



METRO MUSEUM OF AMERICAN ART

SENIOR THESIS FINAL PRESENTATION

Vincent A. Rossi

Construction Management





PROJECT BACKGROUND

■ General Building Data

- Location: Major City, United States
- Occupancy Type: Museum / Assembly
- Height : 9 Stories
- Size: 222,952 GSF
- Total Cost: \$266,000,000
- Cost Per Square Foot: \$1200
- Dates of Construction: Oct, 2011 – Nov 2014





PROJECT SITE

■ Project Constraints

- Downtown in a Major U.S. City
- Existing 90' Tall Building to the South
- Highway access to the West
- Highline Park / Walkway to the East
- Existing Low Rise Buildings to the North
- Highline Maintenance Building Construction
- Constricted Site





PROJECT SITE

Project Constraints

- Downtown in a Major U.S. City
- Existing 90' Tall Building to the South
- Highway access to the West
- Highline Park / Walkway to the East
- Existing Low Rise Buildings to the North
- Highline Maintenance Building Construction
- Constricted Site





PROJECT SITE

Project Constraints

- Downtown in a Major U.S. City
- Existing 90' Tall Building to the South
- Highway access to the West
- Highline Park / Walkway to the East
- Existing Low Rise Buildings to the North
- Highline Maintenance Building Construction
- Constricted Site





PROJECT SITE

Project Constraints

- Downtown in a Major U.S. City
- Existing 90' Tall Building to the South
- Highway access to the West
- Highline Park / Walkway to the East
- Existing Low Rise Buildings to the North
- Highline Maintenance Building Construction
- Constricted Site





PROJECT SITE

Project Constraints

- Downtown in a Major U.S. City
- Existing 90' Tall Building to the South
- Highway access to the West
- Highline Park / Walkway to the East
- Existing Low Rise Buildings to the North
- Highline Maintenance Building Construction
- Constricted Site





PROJECT SITE

■ Project Constraints

- Downtown in a Major U.S. City
- Existing 90' Tall Building to the South
- Highway access to the West
- Highline Park / Walkway to the East
- Existing Low Rise Buildings to the North
- Highline Maintenance Building Construction
- Constricted Site



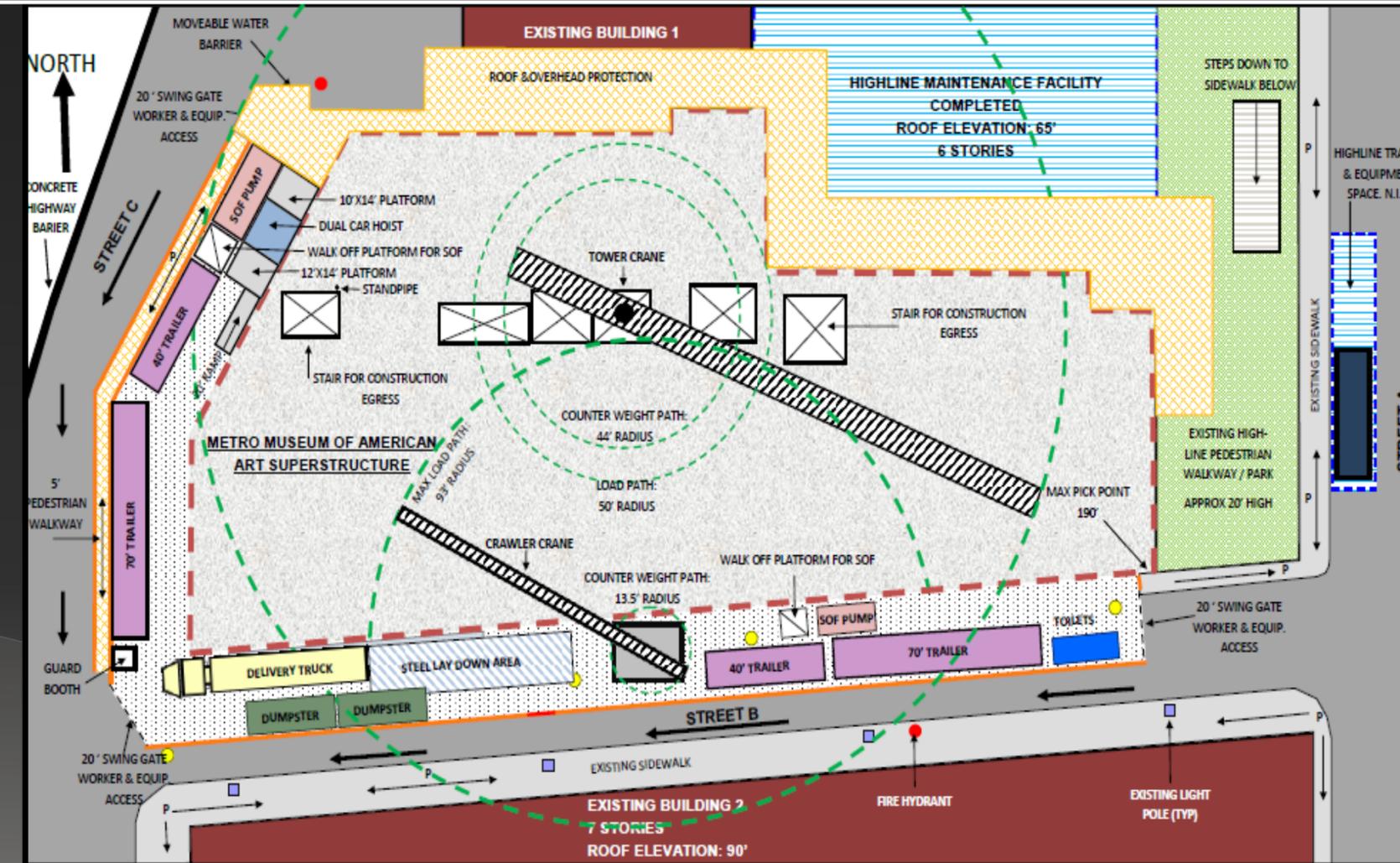


PROJECT SITE

PROJECT SITE

Project Constraints

- Downtown in a Major U.S. City
- Existing 90' Tall Building to the South
- Highway access to the West
- Highline Park / Walkway to the East
- Existing Low Rise Buildings to the North
- Highline Maintenance Building Construction
- Constricted Site



LEGEND		EXISTING BUILDING	ROOF/OVERHEAD PROTECTION
CONSTRUCTION FENCING	ASPHALT ROADWAY	MULTI-USE CONSTRUCTION AREA	FIRE HYDRANT
MMAA BUILDING PERIMETER	MMAA BUILDING AREA	HIGHLINE BUILDING FOOTPRINT	LIGHT POLE
PEDESTRIAN TRAFFIC FLOW	HIGHLINE BUILDING PERIMETER	EXISTING SIDEWALK	MOVEABLE WATER BARRIER
			MANHOLE COVER
			CRANE SWING RADIUS

DATE: SEPTEMBER 17th, 2012
 AUTHOR: VINCENT A. ROSSI

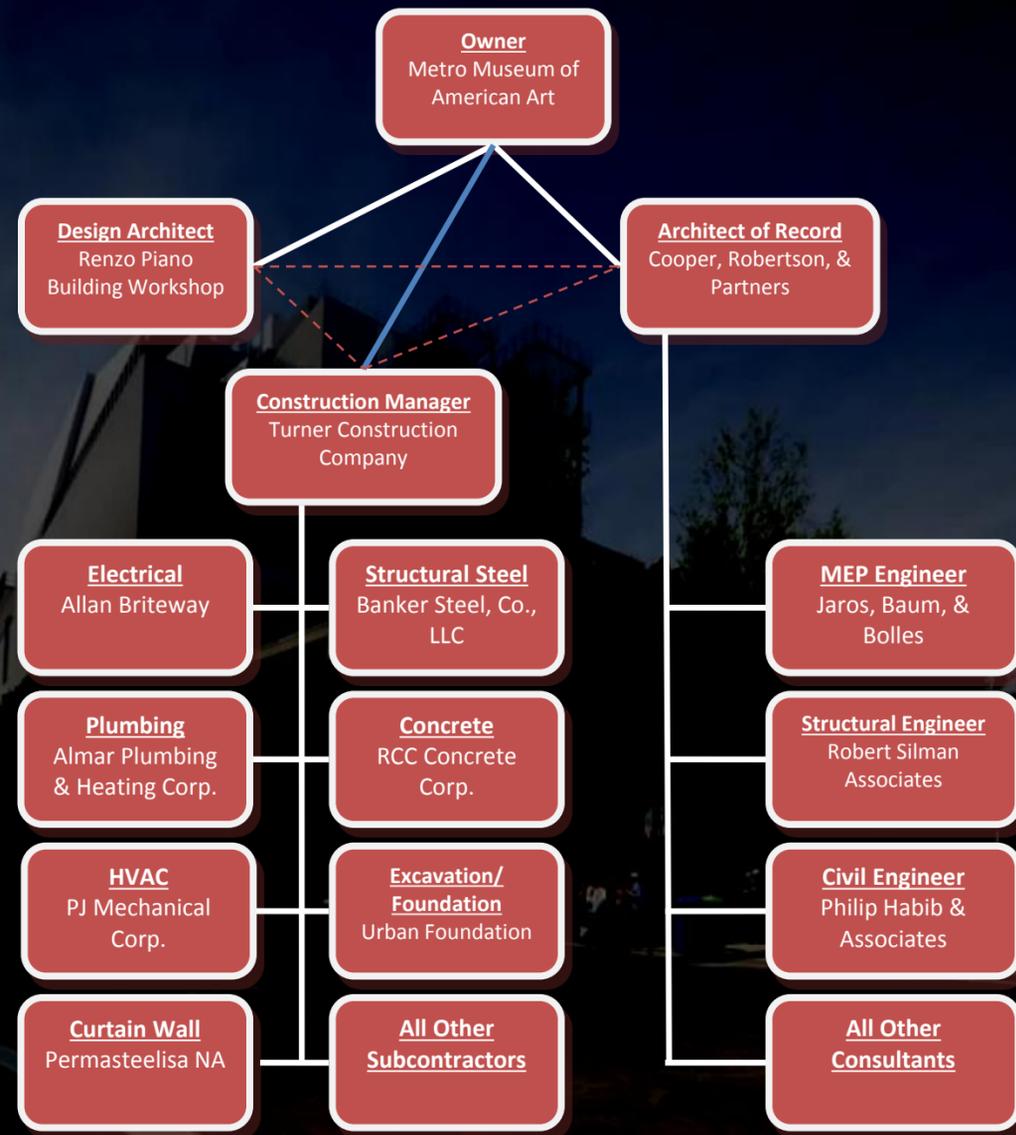
METRO MUSEUM OF AMERICAN ART
 PHASE 3: SUPERSTRUCTURE



PROJECT TEAM

- Owner: Metro Museum of American Art
- Design Architect: Renzo Piano Building Workshop
- Architect of Record: Cooper, Robertson & Partners
- Construction Manager: Turner Construction Co.

Turner
Building the Future



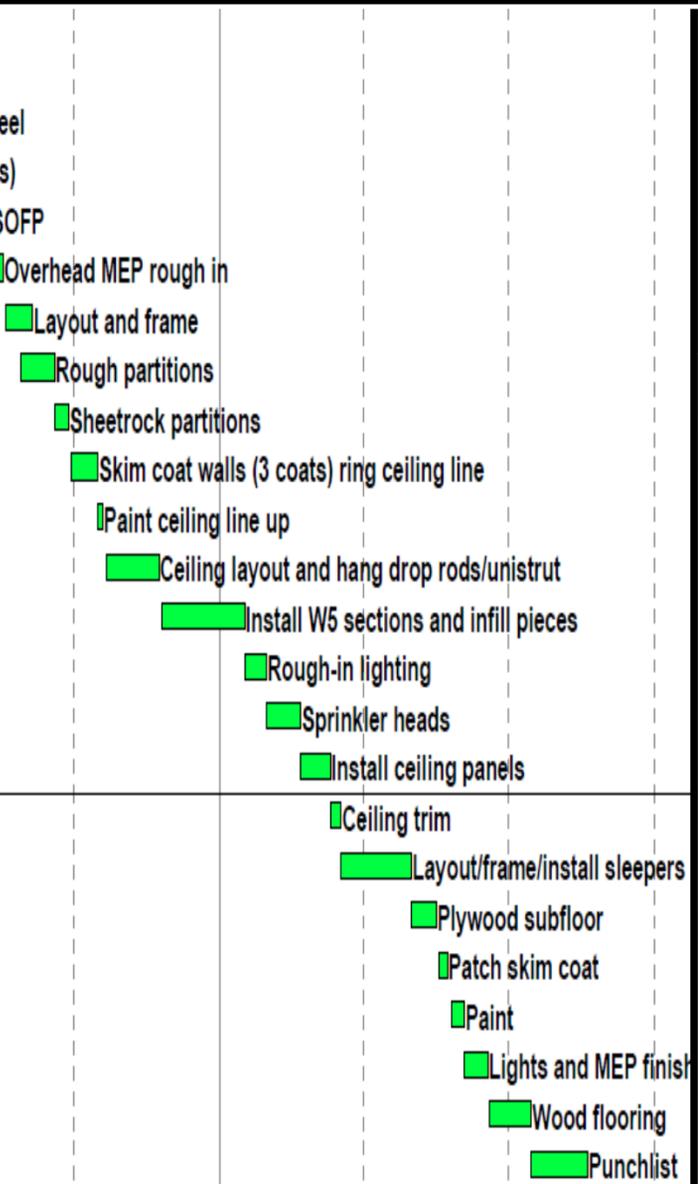
PROJECT DELIVERY METHOD

Design – Bid – Build Project
Delivery Method

Cost Plus Contract with a GMP
Option



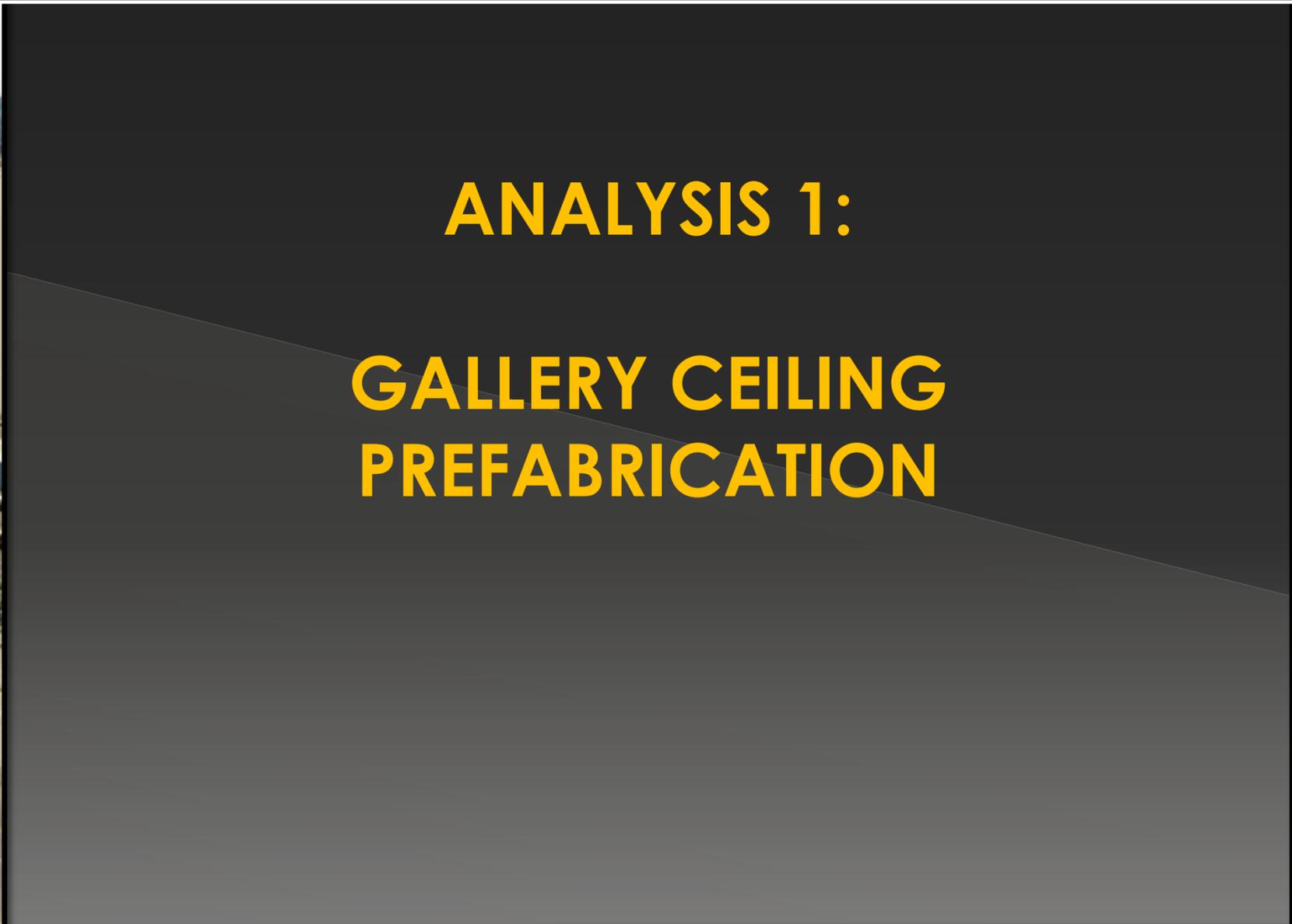
Gallery					
INT-5-100	Install hangers	01-29-13	02-11-13	10	10
INT-5-101	Protect surface adjacent to steel	02-12-13	02-19-13	5	5
INT-5-122	Cure SOFP (28 cal days)	03-06-13	04-02-13	20	20
INT-5-102	Paint metal deck & SOFP	04-03-13	04-16-13	10	10
INT-5-103	Overhead MEP rough in	06-21-13	08-16-13	40	40
INT-5-104	Layout and frame	08-19-13	09-04-13	12	12
INT-5-105	Rough partitions	08-28-13	09-18-13	15	15
INT-5-106	Sheetrock partitions	09-19-13	09-27-13	7	7
INT-5-107	Skim coat walls (3 coats) ring ceiling line	09-30-13	10-15-13	12	12
INT-5-108	Paint ceiling line up	10-16-13	10-18-13	3	3
INT-5-109	Ceiling layout and hang drop rods/unistrut	10-21-13	11-22-13	25	25
INT-5-110	Install W5 sections and infill pieces	11-25-13	01-15-14	35	35
INT-5-111	Rough-in lighting	01-16-14	01-29-14	10	10
INT-5-112	Sprinkler heads	01-30-14	02-20-14	15	15
INT-5-113	Install ceiling panels	02-21-14	03-10-14	12	12
INT-5-114	Ceiling trim	03-11-14	03-17-14	5	5
INT-5-115	Layout/frame/install sleepers	03-18-14	04-30-14	32	32
INT-5-116	Plywood subfloor	05-01-14	05-16-14	12	12
INT-5-117	Patch skim coat	05-19-14	05-23-14	5	5
INT-5-118	Paint	05-27-14	06-03-14	6	6
INT-5-119	Lights and MEP finish trim	06-04-14	06-17-14	10	10
INT-5-120	Wood flooring	06-19-14	07-15-14	18	18
INT-5-123	Punchlist	07-16-14	08-19-14	25	25



PROJECT SCHEDULE SUMMARY

- 37 Month Construction Schedule (10/11 – 11/14)
 - Interior fit-out longest project phase by far.
 - Due to long gallery fit-outs. (19 Months)
 - Start to Finish activity relationships.
 - Only one trade active per gallery.

GALLERY FIT-OUT SCHEDULE OVERVIEW			
Gallery	Start Date	Finish Date	Duration (Days)
1 st Floor Gallery	19-Dec-12	26-Jun-14	390
5 th Floor Gallery	29-Jan-13	19-Aug-14	401
6 th Floor Gallery	12-Feb-13	16-Sep-14	411
7 th Floor Gallery	21-Feb-13	14-Oct-14	424
8 th Floor Gallery	28-Feb-13	28-Nov-14	452
Average			416





PROBLEM IDENTIFICATION AND GOALS

■ Problem:

- Ceiling system takes over 100 days to construct.

■ Goal:

- Reduce the length of the gallery fit-out schedule.

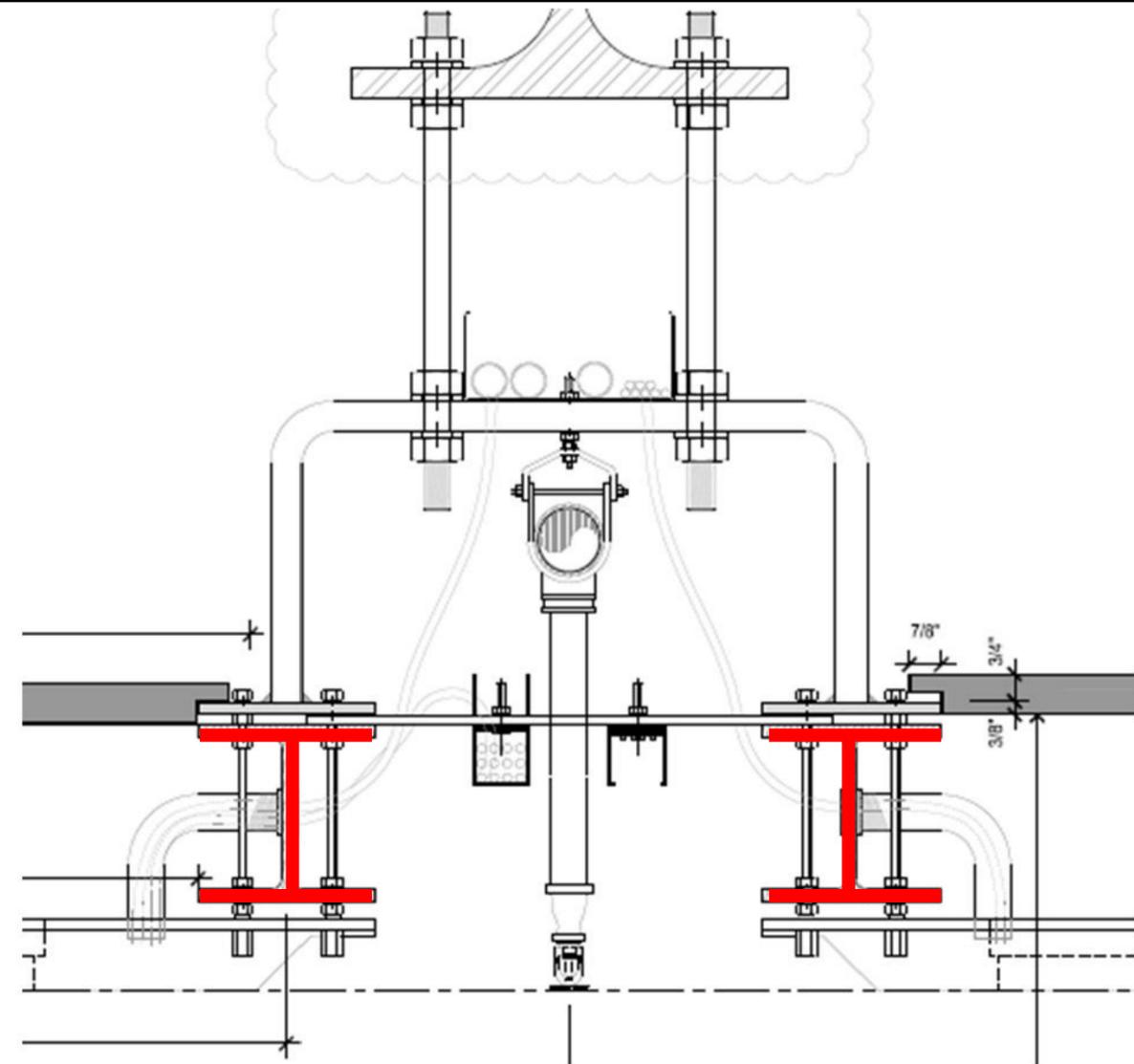




PROBLEM IDENTIFICATION AND GOALS

- Galleries are located on the 1st, and 5th-8th floors.
- Floors 5 – 7 will be prefabricated.
- Floors 1 and 8 are substantially different.

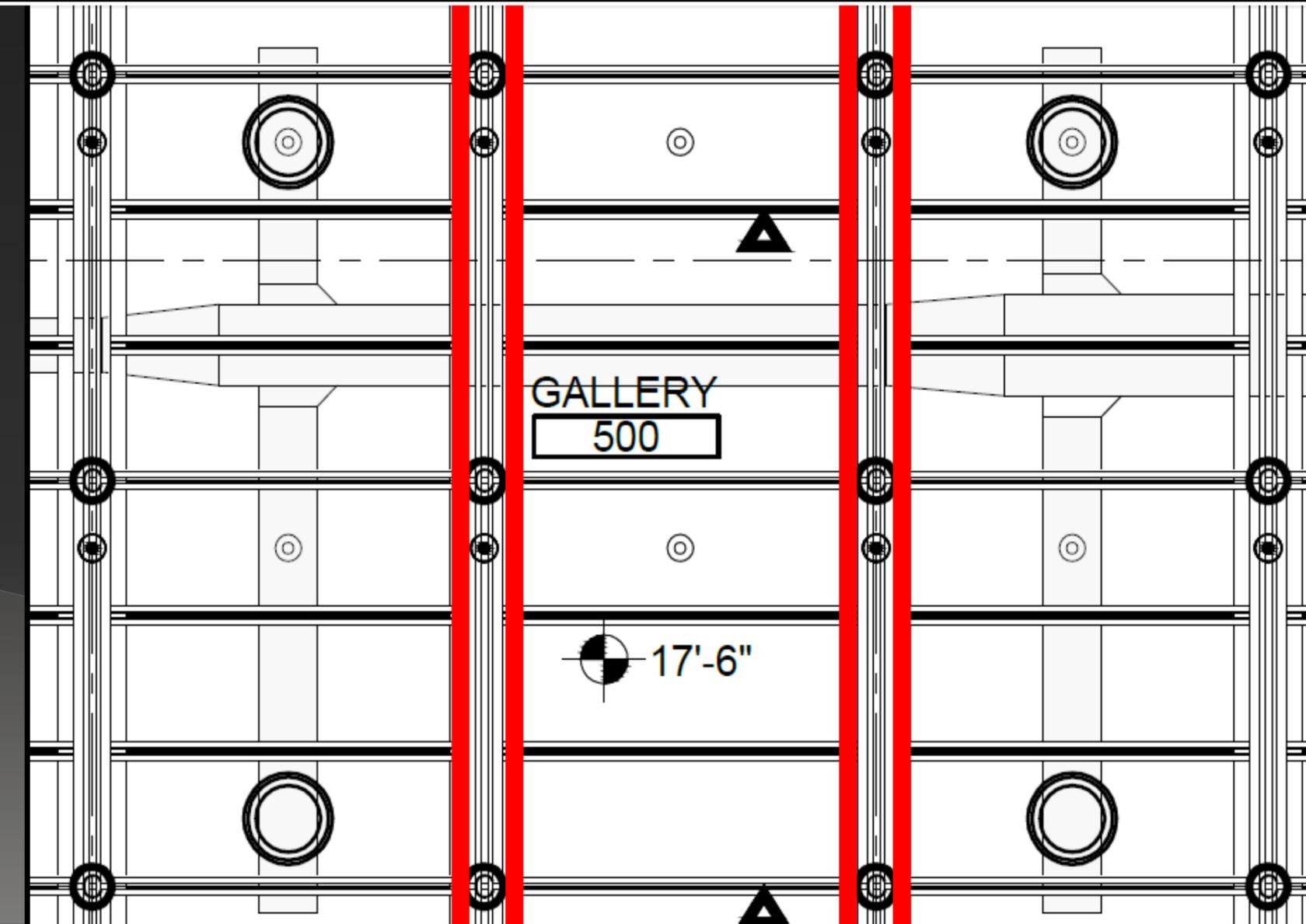


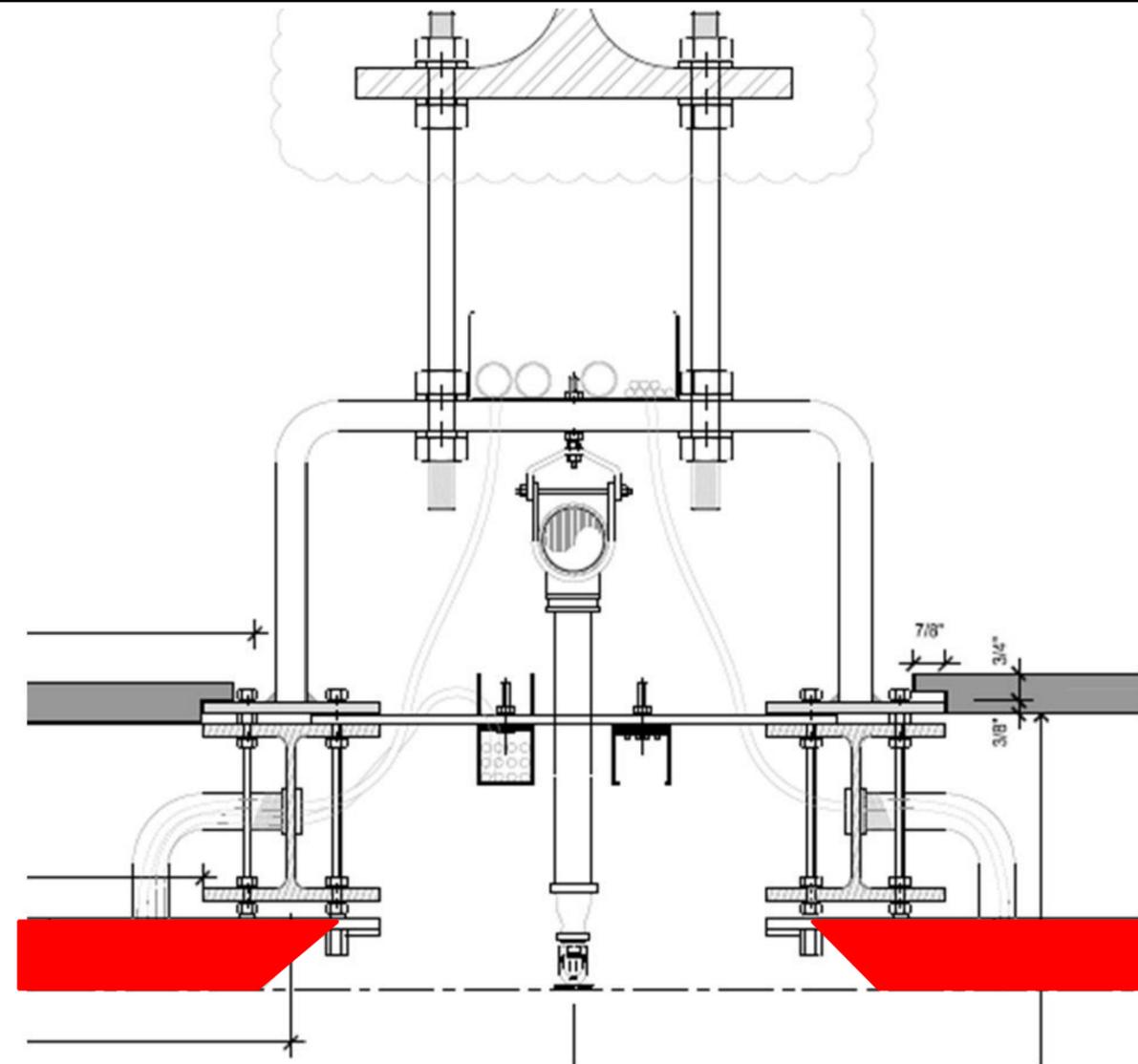


GALLERY CEILING CONSTRUCTION

Design Elements:

- Grid of structural steel members
 - W5x14 Members N-S
 - 2x2x1/4 Steel Angles E-W
 - Bent Steel Plate Hanger
- Lighting Track
- Fire Protection System

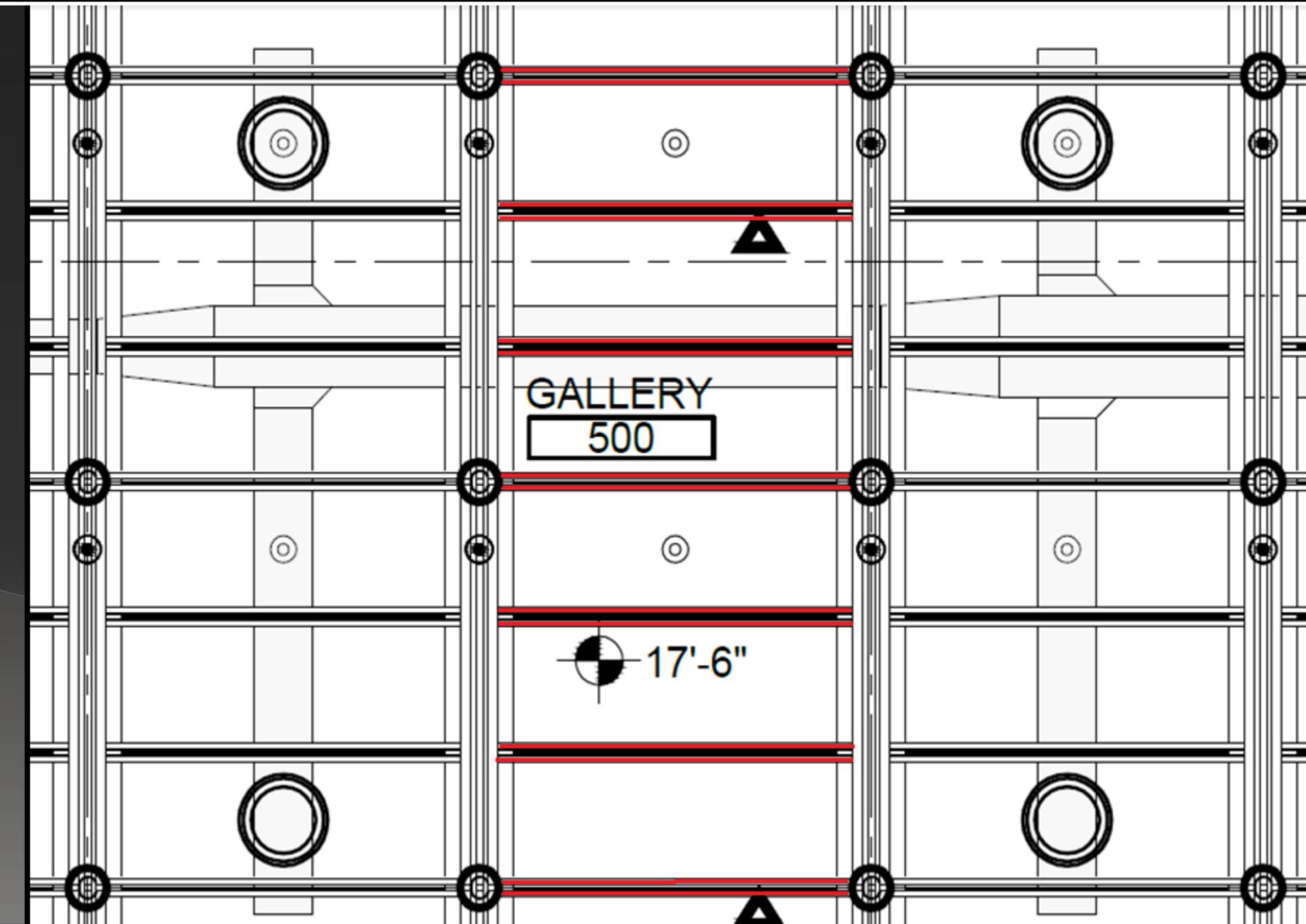


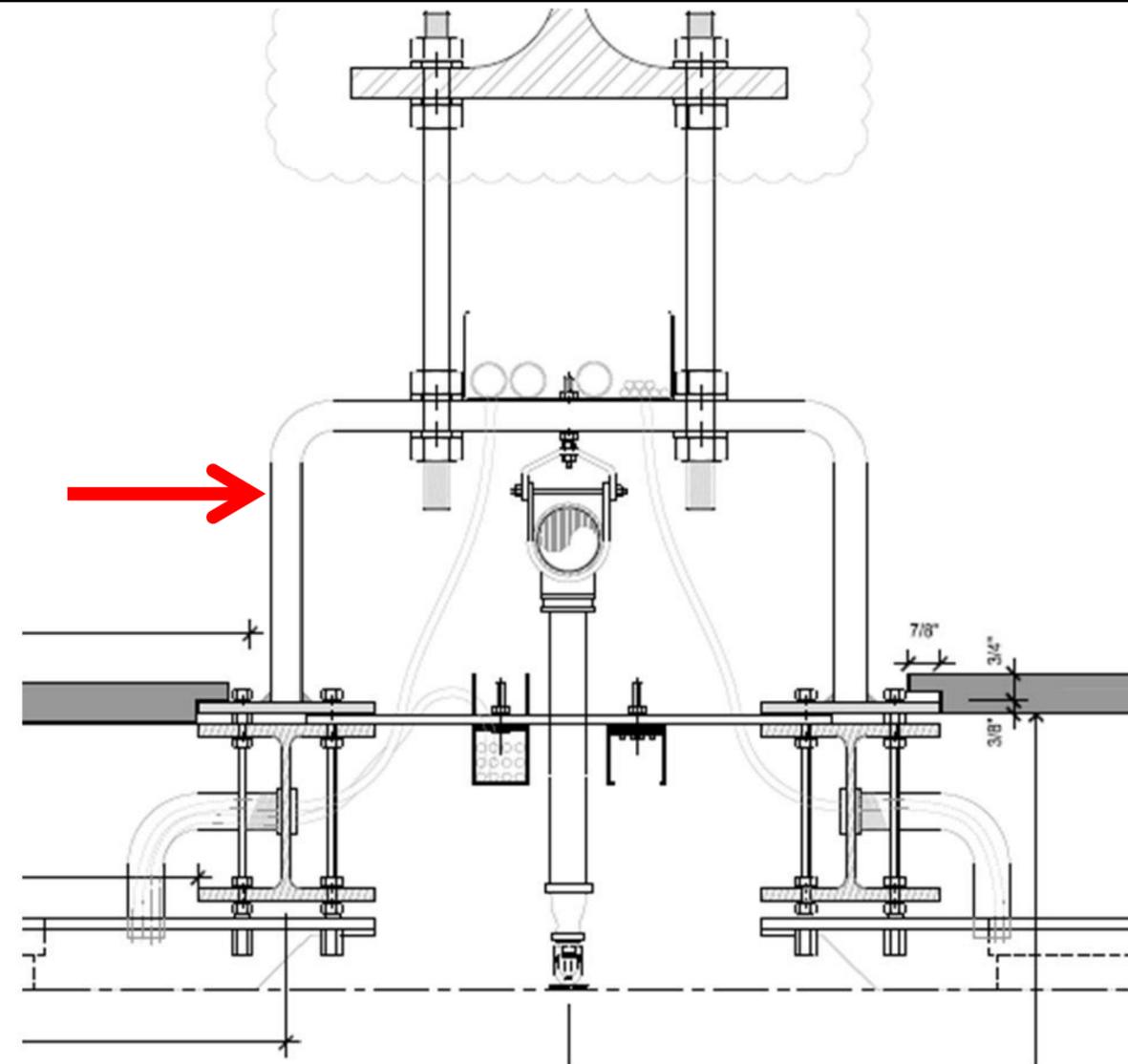


GALLERY CEILING CONSTRUCTION

Design Elements:

- Grid of structural steel members
 - W5x14 Members N-S
 - 2x2x1/4 Steel Angles E-W
 - Bent Steel Plate Hanger
- Lighting Track
- Fire Protection System

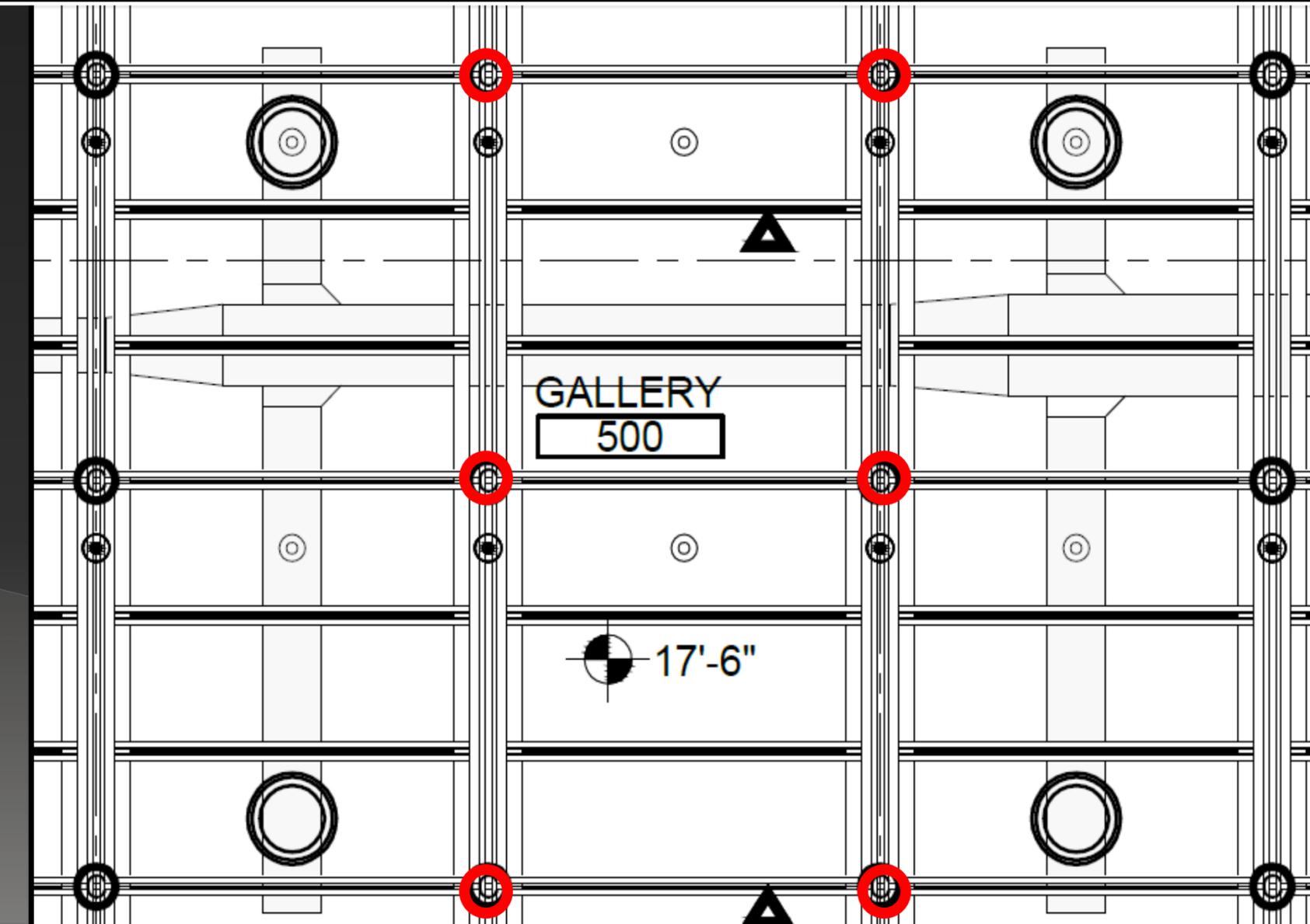


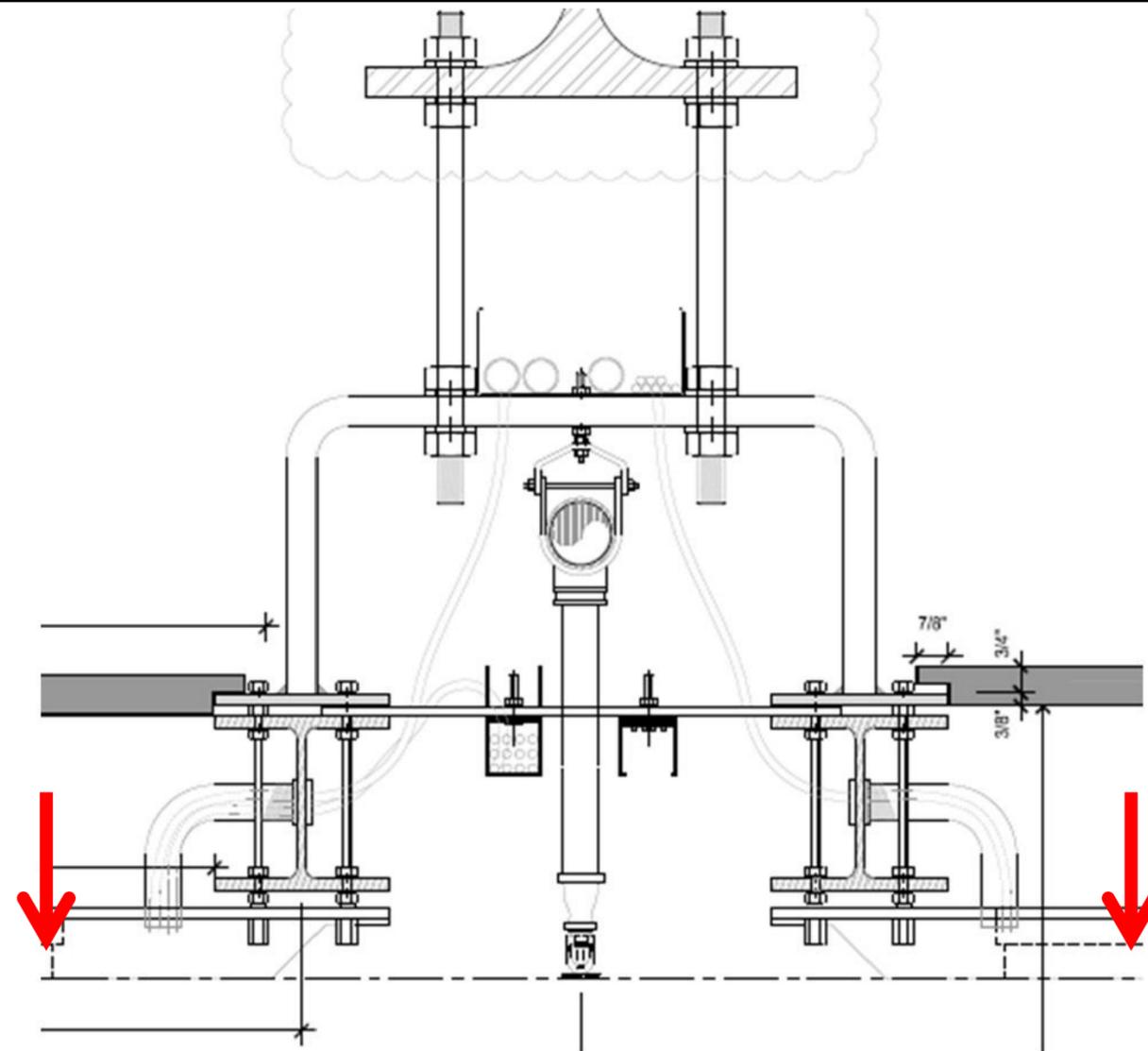


GALLERY CEILING CONSTRUCTION

Design Elements:

- Grid of structural steel members
 - W5x14 Members N-S
 - 2x2x1/4 Steel Angles E-W
- Bent Steel Plate Hanger
- Lighting Track
- Fire Protection System

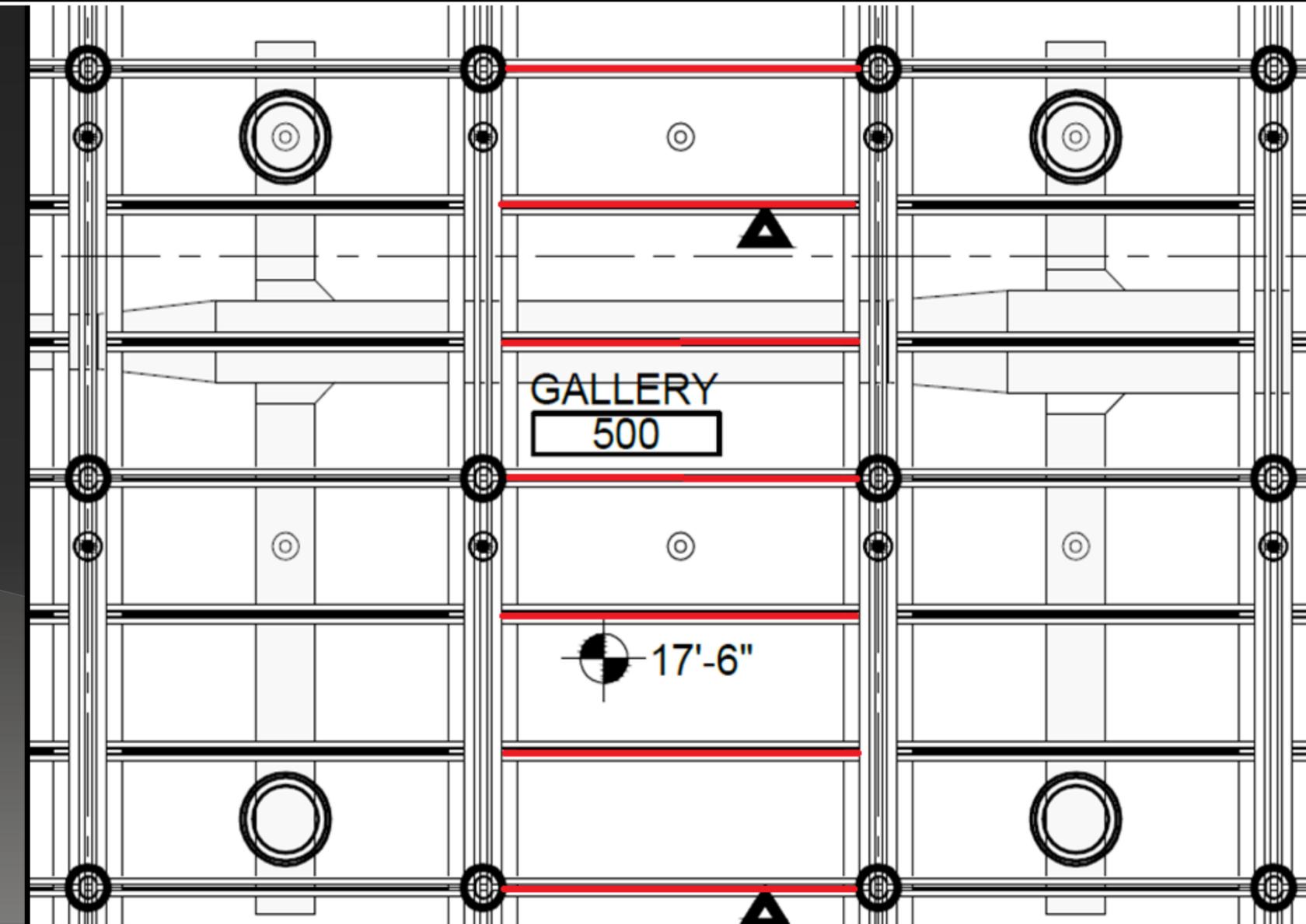


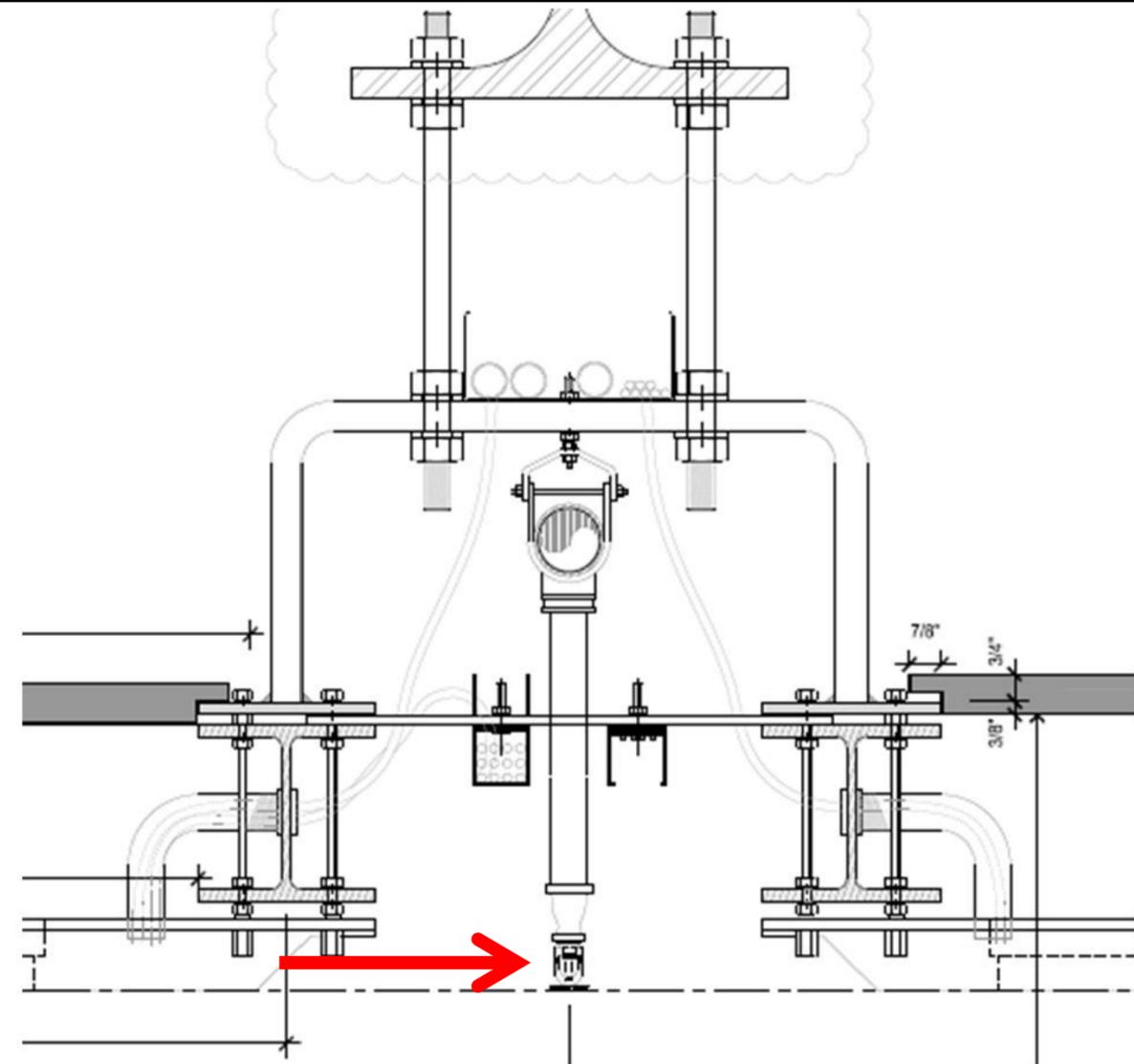


GALLERY CEILING CONSTRUCTION

Design Elements:

- Grid of structural steel members
 - W5x14 Members N-S
 - 2x2x1/4 Steel Angles E-W
 - Bent Steel Plate Hanger
- Lighting Track
- Fire Protection System

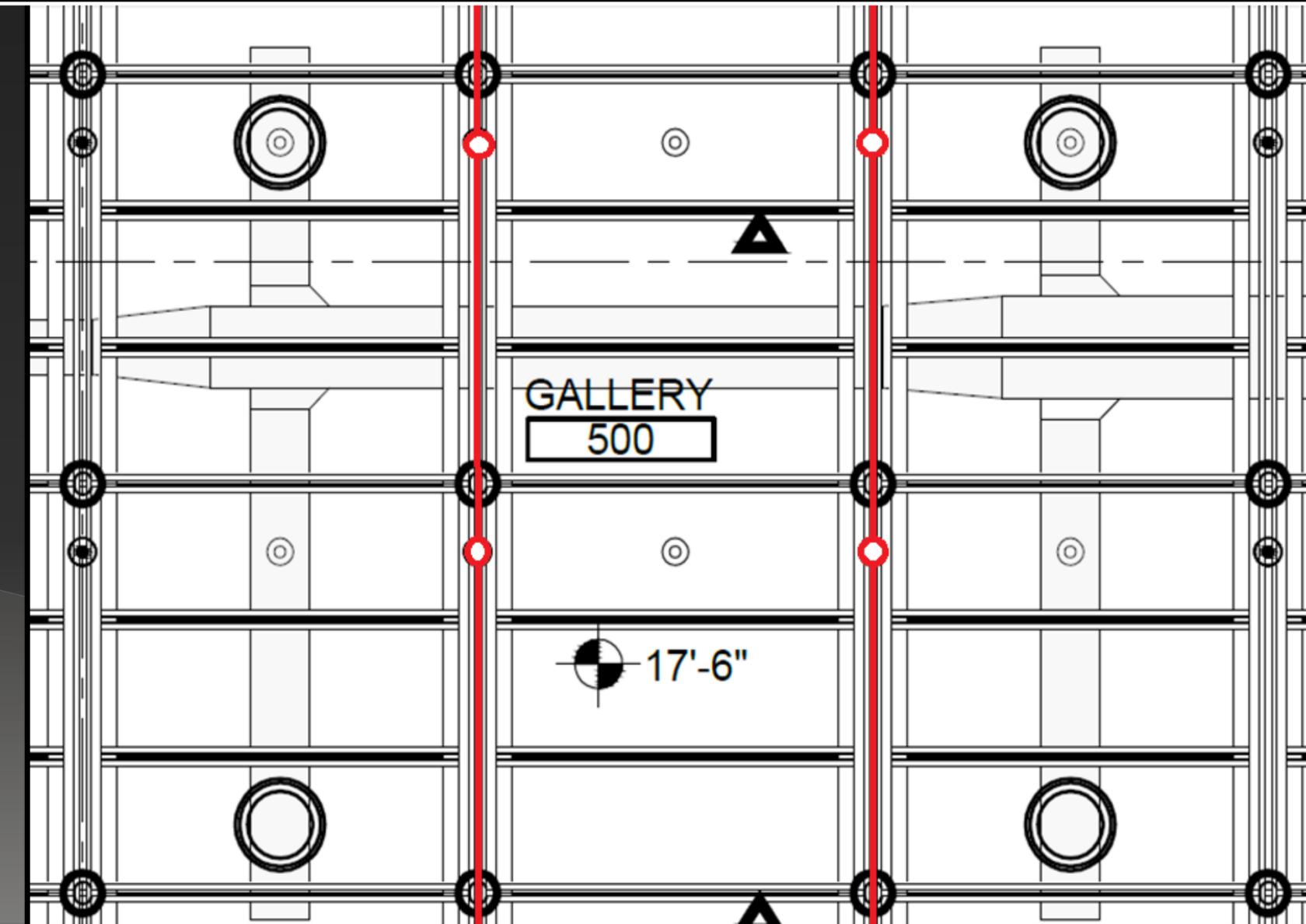


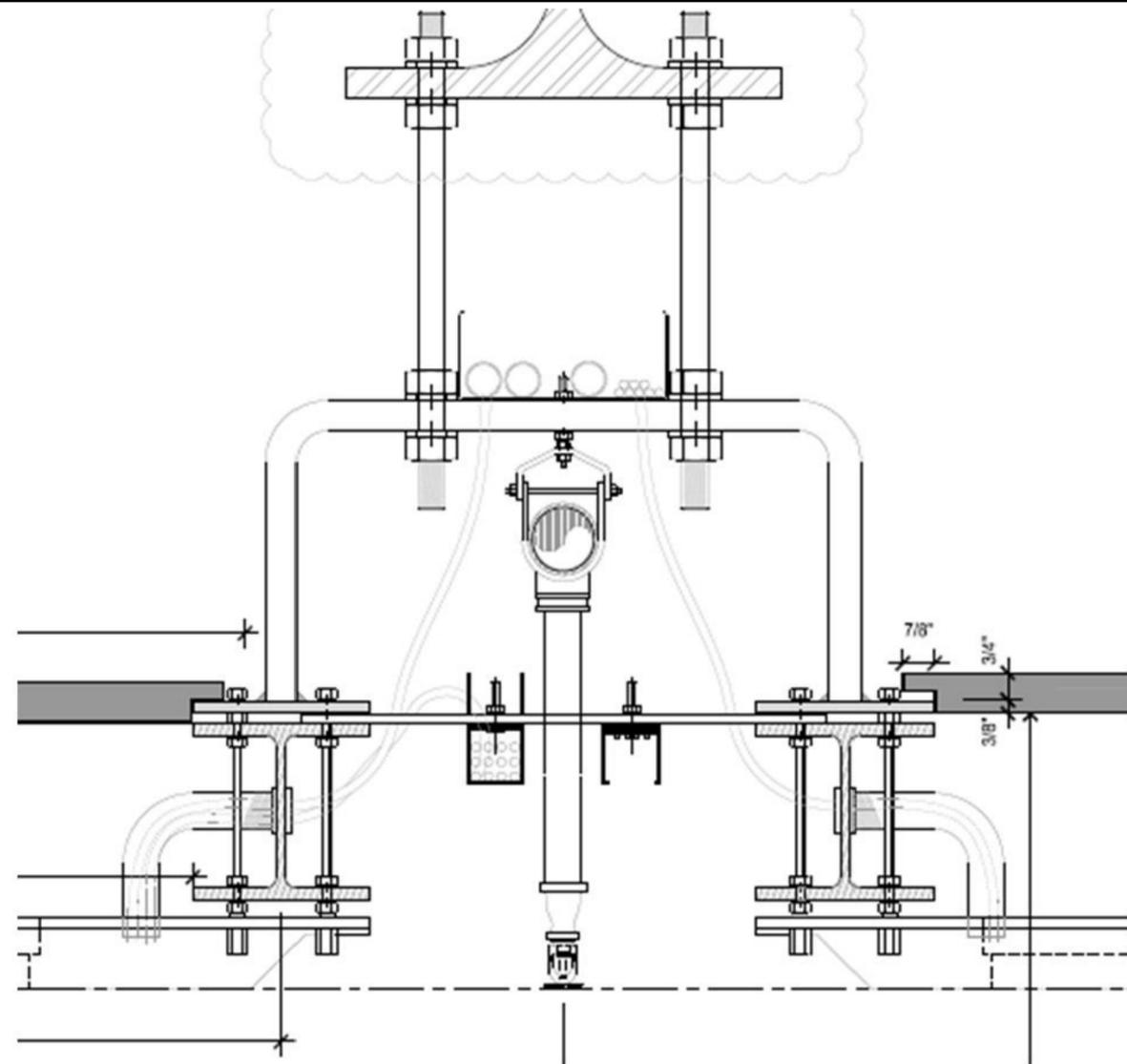


GALLERY CEILING CONSTRUCTION

Design Elements:

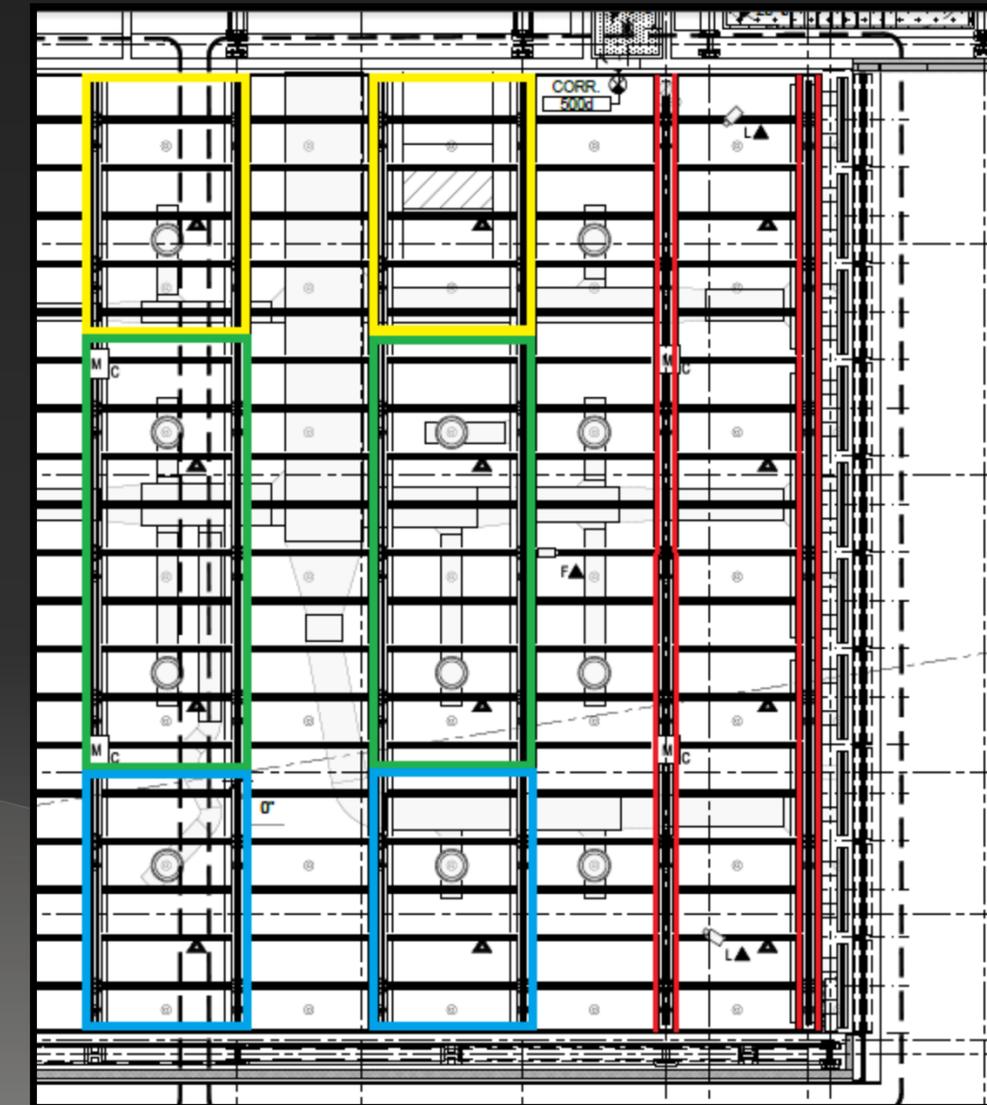
- Grid of structural steel members
 - W5x14 Members N-S
 - 2x2x1/4 Steel Angles E-W
 - Bent Steel Plate Hanger
- Lighting Track
- Fire Protection System



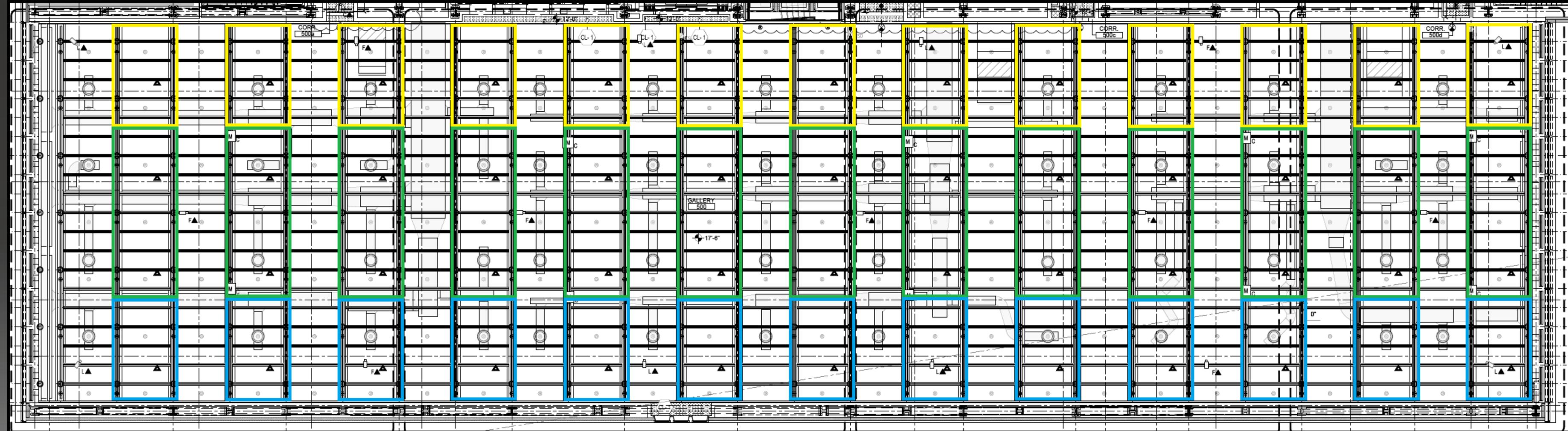


DESIGN FOR PREFABRICATION

- Limiting Size factor: Shipping Width
- Module Specifications:
 - Group 2 Sets of W5 Members
 - Connected with Steel Angle Assembly
 - Includes 50% of the Lighting Assemblies
 - Includes 100% of the Sprinkler System
 - Width: 10' 10-1/2"
 - Varying Lengths

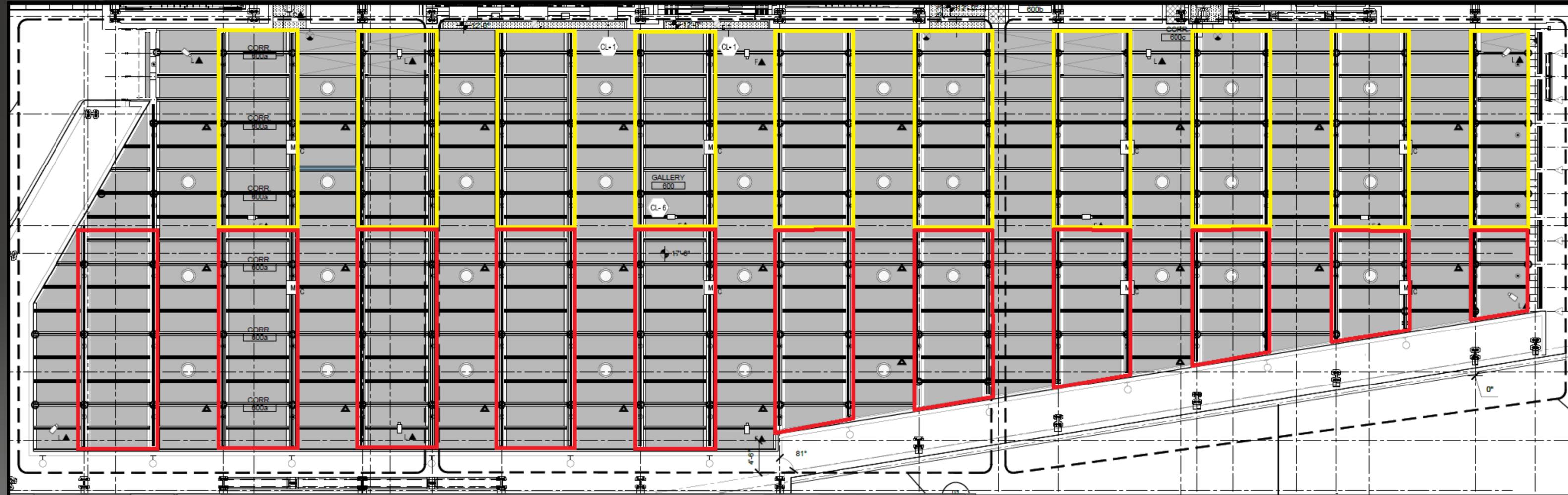


5th FLOOR GALLERY MODULE LAYOUT



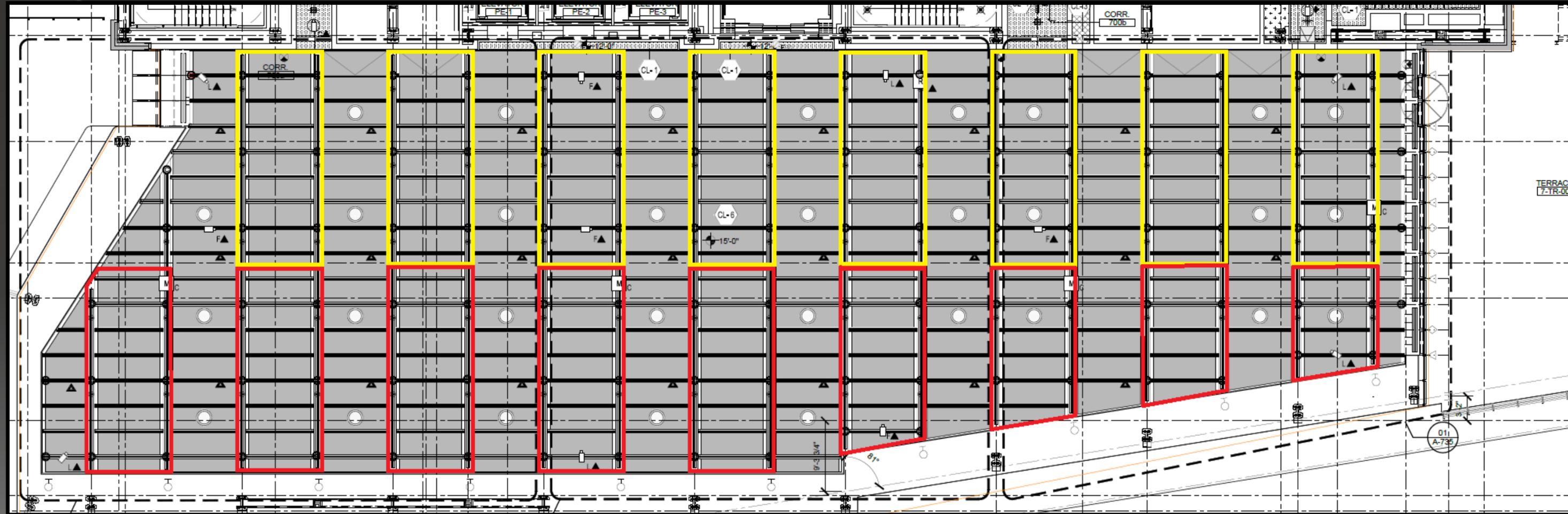
- **Gallery Dimensions**
 - 260' x 66'
- **Module Inventory: 39 Total**
 - (26), 18' Modules
 - (13), 30' Modules

6th FLOOR GALLERY MODULE LAYOUT



- **Gallery Dimensions**
 - 216' x 60'
- **Module Inventory: 21 Total**
 - (10), 28'4" Modules
 - (6), 31'8" Modules
 - (5), Varying Length

7th FLOOR GALLERY MODULE LAYOUT



- **Gallery Dimensions**
 - 180'6" x 55'4"
- **Module Inventory: 17 Total**
 - (8), 28'4" Modules
 - (5), 28' Modules
 - (4), Varying Length



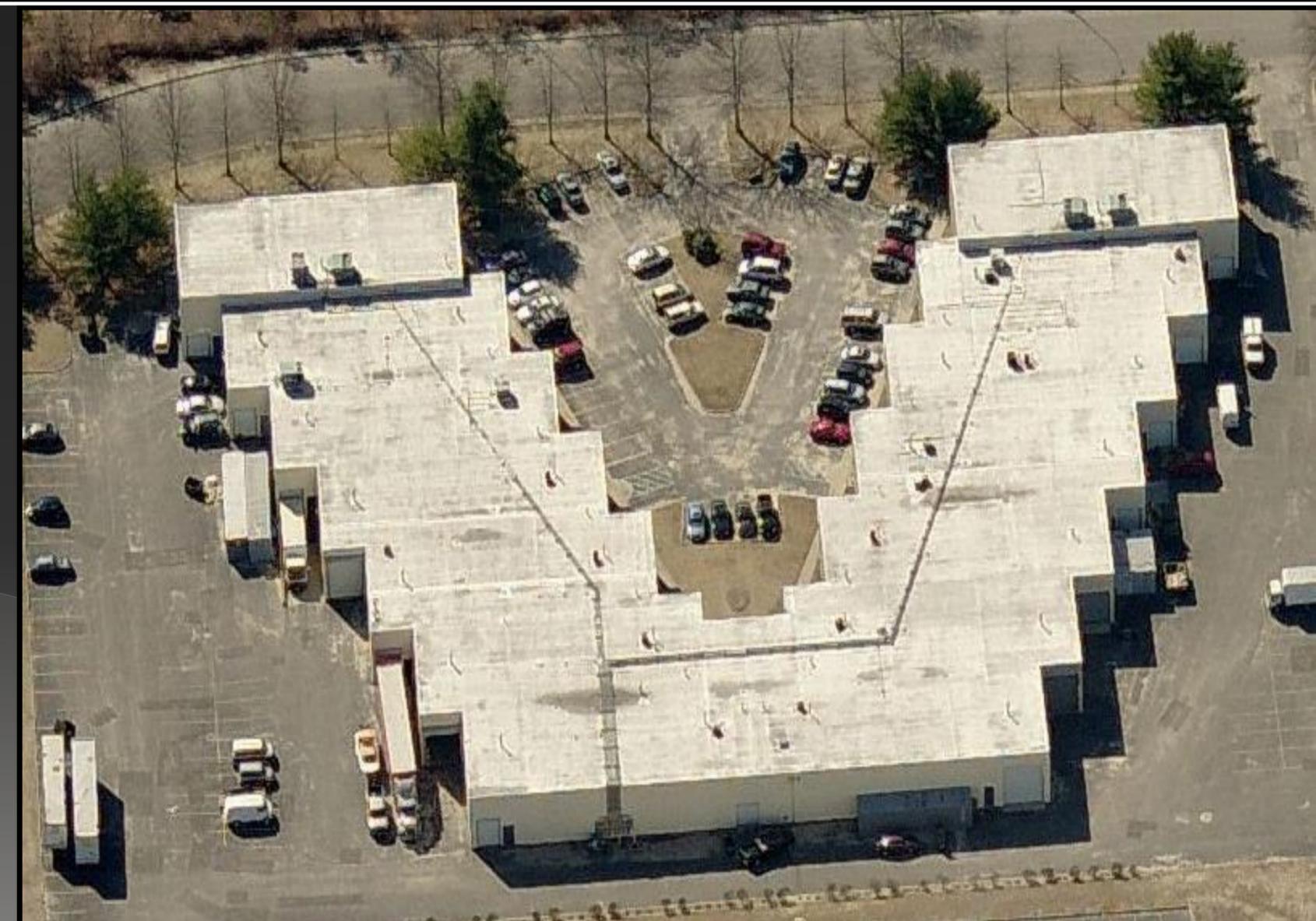
MANUFACTURING WAREHOUSE

■ Benefits

- Reduces on-site construction time.
- Safer and more productive workforce.

■ Considerations

- Size
 - Need 11,000 SF to construct and store units.
- Location
- Cost

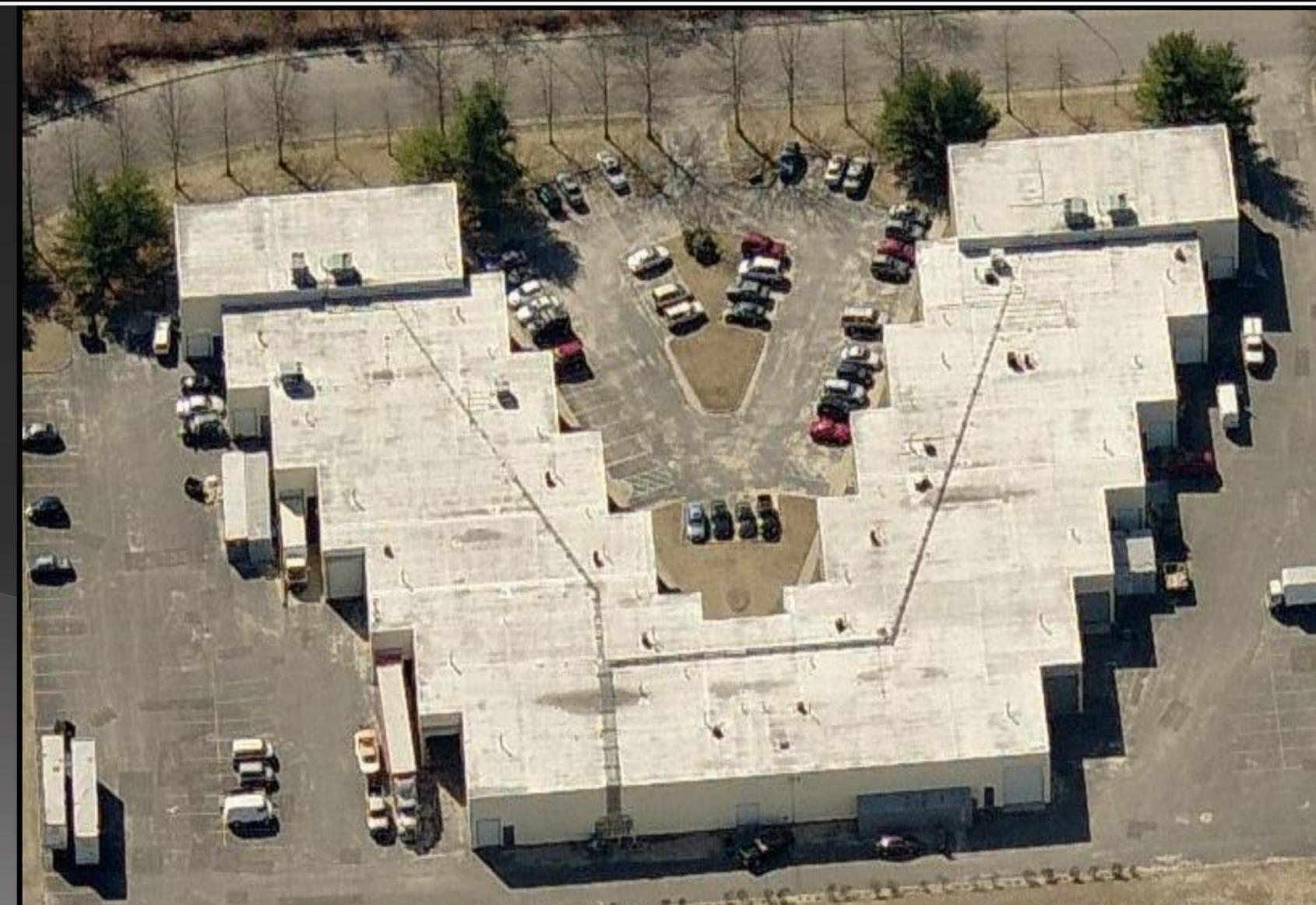




MANUFACTURING WAREHOUSE

Selected Warehouse Specifications:

- 12,420 SF
 - Allows for a 3 station assembly line & storage
- Approximately 50 miles from the site.
- Costs \$7.25 SF/Yr
 - 5 month lease needed
 - \$37,500



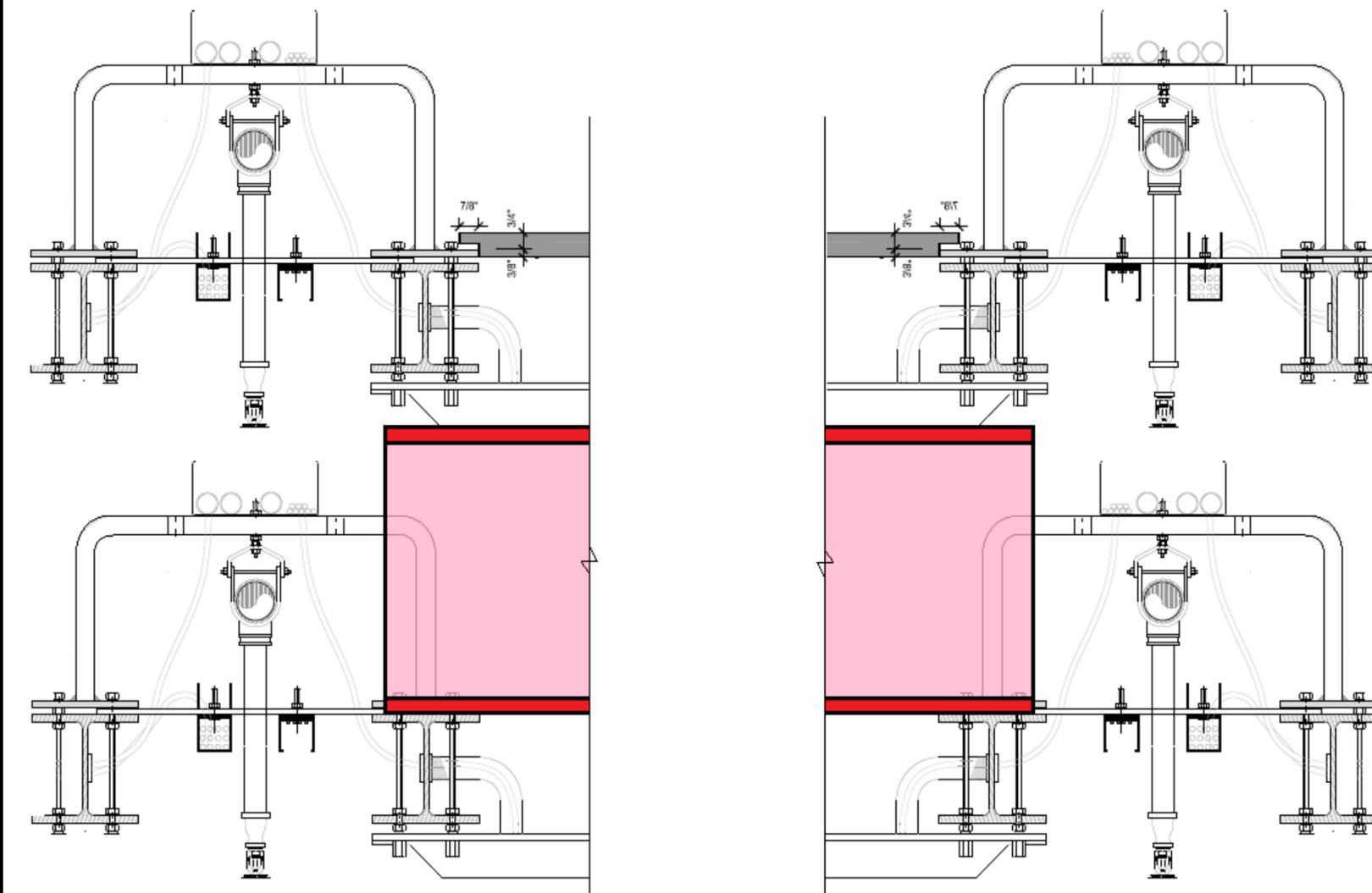
TRANSPORTATION

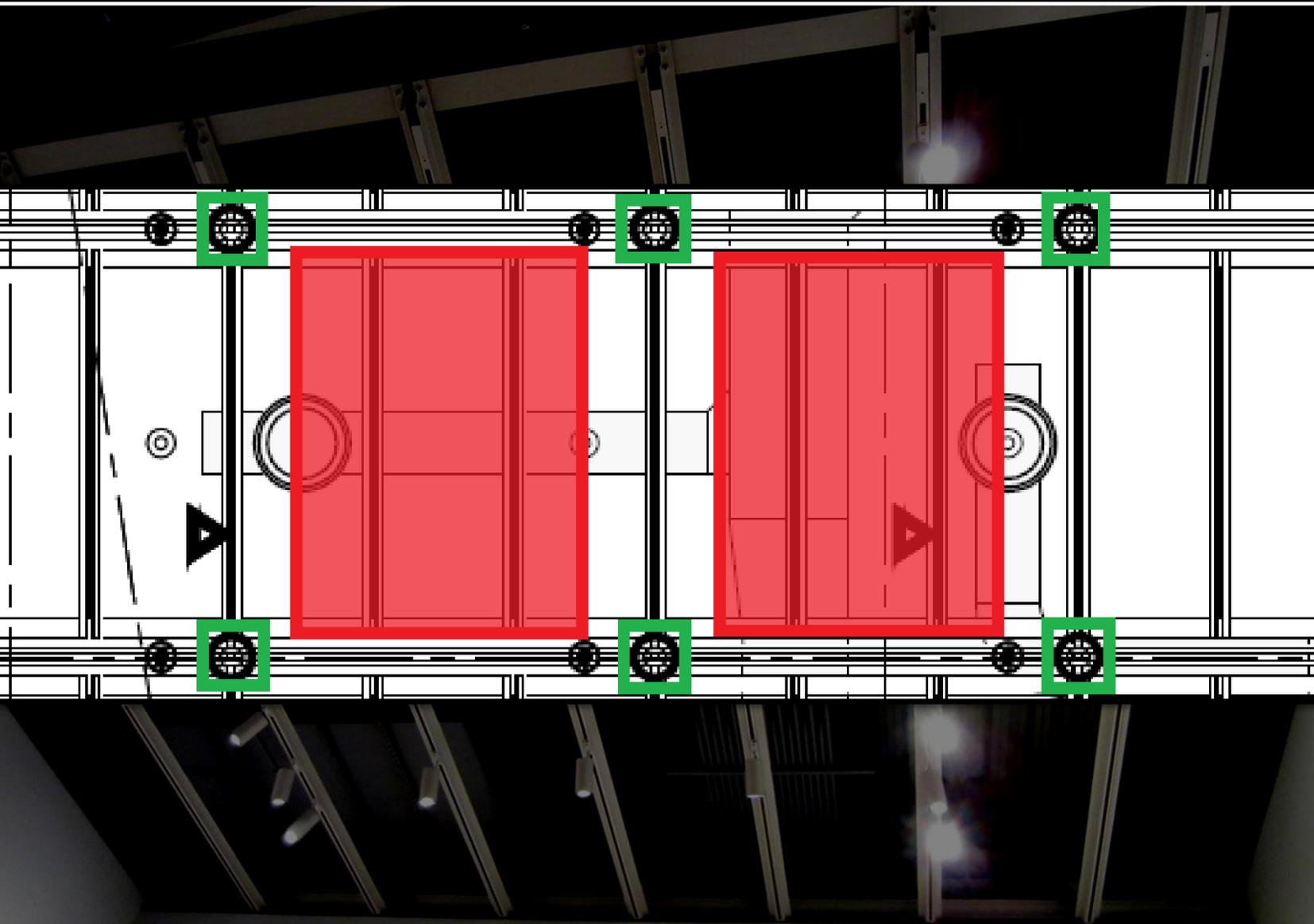
- Limit the amount of loads to the site.
 - Stacking the modules: Max Height 13'6"
 - 1' High wooden pallets
 - Total module height: 1'5-1/2"
 - Modules stacked 6 high

LEGAL DIMENSIONS, WEIGHTS & GROSS WEIGHTS FOR [REDACTED] STATE

IV. The maximum legal dimensions (overall, inclusive of load, bumpers, etc.) are:

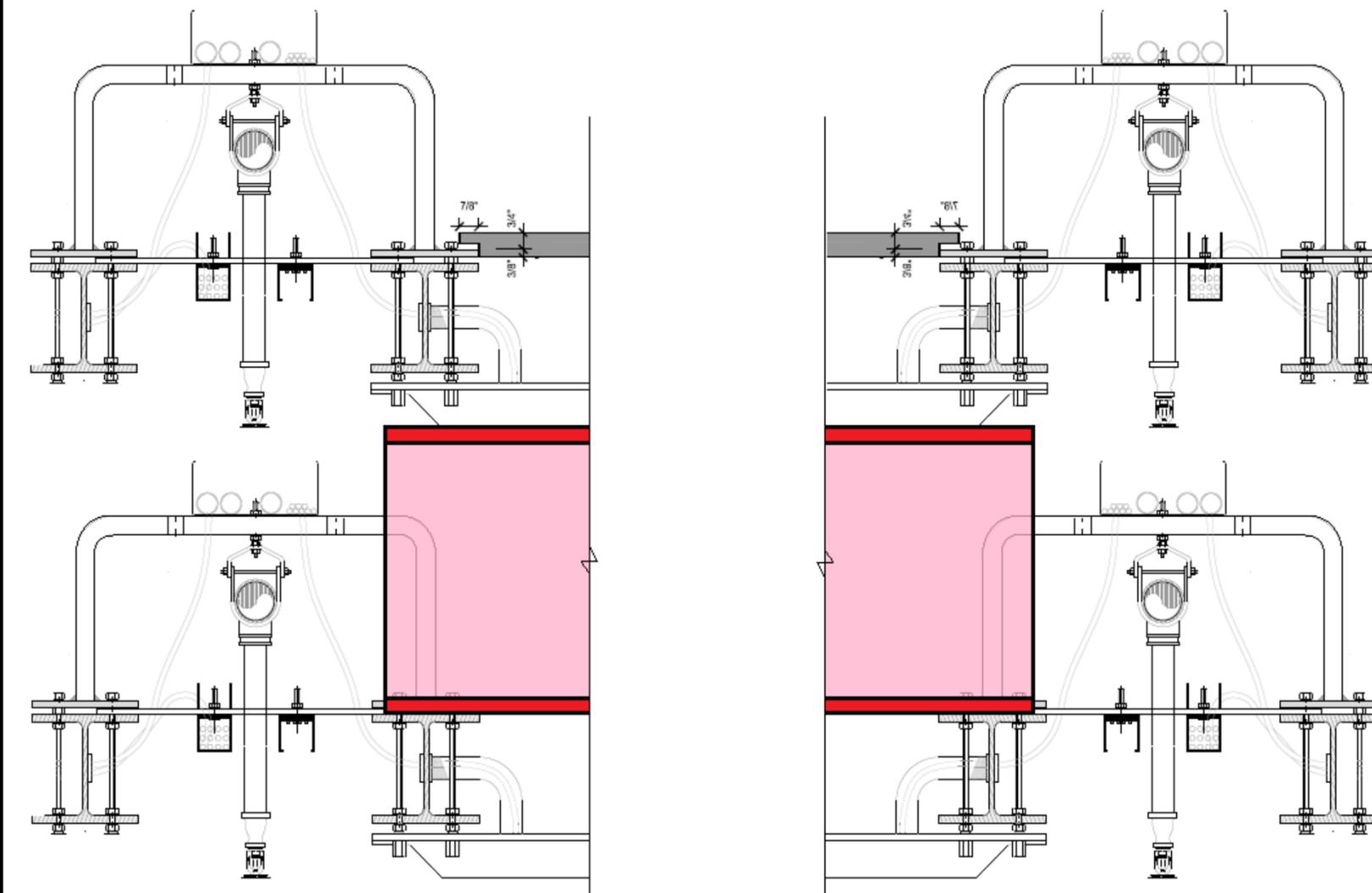
		State Highway	Qualifying or Access Highway
A.	Width of Vehicle, inclusive of load	8 feet ¹	8 feet 6 inches
B.	Height of vehicle from underside of tire to top of vehicle, inclusive of load	13 feet 6 inches	13 feet 6 inches
C.	Length of single vehicle inclusive of load and bumpers	40 feet	40 feet
D.	Length of a combination of vehicles inclusive of load and bumpers	65 feet ²	Unlimited ²
E.	Length of a single trailer	48 feet	53 feet ³
F.	Length of a single twin trailer	28 feet 6 inches	28 feet 6 inches





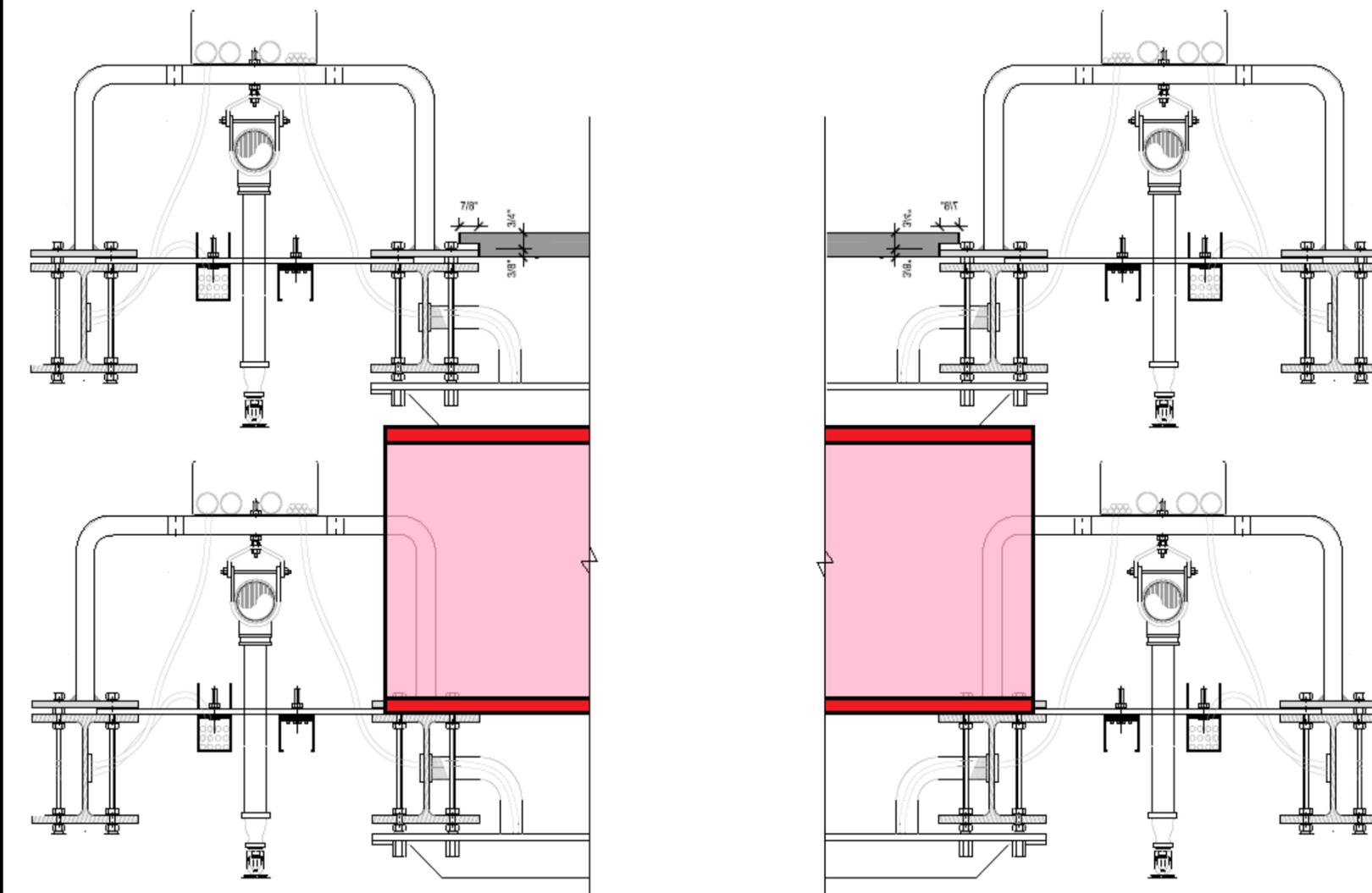
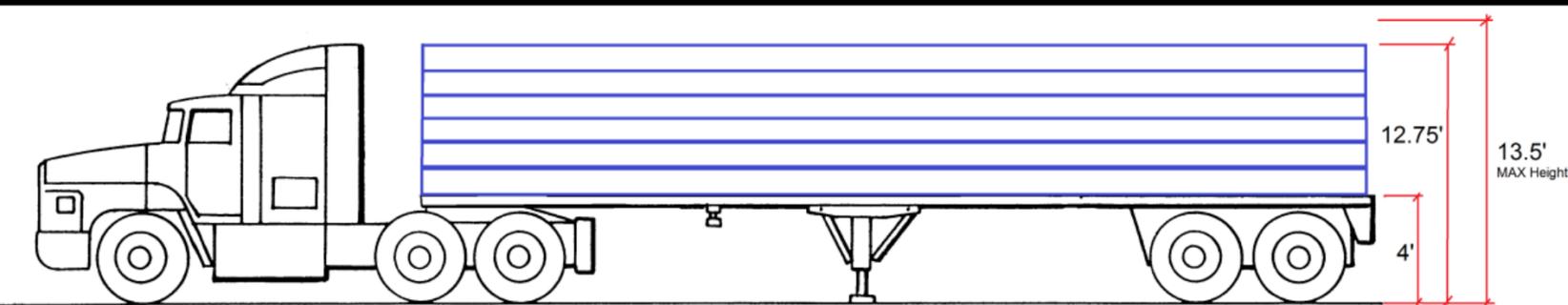
TRANSPORTATION

- Limit the amount of loads to the site.
 - Stacking the modules: Max Height 13'6"
 - 1' High wooden pallets
 - Total module height: 1'5-1/2"
 - Modules stacked 6 high



TRANSPORTATION

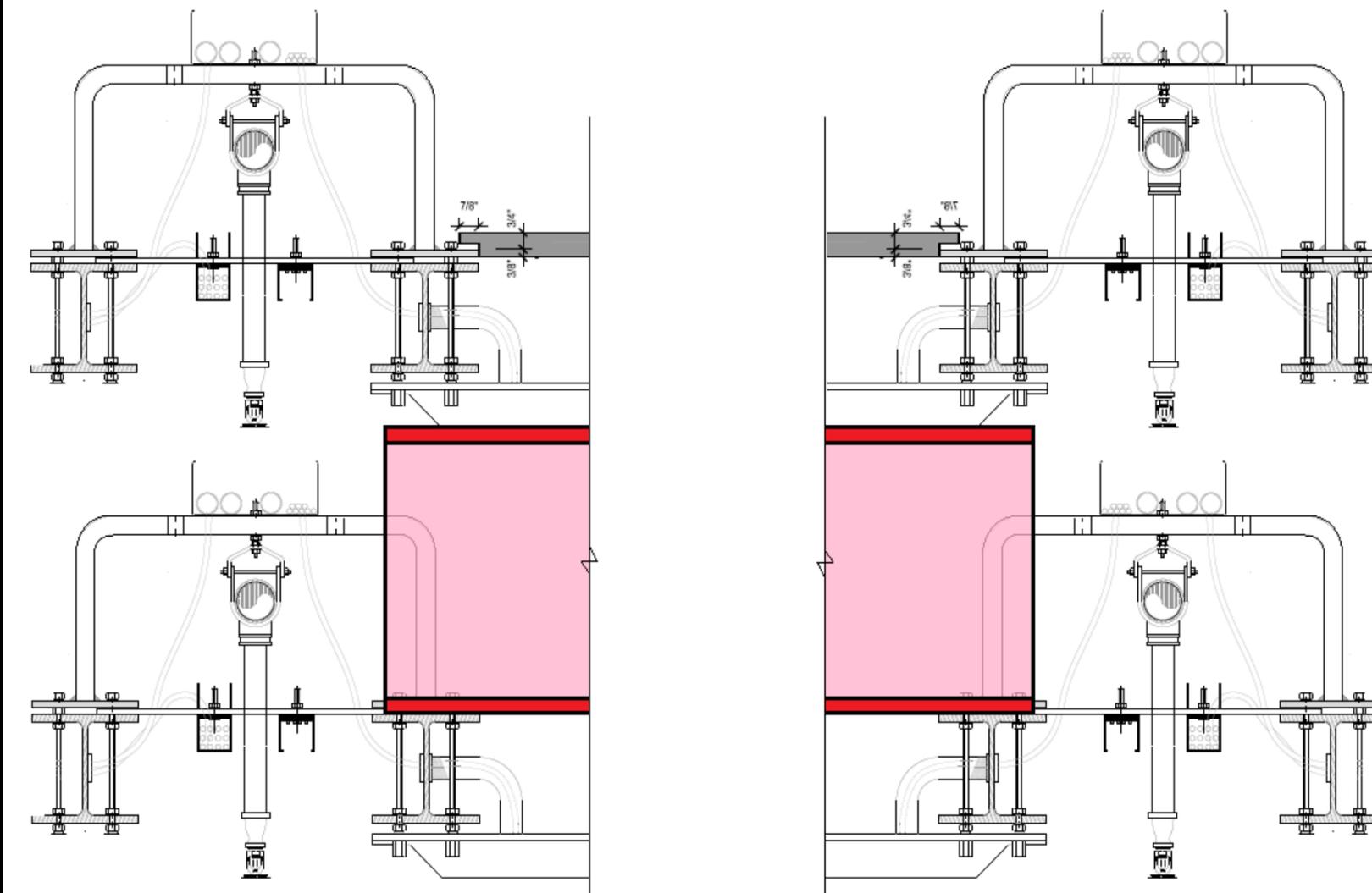
- Limit the amount of loads to the site.
 - Stacking the modules: Max Height 13'6"
 - 1' High wooden pallets
 - Total module height: 1'5-1/2"
 - Modules stacked 6 high

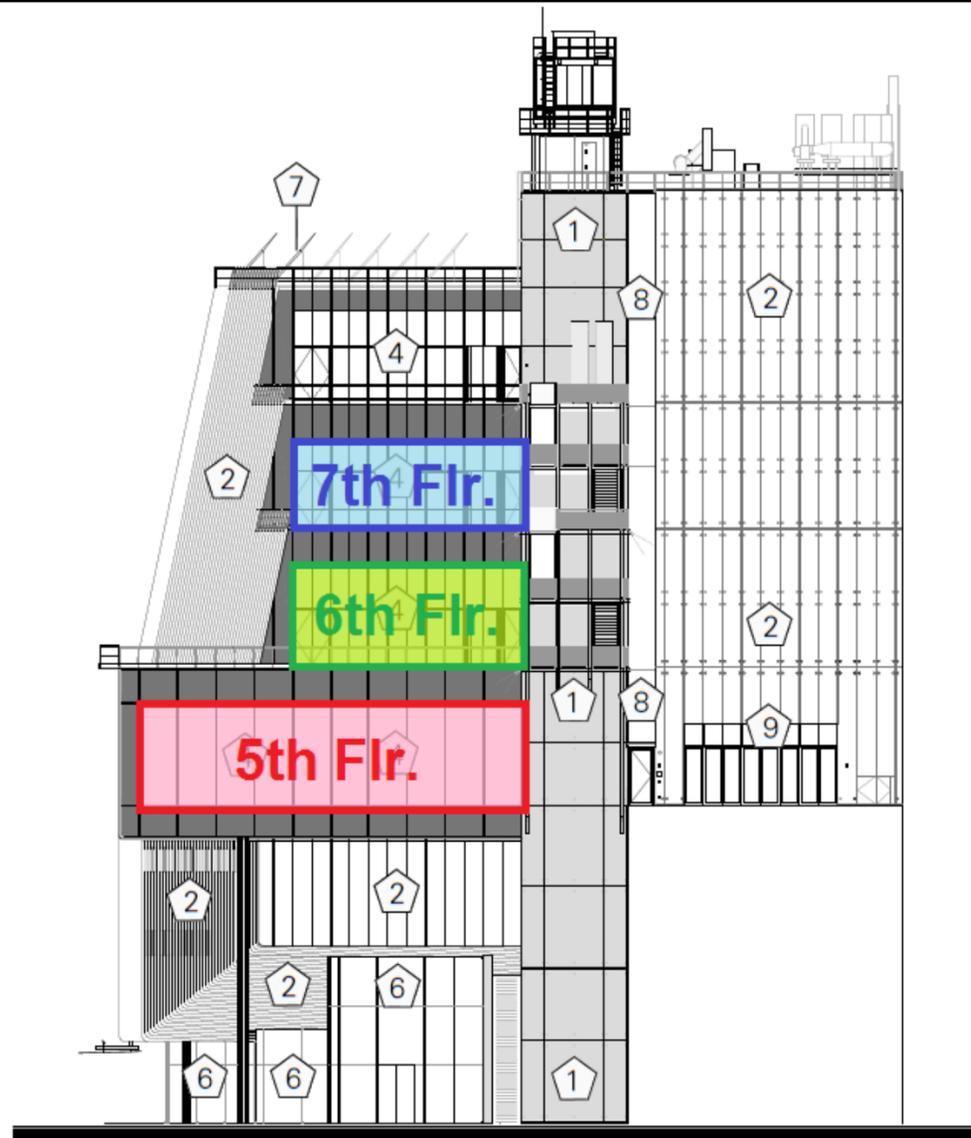




TRANSPORTATION

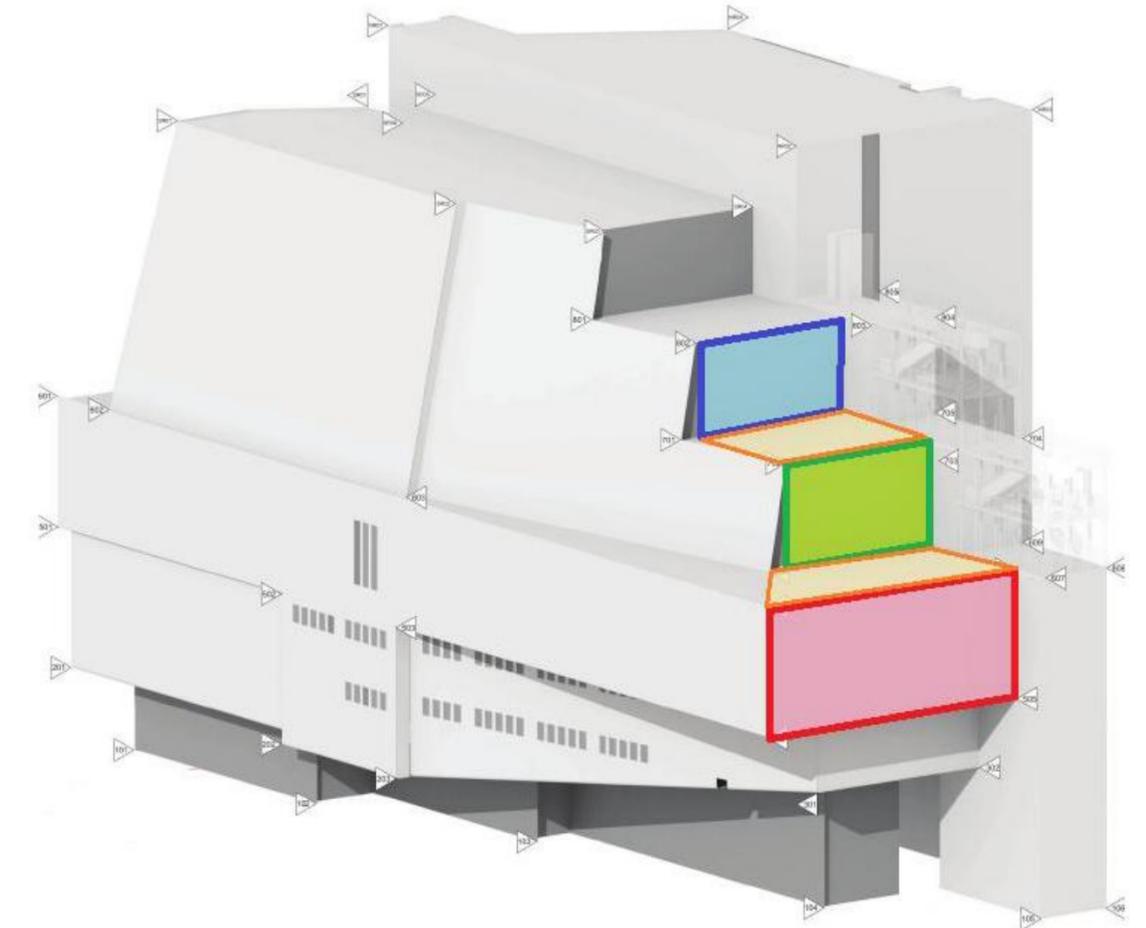
- 9 Truckloads needed
- Transportation Costs
 - \$400 / Shipment
 - \$40 / Permit
 - Wooden Pallets - \$10,600
 - Loading Labor & Equipment – \$6,600
- Total: \$21,250

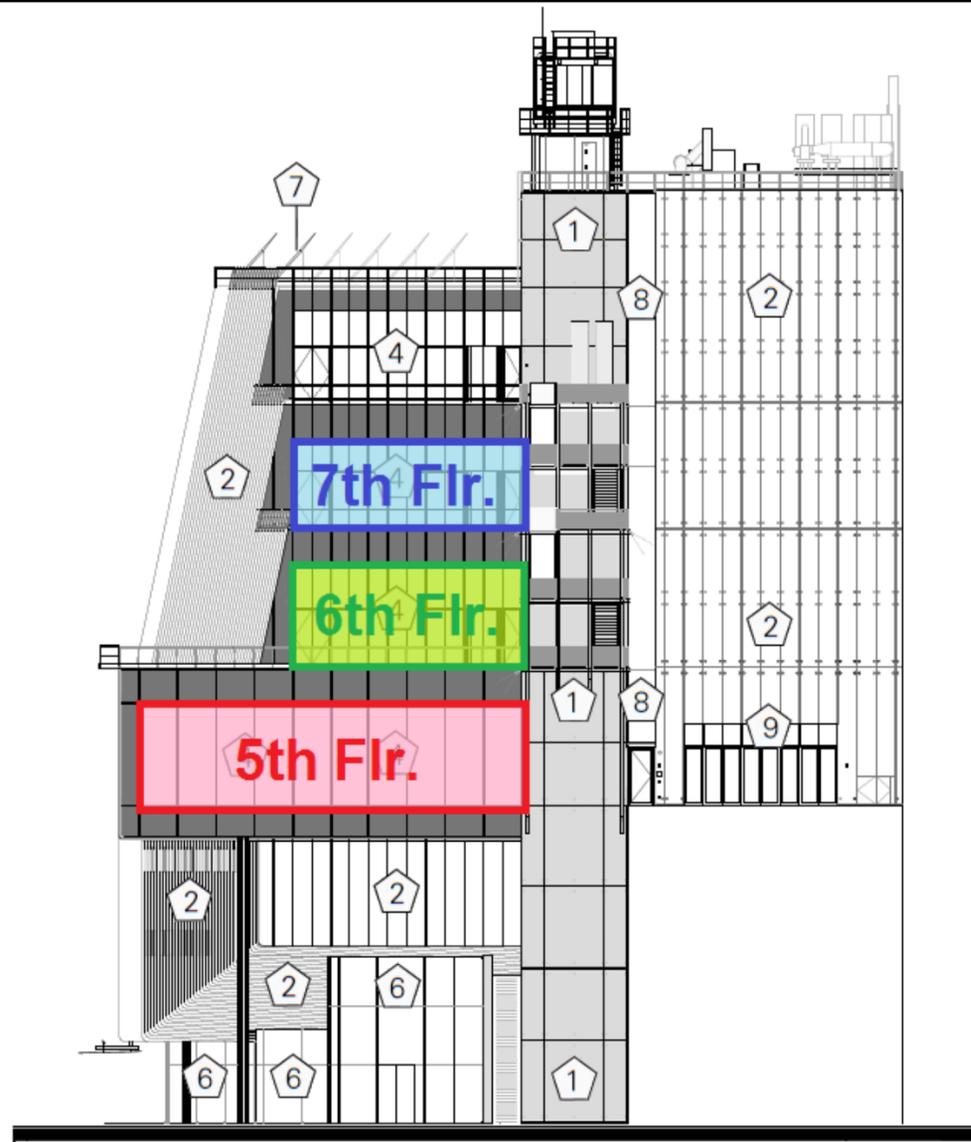




HOISTING

- Hoist into place before east side curtain wall work.
 - E. Curtain Wall Start: 10/25/13.
- 3 days needed to hoist 77 modules.
 - Truck mounted hydraulic crane.
- Module storage in center of the galleries until needed.

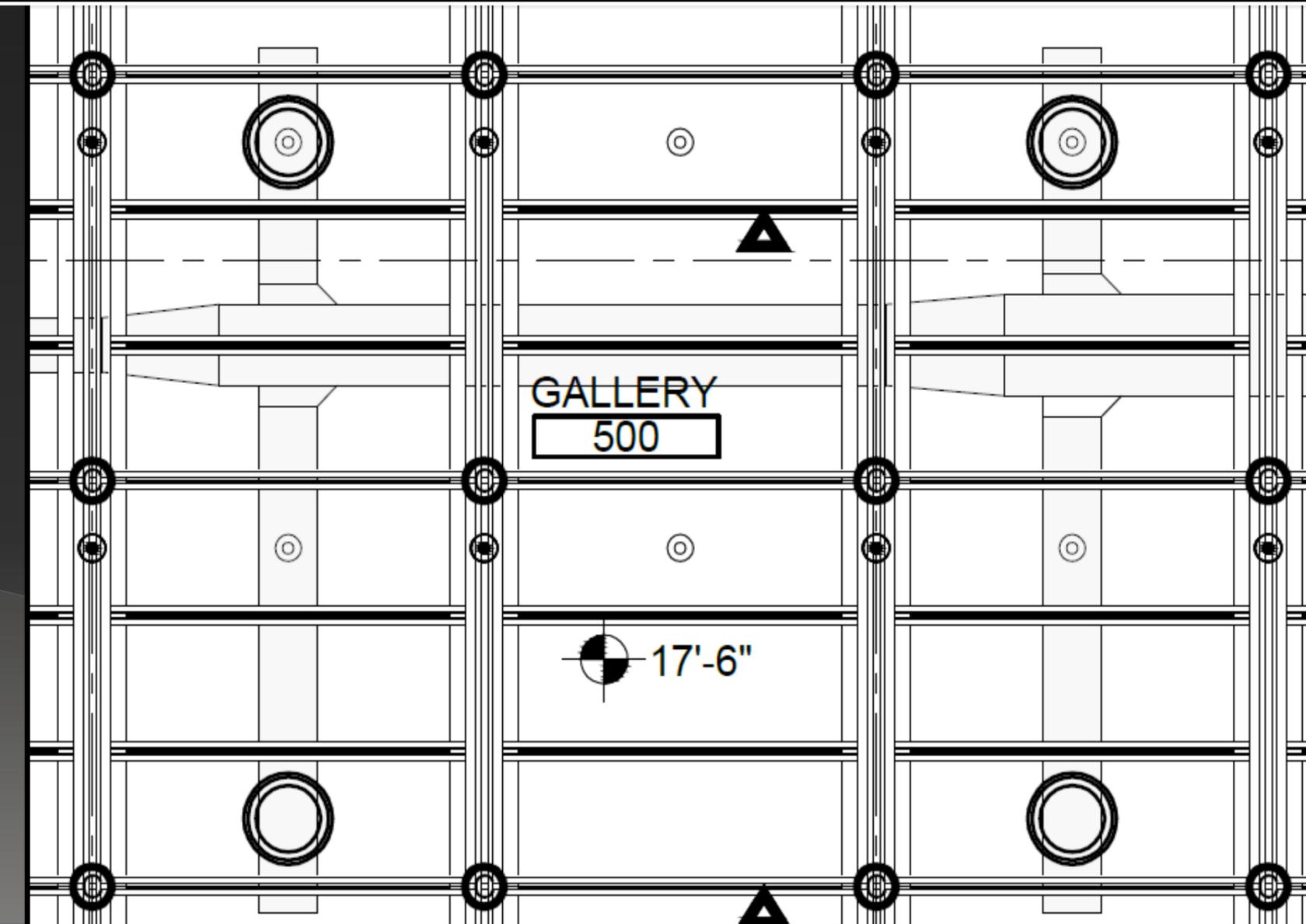




INSTALLATION

■ Sequence of New Activities

- Module Positioning & Hoisting:
 - Average of 2 Days / Gallery
- Remaining W5 Installation:
 - 2 Days / Gallery
- Remaining Lighting Assembly Installation:
 - Average of 2 Days / Gallery
- Electrical & Fire Protection Connections:
 - Average of 2 Days Each / Gallery



Gallery					
INT-5-100	Install hangers	01-29-13	02-11-13	10	10
INT-5-101	Protect surface adjacent to steel	02-12-13	02-19-13	5	5
INT-5-122	Cure SOFP (28 cal days)	03-06-13	04-02-13	20	20
INT-5-102	Paint metal deck & SOFP	04-03-13	04-16-13	10	10
INT-5-103	Overhead MEP rough in	06-21-13	08-16-13	40	40
INT-5-104	Layout and frame	08-19-13	09-04-13	12	12
INT-5-105	Rough partitions	08-28-13	09-18-13	15	15
INT-5-106	Sheetrock partitions	09-19-13	09-27-13	7	7
INT-5-107	Skim coat walls (3 coats) ring ceiling line	09-30-13	10-15-13	12	12
INT-5-108	Paint ceiling line up	10-16-13	10-18-13	3	3
INT-5-109	Ceiling layout and hang drop rods/unistrut	10-21-13	11-22-13	25	25
INT-5-110	Install W5 sections and infill pieces	11-25-13	01-15-14	35	35
INT-5-111	Rough-in lighting	01-16-14	01-29-14	10	10
INT-5-112	Sprinkler heads	01-30-14	02-20-14	15	15
INT-5-113	Install ceiling panels	02-21-14	03-10-14	12	12
INT-5-114	Ceiling trim	03-11-14	03-17-14	5	5
INT-5-115	Layout/frame/install sleepers	03-18-14	04-30-14	32	32
INT-5-116	Plywood subfloor	05-01-14	05-16-14	12	12
INT-5-117	Patch skim coat	05-19-14	05-23-14	5	5
INT-5-118	Paint	05-27-14	06-03-14	6	6
INT-5-119	Lights and MEP finish trim	06-04-14	06-17-14	10	10
INT-5-120	Wood flooring	06-19-14	07-15-14	18	18
INT-5-123	Punchlist	07-16-14	08-19-14	25	25

Install hangers
Protect surface adjacent to steel
Cure SOFP (28 cal days)
Paint metal deck & SOFP
Overhead MEP
Layout and
Rough pa
Sheetro
Skim
Paint

SCHEDULE ANALYSIS

- Schedule remains the same until the MEP Rough-In activity.
- Eighth floor gallery fit-out will be started first.
 - Followed by 5th – 7th in order.
- On site construction reduced from 85 days to 14 per prefabricated gallery.
- New gallery fit-out schedule shortened by 41 working days.
- Overall project schedule shortened by 26 working days.

ESTIMATED SCHEDULE REDUCTION PER GALLERY				
Activity	Original Duration	Percentage Reduced	New Duration	Work Days Saved or Lost
Ceiling Layout/ Drop Rods	25	100	0	25
Install W5 Sections	35	95	2	33
Rough-In Lighting	10	100	0	10
Sprinkler System	15	100	0	15
Module Positioning & Hoisting	0	n/a	2	2
Lighting Assembly Installation	0	n/a	2	2
Electrical Connections	0	n/a	6	6
Fire Protection Connections	0	n/a	2	2
Total	85		14	71



COST ANALYSIS

- General Conditions savings of \$99,500 per week.
 - \$497,500 saved over 5 weeks.
- Prefabrication Expenses totaled \$151,933

- Total Savings of \$345,567

COST IMPLICATIONS OF THE PREFABRICATION PROCESS

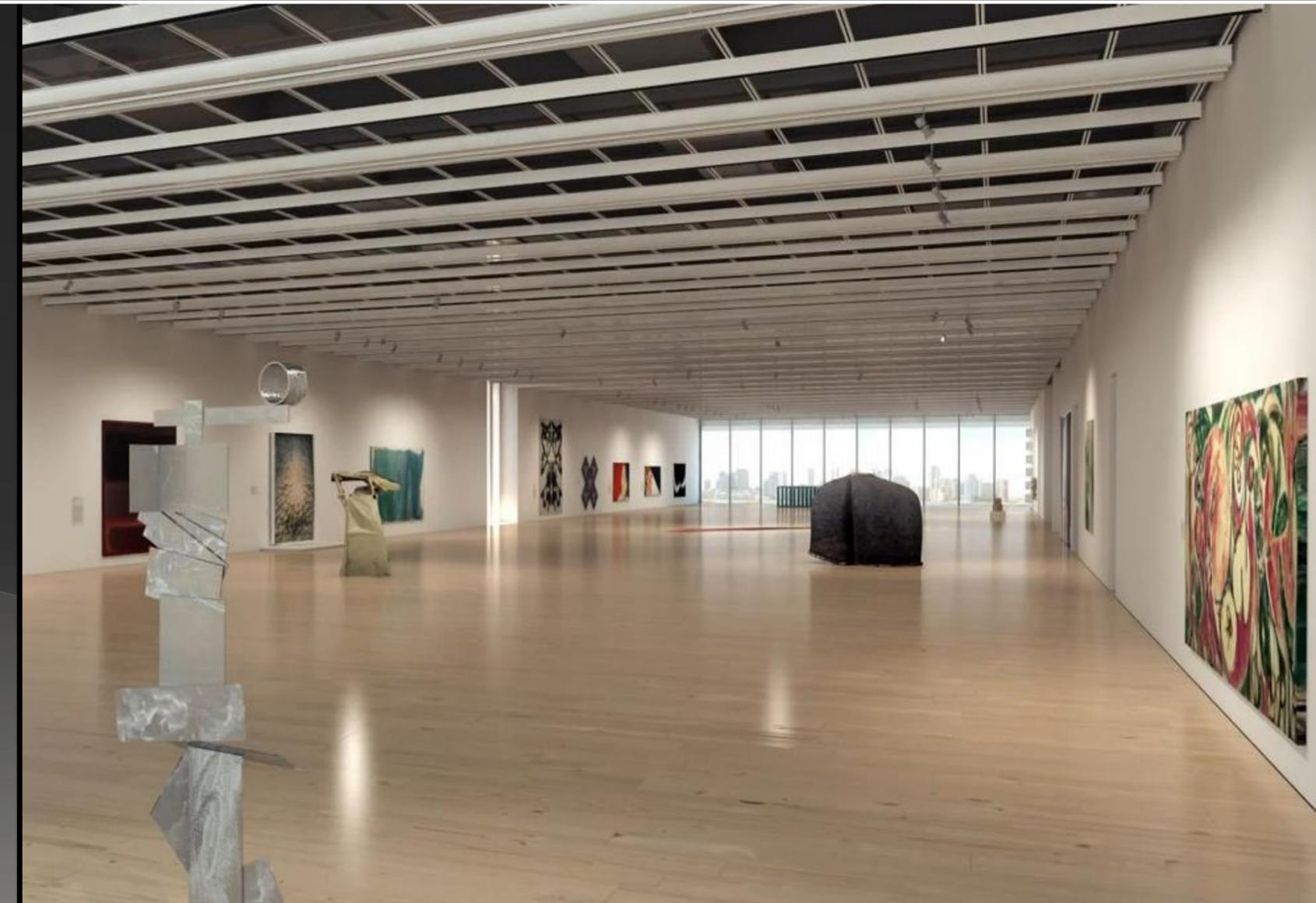
Item	Description	Cost Impact (\$)
Manufacturing		
Warehouse Rental	Five months rent of 12,420 SF @ \$7.25/SF/Yr.	37,518.75
Additional Labor	Laborer to move modules between stations.	48,432.38
Transportation		
Trucking Costs	Nine Trucks at \$400/Truck.	3,600.00
Permits	Nine Permits at \$40/Permit.	360.00
Wood Pallets	57 Custom Pallets	10,613.65
Loading Costs	Crane, Labor, & Operating Costs at the Warehouse	6,680.56
Installation		
Hydraulic Crane	Three days rent, mobilization costs, and labor associated with receiving the modules.	10,739.56
Installation Labor	Labor associated with the new activities.	33,987.76
General Conditions	Five weeks of general conditions savings.	497,500.00
Net Total		345,567.34



CONCLUSION & RECOMMENDATION

- Schedule Savings: 5 Weeks
- Cost Savings: \$345,000

- Implement the prefabrication process.







PROBLEM IDENTIFICATION AND GOALS

- **Problem:**
 - Ceiling system takes over 100 days to construct.
 - Labor and cost intensive.
- **Goal:**
 - Modify the architectural design in order to facilitate a faster construction sequence.

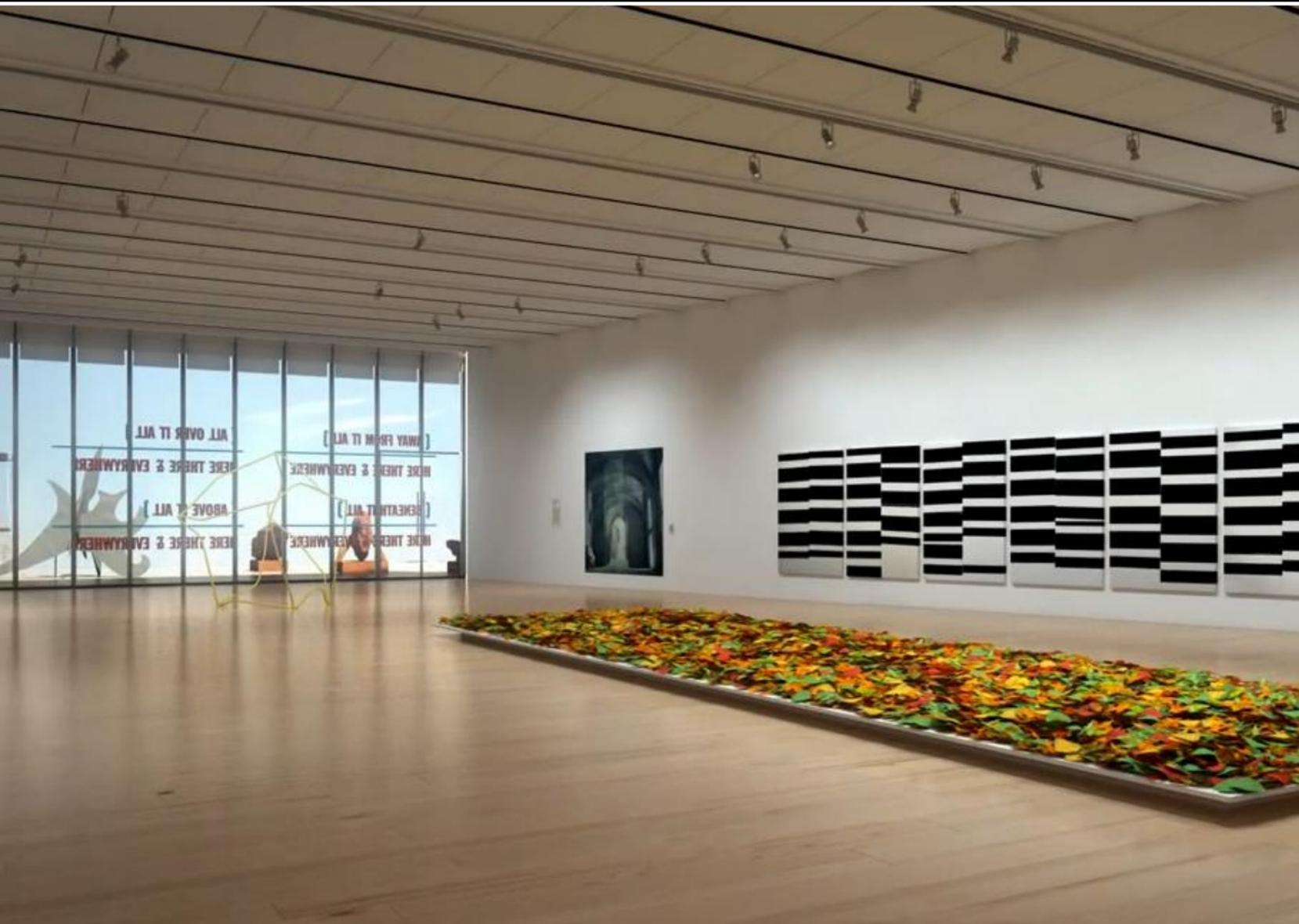




ORIGINAL CEILING DESIGN & ARCHITECTURE

- **MMAA Interior Architecture**
 - Minimalistic Interior Spaces
 - Accentuates the Art Showcases
 - Few Gallery Finishes
 - Wood Plank Floor
 - Drywall Walls
 - Steel Grid Ceiling is the only ornate finish.





ORIGINAL CEILING DESIGN & ARCHITECTURE

- **MMAA Interior Architecture**
 - Minimalistic Interior Spaces
 - Accentuates the Art Showcases
 - Few Gallery Finishes
 - Wood Plank Floor
 - Gypsum Board Walls
 - Steel Grid Ceiling is the only ornate finish.





ORIGINAL CEILING DESIGN & ARCHITECTURE

- **MMAA Exterior Architecture**
 - Unique Building Shape
 - Stepped Terraces
 - Top Cone Structure
 - Cantilevered Entrance





ORIGINAL CEILING DESIGN & ARCHITECTURE

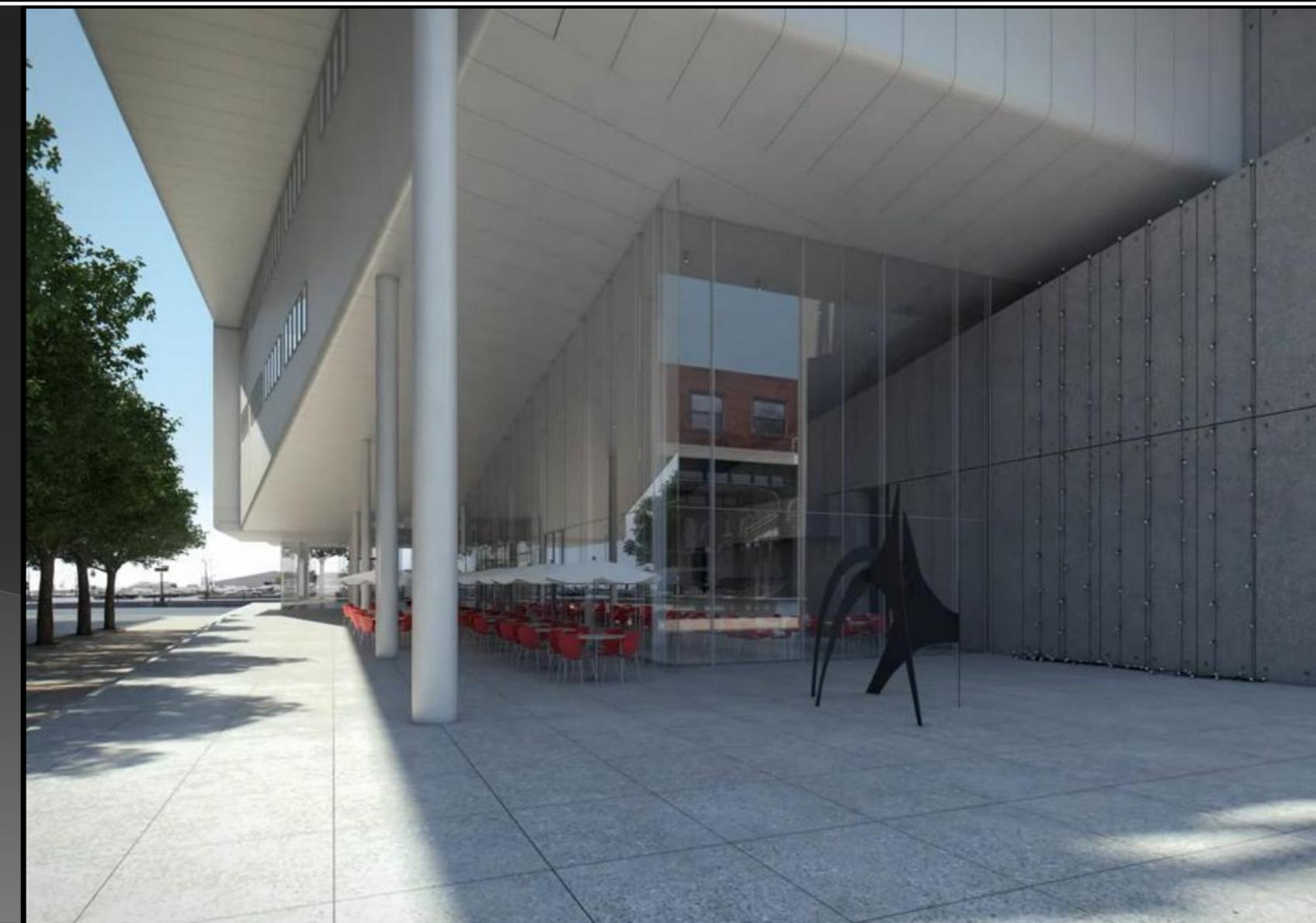
- **MMAA Exterior Architecture**
 - Unique Building Shape
 - Stepped Terraces
 - Top Cone Structure
 - Cantilevered Entrance





ORIGINAL CEILING DESIGN & ARCHITECTURE

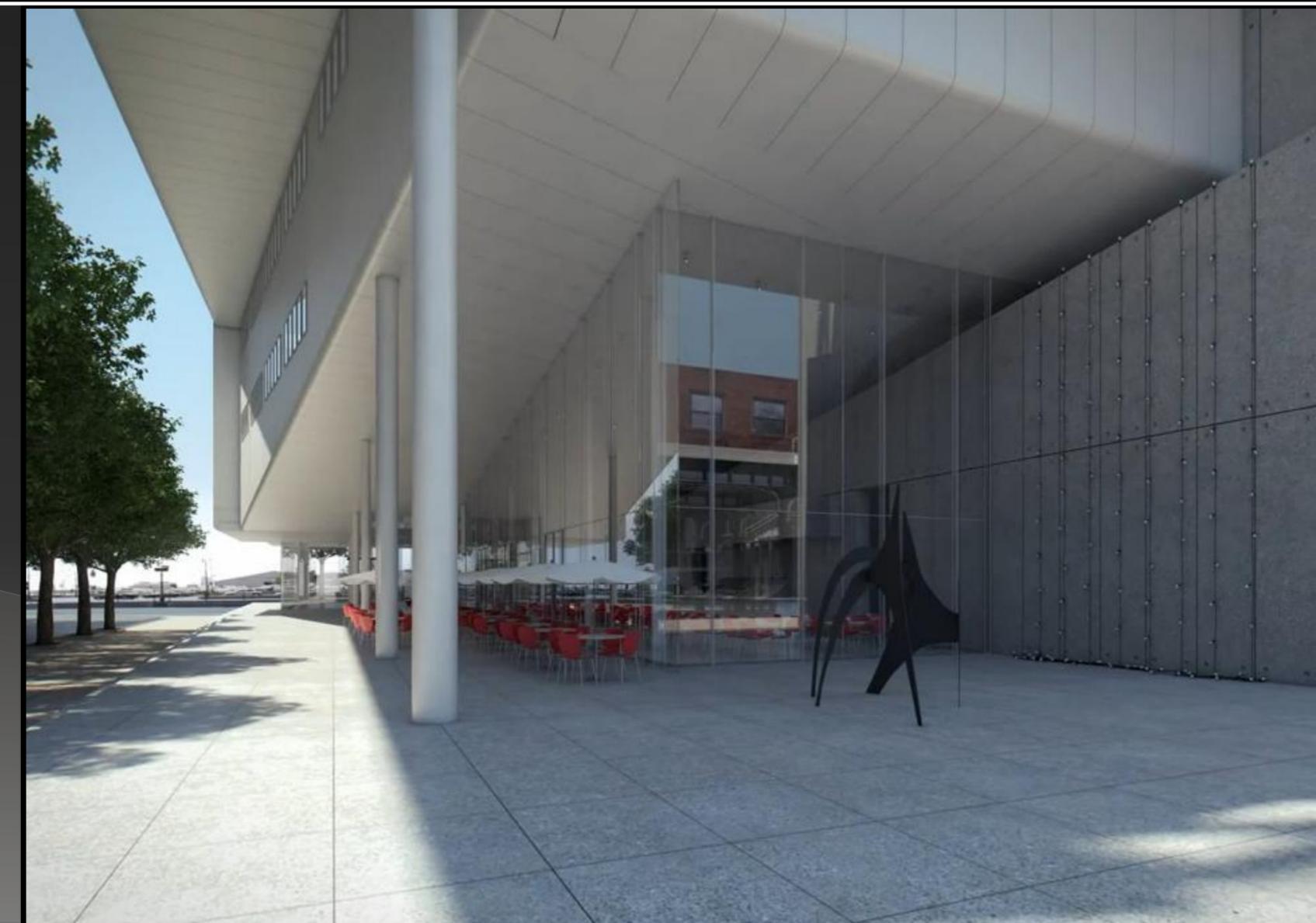
- **MMAA Exterior Architecture**
 - Unique Building Shape
 - Stepped Terraces
 - Top Cone Structure
 - Cantilevered Entrance





DESIGN GOALS

- Maintain the uniqueness.
- Expose the MEP & structural systems, but don't focus on them.
- Simpler construction methods.
- Cost effective solution.
- Keep the ceiling height the same.
- Do not disturb the mechanical systems.



ORIGINAL CEILING SCHEDULE & COSTS

- Ceiling Structure takes 77 working days to complete.
- 5th Floor Ceiling System costs \$461K
 - Total: \$1.16M

ORIGINAL GALLERY CEILING ACTIVITY LENGTHS	
Activity	Duration (Working Days)
Ceiling Layout/ Hanging Drop Rods	25
Install W5 Sections & Infill Pieces	35
Install Ceiling Panels	12
Ceiling Trim	5
Total	77

ORIGINAL 5th FLOOR GALLERY CEILING SYSTEM TAKEOFFS

Item	Unit	Quantity
W5x16 Members	LF	3,564
2x2x1/4 Angle Members	LF	8,974
C5x09 Members	LF	451
Bent Steel Plate Hanger	EA	189

GALLERY CEILING ESTIMATES

Item	Unit	Quantity
5 th Floor Gallery Cost	\$	461,353
Cost Per Square Foot	\$/SF	26.89
5 th -8 th Floor Cost Extrapolated	\$	1,157,146



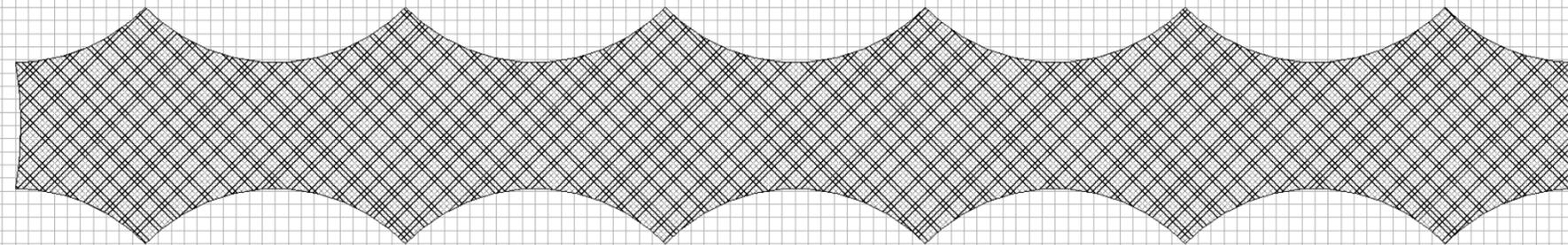
NEW CEILING DESIGN (Arch. Breadth)

- Two Part Ceiling System
 - Perimeter: Tegular Acoustical Panels
 - Center: 8" Square Open Cell Grid
 - Exposes 90% of the ceiling above.
- Structure above painted dark blue.

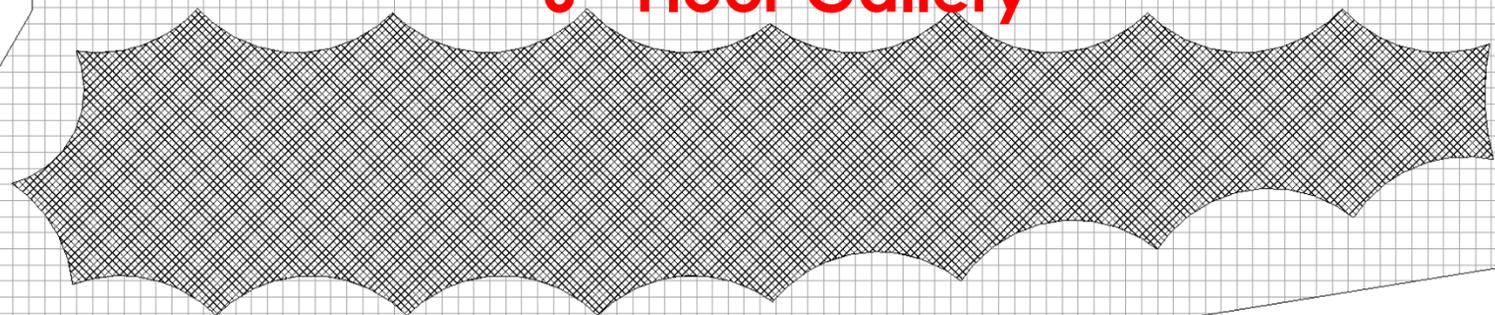


NEW CEILING DESIGN (Arch. Breadth)

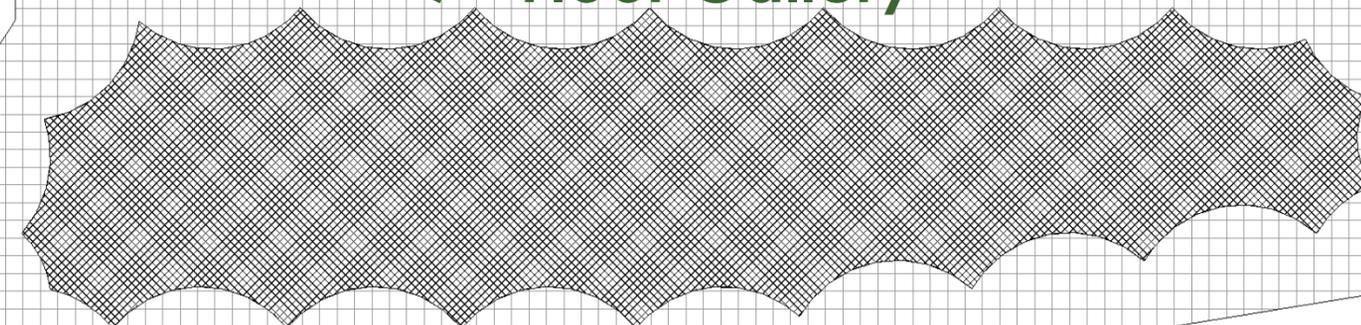
■ 5th Floor Gallery

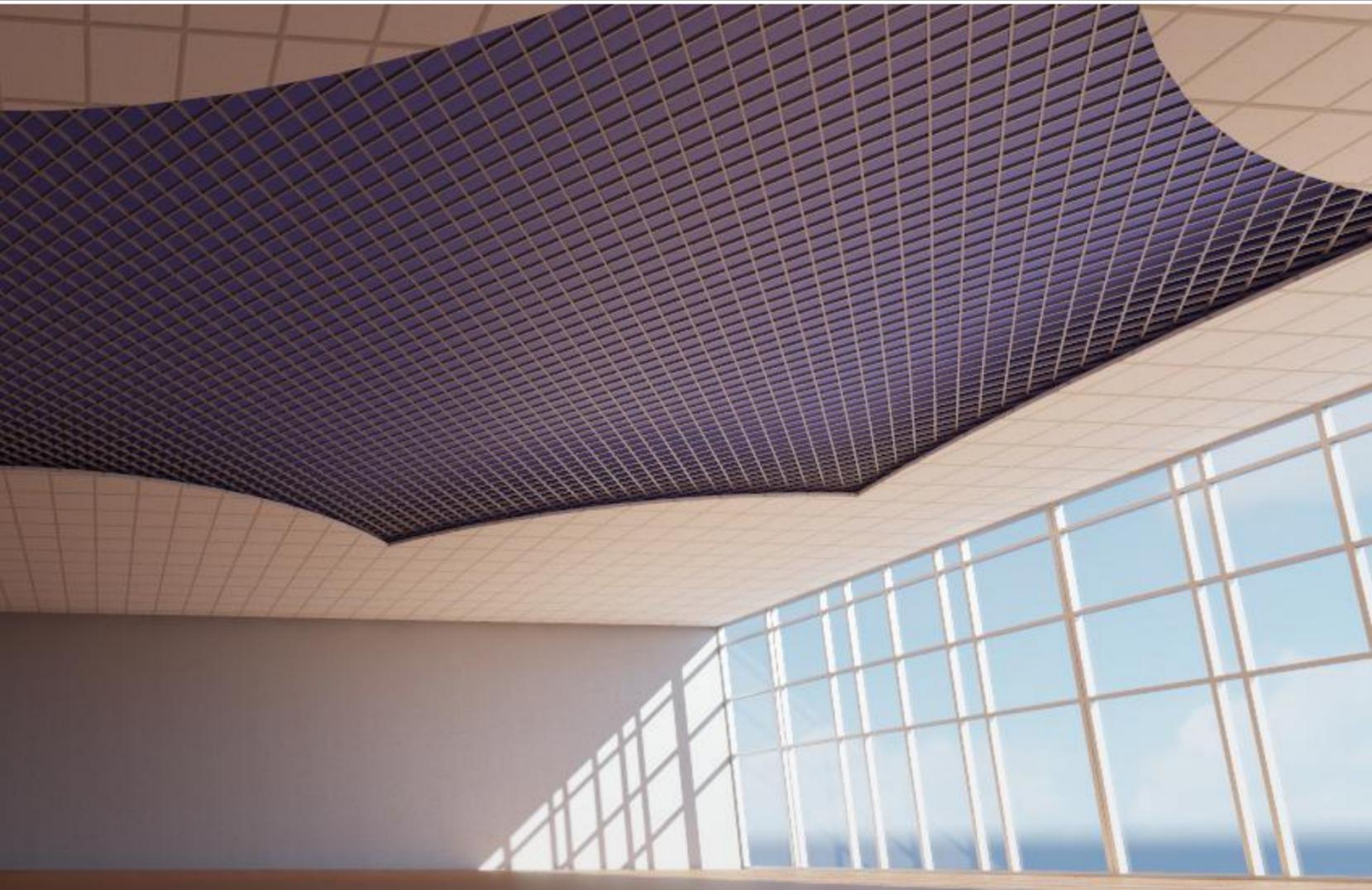


■ 6th Floor Gallery



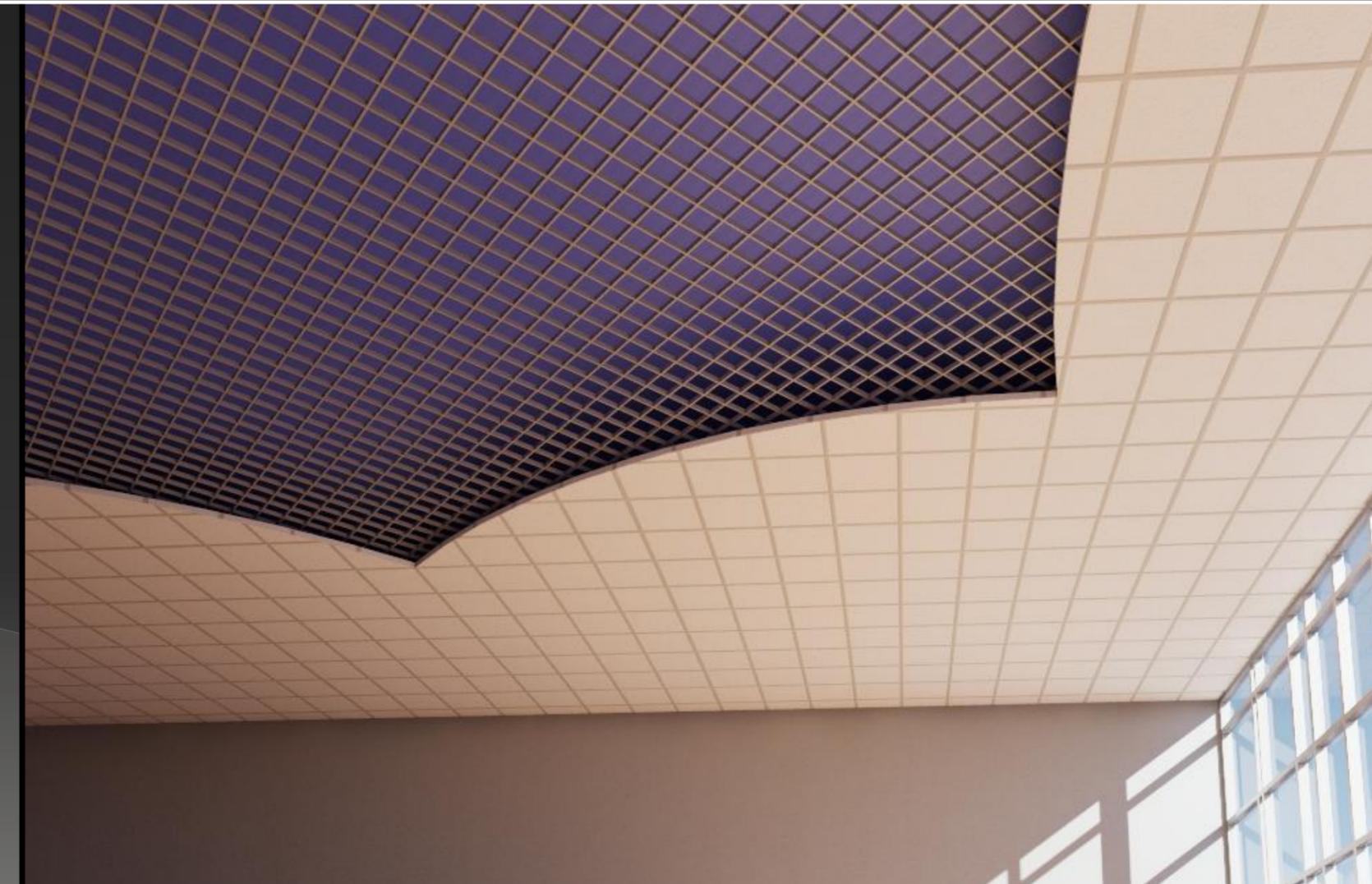
■ 7th Floor Gallery





NEW CEILING DESIGN (Arch. Breadth)

CEILING SYSTEM TAKEOFFS BY FLOOR			
Floor	Total (SF)	Acoustical Ceiling (SF)	Open Cell Grid (SF)
5 th	17,160	11,317	5,843
6 th	11,353	6,574	4,779
7 th	9,467	4,884	4,583
8 TH	5,060	0	5,060
Total	43,040	22,775	20,265



NEW CEILING SCHEDULE

CEILING SYSTEM TAKEOFFS BY FLOOR

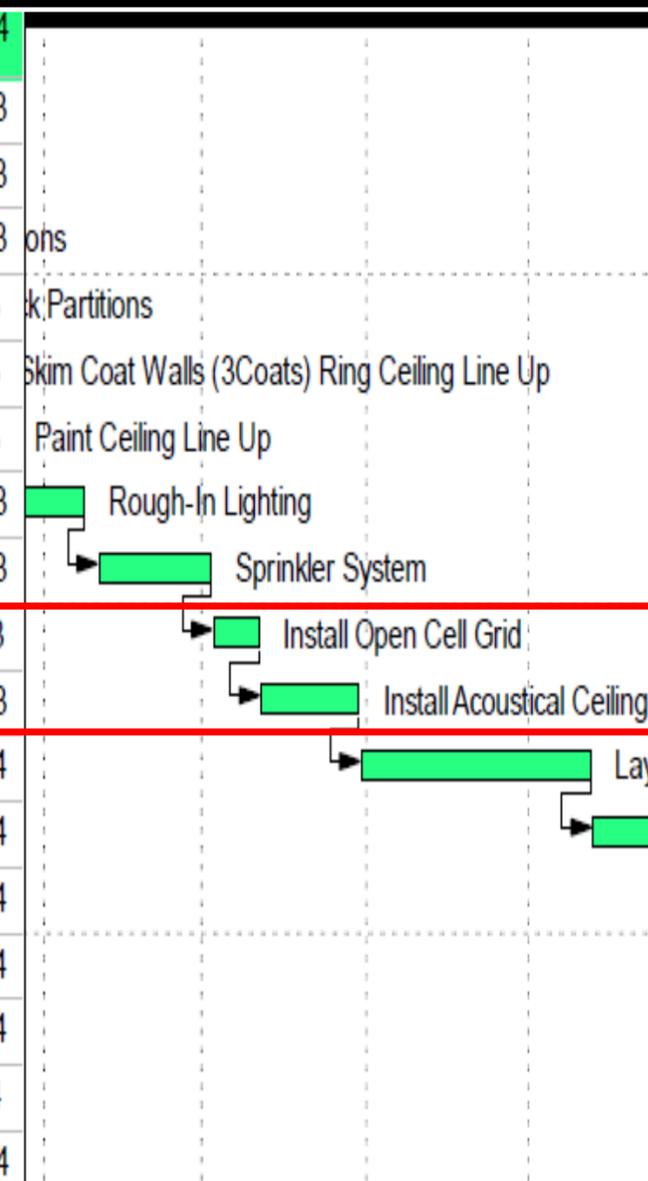
Floor	Acoustical Ceiling (SF)	Open Cell Grid (SF)	Installation Time for AC (Days)	Installation Time for Grid (Days)
5 th	11,317	5,843	12	7
6 th	6,574	4,779	7	6
7 th	4,884	4,583	5	6
8 TH	0	5,060	0	6
Total			24	25

NOTE: Productivity Values:

- Acoustical Panels (4 Carp): 1000 SF/Day
- Open Cell Grid (2 Carp): 860 SF/Day

- Average Length of Construction:
 - Original Ceiling: 77 Days
 - Redesigned Ceiling: 12 Days
- Shortened Gallery Fit-Out Schedule by 83 working Days.
- Shortened the Overall Project Schedule by 26 Working Days.

NEW CEILING.1 5th Floor Ga		241	21-Jun-13	29-May-14
5000	Overhead MEP Rough-In	40	21-Jun-13*	16-Aug-13
5010	Layout & Frame	12	19-Aug-13	04-Sep-13
5020	Rough Partitions	15	05-Sep-13	25-Sep-13
5030	Sheetrock Partitions	7	26-Sep-13	04-Oct-13
5040	Skim Coat Walls (3Coats) f	12	07-Oct-13	22-Oct-13
5050	Paint Ceiling Line Up	3	23-Oct-13	25-Oct-13
5060	Rough-In Lighting	10	28-Oct-13	08-Nov-13
5070	Sprinkler System	15	11-Nov-13	02-Dec-13
5080	Install Open Cell Grid	7	03-Dec-13	11-Dec-13
5090	Install Acoustical Ceiling	12	12-Dec-13	30-Dec-13
5100	Layout Frame & Install Slec	32	31-Dec-13	12-Feb-14
5110	Plywood Subfloor	12	13-Feb-14	28-Feb-14
5120	Patch Skim Coat	5	03-Mar-14	07-Mar-14
5130	Paint	6	10-Mar-14	17-Mar-14
5140	Lights and MEP Finish Trim	10	18-Mar-14	31-Mar-14
5150	Wood Flooring	18	01-Apr-14	24-Apr-14
5160	Punchlist	25	25-Apr-14	29-May-14



NEW CEILING COST

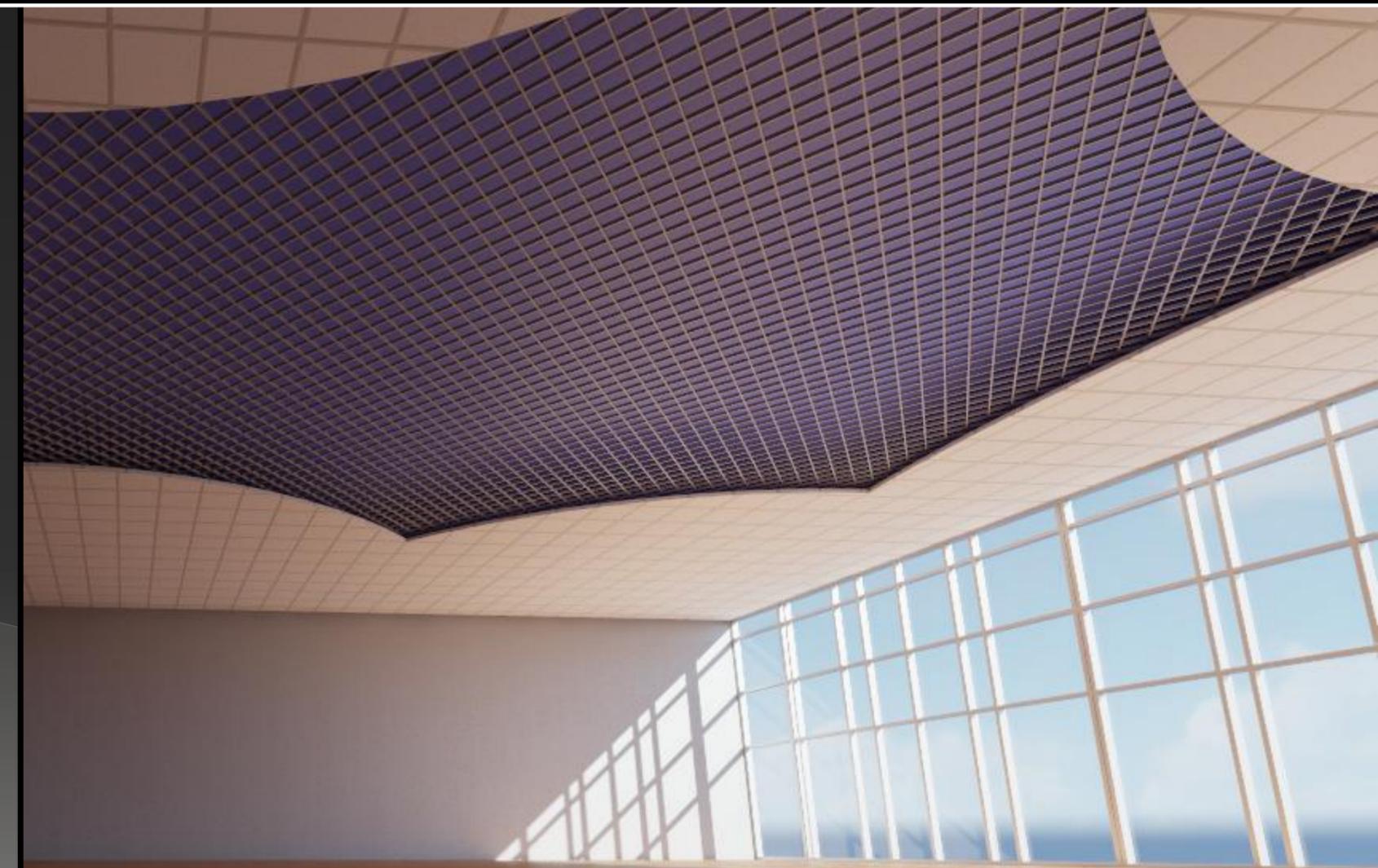
ORIGINAL VS REDESIGNED CEILING SYSTEM ESTIMATES

Floor	Original Estimate (\$)	Redesigned Estimate (\$)	Difference (\$)
5 th	461,353	196,129	265,224
Total	1,157,147	473,701	683,446

REDESIGNED CEILING SYSTEM COST SAVINGS

Description	Cost Savings (\$)
Material & Labor Savings	683,446
General Conditions Savings	497,500
Total	1,180,946

- 5th Floor Gallery Ceiling Estimate:
 - \$196,000
- Total Ceiling System Estimate
 - \$474,000
- Redesign Cost Savings:
 - \$683,000
- Total Cost Savings:
 - \$1,181,000





CONCLUSION & RECOMMENDATION

- Schedule Savings: 5 Weeks
- Cost Savings: \$1.18M

- Implement the redesigned ceiling system.
- Final Decision is up to the Owner.





**ANALYSIS 2:
SHORT INTERVAL PRODUCTION
SCHEDULE**



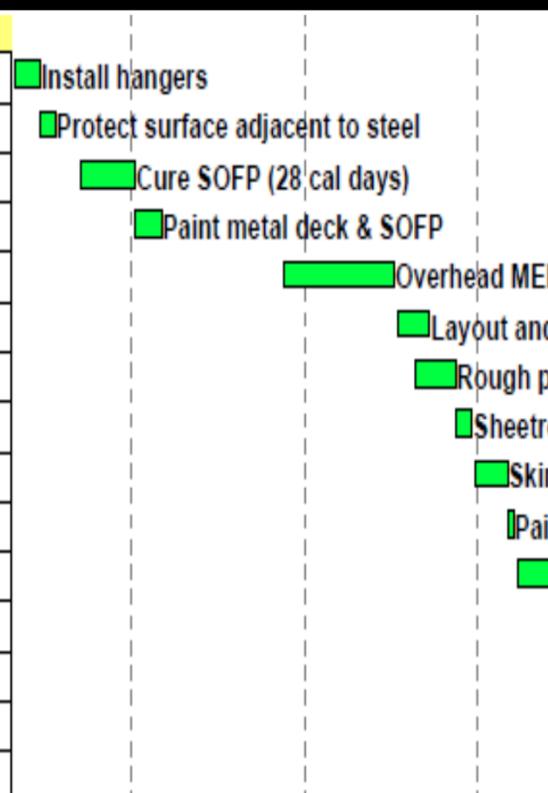


PROBLEM IDENTIFICATION AND GOALS

- **Problem:**
 - Gallery Fit-Outs take over 400 days on average to complete.
- **Goal:**
 - Reduce the Gallery Fit-Out length in order to reduce the overall project schedule.



Gallery					
INT-5-100	Install hangers	01-29-13	02-11-13	10	10
INT-5-101	Protect surface adjacent to steel	02-12-13	02-19-13	5	5
INT-5-122	Cure SOFP (28 cal days)	03-06-13	04-02-13	20	20
INT-5-102	Paint metal deck & SOFP	04-03-13	04-16-13	10	10
INT-5-103	Overhead MEP rough in	06-21-13	08-16-13	40	40
INT-5-104	Layout and frame	08-19-13	09-04-13	12	12
INT-5-105	Rough partitions	08-28-13	09-18-13	15	15
INT-5-106	Sheetrock partitions	09-19-13	09-27-13	7	7
INT-5-107	Skim coat walls (3 coats) ring ceiling line	09-30-13	10-15-13	12	12
INT-5-108	Paint ceiling line up	10-16-13	10-18-13	3	3
INT-5-109	Ceiling layout and hang drop rods/unistrut	10-21-13	11-22-13	25	25
INT-5-110	Install W5 sections and infill pieces	11-25-13	01-15-14	35	35
INT-5-111	Rough-in lighting	01-16-14	01-29-14	10	10
INT-5-112	Sprinkler heads	01-30-14	02-20-14	15	15
INT-5-113	Install ceiling panels	02-21-14	03-10-14	12	12
INT-5-114	Ceiling trim	03-11-14	03-17-14	5	5
INT-5-115	Layout/frame/install sleepers	03-18-14	04-30-14	32	32
INT-5-116	Plywood subfloor	05-01-14	05-16-14	12	12
INT-5-117	Patch skim coat	05-19-14	05-23-14	5	5
INT-5-118	Paint	05-27-14	06-03-14	6	6
INT-5-119	Lights and MEP finish trim	06-04-14	06-17-14	10	10
INT-5-120	Wood flooring	06-19-14	07-15-14	18	18
INT-5-123	Punchlist	07-16-14	08-19-14	25	25



PROBLEM ANALYSIS

- Reasons for long gallery fit-outs.
 - Start to Finish activity relationships.
 - Only one trade in each gallery performing work at a time.
- A SIPS will expedite this schedule area.



Gallery					
INT-5-100	Install hangers	01-29-13	02-11-13	10	10
INT-5-101	Protect surface adjacent to steel	02-12-13	02-19-13	5	5
INT-5-122	Cure SOFP (28 cal days)	03-06-13	04-02-13	20	20
INT-5-102	Paint metal deck & SOFP	04-03-13	04-16-13	10	10
INT-5-103	Overhead MEP rough in	06-21-13	08-16-13	40	40
INT-5-104	Layout and frame	08-19-13	09-04-13	12	12
INT-5-105	Rough partitions	08-28-13	09-18-13	15	15
INT-5-106	Sheetrock partitions	09-19-13	09-27-13	7	7
INT-5-107	Skim coat walls (3 coats) ring ceiling line	09-30-13	10-15-13	12	12
INT-5-108	Paint ceiling line up	10-16-13	10-18-13	3	3
INT-5-109	Ceiling layout and hang drop rods/unistrut	10-21-13	11-22-13	25	25
INT-5-110	Install W5 sections and infill pieces	11-25-13	01-15-14	35	35
INT-5-111	Rough-in lighting	01-16-14	01-29-14	10	10
INT-5-112	Sprinkler heads	01-30-14	02-20-14	15	15
INT-5-113	Install ceiling panels	02-21-14	03-10-14	12	12
INT-5-114	Ceiling trim	03-11-14	03-17-14	5	5
INT-5-115	Layout/frame/install sleepers	03-18-14	04-30-14	32	32
INT-5-116	Plywood subfloor	05-01-14	05-16-14	12	12
INT-5-117	Patch skim coat	05-19-14	05-23-14	5	5
INT-5-118	Paint	05-27-14	06-03-14	6	6
INT-5-119	Lights and MEP finish trim	06-04-14	06-17-14	10	10
INT-5-120	Wood flooring	06-19-14	07-15-14	18	18
INT-5-123	Punchlist	07-16-14	08-19-14	25	25

Install hangers
Protect surface adjacent to steel
Cure SOFP (28 cal days)
Paint metal deck & SOFP
Overhead MEP
Layout and
Rough pa
Sheetro
Skim
Paint

ACTIVITY ANALYSIS

- SIPS will focus on 5th – 8th floor galleries
- Will commence with the “MEP Rough In”
- Activities adjusted to a 20 day maximum schedule length per gallery.
 - Ex: MEP Rough In
- Crew Sizes adjusted to make each activity length 20 days / gallery.



ZONE DEFINITION

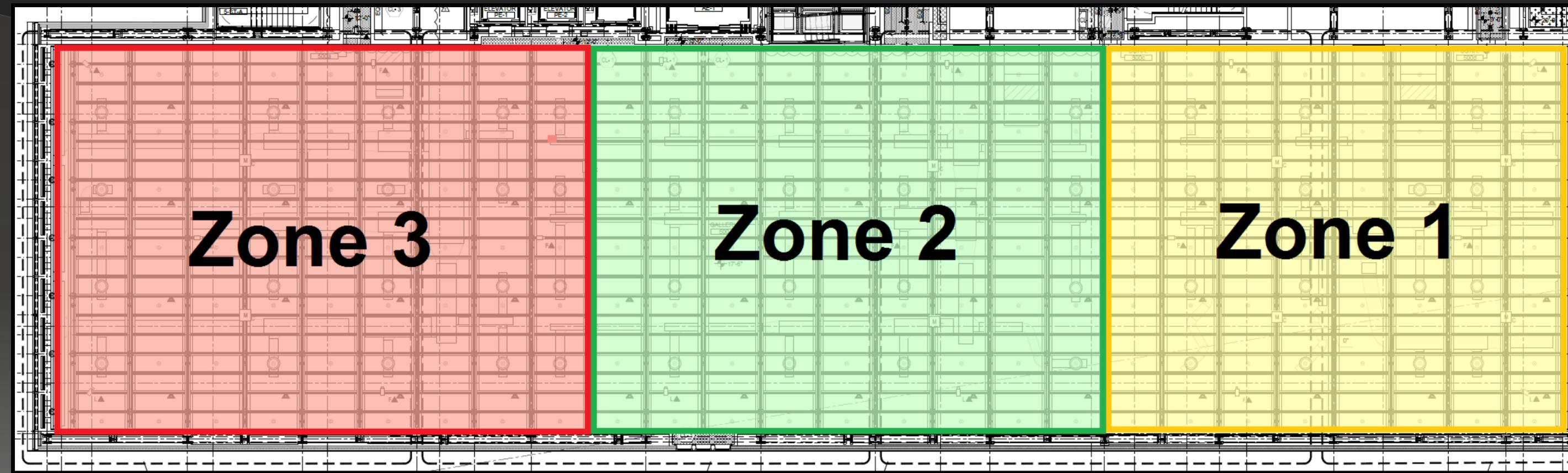
SQUARE FOOTAGE PER GALLERY

Floor	Square Footage	Number of Zones	Square Footage Per Zone
5 th	17,160	3	5,700
6 th	11,353	2	5,675
7 th	9,467	2	4,734
8 th	5,060	1	5,060
Total	43,040	8	5,380

- A SIPS is most effective when the zone sizes are equal.
- MMAA zones will be approximately 5,000 SF.
- Gives a total of 8 zones.
- Total schedule length (80 days / activity) will be split evenly between the 8 zones.
 - Creates 10 day activity lengths / zone.



5th FLOOR ZONES



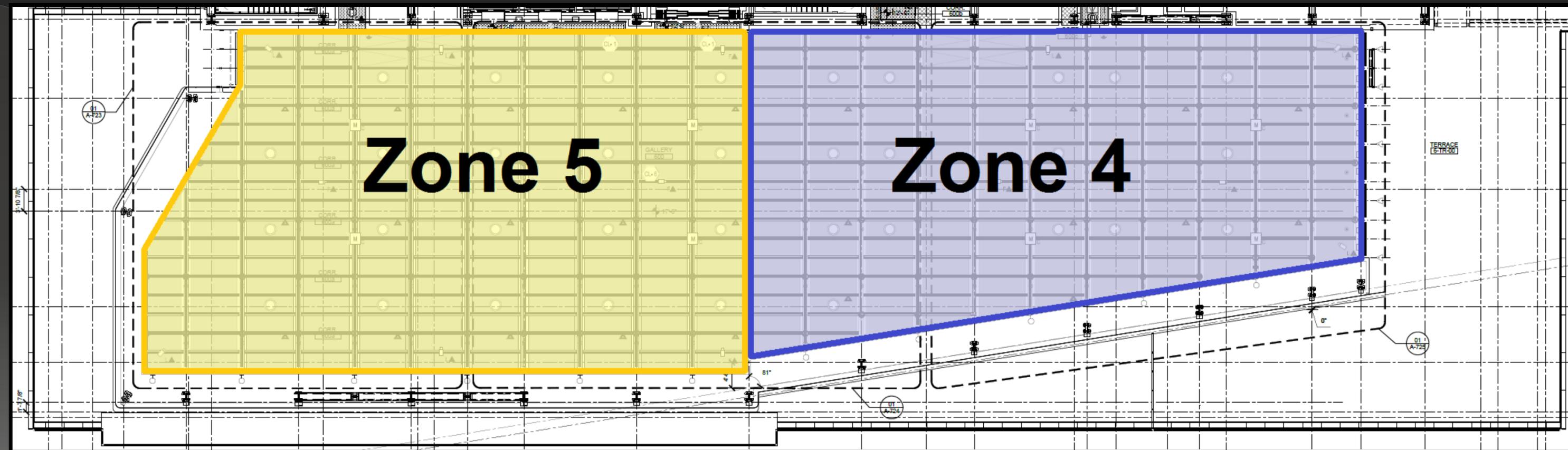
Zone 3

Zone 2

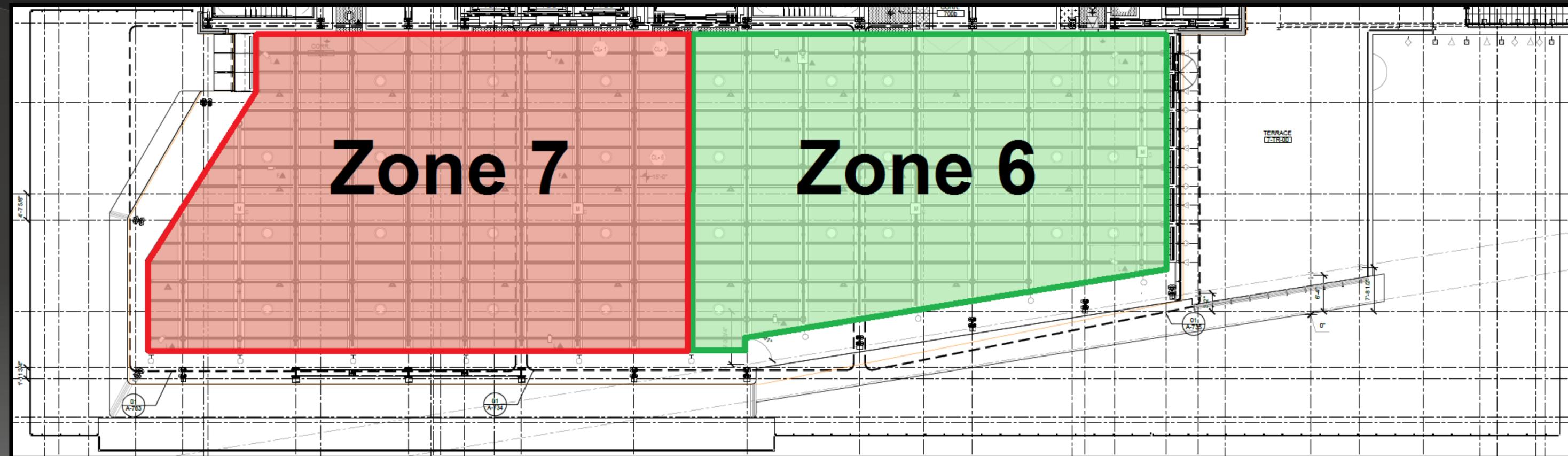
Zone 1

- 3 Zones:
 - Average of 5,700 SF

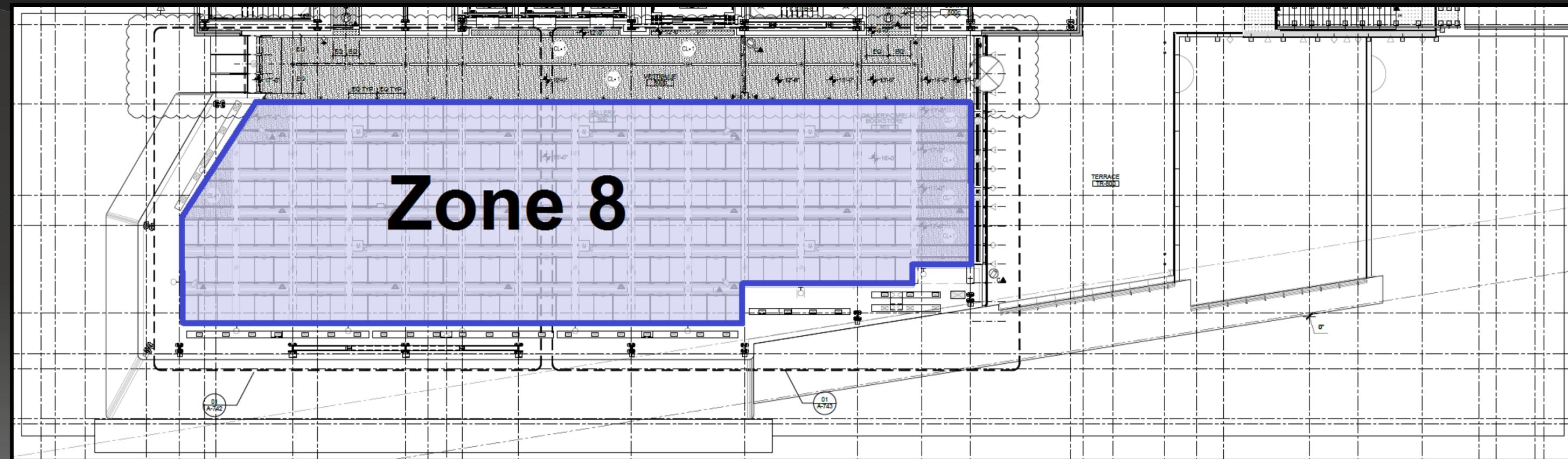
6th FLOOR ZONES



- 2 Zones:
 - Average of 5,675 SF

7th FLOOR ZONES

- 2 Zones:
 - Average of 4,734 SF

8th FLOOR ZONE

- 1 Zone:
 - Average of 5,060 SF

SIPS Schedule for the Metro Museum of American Art

	Jun-13		Jul-13				Aug-13				Sep-13				Oct-13				Nov-13				Dec-13				Jan-14				Feb-14				Mar-14					Apr-14				May-14					Jun-14					
	6/17	6/24	7/1	7/8	7/15	7/22	7/29	8/5	8/12	8/19	8/26	9/2	9/9	9/16	9/23	9/30	10/7	10/14	10/21	10/28	11/4	11/11	11/18	11/25	12/2	12/9	12/16	12/23	12/30	1/6	1/13	1/20	1/27	2/3	2/10	2/17	2/24	3/3	3/10	3/17	3/24	3/31	4/7	4/14	4/21	4/28	5/5	5/12	5/19	5/26	6/2	6/9	6/16	6/23
Zone 1		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	[Greyed out]																																	
Zone 2	[Greyed out]			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	[Greyed out]																															
Zone 3	[Greyed out]					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	[Greyed out]																													
Zone 4	[Greyed out]							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	[Greyed out]																											
Zone 5	[Greyed out]									1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	[Greyed out]																									
Zone 6	[Greyed out]											1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	[Greyed out]																							
Zone 7	[Greyed out]													1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	[Greyed out]																					
Zone 8	[Greyed out]															1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	[Greyed out]																			

1
2
3
4
5

- Mechanical Rough-In
- Electrical Rough-In
- Layout & Frame Partitions
- Install Rough & Sheetrock Partitions
- Skim Coat Walls & Paint Ceiling Line Up

6
7
8
9
10

- Ceiling Layout
- Hang Drop Rods
- Install W5 Sections
- Install Infill Pieces
- Rough-In Lighting

11
12
13
14
15

- Install Sprinklers
- Install Ceiling Panels and Ceiling Trim
- Layout/ Frame Sleepers
- Install Sleepers
- Install Plywood Subfloor

16
17
18
19

- Patch Skim Coat / Paint
- Lights and MEP Finish Trim
- Wood Flooring
- Punchlist

SCHEDULE ANALYSIS

SIPS SUMMARY

Gallery	Start Date	Finish Date	SIPS Schedule Length (Weeks)
5 th	6/24/13	4/18/14	43
6 th	8/5/13	5/16/14	41
7 th	9/2/13	6/13/14	41
8 th	9/30/13	6/27/14	39
Overall	6/24/13	6/27/14	53

- SIPS shortened the gallery fit-out from 17 to 12 months.
 - Doubled the amount of work being completed at a time.
 - Consistent & efficient flow of trades.
- No extra man-hours were worked due to the SIPS.
- Overall project schedule reduced by 26 working days.



COST ANALYSIS

SIPS SUMMARY

Gallery	Start Date	Finish Date	SIPS Schedule Length (Weeks)
5 th	6/24/13	4/18/14	43
6 th	8/5/13	5/16/14	41
7 th	9/2/13	6/13/14	41
8 th	9/30/13	6/27/14	39
Overall	6/24/13	6/27/14	53

- Total man-hours and material usage remained the same.
 - No additional costs were incurred.
- 5 week of general conditions were saved.
 - Results in \$497,500 in savings.





CONCLUSION & RECOMMENDATION

- Schedule Savings: 5 Weeks
- Cost Savings: \$497,500

- Implement the SIPS.





CONCLUSION & RECOMMENDATION

▪ Prefabrication Analysis

- Schedule Savings: 5 Weeks
- Cost Savings: \$345,000

▪ Redesign Analysis

- Schedule Savings: 5 Weeks
- Cost Savings: \$1,181,000

▪ SIPS Analysis

- Schedule Savings: 5 Weeks
- Cost Savings: \$497,500

▪ Recommendations:

- Implement the SIPS.
- Implement the redesign at the owners discretion.



QUESTIONS?

ACKNOWLEDGEMENTS

Turner
Building the Future

Metro Museum of American Art
Renzo Piano Building Workshop
Ray Sowers: CM Advisor
Penn State AE Faculty
Family & Friends