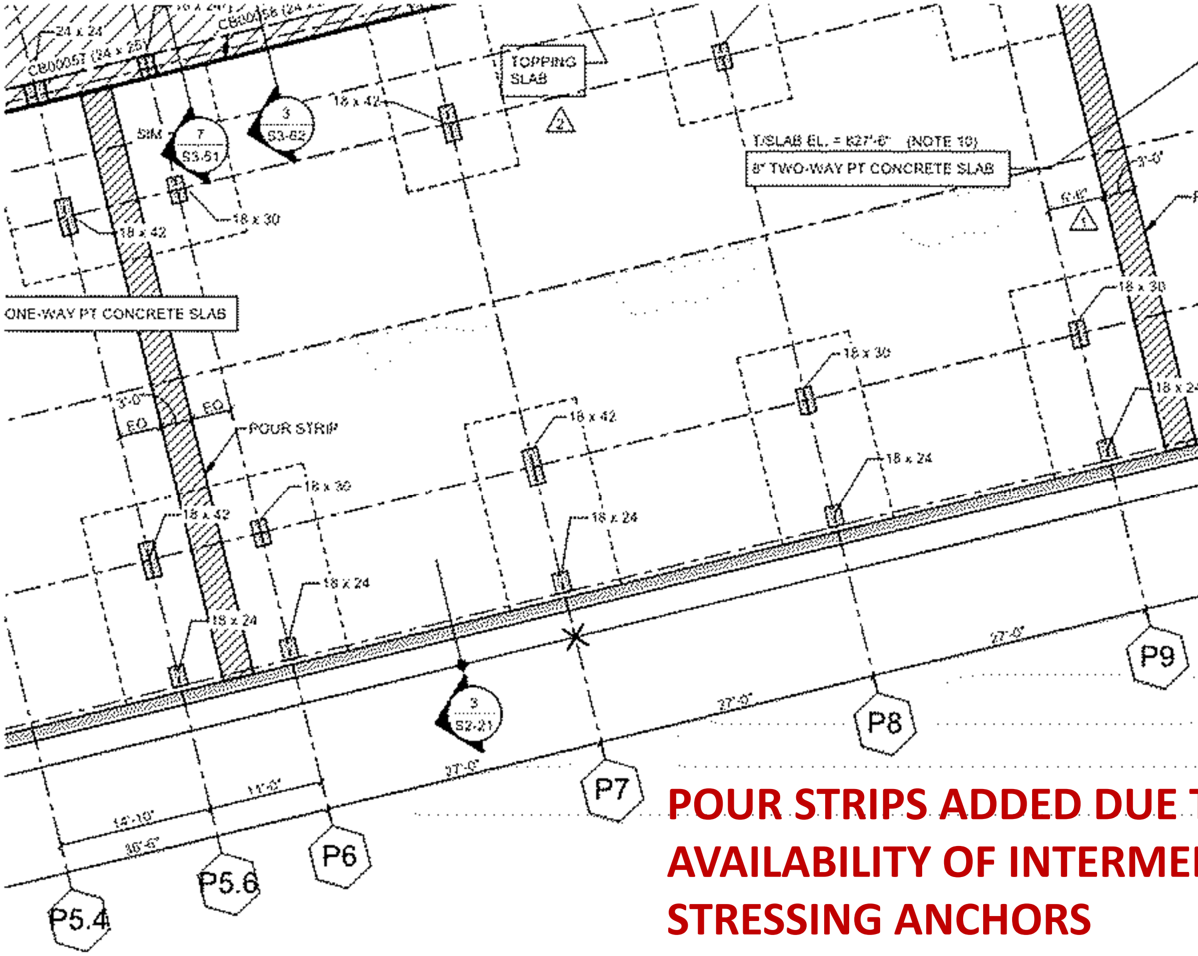
DRILLED PIER ELEVATION

MAXIMUM SOCKET LENGTH = 40 FEET

MAT AT SHEAR WALL CORE
8 FEET THICK

MAT AT SHEAR WALL CORE

2 LAYERS GR75 #11@6” AT BOTTOM AND GR75 #11@6” TOP

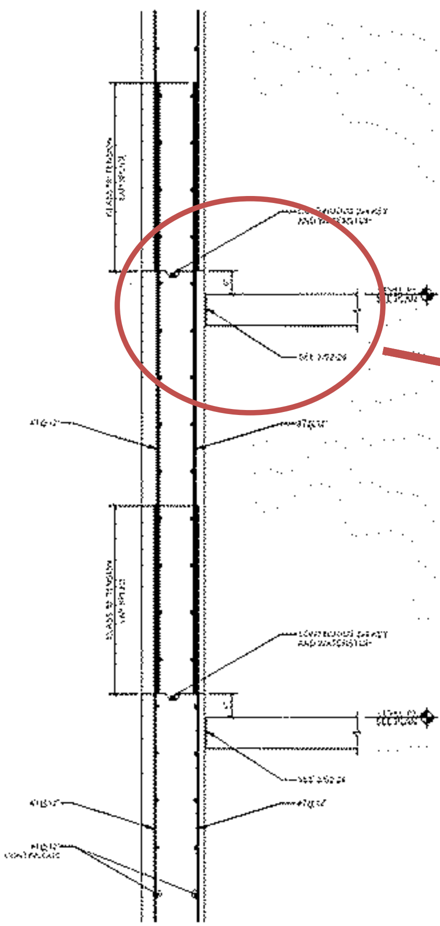


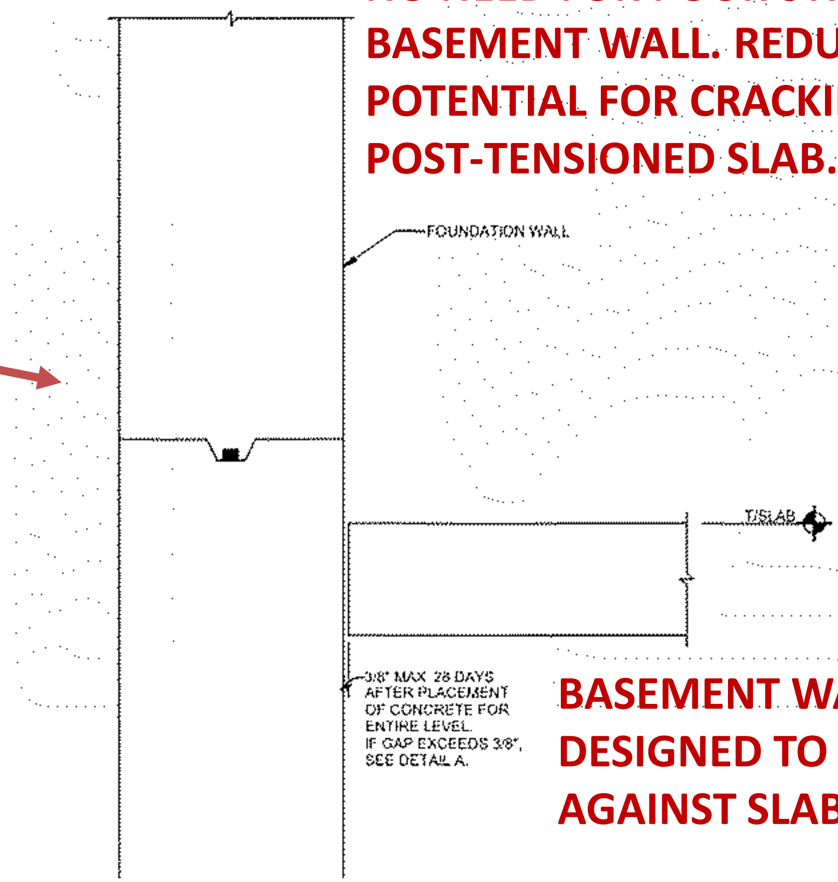
POUR STRIPS ADDED DUE TO LACK OF AVAILABILITY OF INTERMEDIATE STRESSING ANCHORS

BELOW GRADE PARKING LEVEL

POUR STRIP – NO INTERMEDIATE STRESSING ANCHORS

NO NEED FOR POUR STRIP AT BASEMENT WALL. REDUCES POTENTIAL FOR CRACKING OF POST-TENSIONED SLAB.

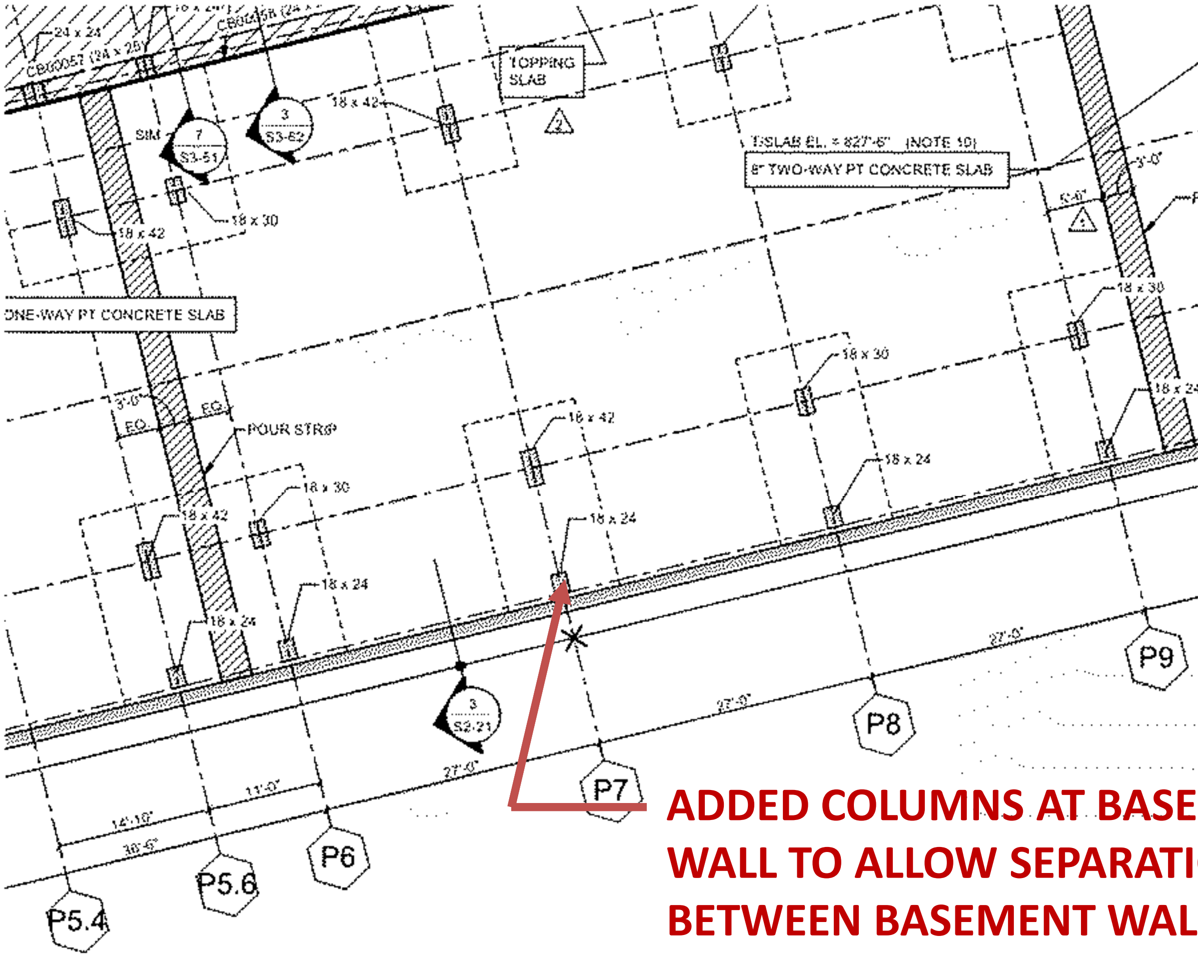




BASEMENT WALL DESIGNED TO PUSH AGAINST SLAB

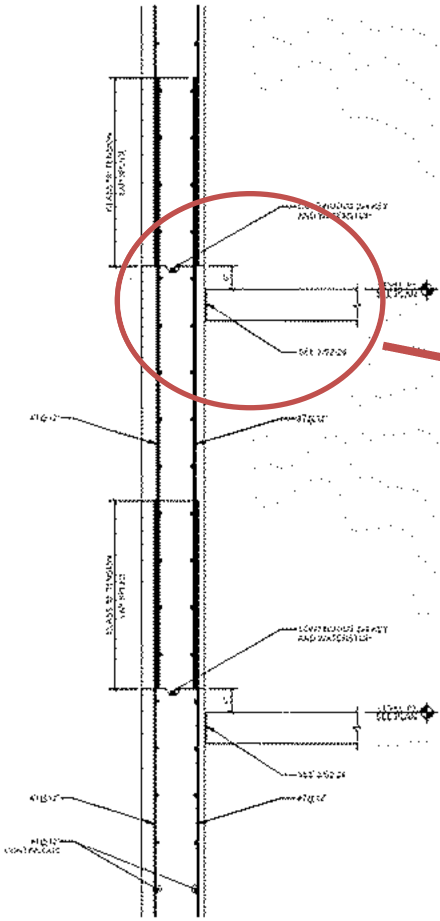
BASEMENT WALL SECTION

BASEMENT WALL IS NOT TIED INTO BELOW GRADE PARKING DECK SLAB

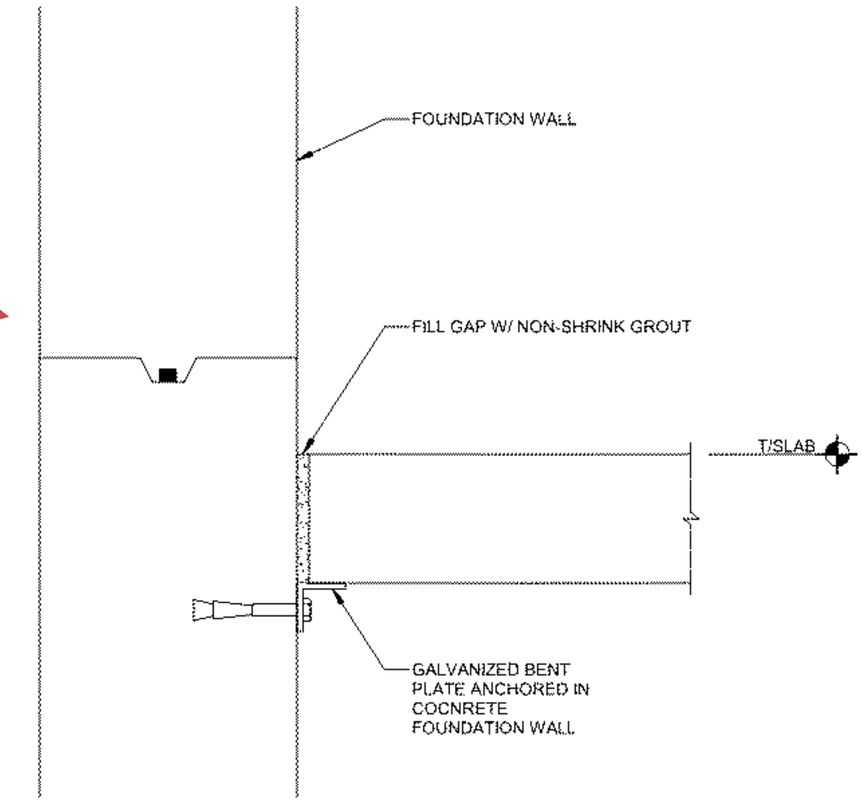


ADDED COLUMNS AT BASEMENT WALL TO ALLOW SEPARATION BETWEEN BASEMENT WALL AND SLAB

BELOW GRADE PARKING LEVEL

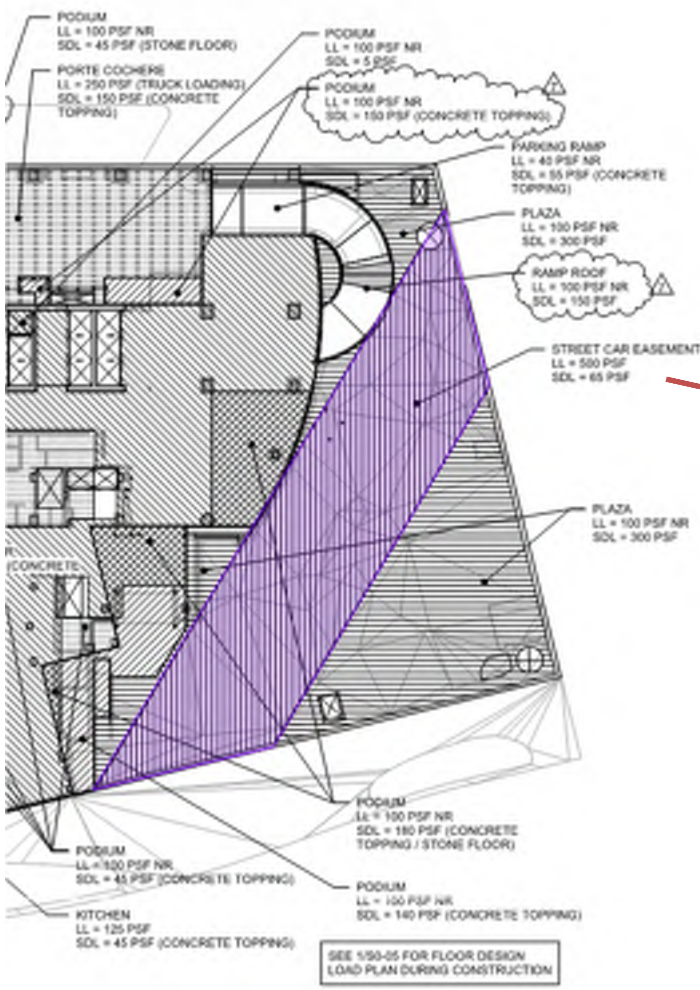


BASEMENT WALL SECTION



DETAIL USED IF GAP BETWEEN BASEMENT WALL AND SLAB EXCEEDS 3/8”

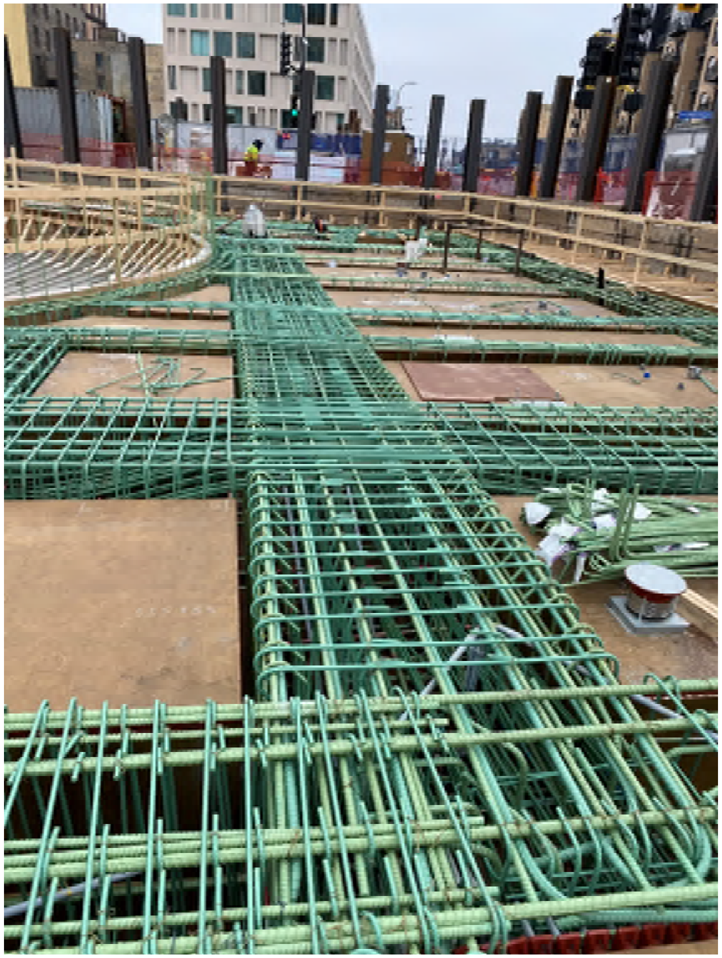
EPOXY COATED REINFORCING STEEL AT EXPOSED AREAS



PLAZA IN HIGHLIGHTED AREA IS AN EASEMENT FOR A FUTURE STREETCAR PROJECT

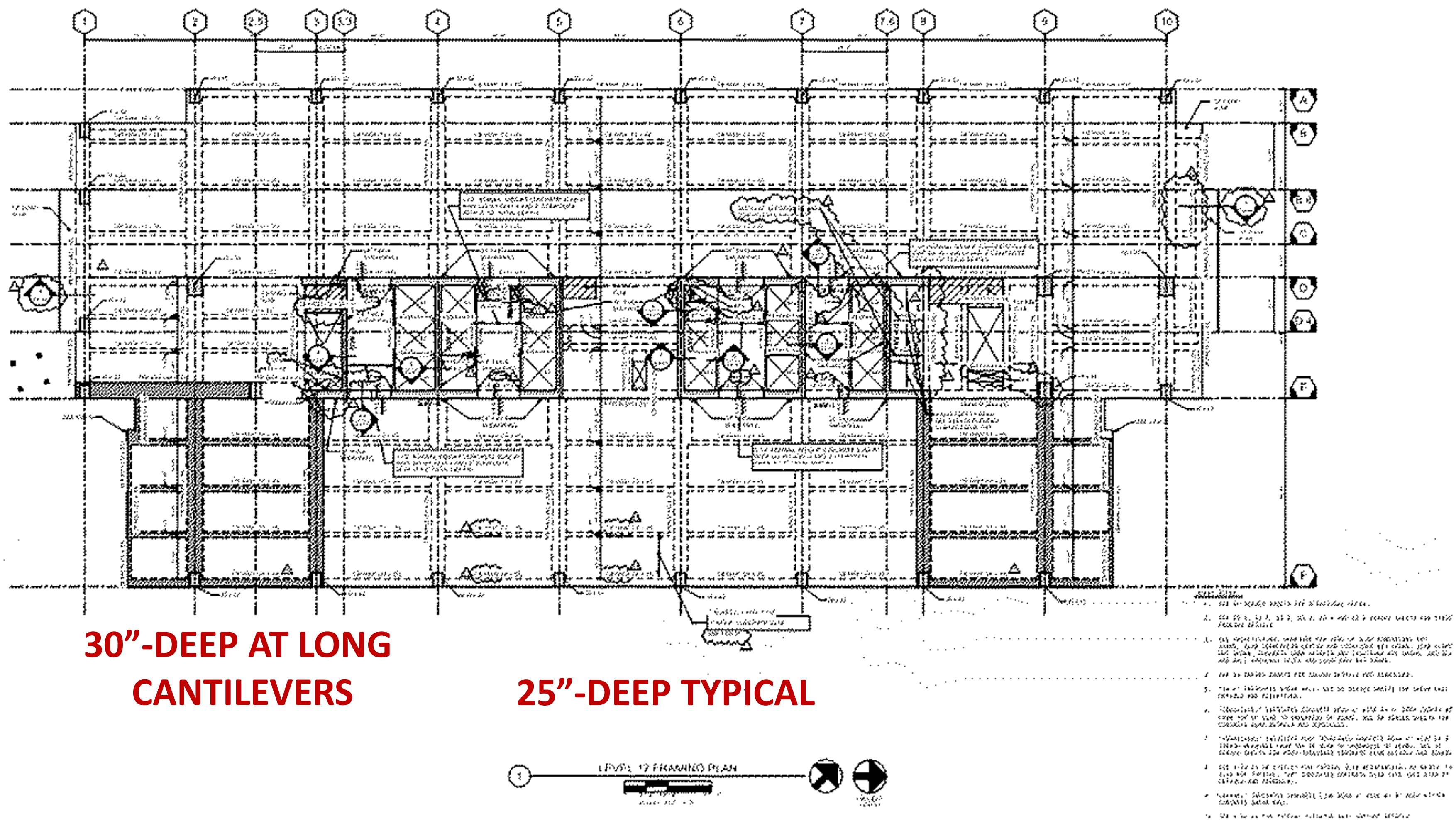
STREETCAR EASEMENT
LL = 500 PSF
SDL = 65 PSF

FLOOR DESIGN LOAD PLAN AT PLAZA LEVEL



FRAMING AT STREETCAR EASEMENT

SHEAR WALL CORES



30”-DEEP AT LONG CANTILEVERS

25”-DEEP TYPICAL

TYPICAL OFFICE LEVEL FRAMING PLAN

WIND TUNNEL STUDY MODEL – 1:400 SCALE MODEL OF RBC GATEWAY BUILDING WITH MODELS OF SURROUNDING BUILDINGS WITHIN 1,500 FEET

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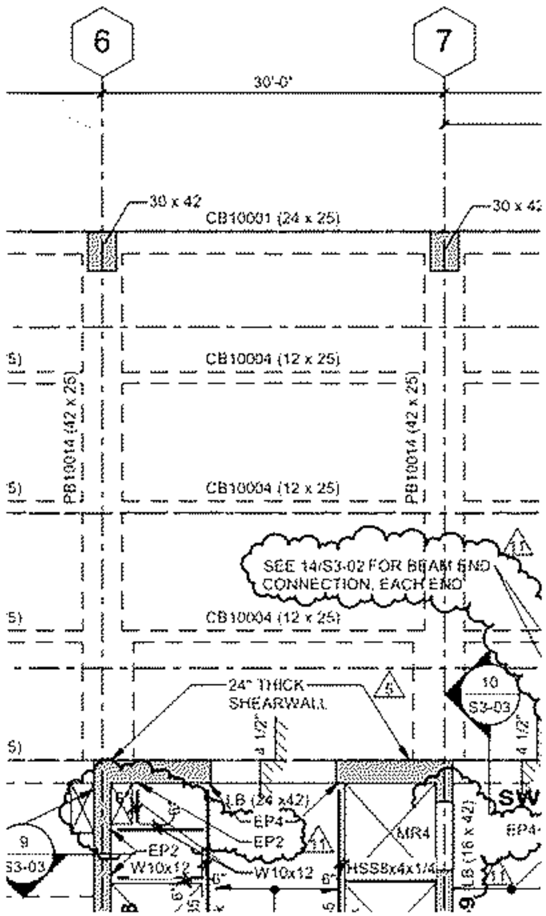
STUDY WAS CONDUCTED USING THE HIGH-FREQUENCY PRESSURE INTEGRATION (HFPI) TECHNIQUE FOR THE PREDICTION OF WIND-INDUCED STRUCTURAL RESPONSES

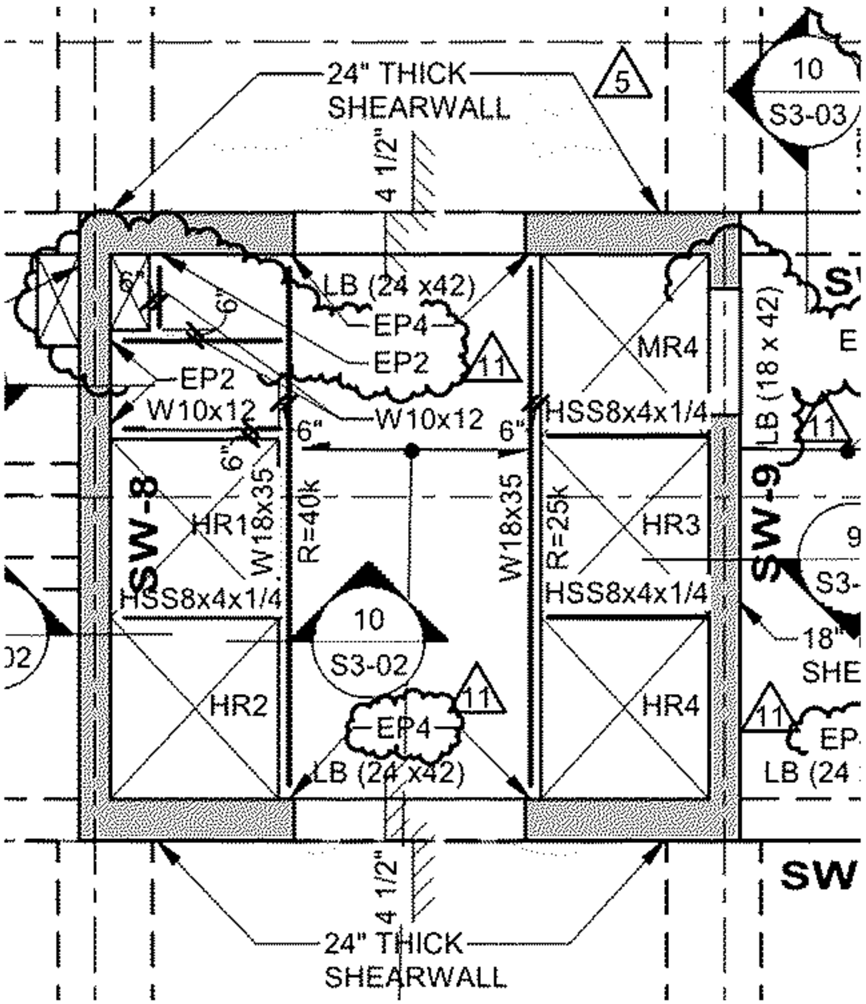


TYPICAL BAY OFFICE LEVEL

SLAB: 5 INCHES THICK
BEAMS: 12" X 25" TYPICAL
PT GIRDERS: 42" X 25"

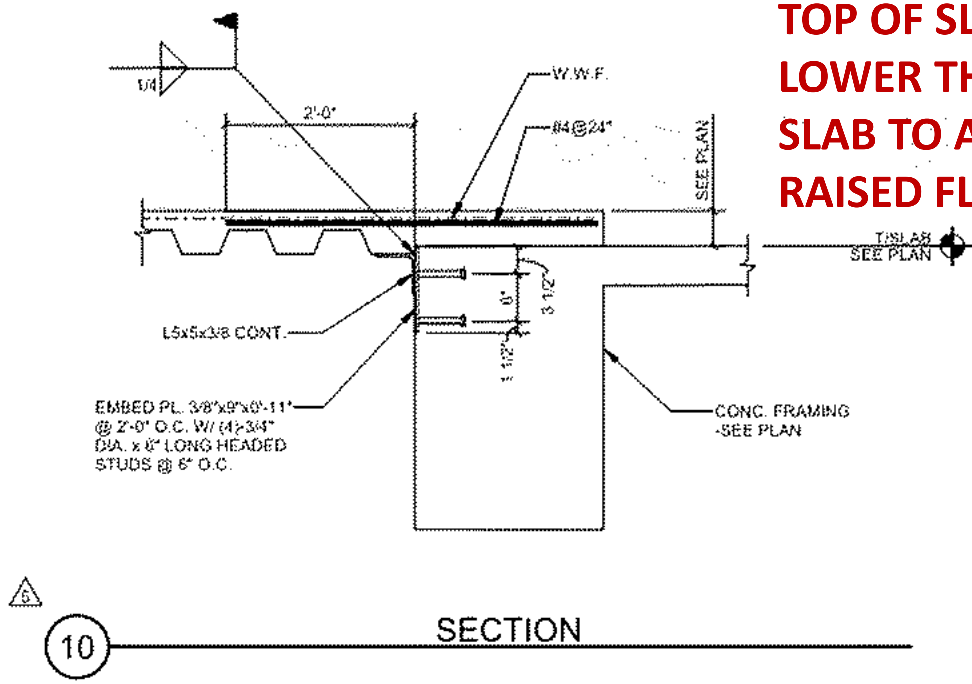
SLIP FORMING FOR CONCRETE SHEAR WALL CORES

STAYBOX REBAR SYSTEM FOR SLAB DOWELS



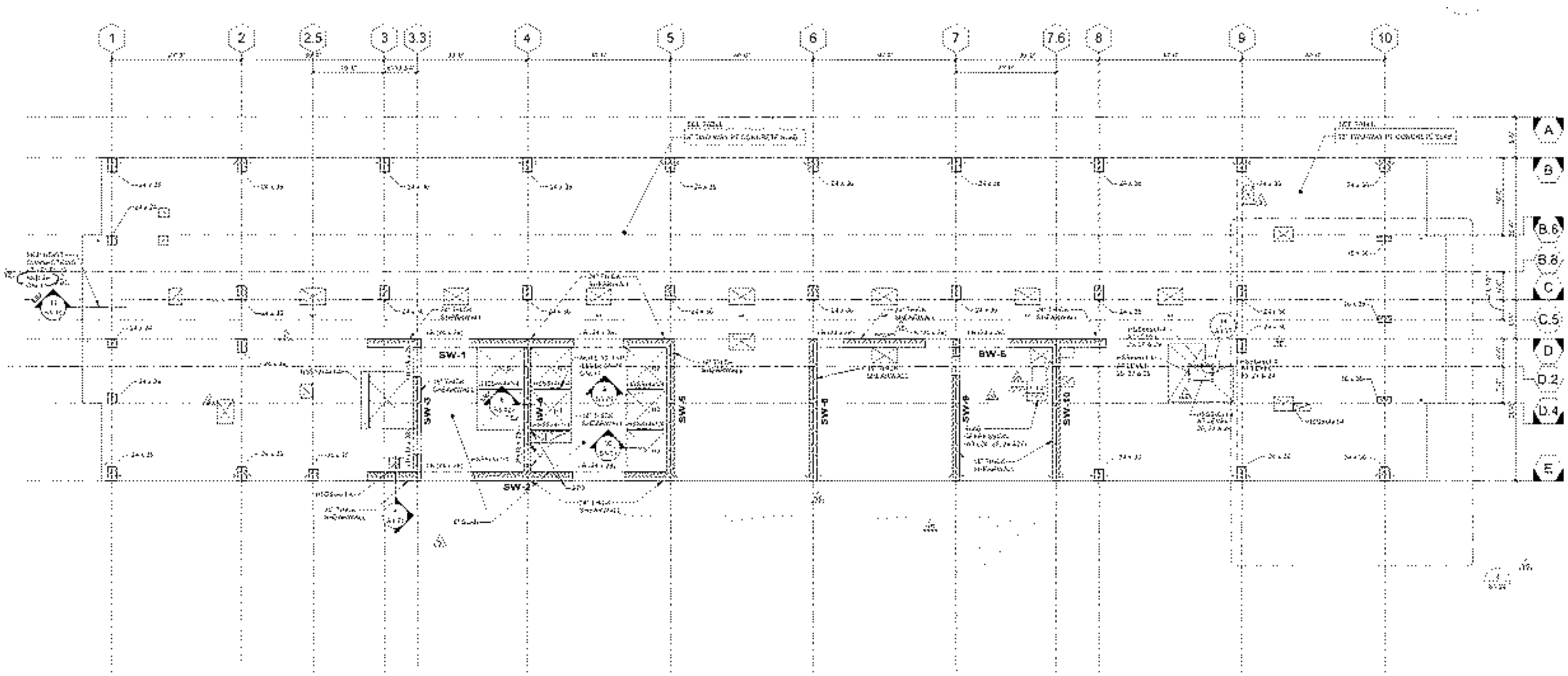
STEEL INFILL FRAMING AT CORE

STEEL FRAMING AND COMPOSITE STEEL DECK INSTALLED AFTER CONSTRUCTION OF SLIP FORMED CONCRETE CORE SHEAR WALLS. CONCRETE SLAB PLACED ON STEEL DECK AFTER CONCRETE FLOOR FRAMING CONSTRUCTION.



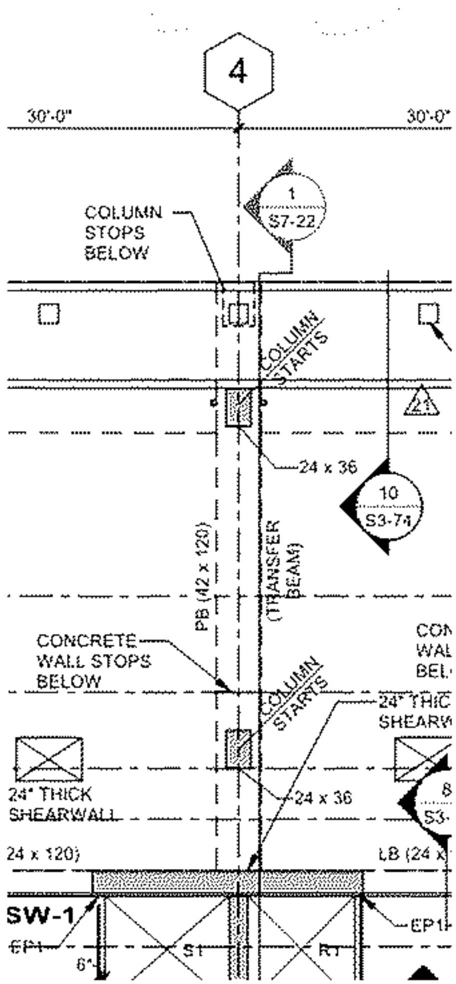
TOP OF SLAB 4-1/2" LOWER THAN TOP OF CORE SLAB TO ACCOMMODATE A RAISED FLOOR FOR RBC

CONCRETE ON STEEL DECK PLACED AFTER CONSTRUCTION OF CONCRETE FRAMING



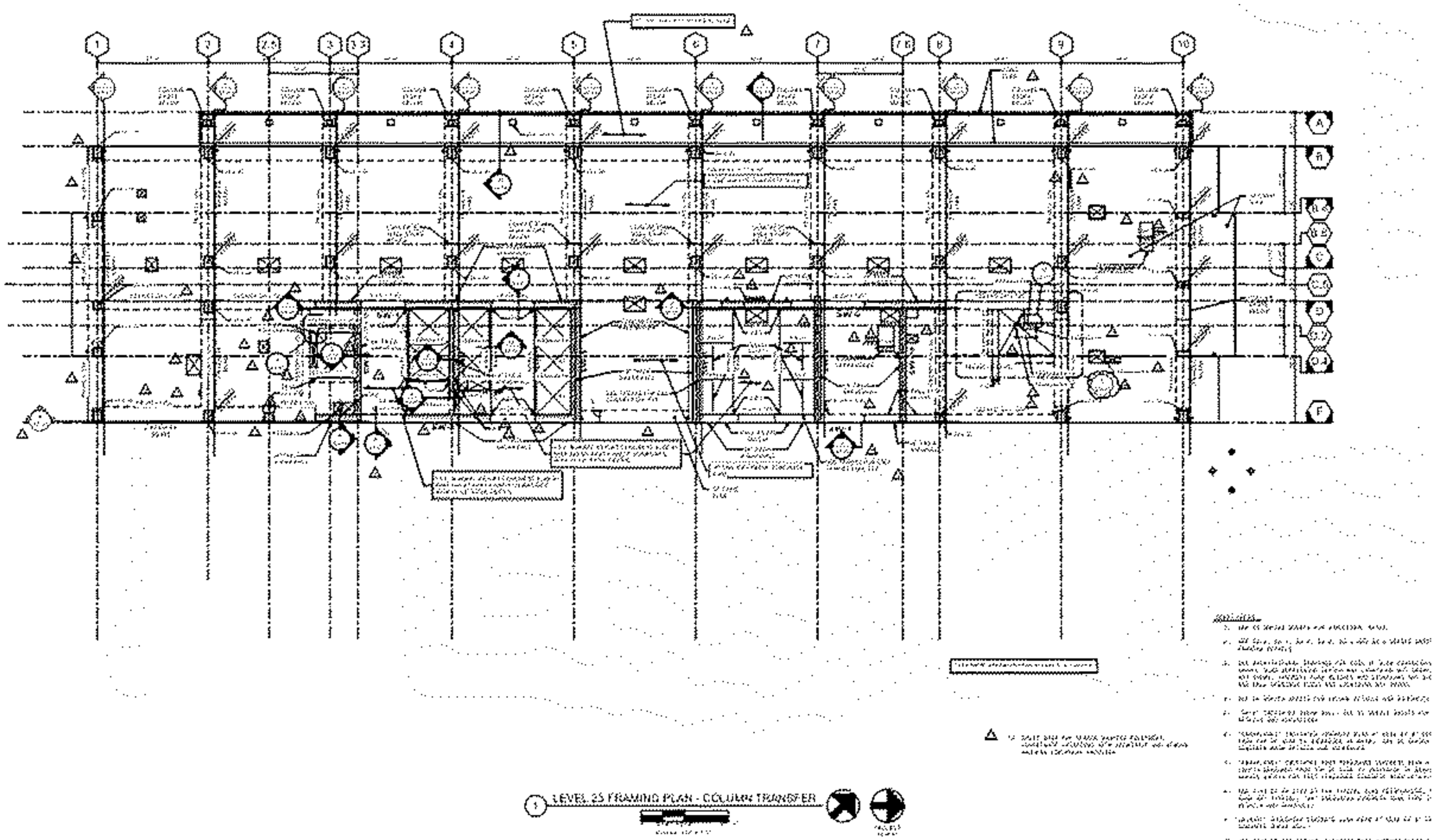
8” TWO-WAY POST-TENSIONED CONCRETE SLAB
LAYOUT OF COLUMNS DO NOT ALIGN WITH COLUMNS
OF OFFICE BUILDING BELOW

TYPICAL HOTEL FLOOR FRAMING PLAN



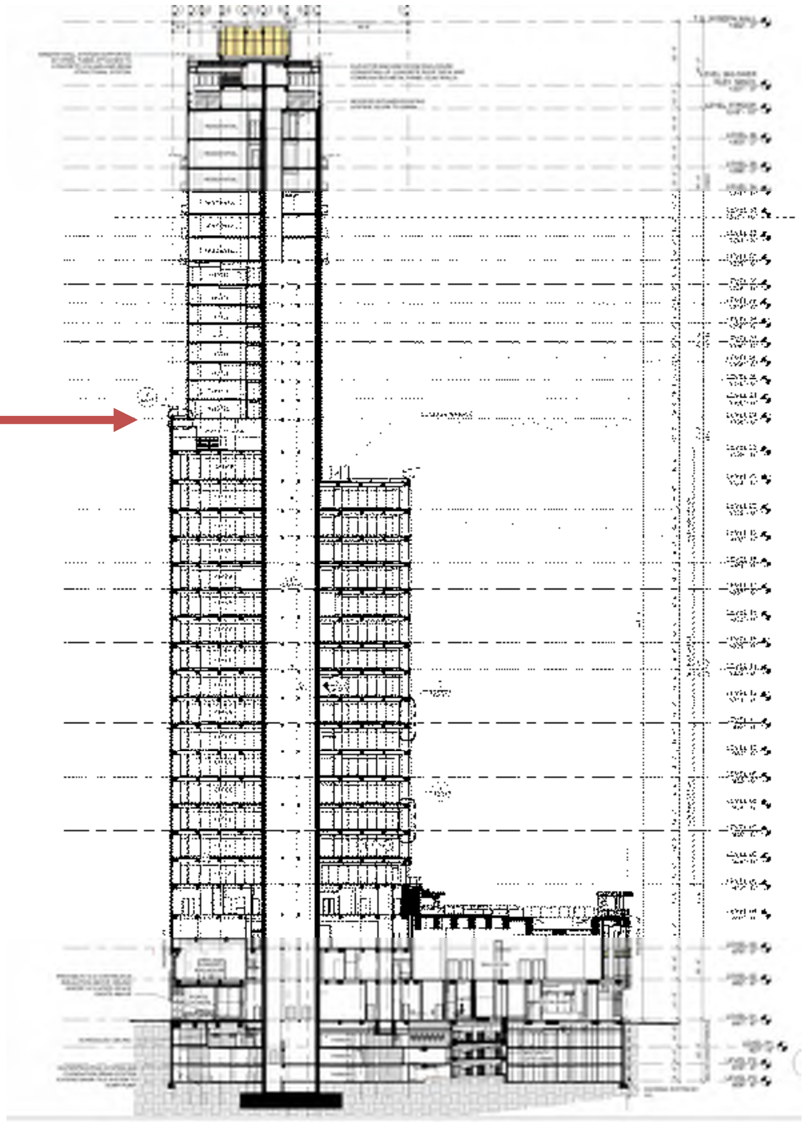
TRANSFER BEAM

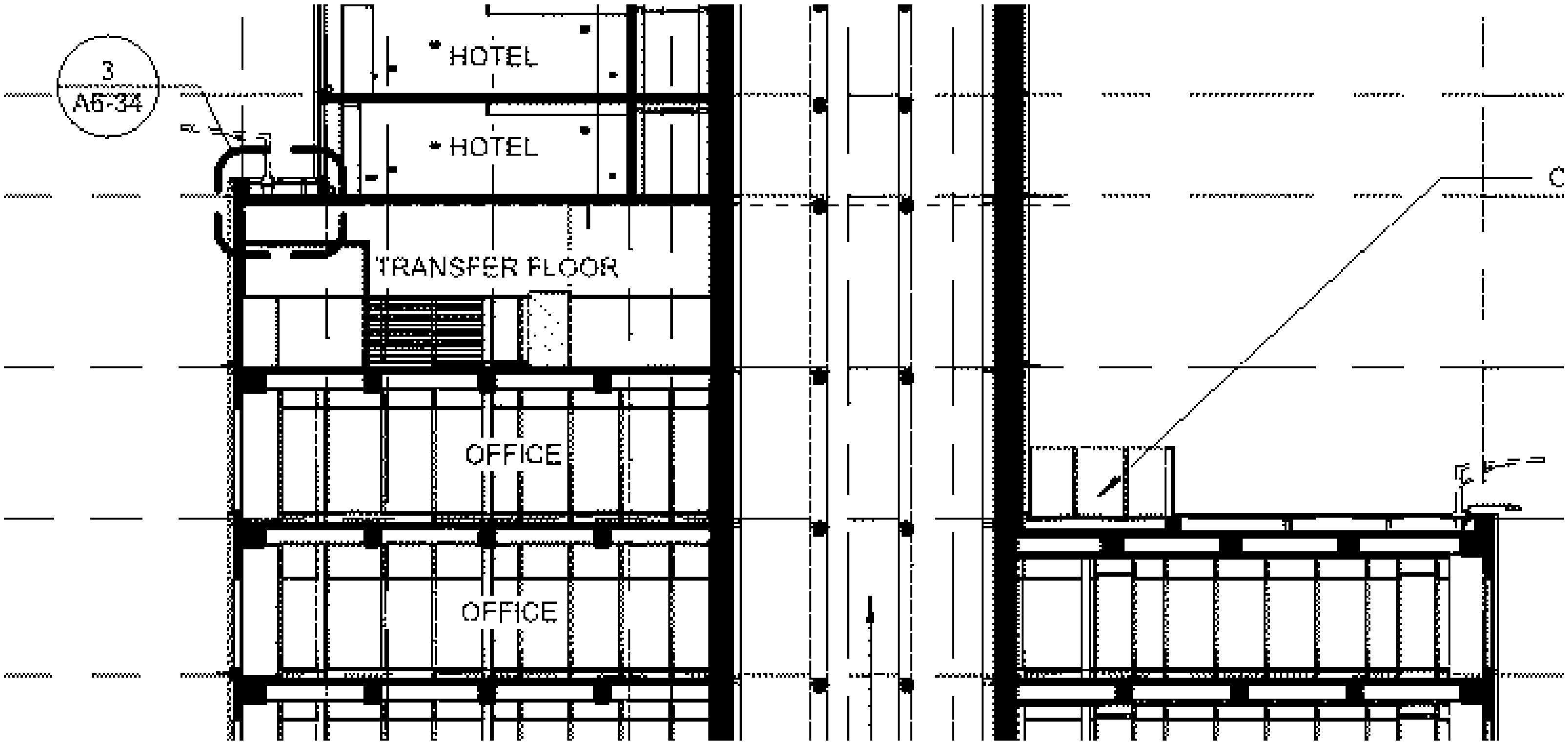
LAYOUT OF COLUMNS FOR RESIDENTIAL FLOORS WORK WELL WITH LAYOUT OF COLUMNS FOR HOTEL FLOORS. LAYOUT OF COLUMNS AT UPPER RESIDENTIAL AND HOTEL LEVELS DOES NOT WORK FOR THE OFFICE LEVELS. TRANSFER BEAMS REQUIRED TO TRANSFER LOADS FROM UPPER-LEVEL COLUMNS TO LOWER-LEVEL COLUMNS.



TRANSFER FLOOR AT LEVEL 23

TRANSFER FLOOR
AT LEVEL 23





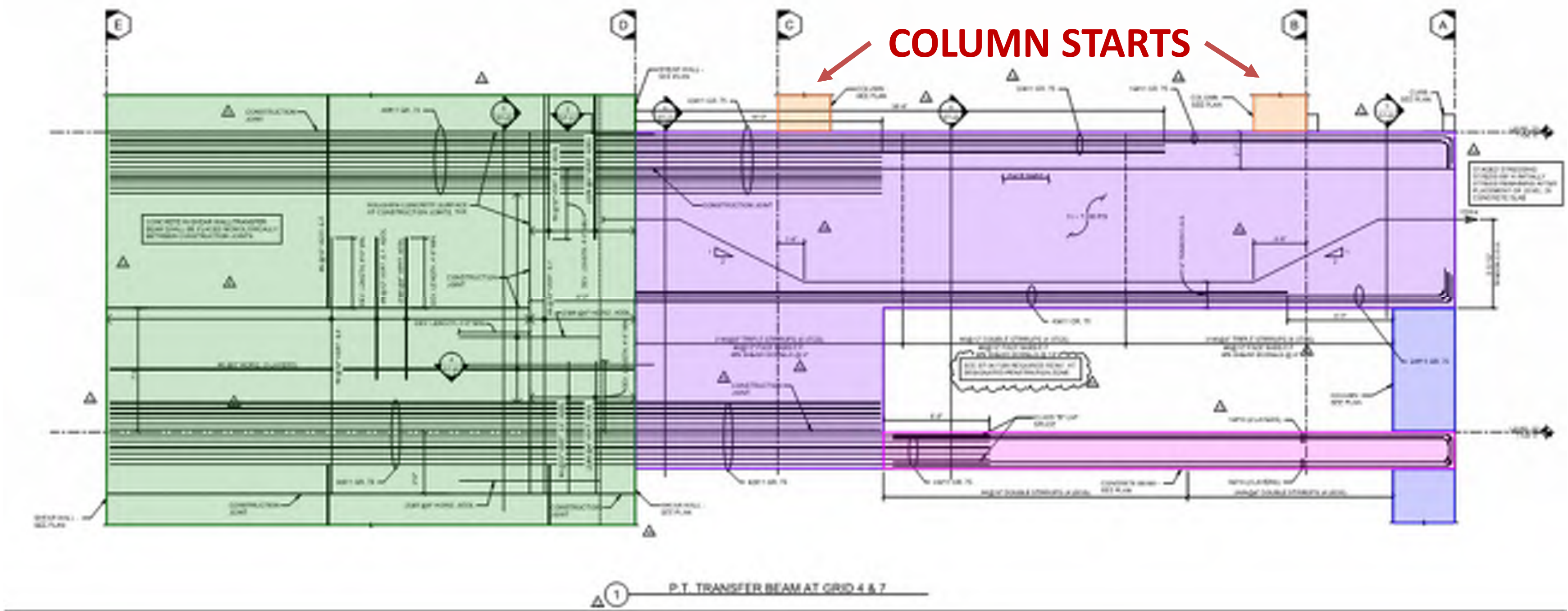
TRANSFER FLOOR AT LEVEL 23

SHEAR WALL

15’ DEEP PORTION OF TRANSFER BEAM

10’ DEEP PORTION OF TRANSFER BEAM

COLUMN STARTS



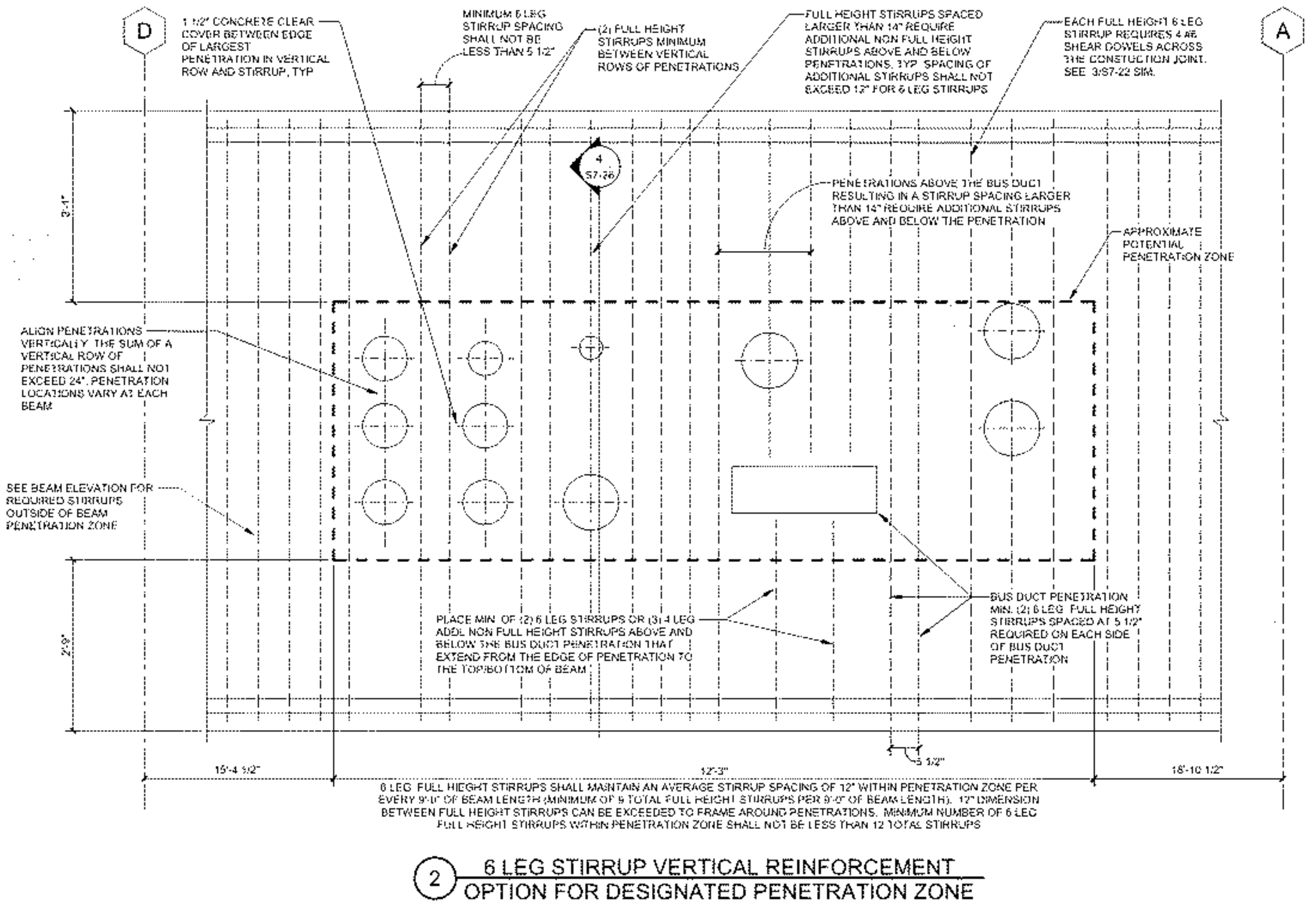
TRANSFER BEAM ELEVATION

TRANSFER BEAM

TRANSFER BEAM

TRANSFER BEAM

TRANSFER BEAM



DESIGNATED PENETRATION ZONES AT TRANSFER BEAMS

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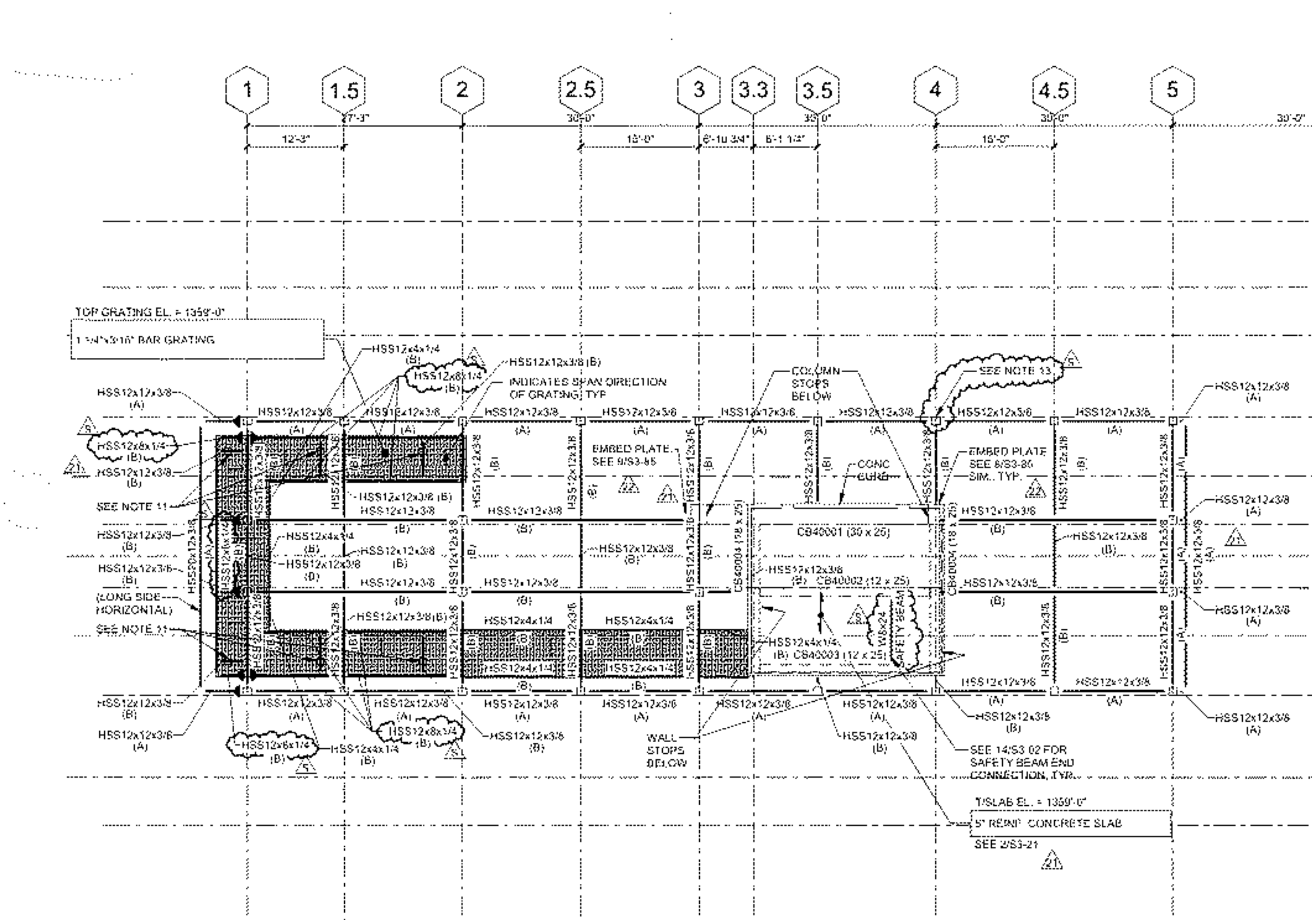
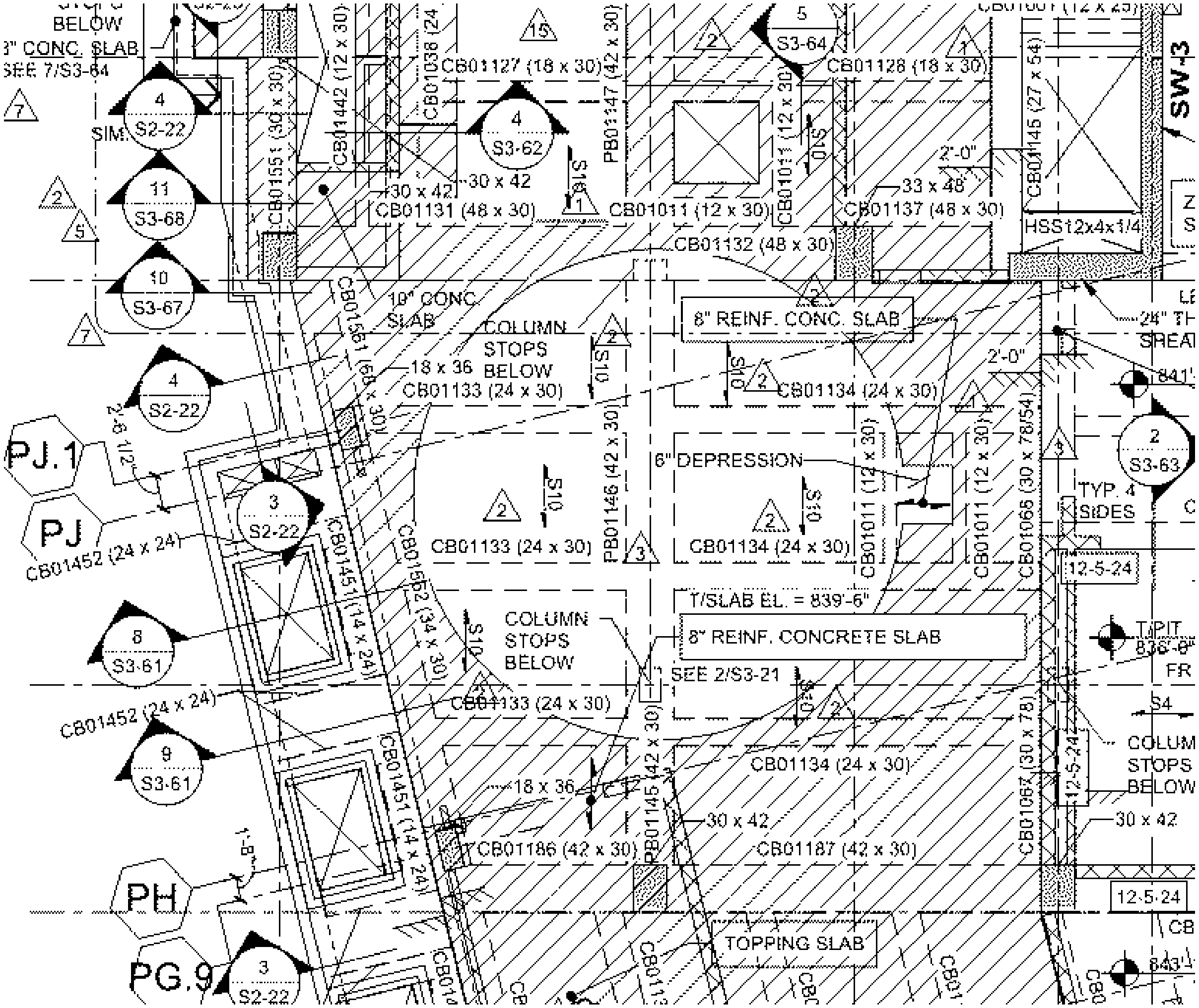
PENETRATIONS IN A TRANSFER BEAM



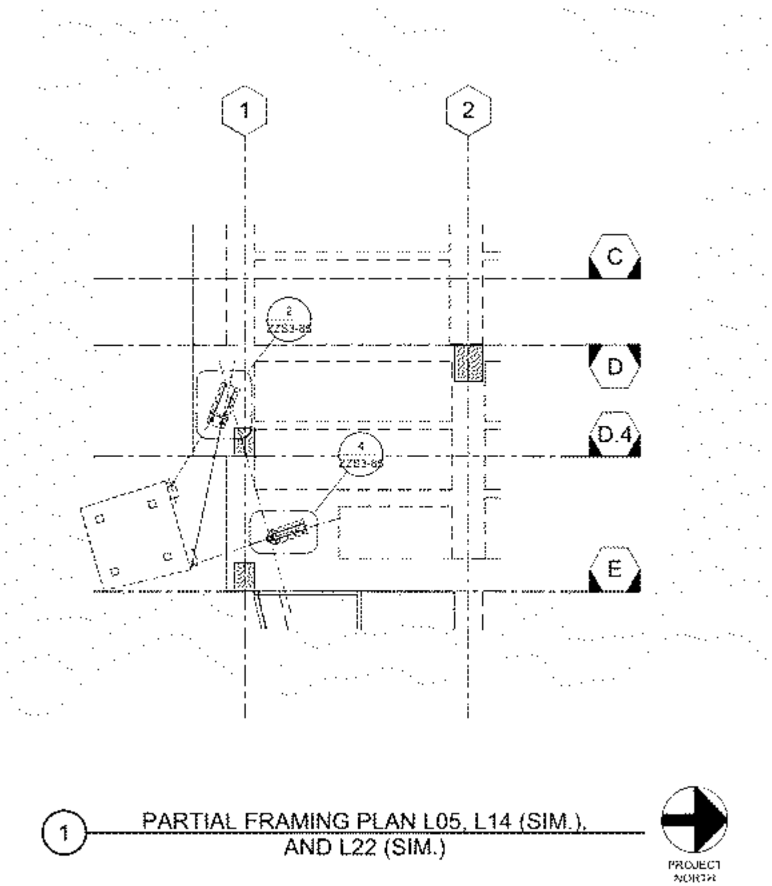
FRAMING AT THE TOP OF THE BUILDING

HSS FRAMING AT THE TOP OF THE BUILDING

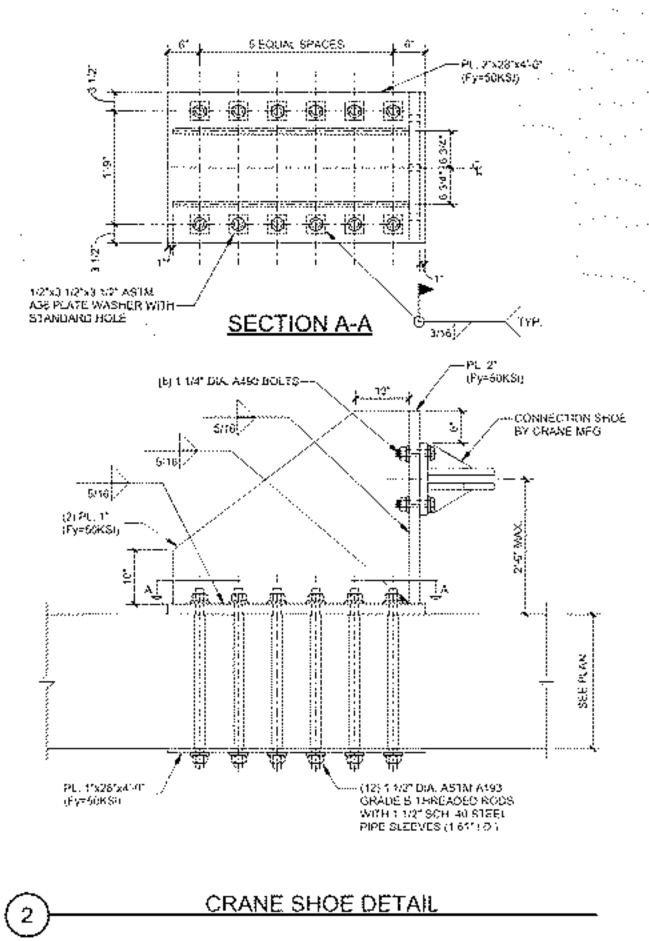


TRUCK TURNTABLE AT LOADING DOCK

TRUCK TURNTABLE AT LOADING DOCK



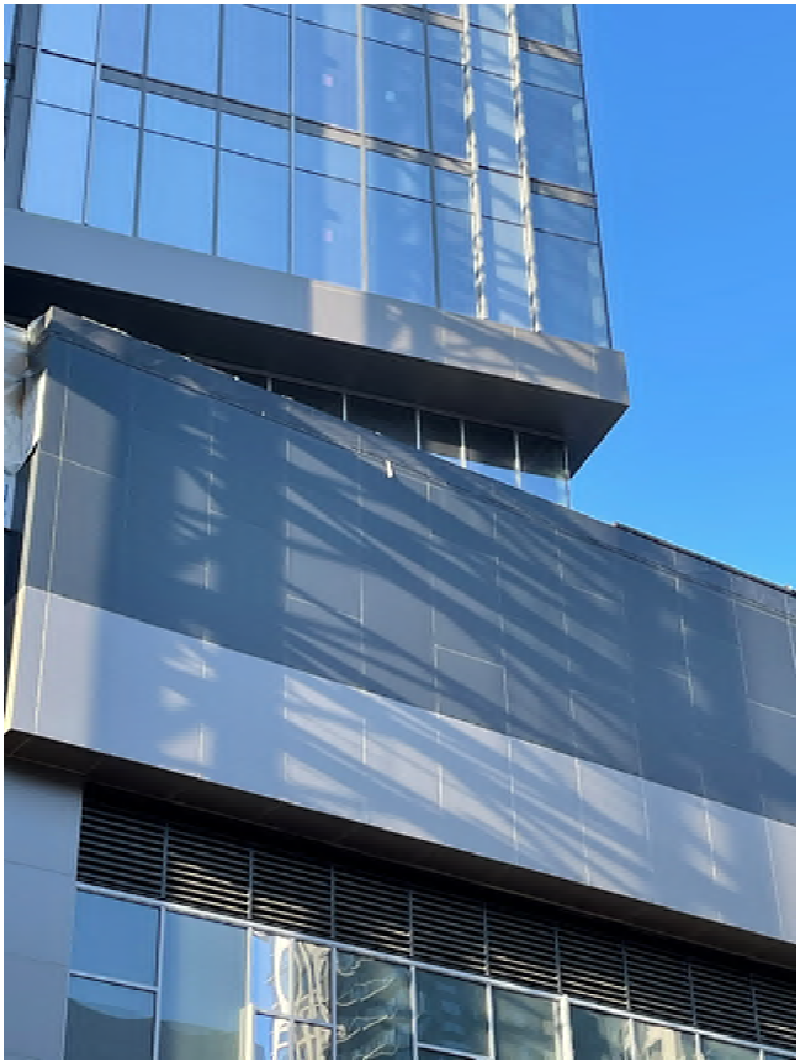
1 PARTIAL FRAMING PLAN L05, L14 (SIM.), AND L22 (SIM.)



2 CRANE SHOE DETAIL

TOWER CRANE TIE-IN

TOWER CRANE TIE-IN



THE END OF STRUCTURAL ENGINEERING PRESENTATION

Construction Highlights

Slip Form Core Construction

Slip-Form Concrete Core Construction

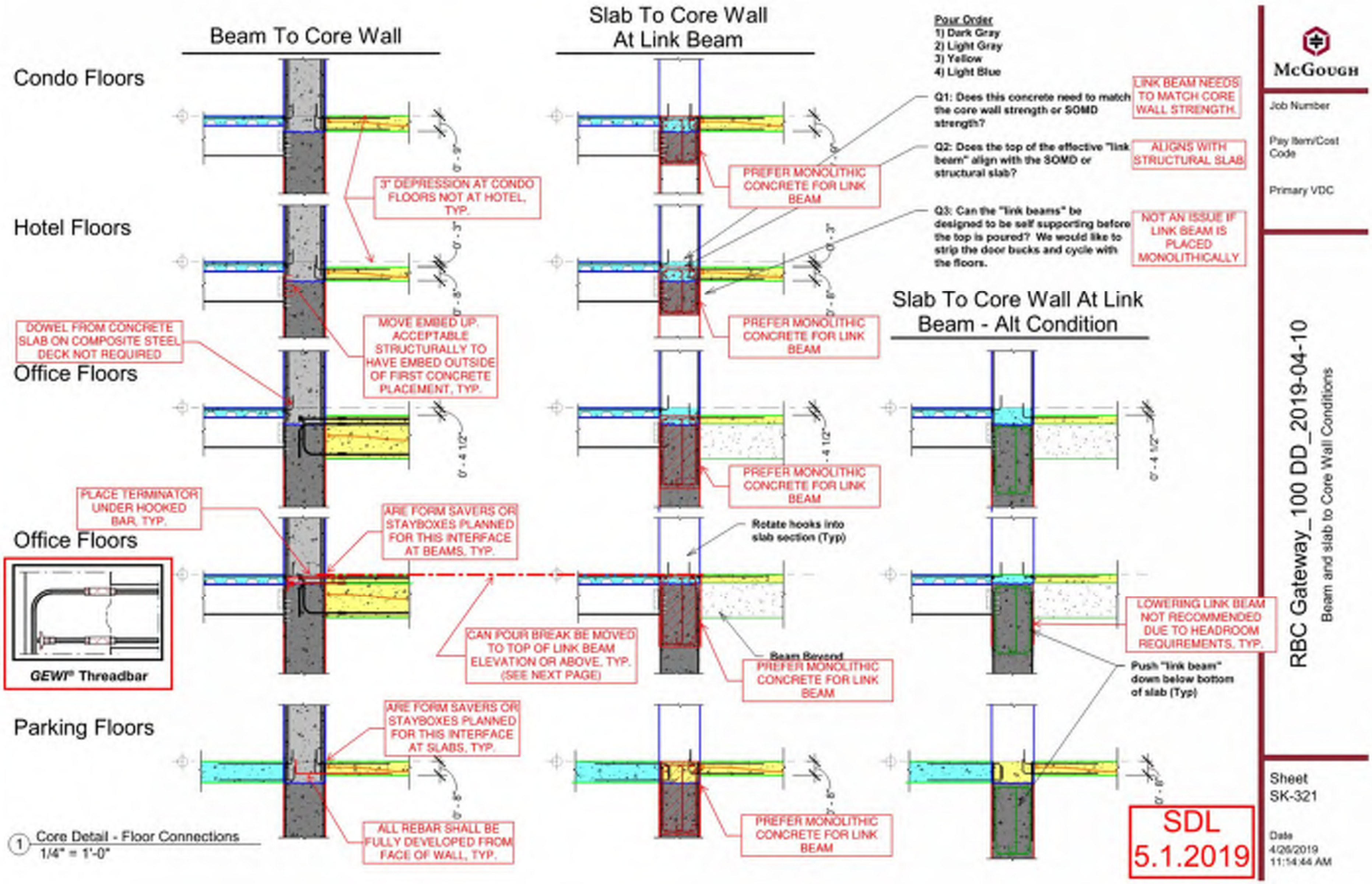
Attributes

- **Better concrete placement approach with placing boom on core**
- **Controlled weather environment with a vertical traveling form system**
- **"Core ahead" approach decouples critical path items such as decks and core**
- **Leveled manpower for the Contractor**

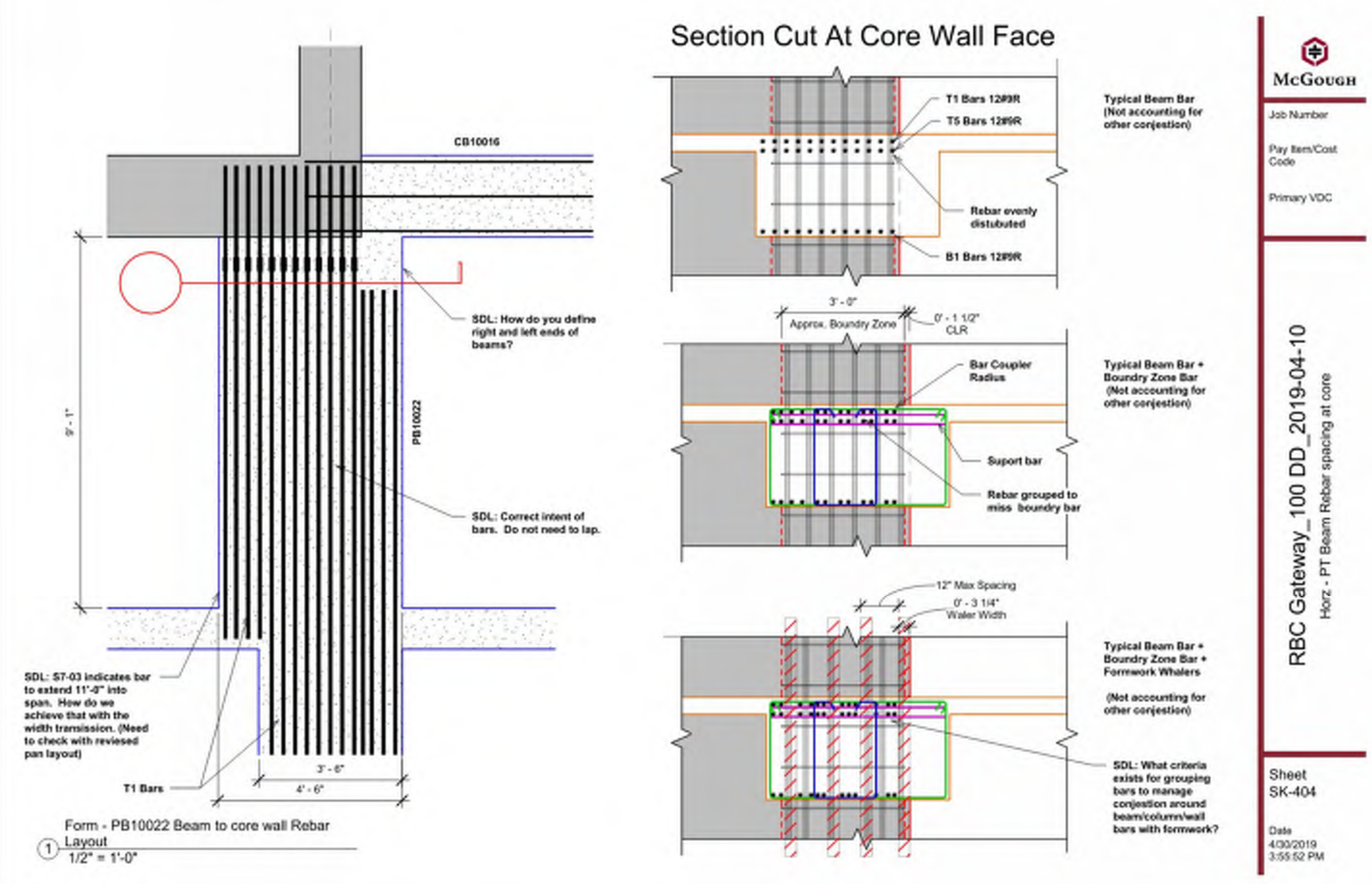
Challenges

- **Beam/deck interface with core and constructability detailing**
- **Transfer floor constructability**
- **Core configuration changes**
- **Interior deck changes**

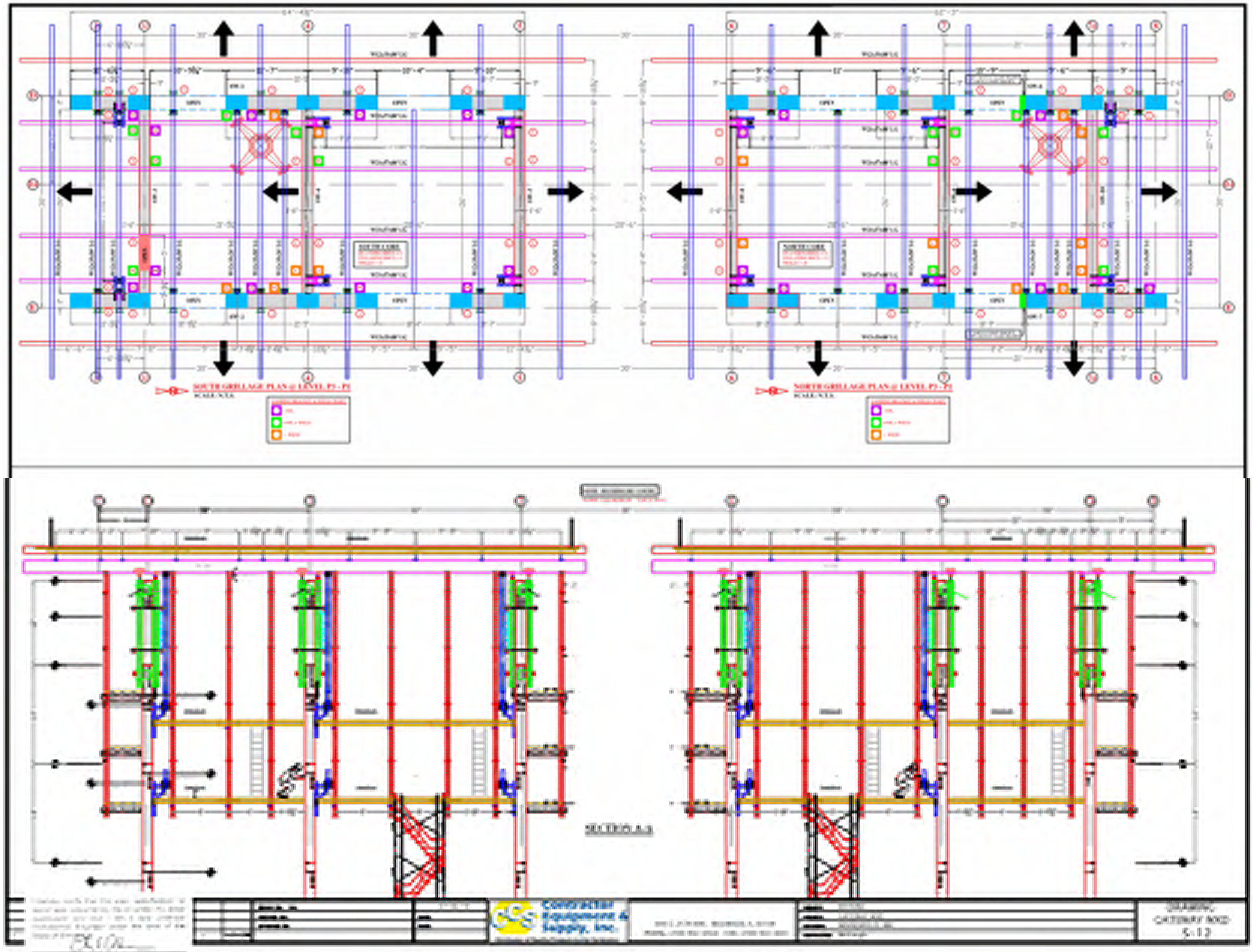
RBC – Gateway: Core Construction



RBC – Gateway: Core Construction



RBC – Gateway: Core Construction



RBC – Gateway: Core Construction

Beam pocket and core system

General bar congestion and concrete elements

RBC – Gateway: Core Construction

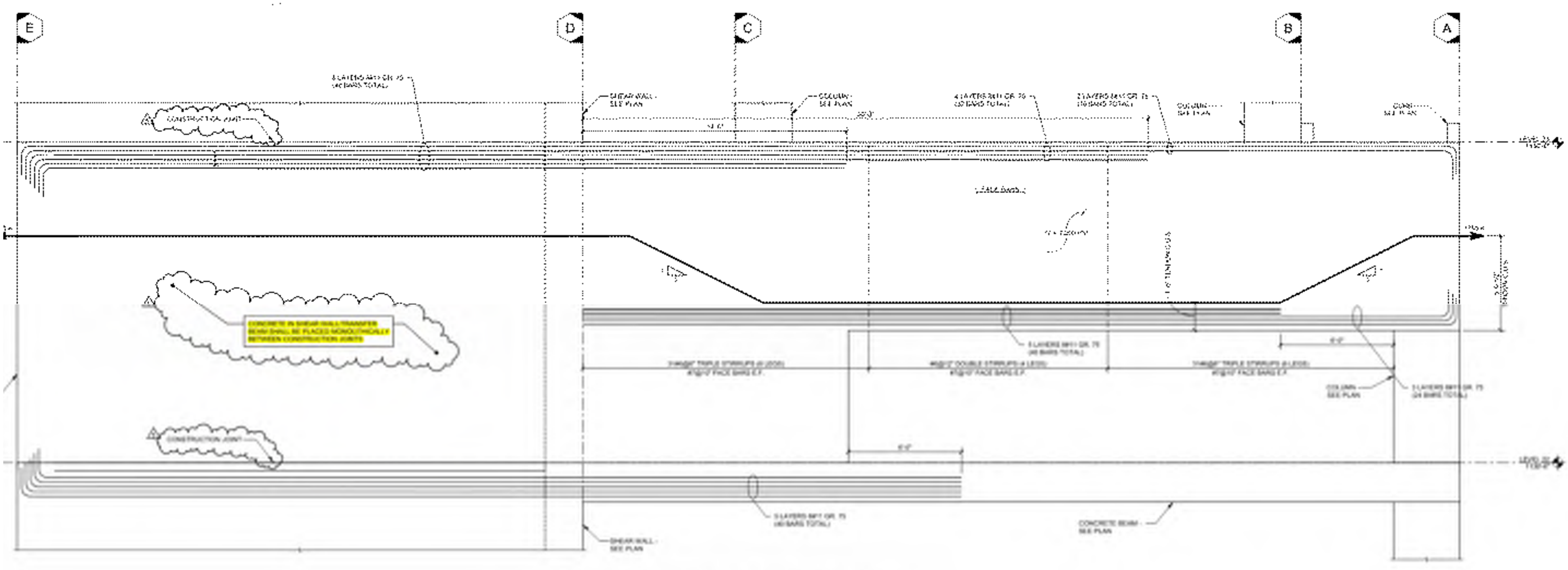
RBC – Gateway: Core Construction

Transfer Floor Construction

RBC – Gateway: Transfer Floor

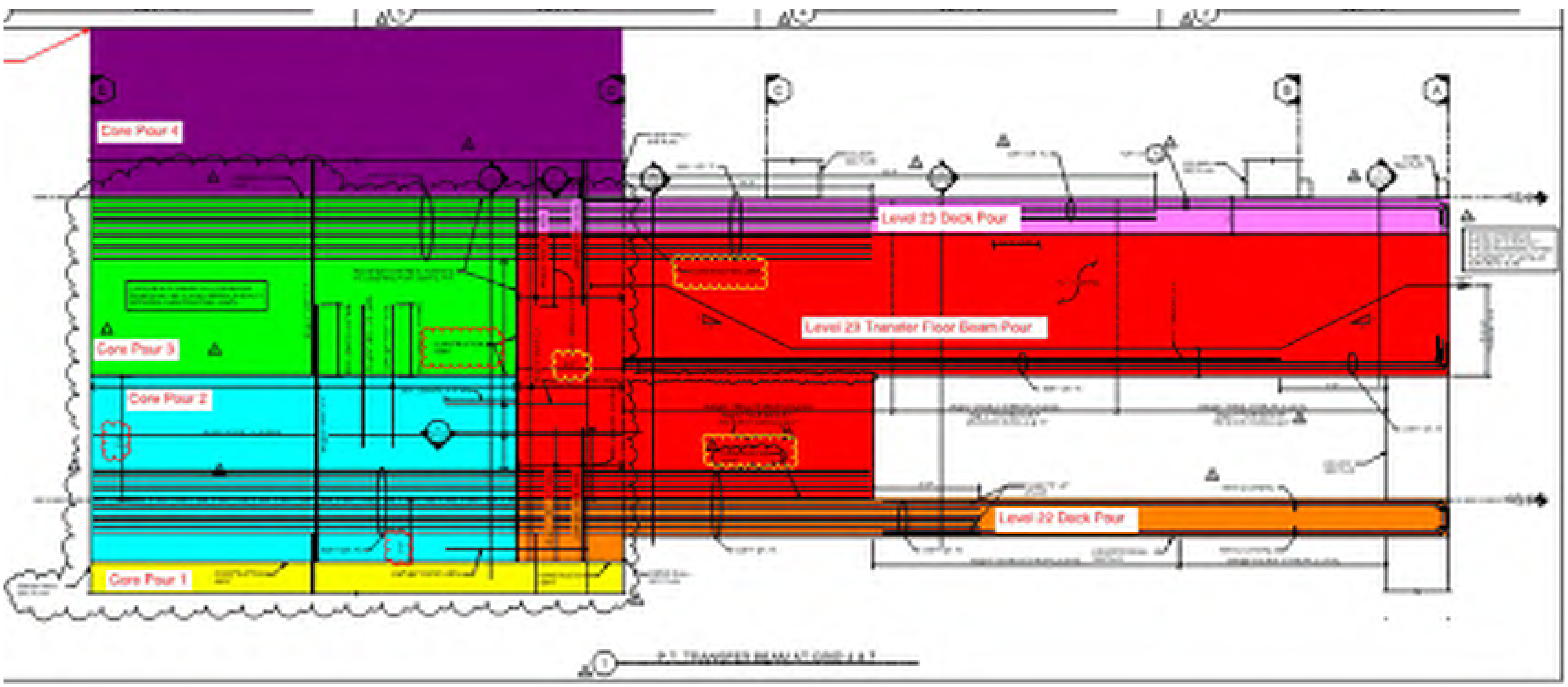
- **Concrete in shear wall/transfer beam to be placed monolithically was first denoted in CP-4 (1/20/2020) (68 total #11 bars top and bottom)**

- **Constraints with the approach indicated in the structural drawings**
  - **Core formwork was ahead of deck.**
  - **CJ to CJ height of 17'. Self climbing system can only place in lifts up to 14'10"**
  - **Would require outside face of core formwork system to be removed and re-installed to accommodate being placed monolithically.**
  - **Three shear walls increasing in width.**

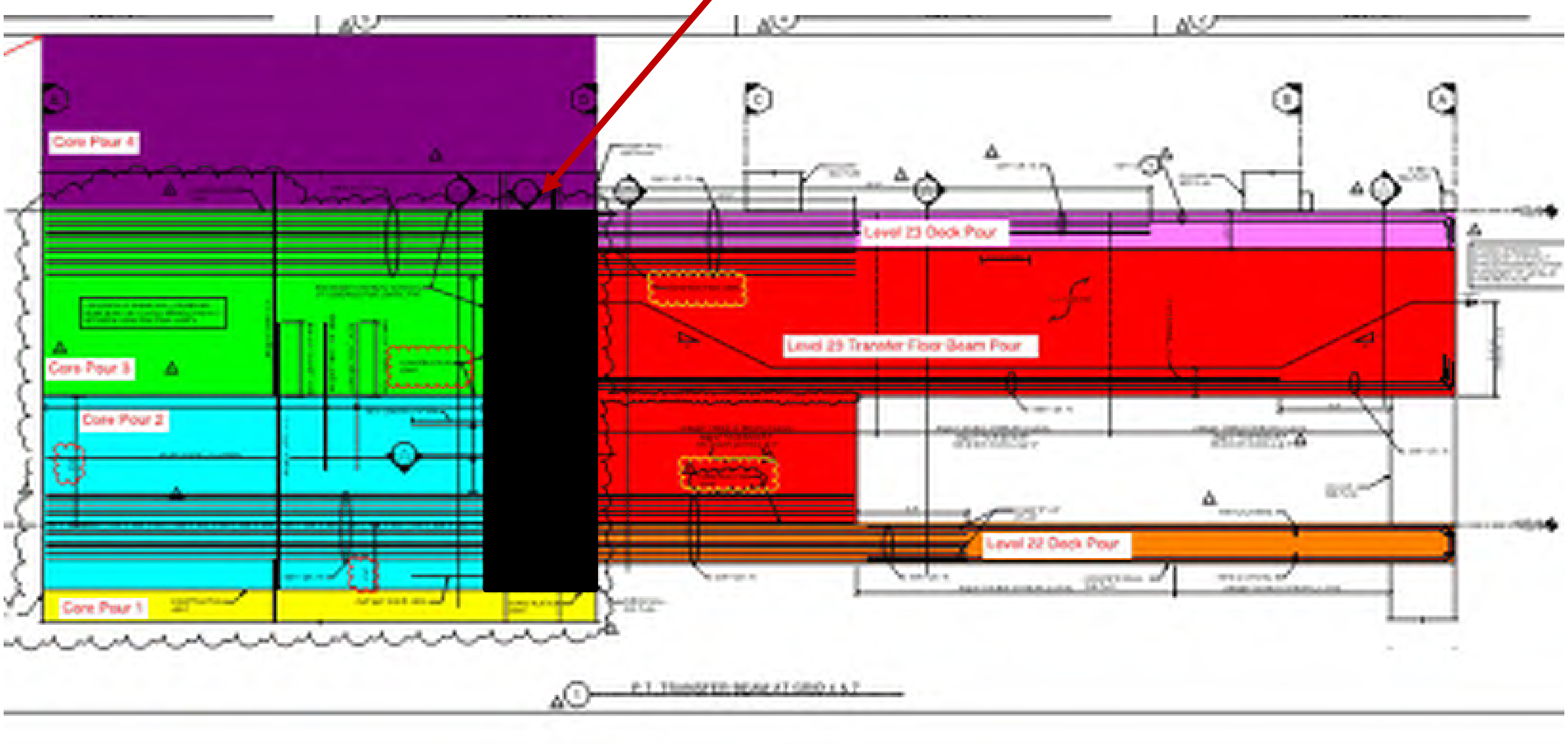


2 P.T. TRANSFER BEAM AT GRIDS 4, 5, 6, & 7

Construction Sequence of the Transfer Floor with Core/decks and beams

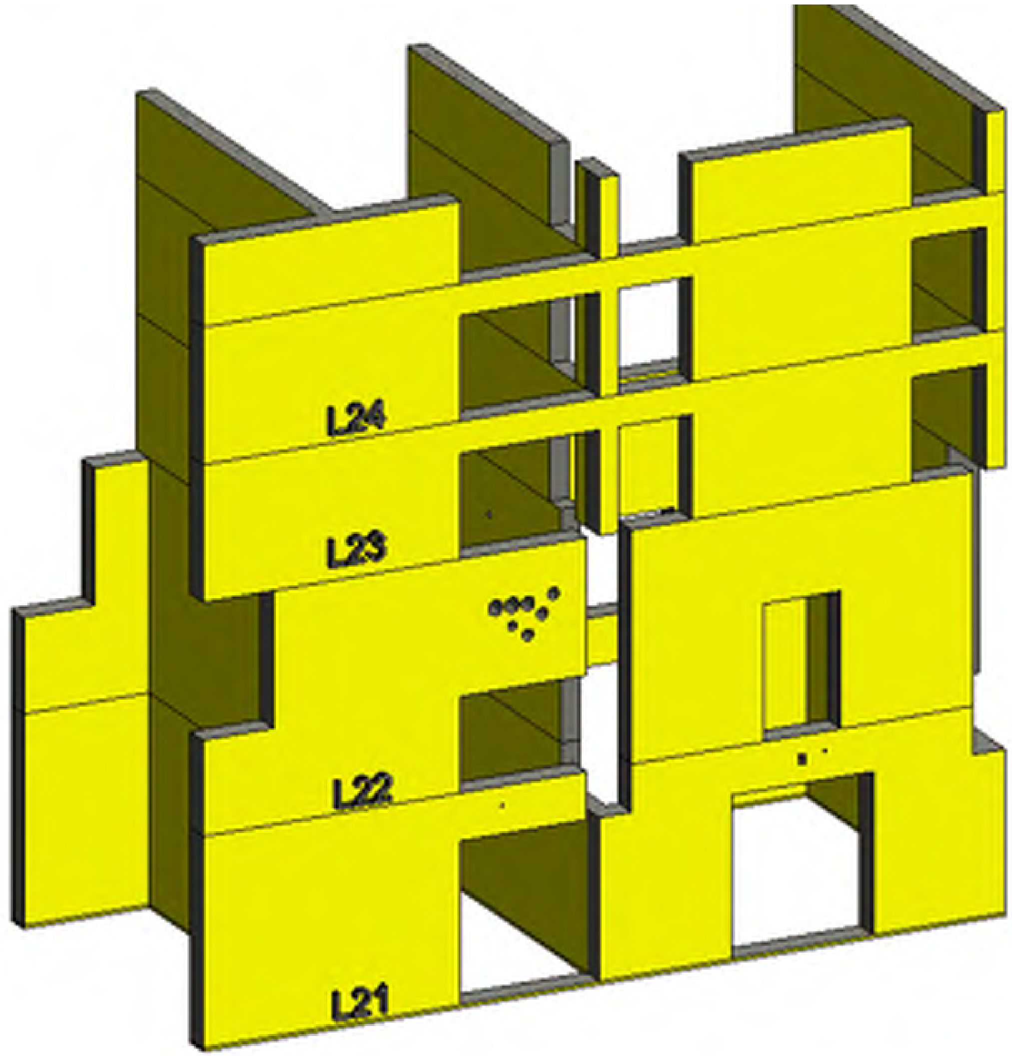


6'-0" Deep Pocket Into Core Wall



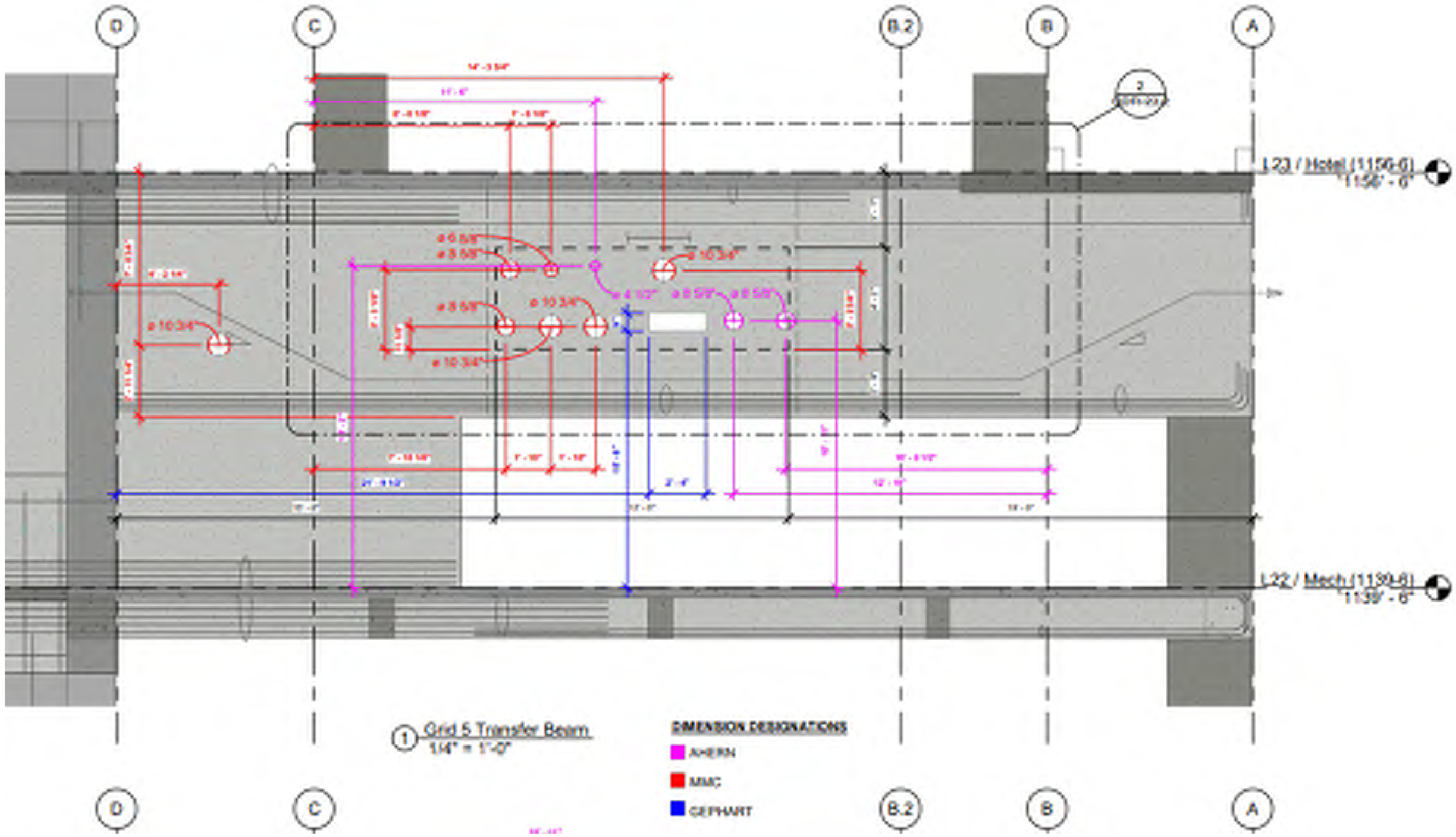
RBC – Gateway: Transfer Floor

McGough Model identified a cantilever condition when the box-outs within the core were introduced.



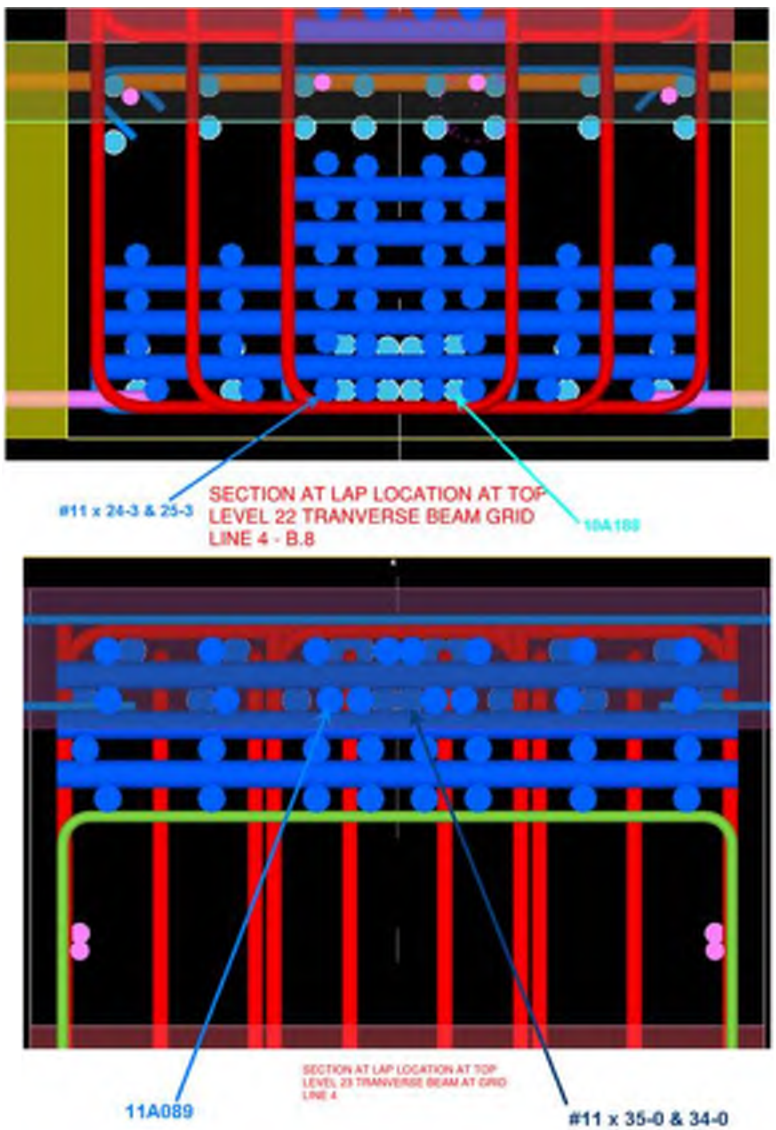
RBC – Gateway: Transfer Floor

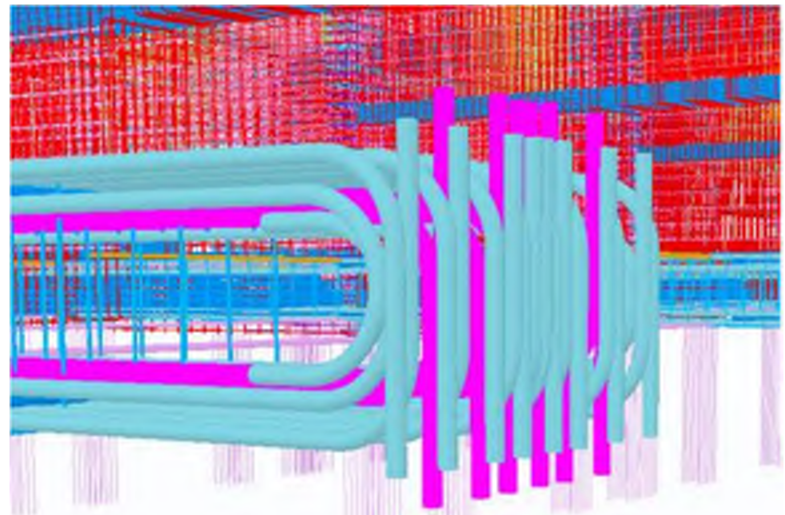
Transfer Beam Sleeve Penetrations



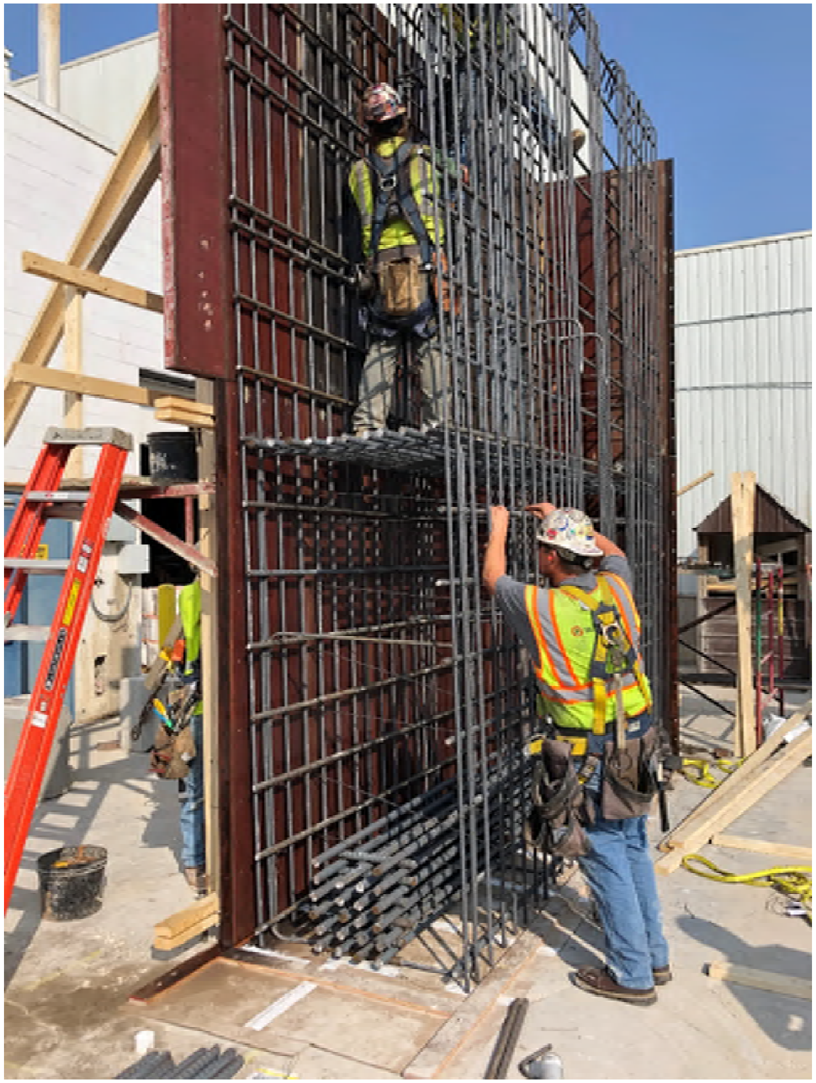
RBC – Gateway: Transfer Floor

Items the Rebar Model assisted in solving prior to physical work;





RBC – Gateway: Transfer Floor – Full Scale Mock Up



RBC – Gateway: Transfer Floor – Full Scale Mock Up

RBC – Gateway: Transfer Floor

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