BIM

In Construction

Presentation at Northern Virginia NAIOP seminar on BIM - Thursday, March 6, 2008
Alexander V. Zolotov Alex.Zolotov@ClarkConstruction.com

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Benefits of BIM for Construction

Effective tool for:

- coordination and constructability reviews
- achieving fast-track schedules and staying within budget
- more reliable planning and budgeting
- more dynamic, real-time value analysis and decision-making

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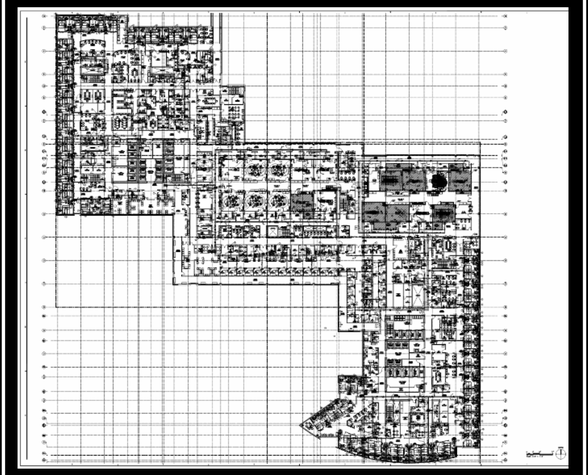
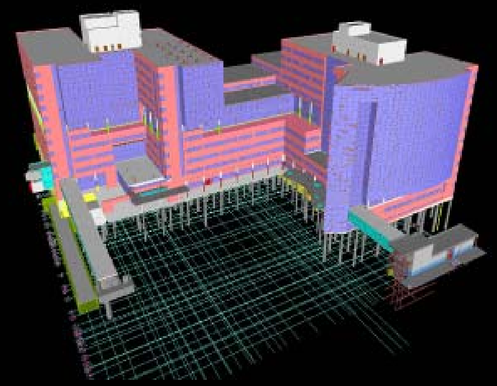
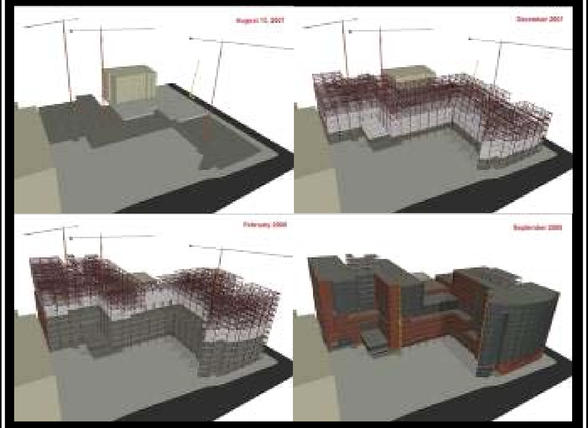
Model Evolution



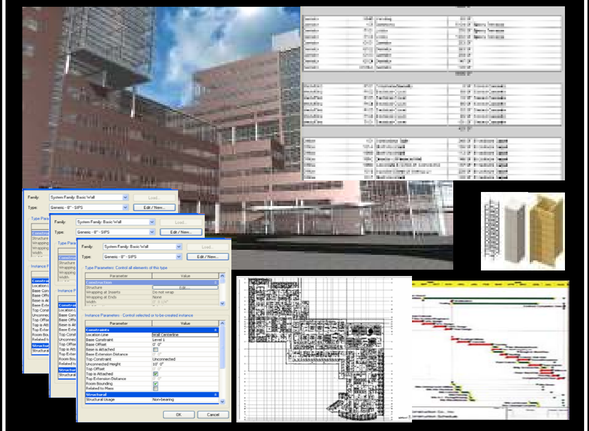
2D Model
(Provides diagrammatic representation of space and details)



3D CAD Model
(Adds 3D perspective of physical components)



4D CAD Model
(Adds time dimension for construction process visualization)



BIM
(Adds attribute information, e.g., cost, material properties, etc.)

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Building Information Model (BIM)
is a data-rich intelligent representation of the project.

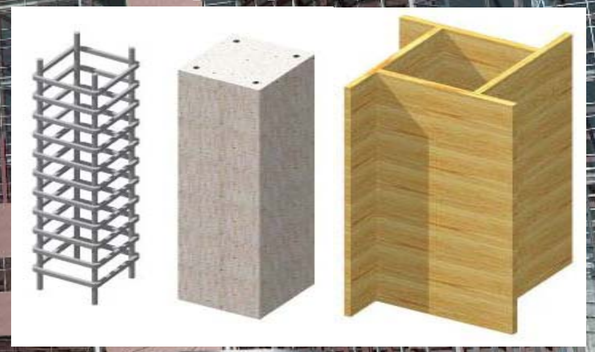
AE Team Information

Schedule

Resources, Sequences, and Durations

Subcontractor Design **Info.**

Materials and Equipment



Quantities, Cost, Size, Location, Specifications, etc.

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BIM in Practice

- DC Ballpark
  - Fast-track design and construction
- The Johns Hopkins Hospital New Clinical Building
  - Coordination of complex healthcare project with multiple systems in tight ceiling space
  - 4-D Schedule analysis
- Downtown Office Building
  - Unique coordination challenges
- GMU VI
  - Quantity extraction and budgeting

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BIM Implementation by General Contractors

Coordination Visualization Models

- **Steel Coordination**
- 3D MEP Spatial Coordination
- Unique Project Challenges

Scheduling

- 4D Models for Analysis and Communication

Estimating

- Automated quantity take-off

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DC Ballpark – Steel Model

- Design Build HOK/Devrouax & Purnell – Clark/Hunt/Smoot
- Fast track (23 month) – Tight site – No room for error
- 8,000 tons of steel – 41,000 seats
- 3D Steel Model by
  ReStl/Thornton Tomasetti – Mt. Enterprises – Banker Steel
  - cutting 2 month from schedule
  - almost 90% decrease of RFIs
- First Major League facility to seek LEED certification

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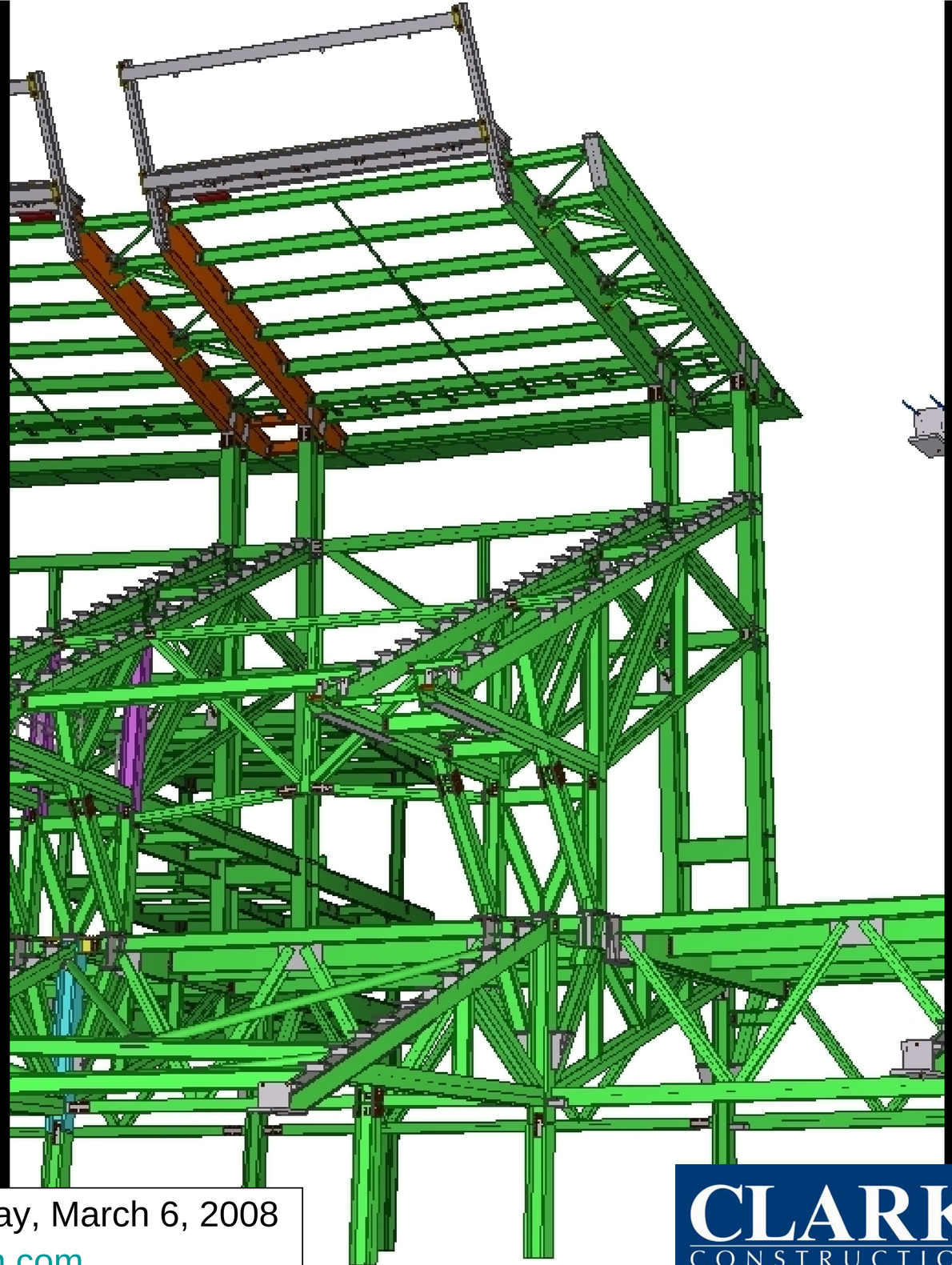

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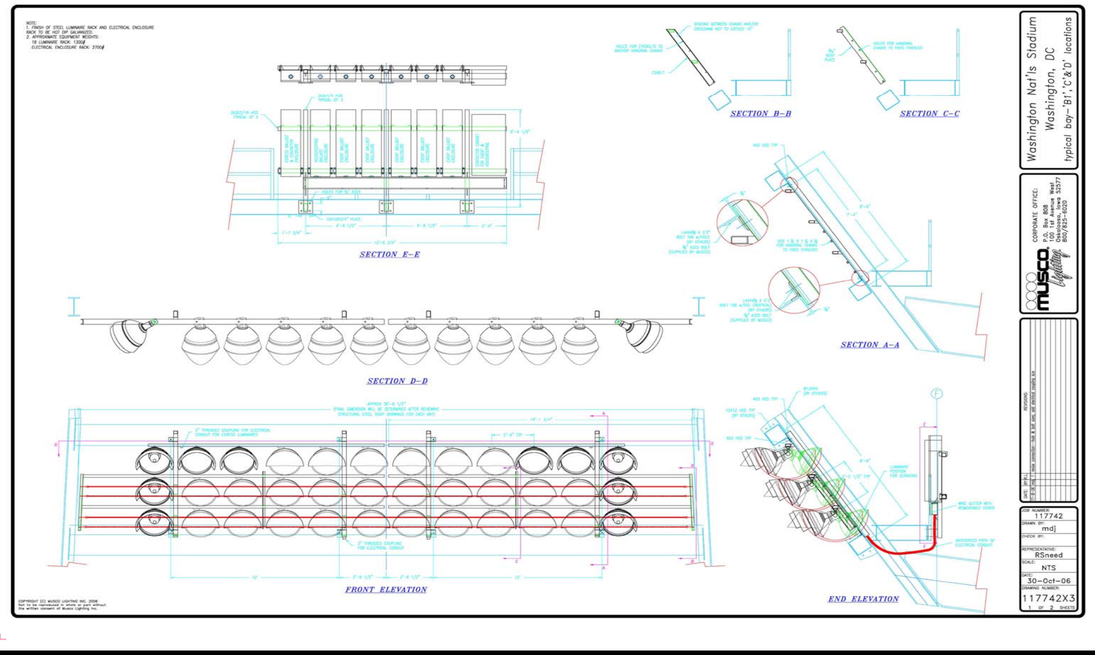

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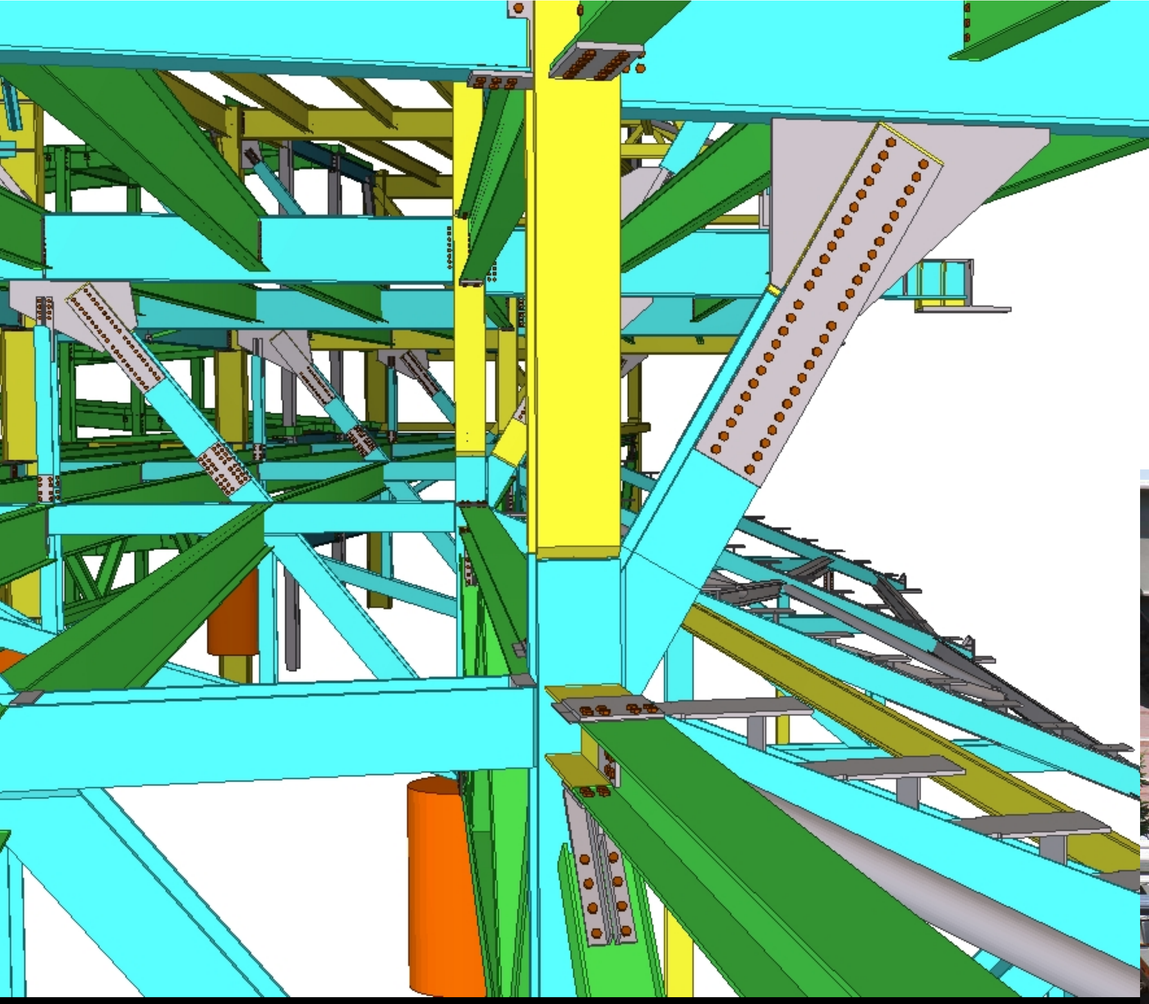

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JHH - 3D MEP Spatial Coordination

- Perkins+Will / BR+A / Thornton Tomasetti – Clark / Banks
- Adult Cardiovascular – Critical Care & Children's Critical Care
  - 1.5 million sq ft
  - 560 beds (355 adult, 205 pediatric)
  - 33 operating rooms
  - 42 radiological suites
  - 96 emergency treatment areas
- Complex MEP systems
  - 25,000 lf of Steam and Condensate Piping
  - 22,000 lf of Chilled Water Piping
  - 155,000 lf of Hot Water Piping
  - 234,000 lf of Domestic Water Piping
  - 176,000 lf of Waste and Vent Piping
  - 1,703,364 lf of Electrical Conduit

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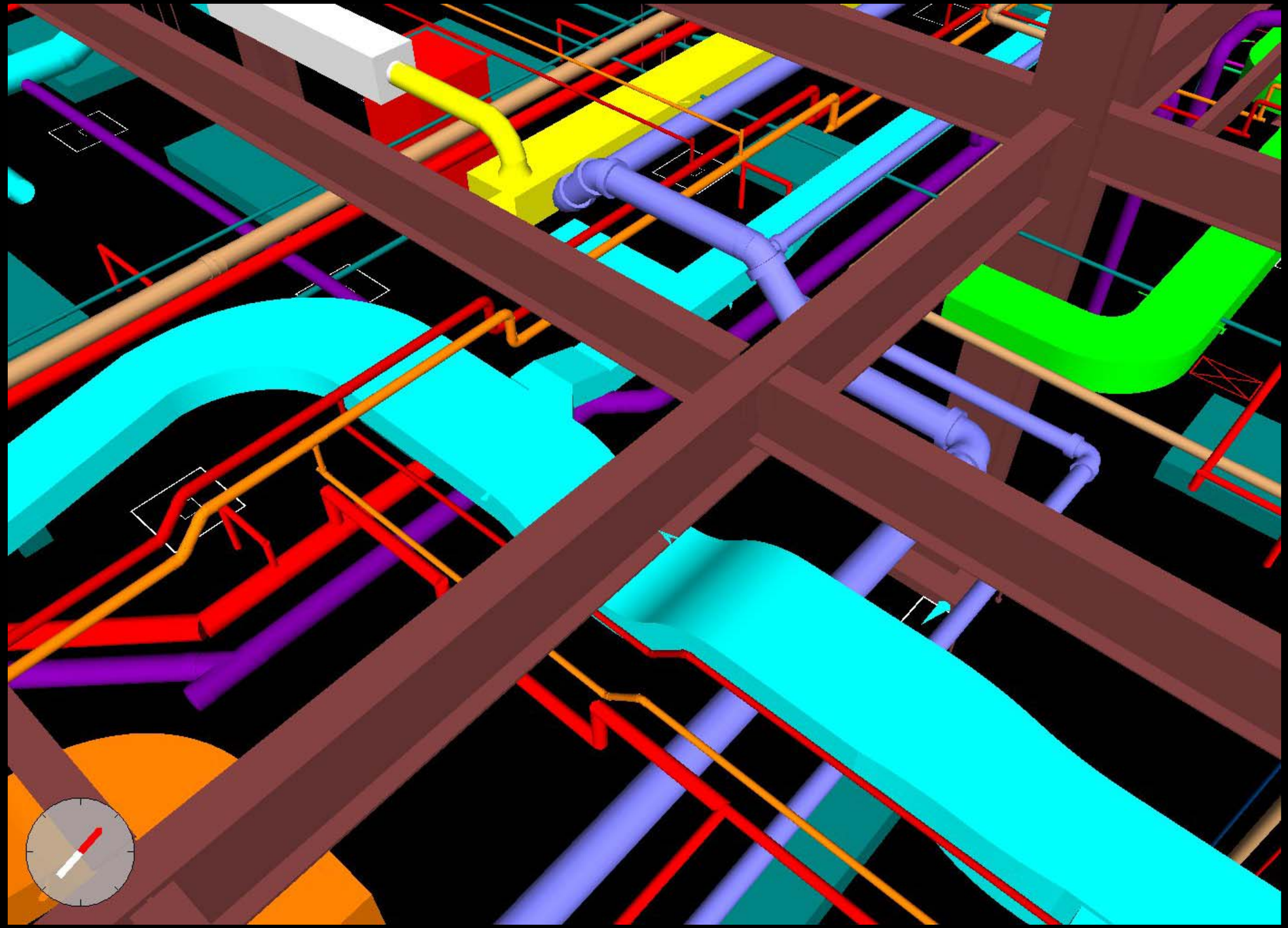

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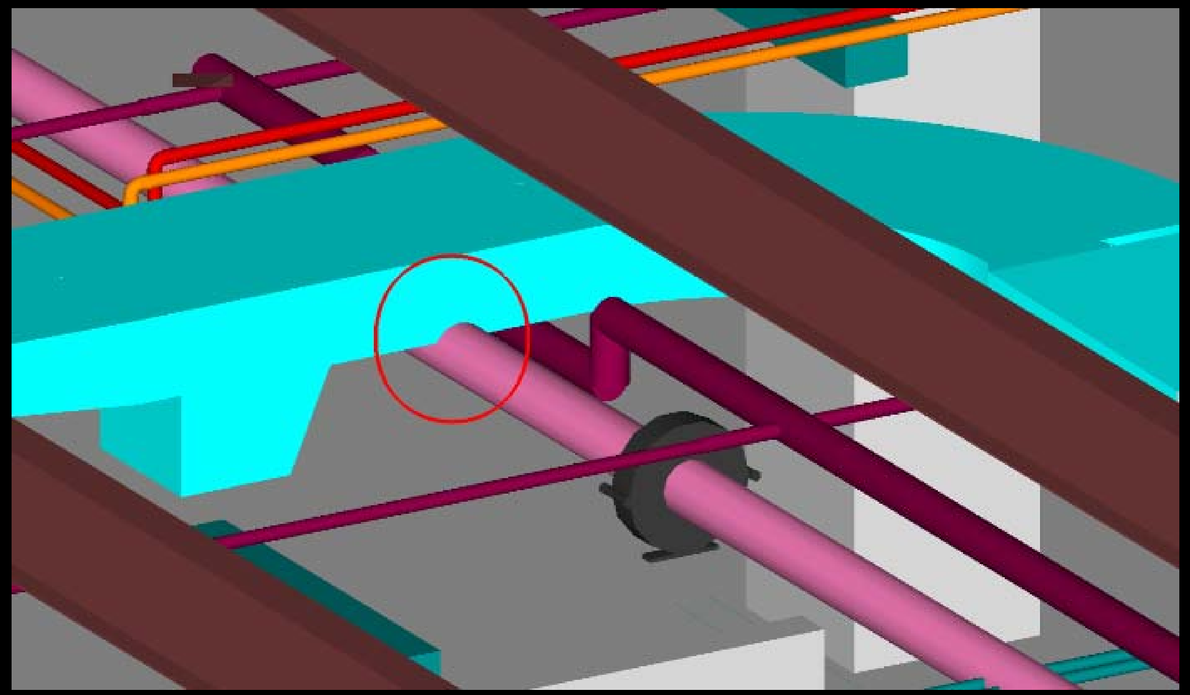
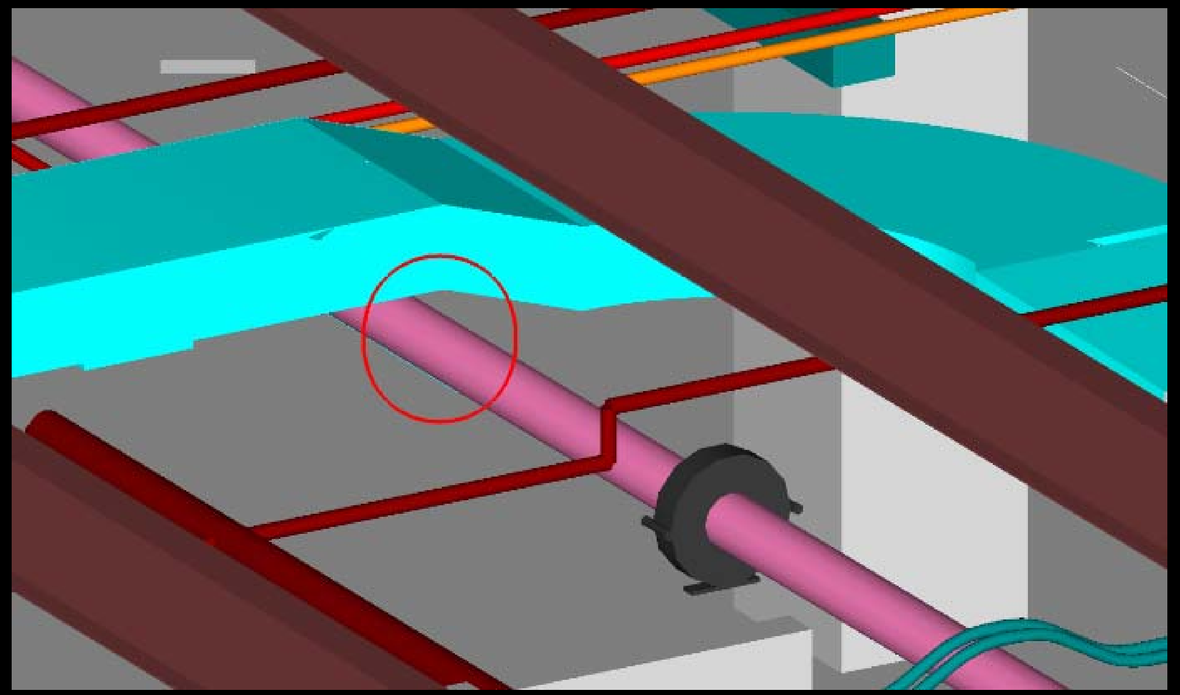
Clash Examples



First Run



Second Run

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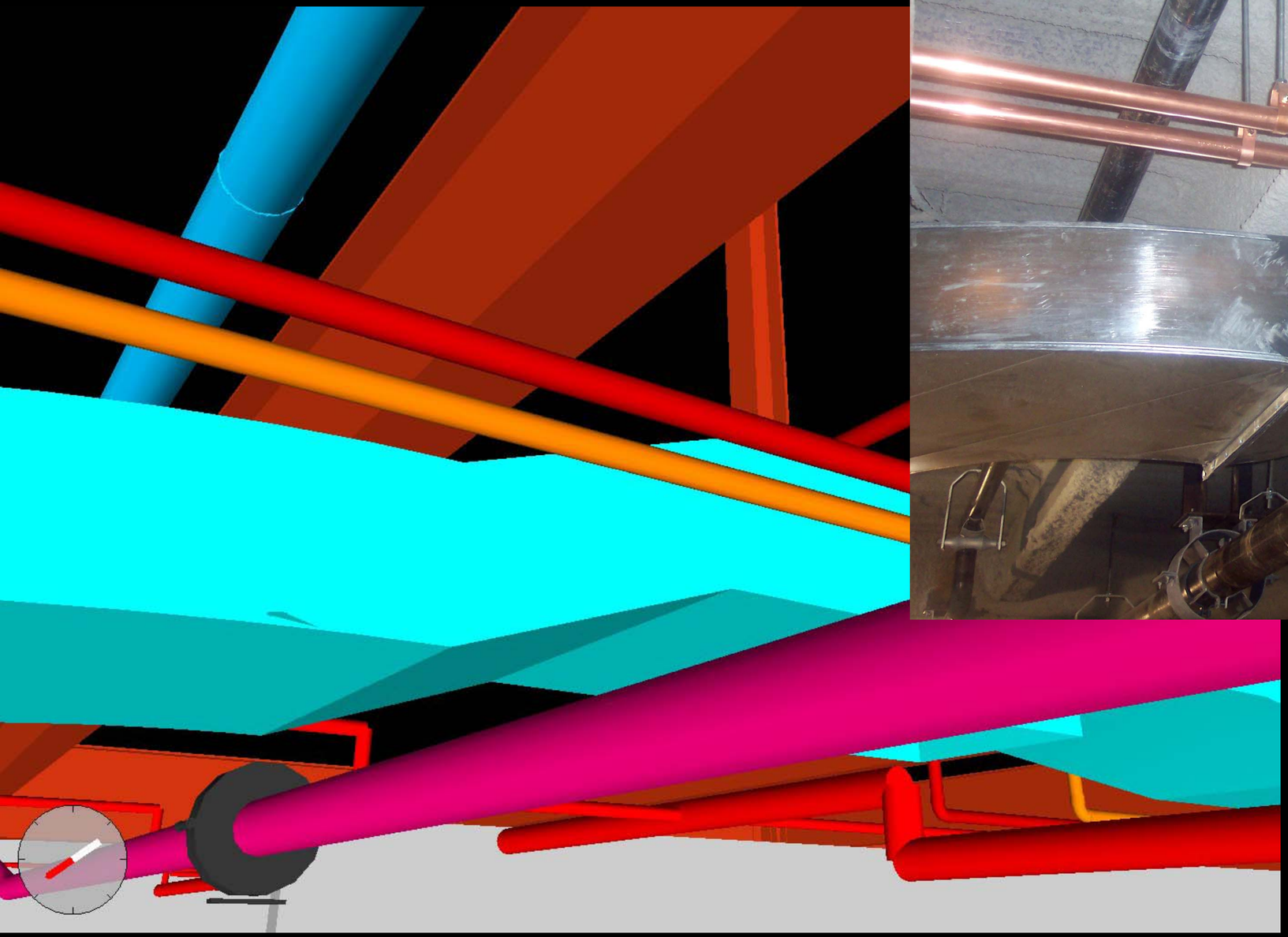
CLARK CONSTRUCTION



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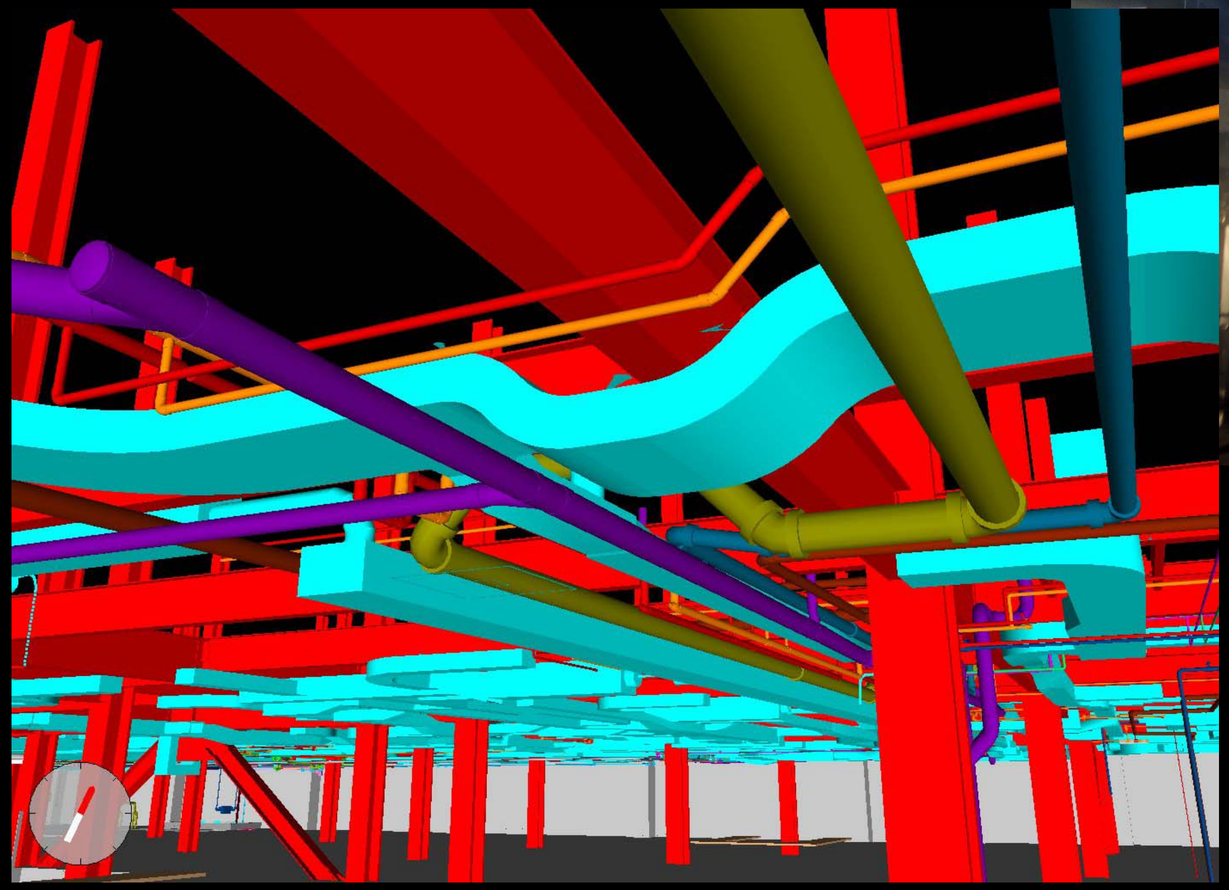

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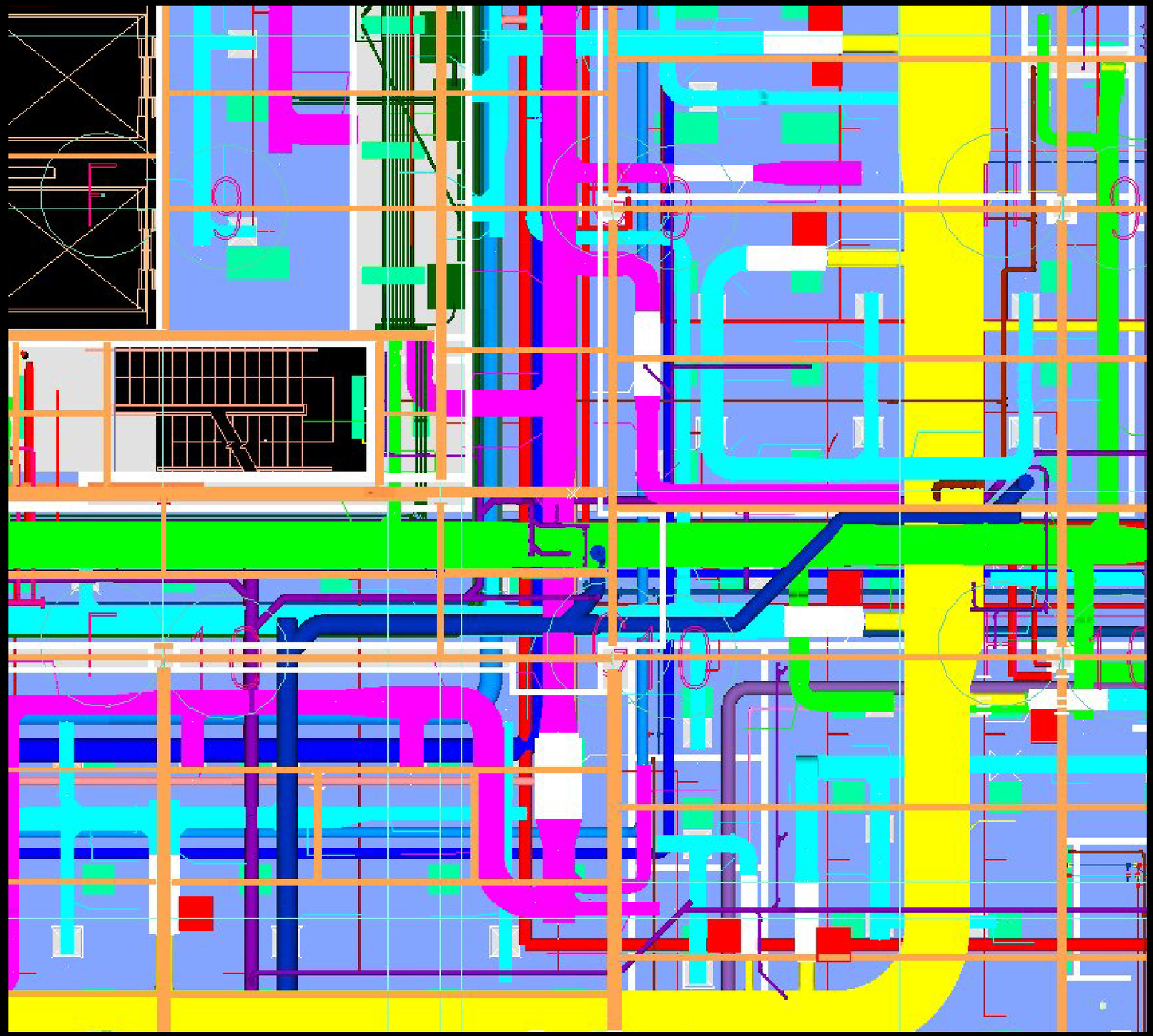

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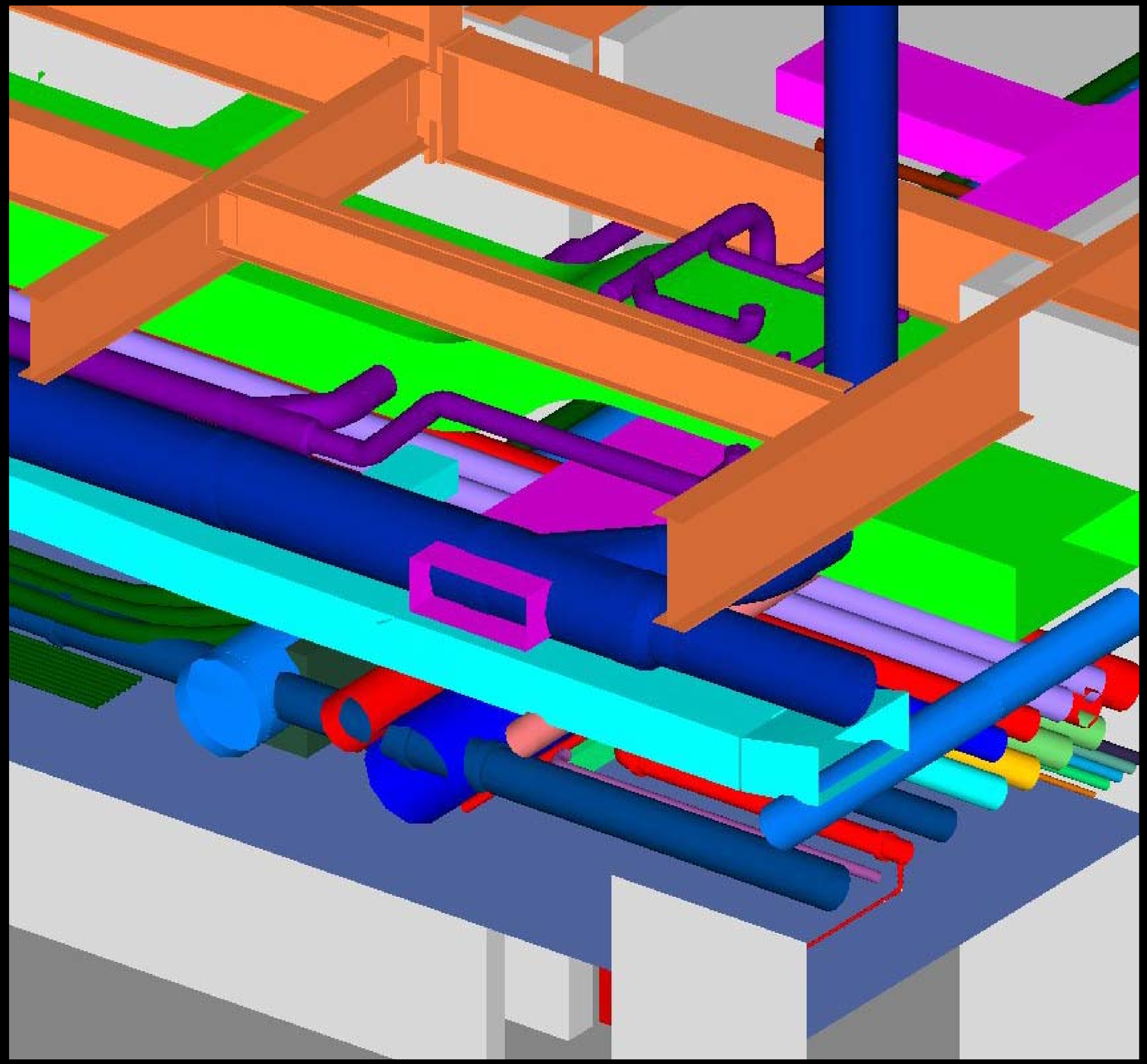

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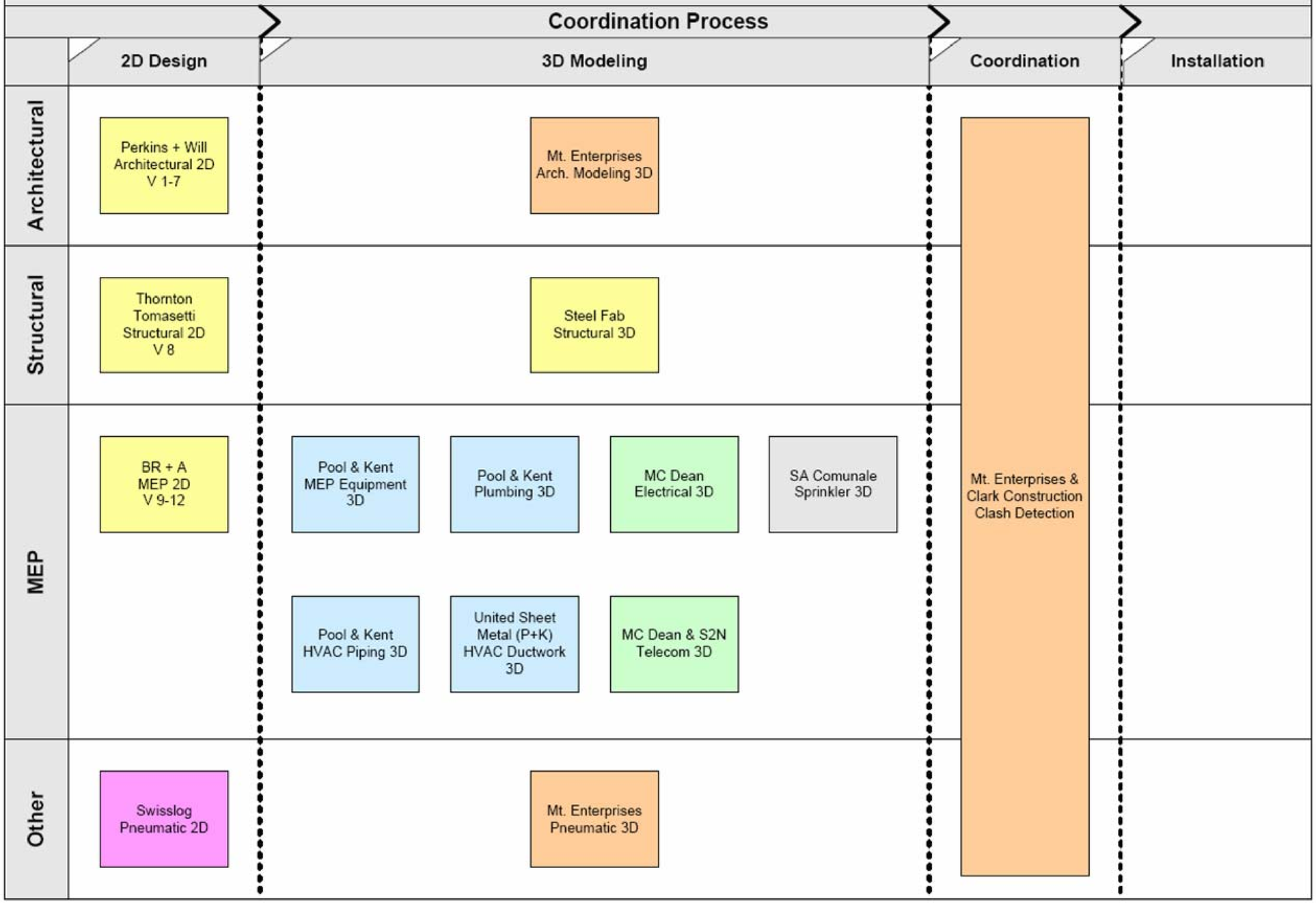
The Johns Hopkins Hospital New Clinical Building



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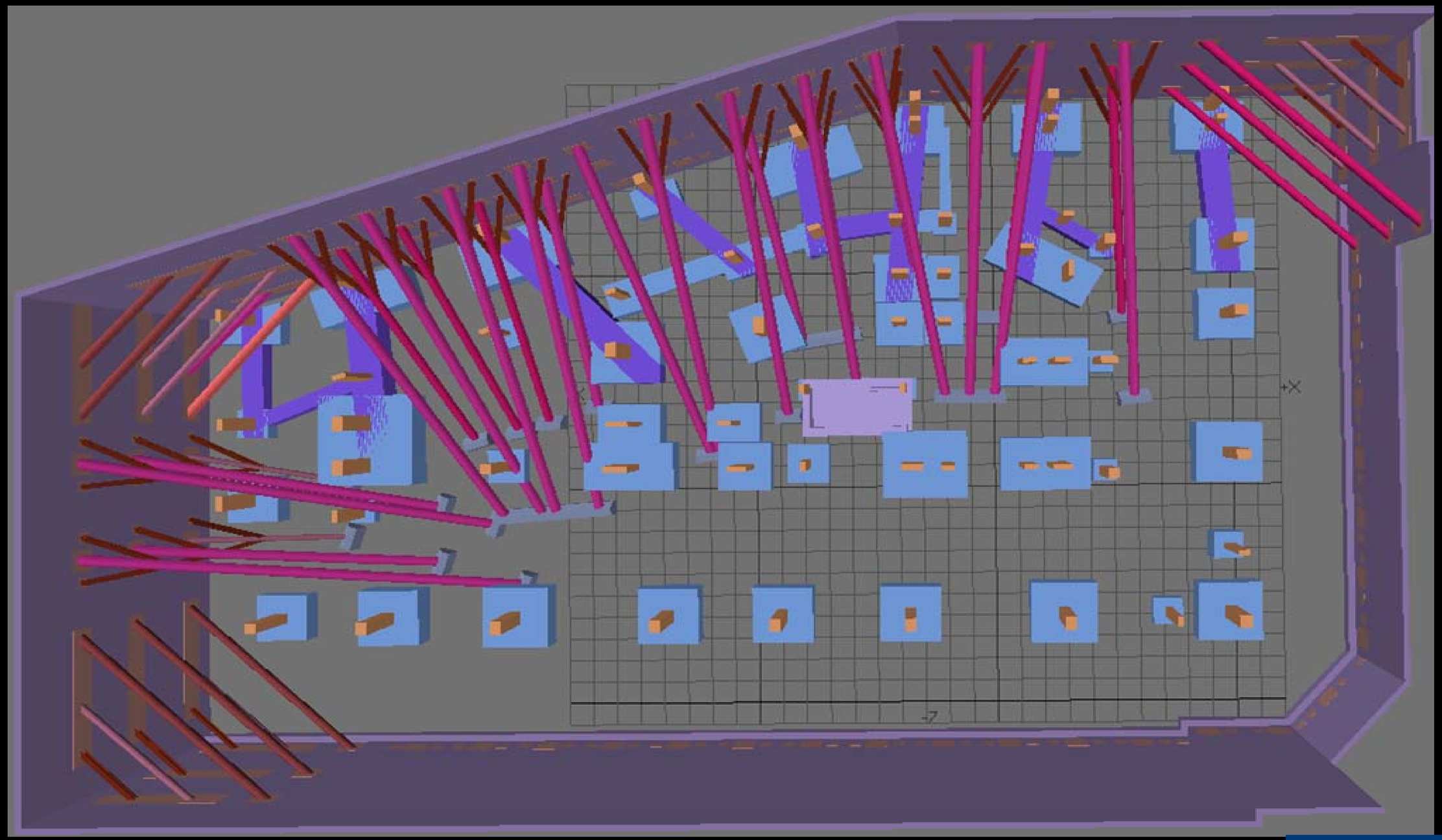
Office Building, Washington, DC



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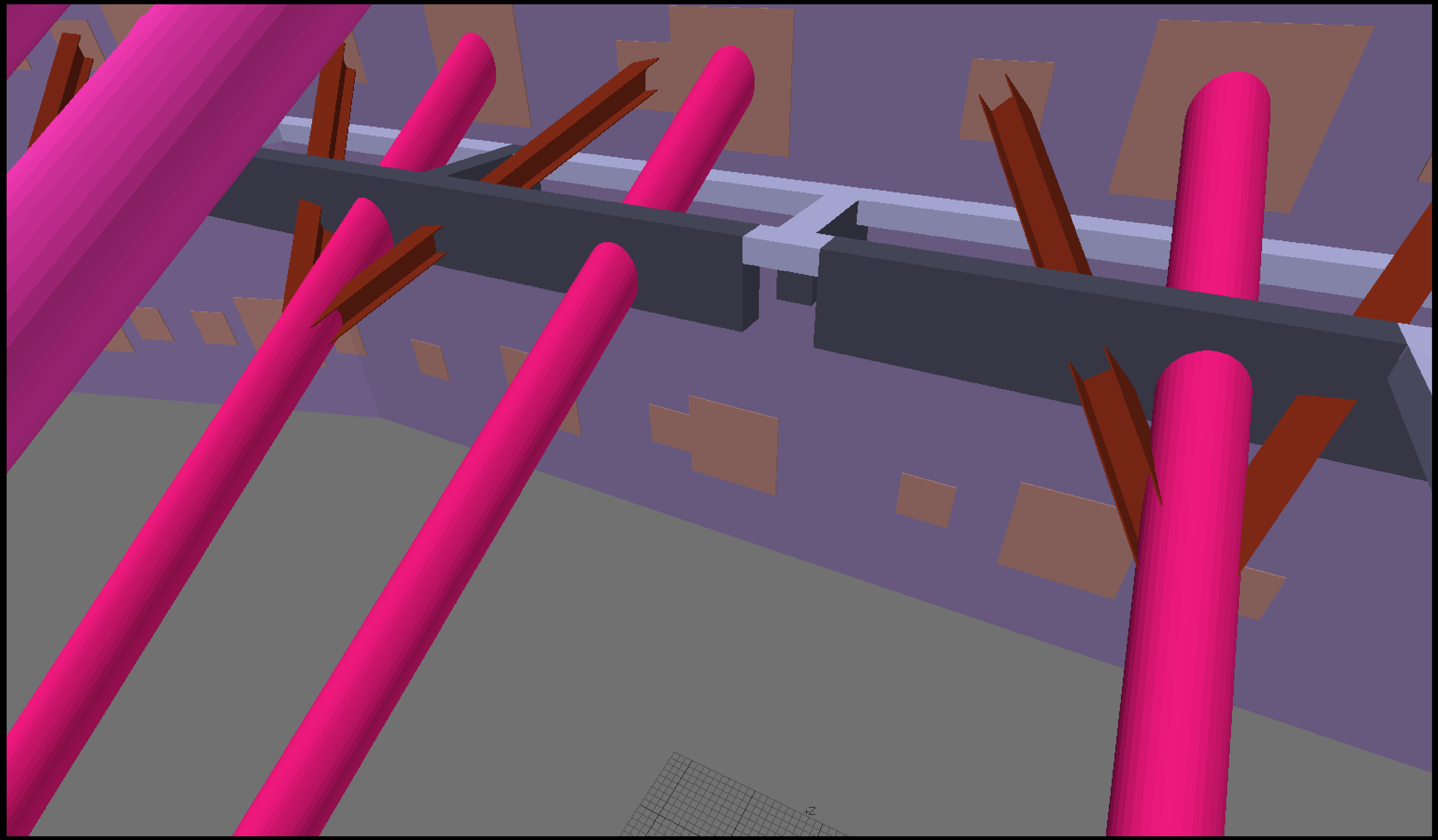

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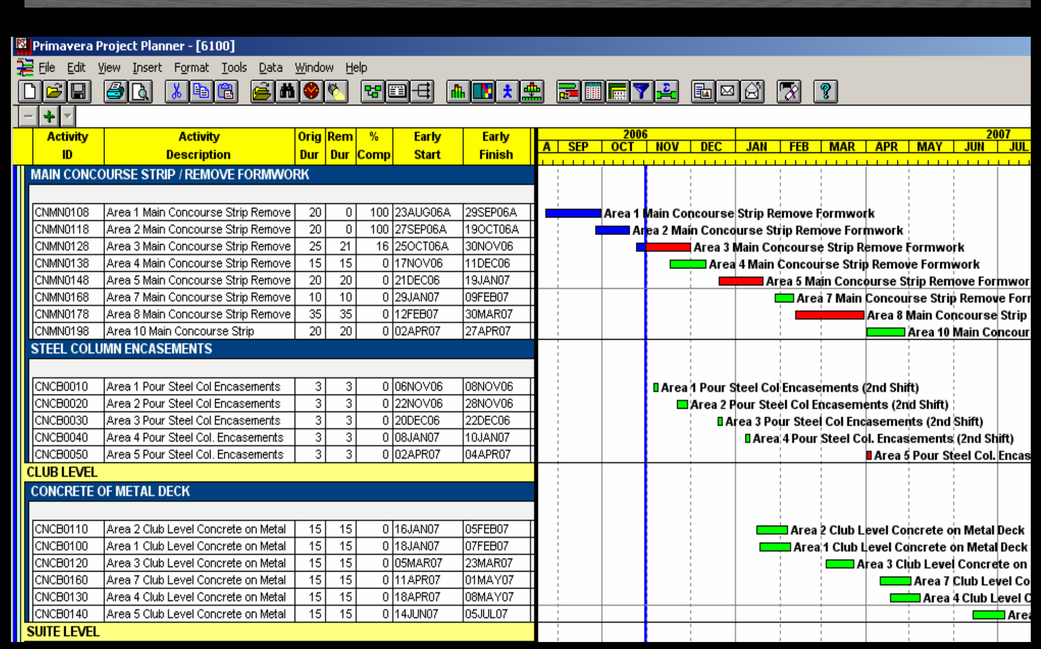
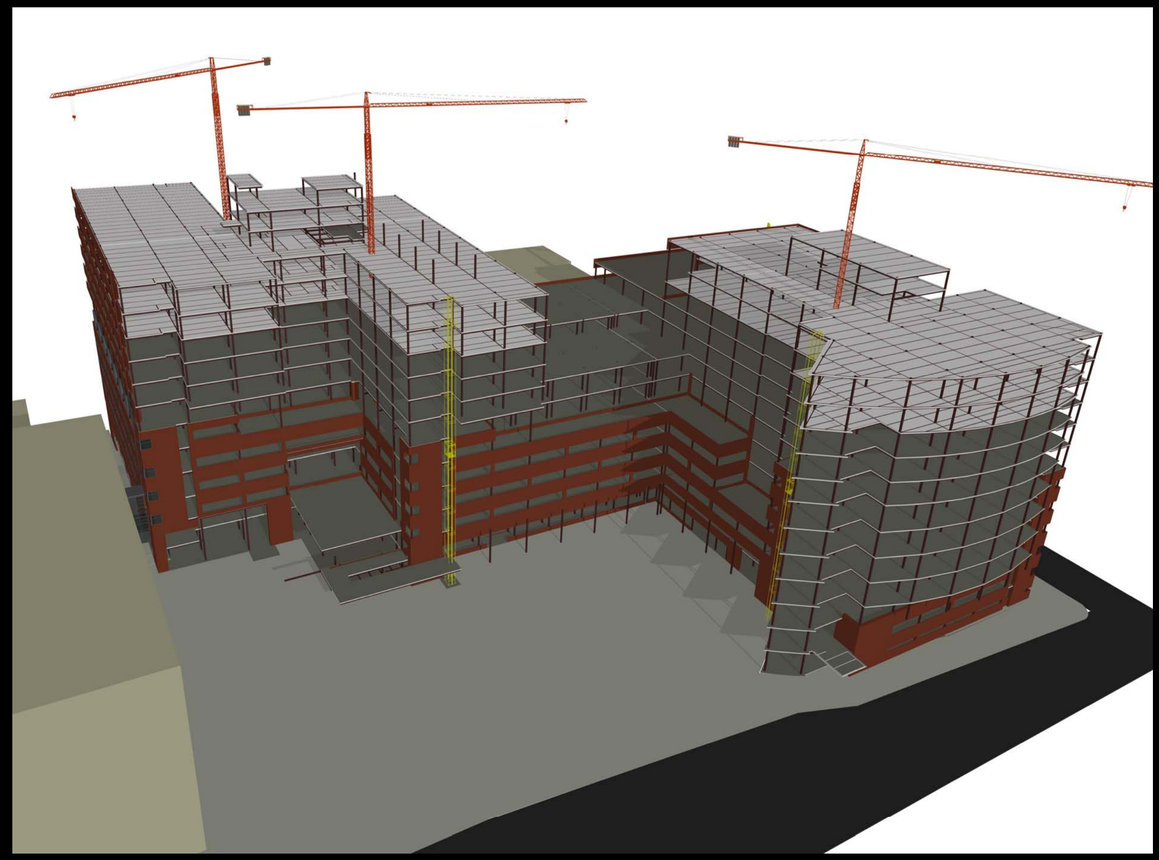
Johns Hopkins Hospital



Merge 3D Model with Schedule (4D Model)



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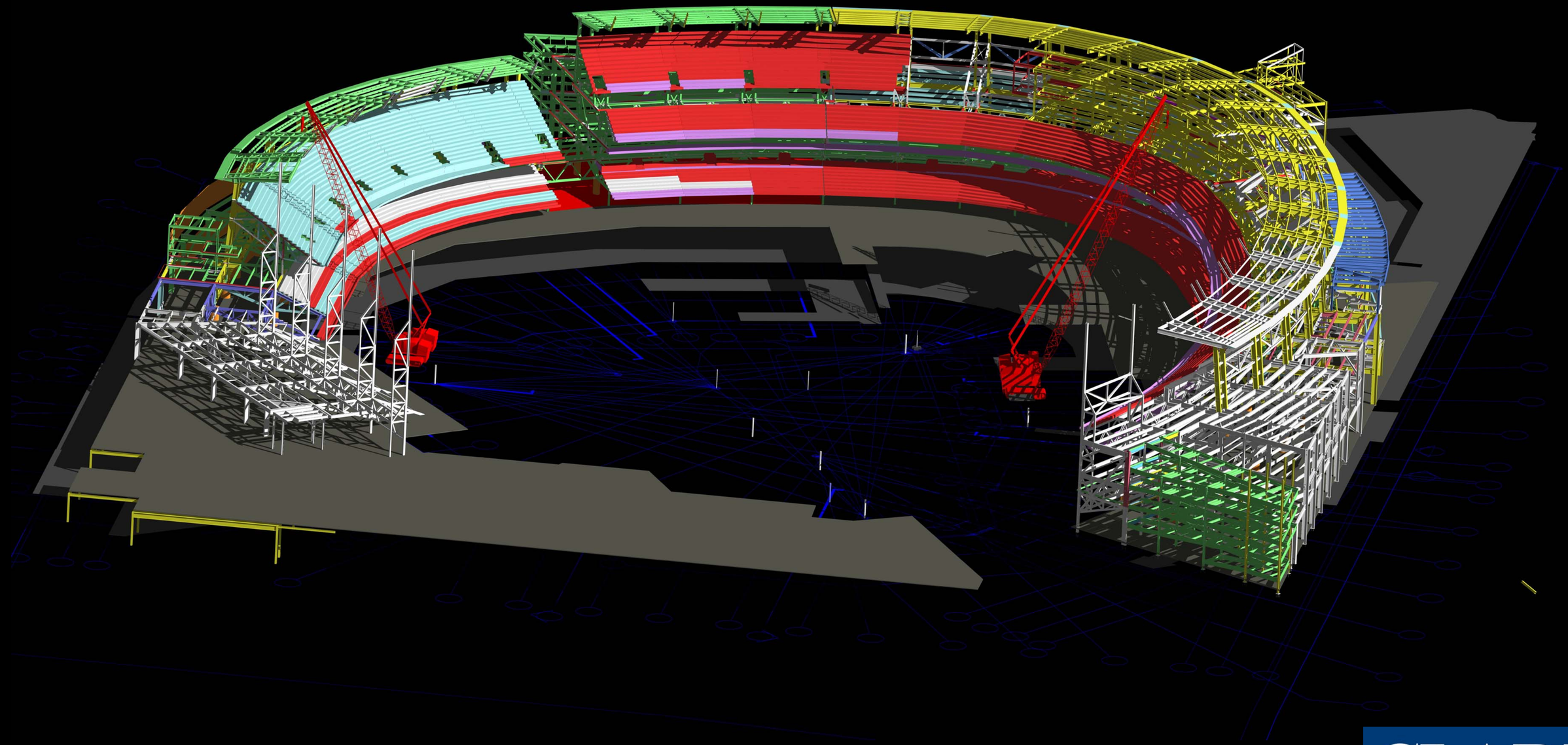
4D at DC Ballpark



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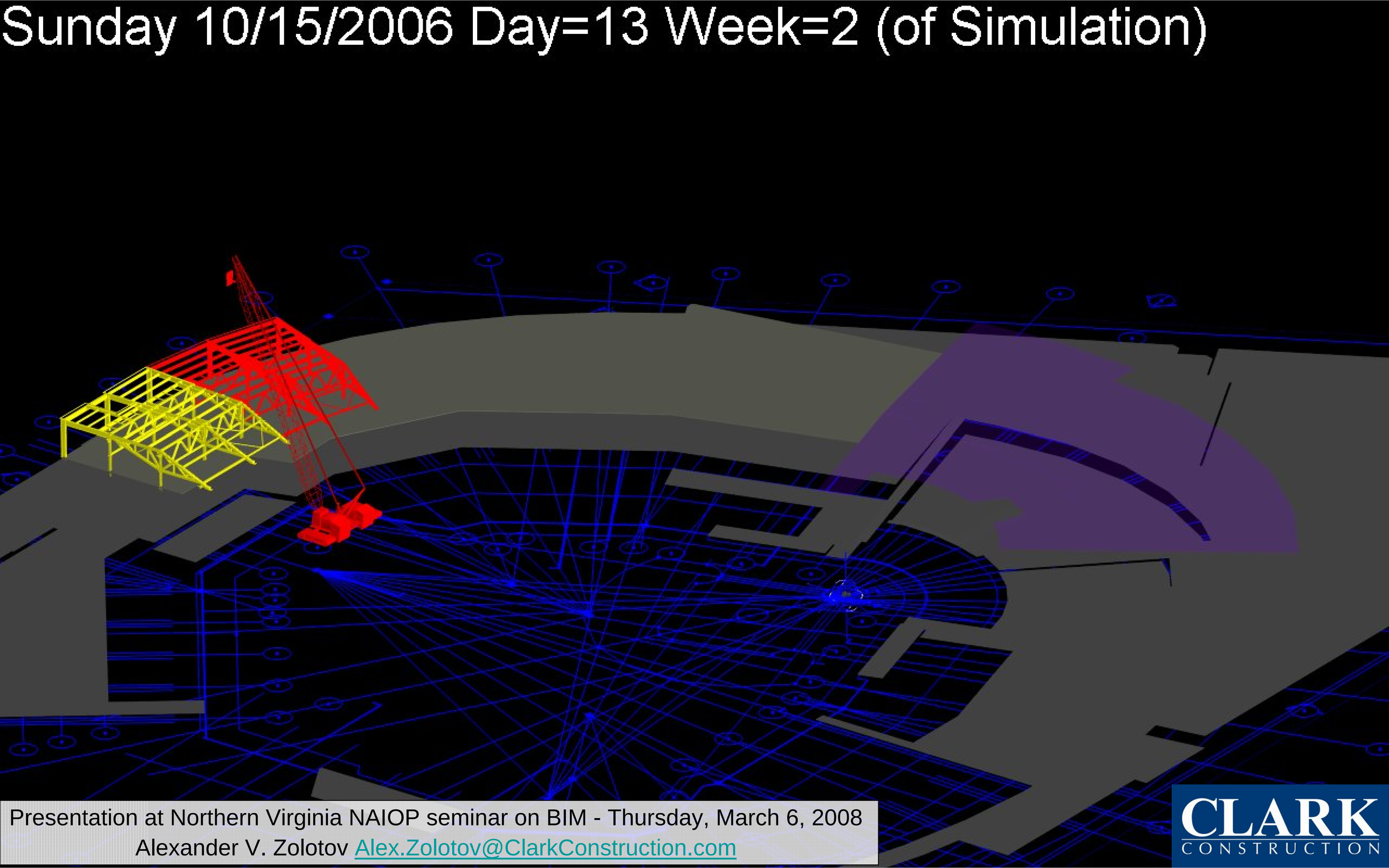
Sunday 10/15/2006 Day=13 Week=2 (of Simulation)



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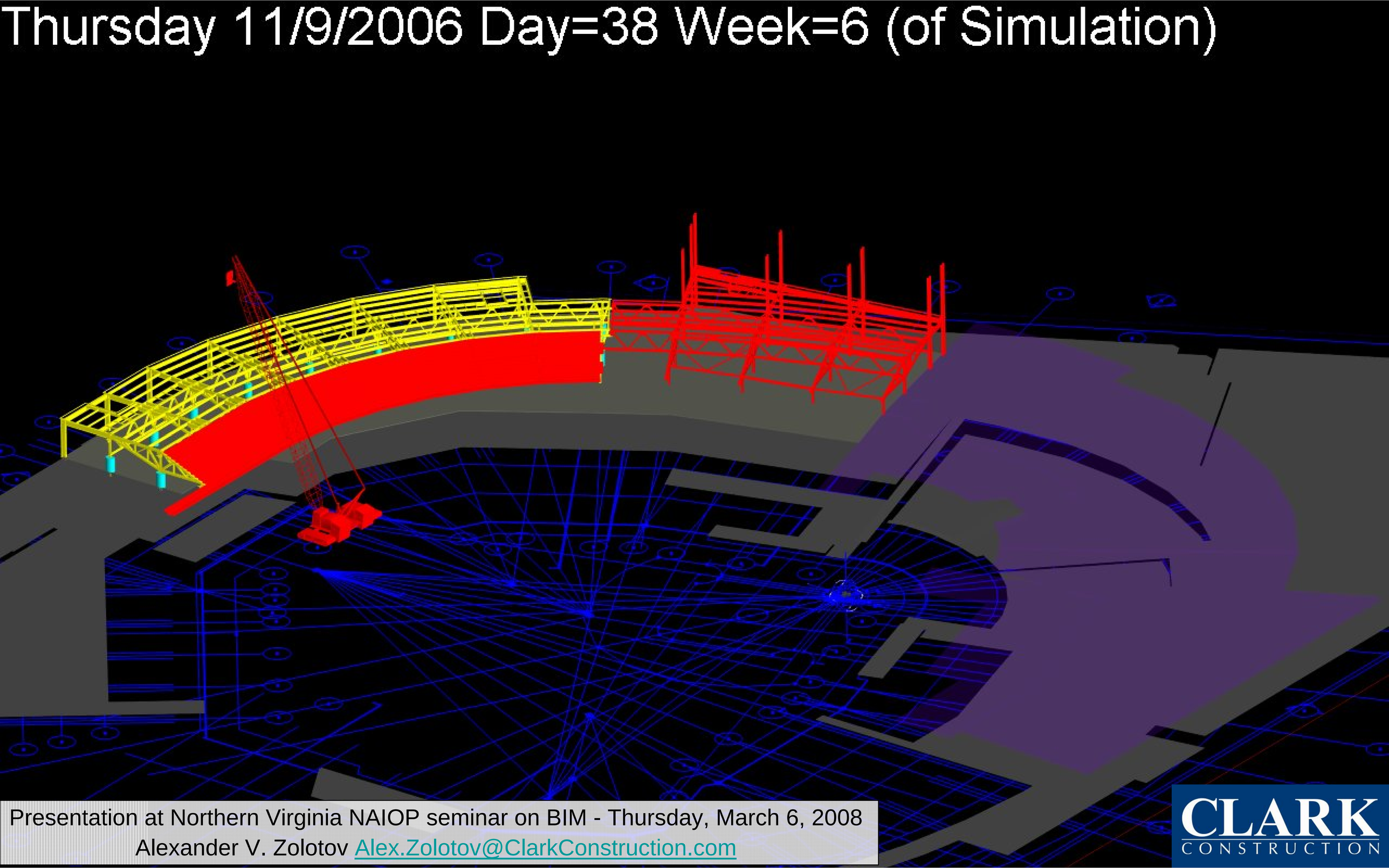
Thursday 11/9/2006 Day=38 Week=6 (of Simulation)



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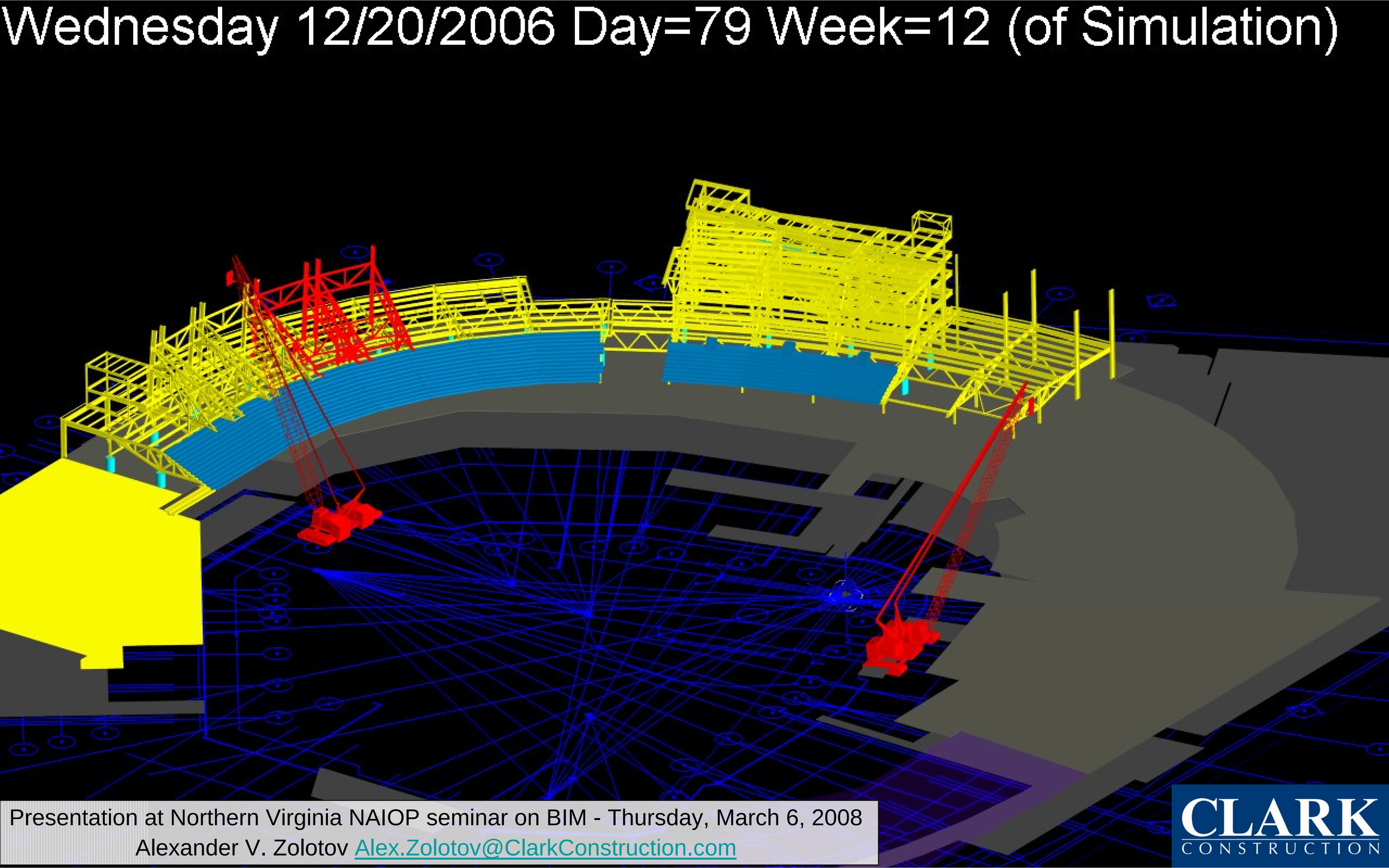
Wednesday 12/20/2006 Day=79 Week=12 (of Simulation)



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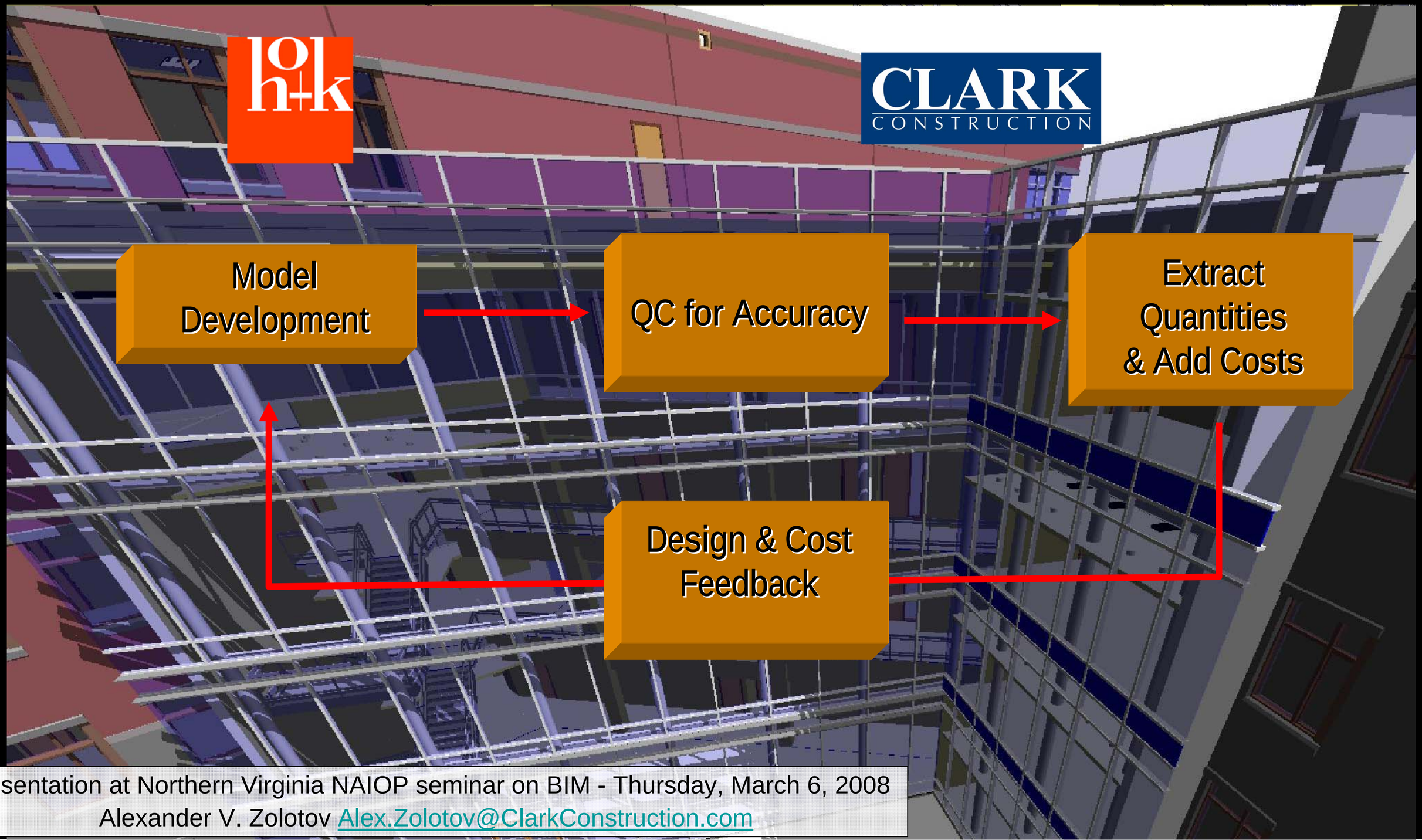
Model Costing – GMU VI



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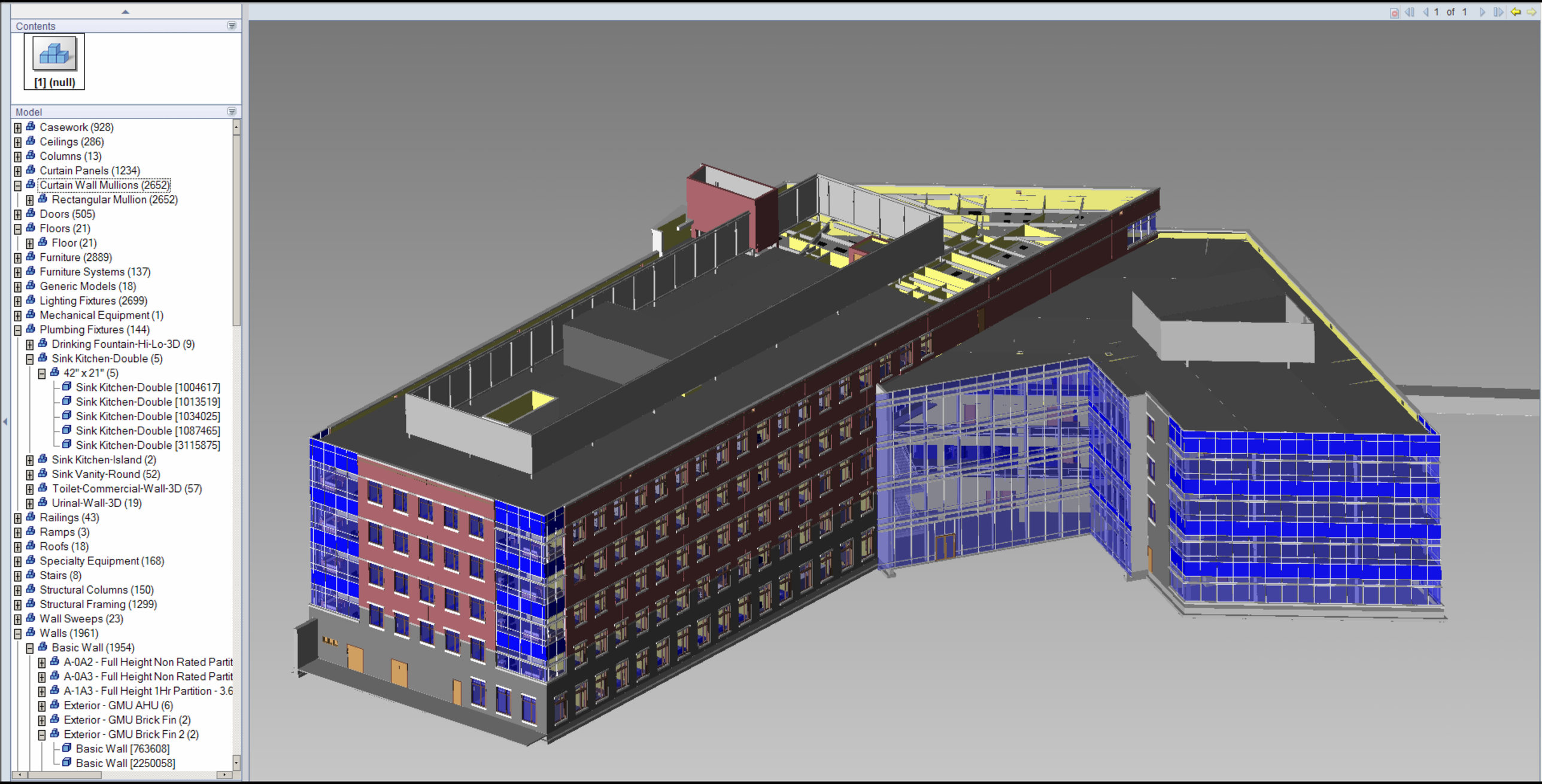

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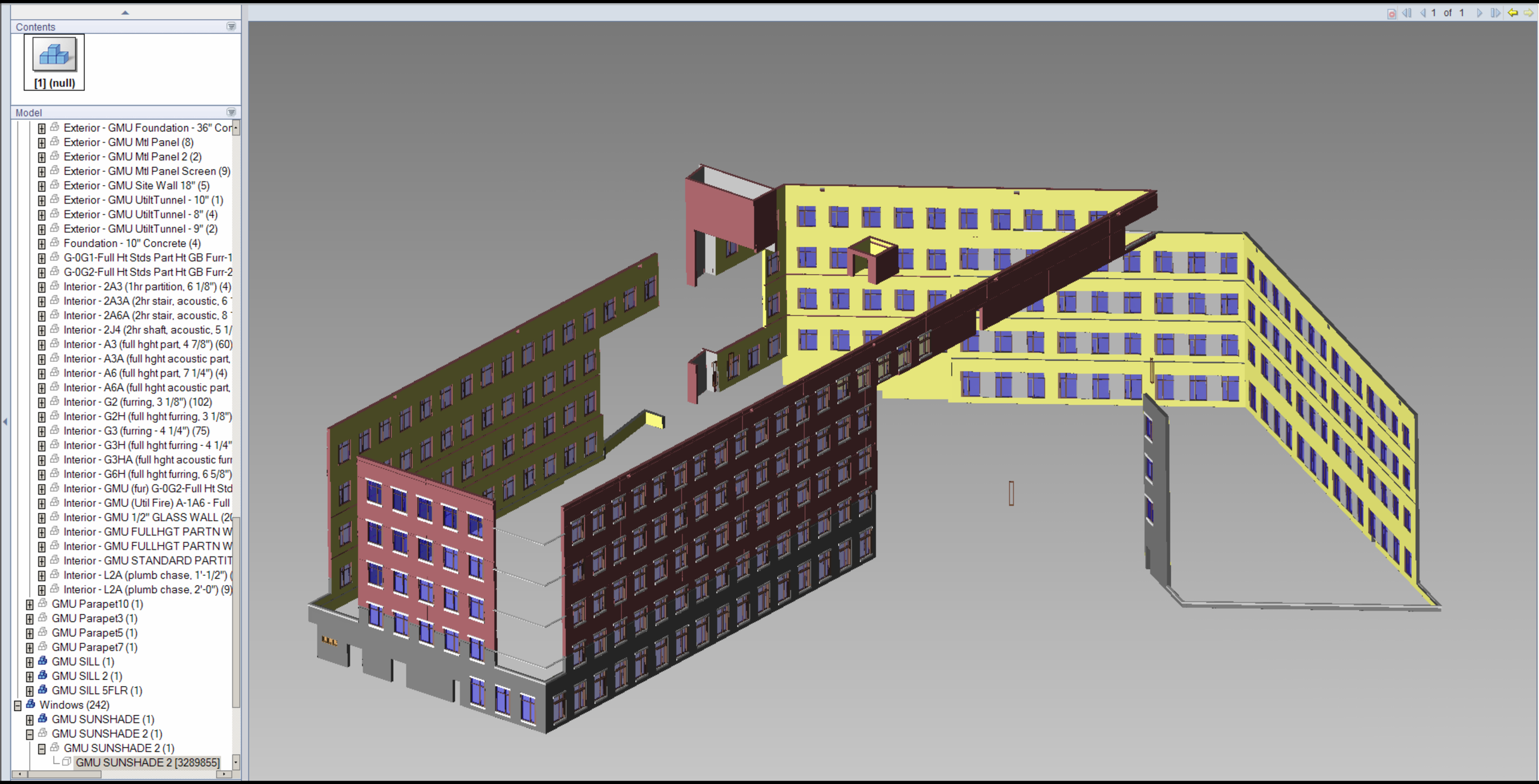

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Autodesk Revit Building 9.1 - [GMU Model_clark_02_07_07 - Schedule: Copy of qs-Wall Quantities by Assembly]

File Edit View Modeling Drafting Site Tools Settings Window Help

Move Copy Rotate Array Mirror Group 3D

Plane Demolish Align Split Trim Offset

Headers: Group Ungroup Rows: New Delete Show

Basics

Modify
Wall
Door
Window
Component
Room
Roof
Floor
Grid
Lines
Ref Plane
Dimension
Section
Level
Text

GMU Model_clark_02_07_07 - Project browser

- DOOR LEGEND
- DRAWING ANNOTATIONS
- FILL PATTERNS DRAFTING
- FILL PATTERNS MODEL
- Legend 1
- Legend 2
- Legend 3
- Legend 4
- Legend 5
- Legend 6
- POWER/DATA LEGEND
- RCP Legend
- Z ALL ANNOTATIONS
- Schedules/Quantities
  - 00-WALL AREA
  - Area Schedule (Gross Building)
  - Area Schedule (Rentable)
  - Ceiling Schedule
  - Copy of DD FINISH SCHEDULE 1
  - Copy of DD FINISH SCHEDULE 2
  - Copy of DD FINISH SCHEDULE 3
  - **Copy of qs-Wall Quantities by Assembly**
  - DD FINISH SCHEDULE
  - DOOR SCHEDULE
  - DOOR SCHEDULE 2
  - DOOR SCHEDULE 3
  - DOOR SCHEDULE 4
  - DRAWING LIST
  - ELECTRICAL FIXTURE SCHEDULE
  - FINISH SCHEDULE
  - Floor Schedule
  - GMU ASSIGNABLE AREA
  - GMU BY SPACE
  - GMU G. FLOWERS
  - GMU PROGRAM
  - GMU PROGRAM #
  - GMU PROGRAM TEMP
  - GMU ROOM ALL
  - GMU ROOM BCOM EGRESS
  - GMU ROOM BCOM EGRESS (2)
  - GMU ROOM BCOM EGRESS (3)
  - GMU ROOM BCOM EGRESS (4)
  - GMU ROOM BCOM EGRESS (5)
  - GMU ROOM EGRESS LOAD
  - GMU ROOM SCHEDULE
  - GMU SD BCOM (HOK)
  - ISSUE LIST
  - KEYNOTES
  - Panel Schedule
  - qa-Area Schedule (Gross Building)
  - qa-Casework Quantities
  - qa-Ceiling Quantities by Type

View
Modelling
Drafting
Site
Construction

Copy of qs-Wall Quantities by Assembly

Assembly Code	Assembly Description	Length - Center To Center	Width	Calculated To Butt-End Dimensions Area	Calculated To Butt-End Dimensions Volume	Wall Type	Co eo	Wall Assembly
B2010158	Ext. Wall - Brick Veneer w/ Stud	160' - 7 7/16"	1.25	5015.02	6221.63	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	92' - 3 1/4"	1.25	2979.59	3681.48	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	113' - 11 1/8"	1.25	2546.49	3145.48	BR 1		Exterior - GMU Brick on Mtl. Stud
B2010158	Ext. Wall - Brick Veneer w/ Stud	121' - 2 15/16"	1.25	840.89	1038.14	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	17' - 9 1/2"	0.88	261.13	228.48	MT1		Exterior - GMU Mtl Panel
B2010158	Ext. Wall - Brick Veneer w/ Stud	63' - 7 1/2"	0.88	66.19	57.91	MT1		Exterior - GMU Mtl Panel
B2010158	Ext. Wall - Brick Veneer w/ Stud	233' - 8 1/8"	1.25	6084.10	7514.26	BR 1		Exterior - GMU Brick on Mtl. Stud
B2010158	Ext. Wall - Brick Veneer w/ Stud	44' - 5 3/8"	1.25	159.67	192.87	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	19' - 4 1/2"	1.25	36.72	45.90	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	19' - 4 1/2"	1.25	99.30	122.05	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	29' - 6 3/4"	0.96	779.06	746.60			Exterior - GMU Brick Fin
B2010158	Ext. Wall - Brick Veneer w/ Stud	10' - 5 3/8"	0.96	466.90	447.45	BR 2		Exterior - GMU Brick Fin 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	26' - 2 3/8"	0.96	565.90	538.33			Exterior - GMU Brick Fin
B2010158	Ext. Wall - Brick Veneer w/ Stud	153' - 1"	1.25	2184.33	2693.96	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	126' - 10 1/16"	1.25	1800.51	2204.83	BR 1		Exterior - GMU Brick on Mtl. Stud
B2010158	Ext. Wall - Brick Veneer w/ Stud	19' - 5"	1.25	242.55	303.19	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	9' - 4 1/2"	1.25	59.58	72.28	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	6' - 7 7/16"	1.25	32.39	39.93	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	29' - 2 1/8"	1.25	112.11	139.58	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	186' - 4"	1.25	957.73	1156.29	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	74' - 0"	1.25	2042.88	2500.21	BR 1		Exterior - GMU Brick on Mtl. Stud
B2010158	Ext. Wall - Brick Veneer w/ Stud	83' - 4 1/2"	1.25	1141.06	1405.10	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	42' - 2 3/4"	0.63	591.02	369.39			Exterior - GMU AHU
B2010158	Ext. Wall - Brick Veneer w/ Stud	20' - 5 1/2"	0.63	236.98	148.11			Exterior - GMU AHU
B2010158	Ext. Wall - Brick Veneer w/ Stud	42' - 2 3/4"	0.63	519.06	324.41			Exterior - GMU AHU
B2010158	Ext. Wall - Brick Veneer w/ Stud	20' - 5 1/2"	0.63	229.74	143.59			Exterior - GMU AHU
B2010158	Ext. Wall - Brick Veneer w/ Stud	49' - 5 1/2"	0.46	653.33	299.44	MT 2		Exterior - GMU Mtl Panel Screen
B2010158	Ext. Wall - Brick Veneer w/ Stud	23' - 0 1/2"	0.46	303.89	139.28	MT 2		Exterior - GMU Mtl Panel Screen
B2010158	Ext. Wall - Brick Veneer w/ Stud	10' - 3 1/2"	0.96	168.00	161.00	BR 2		Exterior - GMU Brick Fin 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	7' - 1"	0.88	383.20	335.30	MT1		Exterior - GMU Mtl Panel
B2010158	Ext. Wall - Brick Veneer w/ Stud	9' - 9 11/16"	0.88	582.33	496.78	MT1		Exterior - GMU Mtl Panel
B2010158	Ext. Wall - Brick Veneer w/ Stud	41' - 11 3/4"	0.63	591.02	369.39			Exterior - GMU AHU
B2010158	Ext. Wall - Brick Veneer w/ Stud	20' - 5 1/2"	0.88	251.47	220.03	MT2		Exterior - GMU Mtl Panel 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	41' - 11 3/4"	0.63	515.98	322.49			Exterior - GMU AHU
B2010158	Ext. Wall - Brick Veneer w/ Stud	20' - 5 1/2"	0.88	243.78	213.31	MT2		Exterior - GMU Mtl Panel 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	18' - 0 13/16"	1.25	945.88	1182.35	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	12' - 2 11/16"	1.25	17.67	21.60	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	78' - 7 15/16"	1.25	103.04	128.80	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	9' - 11"	1.25	104.22	130.28	BR 1		Exterior - GMU Brick on Mtl. Stud
B2010158	Ext. Wall - Brick Veneer w/ Stud	10' - 2 1/2"	1.25	95.29	115.69	BR 1		Exterior - GMU Brick on Mtl. Stud
B2010158	Ext. Wall - Brick Veneer w/ Stud	9' - 11"	1.25	92.56	115.69	BR 1		Exterior - GMU Brick on Mtl. Stud
B2010158	Ext. Wall - Brick Veneer w/ Stud	10' - 2 1/2"	1.25	35.63	42.11	BR 1		Exterior - GMU Brick on Mtl. Stud
B2010158	Ext. Wall - Brick Veneer w/ Stud	46' - 9 3/16"	0.46	630.29	288.88	MT 2		Exterior - GMU Mtl Panel Screen
B2010158	Ext. Wall - Brick Veneer w/ Stud	3' - 2 1/16"	0.46	36.17	15.93	MT 2		Exterior - GMU Mtl Panel Screen
B2010158	Ext. Wall - Brick Veneer w/ Stud	22' - 11 1/4"	0.46	303.86	138.62	MT 2		Exterior - GMU Mtl Panel Screen
B2010158	Ext. Wall - Brick Veneer w/ Stud	1' - 11 11/16"	1.25	10.40	13.00	SB 1		Exterior - GMU Cast Stn on Mtl. Stud 2
B2010158	Ext. Wall - Brick Veneer w/ Stud	6' - 4 1/2"	0.46	4.20	1.92	MT 2		Exterior - GMU Mtl Panel Screen
B2010158	Ext. Wall - Brick Veneer w/ Stud	23' - 11 1/2"	0.88	347.67	304.21	MT1		Exterior - GMU Mtl Panel

Ready

NUM

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CLARK CONSTRUCTION

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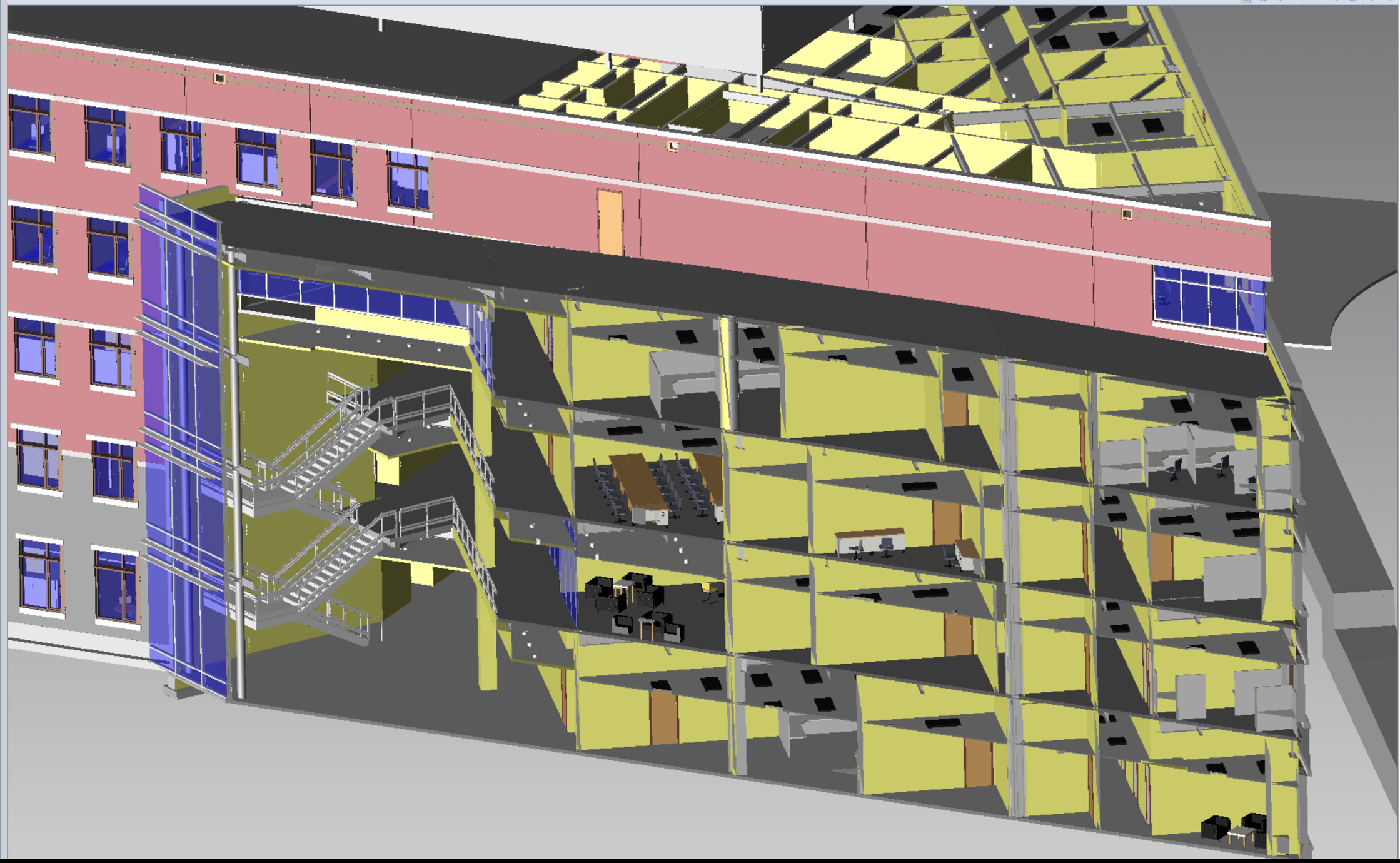
Animations



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CLARK CONSTRUCTION

BIM Implementation

Coordination Visualization Models

- Steel Coordination
- 3D MEP Spatial Coordination
- Unique Project Challenges

Scheduling

- 4D Models for Analysis and Communication

Estimating

- Automated quantity take-off

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Benefits of BIM

Effective tool for:

- coordination and constructability reviews
- achieving fast-track schedules and staying within budget
- more reliable planning and budgeting
- more dynamic, real-time value analysis and decision-making

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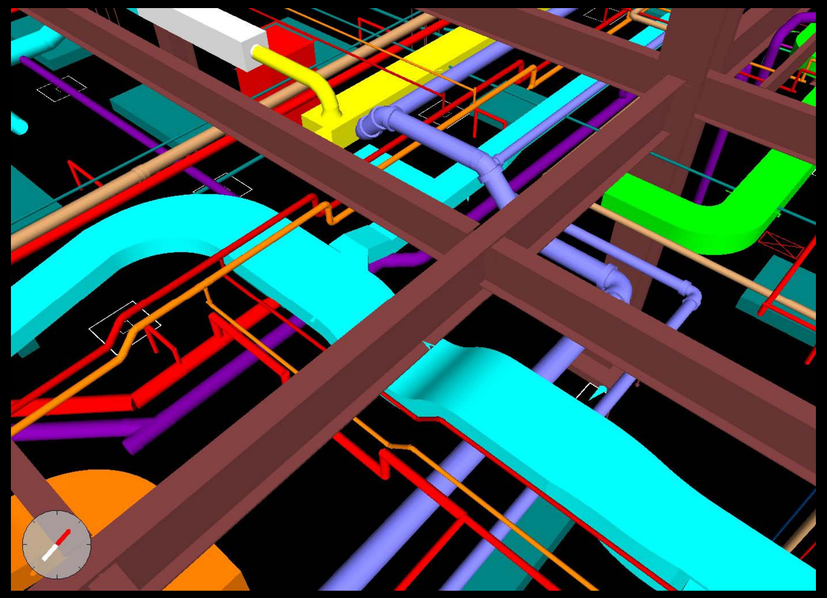
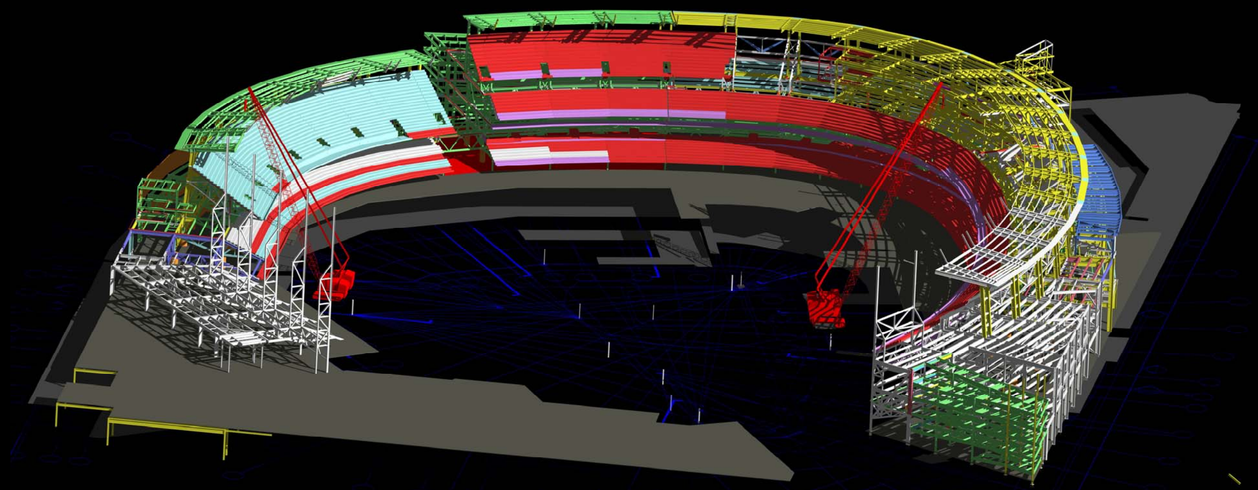
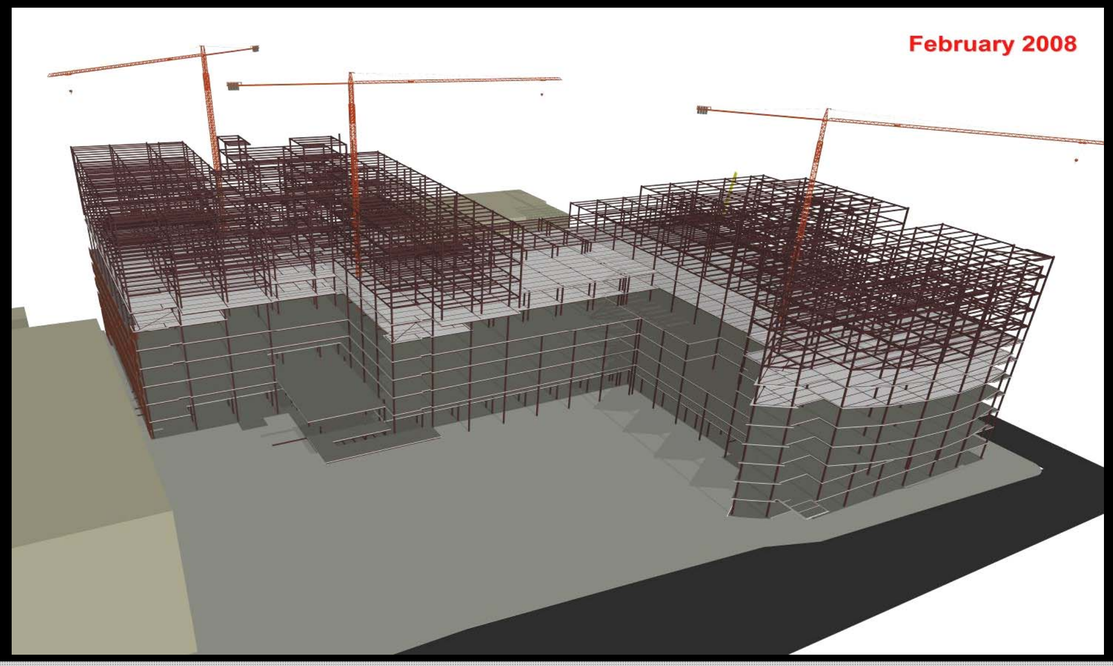




Thank you!



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