



Stanley D. Lindsey
and Associates, Ltd.

1966
SDL
S



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

RBC - Gateway



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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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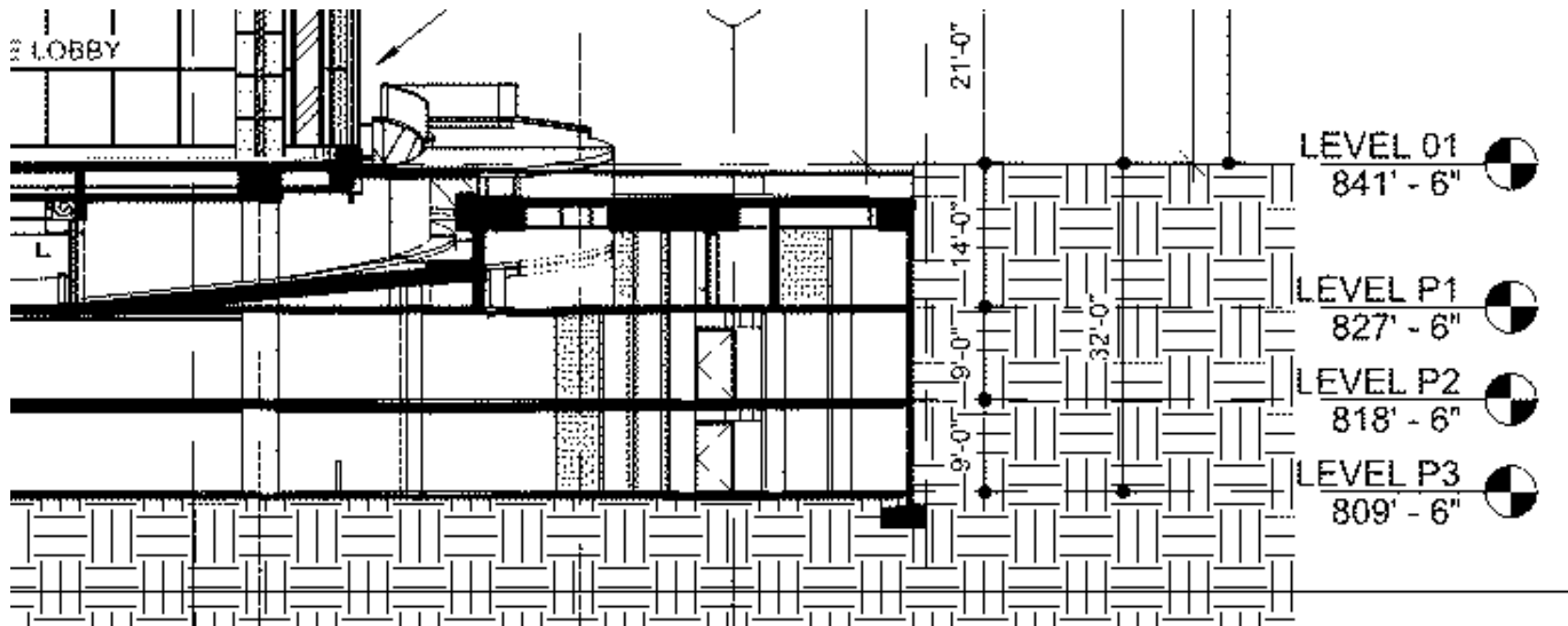


Engineering Overview

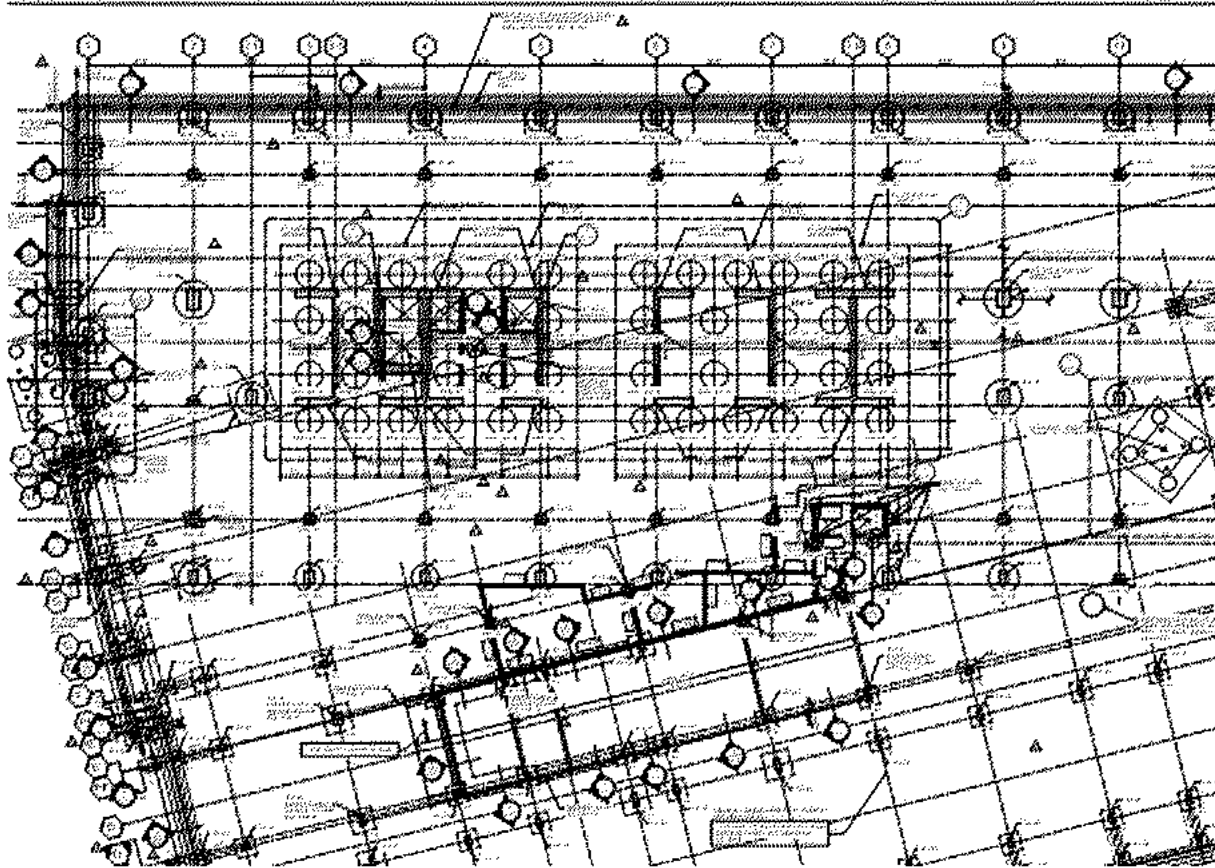
What are the responsibilities of structural engineers?

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

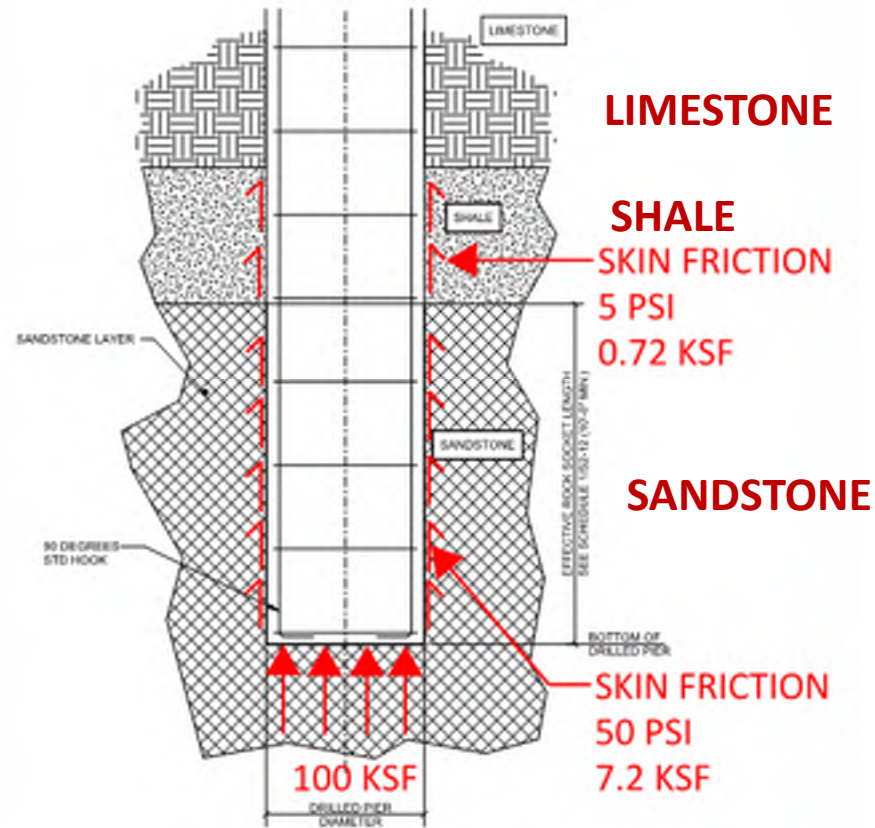
STRUCTURAL ENGINEERING



THREE LEVELS OF BELOW GRADE PARKING



FOUNDATION PLAN



**DRILLED PIER ELEVATION
MAXIMUM SOCKET LENGTH = 40 FEET**



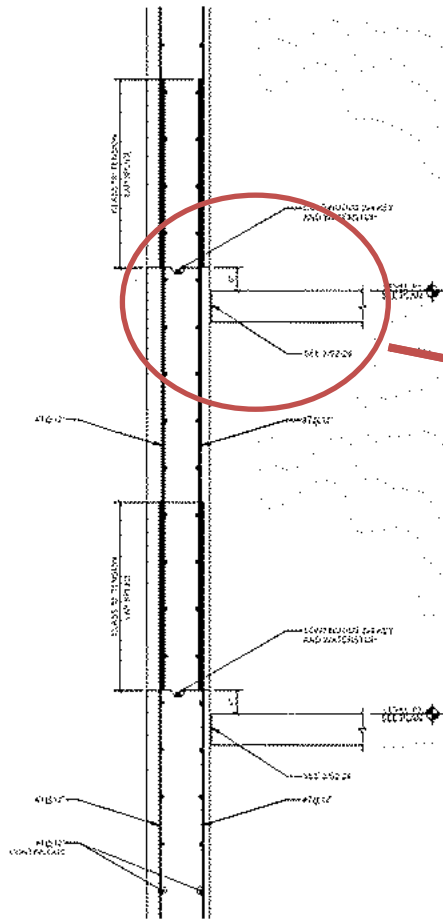
**MAT AT SHEAR WALL CORE
8 FEET THICK**



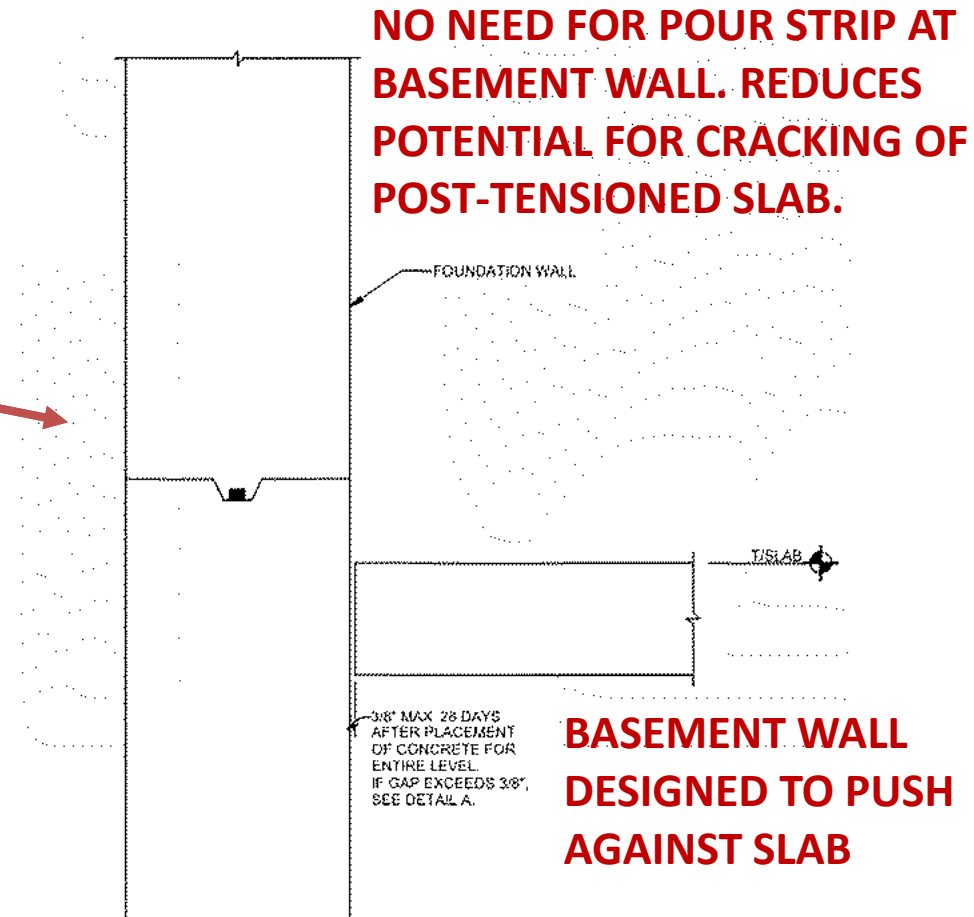
**MAT AT SHEAR WALL CORE
2 LAYERS GR75 #11@6" AT BOTTOM AND GR75 #11@6" TOP**



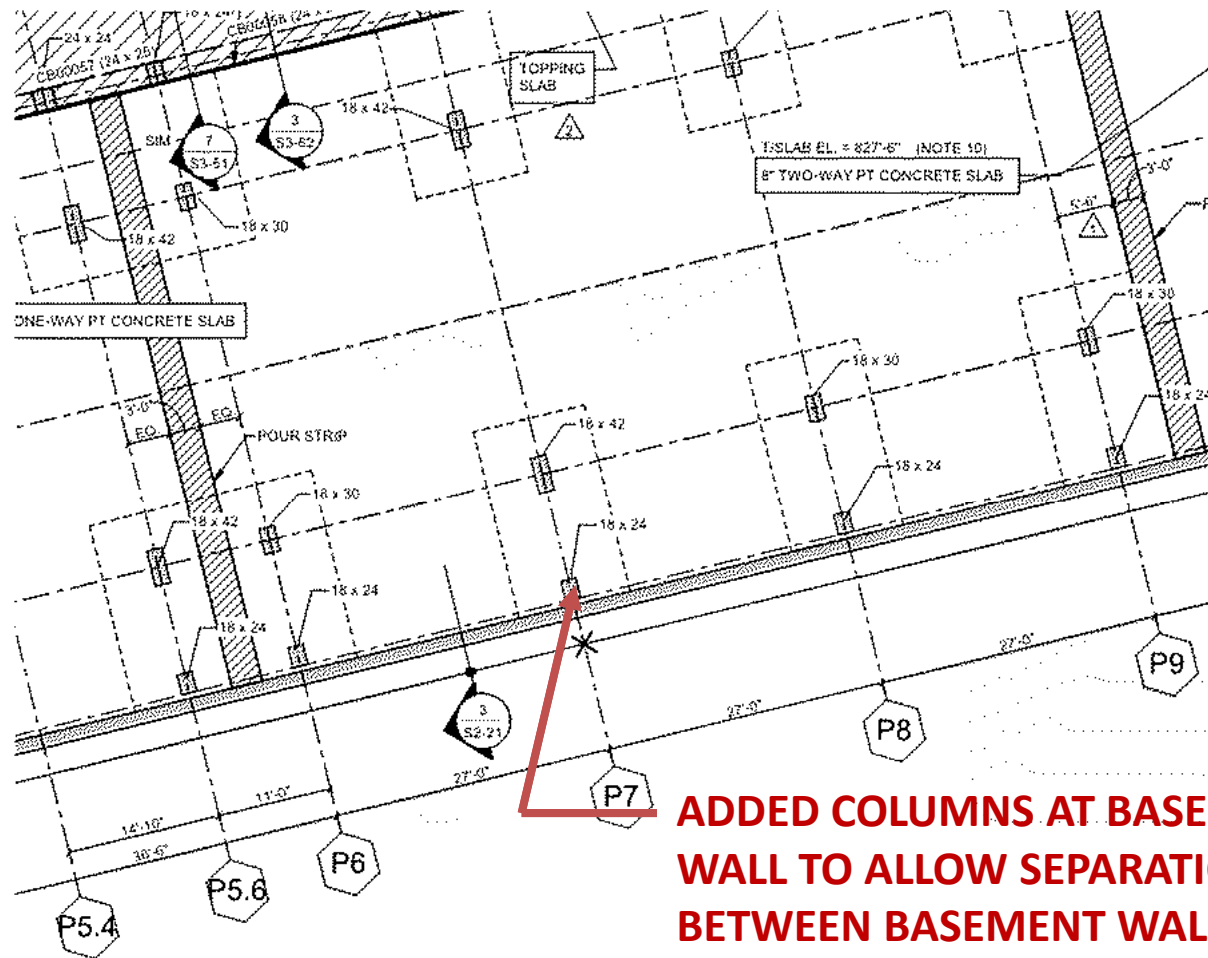
**POUR STRIP – NO INTERMEDIATE
STRESSING ANCHORS**



BASEMENT WALL SECTION

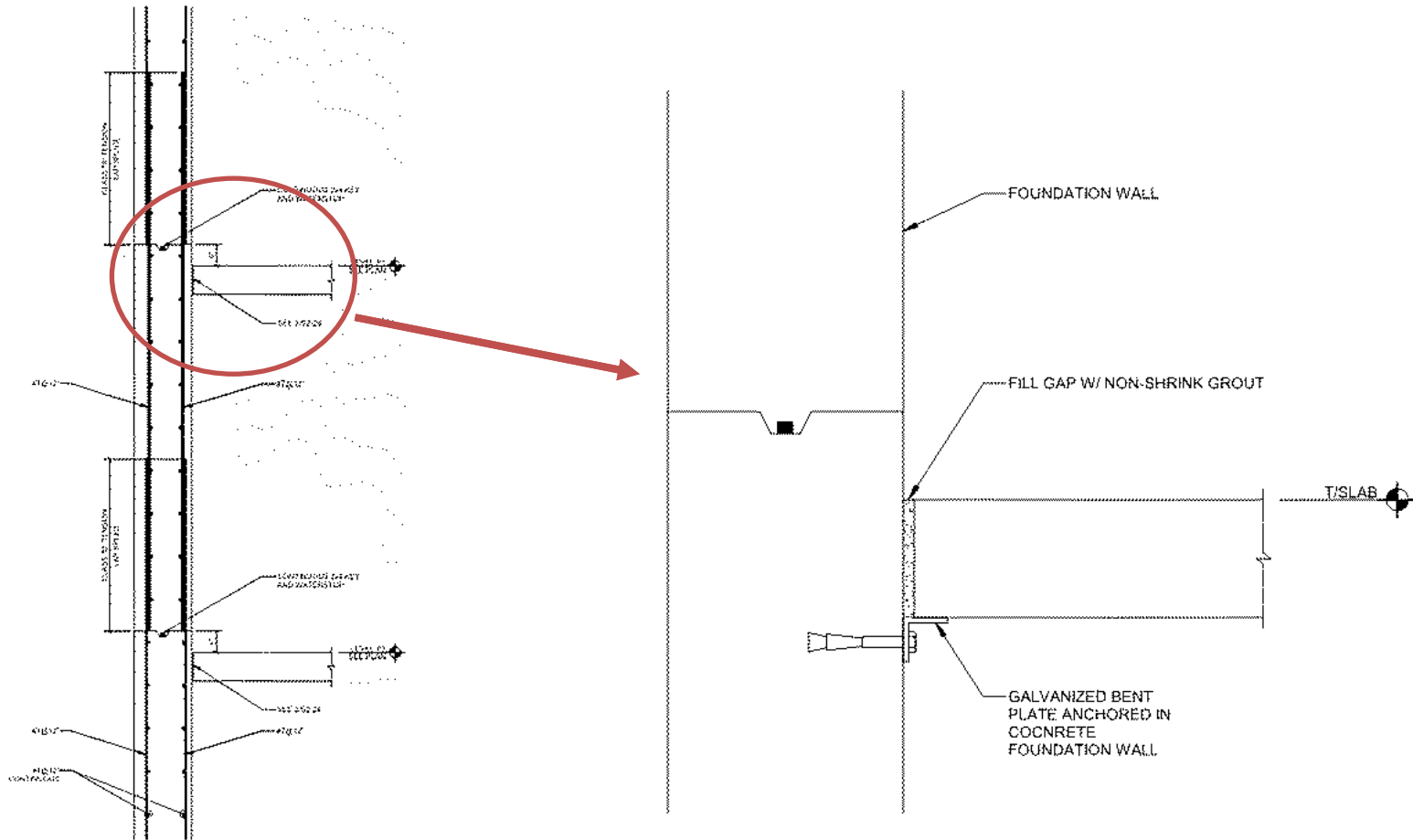


BASEMENT WALL IS NOT TIED INTO BELOW GRADE PARKING DECK SLAB



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

BELOW GRADE PARKING LEVEL

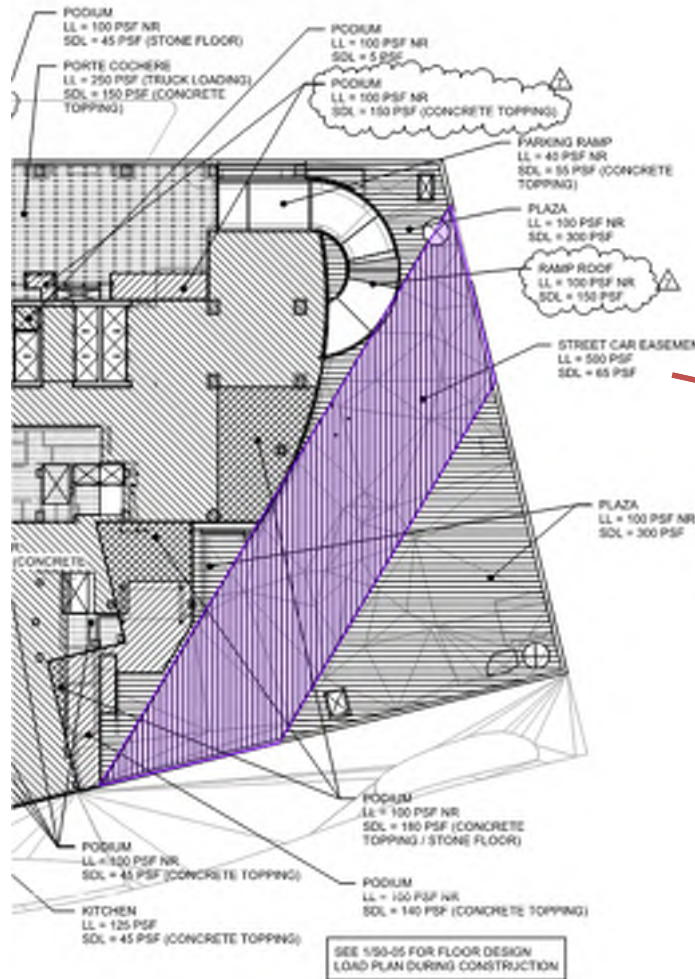


BASEMENT WALL SECTION

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



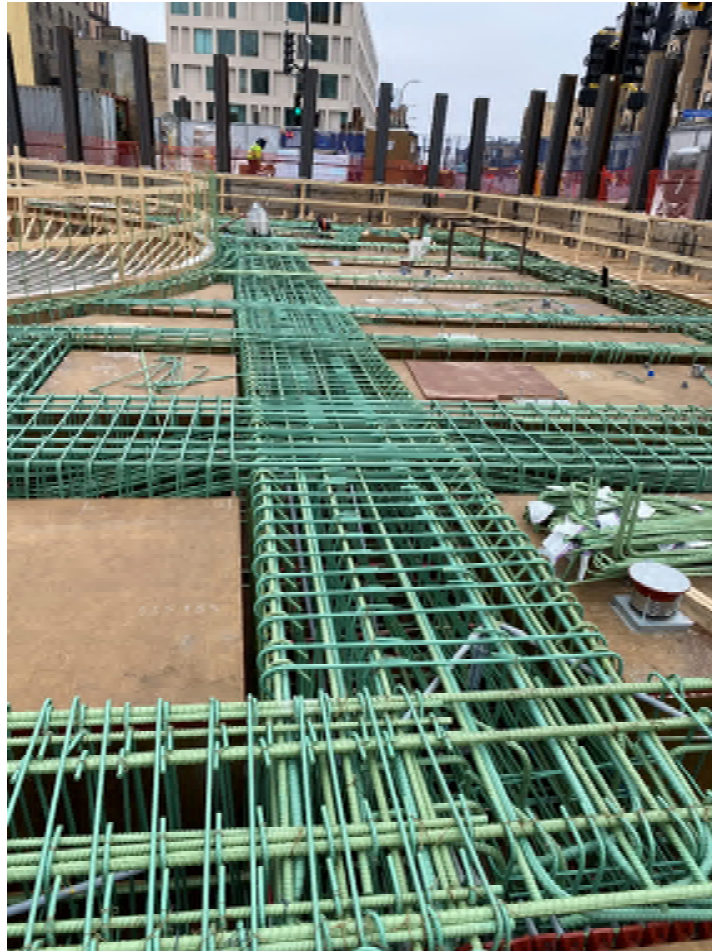
EPOXY COATED REINFORCING STEEL AT EXPOSED AREAS



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

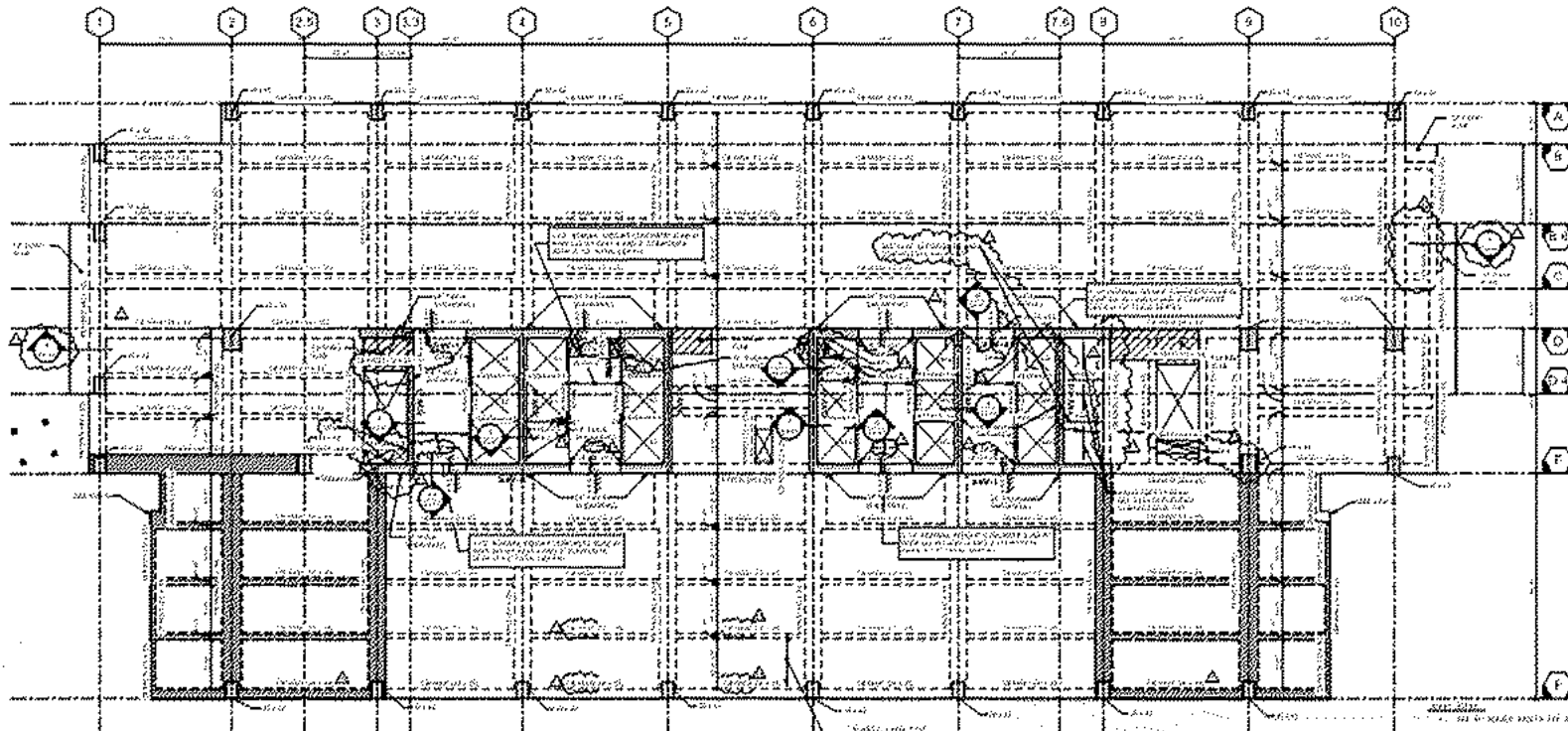
**STREETCAR EASEMENT
LL = 500 PSF
SDL = 65 PSF**

**FLOOR DESIGN LOAD PLAN
AT PLAZA LEVEL**



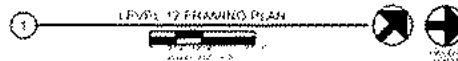
FRAMING AT STREETCAR EASEMENT

SHEAR WALL CORES



**30"-DEEP AT LONG
CANTILEVERS**

25"-DEEP TYPICAL



- 1. SEE SHEAR WALLS FOR REINFORCING DETAILS.
- 2. SEE 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

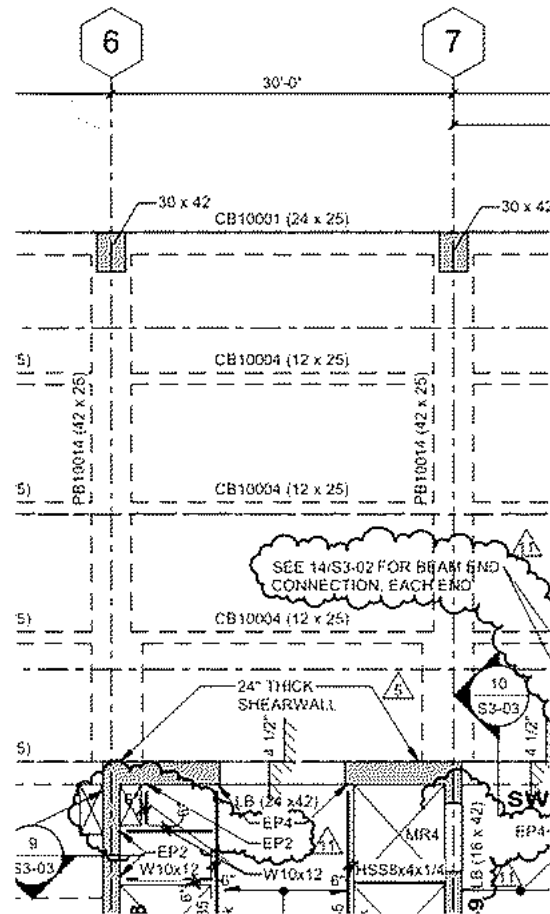
TYPICAL OFFICE LEVEL FRAMING PLAN



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



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



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

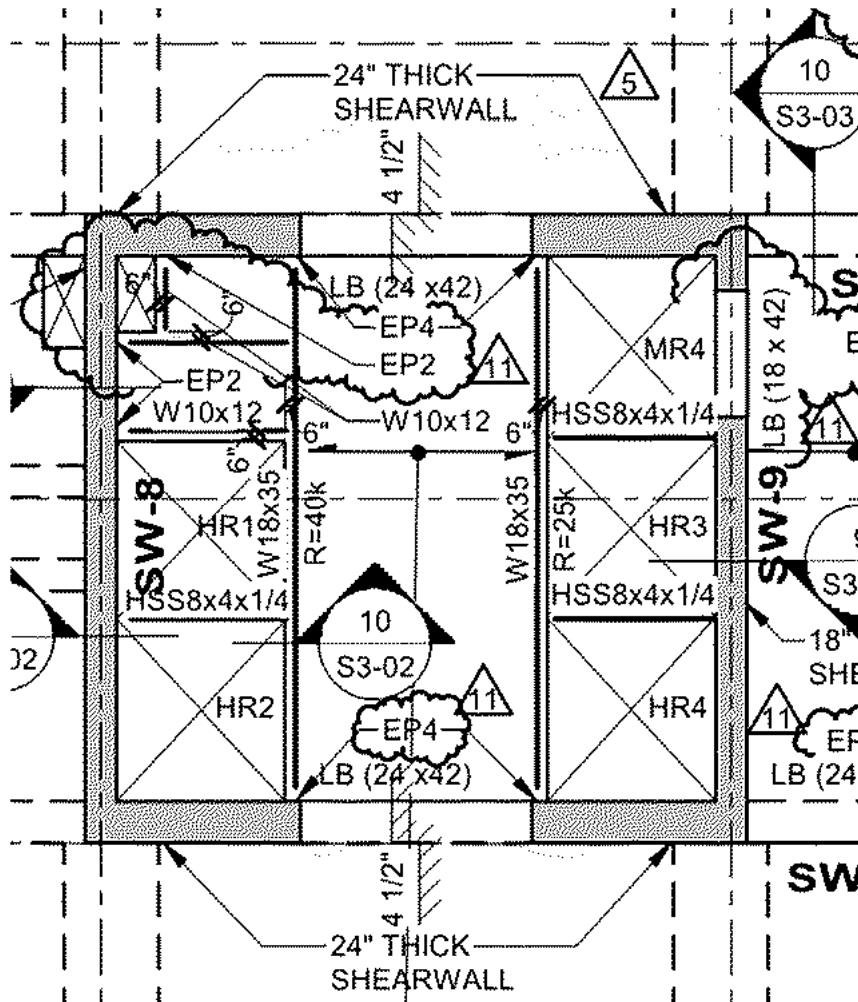
TYPICAL BAY OFFICE LEVEL



SLIP FORMING FOR CONCRETE SHEAR WALL CORES

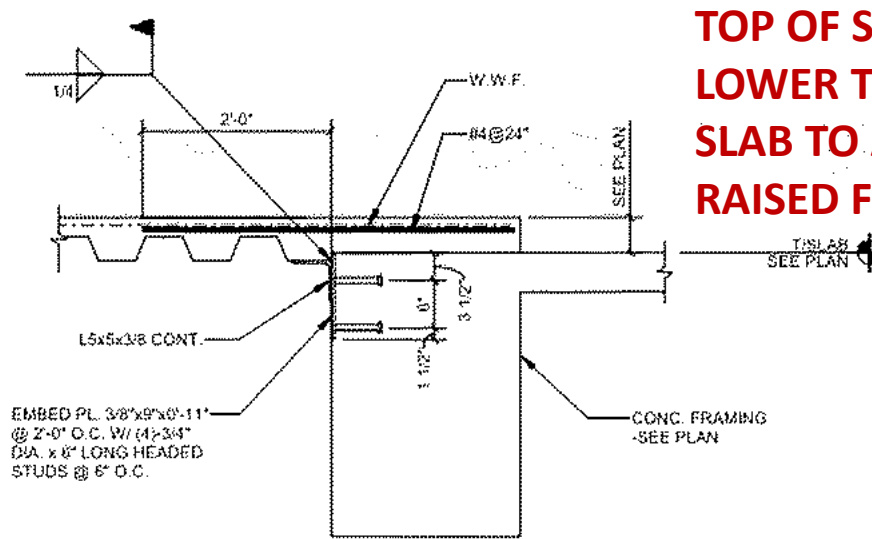


STAYBOX REBAR SYSTEM FOR SLAB DOWELS



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.

STEEL INFILL FRAMING AT CORE



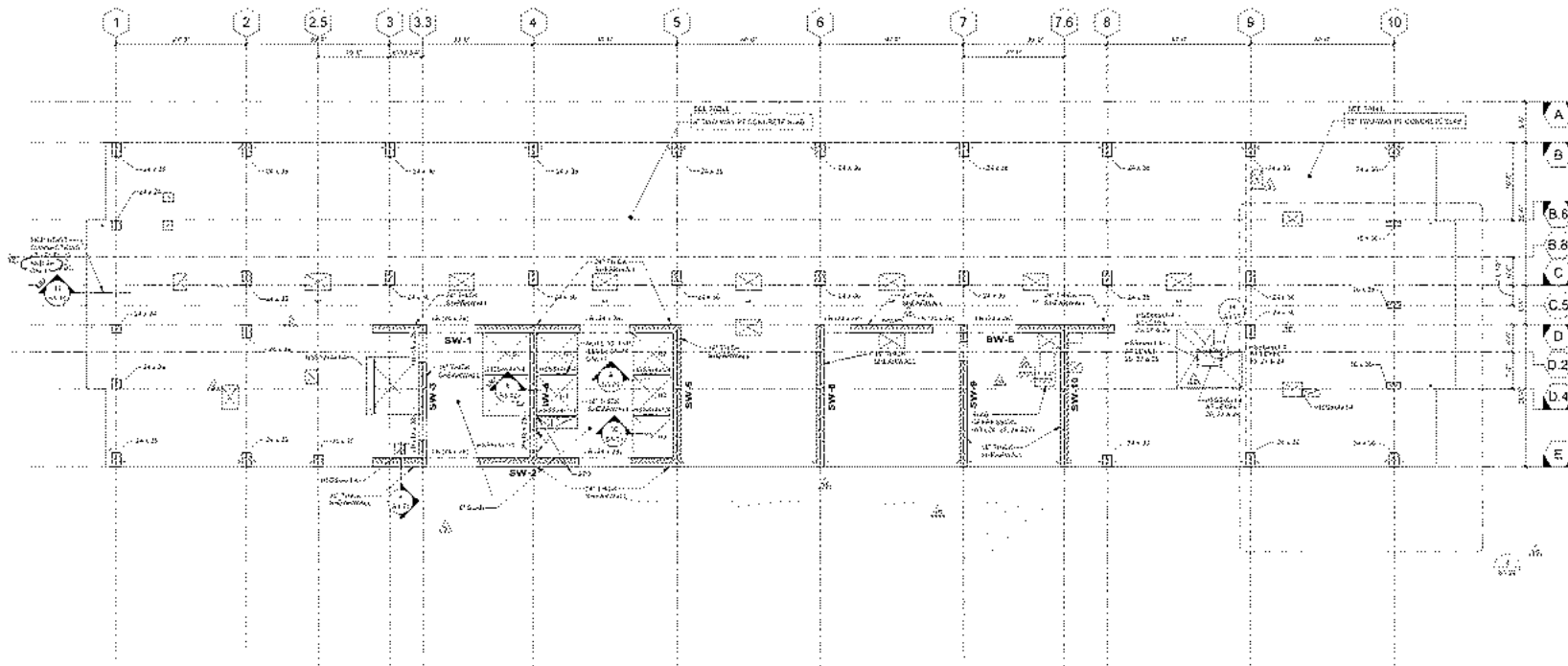
**TOP OF SLAB 4-1/2"
LOWER THAN TOP OF CORE
SLAB TO ACCOMMODATE A
RAISED FLOOR FOR RBC**



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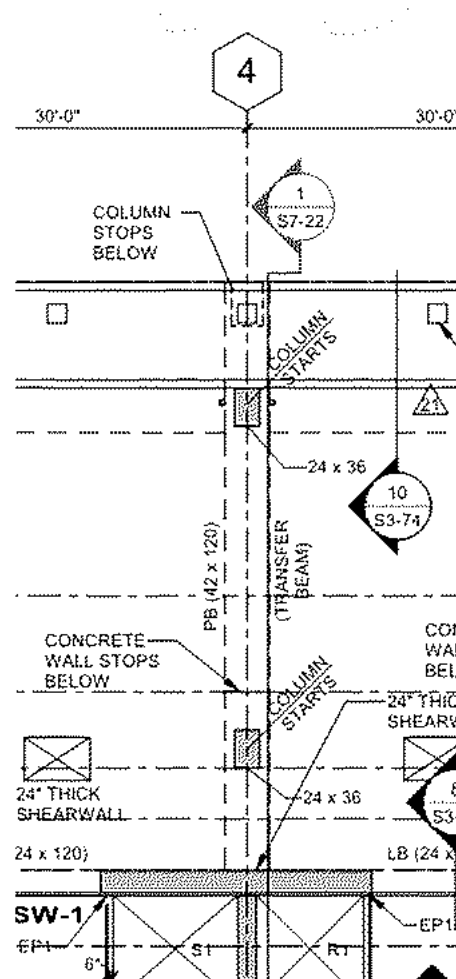
SECTION

**CONCRETE ON STEEL DECK PLACED AFTER
CONSTRUCTION OF CONCRETE FRAMING**



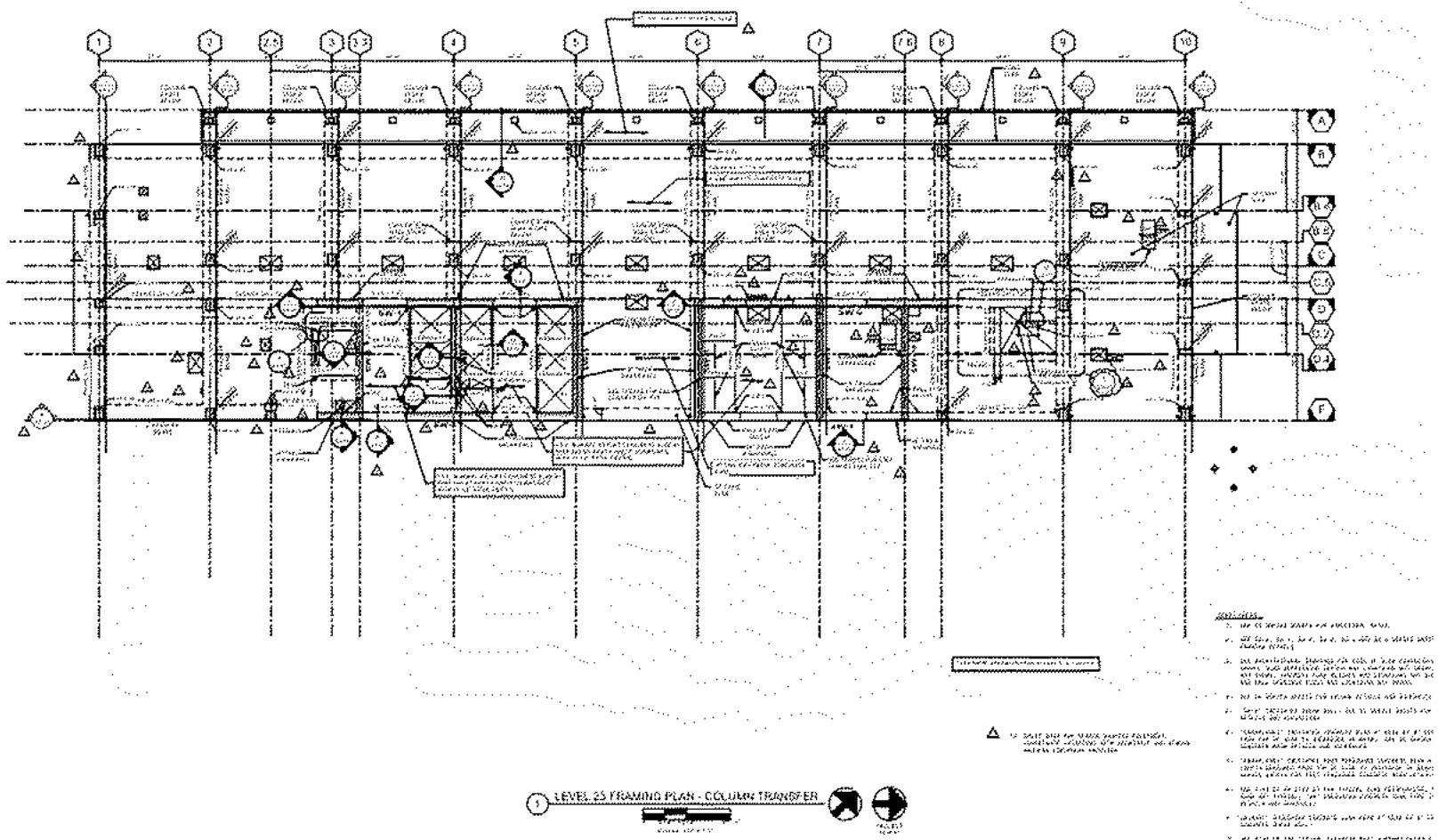
**8" TWO-WAY POST-TENSIONED CONCRETE SLAB
LAYOUT OF COLUMNS DO NOT ALIGN WITH COLUMNS
OF OFFICE BUILDING BELOW**

TYPICAL HOTEL FLOOR FRAMING PLAN



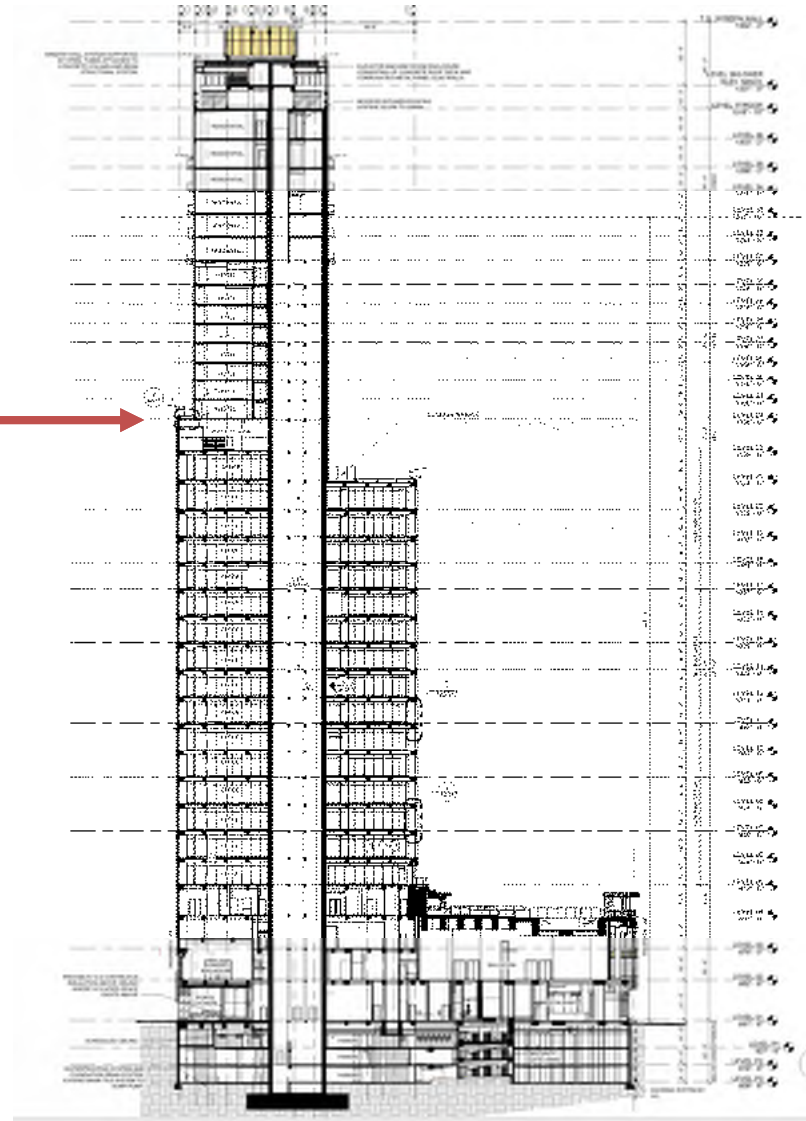
TRANSFER BEAM

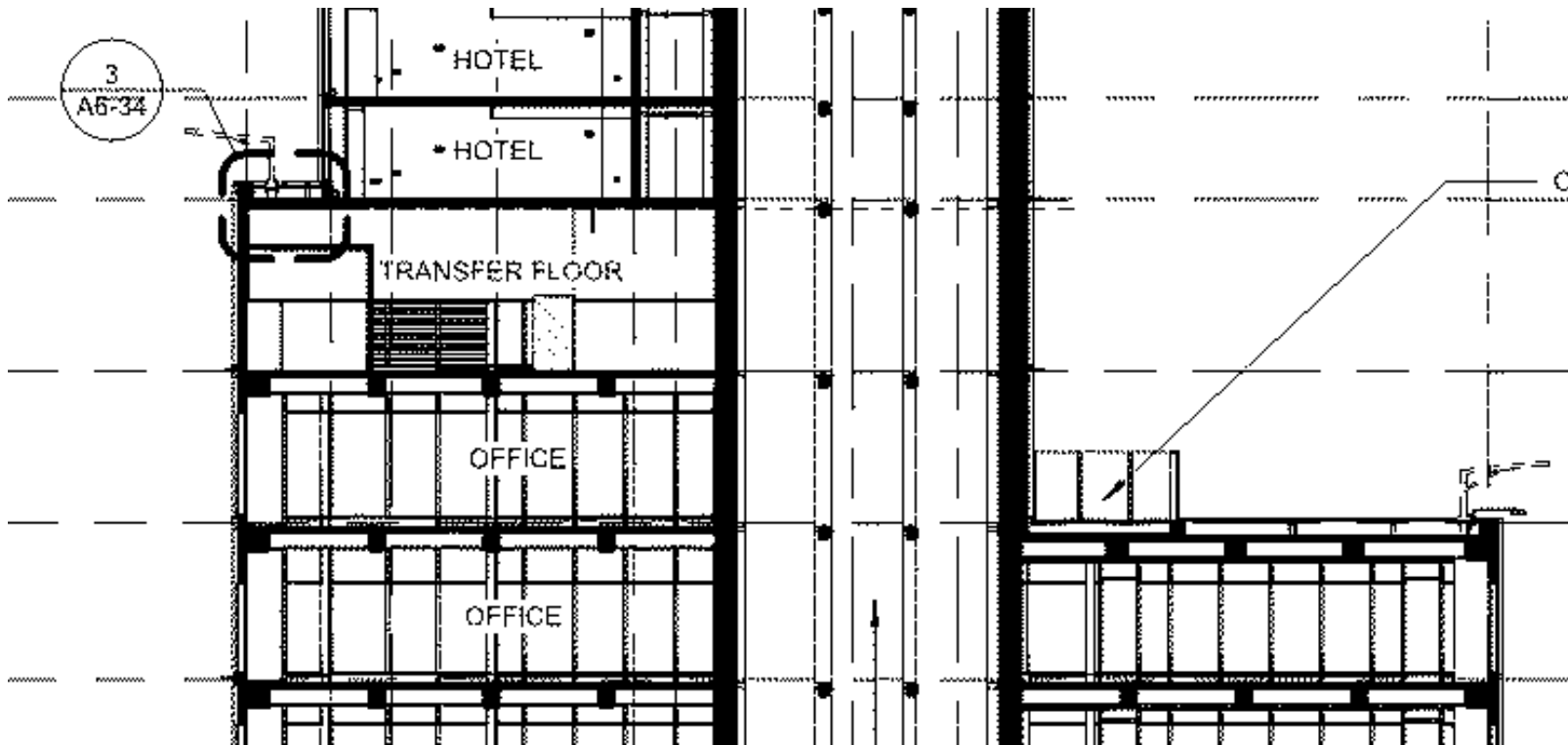
LAYOUT OF COLUMNS FOR RESIDENTIAL FLOORS WORK WELL WITH LAYOUT OF COLUMNS FOR HOTEL FLOORS. LAYOUT OF COLUMNS AT UPPER RESIDENTIAL AND HOTEL LEVELS DOES NOT WORK FOR THE OFFICE LEVELS. TRANSFER BEAMS REQUIRED TO TRANSFER LOADS FROM UPPER-LEVEL COLUMNS TO LOWER-LEVEL COLUMNS.



TRANSFER FLOOR AT LEVEL 23

**TRANSFER FLOOR
AT LEVEL 23**





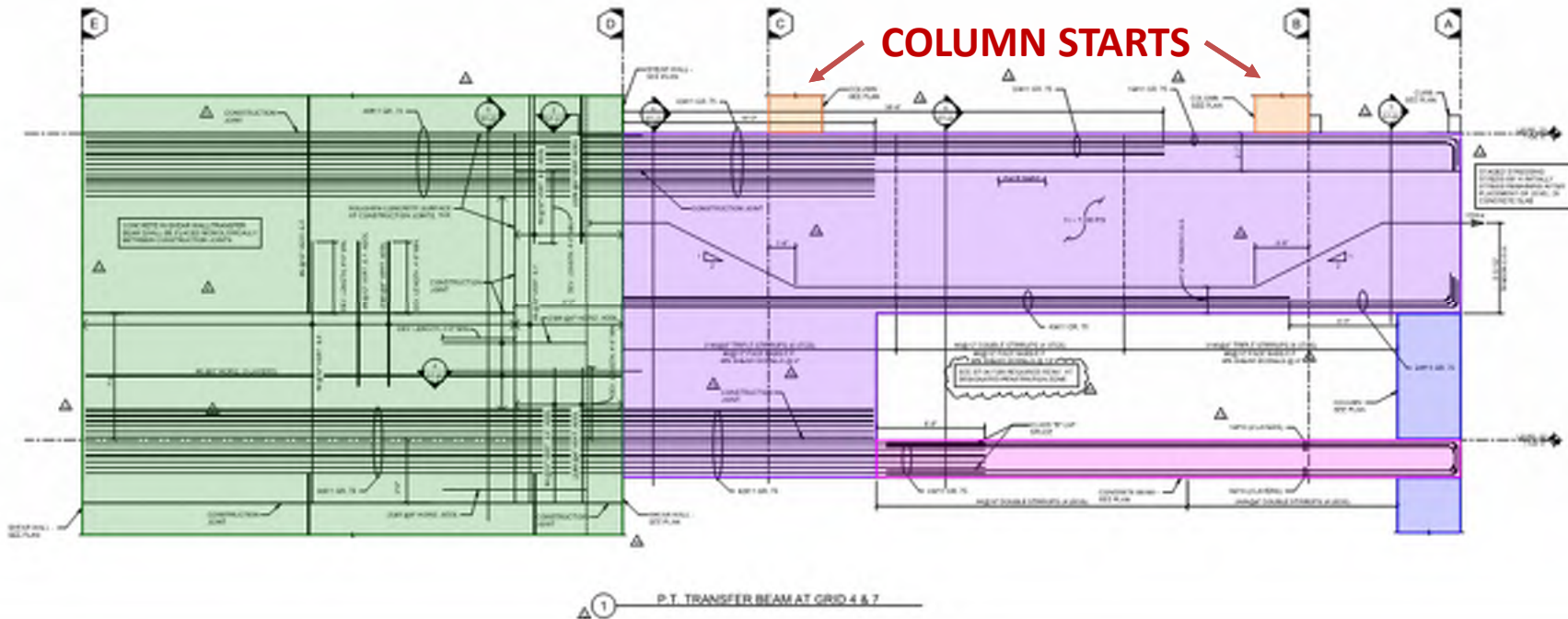
TRANSFER FLOOR AT LEVEL 23

SHEAR WALL

**15' DEEP PORTION
OF TRANSFER
BEAM**

**10' DEEP PORTION
OF TRANSFER
BEAM**

COLUMN STARTS



TRANSFER BEAM ELEVATION



TRANSFER BEAM



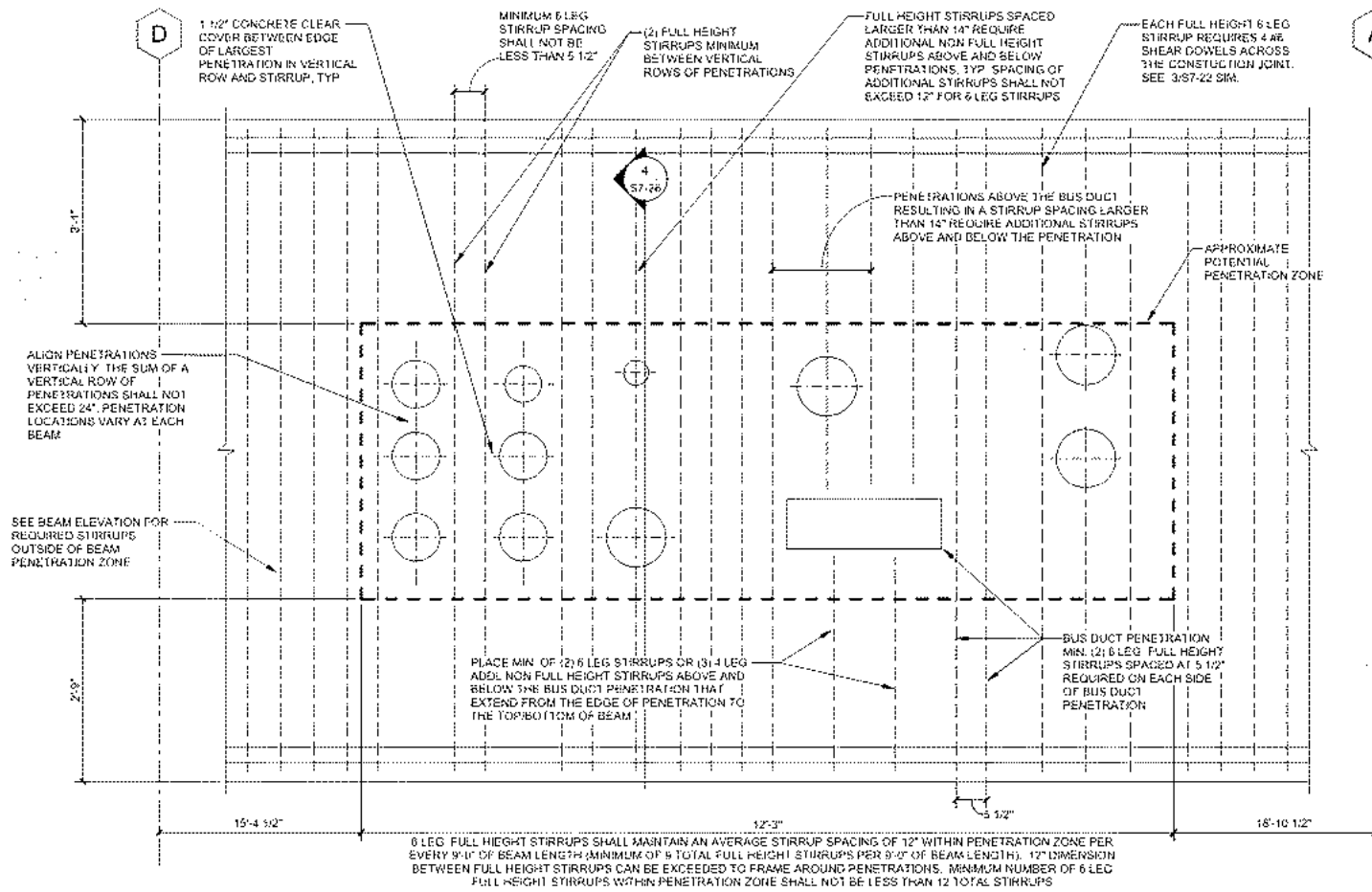
TRANSFER BEAM



TRANSFER BEAM



TRANSFER BEAM



2 6 LEG STIRRUP VERTICAL REINFORCEMENT
OPTION FOR DESIGNATED PENETRATION ZONE

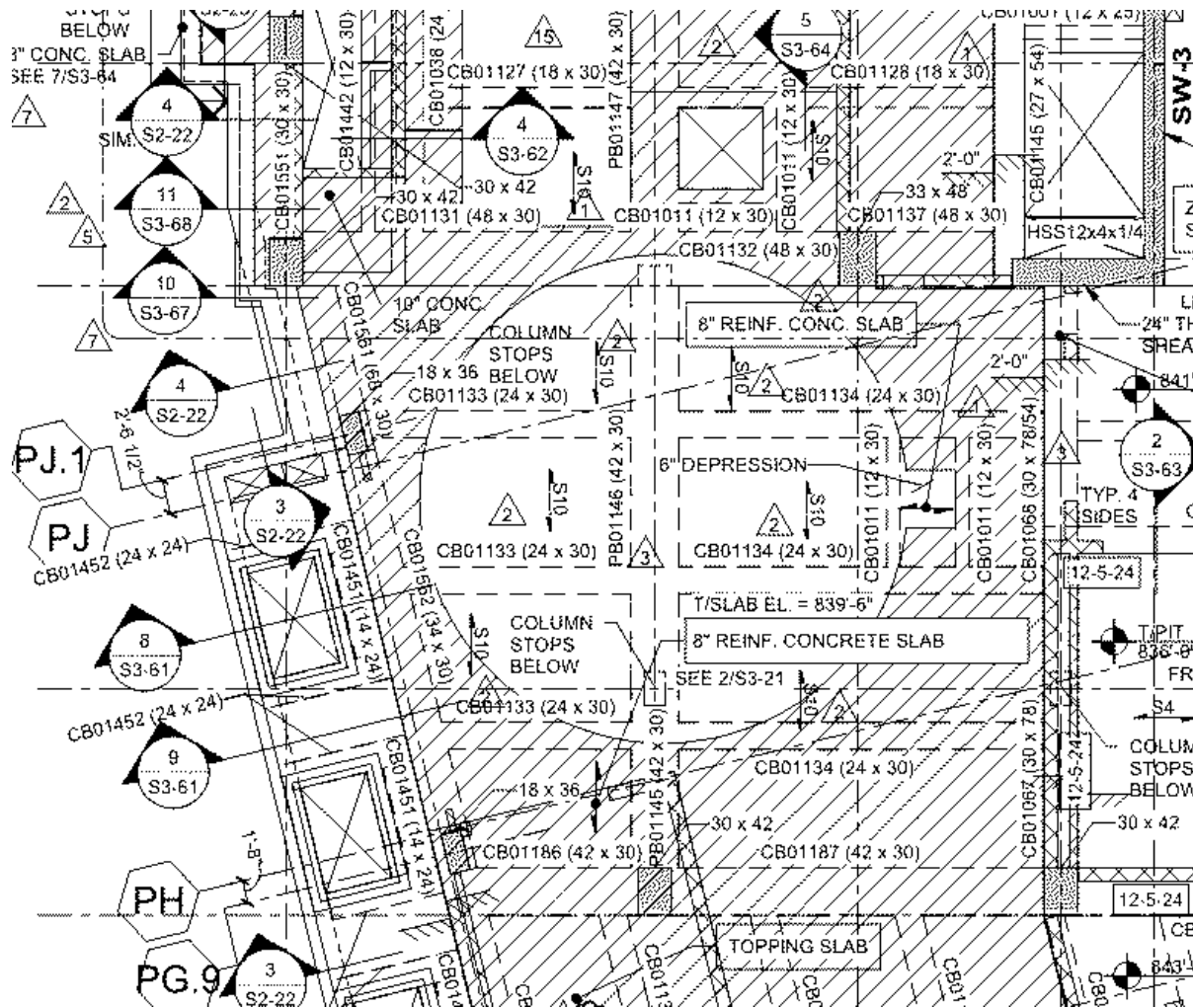
DESIGNATED PENETRATION ZONES AT TRANSFER BEAMS



PENETRATIONS IN A TRANSFER BEAM



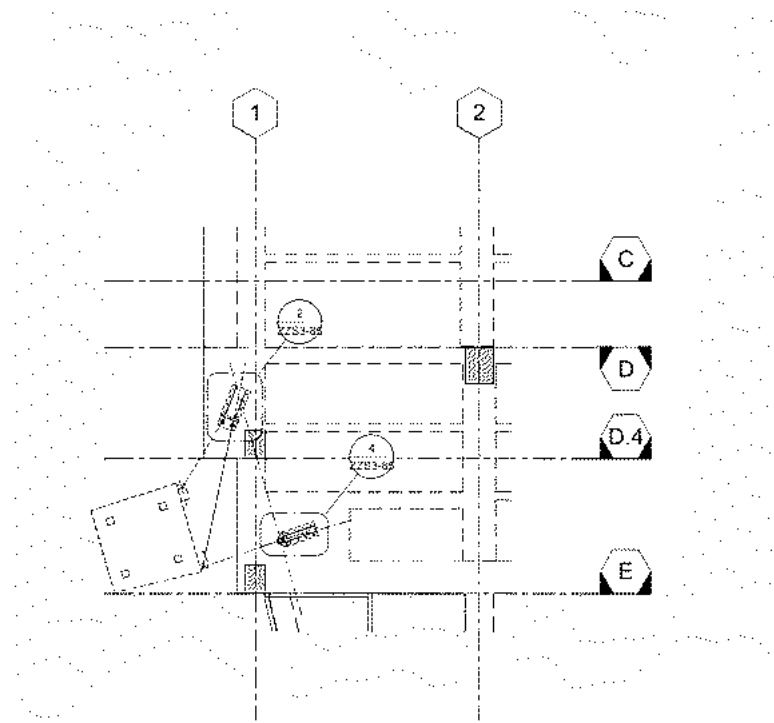
HSS FRAMING AT THE TOP OF THE BUILDING



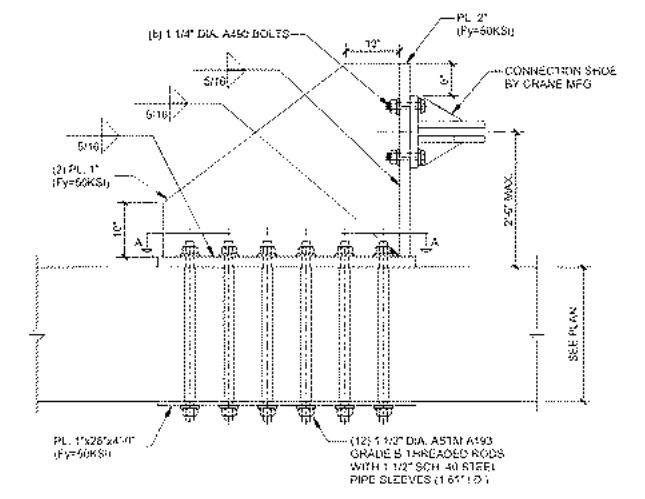
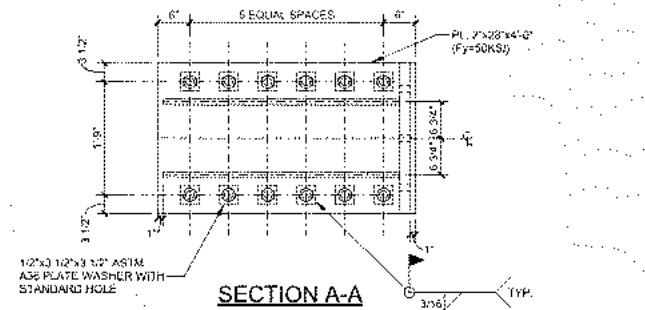
TRUCK TURNTABLE AT LOADING DOCK



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

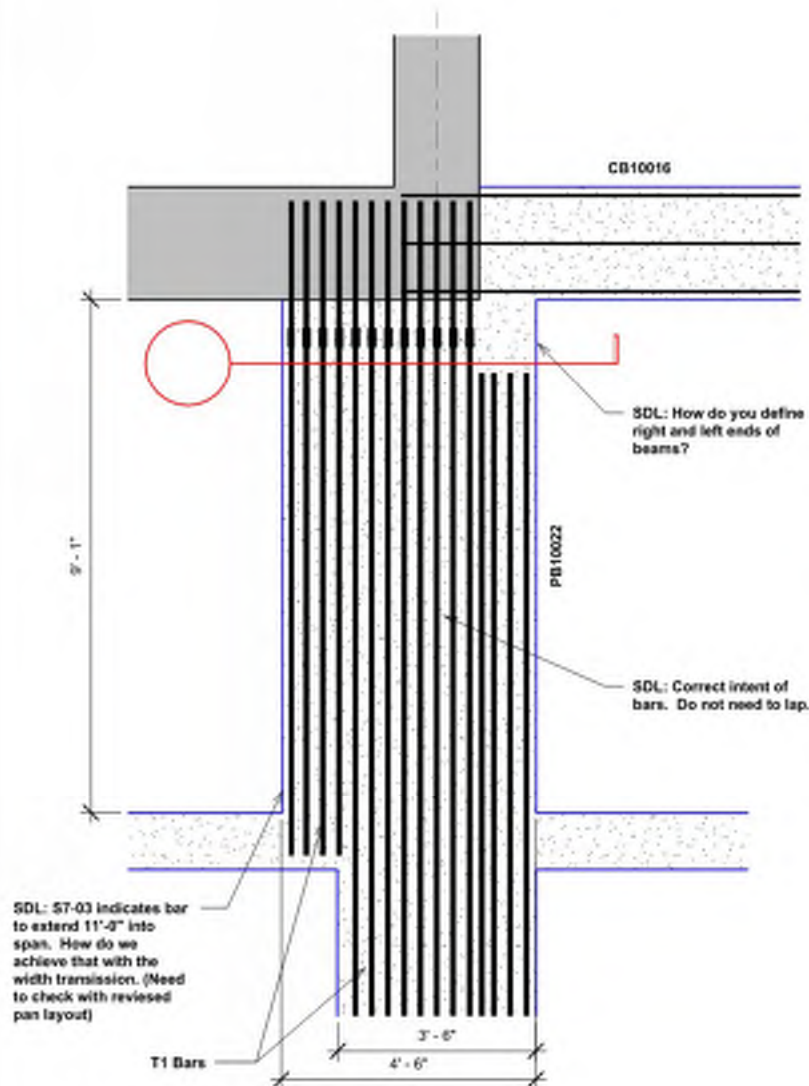
Attributes

- 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
- Levelled manpower for the Contractor

Challenges

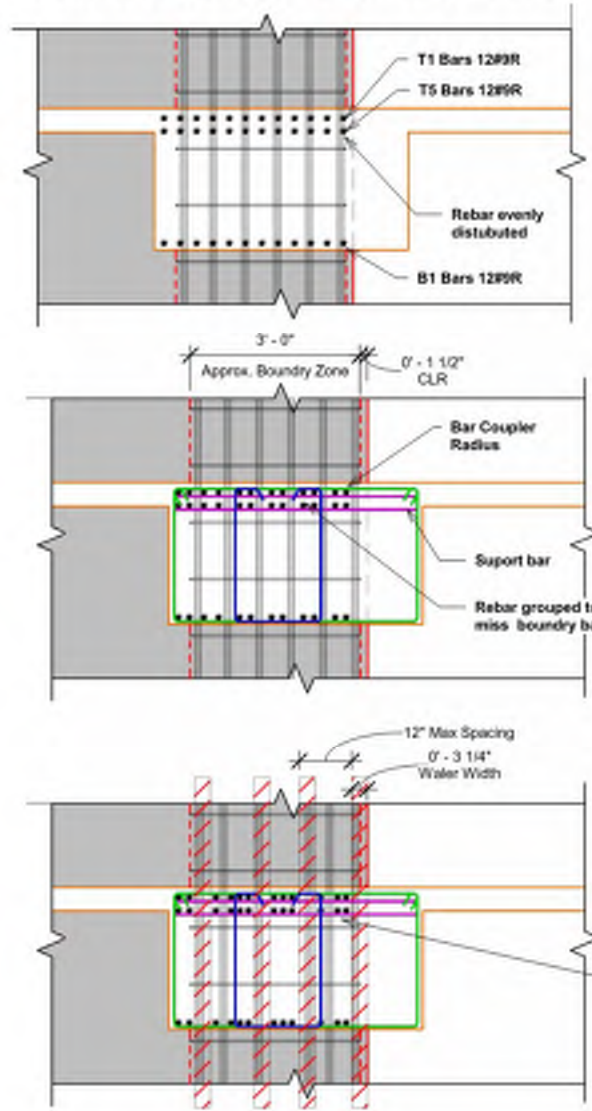
- Beam/deck interface with core and constructability detailing
- Transfer floor constructability
- Core configuration changes
- Interior deck changes

RBC – Gateway: Core Construction



Form - PB10022 Beam to core wall Rebar Layout
 1/2" = 1'-0"

Section Cut At Core Wall Face



Typical Beam Bar
 (Not accounting for other congestion)

Typical Beam Bar +
 Boundary Zone Bar
 (Not accounting for other congestion)

Typical Beam Bar +
 Boundary Zone Bar +
 Formwork Whalers
 (Not accounting for other congestion)

SDL: What criteria exists for grouping bars to manage congestion around beam/column/wall bars with formwork?



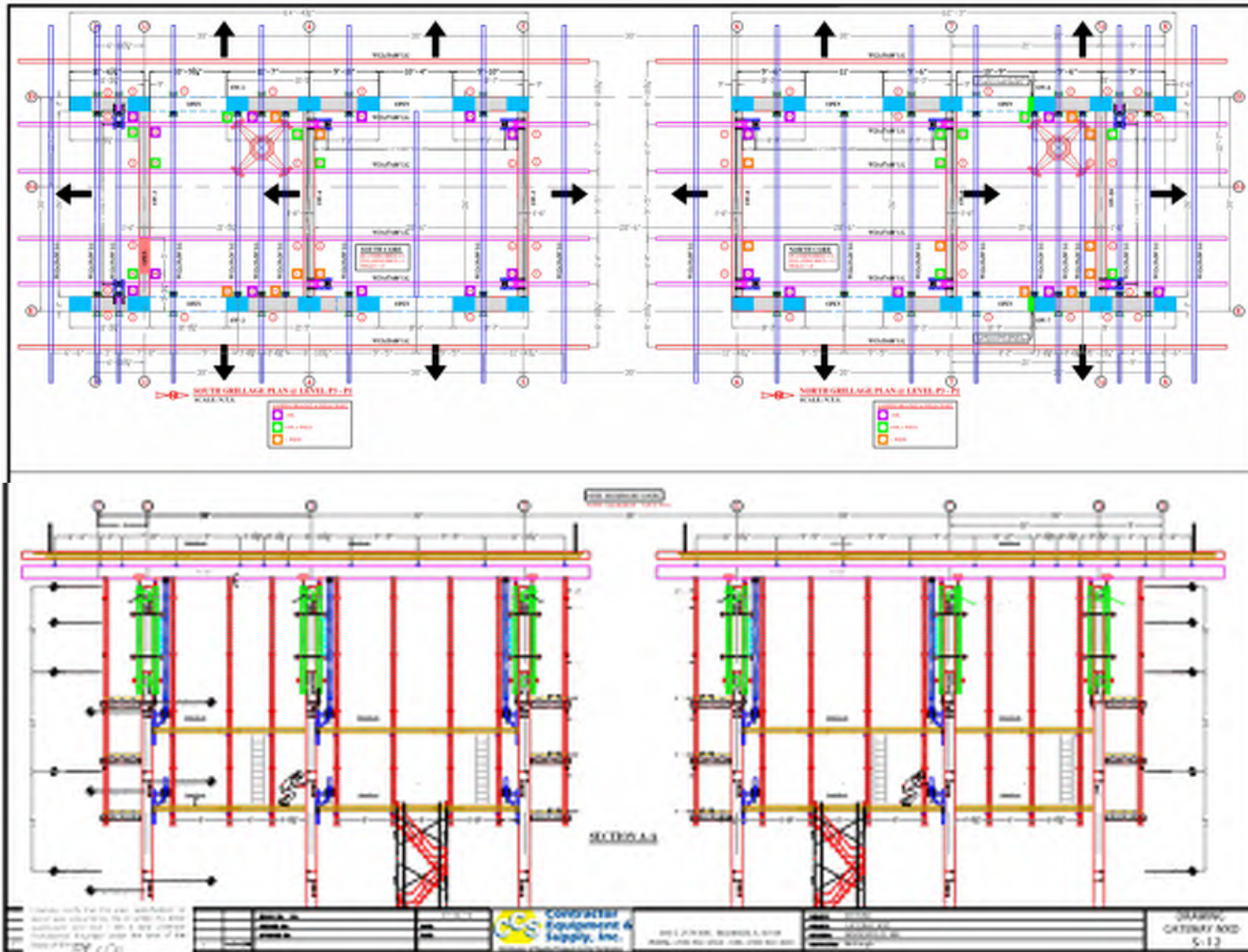
Job Number
 Pay Item/Cost Code
 Primary VDC

RBC Gateway_100 DD_2019-04-10
 Horiz - PT Beam Rebar spacing at core

Sheet SK-404

Date 4/03/2019 3:55:52 PM

RBC – Gateway: Core Construction



Beam pocket and core system



General bar congestion and concrete elements



RBC – Gateway: Core Construction

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RBC – Gateway: Core Construction

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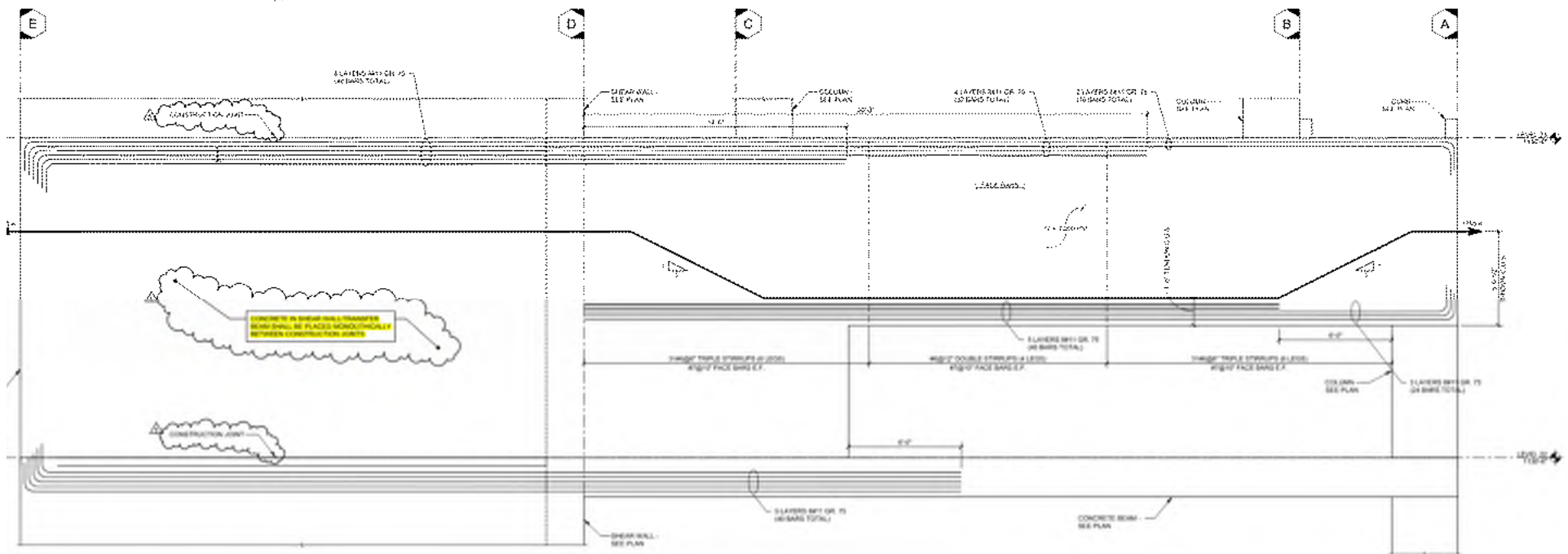


Transfer Floor Construction

RBC – Gateway: Transfer Floor

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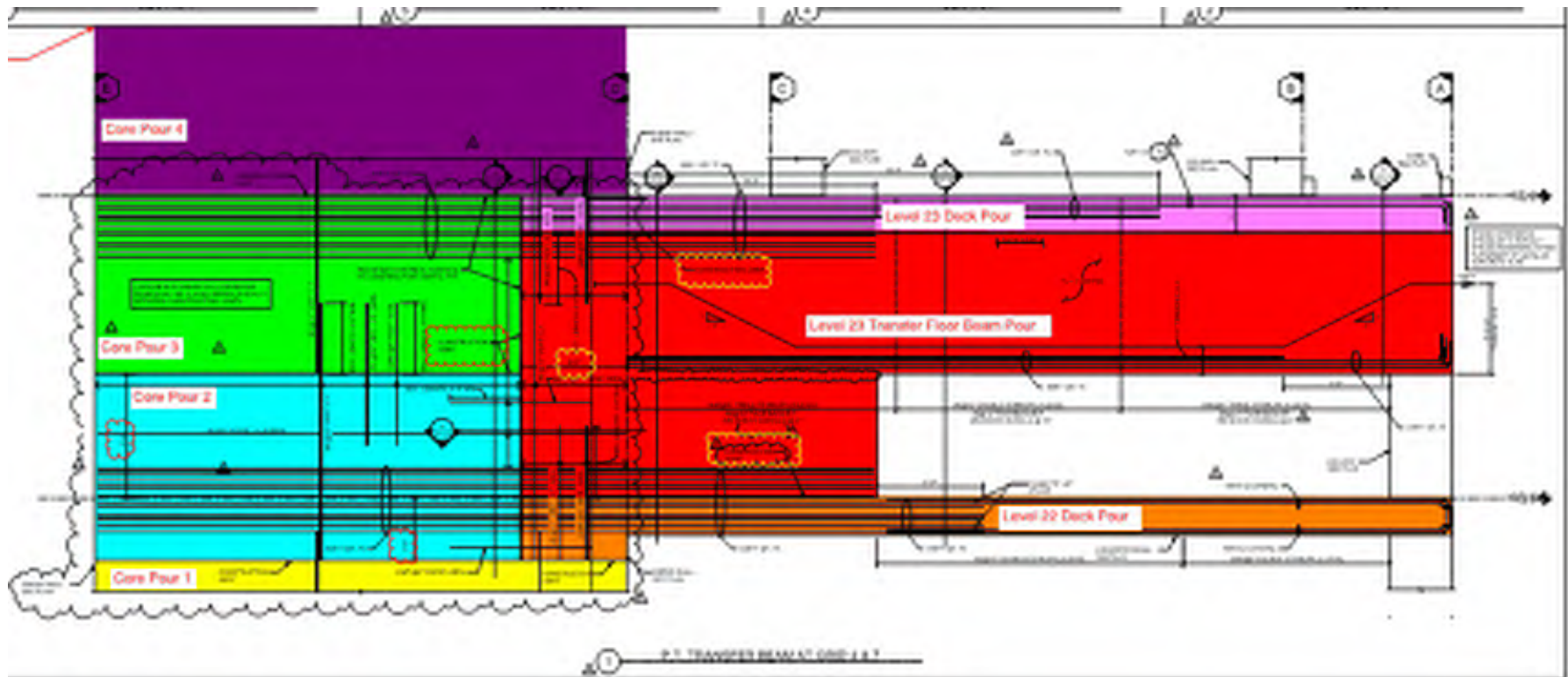
- Concrete in shear wall/transfer beam to be placed monolithically was first denoted in CP-4 (1/20/2020) (68 total #11 bars top and bottom)
- Constraints with the approach indicated in the structural drawings
 - Core formwork was ahead of deck.
 - CJ to CJ height of 17'. Self climbing system can only 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

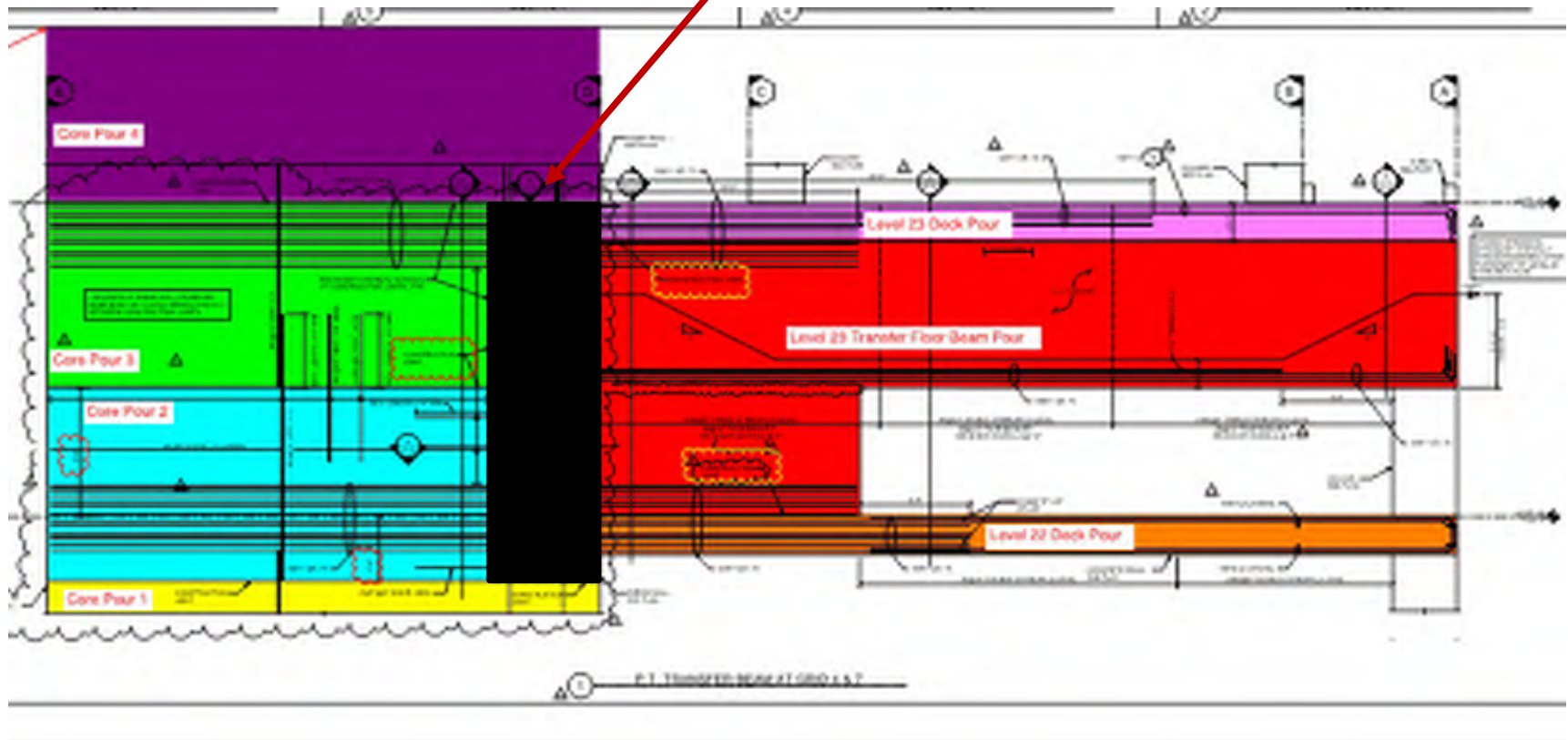
RBC – Gateway: Transfer Floor

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

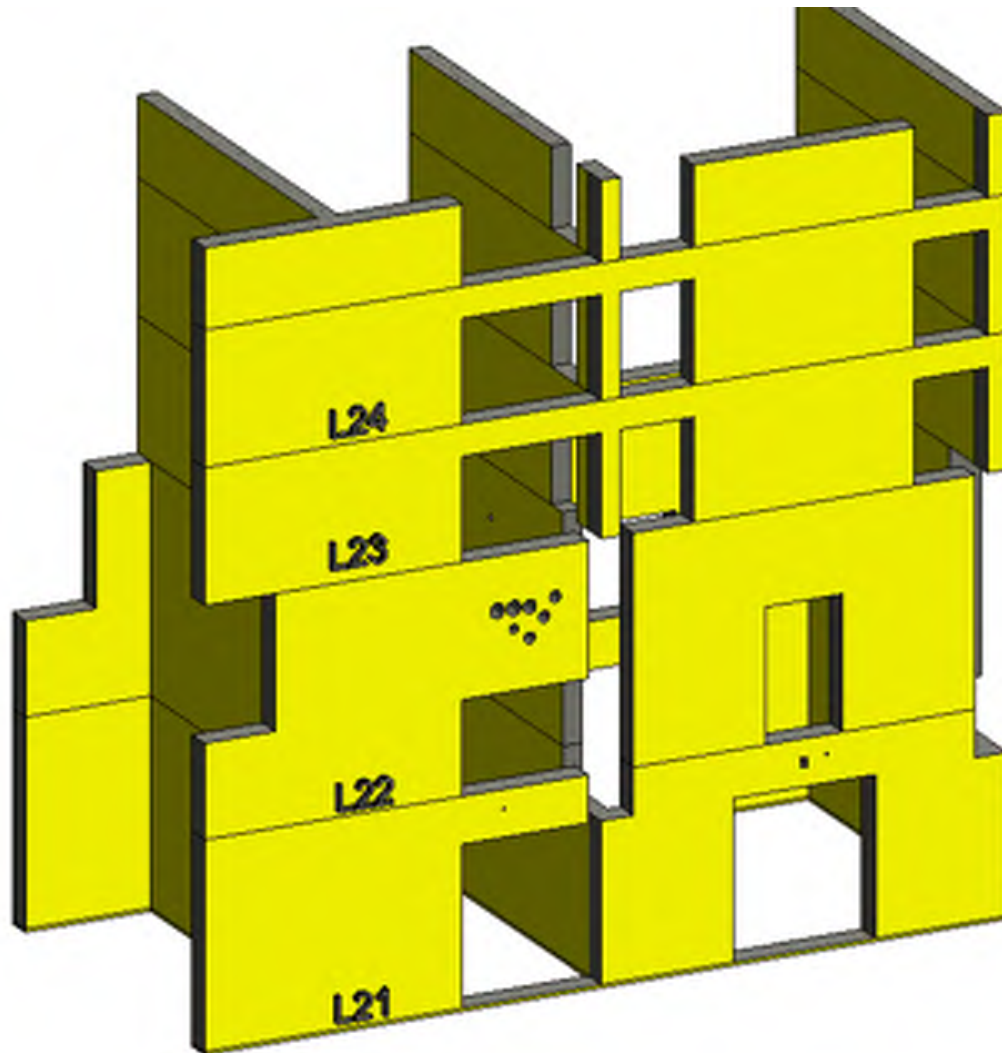


RBC – Gateway: Transfer Floor

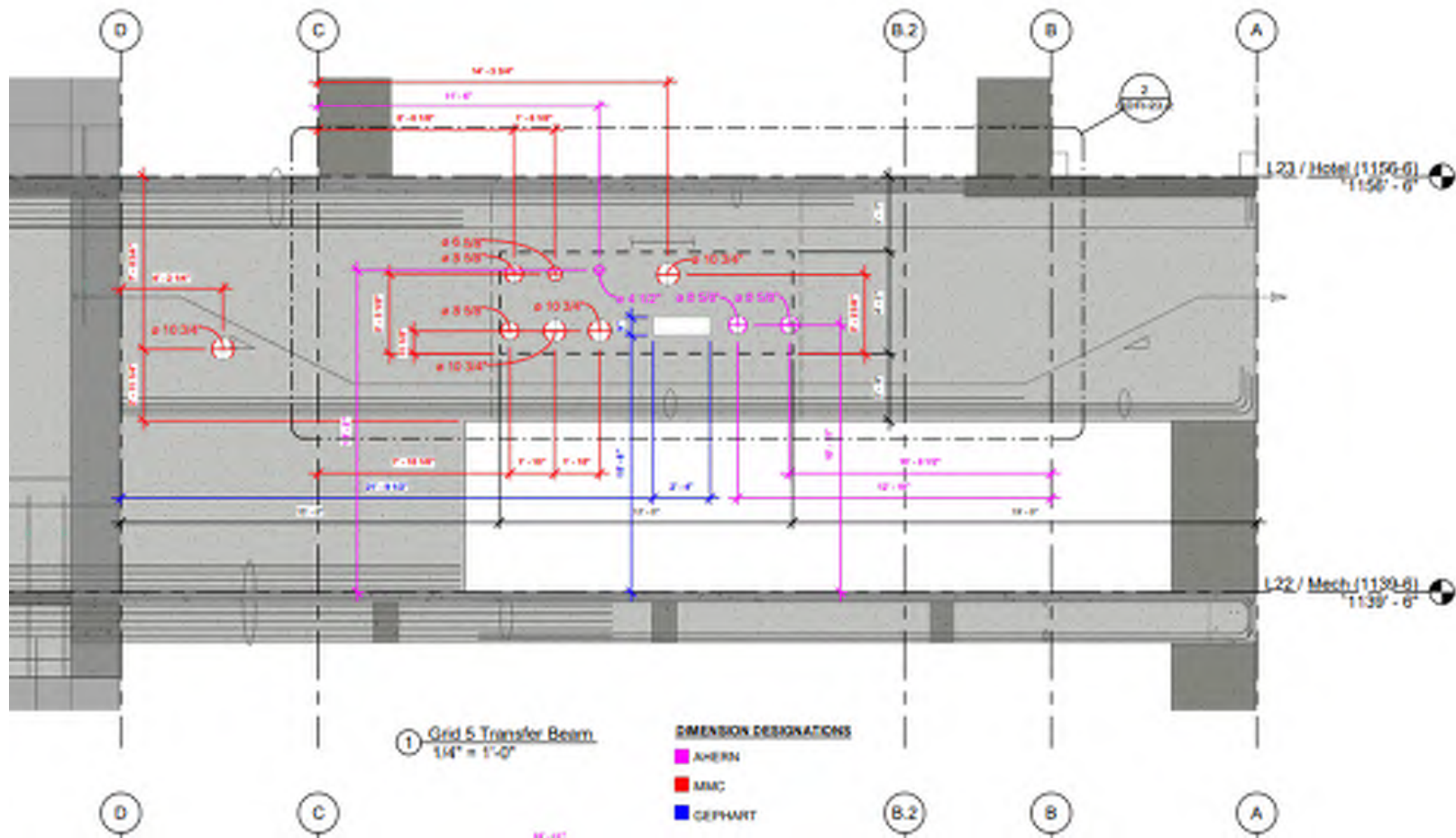
6'-0" Deep Pocket Into Core Wall



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

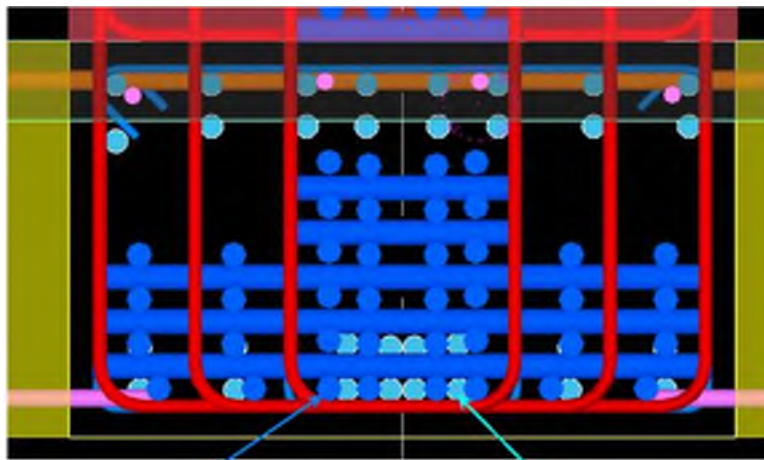


Transfer Beam Sleeve Penetrations

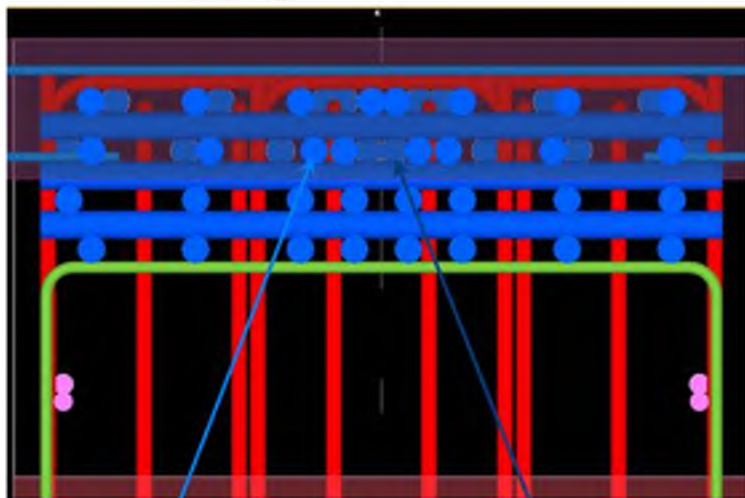


RBC – Gateway: Transfer Floor

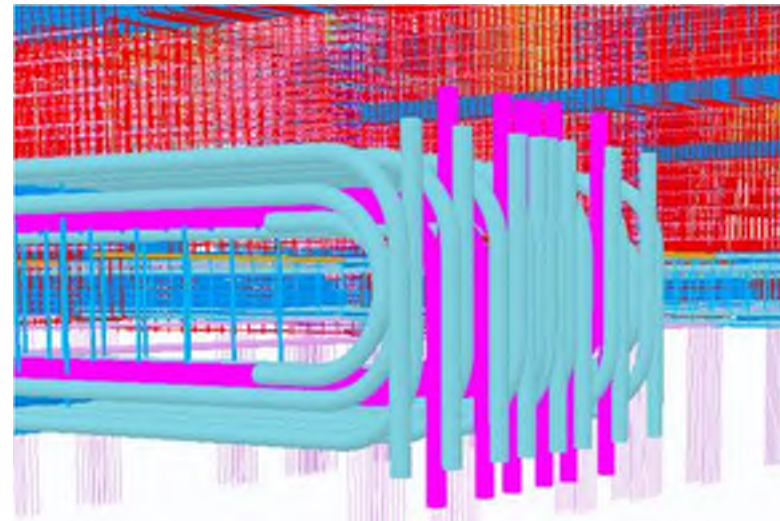
Items the Rebar Model assisted in solving prior to physical work;



#11 x 24-3 & 25-3
SECTION AT LAP LOCATION AT TOP LEVEL 22 TRANSVERSE BEAM GRID LINE 4 - B.B
10A100

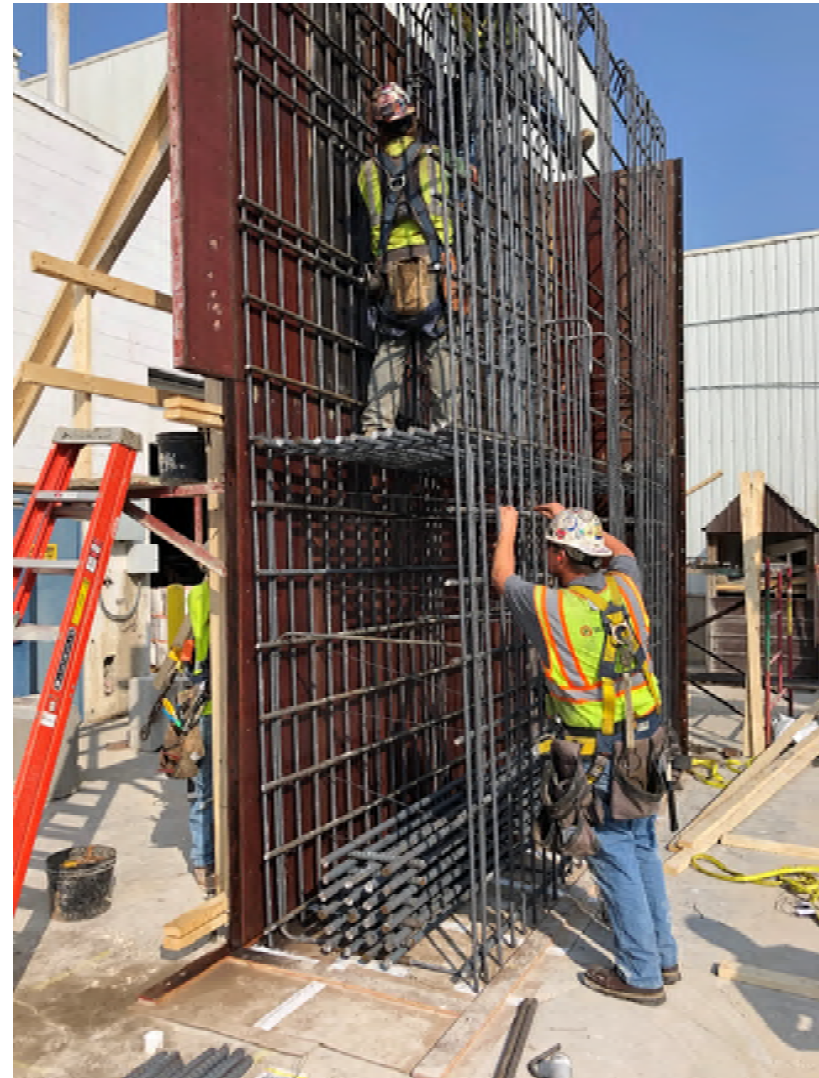


11A089
SECTION AT LAP LOCATION AT TOP LEVEL 23 TRANSVERSE BEAM AT GRID LINE 4
#11 x 35-0 & 34-0



RBC – Gateway: Transfer Floor – Full Scale Mock Up

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RBC – Gateway: Transfer Floor – Full Scale Mock Up

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RBC – Gateway: Transfer Floor

81



RBC – Gateway: Transfer Floor

82



RBC – Gateway: Transfer Floor

83



RBC – Gateway: Transfer Floor

84



RBC – Gateway: Transfer Floor

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