AGENDA

CHARTER TOWNSHIP OF MERIDIAN

CONSTRUCTION BOARD OF APPEALS - **SPECIAL MEETING**

May 19, 2026 3:30 PM

1. CALL MEETING TO ORDER

2. ROLL CALL

3. APPROVAL OF AGENDA

4. APPROVAL OF MINUTES
   A. August 21, 2024

5. HEARING –Terra Firma Climbing Gym at 2655 Grand River – Use Group Discussion

6. PUBLIC REMARKS

7. ADJOURNMENT

DRAFT

CHARTER TOWNSHIP OF MERIDIAN
BUILDING BOARD OF APPEALS
REGULAR MEETING MINUTES

August 21, 2024
5151 Marsh Road, Okemos, MI 48864-1198
517.853.4000, Town Hall Room, 8:30 A.M.

Present: Members Chair Potterpin, Vice-Chair Cawood

Staff: John Hines, Senior Building Inspector and John Heckaman, Township Building Official

Applicant Representatives: Tenant Stan Gill, Building Owner Duff Schroeder, Architect Russ Peabody. Regarding address: 4665 Dobie Road, Site 240, "In The Wings"

1. Call meeting to order
   Chair Potterpin called to order the meeting at 8:37 a.m.

2. Approval of Agenda
   The agenda was approved.
   VOICE VOTE: Motion approved unanimously.

3. Approval of Minutes
   The minutes of the February 7, 2023 meeting were approved.
   VOICE VOTE: Motion approved unanimously.

4. Hearing
   Public Hearing opened by Chair Potterpin at 8:40 a.m.

   The representatives' from "In The Wings" presented a narrative of the intended use of the tenant space and a set of plans showing the proposed space. They also presented the code language identifying what constitutes a "B" use group as compared to what an "A-1" use group includes. Senior Inspector Hines described in detail the use of the space and why he determined to space to be more closely related to that of an "A-1" occupancy. There was a lengthy discussion back and forth between the board members and the applicants, as well as discussions including the interpretation of the code from Senior Inspector Hines.

   Chair Potterpin moved to deny the request to identify the use group as "B" and concur with the plan review determination that "A-1" is correct. Vice-Chair Cawood seconded the motion.

   MOTION CARRIED: 2-0

   Chair Potterpin closed the public hearing at 10:00 a.m.

5. Public Remarks

Jane Falion spoke in favor of the applicant and the lack of theatrical programs.

6. Adjournment

Chair Potterpin moved to adjourn the meeting at 10:10AM

Seconded by Vice-Chair Cawood

Motion carried 2-0

CHARTER TOWNSHIP OF MERIDIAN
LEGAL NOTICE
Construction Board of Appeals – 2655 East Grand River Avenue, Suite A
Terra Firma Boulding Company

Notice is hereby given that the Construction Board of Appeals of the Charter Township of Meridian will hold a hearing on Tuesday, May 19, 2026 at 3:30 p.m. in the Meridian Municipal Building, Town Hall Room, 5151 Marsh Road, Okemos, MI, 48864 (phone 517-853-4560) to hear an appeal from Terra Firma Bouldering Company. The applicant is seeking a plan review determination on the applicable use group or determination of equivalency for compliance with the 2021 MBC.

Materials related to the request are available for viewing in the Department of Community Planning and Development office (5151 Marsh Road, Okemos, 48864), Monday-Friday, 8am-5pm.

I, Ronald F. Rau, Township Building Official, posted **A NOTICE OF HEARING** on the 14th day of May, 2026

Ronald F. Rau

Township Building Official

To: **Construction Board of Appeals**

From: **Timothy R. Schmitt, *AICP***
Community Planning and Development Director

Date: **May 15, 2026**

Re: **Terra Firma Climbing Gym (2655 Grand River) – Appeal of use determination/equivalency determination**

Terra Firma Climbing Gym at 2655 Grand River Avenue, has gone through plan review, construction, and inspections, and is now at the point of final approval and occupancy. The permit was issued originally with the climbing structures being noted as 'by others' with a separate submittal being required, as they were considered a fixture to the space. After not receiving the information, Staff inspected the facility and determined that the climbing structures would fall under Section 424 of the 2021 Michigan Building. As built, Staff notes the following concerns with respect to the structures under Section 424:

- The flame spread did not meet the flame spread index per 424.2 (10) and table 803.13
- Fire protection was not shown to comply with section 424.3
- The play structures did not have the required 5' separation from building walls, partitions, and means of egress per Section 424. 4
- The play structures have not been demonstrated to the building official to have adequate fire safety per section 424. 5

The applicant has provided a substantial amount of information attached to this memo, relating to the fire issues and whether or not Section 424 is applicable. We look forward to discussing this matter with the Board and working through a path forward for this project.

CHARTER TOWNSHIP OF MERIDIAN
PLANNING DIVISION
5151 MARSH ROAD, OKEMOS, MI 48864
(517) 853-4560

BUILDING BOARD OF APPEALS HEARING APPLICATION

A. Applicant Terra Firma East Lansing - Alex Williams
Address of Applicant 2655 E Grand River Ave
East Lansing, MI 48823
Telephone (Work) 517-505-0525 Telephone (Home) _____
Fax _____ Email address: alex@climbterrafirma.com
Interest in property (circle one): Owner Tenant Option Other

B. Site address/location 2655 E Grand River Ave
Zoning district C-2 Parcel number 02-02-20-205-019

C. Nature of request (Please check all that apply):
- ☒ Request for variance(s)
- ☐ Request for interpretation of provision(s) of the "Zoning Ordinance" of the Code of Ordinances
- ☒ Review an order, requirements, decision, or a determination of a Township official charged with interpreting or enforcing the provisions of the "Zoning Ordinance" of the Code of Ordinances

International Property Maintenance Code section(s) N/A

D.

Required Supporting Material	Supporting Material if Applicable
-Property survey	-Architectural sketches
-Legal description	-Other
-Proof of property ownership or approval letter from owner	
-Site plan to scale	
-Written statement, which demonstrates how all the review criteria will be met (See next page)	

Signature of Applicant | Alex Williams (Print Name) | 05/14/2026 (Date)

Fee: _____ Received by/Date: _____

I (we) hereby grant permission for members of the Charter Township of Meridian Building Board of Appeals, Township staff members and the Township's representatives or experts the right to enter onto the above described property (or as described in the attached information) in my (our) absence for the purposes of gathering information including but not limited to the taking and the use of photographs. ***(Note to Applicant(s): This is optional and will not affect any decision on your application.)***

Signature of Applicant(s) — Date: 05/14/2026

Signature of Applicant(s) — Date: _____

TERRA FIRMA E.L.

CLIMBING GYM

2655 E Grand River Ave

East Lansing, MI 48823

ABBREVIATIONS

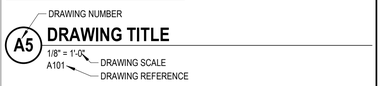
A/C	AIR CONDITIONING	HM	HOLLOW METAL
A/V	AUDIO / VIDEO, AUDIO / VISUAL	HORZ	HORIZONTAL
ACC	ACCESSIBLE, ACCESSIBILITY	HVAC	HEATING / VENTILATION / AIR CONDITIONING
ACP	ACOUSTICAL CEILING PANELS		
ACT	ACOUSTICAL CEILING TILE	IN, "	INCH
ADA	AMERICANS WITH DISABILITIES ACT	INS	INSULATE, INSULATION
AFF	ABOVE FINISHED FLOOR	INT	INTERIOR
ALT	ALTERNATE		
ALUM	ALUMINUM	LAV	LAVATORY
ARCH	ARCHITECT, ARCHITECTURAL	LEED	LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN
AUTO	AUTOMATIC		
		LVL	LAMINATED VENEER LUMER
BLDG	BUILDING	LVT	LUXURY VINYL TILE
BO	BOTTOM OF		
BRG	BEARING	MATL	MATERIAL(S)
		MAX	MAXIMUM
CAB	CABINET, CABINETRY	MECH	MECHANICAL
CF/CI	CONTRACTOR FURNISHED / CONTRACTOR INSTALLED	MFR	MANUFACTURER, MANUFACTURED
CF/OI	CONTRACTOR FURNISHED / OWNER INSTALLED	MIN	MINIMUM
		MISC	MISCELLANEOUS
CFMF	COLD FORMED METAL FRAMING	MTL	METAL
CJ	CONTROL JOINT		
CL	CENTERLINE	NEC	NATIONAL ELECTRIC CODE
CLG	CEILING	NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
CLR	CLEAR, CLEARANCE		
CMU	CONCRETE MASONRY UNIT	NIC	NOT IN CONTRACT
COL	COLUMN	NOM	NOMINAL
CONC	CONCRETE	NTS	NOT TO SCALE
CONT	CONTINUOUS, CONTINUATION		
COORD	COORDINATE	OC	ON CENTER
CPT	CARPET	OF/CI	OWNER FURNISHED, CONTRACTOR INSTALLED
CR	CARD READER		
CTR	CENTER	OF/OI	OWNER FURNISHED, OWNER INSTALLED
		OH	OVERHEAD
D	DEEP, DEPTH	OHD	OVERHEAD DOOR
DEFS	DIRECT-APPLIED EXTERIOR FINISH SYSTEM	OPP	OPPOSITE
		ORD	OVERFLOW ROOF DRAIN
DEG	DEGREE(S)		
DEMO	DEMOLISH, DEMOLITION	PERF	PERFORATE, PERFORATED
DF	DRINKING FOUNTAIN	PERP	PERPENDICULAR
DIA	DIAMETER	PLAM	PLASTIC LAMINATE
DIAG	DIAGONAL	PLUM	PLUMBING
DIM	DIMENSION, DIMENSIONAL	PNT	PAINT, PAINTED
DIST	DISTANCE		
DN	DOWN	QTY	QUANTITY
DR	DOOR		
DTL	DETAIL	RD	ROOF DRAIN, ROAD
DW	DISHWASHER	REF	REFRIGERATOR
DWG	DRAWING(S)	REQ	REQUIRED, REQUIREMENT
		REV	REVISE, REVISION
EIFS	EXTERIOR INSULATION AND FINISH SYSTEM	RO	ROUGH OPENING
		ROW	RIGHT OF WAY
EJ	EXPANSION JOINT	RTU	ROOF TOP UNIT
ELEC	ELECTRIC, ELECTRICAL		
ELEV	ELEVATOR	SCHED	SCHEDULE
EMER	EMERGENCY	SF	SQUARE FEET, SQUARE FOOT
ENG	ENGINEER	SHR	SHOWER
EQ	EQUAL	SIM	SIMILAR
EQUIP	EQUIPMENT	SIP	STRUCTURAL INSULATED PANEL
EST	ESTIMATE(D)	SPEC	SPECIFICATION
EX	EXISTING	SPKLR	SPRINKLER
EXT	EXTERIOR	STC	SOUND TRANSMISSION COEFFICIENT
FD	FLOOR DRAIN	STOR	STORAGE
FDC	FIRE DEPARTMENT CONNECTION	STR	STRUCTURAL
FDN	FOUNDATION		
FE	FIRE EXTINGUISHER	T&G	TONGUE AND GROOVED
FEC	FIRE EXTINGUISHER CABINET	TEMP	TEMPORARY
FFE	FINISHED FLOOR ELEVATION	TO	TOP OF
FRT	FIRE RETARDANT TREATED	TYP	TYPICAL
FT, '	FOOT, FEET		
FTG	FOOTING	UC	UNDER COUNTER
FURN	FURNITURE	UL	UNDERWRITERS LABORATORY
FUT	FUTURE	UNO	UNLESS NOTED OTHERWISE
		UR	URINAL
GA	GAUGE, GAGE		
GALV	GALVANIZED	VCT	VINYL COMPOSITION TILE
GC	GENERAL CONTRACTOR, GENERAL CONTRACT	VERT	VERTICAL, VERTICALLY
		VIF	VERIFY IN FIELD
GWB	GYPSUM WALL BOARD		
GYP	GYPSUM	WC	WATER CLOSET
		WD	WOOD
H	HEIGHT	WDW	WINDOW
HDW	HARDWARE		

GENERAL SYMBOLOGY

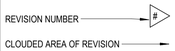
DRAWING TITLES

PLAN TITLE

PLAN CALLOUT / SECTION / ELEVATION TITLE



REVISION SYMBOLS



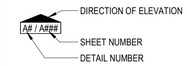
LOCATION SYMBOLS

BUILDING SECTION

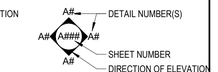
WALL SECTION

DETAIL SECTION

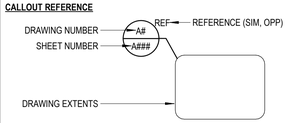
EXTERIOR ELEVATION



INTERIOR ELEVATION

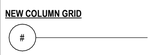


CALLOUT REFERENCE



DATUM SYMBOLS

NEW COLUMN GRID



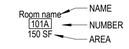
LEVEL

EXISTING COLUMN GRID

SPOT ELEVATION

TAGS

ROOM TAG

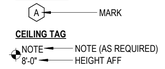


DOOR TAG

RESTROOM ACCESSORY TAG

WINDOW TAG

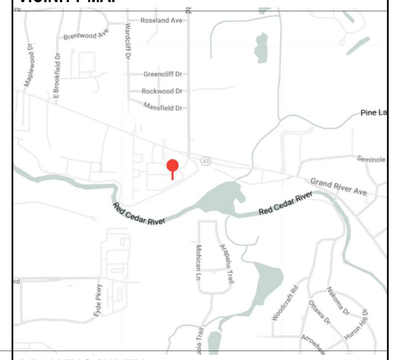
CEILING TAG



SYMBOLS

BREAK LINE

VICINITY MAP



DRAWING INDEX

GENERAL		
T001	TITLE DRAWING	
G101	CODE COMPLIANCE PLANS	
G201	ACCESSIBILITY DETAILS	
ARCHITECTURAL		
AD101	DEMOLITION PLAN	
A101	FLOOR PLANS	
A111	CEILING PLANS	
A301	BUILDING SECTIONS	
A401	RESTROOM BLOCK PLANS AND ELEVATIONS	
A501	INTERIOR ELEVATIONS	
A601	DOOR SCHEDULE, WINDOWS, AND DETAILS	

PROJECT TEAM

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CODY ERICKSON
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pinnacle construction group

DESIGN/BUILD CONTRACTOR

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1000 FRONT AVE.
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616-451-0500

WWW.ASKOURCLIENTS.COM

PROJECT TEAM

MICHAEL BUNCH
KEVIN SWANSON

PROJECT NUMBER

25-015

TERRA FIRMA E.L.
CLIMBING GYM
2655 E Grand River Ave
East Lansing, MI 48823

LICENSING STAMP

ISSUANCE

BID SET
07/23/2025

REVISIONS

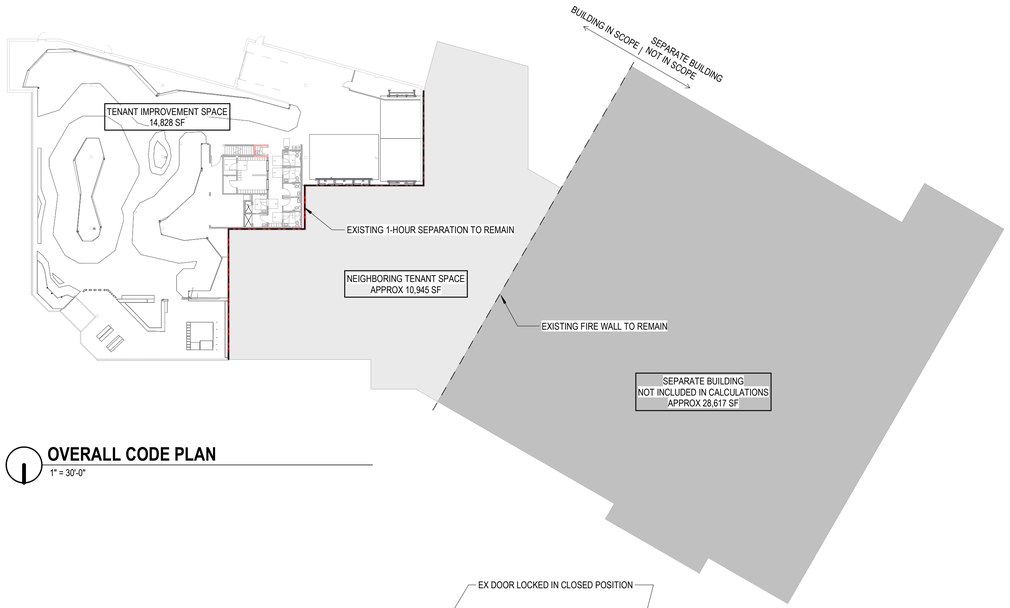
NO.	DATE	DESCRIPTION
1	08/14/2025	ADDENDUM 1

SHEET NAME

TITLE DRAWING

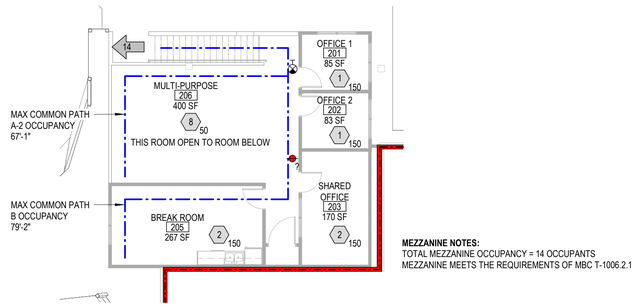
SHEET NUMBER

T001



OVERALL CODE PLAN

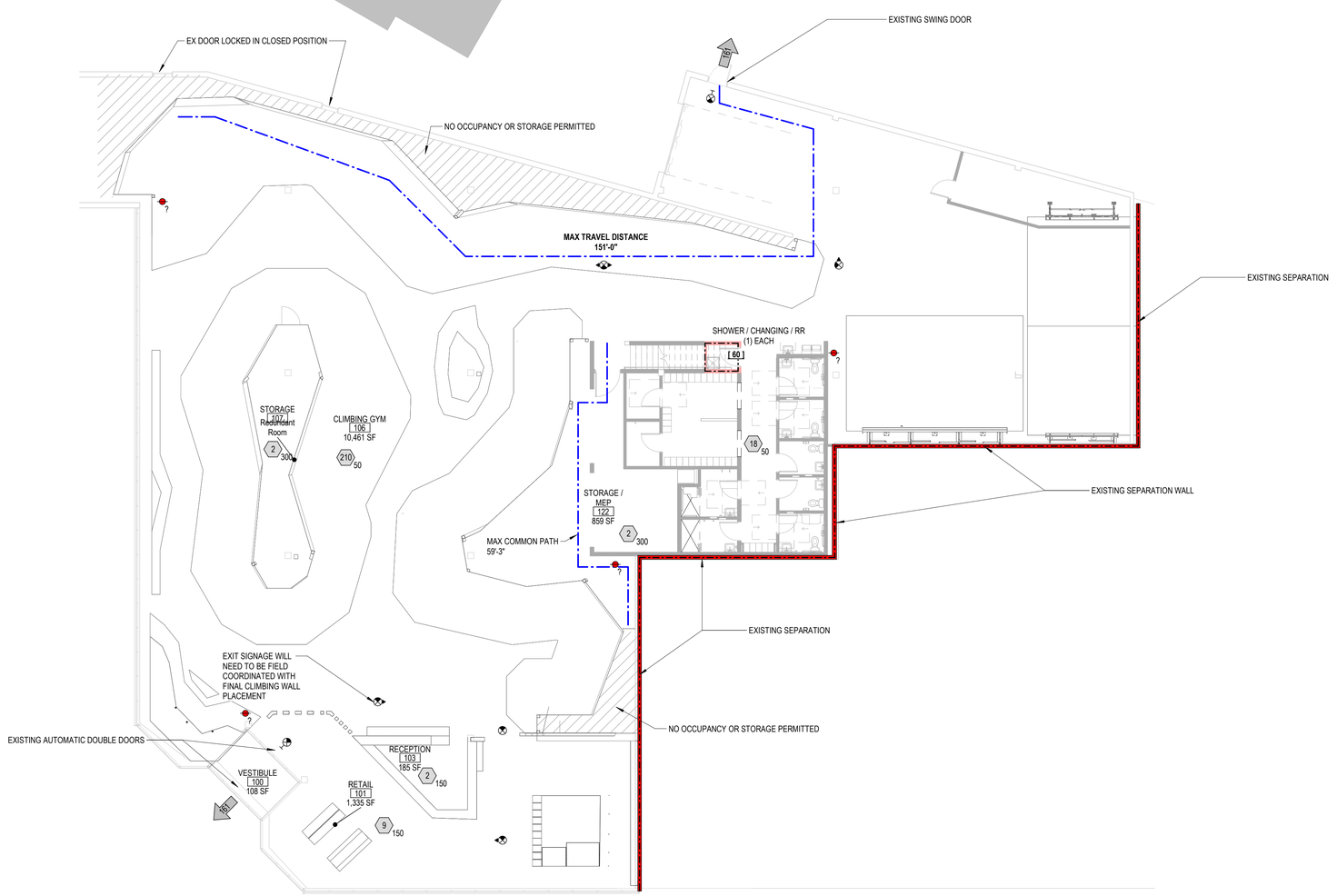
1" = 30'-0"



MEZZANINE NOTES:
TOTAL MEZZANINE OCCUPANCY = 14 OCCUPANTS
MEZZANINE MEETS THE REQUIREMENTS OF MBC T-1006.2.1

MEZZANINE CODE PLAN

3/32" = 1'-0"



MAIN LEVEL CODE PLAN

3/32" = 1'-0"

CODE SUMMARY

SITE ADDRESS
2655 E GRAND RIVER AVE
EAST LANSING, MI 48823

LOCAL JURISDICTION
CITY OF LANSING

PROJECT DESCRIPTION
TENANT IMPROVEMENT RENOVATION

APPLICABLE CODES

BUILDING:	2021 MICHIGAN REHABILITATION CODE (MRCEB)
FIRE:	2021 INTERNATIONAL FIRE CODE (IFC)
ACCESSIBILITY:	ICC ANSI A117.1-2017
ELECTRICAL:	2023 NATIONAL ELECTRICAL CODE (NEC) WITH AMENDMENTS
PLUMBING:	2021 MICHIGAN PLUMBING CODE (MPC)
MECHANICAL:	2021 MICHIGAN MECHANICAL CODE (MMC)
ENERGY:	2021 MICHIGAN ENERGY CODE (MEC)

DESIGN CRITERIA
USE GROUP (MBC CHAPTER 3): NON-SEPARATED MIXED-USE
A-3 - ASSEMBLY (CLIMBING / EXERCISE)
M - MERCANTILE (RETAIL)
B - BUSINESS (OFFICES)
CONSTRUCTION TYPE (MBC 602): VB - COMBUSTIBLE, UNPROTECTED (RECLASSIFIED)
SPRINKLER SYSTEM (MBC 903): NFPA 13 FULL COVERAGE
CLASSIFICATION OF WORK (MRCEB CHAPTER 5): CHANGE OF OCCUPANCY

CHANGE OF OCCUPANCY
MEANS OF EGRESS (MRCEB 1012.4): CHANGE TO HIGHER HAZARD CATEGORY (M TO A-3)
HEIGHTS AND AREAS (MRCEB 1012.5): CHANGE TO HIGHER HAZARD CATEGORY (M TO A-3)
EXPOSURE OF EXTERIOR WALLS (MRCEB 1012.6): CHANGE TO HIGHER HAZ. CAT. (M TO A-3)

FLOOR AREA 5
ALLOWABLE AREA:
24,000 SF BASE ALLOWABLE (A-2 / A-3 OCCUPANCY CONTROLLING) (MBC T-506.2)
4,500 SF FRONTAGE INCREASE (>75% OF PERIMETER W/ >30 FT TO PUBLIC WAY)
28,500 SF TOTAL ALLOWABLE
PROPOSED AREA:
25,773 SF

HEIGHT 5
ALLOWABLE HEIGHT:
2 STORIES (MBC T-504.4)
60 FEET (MBC T-504.3)
PROPOSED HEIGHT:
1 STORY W/ MEZZANINE
25 FEET

OCCUPANT LOAD
257 TOTAL OCCUPANTS (MBC T-1004.1.2)
SEE OCCUPANT LOAD TABLE FOR DETAILED BREAKDOWN

EGRESS REQUIREMENTS

MAXIMUM TRAVEL DISTANCE (MBC T-1017.2):	250'
MAXIMUM COMMON PATH (MBC T-1006.2.1):	100' (B OCCUPANCY AREAS) 75' (A-3 AND M OCCUPANCY AREAS)
MAXIMUM DEAD-END (MBC 1020.4):	50'
REMOTENESS OF EXITS (MBC 1007.1.1):	66.33'
MINIMUM CORRIDOR WIDTH (MBC T-1020.2):	44"
MINIMUM EGRESS DOOR WIDTH (MBC 1005.3.2):	54.4"
MINIMUM STAIR WIDTH (MBC 1005.3.1):	2.7"

FIRE SAFETY
FIRE EXTINGUISHERS (MBC 906): LOCATED WITHIN 75' OF EVERY LOCATION IN THE BUILDING
FIRE ALARM (MBC 907): NOT REQUIRED (GROUP A-3, <300 OCCUPANTS)
DRAFTSTOPPING (MBC 718.3, 718.4): NOT REQUIRED
SMOKE AND HEAT VENTS (MBC 910): NOT REQUIRED

FIRE RATED CONSTRUCTION

PRIMARY STRUCTURAL FRAME (MBC T-601):	0-HR
EXTERIOR BEARING WALLS (MBC T-601 T-602):	0-HR
INTERIOR BEARING WALLS (MBC T-601):	0-HR
NONBEARING WALLS (MBC T-601):	0-HR
FLOOR CONSTRUCTION (MBC T-601):	0-HR
ROOF CONSTRUCTION (MBC T-601):	0-HR
SHAFT ENCLOSURES (MBC 713.4):	1-HR
CORRIDOR WALLS (MBC T-1020.1):	0-HR

INTERIOR FINISHES
ALL INTERIOR FINISHES ARE TO COMPLY WITH THE FOLLOWING:
FLAME SPREAD INDEX: 0-25
SMOKE DEVELOPMENT INDEX: 0-450

PLUMBING FIXTURES
MINIMUM REQUIRED (MPC T-403.1):
WC: 5
LAV: 2
DF: 2
SERVICE SINK: 1

PROVIDED:
WC: 5
LAV: 5
DF: 2
SERVICE SINK: 1

SEPARATE FACILITIES REQUIRED FOR MEN AND WOMEN (MPC 403.2)
MAX TRAVEL DISTANCE TO TOILET ROOMS (MPC 403.3.3): 1 STORY, 500 FEET
MAX SUBSTITUTION OF URINALS FOR WC IN ANY ONE TOILET ROOM (MPC 419.2): 50%

USE & OCCUPANCY TAG

X — OCCUPANTS
Y — OCCUPANTS PER 100 SQUARE FEET

PATH OF TRAVEL

FIRE RATED CONSTRUCTION
ONE HOUR FIRE RATED ASSEMBLY

NOTE: PROVIDE INDENTIFICATION FOR RATED/SMOKE TIGHT WALLS AS REQUIRED BY MBC 703.7 IN ACCESSIBILE CONCEALED SPACES.

FEC — FIRE EXTINGUISHER LOCATION
EXIT LIGHT
XXX — EXIT/EXIT ACCESS WITH CAPACITY SERVED

pinnacle construction group
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PROJECT TEAM
MICHAEL BUNCH
MATT DIXON 5

PROJECT NUMBER
25-015

TERRA FIRMA E.L.
CLIMBING GYM
2655 E Grand River Ave
East Lansing, MI 48823

LICENSING STAMP
STATE OF MICHIGAN
MATTHEW T. DIXON
License No. 1301071833
LICENSED ARCHITECT

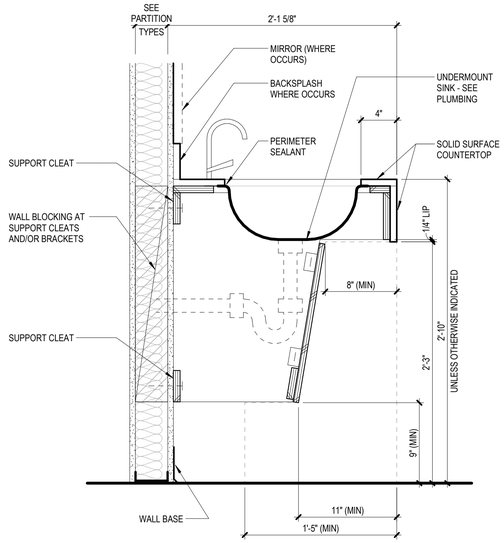
ISSUANCE
BID SET
07/23/2025

REVISIONS

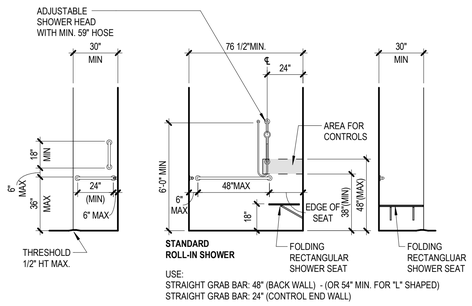
NO.	DATE	DESCRIPTION
1	08/14/2025	ADDENDUM 1
2	10/03/2025	BULLETIN 1
5	04/10/2026	BULLETIN 4

SHEET NAME
CODE COMPLIANCE PLANS

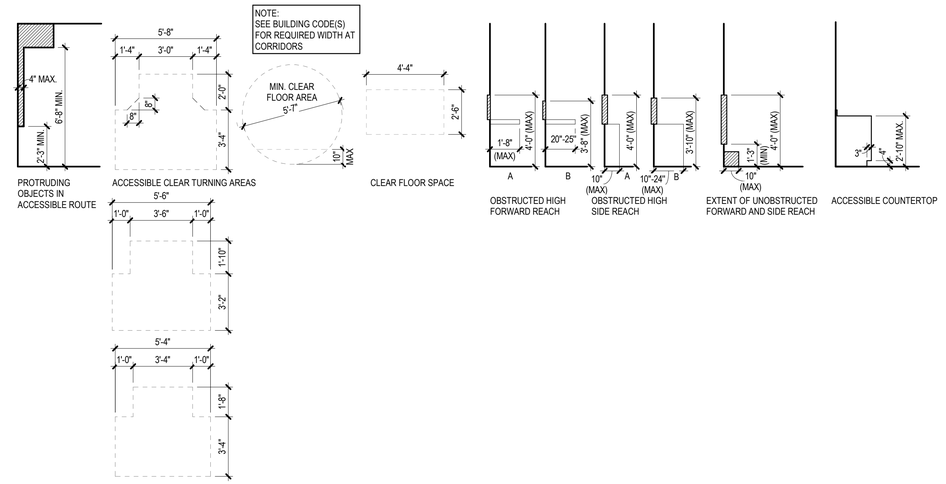
SHEET NUMBER
G101



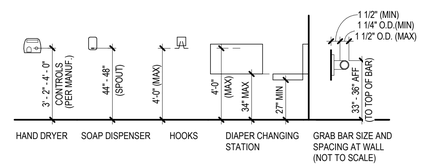
1 TYPICAL SINK BASE DETAIL
1 1/2" = 1'-0"



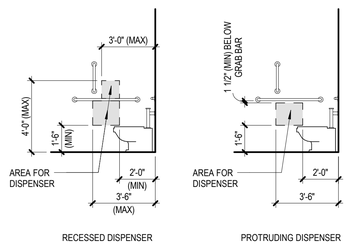
2 ROLL-IN SHOWER
1/4" = 1'-0"



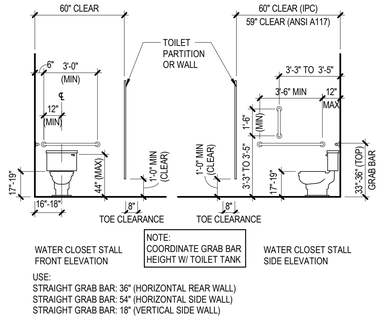
3 ACCESSIBLE CLEARANCES
1/4" = 1'-0"



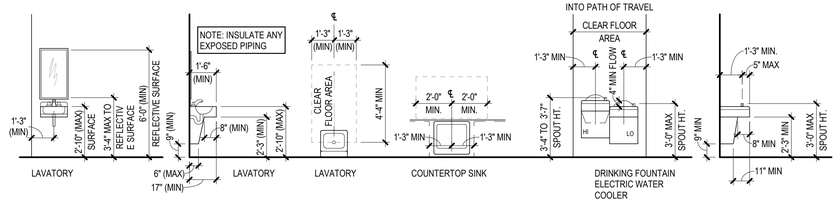
4 TOILET ROOM ACCESSORIES
1/4" = 1'-0"



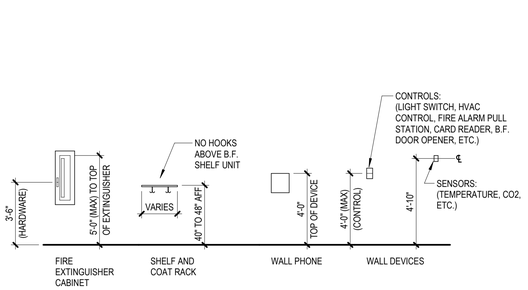
5 TOILET STALL ACCESSORIES
1/4" = 1'-0"



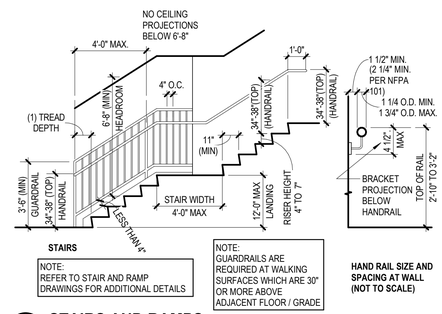
6 WATER CLOSET
1/4" = 1'-0"



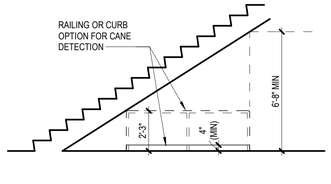
7 PLUMBING FIXTURES
1/4" = 1'-0"



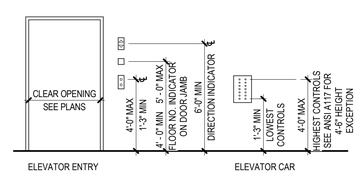
8 MISC. ACCESSORIES & DEVICES
1/4" = 1'-0"



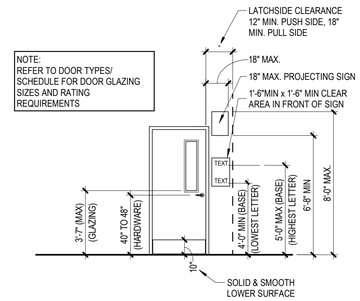
9 STAIRS AND RAMPS
1/4" = 1'-0"



10 REDUCED VERTICAL CLEARANCE
1/4" = 1'-0"



11 ELEVATOR CONTROLS
1/4" = 1'-0"



12 DOORWAY FEATURES
1/4" = 1'-0"

pinnacle construction group

DESIGN/BUILD CONTRACTOR

PINNACLE CONSTRUCTION GROUP
1000 FRONT AVE.
GRAND RAPIDS, MI 49504
616-451-0500

WWW.ASKOURCLIENTS.COM

PROJECT TEAM

MICHAEL BUNCH
KEVIN SWANSON

PROJECT NUMBER

25-015

TERRA FIRMA E.L.
CLIMBING GYM

2655 E Grand River Ave
East Lansing, MI 48823

LICENSING STAMP

ISSUANCE

BID SET
07/23/2025

REVISIONS

NO. DATE DESCRIPTION

SHEET NAME

ACCESSIBLITY DETAILS

SHEET NUMBER

G201

STRUCTURAL NOTES

GENERAL:

1. IF ANY NOTE CONFLICTS WITH ANY DETAIL OR NOTE ON THE PLANS OR IN THE SPECIFICATIONS, THE STRICTEST PROVISION SHALL GOVERN.

2. THE STRUCTURAL DRAWINGS ARE FOR THE PLACEMENT AND SIZE OF STRUCTURAL COMPONENTS ONLY. OSHA, DNR AND SAFETY CODE REQUIREMENTS ARE DETERMINED AND PROVIDED BY OTHERS. HOFFMAN CONSULTANTS IS NOT RESPONSIBLE FOR JOBSITE SAFETY.

3. THE STRUCTURE IS DESIGNED TO BE SELF SUPPORTING AND STABLE AFTER IT IS FULLY COMPLETED. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE, AND TO ENSURE THE SAFETY OF THE STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES THE ADDITION OF TEMPORARY BRACING, GUYS OR TIE DOWNS IF NECESSARY AND BRACING EXCAVATIONS TO PREVENT CAVE IN. SUCH MATERIAL SHALL REMAIN THE CONTRACTORS PROPERTY AFTER COMPLETION OF THE PROJECT.

4. USE OF ENGINEERING DRAWINGS AS ERECTION DRAWINGS BY THE CONTRACTOR IS STRICTLY PROHIBITED.

FOUNDATIONS:

1. FOOTINGS ARE DESIGNED TO BEAR ON SOIL OR ENGINEERED FILL WITH THE FOLLOWING ALLOWABLE BEARING CAPACITY:
   SPREAD FOOTINGS: 3000PSF
   WALL FOOTING: 3000PSF
   (VERIFIED BY QUALIFIED TESTING AGENCY IN FIELD)
   IF MATERIAL OF THIS CAPACITY IS NOT CONFIRMED AT THE ELEVATIONS INDICATED, THE FOOTINGS SHALL BE LOWERED, OR ENLARGED. NOFITY AND CONSULT ENGINEER FOR ADJUSTMENTS.

2. ALL FOUNDATIONS AND SLAB ON GRADE TO BE PREPARED PER ASSUMED 3,000PSF SOIL BEARING CAPACITY, IF 3,000PSF CANNOT BE ACHIEVED, CONTACT ENGINEER FOR FURTHER INSTRUCTION.

3. ALL FILL UNDER SLABS AND ADJACENT TO WALLS SHALL BE CLEAN GRANULAR SOIL COMPACTED TO A MINIMUM OF 95% MODIFIED PROCTOR.

4. EXERCISE CARE WHEN BACKFILLING WALLS. EXCEPT FOR WALLS WITH EQUAL FILL ON BOTH SIDES, NO BACKFILLING OF WALLS SHALL BE DONE UNTIL THE WALL HAS ATTAINED ITS FULL STRENGTH AND HAS BEEN PROPERLY SUPPORTED BY BRACING OR BY COMPLETED FLOOR OR ROOF STRUCTURE. ALTERNATE FILL WHEN BACKFILLING WALLS WITH FILL ON BOTH SIDES.

5. COORDINATE FOUNDATION WORK WITH UNDERGROUND WORK BY MECHANICAL AND ELECTRICAL CONTRACTORS, IF ANY.

6. UNLESS OTHERWISE INDICATED ON DRAWINGS, PROVIDE FOUNDATION DRAINS WITH APPROPRIATE FILTER MATERIAL, AS RECOMMENDED BY SOIL REPORTS OR IF WET SOIL CONDITIONS FROM GROUND WATER ARE ENCOUNTERED.

CONCRETE:

1. ALL CONCRETE SHALL ATTAIN THE FOLLOWING 28 DAY COMPRESSIVE STRENGTHS:
   FOOTINGS, SLAB ON GRADE: 3000PSI
   ALL OTHER CONCRETE: 4000PSI

2. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615. MAIN BARS TO BE GRADE 60, TIES & STIRRUPS TO BE GRADE 40. WELDED WIRE MESH SHALL CONFORM TO ASTM A185.

3. ALL ANCHOR BOLTS SHALL BE ASTM F1554 GRADE 36.

4. MATERIAL AND WORKMANSHIP FOR ALL CONCRETE AND REINFORCING SHALL BE IN ACCORDANCE WITH THE ACI MANUAL OF STANDARD PRACTICE AND THE ACI BUILDING CODE REQUIREMENTS.

5. PROVIDE ENTRAINED AIR IN ALL EXPOSED EXTERIOR CONCRETE.

6. OTHER CONCRETE ADMIXTURES MAY BE USED AS NESESSARY, INCLUDING THE USE OF A PLASTICIZER TO IMPROVE WORKABILITY. HOWEVER, EXTRA WATER SHALL NOT BA ADDED BEYOND THAT WHICH IS REQUIRED FOR PROPER HYDRATION OF THE MIX DESIGN BEING USED. CHLORINE IS NOT AN ACCEPTABLE ADMIXTURE AND SHALL NOT BE USED.

7. FOR REINFORCING SPLICES, UNLESS OTHERWISE INDICATED, MAINTAIN A MINIMUM BAR LAP OF 30 BAR DIAMETERS, AND A MINIMUM LAP OF 8" FOR WIRE MESH. SPLICES FOR REINFORCING MAY BE MECHANICAL OR WELDED IF DESIRED, BUT SUBJECT TO ENGINEER APPROVAL.

8. PROVIDE CORNER BARS TO MATCH ALL HORIZONTAL REINFORCING IN WALLS AND FOOTINGS. PROVIDE DOWELS AS REQUIRED TO MATCH VERTICAL REINFORCING. MAINTAIN MIMUMUM LAP REQUIREMENT.

9. APPROPRIATE CURING MEASURES SHALL BE TAKEN FOR NEW CONCRETE. A MOIST CURE MEATHOD OR A CURING COMPOUND SHALL BE USED. COMMENCEMENT OF CURING OR APPLICATION OR A COMPOUND SHALL BE DONE IMMEDIATELY AFTER FINISHING OR REMOVING FORMWORK. THE CURING COMPOUND SHALL BE COMPATIBLE WITH FLOOR COVERINGS OR COATINGS AND IT SHALL BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

10. APPROPRIATE PROCEDURES FOR COLD OR WARM WEATHER CONCRETE WORK SHALL BE FOLLOWED, AS NECESSARY, IN ACCORDANCE WITH ACI SPECIFICATION.

11. VERIFY AND COORDINATE ALL SLEEVES, OPENINGS, EMBEDDED ITEMS, ETC., AS NECESSARY WITH THE APPLICABLE TRADES THAT REQUIRE THEM.

12. THE CONTRACTOR SHALL ALLOW IN THE BID AN ADDITIONAL ONE (1) TON OF REINFORCING STEEL TO BE PLACED IN THE FIELD AT THE DIRECTION OF THE ENGINEER. ANY UNUSED PORTION OF THIS ALLOWANCE SHALL BE CREDITED TO THE OWNER.

13. PROVIDE CONCRETE COVER OVER REINFORCING BARS AS FOLLOWS, UNLESS NOTED OTHERWISE:
    A. CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH = 3"
    B. PERMANENTLY EXPOSED TO EARTH OR WEATHER:
       #5 AND SMALLER = 1 1/2"
       #6 AND LARGER = 2"
    C. NOT EXPOSED TO EARTH OR WEATHER:
       WALLS, SLABS AND JOISTS = 3/4"
       BEAMS, AND COLUMNS = 1 1/2"

STRUCTURAL STEEL:

1. STEEL DESIGN, FABRICATION AND ERECTION TO BE IN ACCORDANCE WITH THE LATEST AISC SPECIFICATIONS FOR STRUCTURAL STEEL FOR BUILDINGS.

2. UNLESS OTHERWISE INDICATED, ALL W-SHAPE STRUCTURAL STEEL SECTIONS TO CONFORM TO ASTM A992, GRADE 50. TUBE STEEL SHALL CONFORM TO ASTM A500, GRADE B. MISC. ANGLE, CHANNEL, AND PLATE SHALL CONFORM TO ASTM A36, U.N.O.

3. BOLTED CONNECTIONS TO BE MADE WITH ASTM A325-N, 3/4" DIAMETER HIGH STRENGTH BOLTS, UNLESS INDICATED OTHERWISE.

4. ALL WELDED CONNECTIONS SHALL BE IN ACCORDANCE WITH THE LATEST AWS SPECIFICATIONS, UTILIZING E70xx ELECTRODES. WELDING SHALL BE PERFORMED BY CERTIFIED WELDERS.

5. FINAL STAIR CONFIGURATION IS THE RESPONSIBILITY OF THE STAIR SUPPLIER. PROVIDE MICHIGAN PROFESSIONAL ENGINEERING CERTIFICATION WITH SHOP DRAWINGS.

COLD FORMED STEEL FRAMING:

1. LIGHT GAGE FRAMING SHALL BE OF THE SIZES AND GAGES INDICATED ON THE DRAWINGS. CONNECTION DESIGN AND METHODS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE DONE ACCORDING TO MANUFACTURERS SPECIFICATIONS, AS A MINIMUM.

2. ALL COLD FORMED STEEL FRAMING MEMBERS, THEIR DESIGN, FABRICATION AND ERECTION SHALL CONFORM TO THE "SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS" OF THE A.I.S.I. (2020 ED.).

3. ALL FRAMING MEMBERS SHALL BE FORMED FROM STEEL CONFORMING TO ASTM A1003 TYPE "H" OR TYPE "L" WITH A MINIMUM YIELD STRENGTH AS FOLLOWS:
   54, 68, 97 MILS (16, 14 & 12 GAUGE): FY=50 KSI, GRADE 50
   33, 43 MILS (20 & 18 GAUGE) : FY=33 KSI, GRADE 33

4. ALL FRAMING MEMBERS SHALL BE GALVANIZED WITH A G-60 COATING MEETING THE REQUIREMENTS OF ASTM A653.

5. MEMBERS SHALL BE THE MANUFACTURER'S STANDARD "C" SHAPED STUDS/JOISTS OF THE SIZE, FLANGE WIDTH AND GAUGE INDICATED. ALL MEMBERS SHALL HAVE A MINIMUM FLANGE LIP RETURN OF 1/2" AND SATISFY THE MINIMUM PROPERTIES AS PER STEEL STUD MANUFACTURERS ASSOCIATION (SSMA), OR APPROVED EQUAL.

6. THE GAUGE OF ALL TRACKS SHALL BE NO LIGHTER THAN THE FRAMING BEING CONNECTED. UNLESS OTHERWISE INDICATED, CONNECT TRACKS TO CONCRETE WITH MIN. (2) 0.157 DIA. POWDER-ACTUATED FASTENERS (WITH 1" EMBEDMENT) AT 16" O.C.

7. ALL WELDING SHALL BE IN CONFORMANCE WITH AMERICAN WELDING SOCIETY SPECIFICATION D1.3. ALL WELDS SHALL BE TOUCHED UP WITH ZINC RICH PAINT.

8. ALL STRUCTURAL MEMBERS SHALL BE PROPERLY CONNECTED TO EACH OTHER AND TO THE SUPPORTING BACK-UP FRAMING. FASTENINGS SHALL BE MADE WITH SELF TAPPING SCREWS OR WELDS OF SUFFICIENT SIZE TO INSURE THE CONNECTION STRENGTH. UNLESS OTHERWISE NOTED, CONNECT ALL MEMBERS BASED ON THE FOLLOWING LOADINGS:
   JOISTS/RAFTERS - DEAD LOAD AND LIVE LOAD PER THE "DESIGN LOADS"
   RAFTERS - NET WIND LOAD UPLIFT OF 35 PSF
   STUDS LESS THAN 8'-0" LONG - 45 PSF EXTERIOR (5 PSF INTERIOR)
   STUDS BETWEEN 8'-0" AND 10'-0" - 40 PSF EXTERIOR (5 PSF INTERIOR)
   STUDS BETWEEN 10'-6" AND 16'-0" LONG - 35 PSF EXTERIOR (5 PSF INTERIOR)

9. PROVIDE BRIDGING FOR STUDS AT A MAXIMUM SPACING NOT TO EXCEED 4'-0". JOISTS AND RAFTERS AT MID SPAN AND AT A MAXIMUM SPACING NOT TO EXCEED 8'-0". ALL BRIDGING SHALL BE INSTALLED PRIOR TO THE ADDITION OF ANY LOADING. CONNECT BRIDGING TO EACH MEMBER BY WELDING, CLIP ANGLES OR OTHER APPROVED METHOD PER THE MANUFACTURER'S REQUIREMENTS.

10. PROVIDE WEB STIFFENERS AT JOIST AND RAFTER BEARINGS IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS.

11. ALL AXIALLY LOADED STUDS SHALL HAVE FULL BEARING AGAINST THE INSIDE TRACK WEB, PRIOR TO STUD AND TRACK ALIGNMENT.

12. SPLICES IN STUDS OR TRACKS USED FOR HEADERS, JAMBS, JOISTS, RAFTERS OR WALL STUDS ARE NOT PERMITTED.

13. PROVIDE THE MANUFACTURER'S STANDARD TRACK, CLIP ANGLES, BRACING, REINFORCEMENTS, FASTENERS AND ACCESSORIES AS RECOMMENDED BY THE MANUFACTURER OF THE APPLICATION INDICATED AND AS NEEDED TO PROVIDE A COMPLETE FRAMING SYSTEM. UNLESS OTHERWISE NOTED, INSTALL THE METAL FRAMING SYSTEM IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTION S AND RECOMMENDATIONS.

14. THE CONTRACTOR SHALL SUBMIT THE FOLLOWING FOR APPROVAL:
    A. MANUFACTURER'S PRODUCT DATA AND LATEST TECHNICAL DATA.
    B. ERECTION DRAWINGS SHOWING THE NUMBER, TYPE, LOCATION AND SPACING OF ALL MEMBERS. ALL CONNECTIONS AND ATTACHMENTS SHALL BE CLEARLY SHOWN.
    C. THE PROPERTIES OF ALL FRAMING MEMBERS THAT ARE USED IN LOAD BEARING APPLICATIONS, DEMONSTRATING CONFORMANCE WITH THE MINIMUM ACCEPTABLE PROPERTIES NOTED HEREIN.
    D. STRUCTURAL CALCULATIONS FOR ALL MEMBERS AND CONNECTIONS STAMPED BY AN ENGINEER REGISTERED IN THE STATE OF MICHIGAN.

15. UNLESS OTHERWISE NOTED, PROVIDE DOUBLE JACK STUDS AT ALL BEAM BEARINGS.

16. LIVE LOAD DEFLECTION CRITERIA:
    STUDS BACKING UP MASONRY OR STONE VENEER: L/600
    ALL OTHER STUDS: L/360

DESIGN LOADS:

LIVE LOADS (MBC 2021):
STAIRS = 100 PSF
OFFICES = 50 PSF
DEAD LOADS:
FLOOR = 20 PSF

STRUCTURAL ENGINEERING
HOFFMAN CONSULTANTS
4180 44th Street SE - Suite G
Kentwood, Michigan 49512
www.hoffmanconsultants.com

Climbing Gym Mezzanine

for

Terra Firma E.L.

2655 E. Grand River Ave. - East Lansing, Michigan 48823

Revisions

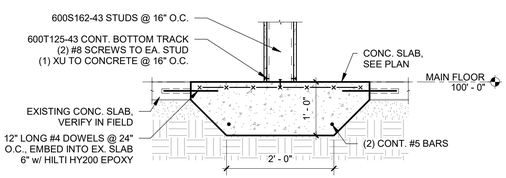
Rev.	Date	Issued For:
	07/07/25	Permit & Construction
	08/15/25	Revised
	10/03/25	Bulletin #1

Seal:

STATE OF MICHIGAN
TIMOTHY J HOFFMAN
ENGINEER
No. 6201063098
LICENSED PROFESSIONAL ENGINEER

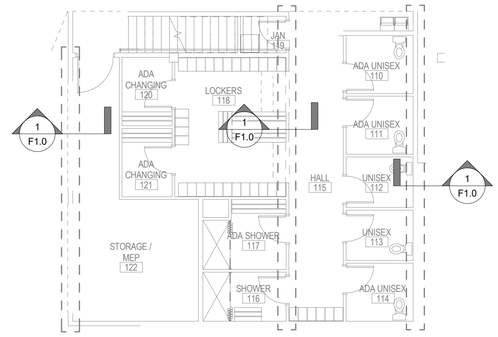
Drawn: BSG
Checked: TJH
Plotted: 10/14/2025 9:12:38 AM
Drawing: General Structural Notes
Project No.: 25581

F0.1



1 F1.0 F1.0 Section @ Thickened Slab

SCALE: 3/4" = 1'-0"



N

Foundation Plan

SCALE: 1/8" = 1'-0"

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ENGINEERING
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TIMOTHY J HOFFMAN
ENGINEER
No. 620103[illegible]
LICENSED PROFESSIONAL ENGINEER

Drawn: BSG

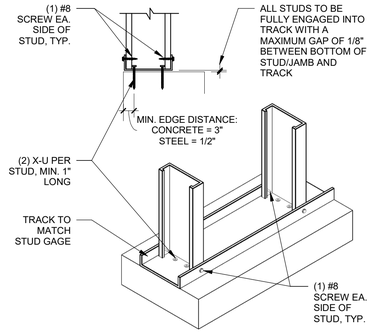
Checked: TJH

Plotted: 10/14/2025 9:12:39 AM

Drawing: Foundation Plan & Details

Project No.: 25581

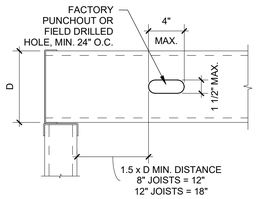
F1.0



NOTE:
SEAT ALL STUDS TIGHT TO TRACK WITH A MAXIMUM GAP OF 1/8" BETWEEN EITHER THE TOP or BOTTOM OF STUD/JAMB AND TRACK

Typical Stud to Track Connection Detail

SCALE: N.T.S.



Joist Punchout Requirements

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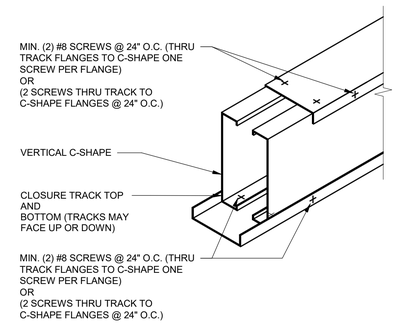
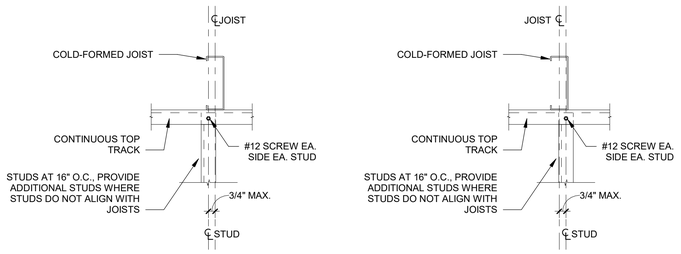


Typical Header Assembly

SCALE: N.T.S.



Joist Bearing Tolerances

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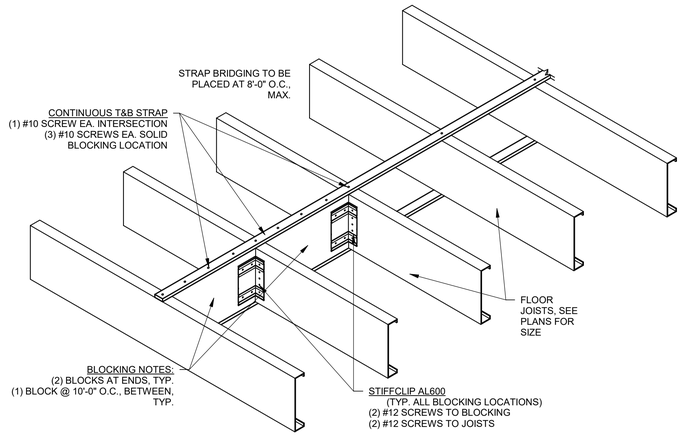

Typical Floor Bridging Detail

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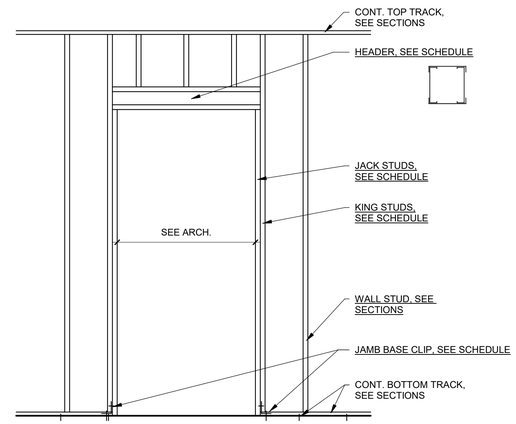
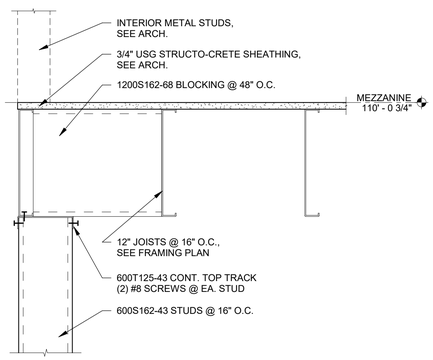


Typical Header Elevation

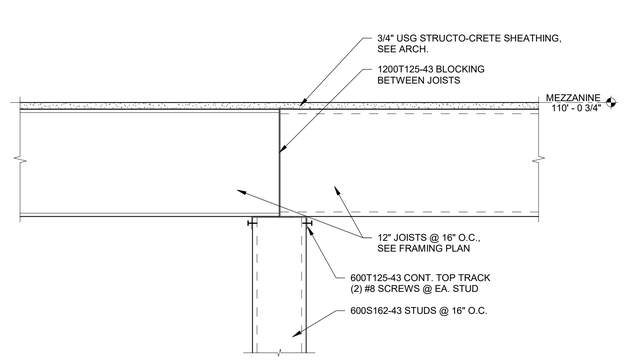
SCALE: N.T.S.

HEADER SCHEDULE								
MARK	HEADER HORIZONTAL TRACKS	HEADER VERTICAL STUDS	HEADER VERTICAL TRACKS	JACK STUDS	KING STUDS	JAMB BASE CLIP	ANCHORS TO JAMB	ANCHORS TO CONC.
H1	(2) 600T125-43	(2) 600S162-97	N/A	(1) 600S162-43	(1) 600S162-43	AL600	(2) #12	(2) XU
H2	(2) 600T125-97	(2) 1200S162-97	(2) 1200T125-97	(3) 600S162-43	(1) 600S162-43	AL600	(2) #12	(2) XU



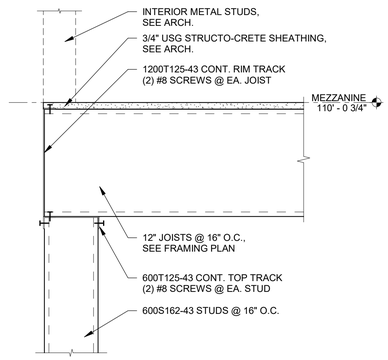
3 S1.0 | S1.0 Section @ Mezzanine End

SCALE: 1 1/2" = 1'-0"



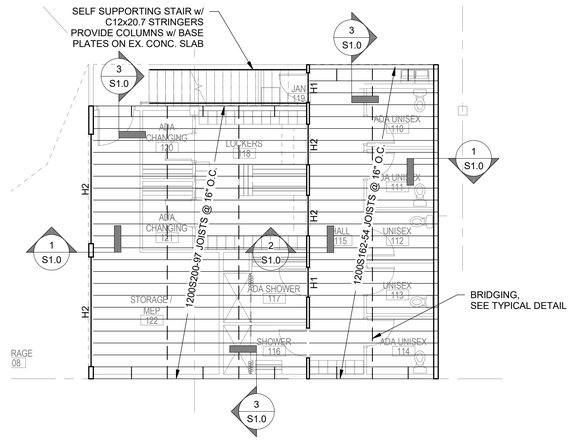
2 S1.0 | S1.0 Section @ Mezzanine Bearing (Double)

SCALE: 1 1/2" = 1'-0"



1 S1.0 | S1.0 Section @ Mezzanine Bearing

SCALE: 1 1/2" = 1'-0"



N

Mezzanine Framing Plan

SCALE: 1/8" = 1'-0"

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No. 620103
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Drawn: BSG

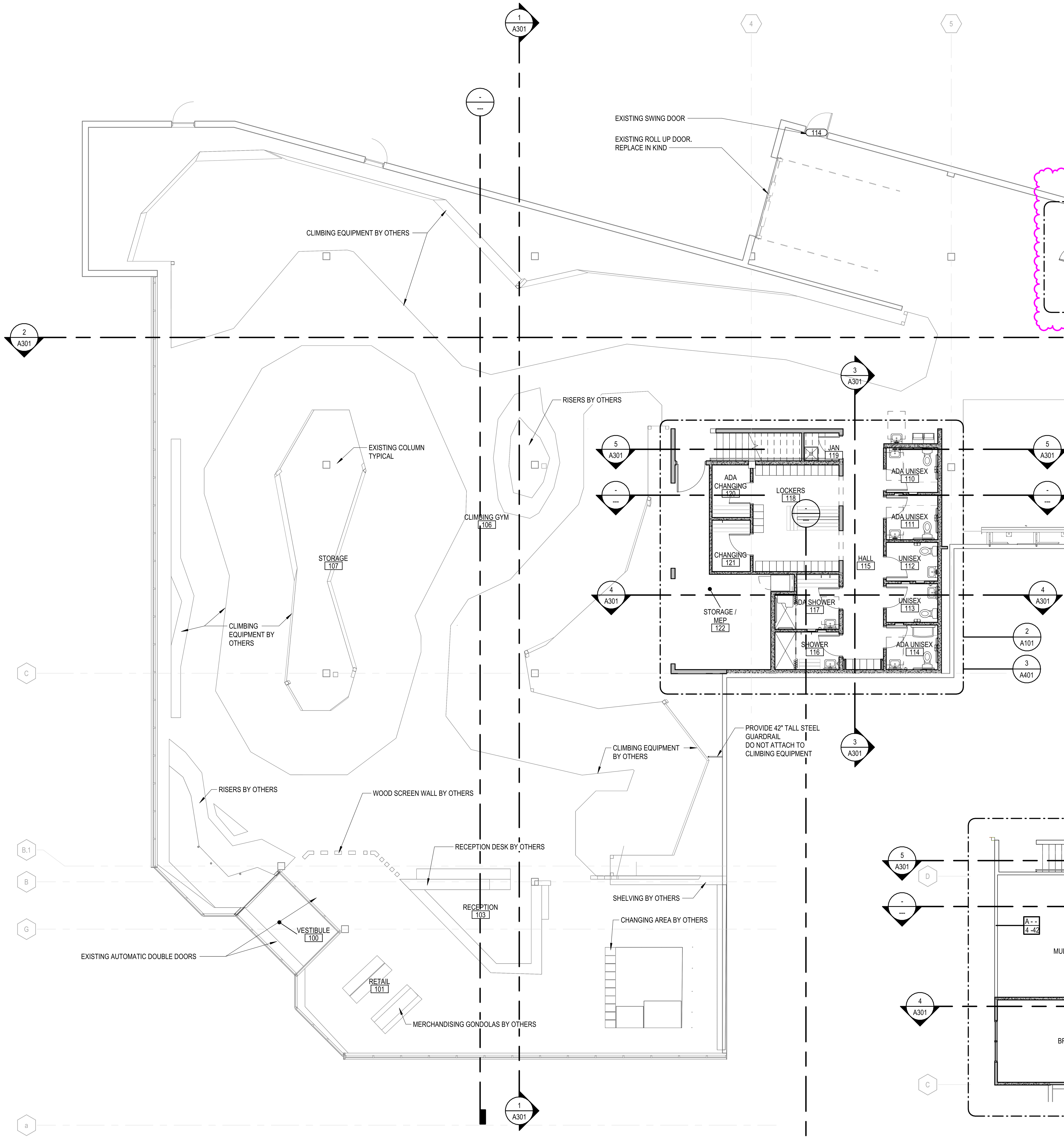
Checked: TJH

Plotted: 10/14/2025 9:12:39 AM

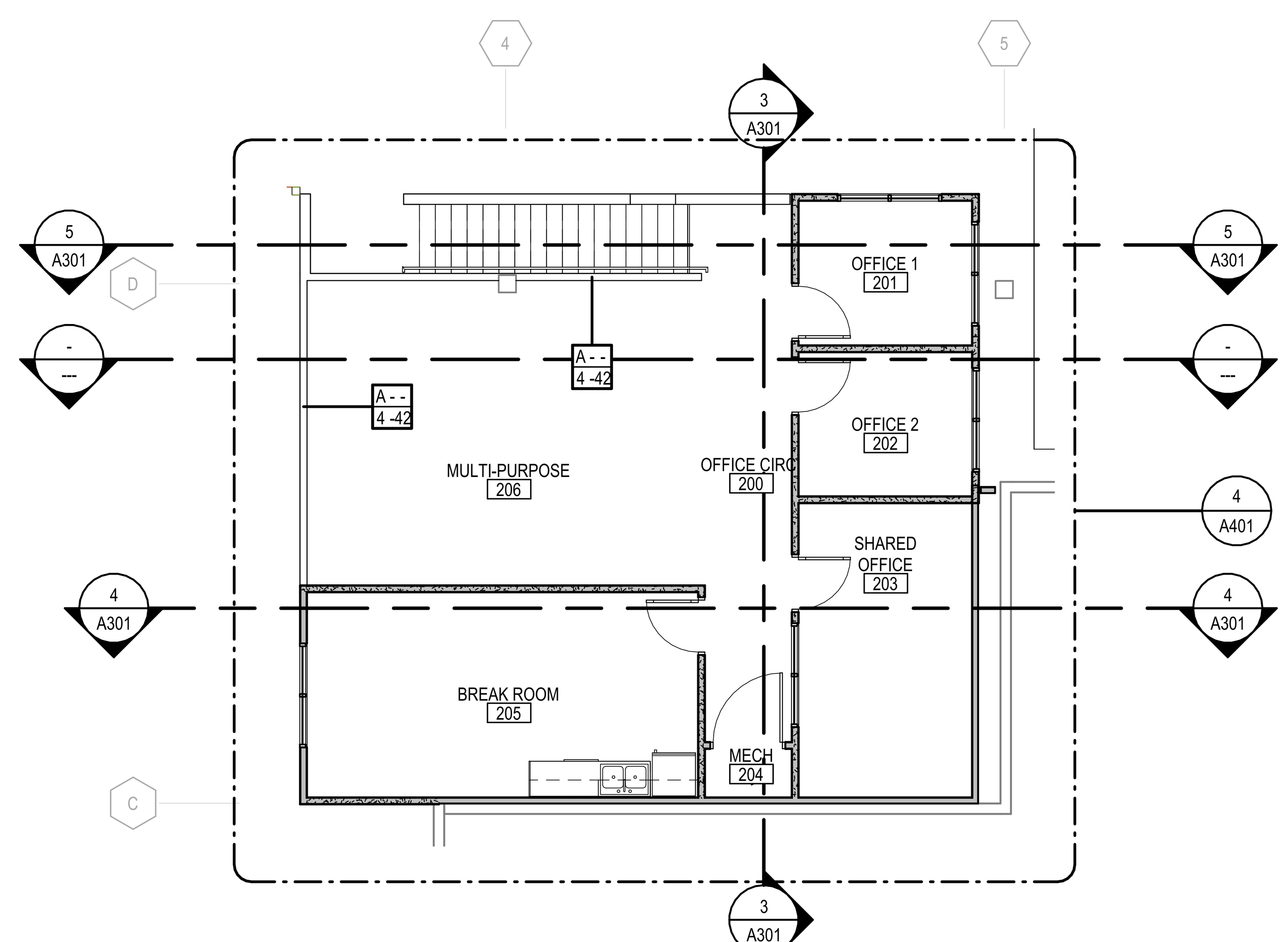
Drawing: Framing Plan & Details

Project No.: 25581

S1.0



1 MAIN LEVEL PLAN
1/8" = 1'-0"



2 MEZZANINE PLAN
1/8" = 1'-0"
A101

GENERAL NOTES

1. DO NOT SCALE DRAWINGS.
2. FINISH FLOOR ELEVATION = 100' - 0". REFER TO CIVIL DRAWINGS FOR EQUIVALENT.
3. REFER TO CODE COMPLIANCE DRAWING(S) FOR LOCATIONS OF RATED ASSEMBLIES.
4. ABBREVIATIONS, TYPICAL MOUNTING DIMENSIONS, AND ANNOTATION SYMBOLOGY ARE SHOWN ON GENERAL INFORMATION DRAWINGS.
5. WALL DIMENSIONS ARE TO FACE OF MASONRY, FACE OF CONCRETE, FACE OF STUDS, EXTERIOR WALL SHEATHING, COLUMN CENTERLINE AS SHOWN OR FACE OF EXISTING CONSTRUCTION UNLESS OTHERWISE NOTED.
6. ALL DIMENSIONS ARE PERPENDICULAR AND PARALLEL, UNLESS NOTED OTHERWISE.
7. PROVIDE APPROVED SMOKE/FIRESTOPPING ASSEMBLIES AT ALL MECHANICAL AND ELECTRICAL PENETRATIONS THROUGH FIRE RATED AND SMOKE RESISTANT PARTITIONS IDENTIFIED ON CODE COMPLIANCE DRAWINGS.
8. CONSTRUCT ALL WALLS TIGHT TO DECK ABOVE AND EXTEND INTO DECK FLUTES AND WEBS OF STEEL MEMBERS UNLESS OTHERWISE NOTED.
9. PROVIDE DEFLECTION TRACK AT TOP OF ALL METAL STUD ASSEMBLIES. DO NOT FASTEN GYP BOARD OR ANY OTHER WALL SHEATHING INTO DEFLECTION TRACK. ALTERNATIVE DEFLECTION ASSEMBLIES MAY BE USED AT THE ARCHITECT'S DISCRETION.
10. PROVIDE ACOUSTICAL SEALANT AT ALL WALLS WITH ACOUSTICAL INSULATION.
11. PROVIDE 5/8" WATER RESISTANT GYPSUM WALLBOARD OR CEMENTITIOUS BACKER BOARD AT ALL WALLS OF TOILET ROOMS, WALLS RECEIVING TILE, AND WALLS BEHIND AND ADJACENT TO SINKS.
12. ALL WOOD EXPOSED TO MOISTURE IS TO BE PRESSURE TREATED
13. ALL SUBCONTRACTORS ARE TO COORDINATE WITH OTHER TRADES TO INSURE COMPATIBILITY OF THEIR RESPECTIVE WORK.
14. PROVIDE WOOD BLOCKING REQUIRED FOR ATTACHMENT OF ALL MISC. HARDWARE AND EQUIPMENT INCLUDING BUT NOT LIMITED TO: TOILET ACCESSORIES, DOOR HARDWARE, ELECTRICAL DEVICES, EQUIPMENT INDICATED, GRAB BARS, HANDRAILS, MILLWORK, ETC. BLOCKING SHALL BE 3/4" PLYWOOD, 16GA GALVANIZED SHEET METAL OR 2X6 SOLID WOOD.
15. TRANSITION LINES OF DIFFERERING FLOORING OCCURRING AT A DOOR SHALL BE LOCATED AT THE CENTER LINE OF THE CLOSED DOOR.
16. UNLESS NOTED OTHERWISE, DOOR HINGES ARE TO BE 4" FROM FINISH FACE OF WALL.
17. PROVIDE CONTROL JOINTS IN GYPSUM WALLBOARD AS RECOMMENDED BY WALLBOARD MANUFACTURER AND COORDINATE LOCATIONS WITH ARCHITECT.
18. THERMAL AND ACOUSTICAL INSULATION, OTHER THAN FOAM PLASTICS, SHALL HAVE A FLAME SPREAD INDEX OF NOT MORE THAN 25 AND A SMOKE DEVELOPMENT OF NOT MORE THAN 450
19. ALL MATERIAL USED IN THE PROJECT IS TO BE ASBESTOS AND MERCURY FREE.

WALL TAG LEGEND

A - -
4 - C

WALL TYPE
SEE TYPICAL WALL ASSEMBLIES

STUD SIZE
0 7/8" METAL TRACK
1 1-5/8" (1-1/2") METAL STUD
2 2-1/2" METAL STUD
3 2X2 WOOD STUD
4 3-5/8" METAL STUD
5 2X4 WOOD STUD
6 6" METAL STUD
7 2X6 WOOD STUD
8 8" METAL STUD
O OTHER: SEE WALL TYPES

CONCRETE/MASONRY THICKNESS
A 4" NOMINAL CMU / 4" CONCRETE
B 6" NOMINAL CMU / 6" CONCRETE
C 8" NOMINAL CMU / 8" CONCRETE
D 10" NOMINAL CMU / 10" CONCRETE
E 12" NOMINAL CMU / 12" CONCRETE
O OTHER: SEE WALL TYPES

WALL INSULATION
A ACOUSTIC INSULATION
T THERMAL INSULATION
- NONE

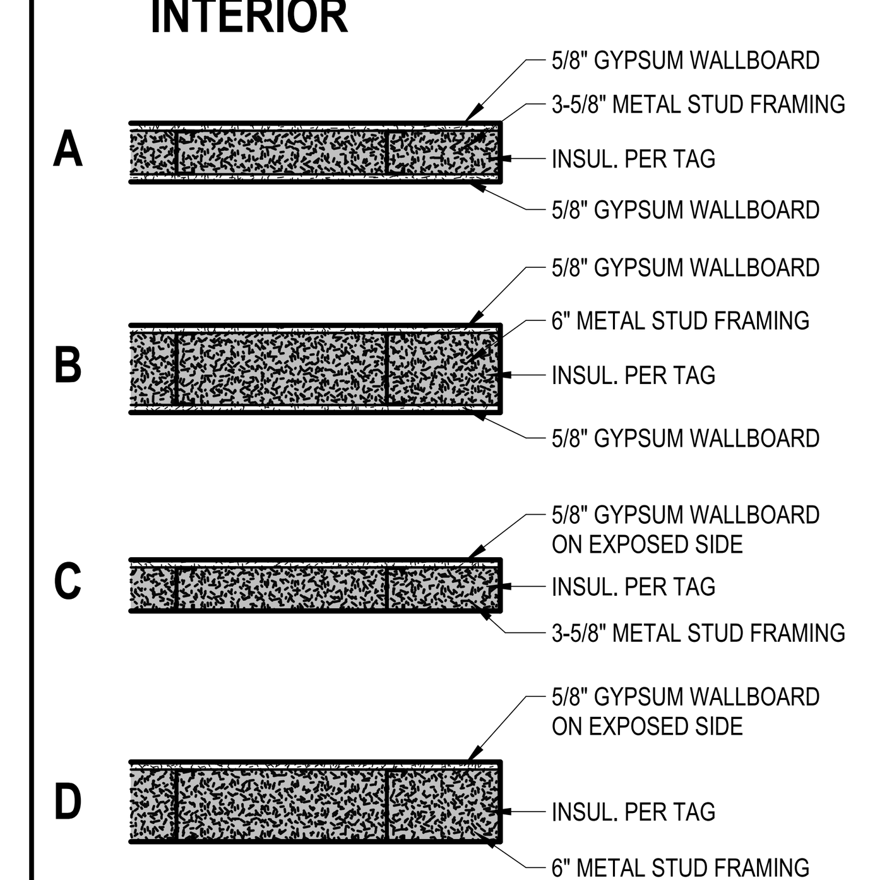
FIRE RESISTANCE RATING
RATING SHOWN IN HOURS

WALL HEIGHT
E EXTERIOR, SEE SECTIONS
X SHAFT, SEE SECTIONS
L BOTTOM OF HARD LID
D UNDERSIDE OF DECK ABOVE
C EXTEND 6" ABOVE CEILING
TOP OF WALL IN INCHES
O OTHER, SEE WALL TYPES

FURRING SIZE
SAME SYMBOLS AS STUD SIZE

TYPICAL WALL ASSEMBLIES

INTERIOR



pinnacle construction group

DESIGN/BUILD CONTRACTOR

PINNACLE CONSTRUCTION GROUP
1000 FRONT AVE.
GRAND RAPIDS, MI 49504
616-451-0500
WWW.ASKOURCLIENTS.COM

PROJECT TEAM

MICHAEL BUNCH
KEVIN SWANSON

PROJECT NUMBER
25-015

TERRA FIRMA E.L.
CLIMBING GYM
2655 E Grand River Ave
East Lansing, MI 48823

LICENSING STAMP

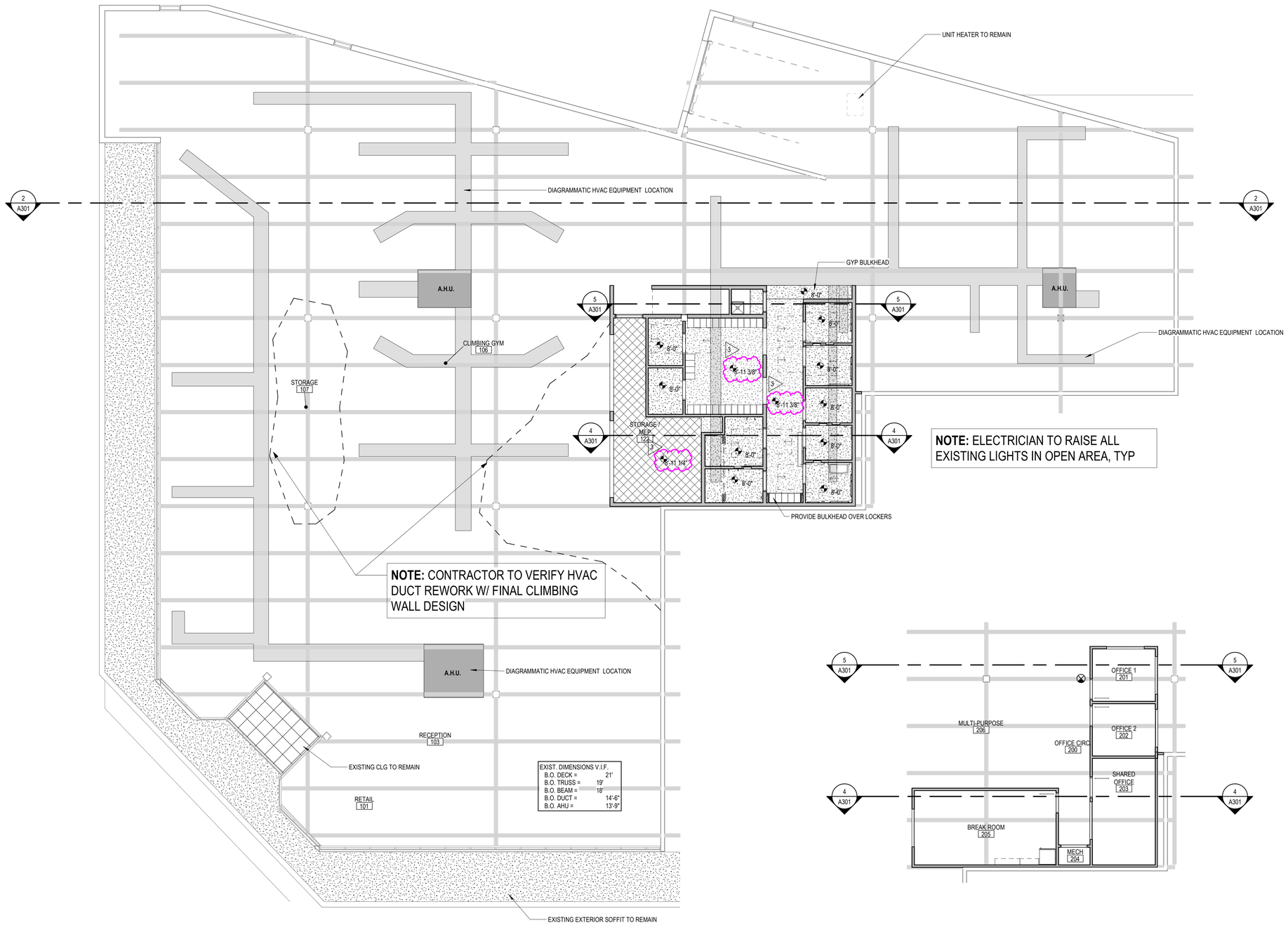
ISSUANCE
BID SET
07/23/2025

REVISIONS

NO.	DATE	DESCRIPTION
1	08/14/2025	ADDENDUM 1
2	10/03/2025	BULLETIN 1
3	11/13/2025	BULLETIN 2
4	01/05/2025	BULLETIN 3

SHEET NAME
FLOOR PLANS

SHEET NUMBER
A101



1 MAIN LEVEL CEILING PLAN

1/8" = 1'-0"
A301

2 MEZZANINE CEILING PLAN

1/8" = 1'-0"
A301

REFLECTED CEILING PLAN LEGEND

1. ALL CEILING GRIDS ARE TO BE CENTERED IN ROOM / AREA OR ALIGNED WITH ADJACENT ROOM / AREA AS INDICATED, UNLESS NOTED OTHERWISE.
2. CEILING HEIGHTS INDICATED ARE DIMENSIONED FROM THE FINISHED FLOOR BELOW.
3. ALL LIGHT FIXTURES, SPRINKLER HEADS, RETURN AIR GRILLES AND SUPPLY AIR GRILLES ARE TO BE LOCATED IN THE CENTER OF THE CEILING PAD, UNLESS NOTED OTHERWISE.
4. COORDINATE MECHANICAL, ELECTRICAL AND FIRE PROTECTION TO ASSURE PROPER CLEARANCES AND LAYOUT.
5. MECHANICAL, ELECTRICAL AND FIRE PROTECTION CONTRACTORS TO PROVIDE ACCESS PANELS IN CEILINGS AS REQUIRED FOR MAINTENANCE OF EQUIPMENT. COORDINATE SIZE AND LOCATIONS OF ACCESS PANELS TO MINIMIZE QUANTITIES. CONTRACTOR IS REQUIRED TO PROVIDE LAYOUT TO ARCHITECT FOR REVIEW PRIOR TO INSTALLATION, UNLESS NOTED OTHERWISE.
6. PROVIDE GYPSUM BOARD CONTROL JOINTS PER MANUFACTURER'S RECOMMENDATIONS.

EXPOSED
(GYM / ENTRY / MEZZANINE OFFICE LEVEL)

5/8" GYPSUM WALLBOARD

PVC CEILING PANEL
BASIS OF DESIGN: TRUSSCORE

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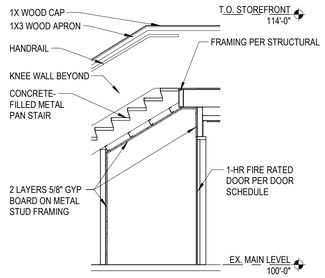
SHEET NAME

CEILING PLANS

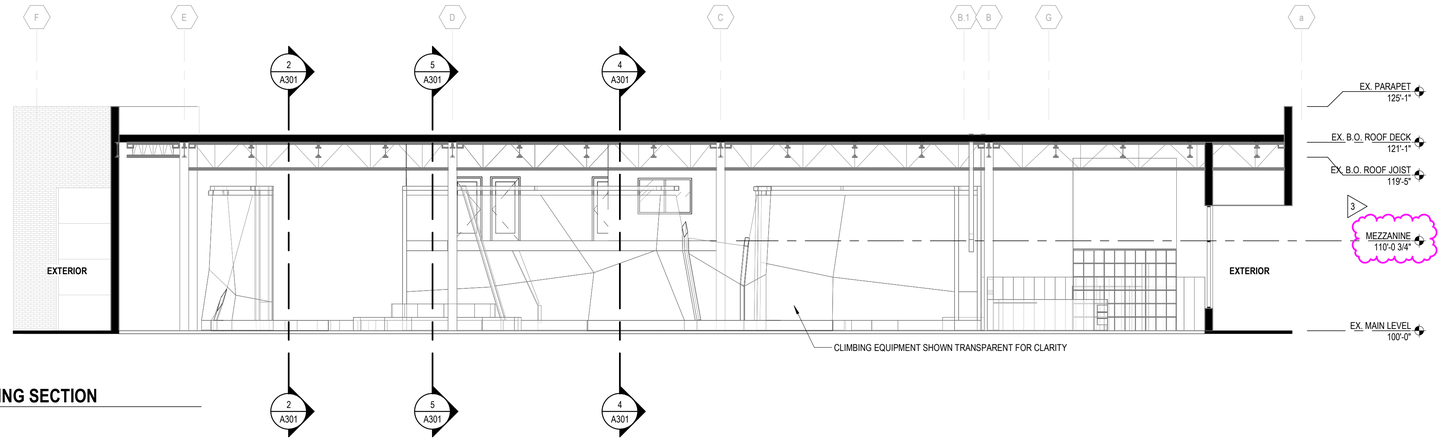
SHEET NUMBER

A111



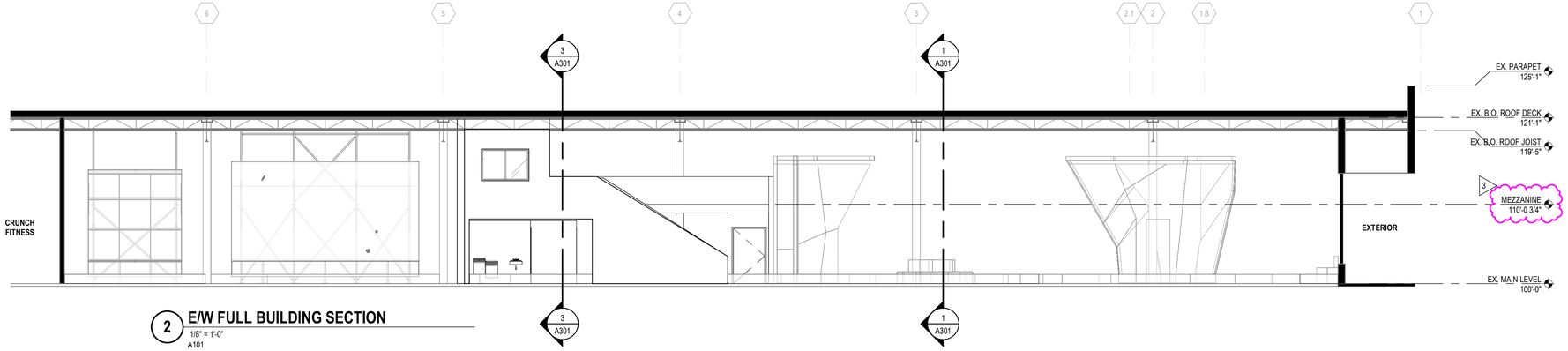
6 JANITOR CLOSET SECTION

1/4" = 1'-0"
A401



1 N/S FULL BUILDING SECTION

1/8" = 1'-0"
A101

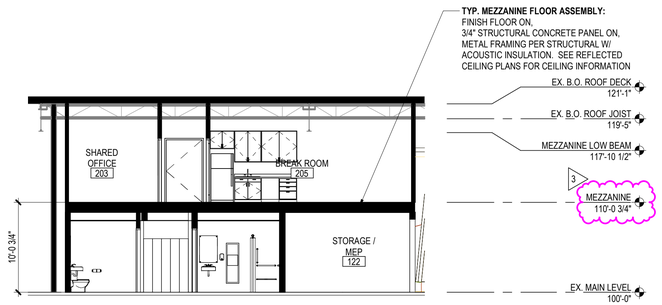


2 E/W FULL BUILDING SECTION

1/8" = 1'-0"
A101

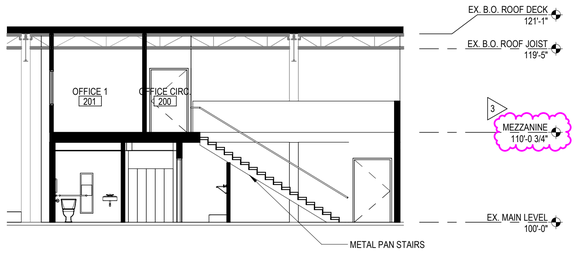
3 N/S MEZZANINE SECTION

1/8" = 1'-0"
A101



4 E/W MEZZANINE SECTION

1/8" = 1'-0"
A101



5 E/W MEZZANINE SECTION @ STAIR

1/8" = 1'-0"
A101

pinnacle construction group

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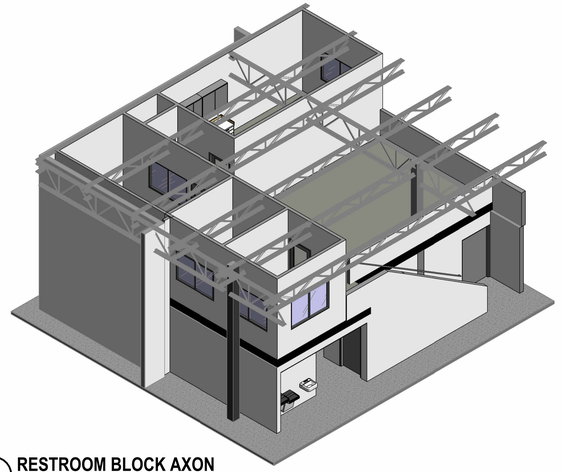
SHEET NAME

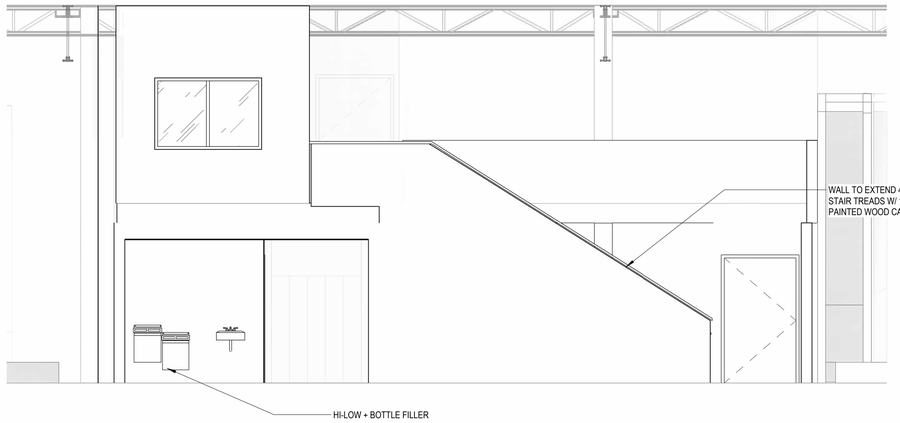
BUILDING SECTIONS

SHEET NUMBER

A301

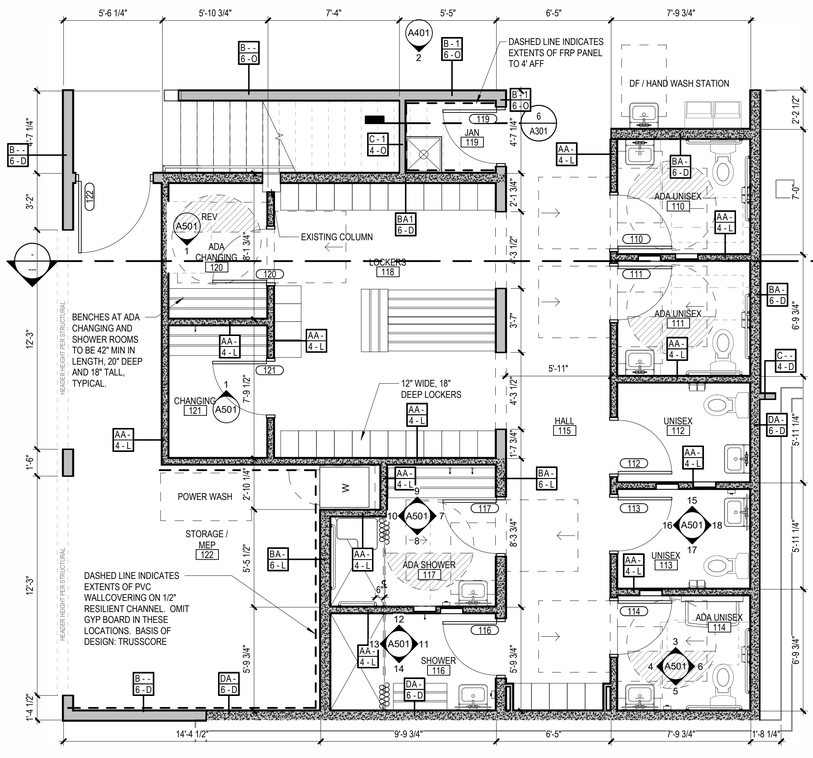


1 RESTROOM BLOCK AXON



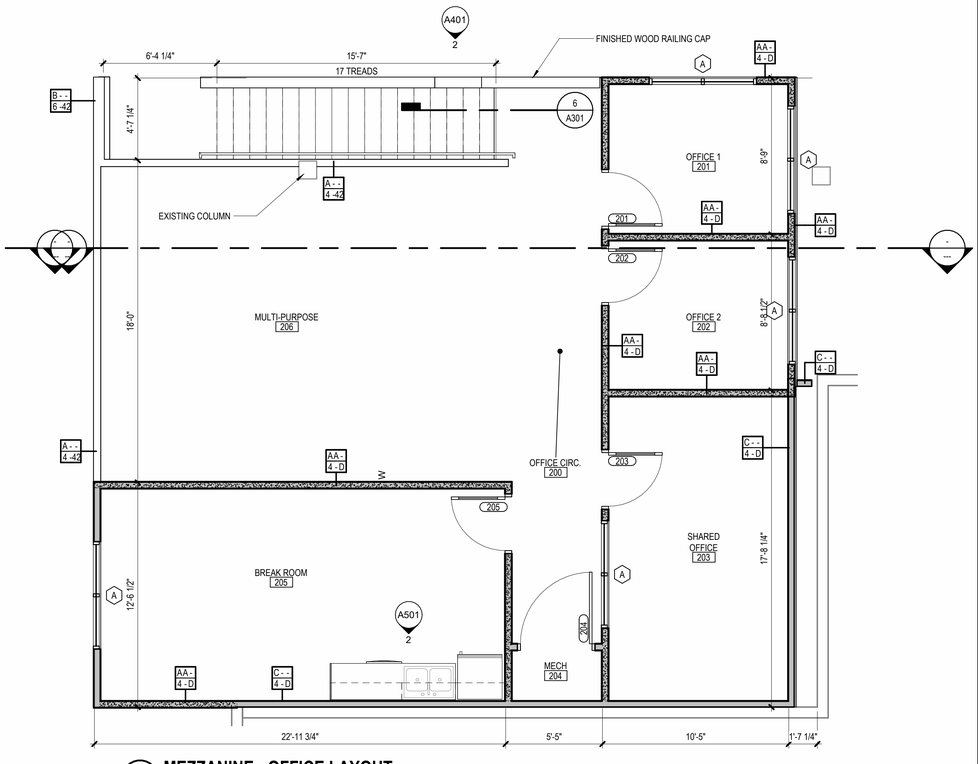
2 RESTROOM BLOCK ELEVATION

1/4" = 1'-0"
A401



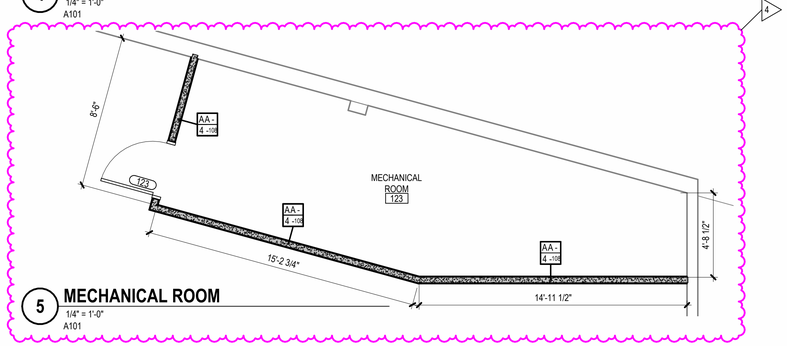
3 MAIN LEVEL - RESTROOM LAYOUT

1/4" = 1'-0"
A101



4 MEZZANINE - OFFICE LAYOUT

1/4" = 1'-0"
A101



5 MECHANICAL ROOM

1/4" = 1'-0"
A101

GENERAL NOTES

1. DO NOT SCALE DRAWINGS.
2. FINISH FLOOR ELEVATION = 100' - 0". REFER TO CIVIL DRAWINGS FOR EQUIVALENT.
3. REFER TO CODE COMPLIANCE DRAWING(S) FOR LOCATIONS OF RATED ASSEMBLIES.
4. ABBREVIATIONS, TYPICAL MOUNTING DIMENSIONS, AND ANNOTATION SYMBOLOGY ARE SHOWN ON GENERAL INFORMATION DRAWINGS.
5. WALL DIMENSIONS ARE TO FACE OF MASONRY, FACE OF CONCRETE, FACE OF STUDS, EXTERIOR WALL SHEATHING, COLUMN CENTERLINE AS SHOWN OR FACE OF EXISTING CONSTRUCTION UNLESS OTHERWISE NOTED.
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10. PROVIDE ACOUSTICAL SEALANT AT ALL WALLS WITH ACOUSTICAL INSULATION.
11. PROVIDE 5/8" WATER RESISTANT GYPSUM WALLBOARD OR CEMENTITIOUS BACKER BOARD AT ALL WALLS OF TOILET ROOMS, WALLS RECEIVING TILE, AND WALLS BEHIND AND ADJACENT TO SINKS.
12. ALL WOOD EXPOSED TO MOISTURE IS TO BE PRESSURE TREATED
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19. ALL MATERIAL USED IN THE PROJECT IS TO BE ASBESTOS AND MERCURY FREE.

WALL TAG LEGEND

WALL TYPE
SEE TYPICAL WALL ASSEMBLIES

STUD SIZE
0 7/8" METAL TRACK
1 1-5/8" (1-1/2") METAL STUD
2 2-1/2" METAL STUD
3 2X2 WOOD STUD
4 3-5/8" METAL STUD
5 2X4 WOOD STUD
6 6" METAL STUD
7 2X6 WOOD STUD
8 8" METAL STUD
O OTHER: SEE WALL TYPES

CONCRETE/MASONRY THICKNESS
A 4" NOMINAL CMU / 4" CONCRETE
B 6" NOMINAL CMU / 6" CONCRETE
C 8" NOMINAL CMU / 8" CONCRETE
D 10" NOMINAL CMU / 10" CONCRETE
E 12" NOMINAL CMU / 12" CONCRETE
O OTHER: SEE WALL TYPES

A - -
4 - D

WALL INSULATION
A ACOUSTIC INSULATION
T THERMAL INSULATION
- NONE

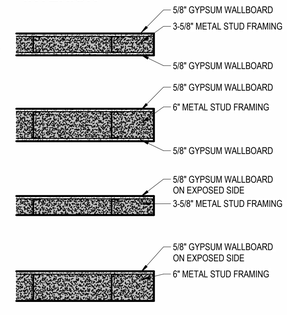
FIRE RESISTANCE RATING
RATING SHOWN IN HOURS

WALL HEIGHT
E EXTERIOR, SEE SECTIONS
X SHAFT, SEE SECTIONS
L BOTTOM OF HARD LID
D UNDERSIDE OF DECK ABOVE
C EXTEND 6" ABOVE CEILING
TOP OF WALL IN INCHES
O OTHER, SEE WALL TYPES

FURRING SIZE
SAME SYMBOLS AS STUD SIZE

TYPICAL WALL ASSEMBLIES

INTERIOR



pinnacle construction group

DESIGN/BUILD CONTRACTOR

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1000 FRONT AVE.
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PROJECT TEAM

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LICENSING STAMP

ISSUANCE

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07/23/2025

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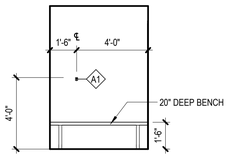
3	11/13/2025	BULLETIN 2
4	01/05/2026	BULLETIN 3

SHEET NAME

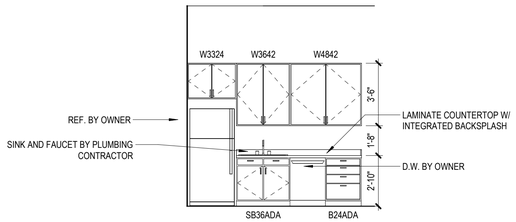
RESTROOM BLOCK PLANS AND ELEVATIONS

SHEET NUMBER

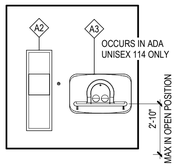
A401



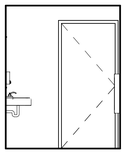
1 ADA CHANGING INTERIOR ELEVATION
1/4" = 1'-0"
A401



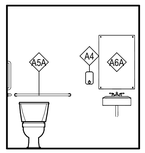
2 BREAK ROOM KITCHENETTE ELEVATION
1/4" = 1'-0"
A401



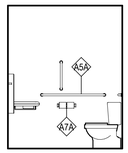
3 ADA UNISEX INTERIOR ELEVATION 1
1/4" = 1'-0"
A401



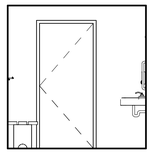
4 ADA UNISEX INTERIOR ELEVATION 2
1/4" = 1'-0"
A401



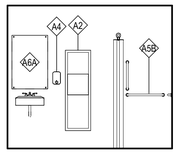
5 ADA UNISEX INTERIOR ELEVATION 3
1/4" = 1'-0"
A401



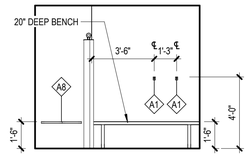
6 ADA UNISEX INTERIOR ELEVATION 4
1/4" = 1'-0"
A401



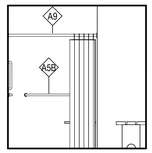
7 ADA SHOWER INTERIOR ELEVATION 1
1/4" = 1'-0"
A401



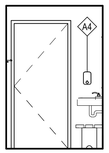
8 ADA SHOWER INTERIOR ELEVATION 2
1/4" = 1'-0"
A401



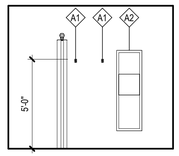
9 ADA SHOWER INTERIOR ELEVATION 3
1/4" = 1'-0"
A401



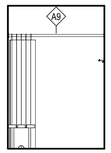
10 ADA SHOWER INTERIOR ELEVATION 4
1/4" = 1'-0"
A401



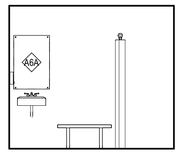
11 SHOWER INTERIOR ELEVATION 1
1/4" = 1'-0"
A401



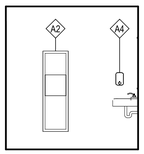
12 SHOWER INTERIOR ELEVATION 2
1/4" = 1'-0"
A401



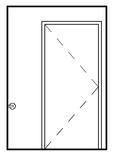
13 SHOWER INTERIOR ELEVATION 3
1/4" = 1'-0"
A401



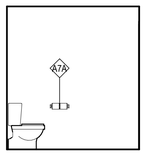
14 SHOWER INTERIOR ELEVATION 4
1/4" = 1'-0"
A401



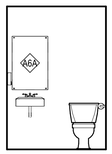
15 UNISEX INTERIOR ELEVATION 1
1/4" = 1'-0"
A401



16 UNISEX INTERIOR ELEVATION 2
1/4" = 1'-0"
A401



17 UNISEX INTERIOR ELEVATION 3
1/4" = 1'-0"
A401

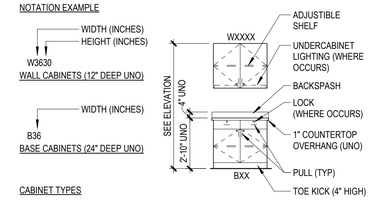


18 UNISEX INTERIOR ELEVATION 4
1/4" = 1'-0"
A401

CASEWORK LEGEND AND NOTES

1. ALL SHELVES ARE ADJUSTABLE, UNLESS NOTED OTHERWISE.
2. PROVIDE EQUAL SIZED FILLER PANELS AT CABINET ELEVATIONS. MINIMUM 1" AND MAXIMUM 6" UNLESS NOTED OTHERWISE.
3. PROVIDE FINISH BASE AT ALL BASE CABINETS TO MATCH ADJACENT WALL BASE, UNLESS NOTED OTHERWISE.
4. PROVIDE SEALANT AT BOTTOM, TOP AND ENDS OF BACKSPLASHES AND SIDESPLASHES.
5. PROVIDE 2" LIGHT VALANCE AT ALL WALL CABINETS WITH UNDERCABINET LIGHTING.
6. EXPOSED OUTSIDE CORNERS OF COUNTERTOPS SHALL BE EASED. REFER TO DRAWINGS FOR ADDITIONAL RADIUS REQUIREMENTS.

NOTATION EXAMPLE



CABINET TYPES

B	BASE CABINET
W	WALL CABINET OR SHELVES
SB	SINK BASE CABINET
T	TALL STORAGE CABINET

ACCESSORY SCHEDULE

SEE G201 FOR INSTALL

MARK	DESCRIPTION
A1	COAT HOOK
A2	RECESSED COMBINATION PAPER TOWEL DISPENSER/WASTE BASKET
A3	SURFACE MOUNTED BABY CHANGING STATION
A4	WALL MOUNTED SOAP DISPENSER
A5A	GRAB BARS FOR TOILET. SEE GENERAL INFORMATION SHEETS
A5B	GRAB BARS FOR SHOWER. SEE GENERAL INFORMATION SHEETS
A6A	MIRROR - 24x36
A7A	TP HOLDER - DOUBLE ROLL
A8	SHOWER SEAT
A9	SHOWER ROD

pinnacle construction group

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616-451-0500

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MICHAEL BUNCH
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25-015

TERRA FIRMA E.L.
CLIMBING GYM
2655 E Grand River Ave
East Lansing, MI 48823

LICENSING STAMP

ISSUANCE

BID SET
07/23/2025

REVISIONS

NO.	DATE	DESCRIPTION
1	08/14/2025	ADDENDUM 1

SHEET NAME

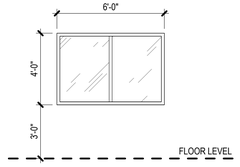
INTERIOR ELEVATIONS

SHEET NUMBER

A501

WINDOW TYPES

DIMENSIONS INDICATE FRAME SIZE
CONTRACTOR TO COORDINATE ROUGH OPENING WITH WINDOW SHOP DRAWINGS



WINDOW TYPE A
HOLLOW METAL
FIXED

HARDWARE SETS

SET #1 (Typ. Restroom Door)
1 EA PRIVACY LOCKSET W/ OCCUPANCY INDICATOR
1 EA KICKPLATE
1 EA CLOSER

SET #2 (Typ. Office Door)
1 EA OFFICE LOCKSET

SET #3 (Typ. Utility Door)
1 EA STOREROOM LOCKSET
1 EA CLOSER
1 EA KICKDOWN
1 EA KICKPLATE

GENERAL NOTES
ALL DOORS TO RECEIVE: WALL OR FLOOR STOP (AS REQUIRED)

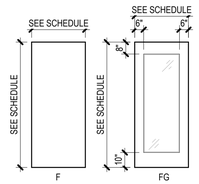
ALL HOLLOW METAL FRAMES TO RECEIVE: SILENCER

ALL HOLLOW METAL AND WOOD DOORS TO RECEIVE: 3 HINGES (UNO)

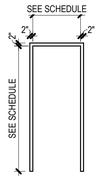
DOOR SCHEDULE

MARK	ROOM NAME	DOOR WIDTH	DOOR HEIGHT	DOOR TYPE	DOOR MATERIAL	DOOR FINISH	FRAME TYPE	FRAME MATERIAL	FRAME FINISH	LABEL	HDW	NOTES
EX. MAIN LEVEL												
110	ADA UNISEX	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		1	PROVIDE ROBE HOOK
111	HALL	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		1	PROVIDE ROBE HOOK
112	HALL	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		1	PROVIDE ROBE HOOK
113	UNISEX	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		1	PROVIDE ROBE HOOK
114	HALL	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		1	PROVIDE ROBE HOOK
116	HALL	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		1	
117	ADA SHOWER	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		1	
119	JAN	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT	60	3	
120	LOCKERS	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		1	
121	CHANGING	3'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		1	
122	STORAGE / MEP	4'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		3	
123	MECHANICAL ROOM	3'-0"	7'-0"	F	HM	PAINT	S	HM	PAINT			ALL HM DOORS AND FRAMES PAINTED TO MATCH ROPPE BLACK BROWN 193
MEZZANINE												
201	OFFICE 1	3'-0"	7'-0"	FG	WD	PREFINISHED	S	HM	PAINT		2	
202	OFFICE 2	3'-0"	7'-0"	FG	WD	PREFINISHED	S	HM	PAINT		2	
203	SHARED OFFICE	3'-0"	7'-0"	FG	WD	PREFINISHED	S	HM	PAINT		2	
204	OFFICE CIRC.	4'-0"	7'-0"	F	WD	PREFINISHED	S	HM	PAINT		3	
205	BREAK ROOM	3'-0"	7'-0"	FG	WD	PREFINISHED	S	HM	PAINT		2	

DOOR TYPES



FRAME TYPES



FINISH SCHEDULE

Number	ROOM NAME	FLOORS FINISH	FLOORS BASE	WALLS	COMMENTS
100	VESTIBULE	POL. CONC.			
101	RETAIL	POL. CONC.			
102	CHANGING	POL. CONC.			
103	RECEPTION	POL. CONC.			
104	CAFE	POL. CONC.			
105	VIEWING	POL. CONC.			
106	CLIMBING GYM	POL. CONC.	VINYL		BASE AT EXPOSED WALLS ONLY
107	STORAGE	POL. CONC.			
108	STORAGE	POL. CONC.			
109	EXERCISE	.3" RUBBER	VINYL	PAINT	WALLS PAINTED SW 7042 - SHOJI WHITE
110	ADA UNISEX	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
111	ADA UNISEX	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
112	UNISEX	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
113	UNISEX	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
114	ADA UNISEX	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
115	HALL	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
116	SHOWER	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
117	ADA SHOWER	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
118	LOCKERS	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
119	JAN	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
120	ADA CHANGING	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
121	CHANGING	LVT	VINYL	PAINT	WALLS PAINTED SW 9175 - DEEP FOREST BROWN
122	STORAGE / MEP	POL. CONC.	VINYL	PAINT	NOT PAINTED, NUDO PANELS WALLS AND CEILING
123	MECHANICAL ROOM	POL. CONC.	VINYL	PAINT	WALLS PAINTED SW 7042 - SHOJI WHITE
200	OFFICE CIRC.	LVT	VINYL	PAINT	WALLS PAINTED SW 7042 - SHOJI WHITE
201	OFFICE 1	LVT	VINYL	PAINT	WALLS PAINTED SW 7042 - SHOJI WHITE
202	OFFICE 2	LVT	VINYL	PAINT	WALLS PAINTED SW 7042 - SHOJI WHITE
203	SHARED OFFICE	LVT	VINYL	PAINT	WALLS PAINTED SW 7042 - SHOJI WHITE
204	MECH	LVT	VINYL	PAINT	WALLS PAINTED SW 7042 - SHOJI WHITE
205	BREAK ROOM	LVT	VINYL	PAINT	WALLS PAINTED SW 7042 - SHOJI WHITE
206	MULTI-PURPOSE	.3" RUBBER	VINYL	PAINT	WALLS PAINTED SW 7042 - SHOJI WHITE

NOTE:
ALL CEILINGS - SW 7042 SHOJI WHITE

EX WALLS AT CLIMBING GYM PAINTED SW 7042 - SHOJI WHITE, DOWN TO TOP OF WINDOWS INCLUDING BULKHEAD OVER WINDOWS. WALLS OF NEW MEZZANINE SPACE FACING OUT TO CLIMBING AREA TO BE PAINTED SW 7042 - SHOJI WHITE

pinnacle construction group

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LICENSING STAMP

ISSUANCE

BID SET

07/23/2025

REVISIONS

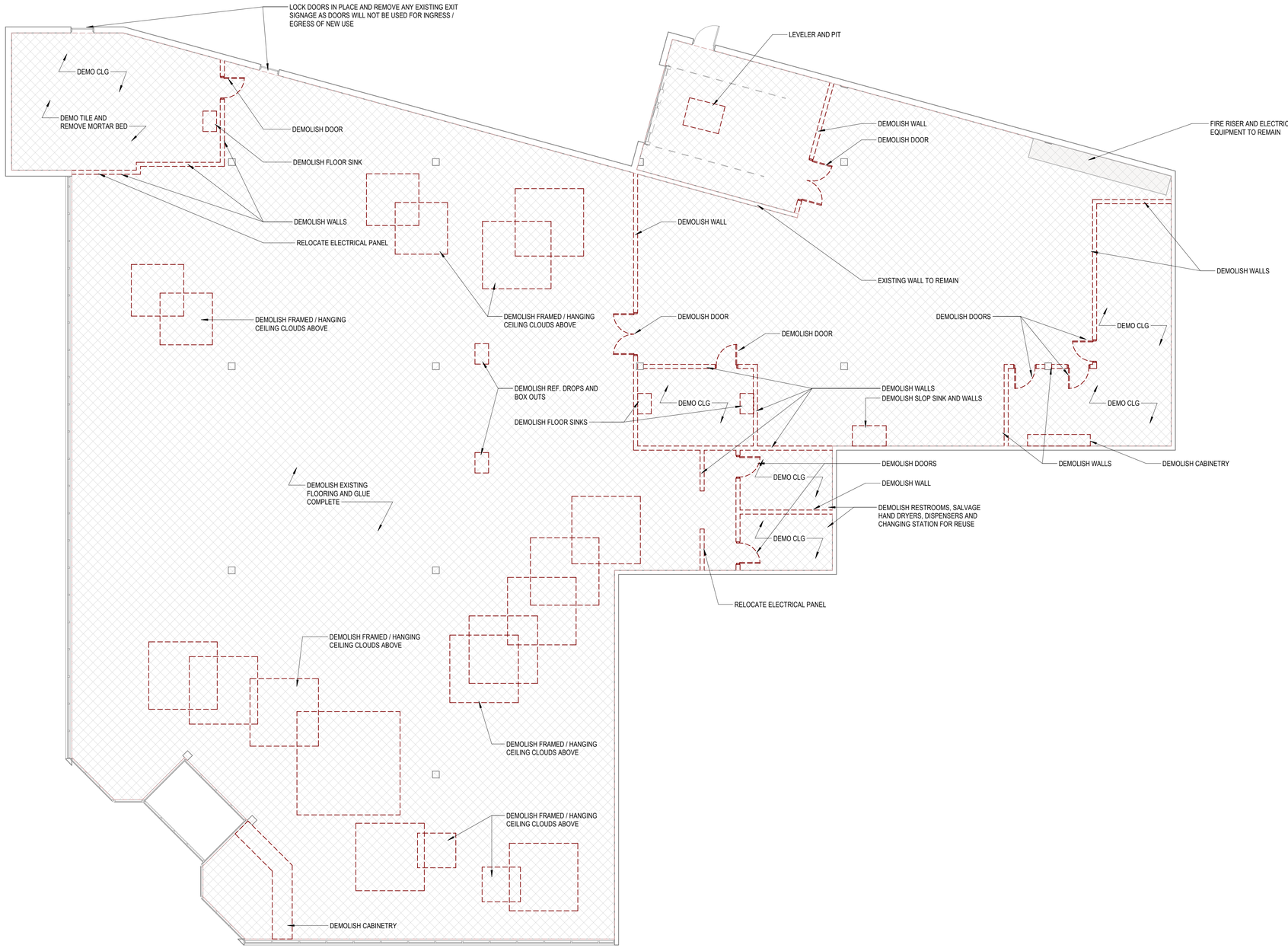
NO.	DATE	DESCRIPTION
1	08/14/2025	ADDENDUM 1
2	10/03/2025	BULLETIN 1
4	01/05/2025	BULLETIN 3

SHEET NAME

DOOR SCHEDULE, WINDOWS, AND DETAILS

SHEET NUMBER

A601



FIRST FLOOR DEMOLITION PLAN

1/8" = 1'-0"

DEMOLITION NOTES AND LEGEND

1. EXISTING BUILDING CONDITION BASED ON OWNER PROVIDED DRAWINGS AND LIMITED FIELD VERIFICATION. VERIFY EXACT CONDITIONS IN FIELD. SHOULD DISCREPANCIES OCCUR, NOTIFY ARCHITECT FOR CLARIFICATIONS.
2. REFER TO ALL DRAWINGS SHOWING NEW CONSTRUCTION AND COORDINATE DEMOLITION REQUIRED TO COMPLETE NEW WORK SHOWN.
3. BEGINNING WORK INDICATES THAT THE CONTRACTOR HAS ACCEPTED AND VERIFIED EXISTING CONDITIONS.
4. COORDINATE DEMOLITION WITH ALL CONTRACTORS WORKING IN AREAS BEING RENOVATED.
5. DURING DEMOLITION, PROTECT ALL ADJACENT CONSTRUCTION TO REMAIN.
6. ANY HAZARDOUS MATERIALS THAT ARE ENCOUNTERED ARE TO BE REMOVED BY THE OWNER.
7. COORDINATE THE RETURN AND STORAGE OF ALL ITEMS DESIGNATED AS SALVAGE WITH OWNER
8. PROVIDE TEMPORARY SHORING AND/OR STAGING OF THE DEMOLITION WORK.
9. MASONRY WALLS MAY BE LOAD-BEARING. COORDINATE DEMOLITION OF ALL WALLS OR PORTIONS OF WALLS FOR NEW OPENINGS WITH STRUCTURAL DOCUMENTS AND EXISTING CONDITIONS. CONTRACTOR IS RESPONSIBLE FOR SHORING ALL STRUCTURE SUPPORTED BY BEARING WALLS PRIOR TO REMOVAL.
10. COORDINATE CONSTRUCTION BARRIER LOCATIONS, NOISY DEMOLITION / CONSTRUCTION, AND WORK NOTED "INTERMITTENT" WITH OWNER.
11. HATCHED AREA(S) OF FULL NON-STRUCTURAL DEMOLITION (AS INDICATED IN LEGEND BELOW): REMOVE ALL WALLS, DOORS, FLOORING, CEILINGS, FIXTURES, MILLWORK, EQUIPMENT, ETC. UNLESS NOTED OTHERWISE. OWNER TO REVIEW SALVAGEABLE ITEMS FOR POTENTIAL RE-USE.

- EXISTING CONSTRUCTION TO REMAIN
- EXISTING CONSTRUCTION TO BE REMOVED
- CONSTRUCTION BARRIER - SMOKE TIGHT
- FULL INTERIOR, NON-STRUCTURAL DEMOLITION (SEE GENERAL NOTE ABOVE)

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KEVIN SWANSON

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CLIMBING GYM

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East Lansing, MI 48823

LICENSING STAMP

ISSUANCE

BID SET
07/23/2025

REVISIONS

NO.	DATE	DESCRIPTION
1	08/14/2025	ADDENDUM 1

SHEET NAME

DEMOLITION PLAN

SHEET NUMBER

AD101

MINIMUM SIZE CONNECTION					
FIXTURE	SAN.	C.W.	H.W.	VENT	REMARKS
W.C.	4"	1"		2"	
LAV.	1 1/2"	1/2"	1/2"	1 1/2"	
SHOWER	2"	1/2"	1/2"	1 1/2"	
SINK	1 1/2"	1/2"	1/2"	1 1/2"	
SERVICE SINK	3"	3/4"	3/4"	1 1/2"	
EWC	1 1/2"	1/2"		1 1/2"	

PLUMBING NOTES

1. IN CONCEALED LOCATIONS WHERE PIPING IS INSTALLED THROUGH STUDS, JOISTS, OR RAFTERS, PROVIDE A 1/16" THICK STEEL PROTECTIVE SHIELD TO PROTECT THE PIPE FROM PUNCTURES.

2. PROVIDE WATER HAMMER ARRESTERS WHERE QUICK CLOSING VALVES ARE USED, OR AS REQUIRED. ARRESTERS SHALL CONFORM TO ASSE 1010 AND ACCESS SHALL BE PROVIDED TO EACH ARRESTER.

3. ALL PLUMBING VENTS THROUGH THE ROOF TO BE INSTALLED A MINIMUM OF 10'-0" AWAY FROM ALL FRESH AIR INTAKE OPENINGS.

4. DO NOT INSTALL ANY PIPING AROUND ELECTRICAL EQUIPMENT TO INSURE ALL CODE REQUIRED CLEARANCES. SEE ELECTRICAL PLANS FOR THESE LOCATIONS.

5. REFER TO MINIMUM SIZE CONNECTION SCHEDULE FOR ALL PLUMBING FIXTURES BRANCH PIPING SIZES.

6. PROVIDE IDENTIFICATION ON ALL SHUT-OFF VALVES SERVING WALL HYDRANTS AND HOSE BIBBS. IDENTIFY ALL OTHER VALVES THAT ARE NOT ADJACENT TO THE FIXTURE THEY SERVE.

7. PROVIDE A TEMPERING VALVE AT ALL ACCESSIBLE HANDWASHING FIXTURES THAT CONFORMS TO ASSE 1070.

8. ALL DOMESTIC PIPING TO BE PEX, INSULATED WITH FOAM PER ENERGY CODE.

9. ALL SANITARY PIPING TO BE SCHEDULE 40 PVC.

10. VENTING SHALL BE INSTALLED IN ACCORDANCE WITH CODE

PLUMBING FIXTURE LIST

WC-1 FLOOR MOUNTED, VITREOUS CHINA, SIPHON JET, ELONGATED BOWL, BOLT CAPS, 16 1/8" RIM HEIGHT, 1 1/2" TOP SPUD. AMERICAN STANDARD MADERA #2305.100. PROVIDE WITH ZURN AQUAVANTAGE #Z-6000AVWS1 FLUSH VALVE, 1.6 GPF WITH LEVER ASSEMBLY INSTALLED ON BARRIER FREE ACCESS SIDE, AND WHITE SOLID PLASTIC OPEN FRONT SEAT, LESS COVER.

L-1 WALL MOUNTED, VITREOUS CHINA, 20"X18", FRONT OVERFLOW, 4" BACK AND 4" CENTERS. AMERICAN STANDARD LUCERNE #0355.012. PROVIDE WITH SINGLE LEVER FAUCET WITH AERATOR DELTA #501-WF 'BARRIER FREE', 3/8" LOOSE KEY OPERATED ANGLE STOPS, PERFORATED DRAIN STRAINER, TRAP ASSEMBLY AND PROTECTIVE PIPE COVERS. CARRIER TO HAVE CONCEALED ARMS, LEVELING AND SECURING SCREWS JOSAM #17100. PROVIDE A TEMPERING VALVE AT ALL ACCESSIBLE HANDWASHING FIXTURES THAT CONFORMS TO ASSE 1070.

SH-1 SHOWER STALL, OASIS #OSH6034. PROVIDE WITH PEERLESS #PPTT14219BN SHOWER TRIM, VACUUM BREAKER, FLOOR DRAIN PROFLO #PF101PNC, CURTAIN ROD AND SHOWER CURTAIN. COMPLETE INSTALLATION TO MEET ADA AND BARRIER FREE REQUIREMENTS, INSTALL SHOWER HEAD, CONTROLS AND GRAB BARS PER MICHIGAN BARRIER FREE SECTION 608.3, 608.5 AND 608.6.

SH-2 ADA COMPLIANT SHOWER STALL, OASIS #SH3P-6334. PROVIDE WITH PEERLESS #PPTT14219BN SHOWER TRIM, FOLD-UP SEAT, VACUUM BREAKER, FLOOR DRAIN PROFLO #PF101PNC, CURTAIN ROD AND SHOWER CURTAIN. COMPLETE INSTALLATION TO MEET ADA AND BARRIER FREE REQUIREMENTS, INSTALL SHOWER HEAD, CONTROLS AND GRAB BARS PER MICHIGAN BARRIER FREE SECTION 608.3, 608.5 AND 608.6.

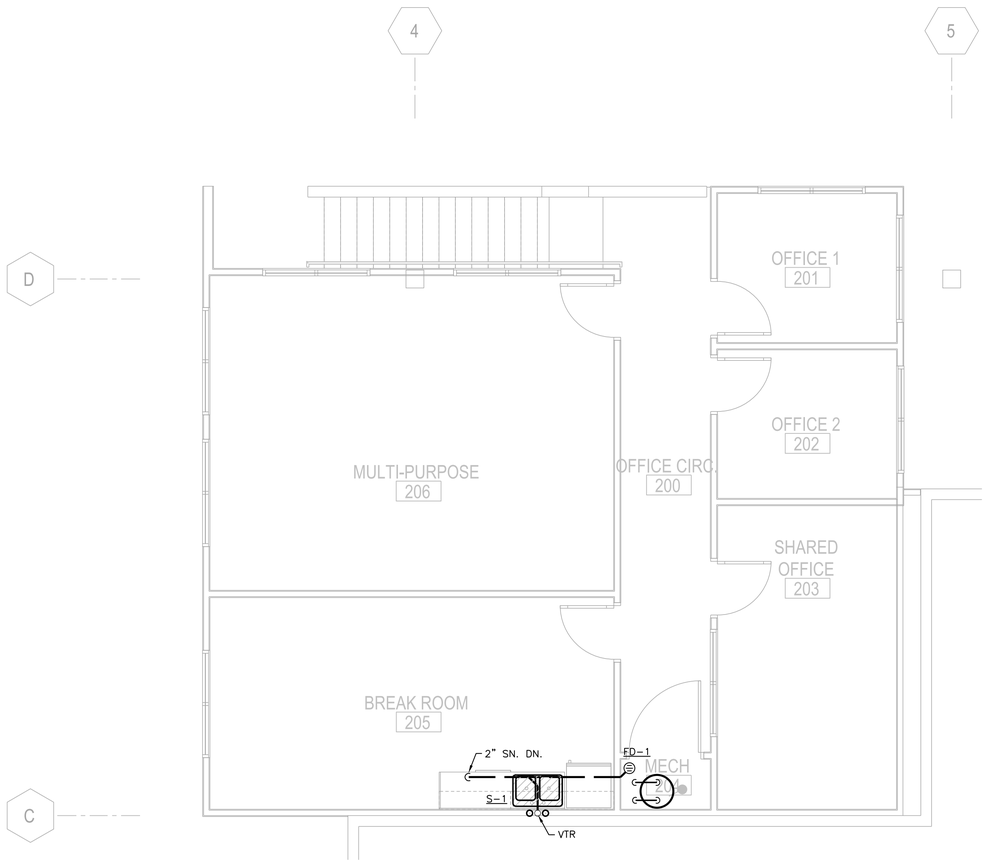
S-1 COUNTERTOP TYPE, SEAMLESS STAINLESS STEEL, 18 GAUGE, INTEGRAL MOUNTING RIM, ELKAY #LR-3319 WITH (2) 14"X14"X7 1/4" BOWLS. PROVIDE WITH FAUCET ELKAY #LK-2423 GOOSENECK, SWING SPOUT WITH AERATOR, 3/8" LOOSE KEY ANGLE STOPS, (2) 3 1/2" BASKET STRAINERS LK-35, 1 1/2" TAILPIECE AND 1 1/2" P-TRAP.

EWC-1 WALL MOUNTED, BARRIER FREE, COOLER MODULE WITH BOTTLE FILLING STATION. HANDICAPPED FOUNTAIN SHALL BE MOUNTED TO PROVIDE AMPLE LEG ROOM AND EASY ACCESS FROM THE SITTING POSITION. HOUSING SHALL BE GRANITE VINYL FINISH WITH TYPE 304 STAINLESS STEEL TOP, MOTOR OVERLOAD PROTECTION, ANSI A 117.1-1992, U.L. LISTED AND ARI RATED. COOL 7.8 GPH TO 50 DEGREE F. WATER AT 90 DEGREE F. AMBIENT AND 80 DEGREE F. INLET WATER TEMPERATURE. ELKAY MODEL EZSTLG8WSSK.

SS-1 FLOOR MOUNTED, PRECAST, ONE PIECE MOLDED STONE WITH BUMPER GUARD ON TWO SIDES. 24"X24"X10" PROFLO #PFMB2424S. PROVIDE WITH WALL MOUNTED COMBINATION FITTING WITH INTEGRAL STOPS, VACUUM BREAKER, WALL BRACE, PAIL HOOK, MOP HANGER, HOSE AND HOSE BRACKET, ZURN #ZJP1996-SF JP1996-SF.

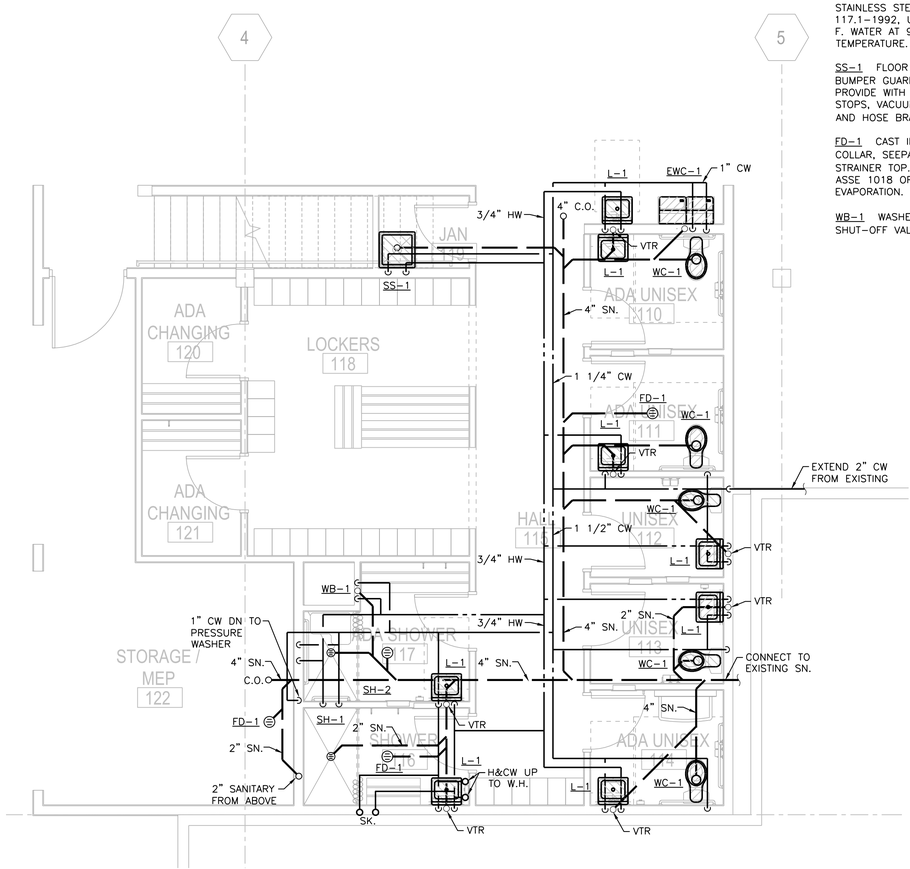
FD-1 CAST IRON FLOOR DRAIN WITH FLANGE, INTEGRAL REVERSIBLE COLLAR, SEEPAGE OPENINGS AND 6" ROUND ADJUSTABLE NICKEL BRONZE STRAINER TOP. ZURN #Z-415. PROVIDE A TRAP SEAL CONFORMING TO ASSE 1018 OR ASSE 1044, ON ALL TRAPS SUBJECT TO LOSS BY EVAPORATION.

WB-1 WASHER BOX, 1-1/2" DRAIN, 1/2" HOT AND COLD WATER SHUT-OFF VALVES. GUY GRAY MODEL #BB150TS.



SECOND LEVEL OFFICE PLAN - PLUMBING

SCALE: 1/4" = 1'-0"



MAIN LEVEL RESTROOM PLAN - PLUMBING

SCALE: 1/4" = 1'-0"

Classic Engineering, LLC
100 Cesar E. Chavez Ave. S.W. Suite 400
Grand Rapids, Michigan 49503
Phone: 616-742-2810

Byron Plumbing, Inc.
4577 88th Street, S.W.
Byron Center, MI 49315
Phone: (616) 878-9411
Fax: (616) 878-1152

TERRA FIRMA E.L.
CLIMBING GYM
2655 E Grand River Ave
East Lansing, MI 48823

ISSUED FOR:	
09-18-25	PERMITS
11-12-25	REVISED
11-25-25	REVISED

PROJECT NUMBER: 2025312

DATE: 09-18-2025

DRAWING NUMBER: P-1

GAS DEMAND

ITEM	CFH
RTU-1	120
RTU-2	225
RTU-3	320
RTU-4	400
TOTAL	1065

CONTRACTOR TO VERIFY WITH GAS COMPANY THAT GAS METER IS SUFFICIENT TO SUPPLY THE SCHEDULED AMOUNT OF GAS.

REGISTER SCHEDULE

ITEM	SIZE	RANGE CFM	MFG & MODEL #
SAR-1	12"X6"	50 – 200	HART & COOLEY 661
SAR-2	14"X8"	175 – 350	HART & COOLEY SVH SPIRAL DIFFUSER
	20"X8"	350 – 550	
DIFF-1	6"ø	75 – 150	HART & COOLEY ARE 24"X24" 12"X12"
	8"ø	150 – 250	
	10"ø	250 – 375	
RAR-1	24"X24"	800	HART & COOLEY RE5-W
EAR-1	6"X6"	75	HART & COOLEY 650 RETURN AIR GRILLE

VENTILATION CALCULATION PER MMC 2021 TABLE 403.3

ROOM	AREA (SQ.FT)	PEOPLE/ 1000 SQ.FT	CFM/ PERSON	CFM/ SQ.FT.	EXHAUST RATE	D.A. REQUIRED	EXHAUST REQUIRED	COMMENTS
100 VESTIBULE	102	--	--	0.06	--	6	--	
101 RETAIL	478	15	7.5	0.12	--	111	--	
102 CHANGING	797	10	5	0.06	--	88	--	
103 FRONT DESK	205	30	5	0.06	--	43	--	
104 CAFE	244	10	5	0.06	--	27	--	
105 VIEWING	363	10	5	0.06	--	40	--	
106 CLIMBING GYM	8257	10	20	0.06	--	2147	--	
107 STORAGE	349	--	--	0.12	--	42	--	
108 STORAGE	654	--	--	0.12	--	78	--	
109 EXERCISE	1019	40	20	0.06	--	876	--	
110 RESTROOM	47	--	--	--	70/WC	--	70	
111 RESTROOM	47	--	--	--	70/WC	--	70	
112 RESTROOM	41	--	--	--	70/WC	--	70	
113 RESTROOM	41	--	--	--	70/WC	--	70	
114 RESTROOM	47	--	--	--	70/WC	--	70	
115 HALL	200	--	--	0.06	--	12	--	
116 SHOWER	50	--	--	--	50/SHR	--	50	
117 SHOWER	63	--	--	--	50/SHR	--	50	
118 LOCKERS	148	--	--	--	0.25/SF	--	37	
119 JANITOR'S CLOSET	20	--	--	--	50/MS	--	50	
120 CHANGING	41	--	--	--	0.25/SF	--	10	
121 CHANGING	41	--	--	--	0.25/SF	--	10	
122 STORAGE/MECHANICAL	270	--	--	0.12	--	32	--	
200 OFFICE CIRCULATION	156	--	--	0.06	--	9	--	
201 OFFICE 1	83	5	5	0.06	--	7	--	
202 OFFICE 2	83	5	5	0.06	--	7	--	
203 SHARED OFFICE	170	5	5	0.06	--	14	--	
204 MECHANICAL	14	--	--	0.12	--	2	--	
205 BREAK ROOM	245	10	5	0.06	--	27	--	
206 MULTI-PURPOSE	397	50	5	0.06	--	76	--	
TOTALS	14673					3644	557	

AIR BALANCE SCHEDULE (CFM)

ITEM	OA	RA	SA	EA	PRESSURE	NOTES
EF-1	--	--	--	600	-600	RUN CONTINUOUSLY WITH LIGHTS
EF-2	--	--	--	100	-100	INTERLOCK WITH MULTI-PURPOSE LIGHTS
RTU-1	200	1800	2000		+200	
RTU-2	800	4200	5000		+800	
RTU-3	1000	5000	6000		+1000	
RTU-4	1700	8300	10000		+1700	
TOTAL	3700	19300	23000	700	+3000	

HVAC UNIT SCHEDULE

RTU MARK	MANUFACTURER AND MODEL NO.	CFM	ESP	RPM	MIN. EER BTUH/WATTS	TOTAL COOLING CAPACITY BTUH	HEATING CAPACITY BTUH HIGH	HEATING CAPACITY BTUH LOW	ELECTRICAL DATA HP	ELECTRICAL DATA VOLTS	ELECTRICAL DATA MOCP	ELECTRICAL DATA MCA	LBS. OPER. WT.	FILTERS	REMARKS
RTU-1	RHEEM RGECYBO60ADU12	2000	0.8	--	10.6	57,000	120,000		--	460/3/60	20	15	592		1 2
RTU-2	RHEEM RGEDYB150ADG22	5000	0.8	1074	10.8	142,000	225,000		--	460/3/60	35	31	1089		1 2
RTU-3	RHEEM RGEGYB180ADG32	6000	0.8	840	10.8	172,000	320,000		--	460/3/60	45	38	2041		1 2
RTU-4	RHEEM RGEGYB300ADH40	10000	0.8	1086	---	284,000	400,000		--	460/3/60	80	62	2211		1 2

1. PROVIDE HONEYWALL 9000 SERIES PROGRAMMABLE TSTAT.
2. PROVIDE DOWNFLOW ECONOMIZER

EXHAUST FAN SCHEDULE

EF MARK	CFM	SONES	AMPS	WATTS	VOLT	ACCESS DISC	ACCESS BDD	ACCESS BIRD SCREEN	ACCESS V-BELT	ACCESS D-DR	MANUFACTURER AND MODEL NO.	RPM	IN W.G.	BHP	REMARKS
EF-1	600	2.5	8.7	--	115/1/60	X				X	CAPTIVEAIR: DU25HFA				3
EF-2	100	0.7	0.3	--	115/1/60	X				X	BROAN: L100E	803	0.25		1 2

1. INTERLOCK WITH BATHROOM LIGHT SWITCH
2. VENT TO EXTERIOR WITH APPROVED WALL OR ROOF CAP. STAY 10 FEET FROM AIR INTAKES.
3. PROVIDE 20" HIGH FACTORY CURB.

MECHANICAL SPECIFICATIONS AND GENERAL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR VISITING THE SITE AND VERIFYING ALL EXISTING FIELD CONDITIONS PRIOR TO INSTALLATION. THESE DRAWINGS ARE DOCUMENTS INDICATE APPROXIMATE LOCATION AND ARE DIAGRAMMATIC IN NATURE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING THE ACTUAL LOCATION OF NEW AND EXISTING MATERIAL.
2. CONTRACTOR IS RESPONSIBLE FOR COORDINATING HIS WORK WITH THE WORK OF ALL OTHER TRADES AND MAKING ANY NECESSARY MODIFICATIONS TO HIS WORK AT NO ADDITIONAL COST, INCLUDING ALL OFFSETS.
3. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH LOCAL CODES. THESE CODES SHALL BE FOLLOWED AS MINIMUM PROVIDING HIGHER GRADES OF MATERIAL AND WORKMANSHIP WHERE REQUIRED BY THESE DOCUMENTS. PROVIDE ALL TESTS REQUIRED BY LOCAL CODES.
4. ALL PERMITS, FEES, LICENSES, APPROVALS AND OTHER ARRANGEMENTS FOR WORK SHALL BE OBTAINED BY THE CONTRACTOR AT HIS OWN EXPENSE.
5. SUBMIT ASSEMBLED PRINTED INSTRUCTIONS FOR THE OPERATION AND MAINTENANCE OF EACH ITEM INSTALLED ALONG WITH EQUIPMENT CUTS AND CONTROL WIRING DIAGRAMS.
6. SUBMIT EQUIPMENT SPECIFICATIONS FOR REVIEW BEFORE PURCHASE.
7. CONTRACTOR SHALL GUARANTEE ALL WORK AND MATERIAL FOR ONE YEAR AFTER COMPLETION AGAINST ALL DEFECTS OF MATERIAL, EQUIPMENT AND WORKMANSHIP.
8. PROVIDE COMBUSTION AIR AND VENTING FOR WATER HEATER.
9. PROVIDE DUCT MOUNTED TEMPERATURE SENSORS AT EACH AC UNIT WIRE BACK TO CENTRALLY LOCATED TSTAT CONTROL, FEILD VERIFY LOCATION WITH OWNER
10. PROVIDE ALL REQUIRED SMOKE DETECTORS FOR HVAC EQUIPMENT OVER 2000 CFM.
11. INSULATE ALL DUCT ABOVE CEILING WITH 1" FIBERGLASS DUCT WRAP.

MAIN FLR: HVAC PLAN

SCALE 1/8"=1'-0"

2ND FLR: HVAC PLAN

SCALE 1/8"=1'-0"

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STATE OF MICHIGAN
MICHAEL J. WYSOCKI
ENGINEER
No. 6201042705
LICENSED PROFESSIONAL ENGINEER

ISSUED FOR	DATE
PLAN REVIEW AND CONSTR.	09/19/25

TENANT BUILD-OUT
TERRA FIRMA
2655 EAST GRAND RIVER AVE
EAST LANSING, MI 48823

SHEET TITLE: HVAC PLAN

ISSUED: 09/19/25

JOB NUMBER: 25-181

SHEET NUMBER: M1

GENERAL PROJECT NOTES

1. THE ELECTRICAL CONTRACTOR SHALL PROVIDE THE ELECTRICAL PORTION OF THE PROJECT. THIS INCLUDES, BUT IS NOT LIMITED TO: TEMPORARY ELECTRIC SERVICE AND DISTRIBUTION FOR CONSTRUCTION PURPOSES; PERMANENT BUILDING SERVICE ENTRANCE EQUIPMENT AND FEEDER DISTRIBUTION; TRENCH EXCAVATION, PUMPING, BACKFILLING AND COMPACTION FOR ALL UNDERGROUND ELECTRICAL WORK; BUILDING INTERIOR PANELBOARDS AND RELATED FEEDER AND BRANCH CIRCUITS; ELECTRICAL DISCONNECTS, DEVICES, BOXES, SWITCHES, AND LIGHTING FIXTURES; EMPTY CONDUITS AND OUTLETS FOR TELEPHONE, COMPUTER, AND CABLE T.V. SYSTEMS; AND COORDINATION WITH THE ELECTRIC UTILITY, OTHER CONTRACTORS, THE ARCHITECT AND OWNER.

2. FOR THE PURPOSES OF THIS CONTRACT, THE TERM "PROVIDE" SHALL MEAN TO PROVIDE ALL LABOR, MATERIAL, EQUIPMENT, TRANSPORTATION, AND SUPERVISION REQUIRED TO FURNISH AND INSTALL.

3. APPLY FOR, OBTAIN, AND PAY FOR ALL REQUIRED PERMITS AND INSPECTION CERTIFICATES.

4. THE NATIONAL ELECTRICAL CODE, NATIONAL ELECTRIC SAFETY CODE, NECA STANDARD OF INSTALLATION SHALL ESTABLISH THE MINIMUM REQUIREMENTS FOR INSTALLATION, BUT IN ADDITION, ALL WORK SHALL ALSO COMPLY WITH OSHA, STATE, COUNTY, LOCAL OR MUNICIPAL CODE REQUIREMENTS AND THE RULES OF THE LOCAL ELECTRIC UTILITY. IN CASE OF CONFLICTS, CONFORM TO THE MORE STRINGENT REQUIREMENTS. TO THE BEST OF THE ENGINEER'S KNOWLEDGE, THESE PLANS AND SPECIFICATIONS COMPLY WITH THE APPLICABLE MINIMUM BUILDING CODES. IN CASES OF CONFLICTS BETWEEN THESE DESIGN DOCUMENTS AND REQUIREMENTS OF ANY OF THE ABOVE CRITERIA, CONTACT THE ENGINEER BEFORE PROCEEDING.

5. ALL MATERIALS USED IN THIS PROJECT SHALL BE NEW AND UNDERWRITERS' LABORATORIES (UL) LISTED AND LABELED, UNLESS OTHERWISE NOTED.

6. SUBMIT SHOP DRAWINGS, CATALOG SHEETS, OR OTHER DESCRIPTIVE DATA WITH SUFFICIENT INFORMATION TO ESTABLISH DESIGN, QUALITY AND PERFORMANCE. SUBMIT DATA FOR: SERVICE EQUIPMENT, DISCONNECTS, FUSES, PANELBOARDS, WIRING DEVICES, WIRE, CONDUIT, LIGHT FIXTURES, TIME SWITCHES, LIGHTING CONTACTORS, SURGE SUPPRESSION DEVICES, TRANSFORMERS, AND GENERATORS. PROVIDE SUBMITTALS AS A SINGLE PACKAGE.

7. PROVIDE EQUIPMENT NAMEPLATES FOR ALL EQUIPMENT, INCLUDING SERVICE EQUIPMENT, PANELBOARDS, DISCONNECTS AND TRANSFORMERS. NAMEPLATES SHALL BE ENGRAVED THREE-LAYER LAMINATED PLASTIC, WHITE LETTERS ON BLACK BACKGROUND. USE 1/8 INCH LETTERS FOR IDENTIFYING INDIVIDUAL EQUIPMENT AND LOADS AND 1/4 INCH LETTERS FOR GROUPED EQUIPMENT AND LOADS. NAMEPLATES FOR SWITCHBOARDS AND PANELBOARDS SHALL INDICATE THE SOURCE OF POWER PER NEC 408.4(B). FOR DEDICATED CIRCUIT POWER OUTLETS, PROVIDE EMBOSSED ADHESIVE TAPE, WITH 1/8 INCH BLACK LETTERS ON CLEAR BACKGROUND. LABEL DEDICATED OUTLETS WITH NAME OF LOAD, PANEL AND CIRCUIT NUMBER. PROVIDE ARC FLASH AND SHOCK HAZARD WARNING LABELS FOR ELECTRICAL EQUIPMENT PER NEC 110.16 AND NFPA-70E. ALSO, PROVIDE LABEL WITH AVAILABLE FAULT CURRENT AND DATE FOR SERVICE EQUIPMENT PER THE NEC.

8. PVC CONDUIT SHALL ONLY BE USED IN THE GROUND OR CONCRETE SLAB AND SHALL BE SCHEDULE 40. ALL ELLS TURNING UP OUT OF THE EARTH OR CONCRETE SLAB SHALL BE ASPHALTUM OR PVC COATED RIGID GALVANIZED STEEL CONDUIT.

9. SEE PANEL SCHEDULES AND ONE-LINE DIAGRAM FOR SIZE OF ALL CONDUCTORS AND CONDUIT.

10. NO MORE THAN 3 PHASE CONDUCTORS (ON ALTERNATING HOT LEGS) SHALL BE COMBINED IN ONE HOMERUN CONDUIT. PROVIDE A DEDICATED FULLSIZE NEUTRAL FOR CIRCUITS REQUIRING A NEUTRAL. A COMMON NEUTRAL FOR MULTIPLE BRANCH CIRCUITS SHALL ONLY BE PROVIDED WHERE SPECIFICALLY ALLOWED BY THE NEC. PER NEC 210.4, IF A COMMON NEUTRAL IS USED FOR A MULTIWIRE BRANCH CIRCUIT MADE UP OF MULTIPLE CIRCUITS (I.E. LIGHTING OR GENERAL PURPOSE RECEPTACLE CIRCUITS), PROVIDE A U.L. LISTED HANDLE TIE OR MULTI-POLE CIRCUIT BREAKER TO SIMULTANEOUSLY DISCONNECT ALL UNGROUNDED CONDUCTORS AT THE POINT WHERE THE CIRCUITS ORIGINATE, AS ALLOWED BY THE AHJ.

11. WITH THE EXCEPTION OF DEVICES ABOVE COUNTERS, MOUNT RECEPTACLES, DATA, PHONE, AND T.V. OUTLETS 18" A.F.F. (TO CENTER OF OUTLET) UNLESS NOTED OTHERWISE. MOUNT SWITCHES AT NO MORE THAN 47" A.F.F. (TO TOP OF SWITCH HANDLE) UNLESS NOTED OTHERWISE. IF THERE ARE OBSTRUCTIONS (I.E. A SERVICE COUNTER), MOUNT SWITCHES AT NO MORE THAN 44" A.F.F. (TO TOP OF SWITCH HANDLE). SEE SECTION 308 OF THE ADA STANDARDS FOR ACCESSIBLE DESIGN FOR MORE INFORMATION. CONFORM TO ALL AMERICANS WITH DISABILITY ACT (ADA) REQUIREMENTS.

12. UNLESS NOTED OTHERWISE, ALL MOTORS, INTEGRAL STARTERS, CONTROL AND MONITORING DEVICES (INCLUDING WIRE AND CONDUIT FOR CONTROL CIRCUITS), TIMERS, RELAYS, PILOT DEVICES AND OTHER REQUIRED CONTROL COMPONENTS FOR MECHANICAL SYSTEMS WILL BE FURNISHED AND INSTALLED UNDER DIVISION 15.

13. UNLESS NOTED OTHERWISE, MAKE POWER WIRING CONNECTIONS TO ALL WATER HEATERS, PUMPS, MACHINERY, APPLIANCES, WATER COOLERS, HVAC EQUIPMENT AND OTHER ELECTRICALLY-OPERATED EQUIPMENT AS INDICATED OR AS REQUIRED. FURNISH AND INSTALL DISCONNECT SWITCHES, STARTERS AND PROTECTIVE DEVICES AS INDICATED ON THE DRAWINGS, EXCEPT FOR ITEMS FURNISHED WITH INTEGRAL DISCONNECT SWITCHES AND/OR STARTERS (SEE MECHANICAL AND PLUMBING SCHEDULES).

14. DRAWINGS ARE INTENDED TO BE DIAGRAMMATIC ONLY. REVIEW ARCHITECTURAL, CIVIL, MECHANICAL, AND PLUMBING DRAWINGS AND COORDINATE WITH OTHER CONTRACTORS TO CONFIRM EXACT LOCATION FOR LIGHTING FIXTURES, ELECTRICAL DEVICES, WIRING AND EQUIPMENT AND AVOID INTERFERENCES BETWEEN RACEWAYS, DUCTS, PIPING, AND STRUCTURAL MEMBERS. RELOCATE EQUIPMENT AS NECESSARY TO MAINTAIN NEC WORKING AND DEDICATED EQUIPMENT SPACE REQUIREMENTS.

15. CONTRACTOR SHALL CONFORM WITH ALL OSHA STANDARDS AND NFPA 70E, STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE, REQUIREMENTS FOR ELECTRICAL SAFETY, INCLUDING PROPER LOCK-OUT / TAG-OUT PROCEDURES AND WEARING APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT (PPE). CONTRACTOR'S EMPLOYEES SHALL HAVE RECEIVED NFPA 70E ARC FLASH TRAINING.

16. THE ABOVE NOTES APPLY TO ALL ELECTRICAL DRAWINGS.

ELECTRICAL SYMBOL LEGEND

SYMBOL	SYMBOL DESCRIPTION	MANUFACTURER	NOTES
○	RECESSED LIGHT FIXTURE	SEE LIGHTING FIXTURE SCHEDULE	
⊙	PENDANT LIGHT FIXTURE	SEE LIGHTING FIXTURE SCHEDULE	
	EXIT SIGN	SEE LIGHTING FIXTURE SCHEDULE	
□	2X2 RECESSED/SURFACE LIGHT FIXTURE	SEE LIGHTING FIXTURE SCHEDULE	
▭	2X4 RECESSED/SURFACE LIGHT FIXTURE	SEE LIGHTING FIXTURE SCHEDULE	
▬	1X4/1X8 SUSPENDED LIGHT FIXTURE	SEE LIGHTING FIXTURE SCHEDULE	
	EM LIGHT FIXTURE	SEE LIGHTING FIXTURE SCHEDULE	
T	THERMOSTAT ROUGH-IN	1 GANG BOX W/ 3/4" TO CEILING SPACE	2
	DUPLEX RECEPTACLE		1
U	DUPLEX RECEPTACLE WITH USB PORTS		1
N/L	DUPLEX RECEPTACLE WITH NIGHT LIGHT		1
	GFI DUPLEX RECEPTACLE		1,5
	COUNTERTOP GFI DUPLEX RECEPTACLE		3,5
	QUAD DUPLEX RECEPTACLE		1
	COUNTERTOP DUPLEX RECEPTACLE		3
	COUNTERTOP QUAD RECEPTACLE		3
	DUPLEX RECEPTACLE - SWITCHED		1
	SPECIAL CONNECTION	FIELD VERIFY REQ & CONFIGURATION	
(J)P (J)D	JUNCTION BOX - P=POWER / D=DATA	FIELD VERIFY REQUIREMENTS	1
▽	VOICE / DATA ROUGH-IN	1 GANG BOX W/ 3/4" TO CEILING SPACE	1
▼	COUNTERTOP VOICE / DATA ROUGH-IN	1 GANG BOX W/ 3/4" TO CEILING SPACE	3
TV	TV ROUGH-IN		4

NOTES:
1) MOUNT 16" ABOVE FINISH FLOOR TO BOTTOM OF BOX UNO.
2) MOUNT 44" ABOVE FINISH FLOOR TO BOTTOM OF BOX UNO.
3) MOUNT 42" ABOVE FINISH FLOOR TO BOTTOM OF BOX UNO.
4) COORDINATE HEIGHTS WITH OWNER
5) RECEPTACLE PROVIDED WITH GFCI PROTECTION.
NOT ALL REQUIRED GFCI LOCATIONS ARE INDIVIDUALLY INDICATED ON THE PLANS.
ALL GFCI PROTECTION SHALL BE PROVIDED AS REQUIRED BY NEC 210.8(B) AND NEC 210.8(D).

ABBREVIATIONS:
WP=WEATHER PROOF
GFI=GROUND FAULT INTERRUPTER
U.N.O. = UNLESS NOTED OTHERWISE
V.I.F. = VERIFY IN FIELD

STATE OF MICHIGAN
MORGAN M. LANDON
ENGINEER
No. 23590
LICENSED PROFESSIONAL ENGINEER
09.22.25

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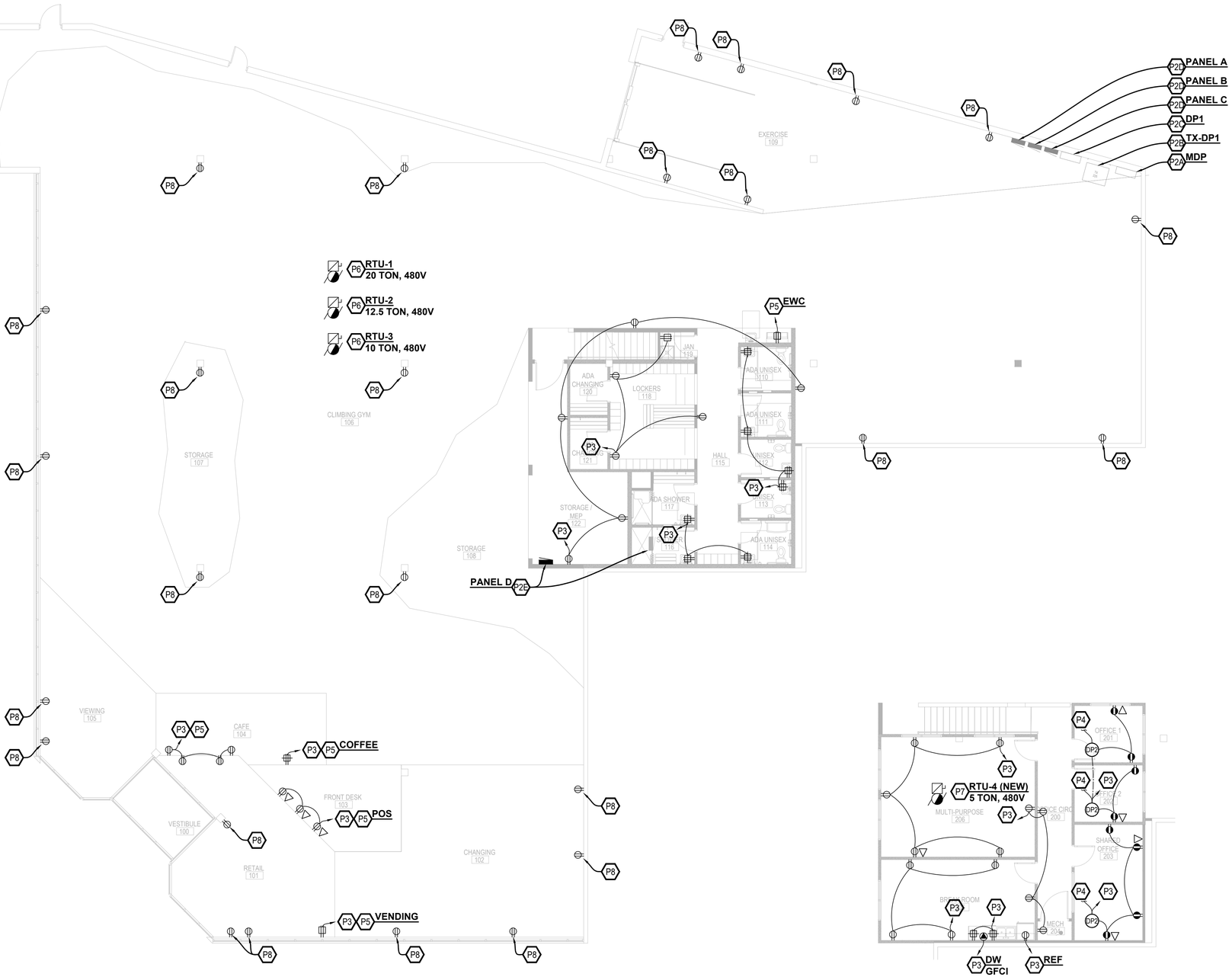
PROPOSED RENOVATION:
TERRA FIRMA E.L.
2655 E Grand River Ave - East Lansing, MI 48823

#	ISSUES DESCRIPTION	DATE
2	PERMITS	2025.09.22
1	90% OWNER REVIEW	2025.08.28

DRAWING TITLE:
NOTES AND SYMBOL LEGEND

PROJECT NO:	DATE: 2025.09.22
PROJECT MGR: Craig Ortega	DRAWING NO: E100
DESIGNED BY: Nick Szotko	
ENGINEERING BY: Morgan Landon	



1ST FLOOR POWER PLAN
SCALE: 1/8" = 1'-0"

2ND FLOOR POWER PLAN
SCALE: 1/8" = 1'-0"

GENERAL NOTES - POWER & LV

1. EXISTING SERVICE IS 800A 480V 3Ø. CONTRACTOR TO VERIFY THAT PROPOSED NEW LOADS DO NOT EXCEED SERVICE CAPACITY. LOAD CALCULATIONS SHALL COMPLY WITH NEC 220.10 THROUGH 220.61. NEC 220.87 SHALL NOT BE USED DUE TO LACK OF HISTORIC LOAD DATA.
2. SPRINKLER MONITOR SYSTEM / FIRE ALARM SYSTEM IS TO BE ENGINEERED, PROVIDED AND INSTALLED BY THE ELECTRICAL CONTRACTOR AND/OR A QUALIFIED SUBCONTRACTOR. SEPARATE DRAWINGS WILL BE ISSUED AND ARE NOT INCLUDED IN THIS PACKAGE.
3. ALL CABLING, BACK BOXES, JACKS, PLATES, IN-WALL ROUGH IN, AND TERMINATIONS FOR DATA OUTLETS BY ELECTRICAL CONTRACTOR. ALL OTHER CABLING, DEVICES, TERMINATIONS, AND SYSTEM COMPONENTS INCLUDING ROUGH-INS FOR LOW VOLTAGE, AUDIO VISUAL, SECURITY, AND CARD ACCESS SHALL BE PROVIDED AND INSTALLED BY OTHERS. COORDINATE ALL LOCATIONS AND EXACT REQUIREMENTS WITH SYSTEM VENDORS PRIOR TO ROUGH-IN.
4. ALL RECEPTACLES AND OUTLETS FOR FIXED EQUIPMENT LOCATED IN AREAS SPECIFIED BY NEC 210.8(B), AND ALL APPLIANCES LISTED IN NEC 210.8(D), SHALL BE PROVIDED WITH GFCI PROTECTION, WHETHER BY GFCI CIRCUIT BREAKER OR GFCI RECEPTACLE. THIS REQUIREMENT APPLIES REGARDLESS OF WHETHER INDIVIDUAL GFCI SYMBOLS ARE SHOWN ON THE PLANS.
6. PROVIDE AUTOMATICALLY CONTROLLED RECEPTACLES IN COMPLIANCE WITH ASHRAE 90.1 2019 AND THE MICHIGAN ENERGY CODE. A MINIMUM OF 50 PERCENT OF ALL 125V, 15- AND 20-AMP RECEPTACLES IN ENCLOSED OFFICES, CONFERENCE ROOMS, COPY/PRINT ROOMS, BREAK ROOMS, CLASSROOMS, AND INDIVIDUAL WORKSTATIONS SHALL BE CONTROLLED. CONTROLLED RECEPTACLES SHALL BE PERMANENTLY MARKED PER NEC AND EVENLY DISTRIBUTED THROUGHOUT THE SPACE. RECEPTACLES SERVING EQUIPMENT REQUIRING CONTINUOUS OPERATION ARE EXEMPT.

P# KEYED NOTES - POWER

1. EXISTING TO REMAIN AS IS.
2. (A) EXISTING PANEL "MDP"
   TO REMAIN AS IS. 480/277V, 800A MCB, 3PH 4W.
   (B) EXISTING TRANSFORMER "DP1"
   TO REMAIN AS IS. 225KVA, 480/277V-208/120V, 3PH 4W
   (C) EXISTING PANEL "DP1"
   TO REMAIN AS IS. 208/120V, 800A MCB, 3PH 4W.
   (D) EXISTING PANEL(S)
   TO REMAIN AS IS. 208/120V, 250A MLO, 3PH 4W.
   USE SPARE SPACES FOR NEW CIRCUITS AS REQUIRED.
   (E) EXISTING PANEL "D" - RELOCATED
   208/120V, 250A MLO, 3PH 4W.
   RELOCATE EXISTING PANEL. EXTEND/REWORK EXISTING FEEDER AND CIRCUITS AS NEEDED. FIELD VERIFY EXACT REQUIREMENTS. USE SPARE SPACES FOR NEW CIRCUITS AS REQUIRED.
3. PROVIDE DEDICATED 120V, 1P20A CIRCUIT FROM NEAREST PANEL WITH SPARE CAPACITY. FIELD VERIFY EXACT REQUIREMENTS AND COORDINATE WITH ENGINEER AS NEEDED.
4. AUTO-CONTROLLED RECEPTACLE(S) - TO OCCUPANCY SENSOR/POWER PACK SHOWN ON LIGHTING PLANS. THE TOP OUTLET TO BE SWITCHED AND CONTROLLED BY SENSOR. THE BOTTOM RECEPTACLE IS UNSWITCHED AND ON THE SAME CIRCUIT. SEE LIGHTING DRAWINGS AND CONTROL DETAILS FOR MORE INFORMATION.
5. OWNER PROVIDED EQUIPMENT. FIELD VERIFY EXACT LOCATION AND REQUIREMENTS. POWER TO DROP FROM DECK.
6. REMOVE EXISTING RTU AND REPLACE WITH NEW UNIT OF IDENTICAL SIZE, VOLTAGE, AND CAPACITY. DISCONNECT AND RECONNECT ALL ASSOCIATED ELECTRICAL FEEDS AND CONTROL WIRING. COORDINATE WITH MECHANICAL CONTRACTOR FOR FINAL CONNECTIONS. CONTRACTOR SHALL CONFIRM EXACT RTU LOCATION(S) IN THE FIELD PRIOR TO WORK. VERIFY NAMEPLATE MCA/MOCP OF NEW UNIT MATCHES EXISTING CIRCUIT AMPACITY AND OVERCURRENT DEVICE. NOTIFY ENGINEER IF DIFFERENT.
7. PROVIDE NEW 480V, 3-PHASE CIRCUIT FROM SPARE SPACE IN EXISTING PANEL MDP TO SERVE NEW 5-TON RTU FOR OFFICE/RESTROOM AREA. PROVIDE 20A/3P BREAKER IN PANEL, 20A FUSED NEMA 3R DISCONNECT AT UNIT, AND ALL REQUIRED CONDUIT, WIRING, AND FITTINGS. COORDINATE WITH MECHANICAL CONTRACTOR FOR FINAL CONNECTIONS.
8. GENERAL CONVENIENCE RECEPTACLE PROVIDE (1) 120V, 20A DUPLEX RECEPTACLE IF NONE EXISTS WITHIN 5'-0" OF THIS CALLOUT. CONNECT TO NEAREST EXISTING 120V, 1P, 20A GENERAL-PURPOSE BRANCH CIRCUIT IN THIS AREA. FIELD-VERIFY CIRCUIT IDENTIFICATION AND AVAILABLE CAPACITY; PROVIDE NEW CIRCUIT TO NEAREST PANEL IF REQUIRED. MATCH DEVICE TYPE, COLOR, MOUNTING HEIGHT, AND COVER PLATE TO ADJACENT DEVICES. PROVIDE GFCI PROTECTION WHERE REQUIRED BY NEC 210.8(B). COORDINATE FINAL LOCATION IN FIELD WITH OWNER.

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PROPOSED RENOVATION:
TERRA FIRMA E.L.
2655 E Grand River Ave - East Lansing, MI 48823

#	ISSUES DESCRIPTION	DATE
2	PERMITS	2025.09.22
1	90% OWNER REVIEW	2025.08.28

DRAWING TITLE: POWER PLANS

PROJECT NO:	DATE: 2025.09.22
PROJECT MGR: Craig Ortega	DRAWING NO: E201
DESIGNED BY: Nick Szotko	
ENGINEERING BY: Morgan Landon	

LIGHTING CONTROLS SCHEDULE

SYMBOL	DESCRIPTION	PART NUMBER	NOTES
SO1	WALL SWITCH SENSOR	NLIGHT-WSXA	1,6
SO2	WALL SWITCH SENSOR - DIMMING	NLIGHT-WSXA-D	2,6
SO3	WALL SWITCH SENSOR - FAN	NLIGHT-WSXA-2P-FAN	1,6
OS1	OCC SENSOR - CEILING MT	NLIGHT-NCM-PDT-10-RJB	2,6
PP1	POWER PACK - DIMMING	NLIGHT-NPP16-D-EFP	6
PP2	POWER PACK - PLUG LOAD	NLIGHT-NPP20-PL	4,6
PP3	POWER PACK	NLIGHT-NPP16-EFP	1,6
PC1	DAYLIGHT SENSOR - INTERIOR	NLIGHT-NCM-ADCX	2,6
SW1	LOW VOLTAGE SWITCH - 1 SCENE	NLIGHT-NPODMA-DX-WH	3

NOTES
1. LIGHTING CONTROL FUNCTION: MANUAL ON/AUTO OFF. AUTO ON/OFF IN CORRIDORS.
2. LIGHTING CONTROL FUNCTION: MANUAL ON/AUTO OFF W/ DIMMING. AUTO ON/OFF IN CORRIDORS.
3. COORDINATE WITH OWNER SWITCH FUNCTIONS AND COLOR PRIOR TO ORDERING.
4. TO CONTROL RECEPTACLES PER MICHIGAN ENERGY CODE VIA OCCUPANCY SENSOR.
5. DUSK TO CONTROL OPERATION. CONFIGURE TO MEET MICHIGAN ENERGY CODE
6. OR APPROVED EQUAL

LIGHTING FIXTURE SCHEDULE

Type	Description	Manufacturer/Brand	Catalog Number	Lumens	CCT	Watts	Voltage	Notes
B2	2' LED STRIP	METALUX	2SNX-23SL-LW-UNV-L835-CD1	2146	35K	14.9	UNV	1,2
B4	4' LED STRIP	METALUX	4SNX-48SL-LW-UNV-L835-CD1	4586	35K	32.1	UNV	1,2
B4E	4' LED STRIP W/ EM BATTERY	METALUX	4SNX-48SL-LW-UNV-L835-CD1-EL10W	4586	35K	32.1	UNV	1,2
C1	6" LED CAN - 2000 LUMEN	HALO	LCR6-21-RD-9FS-E020	2100	35K	23	UNV	1,2
C1E	6" LED CAN - 2000 LUMEN W/ EM BATTERY	HALO	LCR6-21-RD-9FS-E040	2100	35K	23	UNV	1,2
C2	4" LED CAN - 1200 LUMEN	HALO	LCR4-12-ED-9FS-E020	1200	35K	14.5	UNV	1,2
V1	VANITY LIGHT	WAC	WS-77624-30-AL	2180	30K	21	UNV	1,2
X1	EXIT LIGHT	SURE-LITES	APC7R	N/A	RED	2	UNV	1,2,3

NOTES:
1. OR APPROVED EQUAL.
2. VERIFY FIXTURE SELECTION AND COLOR WITH ARCHITECT AND/OR OWNER
3. FIXTURE TO BE MOUNTED 1' ABOVE TOP OF DOOR

AUTO-CONTROLLED RECEPTACLES REQUIREMENTS
PROVIDE AUTOMATICALLY CONTROLLED RECEPTACLES IN COMPLIANCE WITH ASHRAE 90.1 2019 AND THE MICHIGAN ENERGY CODE. A MINIMUM OF 50 PERCENT OF ALL 120V, 15- AND 20-AMP RECEPTACLES IN ENCLOSED OFFICES, CONFERENCE ROOMS, COPY/PRINT ROOMS, BREAK ROOMS, CLASSROOMS, AND INDIVIDUAL WORKSTATIONS SHALL BE CONTROLLED. CONTROLLED RECEPTACLES SHALL BE PERMANENTLY MARKED PER NEC AND EVENLY DISTRIBUTED THROUGHOUT THE SPACE. RECEPTACLES SERVING EQUIPMENT REQUIRING CONTINUOUS OPERATION ARE EXEMPT. OCCUPANCY SENSOR CONTROLLED RECEPTACLES SHALL DE-ENERGIZE WITHIN 20 MINUTES OF THE SPACE BEING VACATED.

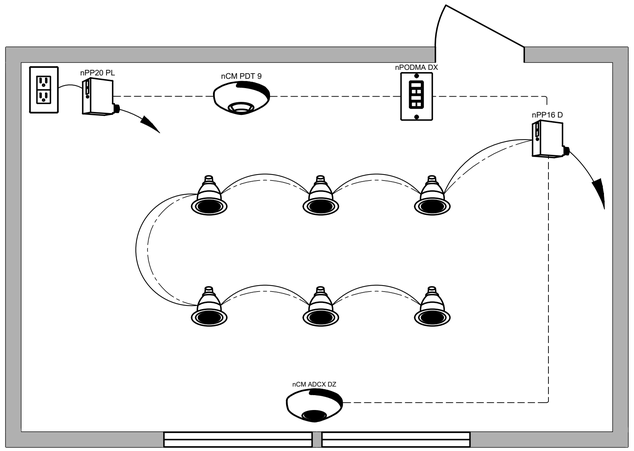

DIAGRAM LEGEND
- CAT-5e CABLE
- LINE VOLTAGE WIRES
- 0-10VDC WIRES
- LINE POWER

SEQUENCE OF OPERATION:

LIGHTS
- ALL LIGHTS ARE DIMMABLE
- FIXTURES ARE CONTROLLED BASED ON POWER PACK LINE VOLTAGE AND 0-10V WIRING
- MAXIMUM LEVEL CAN BE TASK TUNED TO ANY PERCENTAGE VIA PROGRAMMING

OCCUPANCY
- PARTIAL-ON OCCUPANCY SENSORS AUTOMATICALLY ACTIVATE BETWEEN 50-70%
OF CONTROLLED LIGHTING POWER OR FIXTURES MUST BE TURNED ON MANUALLY
- PLUG LOAD TURNS ON AUTOMATICALLY
- FIXTURES AND PLUG LOAD AUTOMATICALLY TURN OFF WHEN ROOM BECOMES VACANT

DAYLIGHT
-NOT REQUIRED IF ROOM HAS <24 FT2. OF GLAZING OR LIGHTING LOAD < 120W IN THE SKYLIT AND THE SIDELIT DAYLIT ZONE
- SMOOTH CONTINUOUS DIMMING
- CUSTOM GROUPING OF FIXTURES INTO SEPARATE DAYLIGHT ZONES (MAX.NUMBER OF ZONES =NUMBER OF FIXTURES)

MANUAL
- ON/OFF & RAISE/LOWER CONTROL OF TWO ZONES OF FIXTURES

1 E300 LIGHTING CONTROL DETAIL - OPEN OFFICE CONCEPT
SCALE: NONE

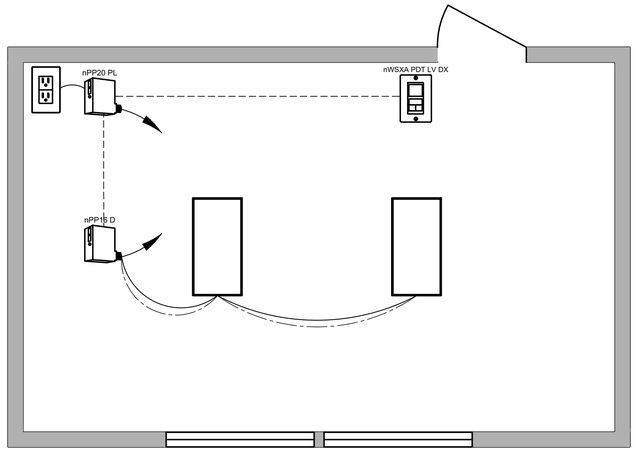

DIAGRAM LEGEND
- CAT-5e CABLE
- LINE VOLTAGE WIRES
- 0-10VDC WIRES
- LINE POWER

SEQUENCE OF OPERATION:

LIGHTS
- ALL LIGHTS ARE DIMMABLE
- FIXTURES ARE CONTROLLED BASED ON POWER PACK LINE VOLTAGE AND 0-10V WIRING
- MAXIMUM LEVEL CAN BE TASK TUNED TO ANY PERCENTAGE VIA PROGRAMMING

OCCUPANCY
- LIGHTS MUST BE TURNED ON MANUALLY (OR OPTIONALLY CAN BE CONFIGURED TO COME ON AUTOMATICALLY TO 50%-70%)
-PLUG LOAD TURNS ON AUTOMATICALLY
- LIGHTS AUTOMATICALLY TURN OFF WHEN ROOM BECOMES VACANT

DAYLIGHT
- NOT REQUIRED IF ROOM HAS <24FT OF GLAZING OR <120W, IN THE SKYLIT AND THE SIDELIT DAYLIT ZONE

MANUAL
- ON/OFF & RAISE/LOWER CONTROL OF LIGHTS

2 E300 LIGHTING CONTROL DETAIL - PRIVATE OFFICE CONCEPT
SCALE: NONE

COMcheck Software Version 4.1.5.5

Interior Lighting Compliance Certificate

Project Information

Energy Code: 90.1 (2016) Standard
Project Title:
Project Type: New Construction

Construction Site: Owner/Agent: Designer/Contractor:

Allowed Interior Lighting Power

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B X C)
1-RESTROOMS & OFFICE (Exercise Center)	2702	0.65	1756
		Total Allowed Watts =	1756

Proposed Interior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
1-RESTROOMS & OFFICE (Exercise Center)				
LED 1: B2: 2' STRIP: LED Linear 15W:	1	1	15	15
LED 2: B4&B4E: 4' STRIP: LED Linear 33W:	1	13	32	417
LED 3: C1&C1E: LED CAN: LED A Lamp 25W:	1	22	23	506
LED 4: C2: LED CAN: LED A Lamp 13W:	1	3	14	44
LED 5: V1: VANITY LIGHT: LED Linear 22W:	1	7	21	147
		Total Proposed Watts =		1129

Interior Lighting PASSES: Design 36% better than code

Interior Lighting Compliance Statement

Compliance Statement: The proposed interior lighting design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed interior lighting systems have been designed to meet the 90.1 (2016) Standard requirements in COM*check* Version 4.1.5.5 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

NICK SZOTKO — Name - Title
Nick Szotko — Signature
2025.08.26 — Date

STATE OF MICHIGAN
MORGAN M. LANDON
ENGINEER
No. 23590
LICENSED PROFESSIONAL ENGINEER
09.22.25

MORGAN LANDON PE, LLC
2054 Brandon Drive NW, Grand Rapids, Michigan 49504
phone 616-890-9321 morgan@milandon.com

division 26 CONSULTING & DESIGN
NICK SZOTKO, LEED AP
616-520-1482

CONSOLIDATED ELECTRICAL CONTRACTORS
LANSING | GRAND RAPIDS | TRAVERSE CITY | ANN ARBOR
877-981-8900 | www.consolectric.com
1095 A MAK-TECH DR
LANSING, MI 48906
517-484-8413

PROPOSED RENOVATION:
TERRA FIRMA E.L.
2655 E Grand River Ave - East Lansing, MI 48823

#	ISSUES DESCRIPTION	DATE
2	PERMITS	2025.09.22
1	90% OWNER REVIEW	2025.08.28

DRAWING TITLE:
LIGHTING SCHEDULES AND DETAILS

PROJECT NO:	DATE: 2025.09.22
PROJECT MGR: Craig Ortega	DRAWING NO: E300
DESIGNED BY: Nick Szotko	
ENGINEERING BY: Morgan Landon	

GENERAL NOTES - LIGHTING

1. CONNECT ALL EXIT SIGNS AND EMERGENCY BATTERIES TO LOCAL LIGHTING CIRCUIT AND AHEAD OF SWITCH LEG AND CONTROLS.
2. UNLESS SHOWN OTHERWISE, EXISTING EMERGENCY EGRESS LIGHTING IS TO REMAIN. CONTRACTOR IS TO FIELD VERIFY ALL EGRESS REQUIREMENTS MEET CODE AND MAKE ANY MODIFICATIONS NECESSARY. COORDINATE WITH ENGINEER AS NEEDED.
3. REUSE EXISTING LOCAL BRANCH LIGHTING CIRCUITS FROM DEMOLITION FOR CONNECTION TO NEW LIGHTING FIXTURES, WHERE SHOWN. CONTRACTOR SHALL FIELD-VERIFY CIRCUIT CAPACITY, CONDITION, AND CODE COMPLIANCE PRIOR TO REUSE. PROVIDE NEW HOMERUNS, WIRING, AND/OR DEVICES AS REQUIRED IF EXISTING CIRCUITS ARE FOUND INADEQUATE OR NONCOMPLIANT.

KEYED NOTES - LIGHTING

L#
1. EXISTING TO REMAIN AS IS.
2. TO SWITCHED RECEPTACLES, SEE POWER SHEETS FOR MORE INFORMATION.

N
1ST FLOOR LIGHTING PLAN
SCALE: 1/8" = 1'-0"
8' 0' 8' 16'

N
2ND FLOOR LIGHTING PLAN
SCALE: 1/8" = 1'-0"
8' 0' 8' 16'

STATE OF MICHIGAN
MORGAN M. LANDON
ENGINEER
No. 23590
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09.22.25

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PROPOSED RENOVATION:
TERRA FIRMA E.L.
2655 E Grand River Ave - East Lansing, MI 48823

#	ISSUES DESCRIPTION	DATE
2	PERMITS	2025.09.22
1	90% OWNER REVIEW	2025.08.28

DRAWING TITLE:
LIGHTING PLANS

PROJECT NO:	DATE: 2025.09.22
PROJECT MGR: Craig Ortega	DRAWING NO: E301
DESIGNED BY: Nick Szotko	
ENGINEERING BY: Morgan Landon	

FIXTURE SCHEDULE					
Label	Manufacturer	Catalog Number	Lamp Lumens	LLF	Watts
A4E	HALO	4SNX-48SL-LWI-UNV-L935-CD	3882.229	0.31	32.1
C1E	METALLUX	LCR6219FSED10MVV	2329.14	0.3	24.3

CALCULATION SUMMARY	
HALL 115	
Average	3.6 fc
Maximum	5.7 fc
Minimum	1.5 fc
Max/Min	3.8:1
Average/Min	2.4:1
LOCKERS 118	
Average	2.8 fc
Maximum	5.8 fc
Minimum	0.5 fc
Max/Min	11.6:1
Average/Min	5.6:1
OFFICE CIRC 200	
Average	2.9 fc
Maximum	5.1 fc
Minimum	0.4 fc
Max/Min	12.8:1
Average/Min	7.3:1

N

1ST FLOOR EMERGENCY LIGHTING CALCULATIONS

SCALE: 1/8" = 1'-0"

8' 0' 8' 16'

N

2ND FLOOR EMERGENCY LIGHTING CALCULATIONS

SCALE: 1/8" = 1'-0"

8' 0' 8' 16'

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PROPOSED RENOVATION:

TERRA FIRMA E.L.

2655 E Grand River Ave - East Lansing, MI 48823

#	ISSUES DESCRIPTION	DATE
2	PERMITS	2025.09.22
1	90% OWNER REVIEW	2025.08.28

DRAWING TITLE:
EMERGENCY LIGHTING CALCULATIONS

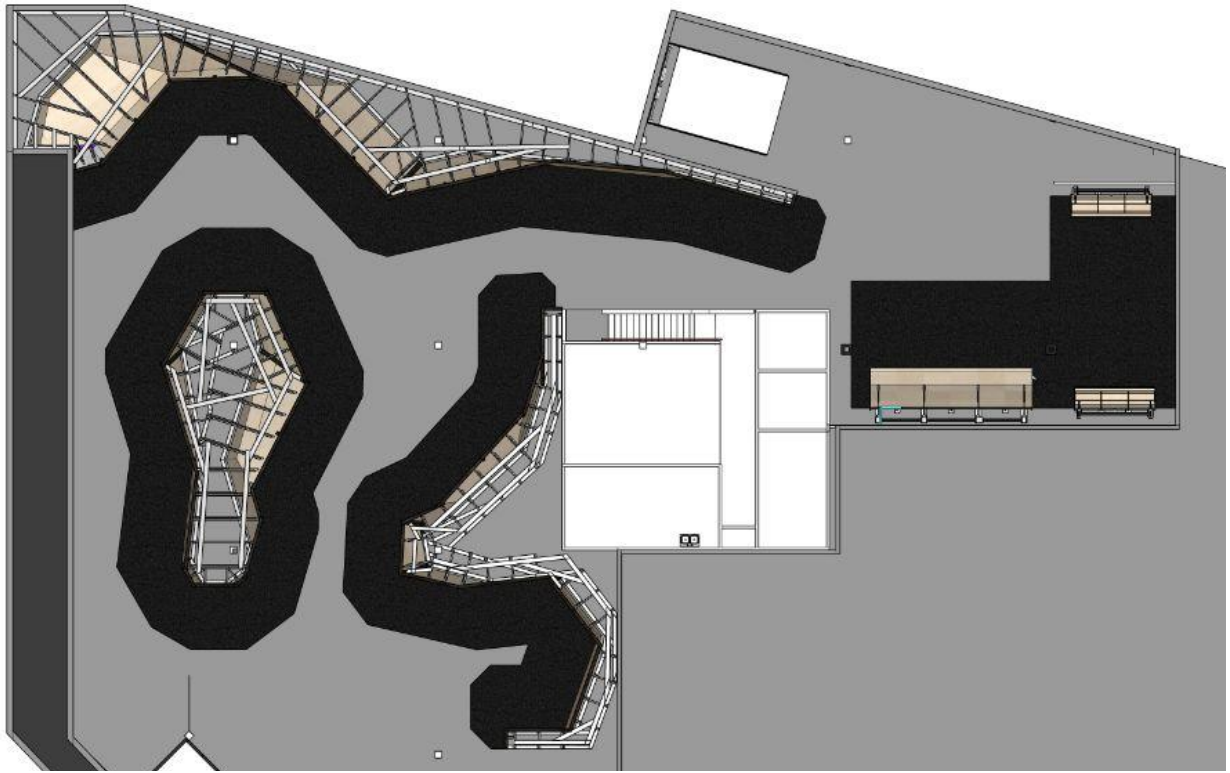
PROJECT NO:	DATE: 2025.09.22
PROJECT MGR: Craig Ortega	DRAWING NO: E401
DESIGNED BY: Nick Szotko	
ENGINEERING BY: Morgan Landon	

Approved Climbing Wall Summary - December 18th 2025

OS487 - Terra Firma EL.

Plan

This plan will be updated with the new building model



Summary

In This Presentation

- Approved Design Summary
    - Wall layout
    - Wall colors

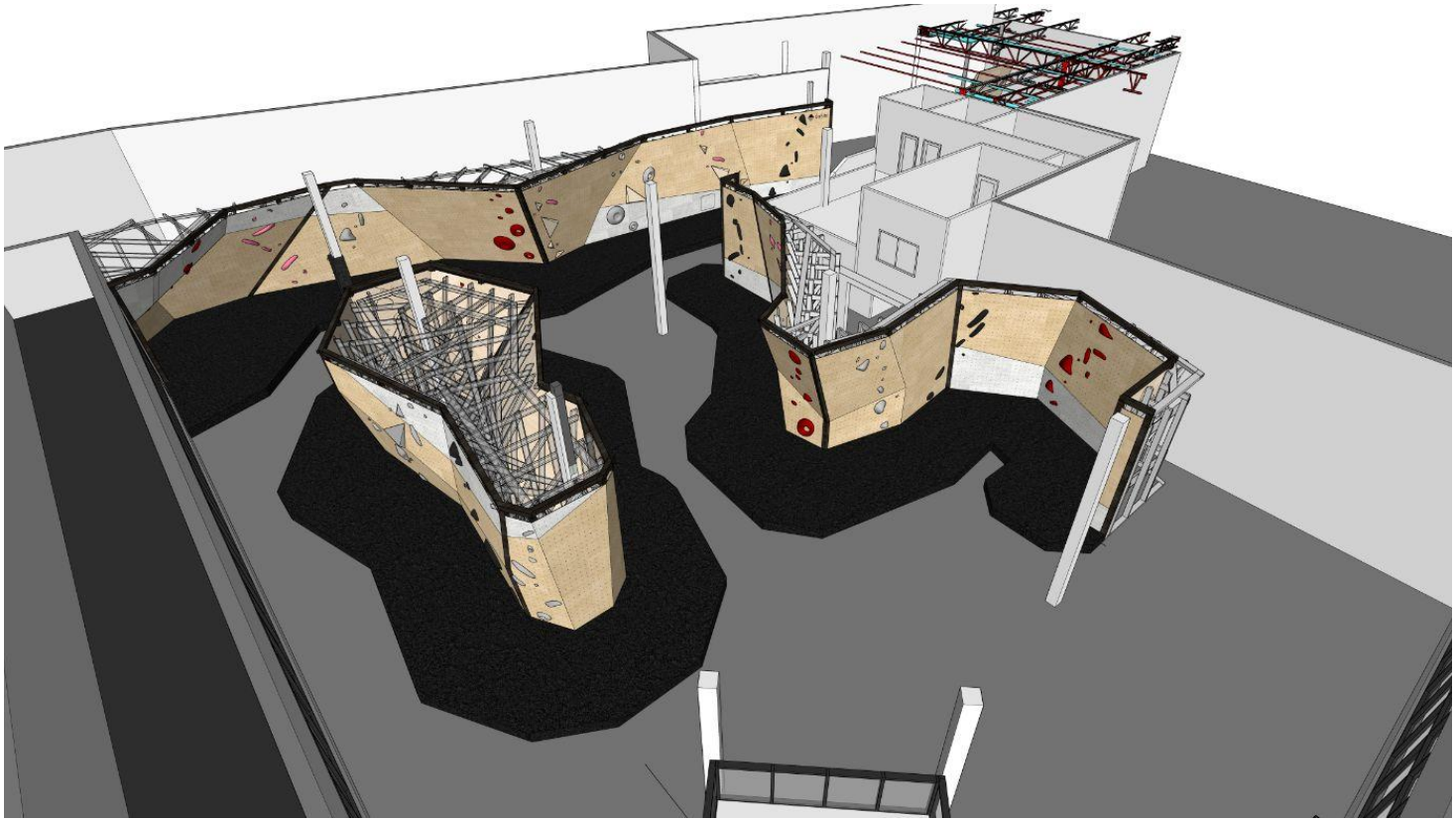
Next Steps

- Furniture Package

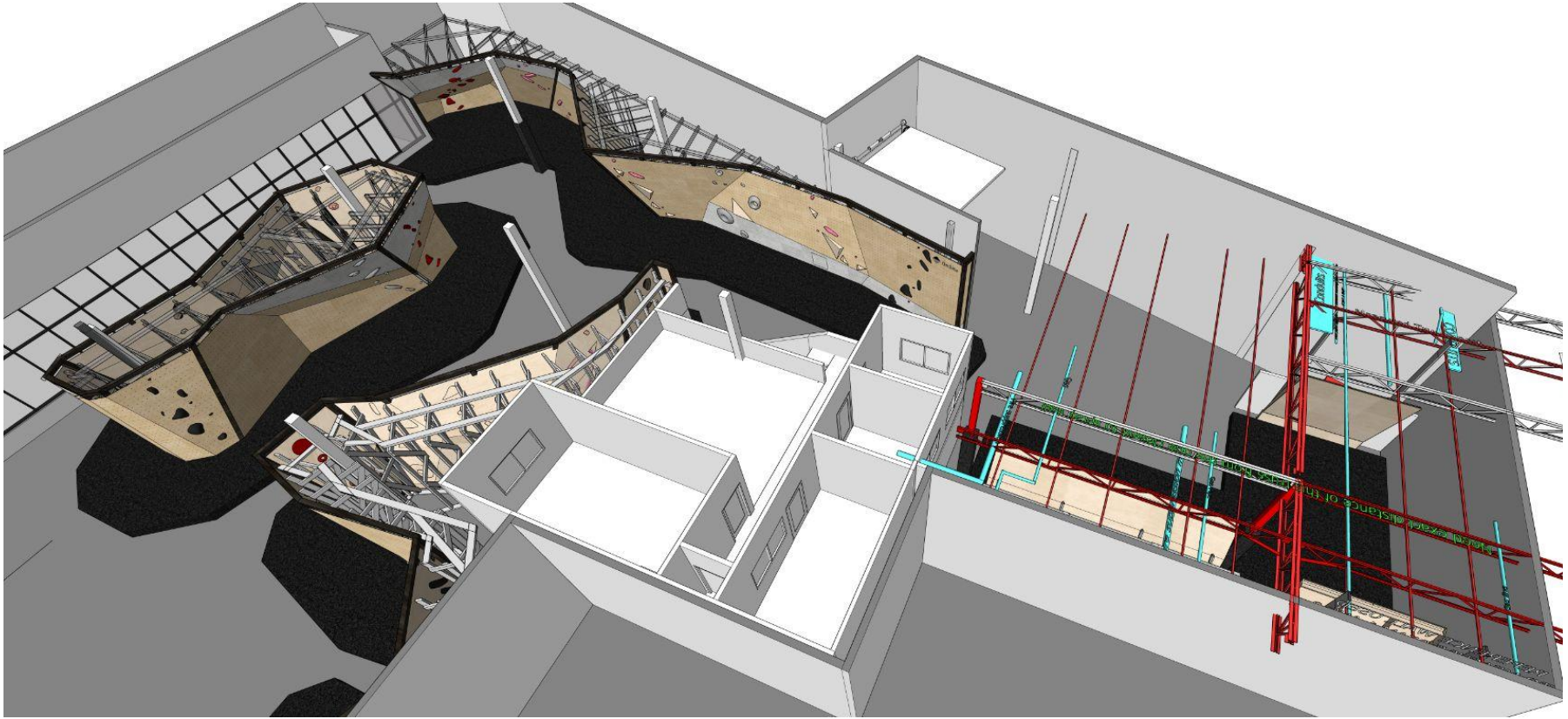
Please note that the plywood panel layouts and T-nut patterns shown are indicative only and will be finalized during the Technical Phase.

Please note that all stain colors shown are indicative only and the actual colors will vary due to natural variation found in plywood.

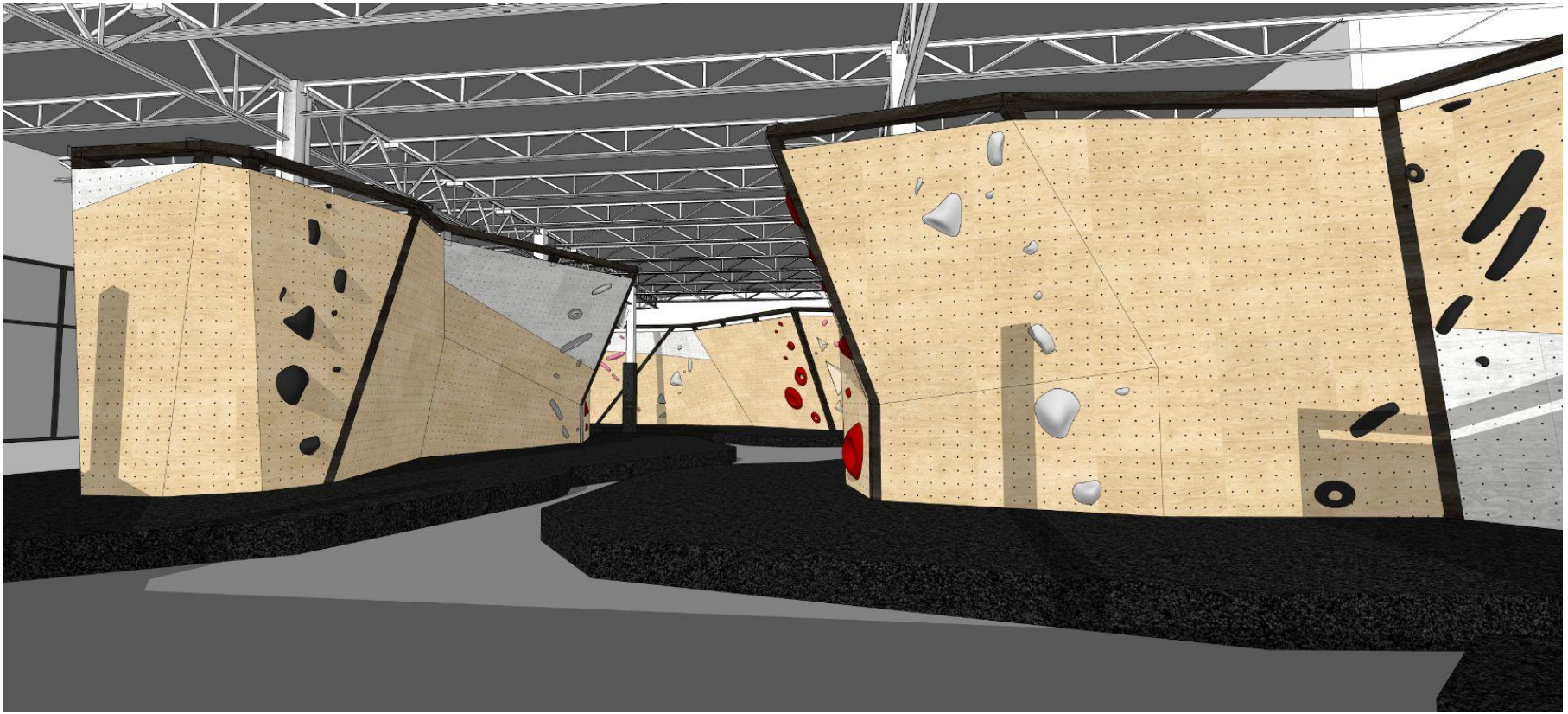
Aerial Views



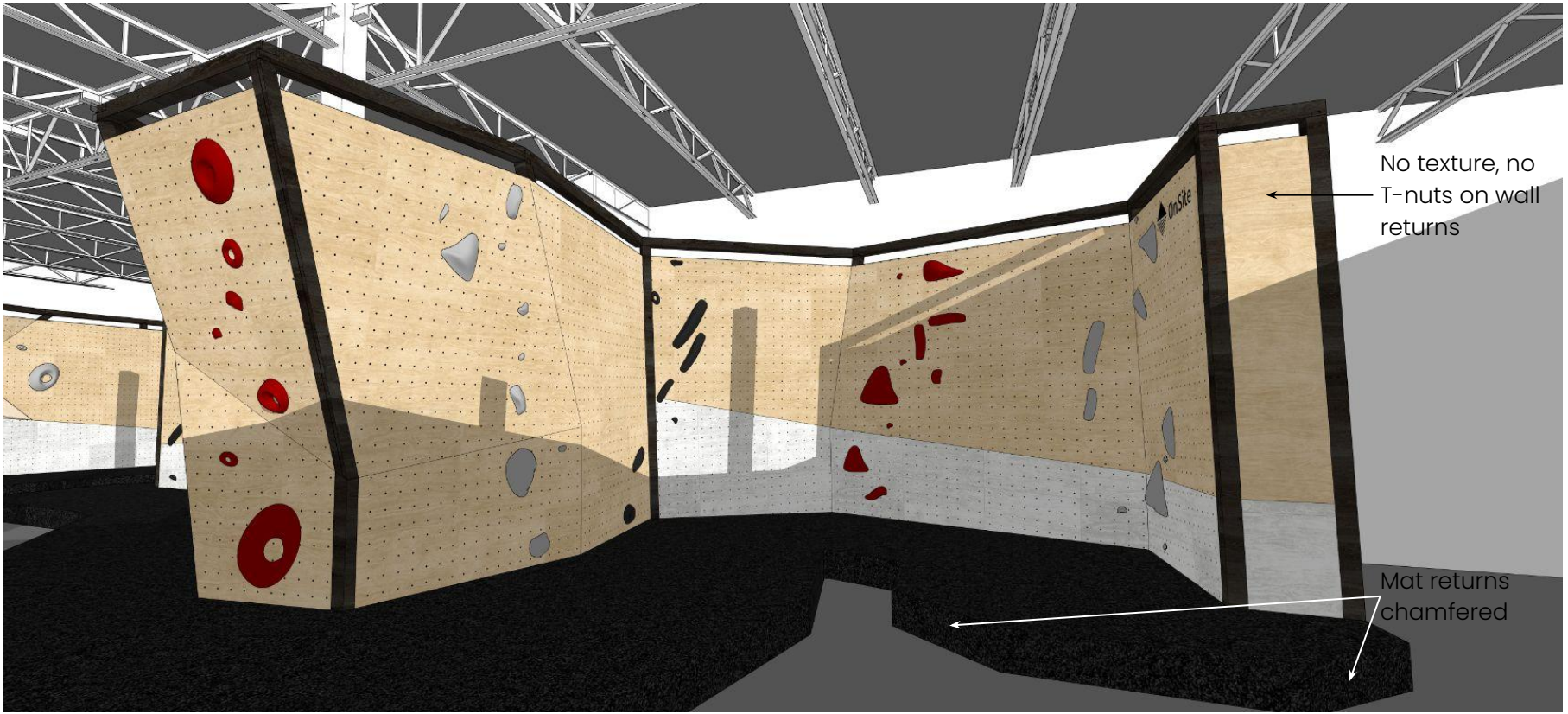
Aerial Views



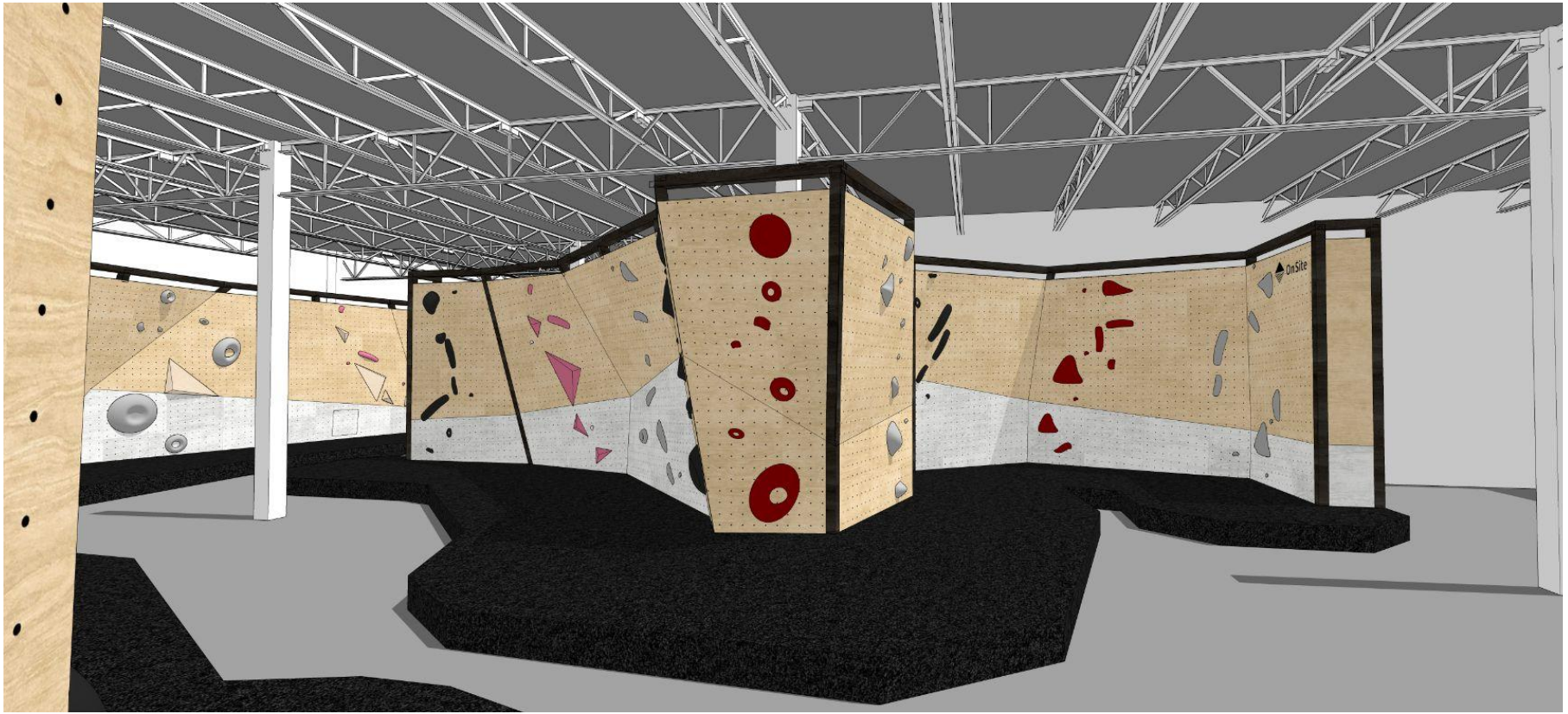
Interior Views



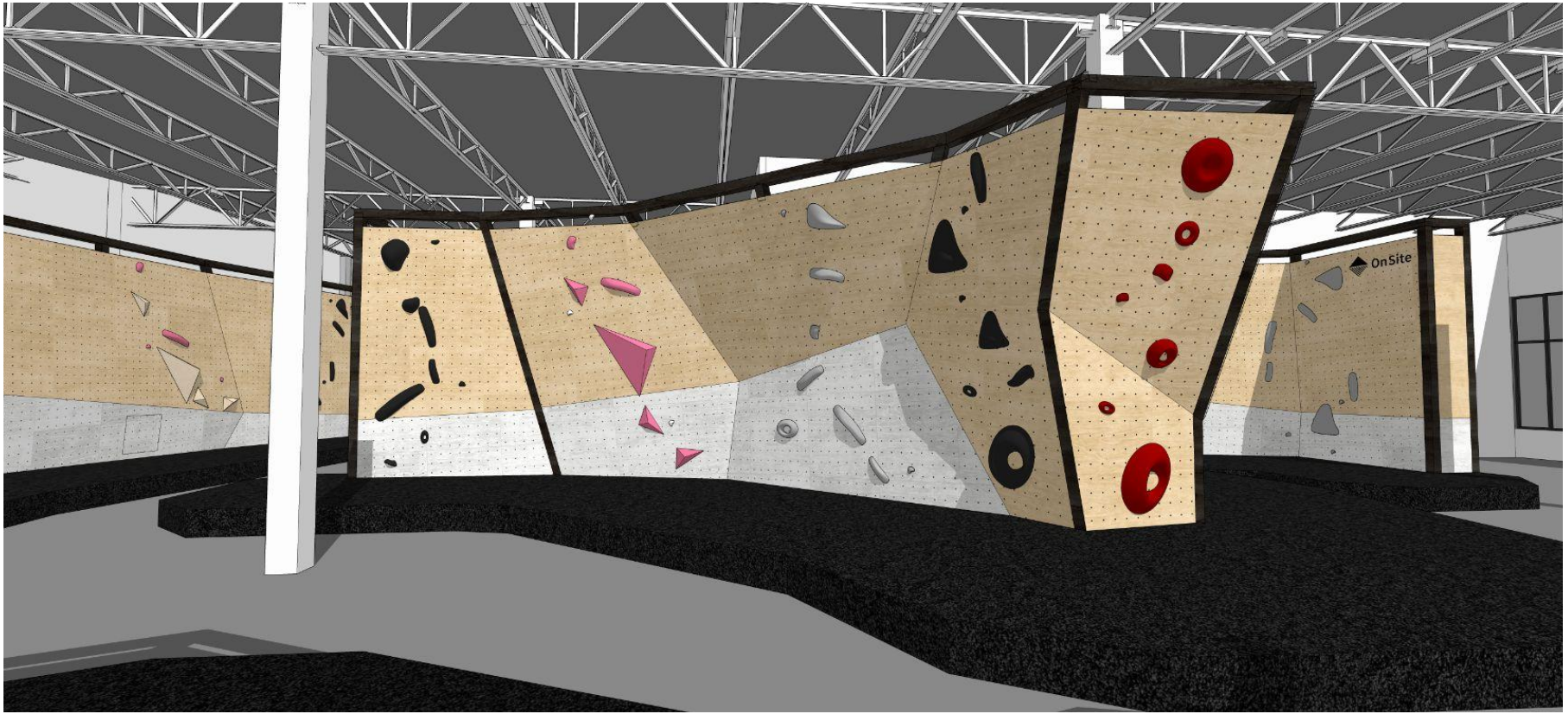
Interior Views



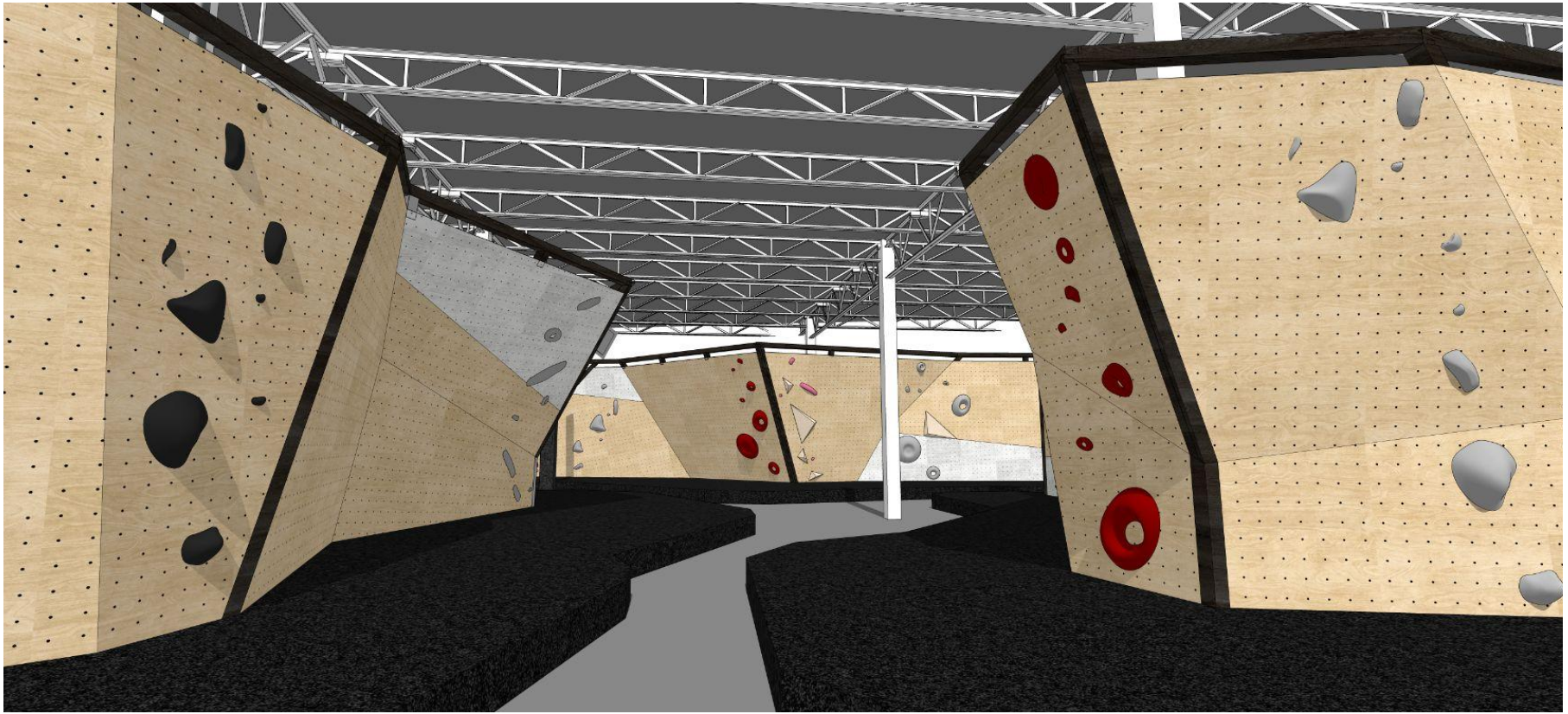
Interior Views



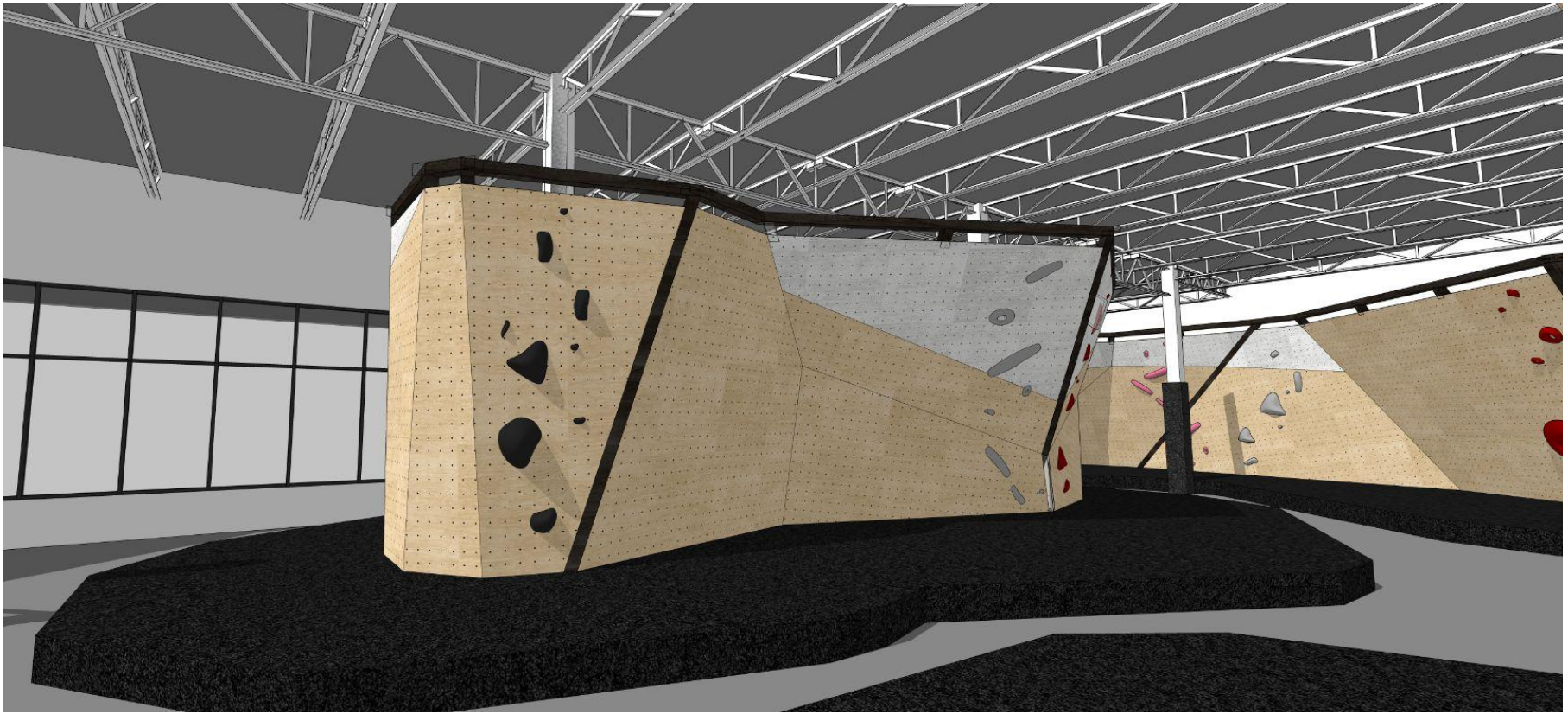
Interior Views



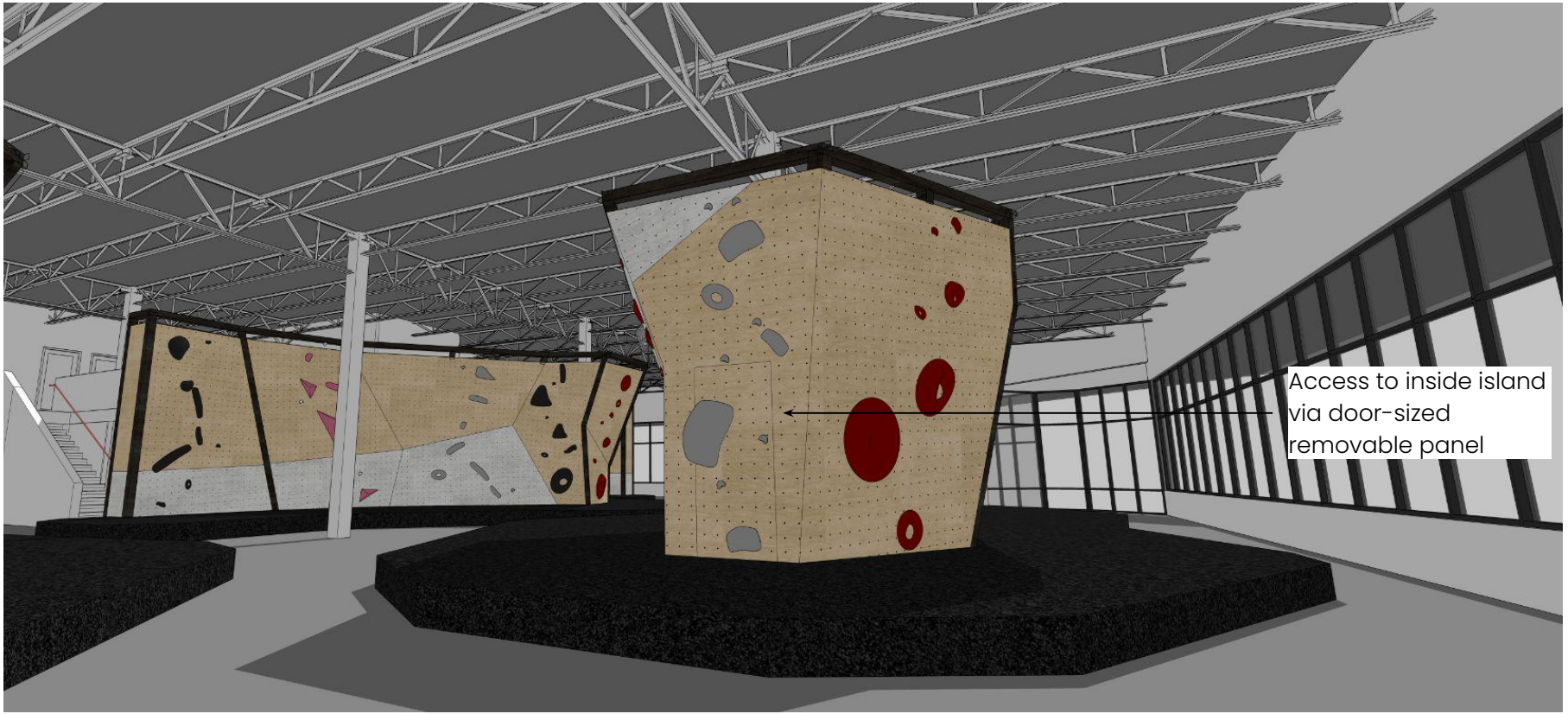
Interior Views



Interior Views



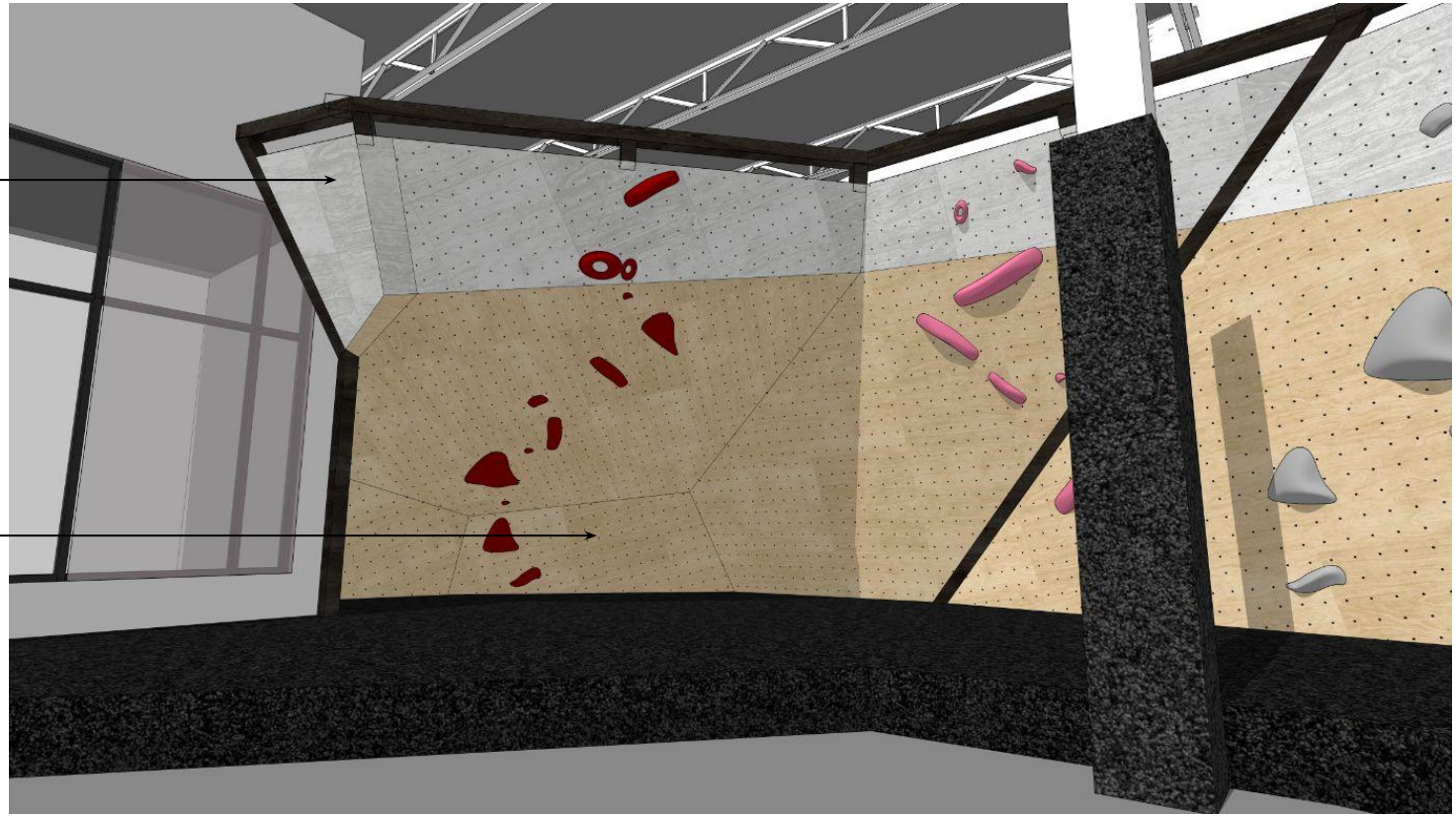
Interior Views



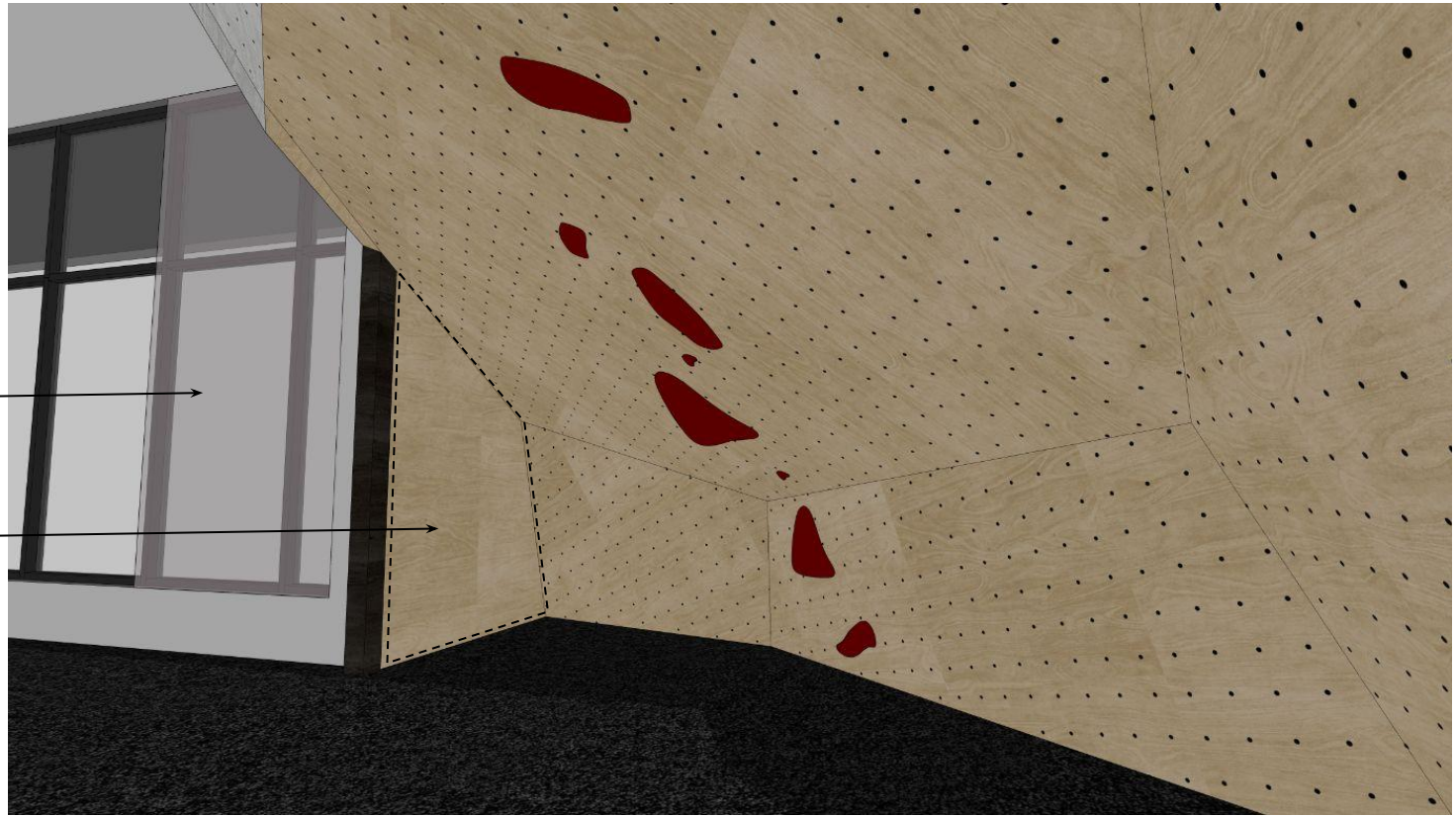
Interior Views

Texture across all panels, No t-nuts within 5' lateral of the windows, to ensure no unsafe problems are set

Access behind this section of wall via building door



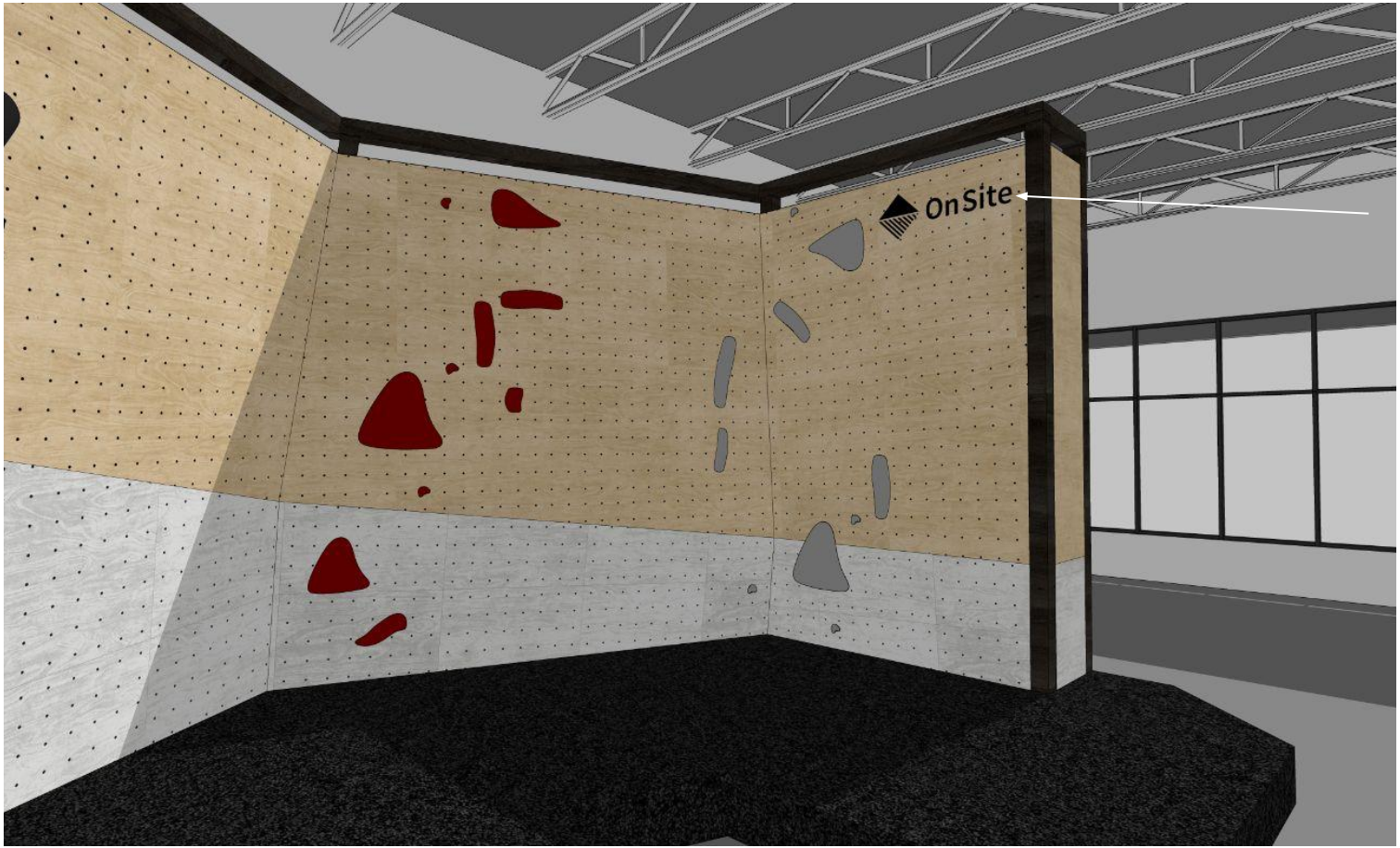
Interior Views



Interior Views

Interior Views

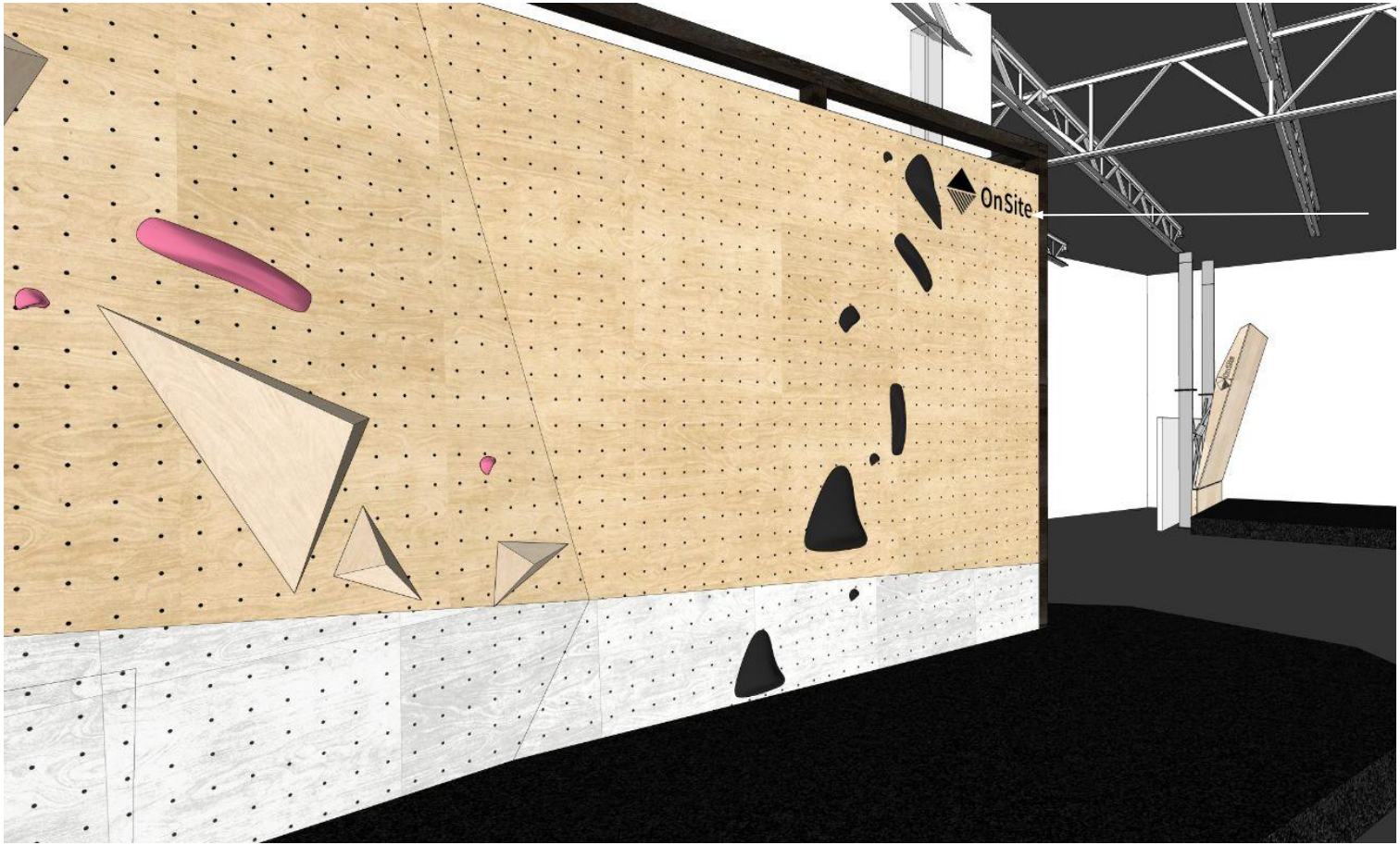
Interior Views



Logo placements

Logo #1
Stain color to coordinate with columns
16” x 48”

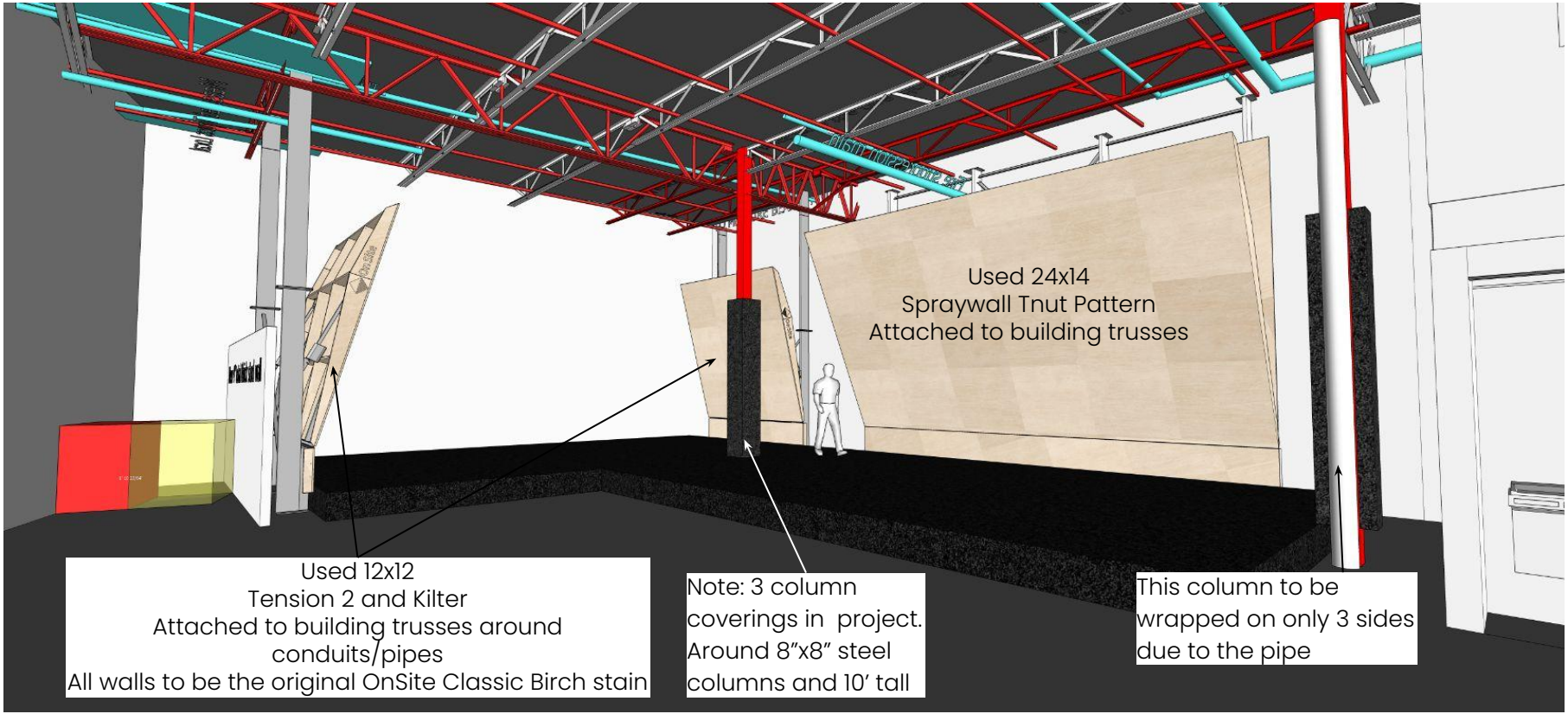
Interior Views



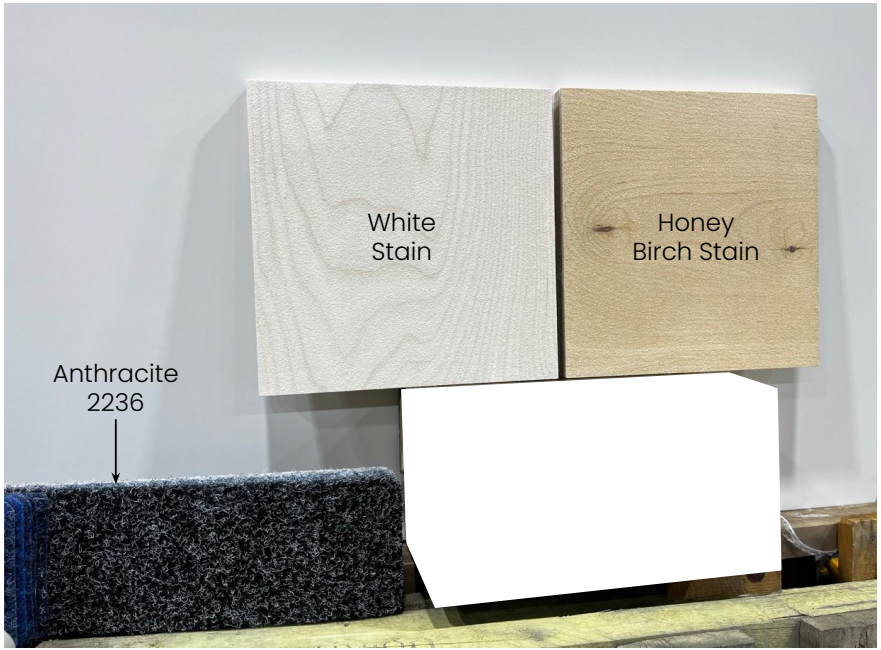
Logo placements

Logo #2
Stain color to coordinate with columns
16” x 48”

Training walls + mats + padding



Approved Samples



Area Summary

OPTION NAME	CLIMBABLE WALL (FT^2)	NON CLIMBABLE WALL (FT^2)	TOTAL WALL (FT^2)	MAT (FT^2)	CLIMBING EXTRAS	TRAINING WALLS	NOTES
Quote Rev1			6500	5452 @14"		One 12x12 legged freestanding One campus board (not included in climbable wall area count)	
Geometry R04	4950	209	5159	5216 @14"		One 12x12 legged freestanding One 12x12 custom attached One 24x14 custom attached spraywall	- Mat count includes training wall mats - Total wall area count does not include training walls - Total linear feet of bouldering wall is approximately 330'. Does not including training walls
Approved Project Summary	5068	105	5173	5122 @14"	3 column paddings to wrap 8"x8" to 10' above mats. Plexiglass to window near cave	One Used 12x12 Kilter Attached One Used Tension 2 Attached One 24x14 Used Spraywall Attached	- Mat count includes training wall mats - Total wall area count does not include training walls

OnSite

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@theonsite

ATELIER

6789 Place Pascal
Gagnon, Montréal,
QC, Canada,
H1P 2V8

OFFICE

2404 Rue Vimont,
Montréal, QC,
Canada,
H1V 3L5

Designers: **Ashleigh - ang@theonsite.com**
Alex - awhiteley@theonsite.com

ZASNOVA

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1310 Ribnica, Slovenija
T 01 836 90 60
info@zasnova.si
www.zasnova.si

STRUCTURAL DESIGEN PS-21/25

Type of the dokumentation:

Static analysis of the structure

Investor/subscriber:

CST Climbing Systems and Tecnology LTD

Koštialova ulica 32
8000 Novo mesto
Slovenija (EU)

Object:

Terra Firma

Designer:

ZASNOVA – gradbeni biro, Lovšin Tone s.p.

Vrvarska pot 1a,
1310 Ribnica
Slovenia (EU)
Phone: +386 41 977 796; E-mail: info@zasnova.si; http: www.zasnova.si

Design office representative :

Tone Lovšin

Responsible engineer:

Sandi Mohar, dipl.inž.grad., IZS G-4126

Numbr of copies:

1 2 A

Date:

28.11.2025

ANNEX 1C

HOME PAGE OF THE PLAN

		CONSTRUCTION PLAN FOR A CLIMBING WALL
CONSTRUCTION DATA		
construction name		**Terra Firma**
short description		**Static analysis deals with the implementation of a new climbing wall**
VRSTE GRADNJE	☑	**NEW CONSTRUCTION - NEWLY BUILT BUILDING**
označiti vse ustrezne vrste gradnje	☐	**NEW CONSTRUCTION - ADDITION**
	☐	**RECONSTRUCTION**
	☐	**CHANGE OF PURPOSE**
	☐	**REMOVAL OF ENTIRE BUILDING**
	☐	**LEGALIZATION**
	☐	**MINOR RECONSTRUCTION**
INFORMATION ABOUT PROJECT DOCUMENTATION		
type of documentation		**Project to be implemented**
project number		**PS-21/25**
PLAN INFORMATION		
plan area		**Construction plan**
plan name		**Climbing wall**
plan number		**PS-20/25**
creation date		**28.11.2025**
change date		
INFORMATION ABOUT THE PLAN DESIGNER		
plan designer (company name)		**ZASNOVA - gradbeni biro, Lovšin Tone s.p.,**
address		**Vrvarska pot 1a, 1310 Ribnica**
responsible person of plan designer		**Tone Lovšin**
signature of responsible person of plan designer		ZASNOVA gradbeni biro LOVŠIN TONE s.p. • projektiranje g.o. • gradbeni nadzor • svetovanje Vrvarska pot 1A Ribnica /Dol.
INFORMATION ABOUT THE PLAN PRODUCER		
name and surname of the authorized architect, authorized engineer		**Sandi Mohar, dipl.ing.grad.**
identification number		**IZS G - 4126**
signature of the authorized architect, authorized engineer		SANDI MOHAR dipl.inž.grad. IZS G-4126

ANNEX 2C

STATEMENT OF THE PLAN DESIGNER AND THE AUTHORIZED EXPERT WHO CREATED THE PLAN IN THE PZI AND PID

PLAN DESIGNER	
plan designer (company name)	**ZASNOVA - gradbeni biro, Lovšin Tone s.p.,**
address	**Vrvarska pot 1a, 1310 Ribnica**
plan designer's responsible person	**Tone Lovšin**

AND THE AUTHORIZED EXPERT WHO CREATED THE PLAN	
authorized expert	**Tone lovšin, dipl.ing.grad.**

DECLARATION:

plan is:

type of documentation	**Construction plan**
plan area of expertise	**Climbing wall**
plan name	**PS-21/25**
plan number	**28.11.2025**
date of creation	

complies with relevant regulations and other normative documents and that the relevant essential and other requirements are met.

authorized expert	**Sandi Mohar, dipl.ing.grad.**
identification number	**IZS G - 4126**
signature of authorized expert	

SANDI MOHAR
dipl.inž.grad.
IZS G-4126

responsible person of the plan designer	**Tone Lovšin**
signature of the responsible person of the plan designer	

ZASNOVA • gradbeni biro LOVŠIN TONE s.p.
• projektiranje g.o.
• gradbeni nadzor
• svetovanje
Vrvarska pot 1A
Ribnica /Dol.

ZASNOVA

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www.zasnova.si

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Vsebina

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- Materials used 5

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Live Load 7

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Deflections 8

Static analysis 9

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- ***In plane resistance of connections TYPE B*** 12
- ***In plane resistance of connections TYPE C*** 13
- ***Resistance of connections – horizontal element to rectangular element TYPE D*** 14
- ***Resistance of connections – fixing columns and frame vericals to the concrete floor slab TYPE E*** 15

ZASNOVA

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1310 Ribnica, Slovenija
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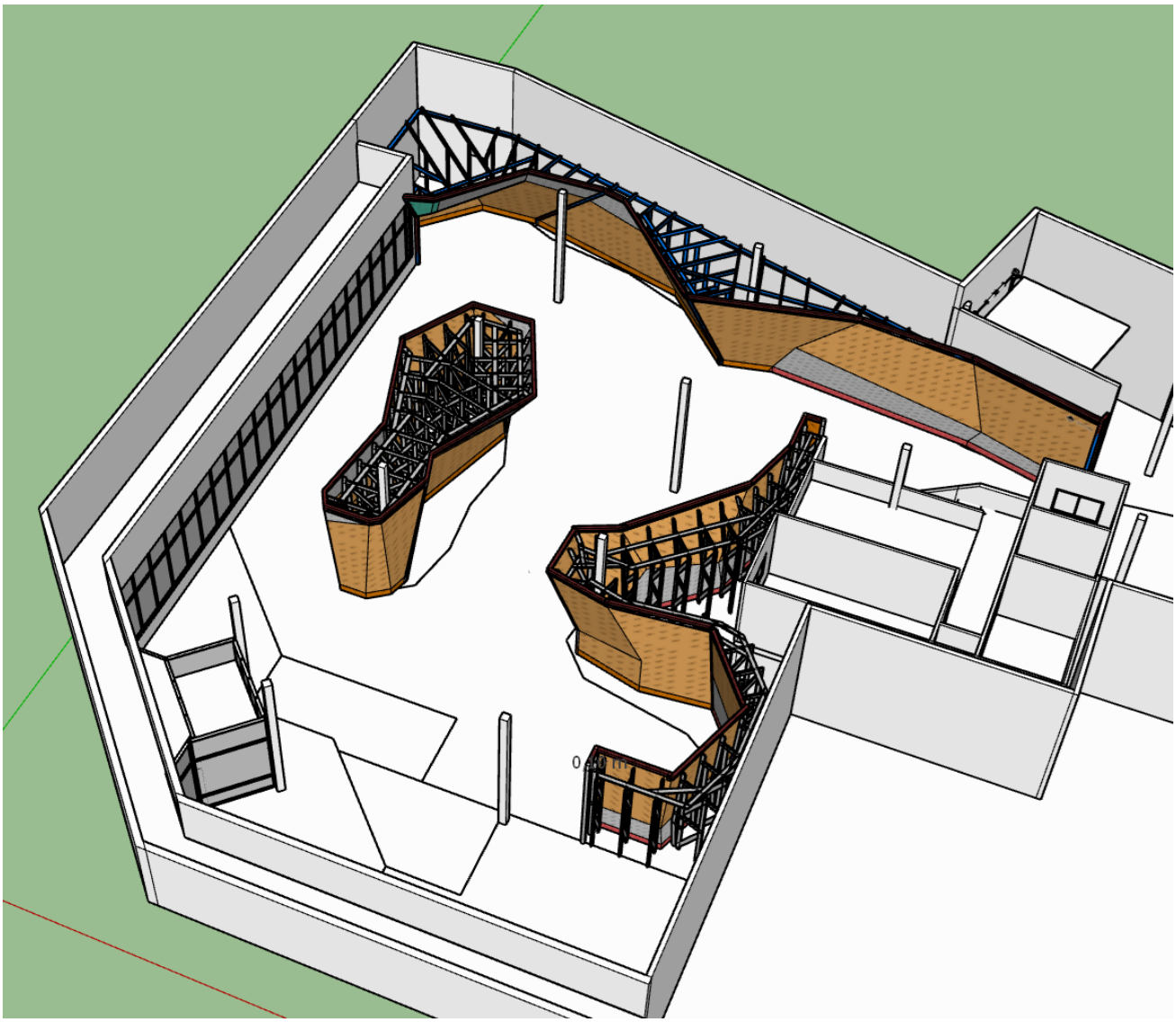
info@zasnova.si
www.zasnova.si

General information about the project

General

The subject of the project is a boulder climbing wall. The wall is located indoors.



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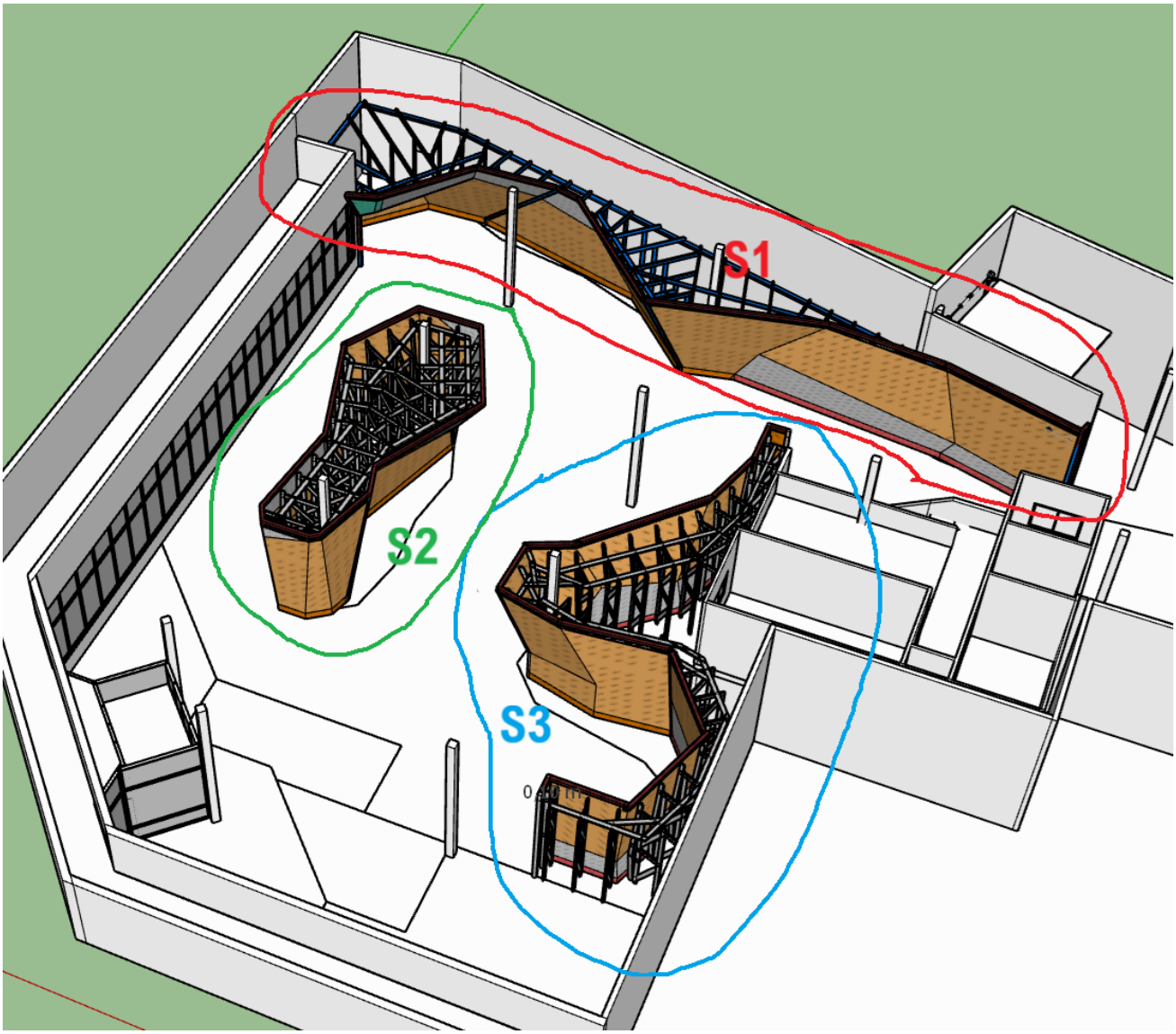

General information

The climbing surface for all walls is represented by birch-plywood boards with the thickness of 21mm. The supporting structure for walls of all sectors is a steel structure.
The wall is ventilated from climbing boards.
The wall joints are mostly screwed with screws M 12. Install at least 2 screws in each joint.
The joints are discussed in detail below.

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Technical report

Climbing surface

The climbing wall will be made of wood. The final surface is 21mm thick plywood panels, which are attached to the steel structure via Fe angles. At the back side panels are connected between each other with wooden plates. This plates are to be screwed on panels with SPAX wood scrwews 6,2x50mm. These screws come with package.

Construction

The timber frames are generally constructed from timber elements, which for the bouldering frames. Part of the wall is made as a free-standing. It is attached only to the floor construction - this is done with 2 x wbr100 angles. Anchoring to concrete walls is done with anchor bolts + epoxy glue.

Materials used

- Wood C24 and GL24 :
- Bolts grade 8.8 and some Torx screws

Static analysis

Technical standards considered

Static analysis, load action determination and the design work is carried out according to the European

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standards Eurocode:

- **Eurocode EN 1990 – Basis of structural design**
- **Eurocode EN 1991-1-1; Actions on structuralism**
- **- Eurocode EN 12572-1; Artificial climbing structures – Part 1; Safe requirements and test methods for ACS with protection points**
- **Eurocode EN 12572-2; Artificial climbing structures – Part 2; Safe requirements and test methods for bouldering walls**
- **Eurocode EN1993-1-8 : Design of steel structures**
- **Eurocode EN1995-1 : Wood design**

Structural design loads for ACS

Structural components are designed for the loads specified in EN 12572-2; Artificial climbing structures – Part 2; Safe requirements and test methods for bouldering walls.

Safety factors:

γG – partial safety factor for permanent effects

γG = 1.0 for favourable effects

γG = 1.35 for unfavourable effects

γQ – partial safety factor for variable effects

γQ = 1.0 for favourable effects

γQ = 1.5 for unfavourable effect:

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▪ Load actions

Dead Load

The dead load comprises the weigh of the steel stucture and weight of the plywood, which is 0,36 kN/m2. Steel plates and bolts are not calculated in the design model. The weight of the steel structure is applied automatically by the structural analysis software.

Climbing wall

Climbing boards (plywood)	$9kN/m^3 \cdot 0,021m$	$= 0,19\ kN/m^2$
Climbing equipment		$= 0,17\ kN/m^2$
	Sum	$\mathbf{= 0,36\ kN/m^2}$

Live Load

Bolder

The live load consists of a gravitational load of magnitude 0,4 kN /m2 acting on the climbing surface of the boulder wall. The load is applied as concentrated forces at the points of attachment of the plywood panels to the steel structure.

Boulder climbing wall

Substitution load per square metre on the climbing surface 0,40 kN/m2

Assessed horizontal force at the top bouldering wall 0,50 kN/m

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Structural analysis

It is made using a computer program Tower 8 (Radimpex).

Deflections

Figure A1.1 - Definitions of vertical deflections

Key :

w_c	Precamber in the unloaded structural member
w_1	Initial part of the deflection under permanent loads of the relevant combination of actions according to expressions (6.14a) to (6.16b)
w_2	Long-term part of the deflection under permanent loads
w_3	Additional part of the deflection due to the variable actions of the relevant combination of actions according to expressions (6.14a) to (6.16b)
w_{tot}	Total deflection as sum of w_1 , w_2 , w_3
w_{max}	Remaining total deflection taking into account the precamber

W_{max} = L/250 – restriciton

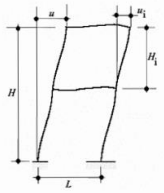

Figure A1.2 - Definition of horizontal displacements

Key :

u	Overall horizontal displacement over the building height H
u_i	Horizontal displacement over a storey height H_i

u_{max} = H/300 conditionally H/150

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Static analysis

- SEGMENT_1

Input data - Structure

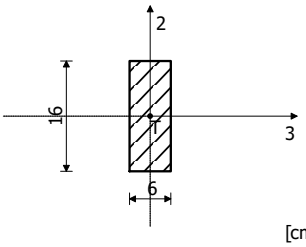
Table of materials

No	Material name	E[kN/m2]	μ	γ[kN/m3]	αt[1/C]	Em[kN/m2]	μm
1	Les-Iglavci-Masiven les	1.000e+7	0.20	5.00	1.000e-5	1.000e+7	0.20

Beam sets

Set: 1 Section: b/d=6/16, Approx. eccentricity

Mat.	A1	A2	A3	I1	I2	I3
1 - Les-Iglavci-M...	9.600e-3	8.000e-3	8.000e-3	8.803e-6	2.880e-6	2.048e-5



[cm]

Set: 2 Section: b/d=6/16, Approx. eccentricity

Mat.	A1	A2	A3	I1	I2	I3
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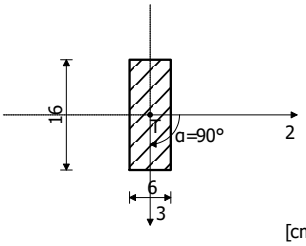
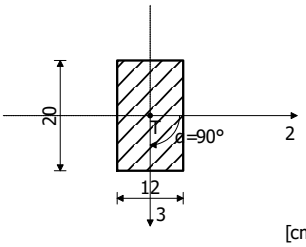


[cm]

Set: 3 Section: b/d=12/20, Approx. eccentricity

Mat.	A1	A2	A3	I1	I2	I3
1 - Les-Iglavci-M...	2.400e-2	2.000e-2	2.000e-2	7.212e-5	8.000e-5	2.880e-5



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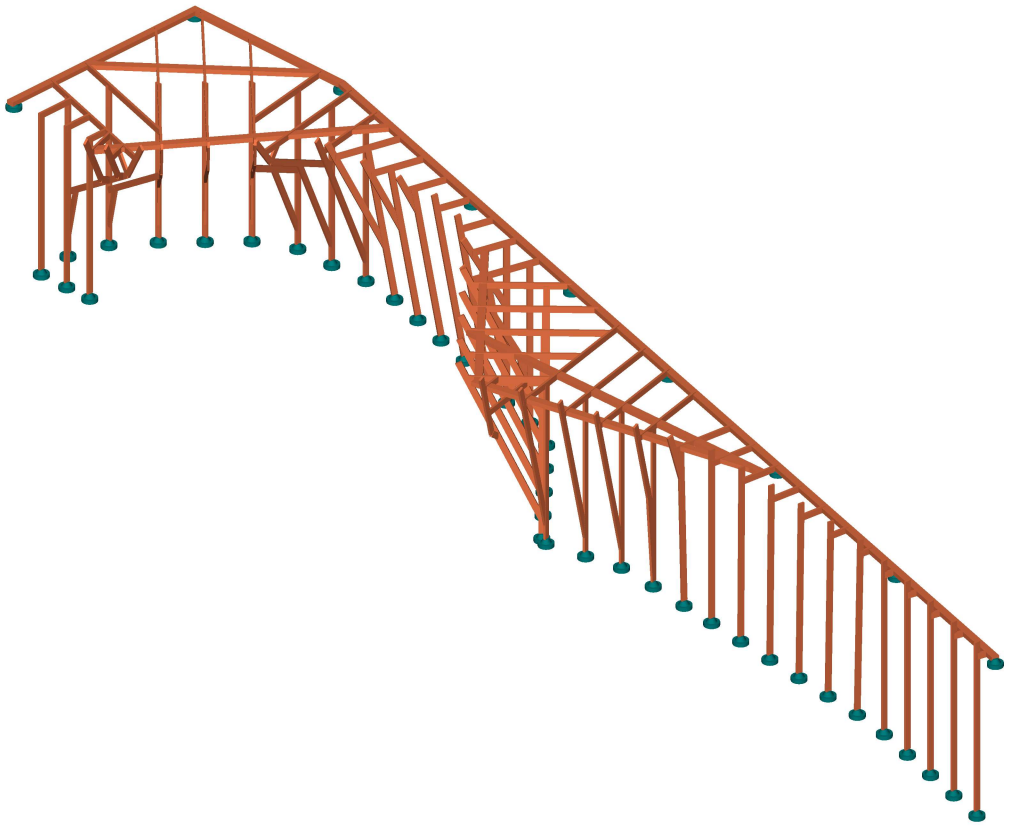
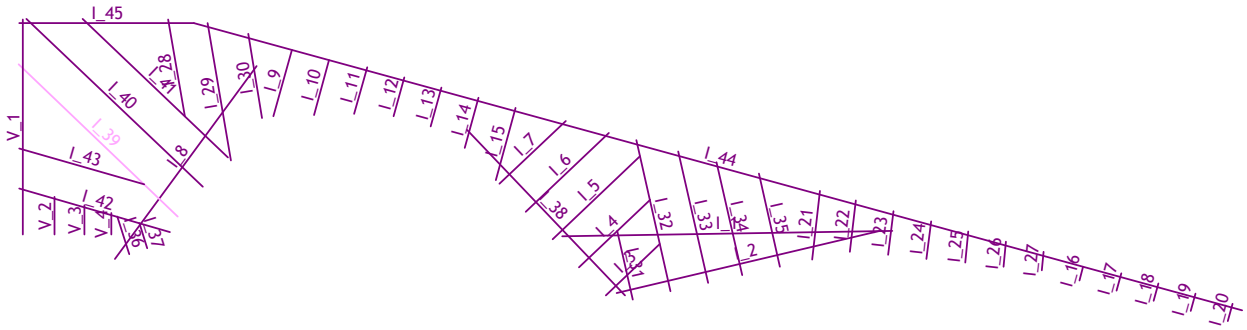
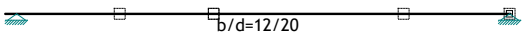


Isometric



Frame disposition



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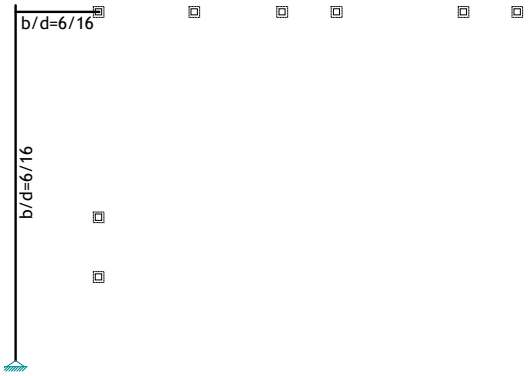

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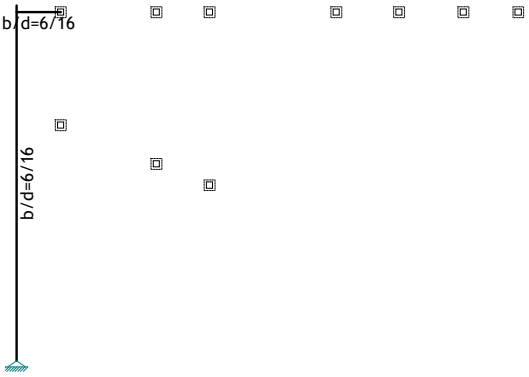
Frame: V_3



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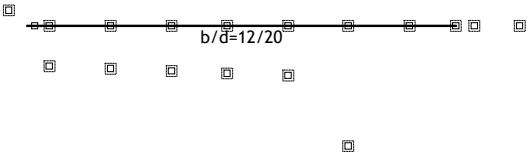
Frame: I_1



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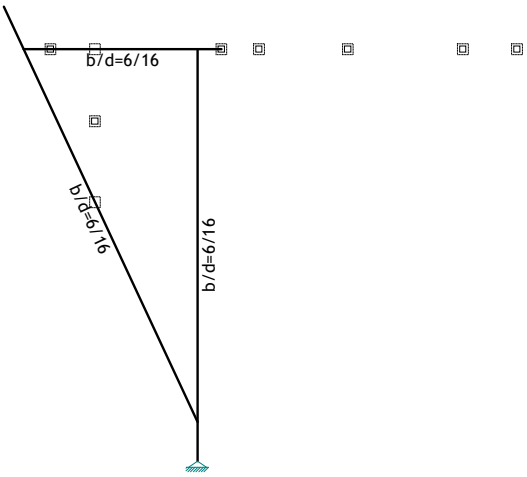

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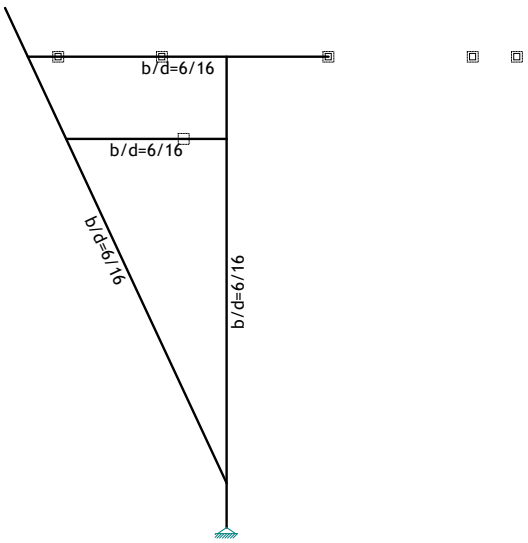

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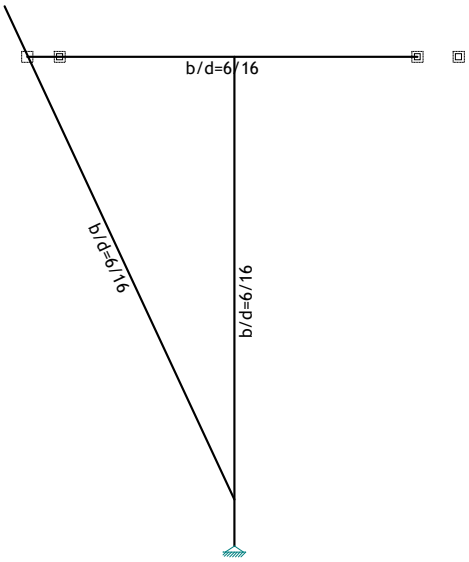

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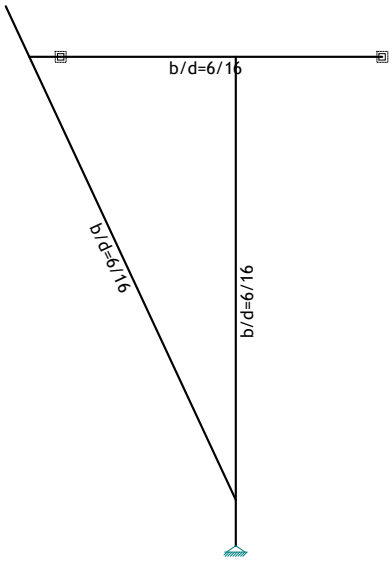

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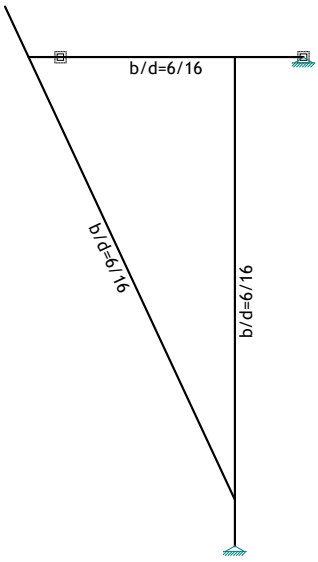

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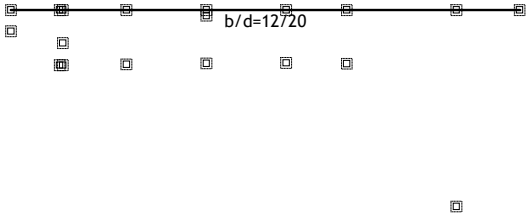

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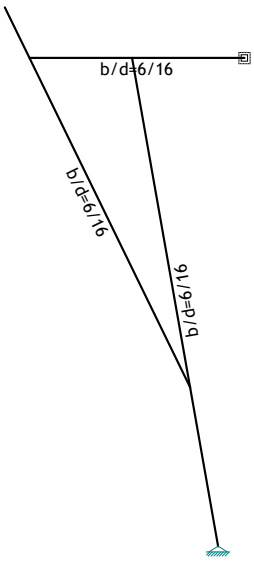

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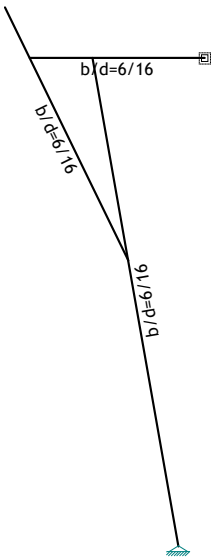

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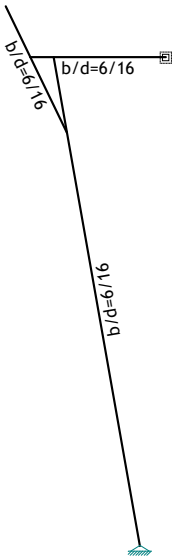

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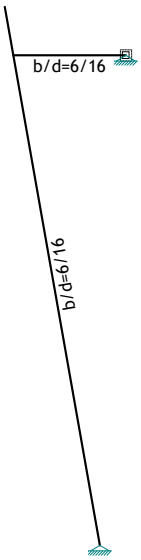

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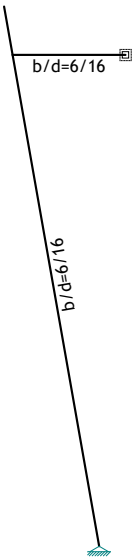

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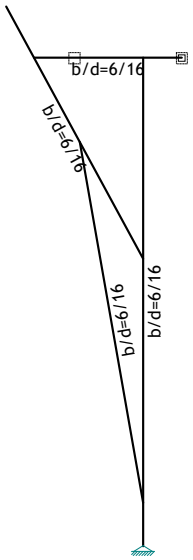

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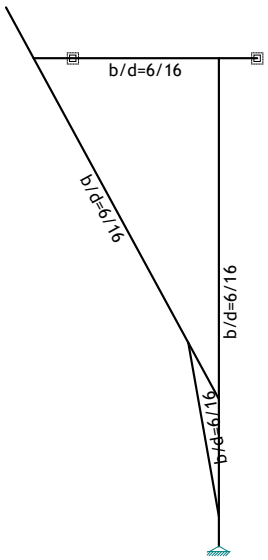

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Frame: I_17

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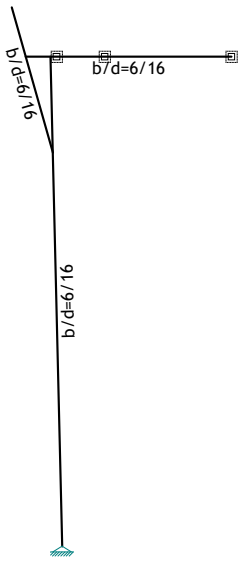

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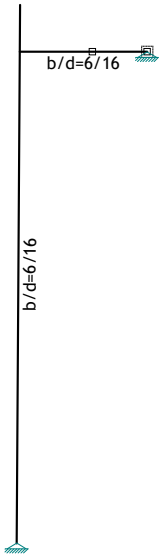

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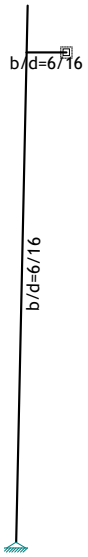

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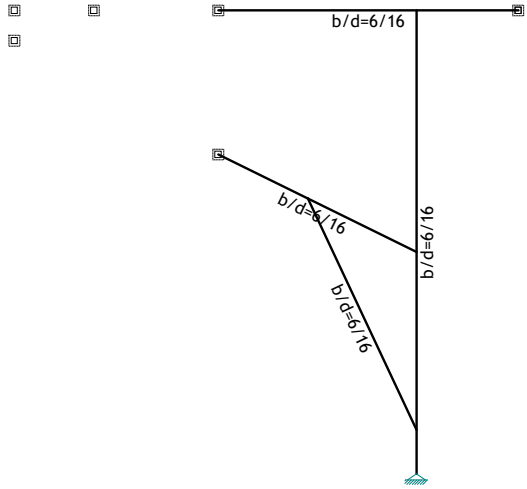

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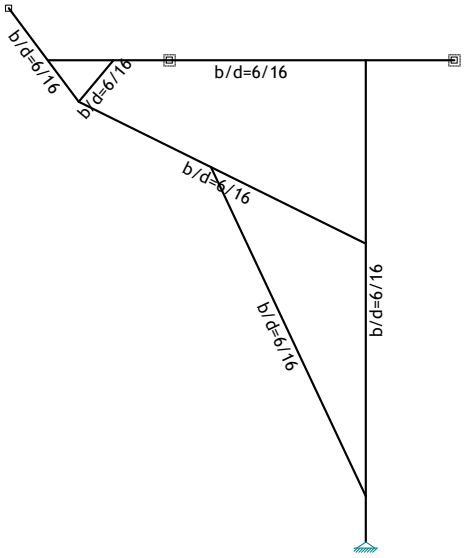

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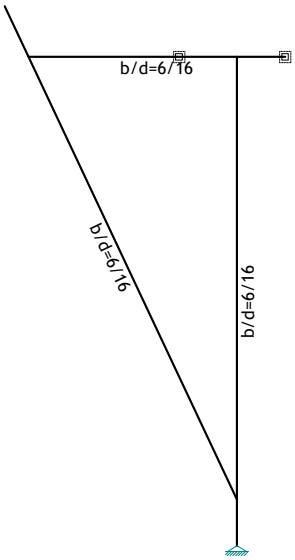

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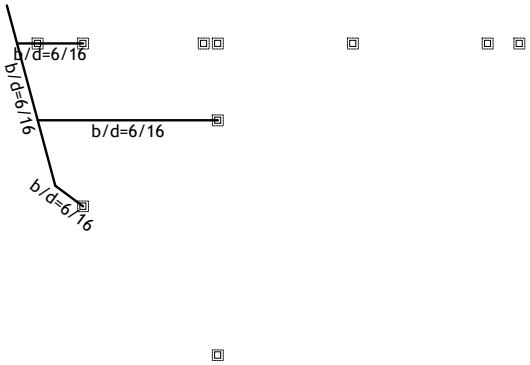

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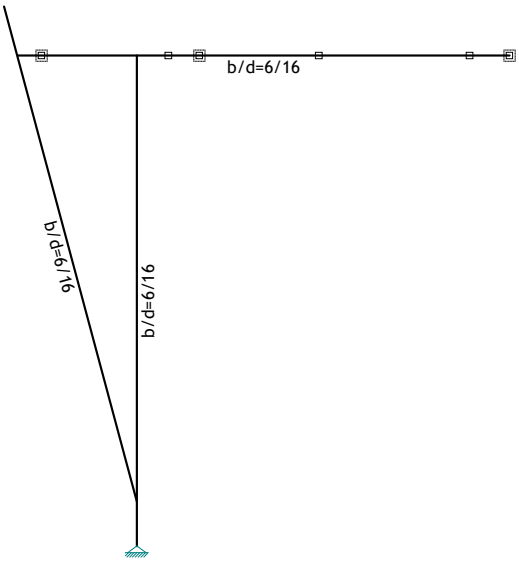

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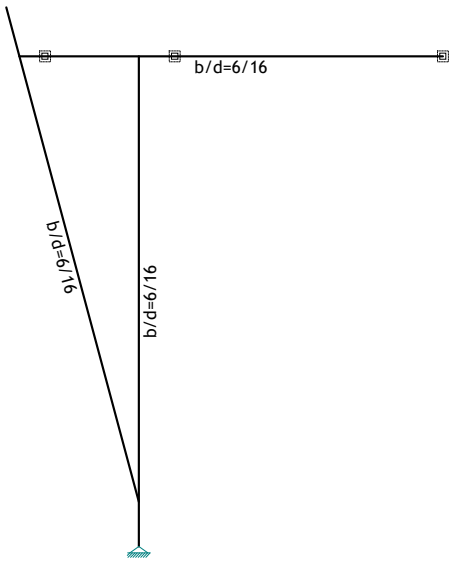

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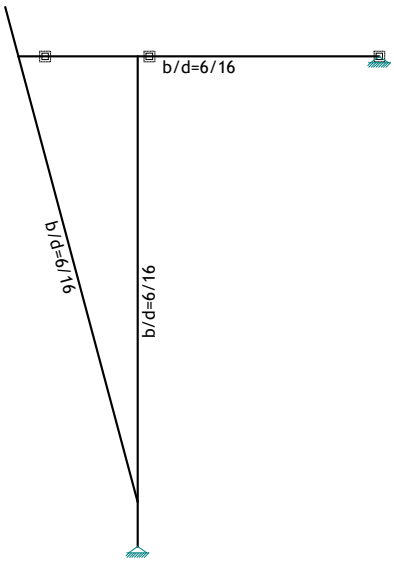

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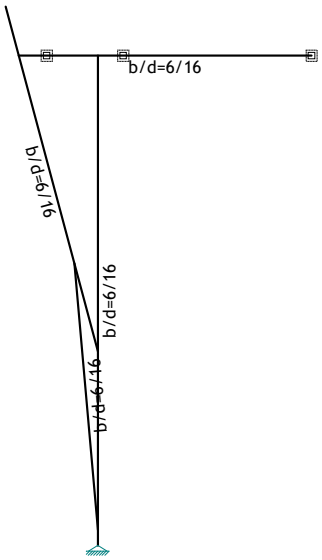

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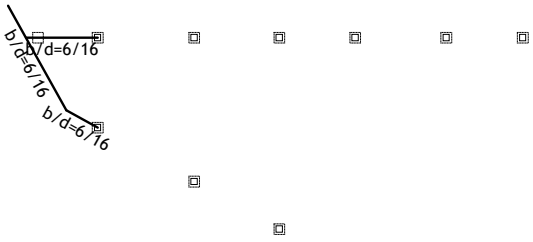

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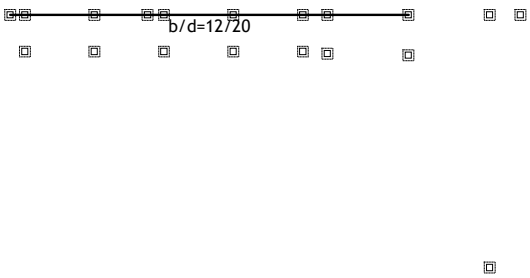

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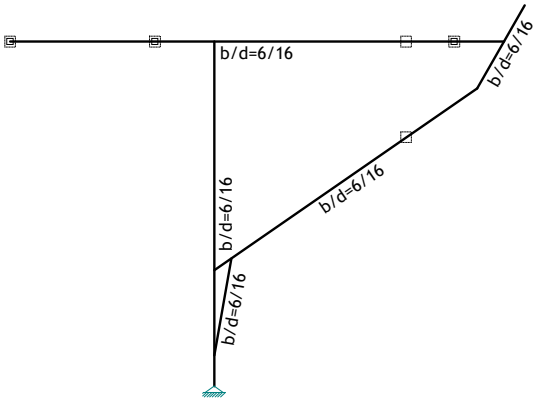

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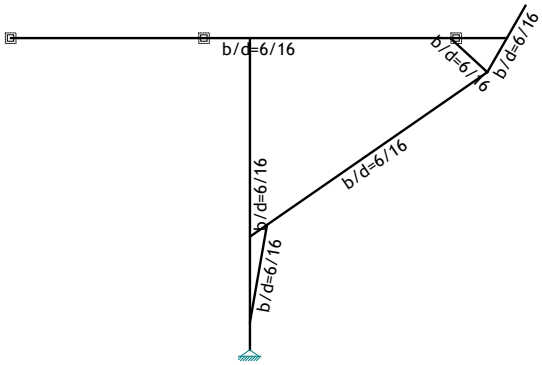

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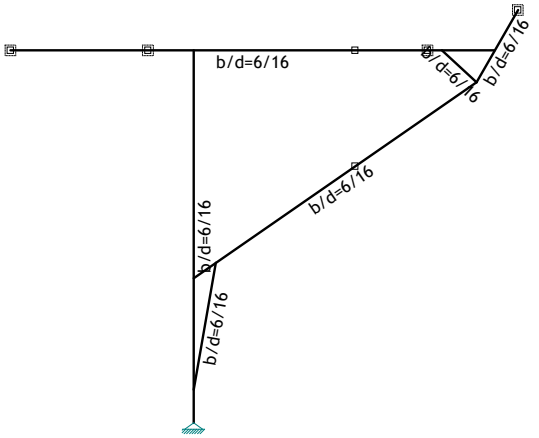

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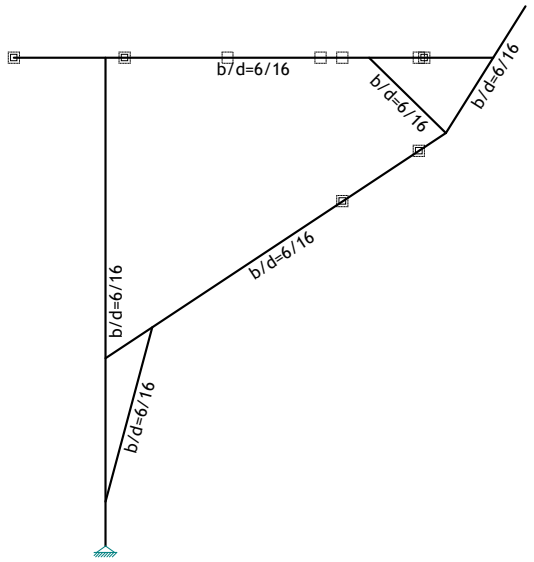

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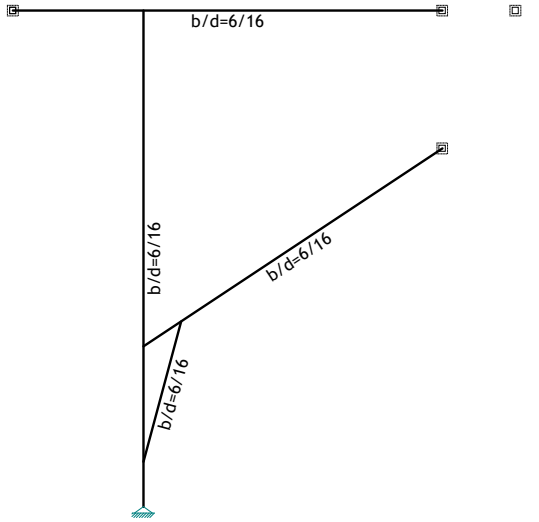

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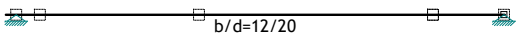

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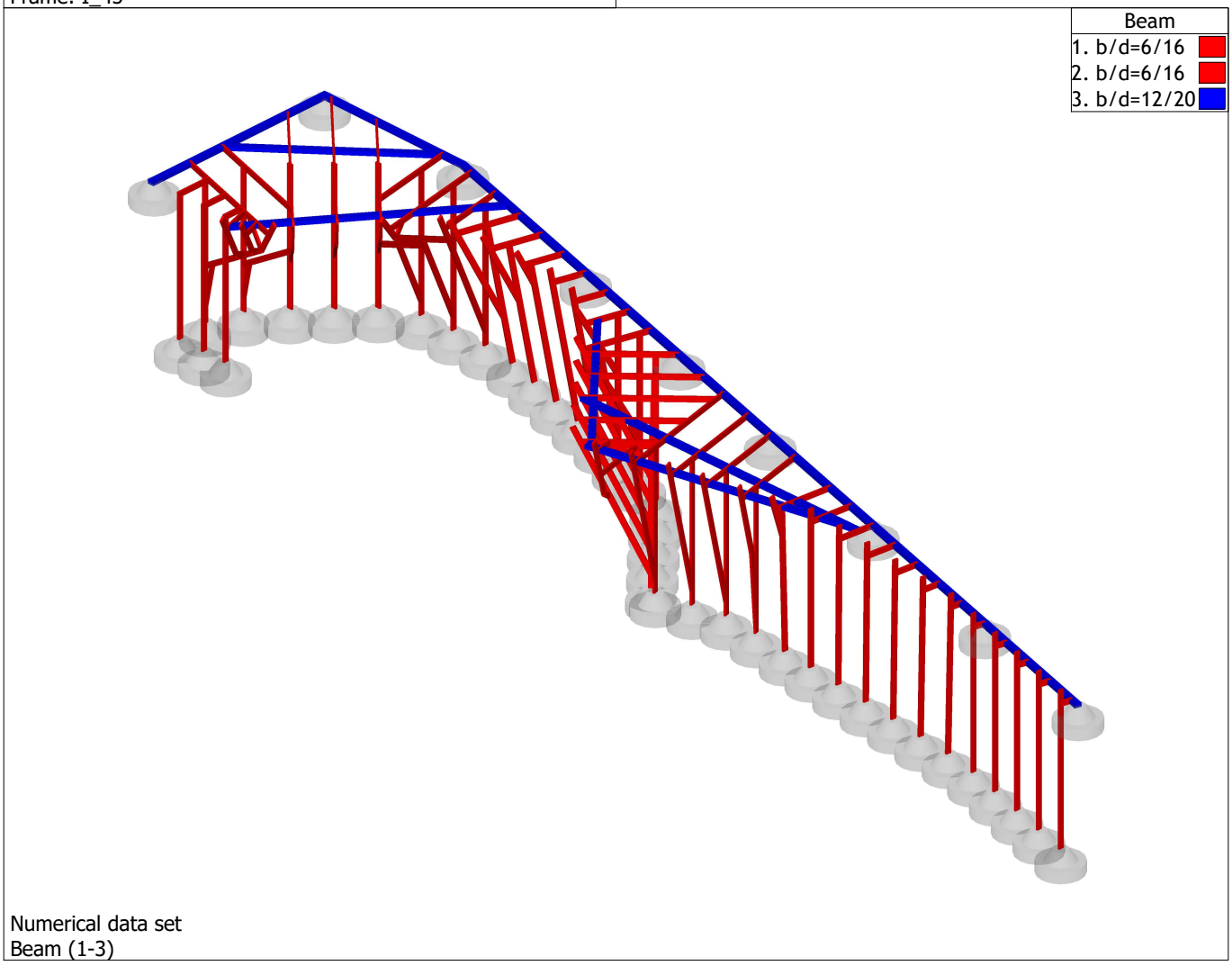
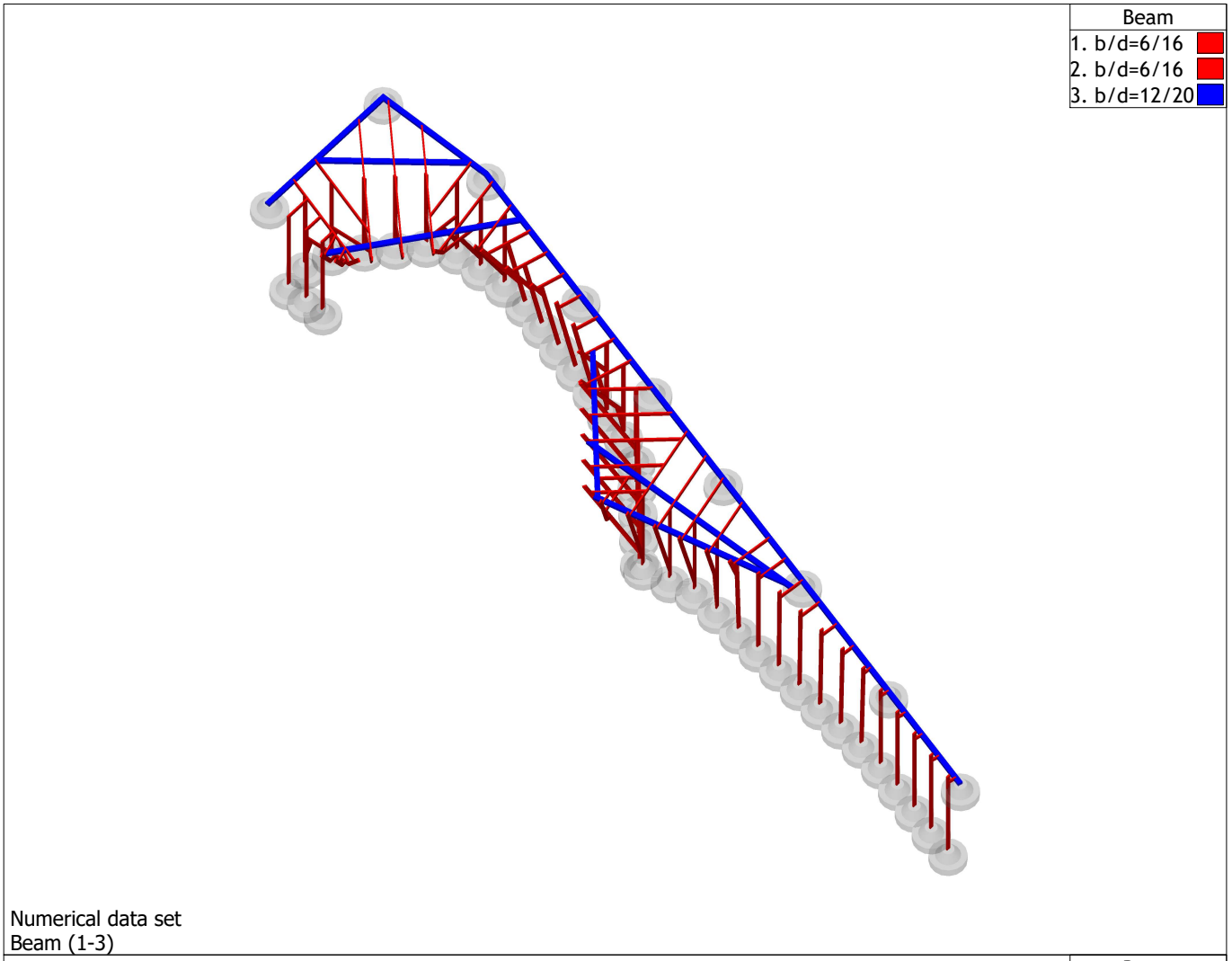
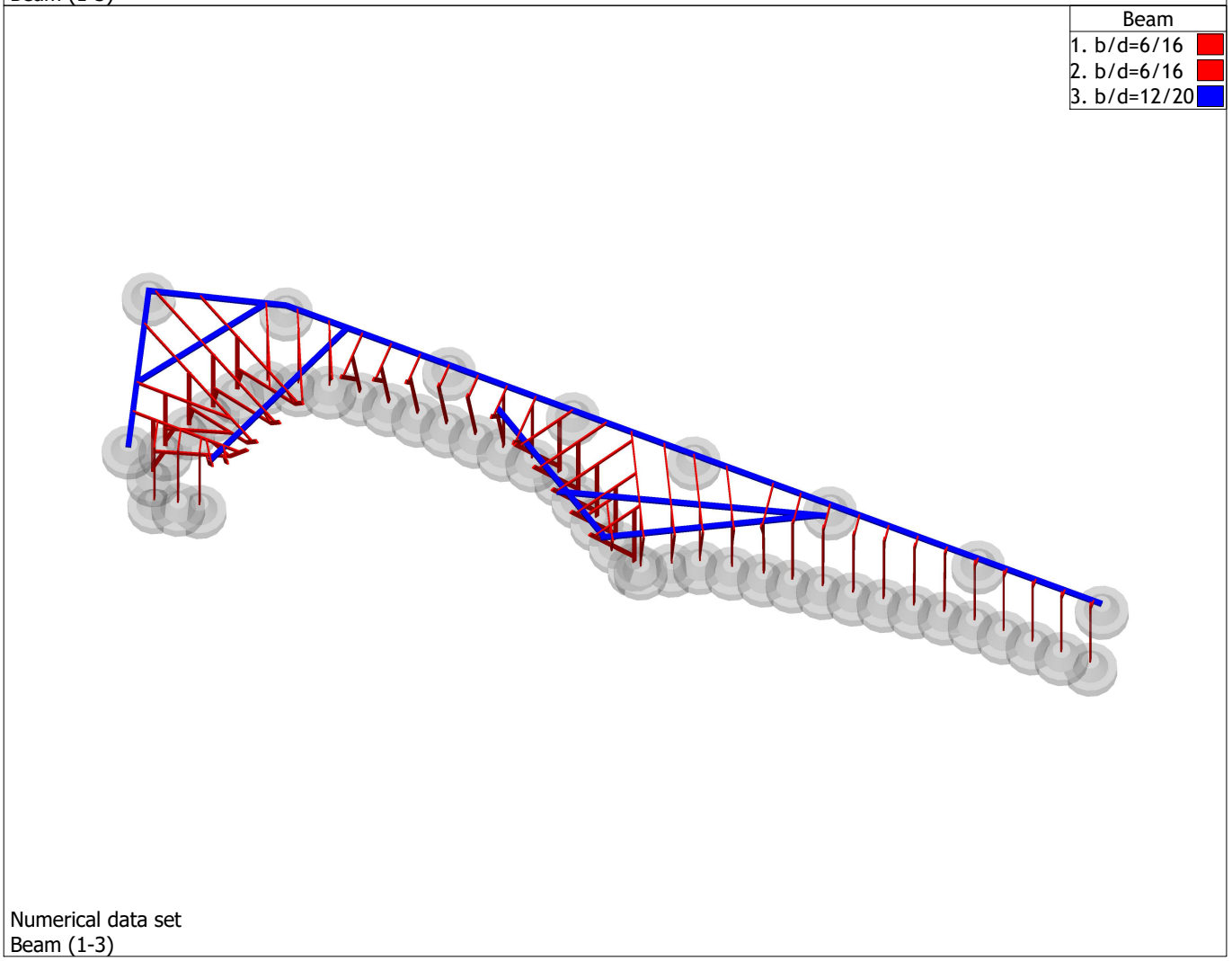


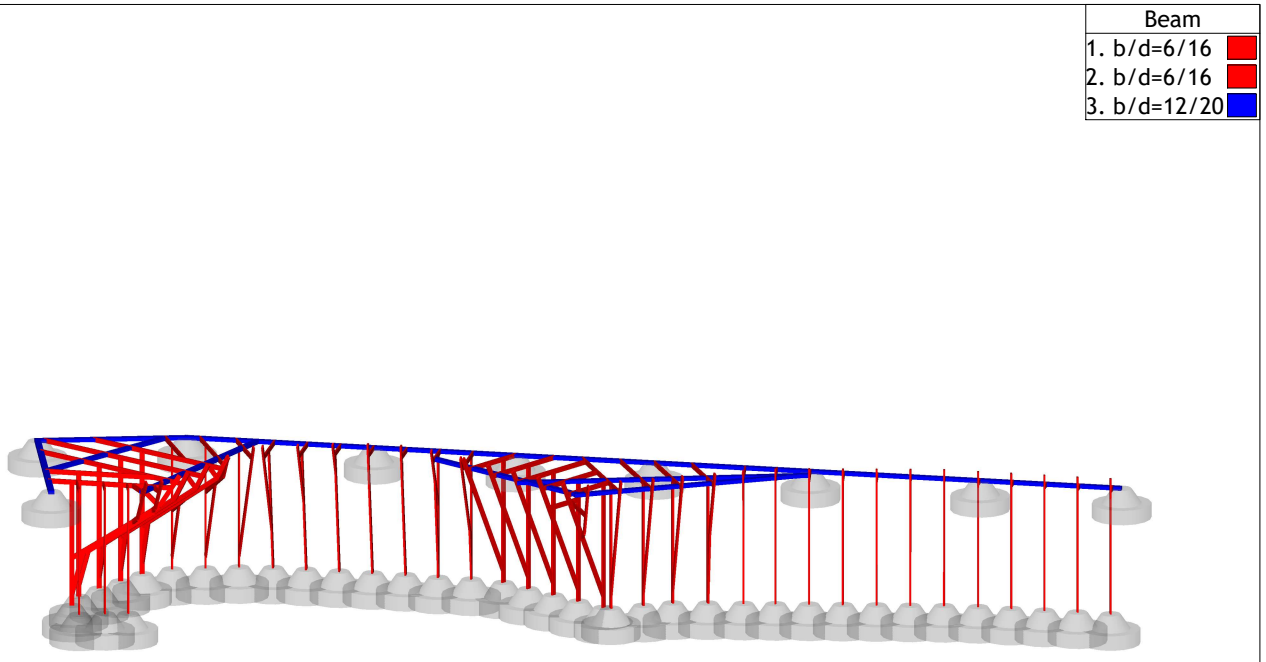
Numerical data set
Beam (1-3)



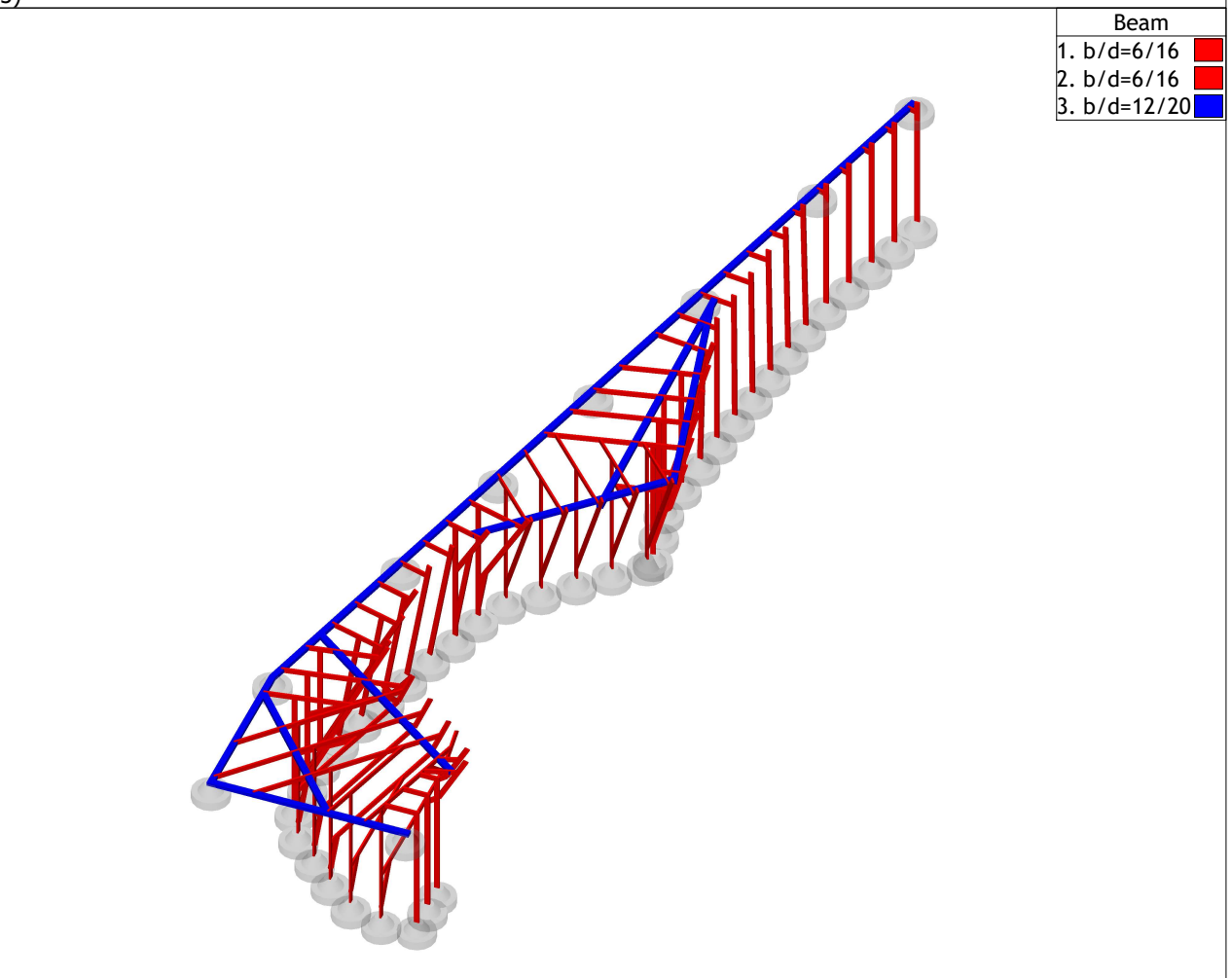
Numerical data set
Beam (1-3)



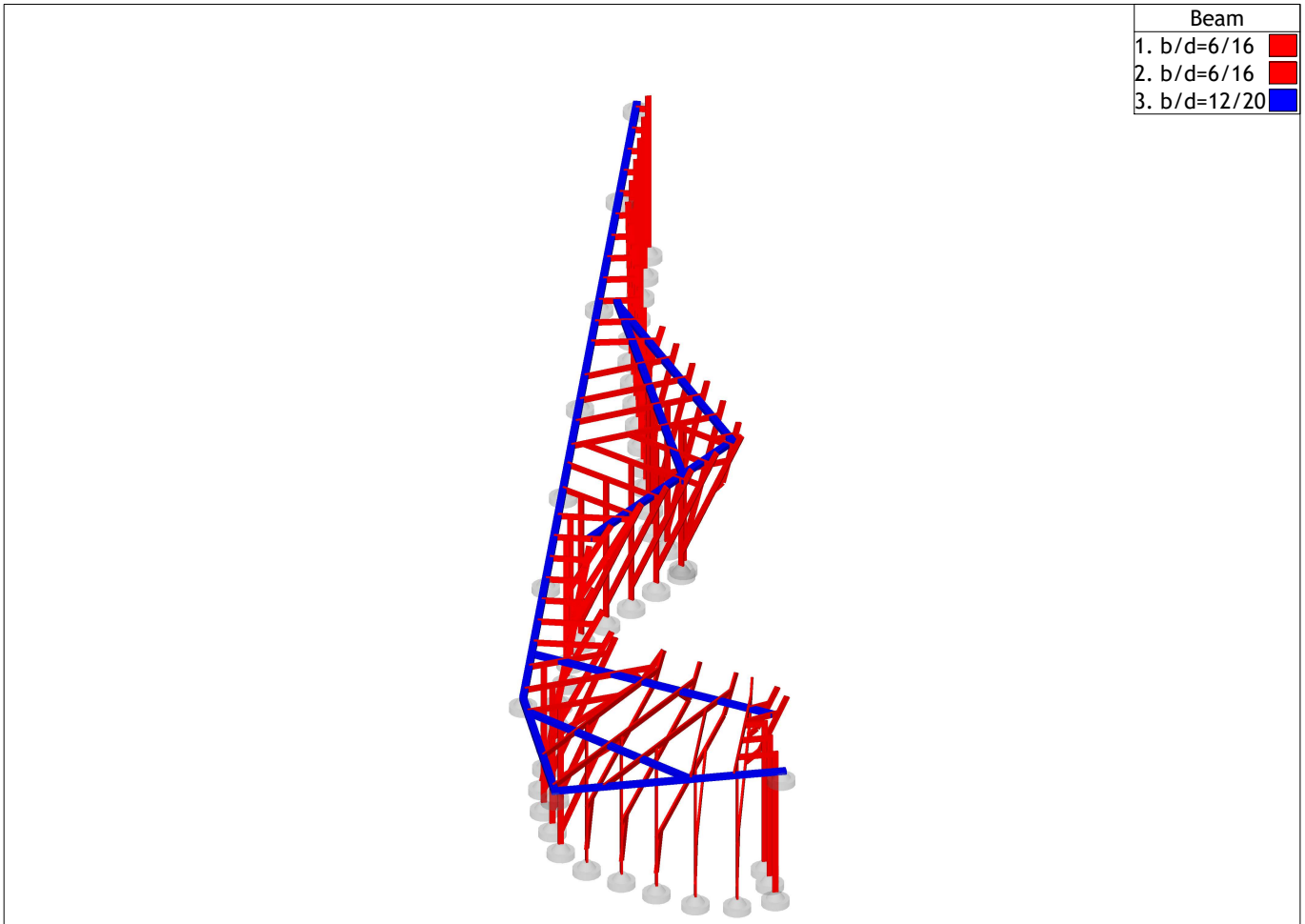
Numerical data set
Beam (1-3)



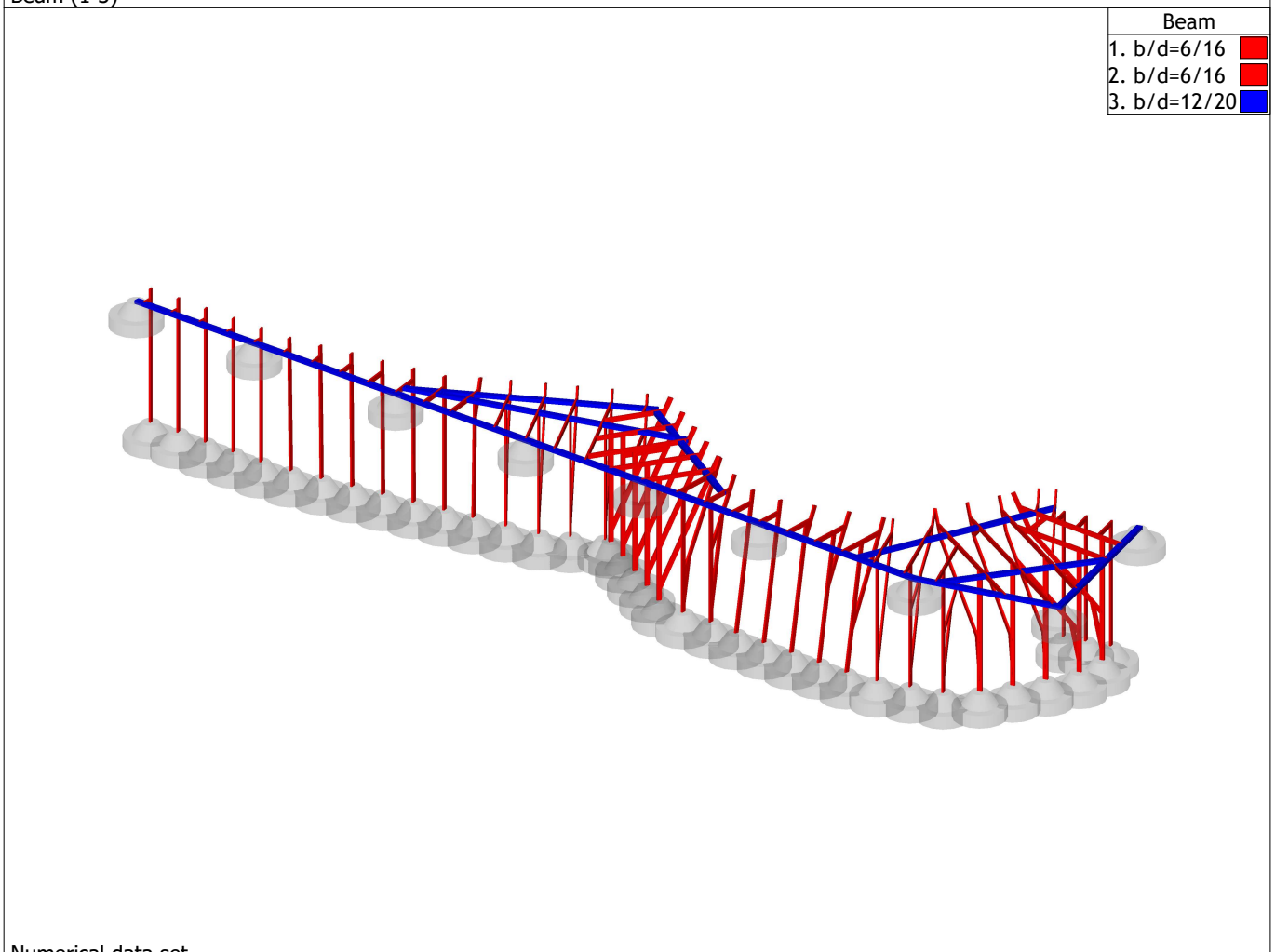
Numerical data set
Beam (1-3)



Numerical data set
Beam (1-3)



Numerical data set
Beam (1-3)



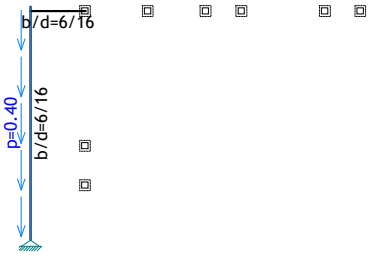
Numerical data set
Beam (1-3)

Input data - Load

Load cases list

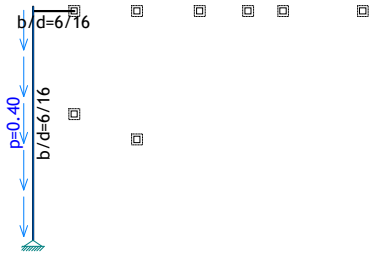
LC	Name	pX [kN]	pY [kN]	pZ [kN]
1	Dead Load (g)	-0.00	-0.00	-86.63
2	Live Load	0.00	0.00	-59.48
3	Live Load (h)	-1.45	-5.30	0.00
4	Comb.: 1.35xI	-0.00	-0.00	-116.95
5	Comb.: 1.35xI+1.5xII	-0.00	-0.00	-206.17
6	Comb.: 1.35xI+1.5xIII	-2.18	-7.96	-116.95
7	Comb.: 1.35xI+1.5xII+1.5xIII	-2.18	-7.96	-206.17
8	Comb.: I	-0.00	-0.00	-86.63
9	Comb.: I+II	-0.00	-0.00	-146.11
10	Comb.: I+III	-1.45	-5.30	-86.63
11	Comb.: I+II+III	-1.45	-5.30	-146.11
12	Comb.: 1.9xI	-0.00	-0.00	-164.59
13	Comb.: 1.9xI+1.29xII	-0.00	-0.00	-241.33
14	Comb.: 1.9xI+1.29xIII	-1.88	-6.84	-164.59
15	Comb.: 1.9xI+1.29xII+1.29xIII	-1.88	-6.84	-241.33

Load 1: Dead Load (g)



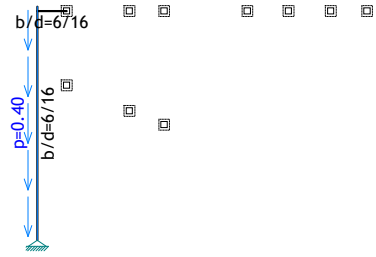
Frame: V_2

Load 1: Dead Load (g)



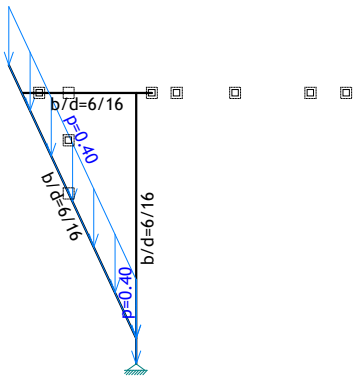
Frame: V_3

Load 1: Dead Load (g)



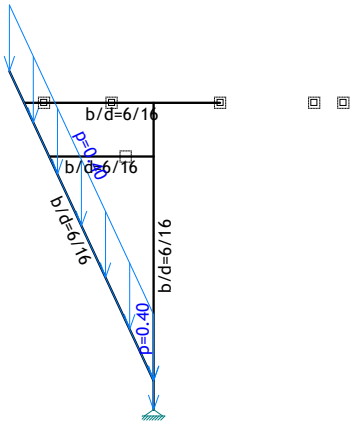
Frame: V_4

Load 1: Dead Load (g)



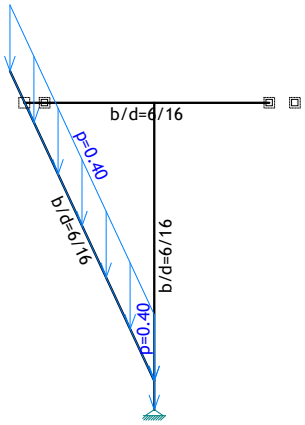
Frame: I_3

Load 1: Dead Load (g)



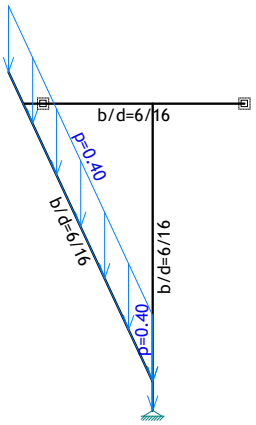
Frame: I_4

Load 1: Dead Load (g)



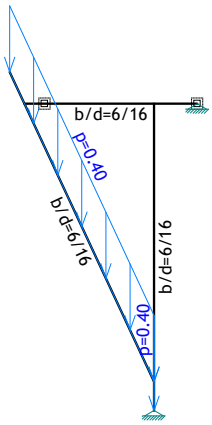
Frame: I_5

Load 1: Dead Load (g)



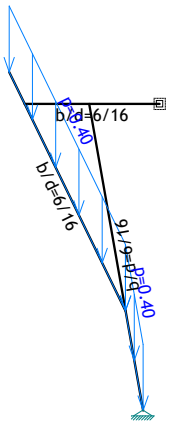
Frame: I_6

Load 1: Dead Load (g)



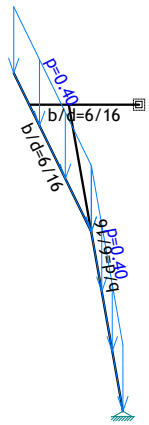
Frame: I_7

Load 1: Dead Load (g)



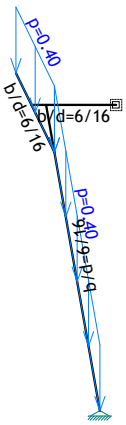
Frame: I_9

Load 1: Dead Load (g)



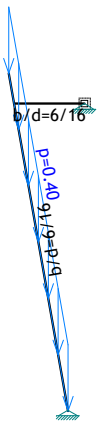
Frame: I_10

Load 1: Dead Load (g)



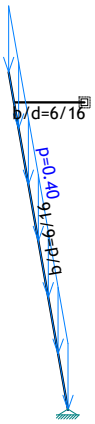
Frame: I_11

Load 1: Dead Load (g)



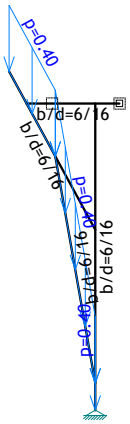
Frame: I_12

Load 1: Dead Load (g)



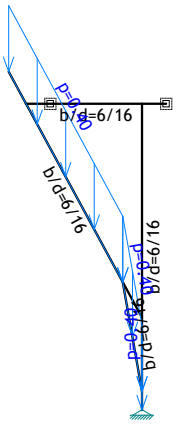
Frame: I_13

Load 1: Dead Load (g)



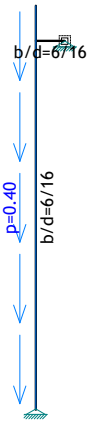
Frame: I_14

Load 1: Dead Load (g)



Frame: I_15

Load 1: Dead Load (g)

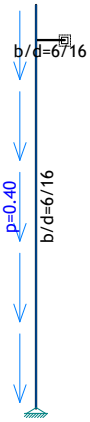


Frame: I_16

Load 1: Dead Load (g)

Frame: I_17

Load 1: Dead Load (g)

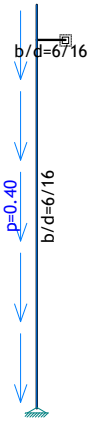


Frame: I_18

Load 1: Dead Load (g)

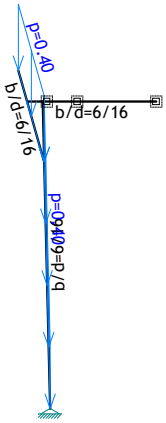
Frame: I_19

Load 1: Dead Load (g)



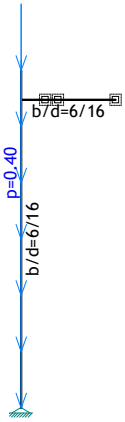
Frame: I_20

Load 1: Dead Load (g)



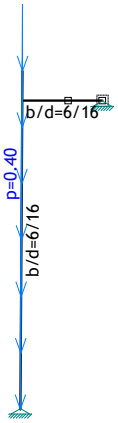
Frame: I_21

Load 1: Dead Load (g)



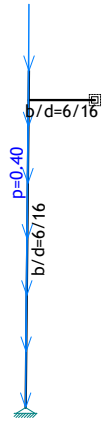
Frame: I_22

Load 1: Dead Load (g)



Frame: I_23

Load 1: Dead Load (g)

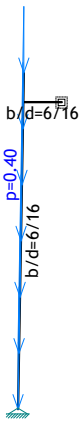


Frame: I_24

Load 1: Dead Load (g)

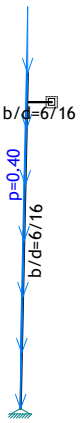
Frame: I_25

Load 1: Dead Load (g)



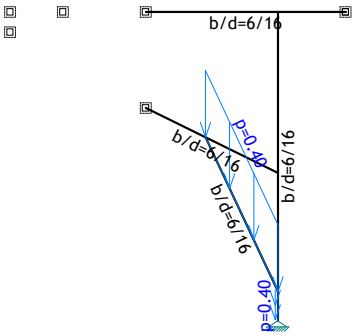
Frame: I_26

Load 1: Dead Load (g)



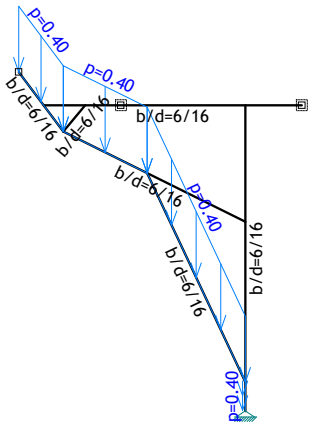
Frame: I_27

Load 1: Dead Load (g)



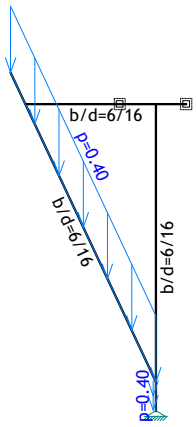
Frame: I_28

Load 1: Dead Load (g)



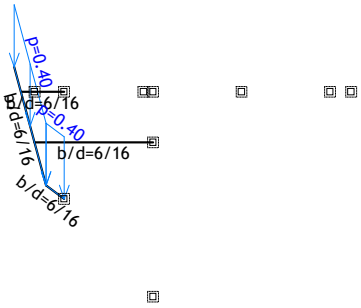
Frame: I_29

Load 1: Dead Load (g)



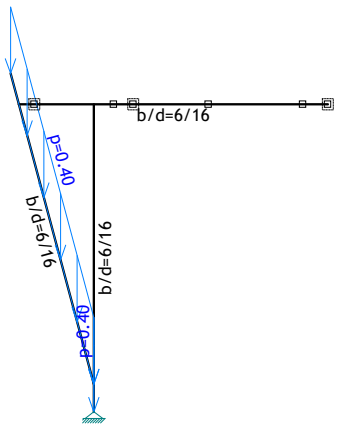
Frame: I_30

Load 1: Dead Load (g)



Frame: I_31

Load 1: Dead Load (g)

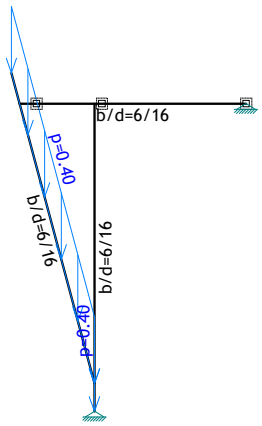


Frame: I_32

Load 1: Dead Load (g)

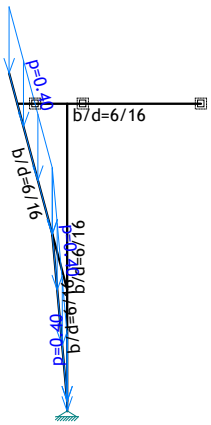
Frame: I_33

Load 1: Dead Load (g)



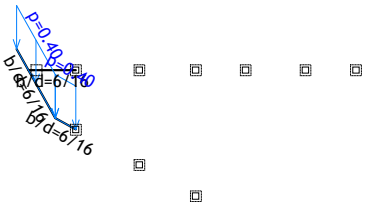
Frame: I_34

Load 1: Dead Load (g)



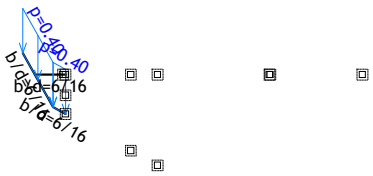
Frame: I_35

Load 1: Dead Load (g)



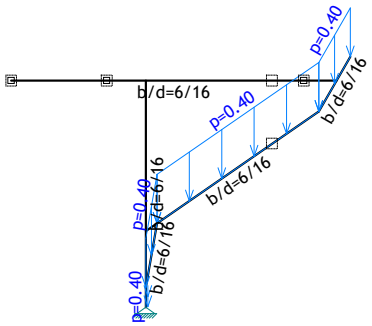
Frame: I_36

Load 1: Dead Load (g)



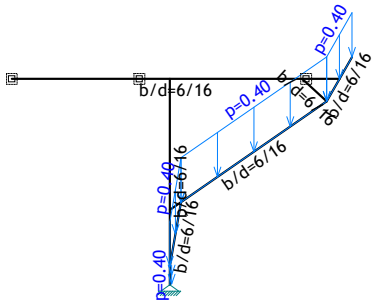
Frame: I_37

Load 1: Dead Load (g)



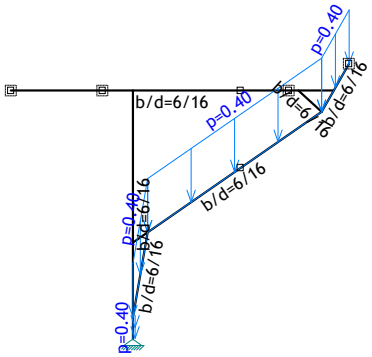
Frame: I_39

Load 1: Dead Load (g)



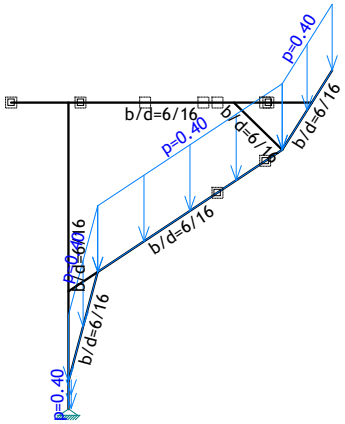
Frame: I_40

Load 1: Dead Load (g)



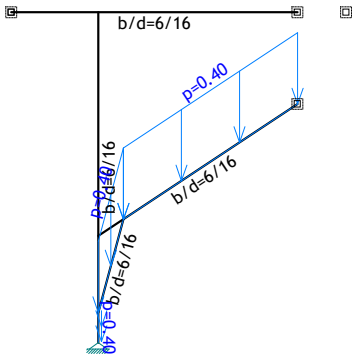
Frame: I_41

Load 1: Dead Load (g)



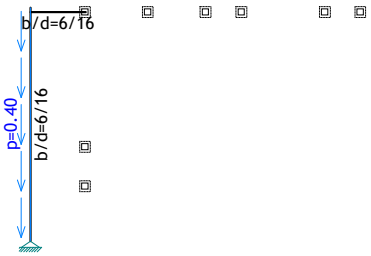
Frame: I_42

Load 1: Dead Load (g)



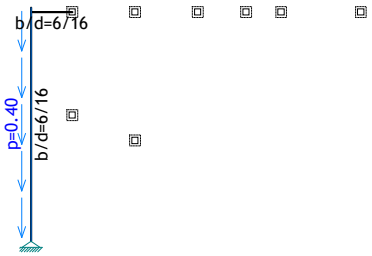
Frame: I_43

Load 2: Live Load



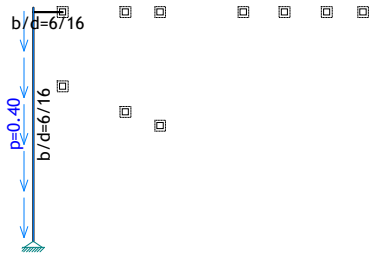
Frame: V_2

Load 2: Live Load



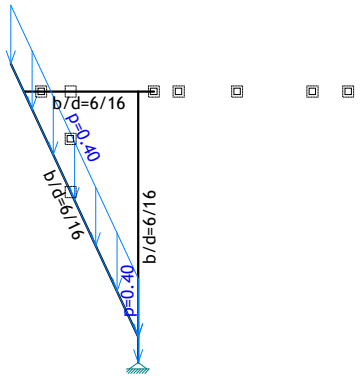
Frame: V_3

Load 2: Live Load



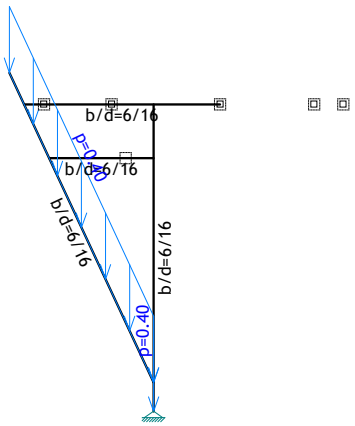
Frame: V_4

Load 2: Live Load



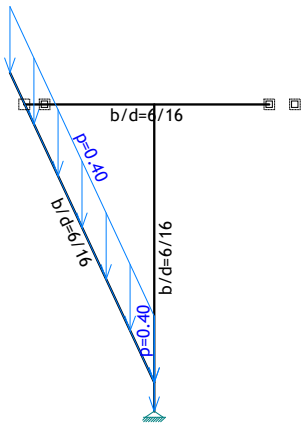
Frame: I_3

Load 2: Live Load



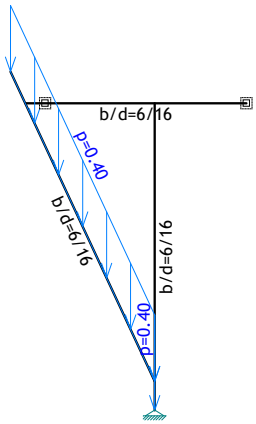
Frame: I_4

Load 2: Live Load



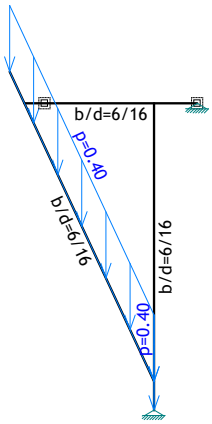
Frame: I_5

Load 2: Live Load



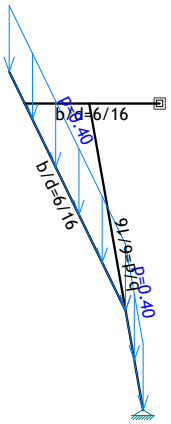
Frame: I_6

Load 2: Live Load



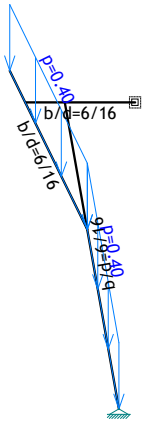
Frame: I_7

Load 2: Live Load



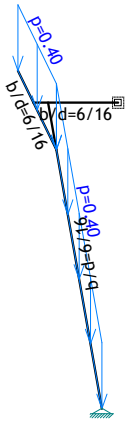
Frame: I_9

Load 2: Live Load



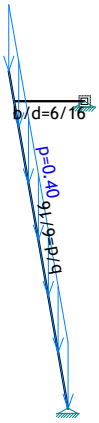
Frame: I_10

Load 2: Live Load



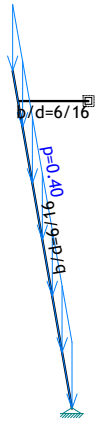
Frame: I_11

Load 2: Live Load



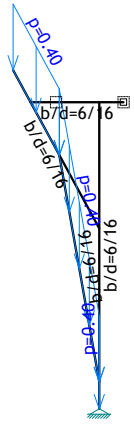
Frame: I_12

Load 2: Live Load



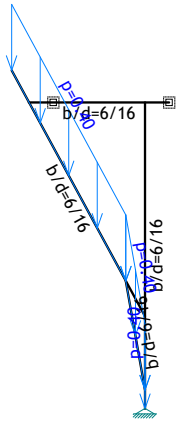
Frame: I_13

Load 2: Live Load



Frame: I_14

Load 2: Live Load



Frame: I_15

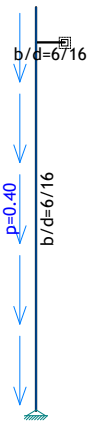
Load 2: Live Load

Frame: I_16

Load 2: Live Load

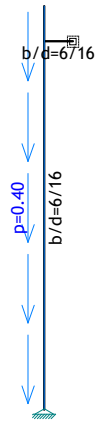
Frame: I_17

Load 2: Live Load



Frame: I_18

Load 2: Live Load

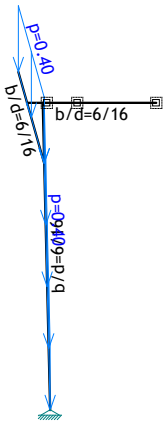


Frame: I_19

Load 2: Live Load

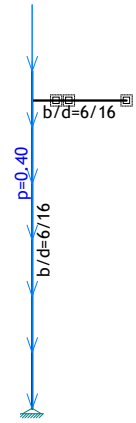
Frame: I_20

Load 2: Live Load



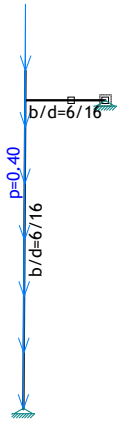
Frame: I_21

Load 2: Live Load



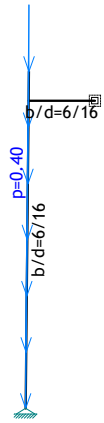
Frame: I_22

Load 2: Live Load



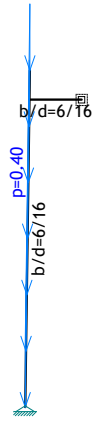
Frame: I_23

Load 2: Live Load



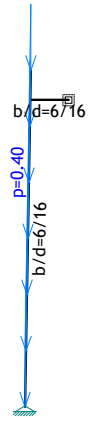
Frame: I_24

Load 2: Live Load



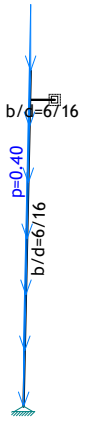
Frame: I_25

Load 2: Live Load



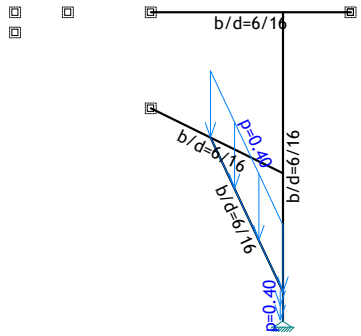
Frame: I_26

Load 2: Live Load



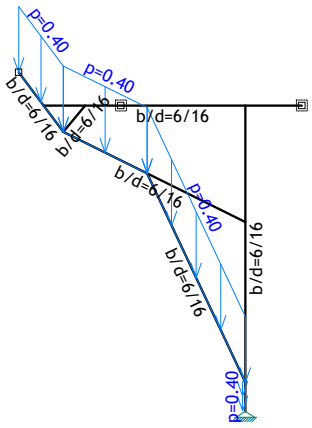
Frame: I_27

Load 2: Live Load



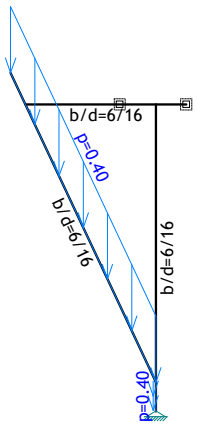
Frame: I_28

Load 2: Live Load



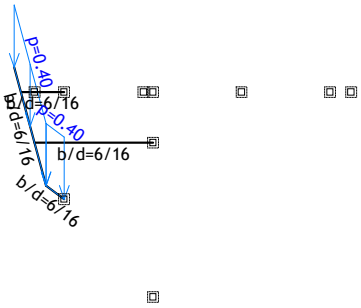
Frame: I_29

Load 2: Live Load



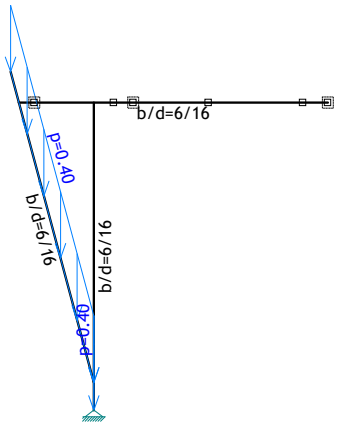
Frame: I_30

Load 2: Live Load



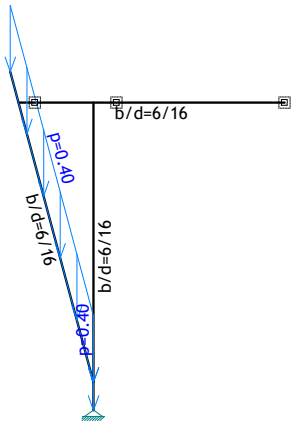
Frame: I_31

Load 2: Live Load



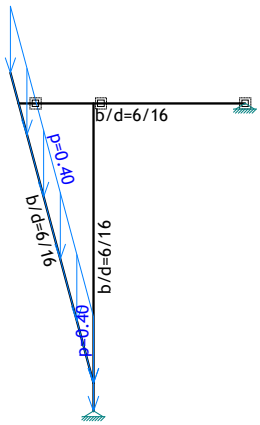
Frame: I_32

Load 2: Live Load



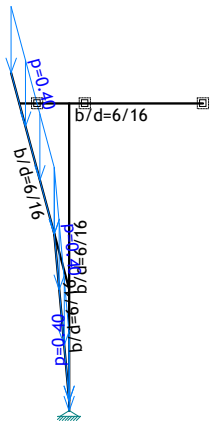
Frame: I_33

Load 2: Live Load



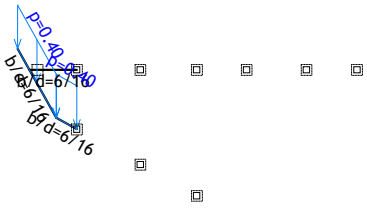
Frame: I_34

Load 2: Live Load



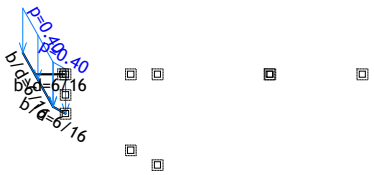
Frame: I_35

Load 2: Live Load



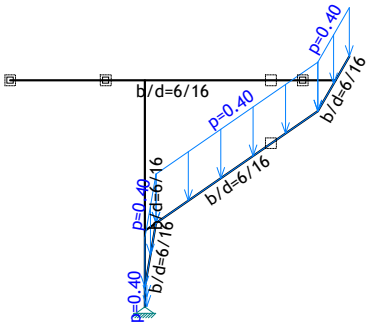
Frame: I_36

Load 2: Live Load



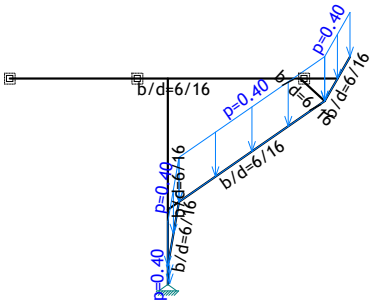
Frame: I_37

Load 2: Live Load



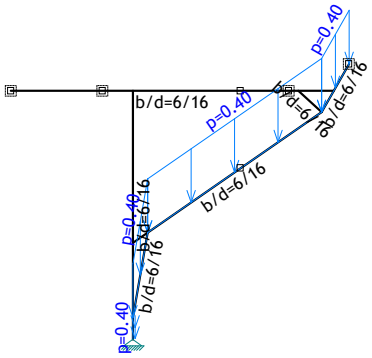
Frame: I_39

Load 2: Live Load



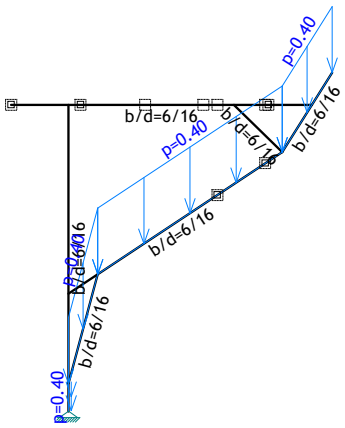
Frame: I_40

Load 2: Live Load



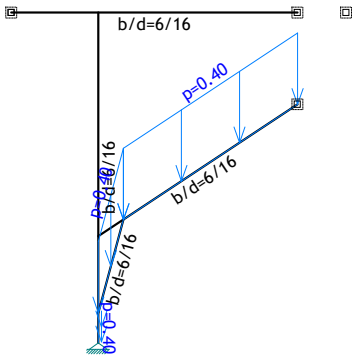
Frame: I_41

Load 2: Live Load



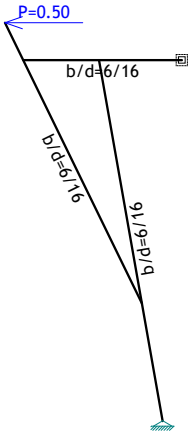
Frame: I_42

Load 2: Live Load



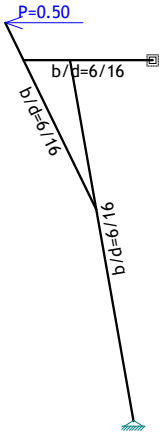
Frame: I_43

Load 3: Live Load (h)



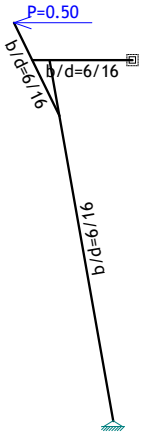
Frame: I_9

Load 3: Live Load (h)



Frame: I_10

Load 3: Live Load (h)



Frame: I_11

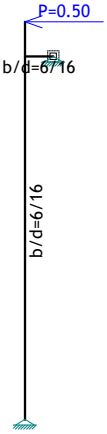
Load 3: Live Load (h)

Frame: I_12

Load 3: Live Load (h)

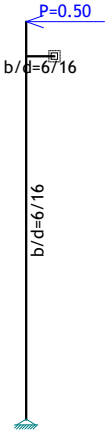
Frame: I_13

Load 3: Live Load (h)



Frame: I_16

Load 3: Live Load (h)



Frame: I_17

Load 3: Live Load (h)

Frame: I_24

Load 3: Live Load (h)

Frame: I_25

Load 3: Live Load (h)

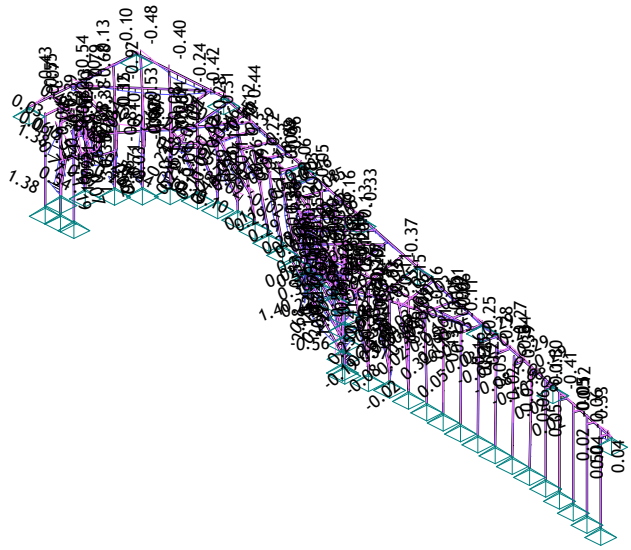
Frame: I_26

Load 3: Live Load (h)

Frame: I_27

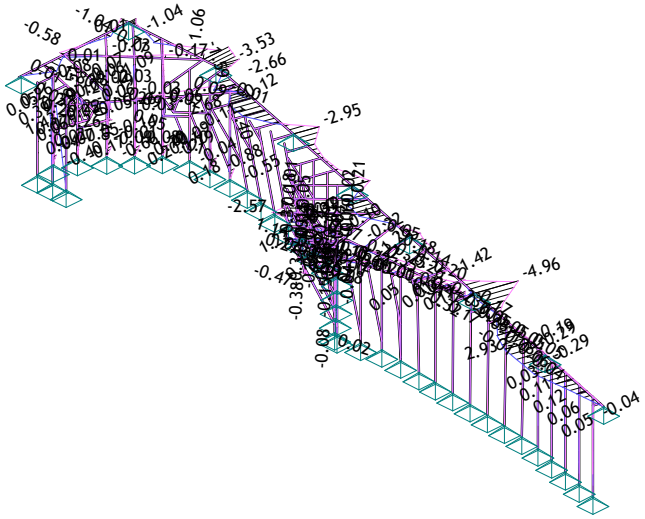
Structural analysis

Load 16: [MSN] 4-7



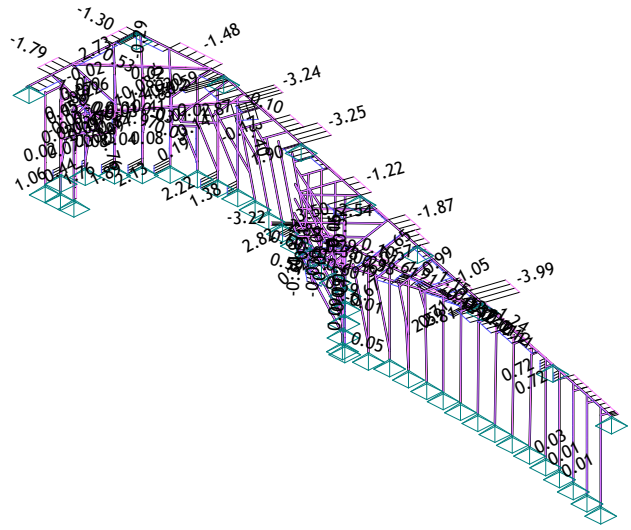
Isometric
Beam Results: max M3= 2.68 / min M3= -3.78 kNm

Load 16: [MSN] 4-7



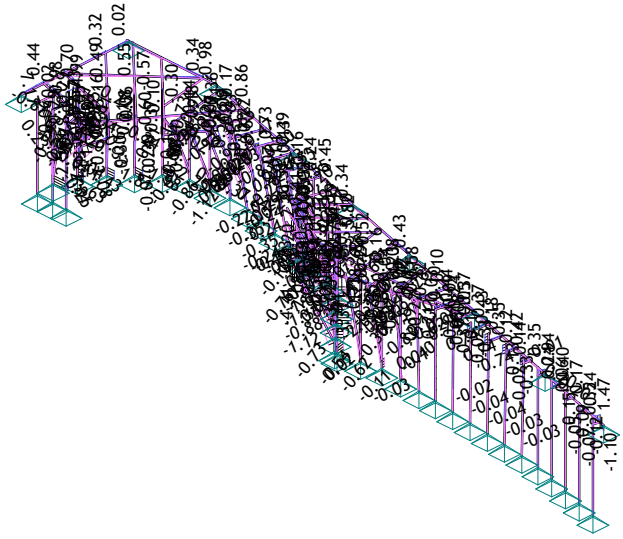
Isometric
Beam Results: max M2= 2.93 / min M2= -4.96 kNm

Load 16: [MSN] 4-7



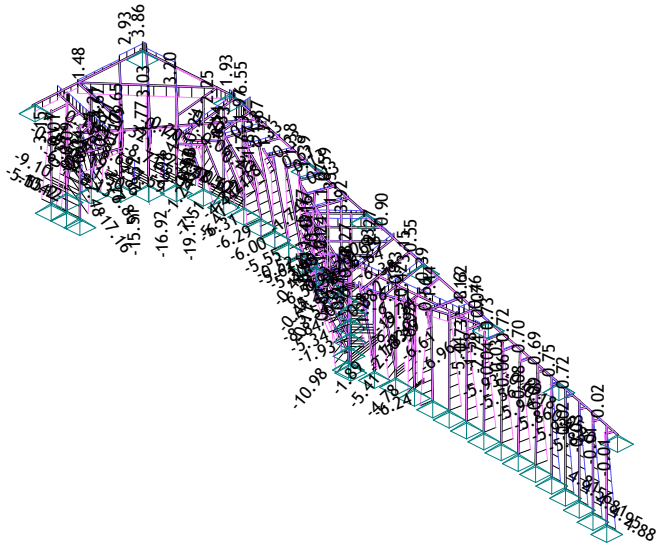
Isometric
Beam Results: max V3= 4.70 / min V3= -3.99 kN

Load 16: [MSN] 4-7



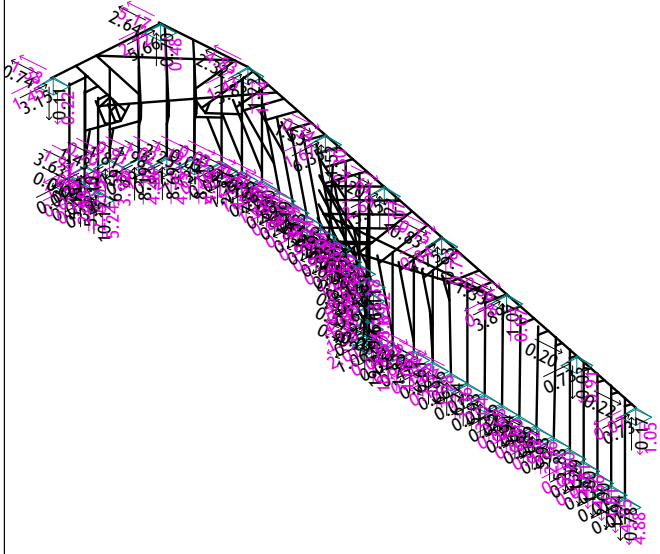
Isometric
Beam Results: max V2= 8.73 / min V2= -4.43 kN

Load 16: [MSN] 4-7



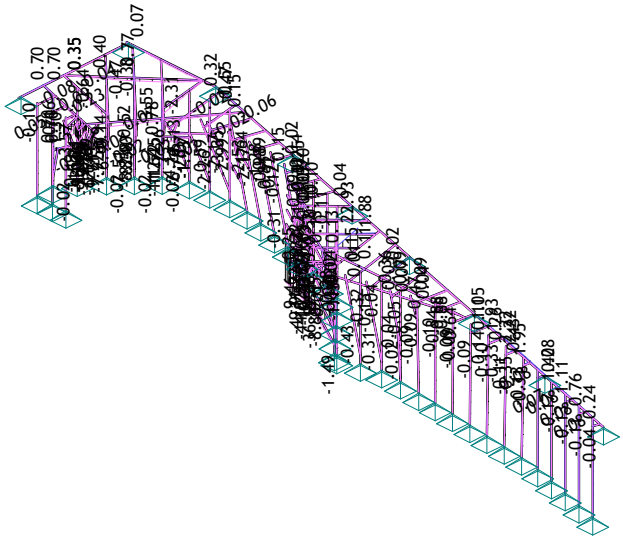
Isometric
Beam Results: max N1= 10.62 / min N1= -19.34 kN

Load 16: [MSN] 4-7



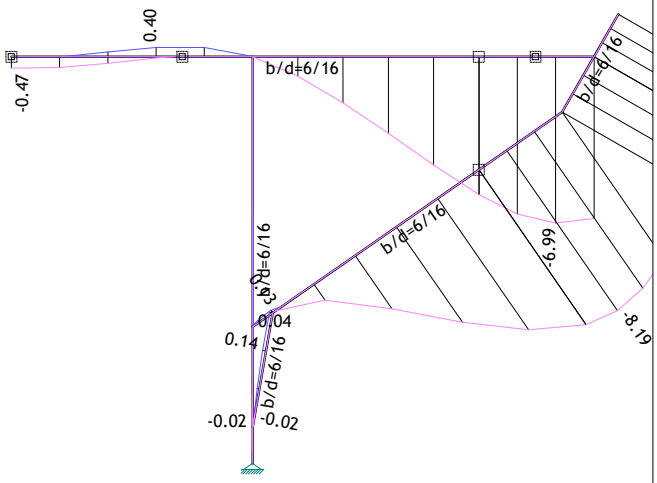
Isometric
Support Reactions

Load 17: [MSU (T=0)] 8-11



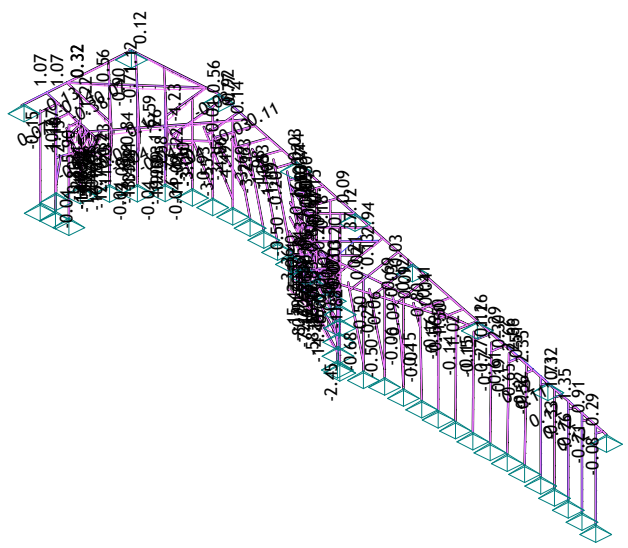
Isometric
Beam Results: max Zd= 22.93 / min Zd= -49.95 m / 1000

Load 17: [MSU (T=0)] 8-11



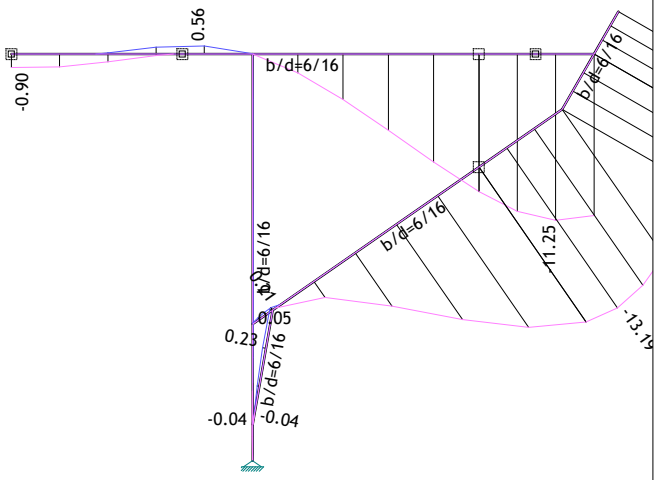
Frame: I_39
Beam Results: max Zd= 0.40 / min Zd= -8.19 m / 1000

Load 18: [MSU (T=fin)] 12-15



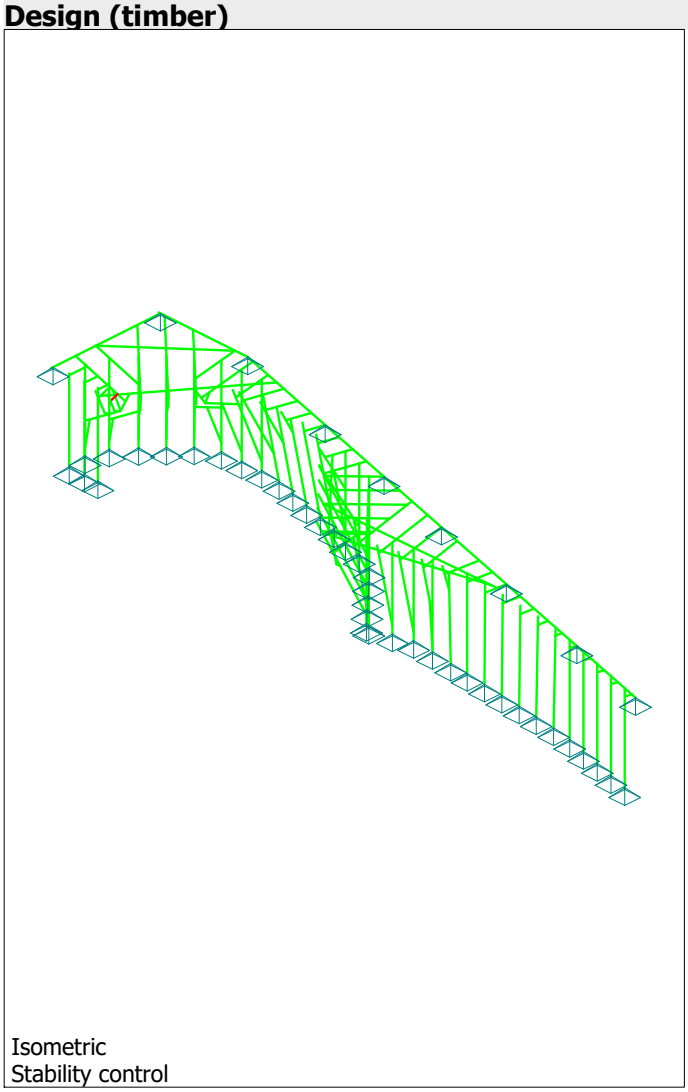
Isometric
Beam Results: max Zd= 37.12 / min Zd= -80.91 m / 1000

Load 18: [MSU (T=fin)] 12-15

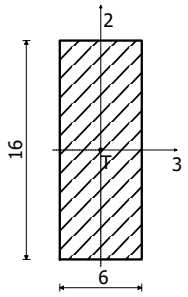


Frame: I_39
Beam Results: max Zd= 0.56 / min Zd= -13.19 m / 1000

Design (timber)



BEAM 34-5
Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

12. γ=0.55	13. γ=0.55	5. γ=0.47
15. γ=0.46	7. γ=0.40	9. γ=0.33
4. γ=0.33	14. γ=0.31	11. γ=0.28
8. γ=0.24	6. γ=0.19	10. γ=0.14

AXIAL AND SHEAR STRESSES CONTROL
(load 12, at 8.0 cm from the start of the member)

The axial force design value	Ned =	-3.823 kN
Transversal Force in Axis 2 Direction	V2ed =	-0.260 kN
Transversal Force in Axis 3 Direction	V3ed ≈	0.000 kN
Bending Moment around Axis 2	M2ed =	0.111 kNm
Bending Moment around Axis 3	M3ed =	1.084 kNm

STRESS CONTROL - COMPRESSION AND BENDING
Load type: basic - permanent

Rectification Coefficient	Kmod =	0.600
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.201
Depth factor - axis 3	Kh_3 =	1.000
Factor considering re-distribution of bending stresses	km =	0.700
Characteristic compressive strength	fc,0,k =	21.000 MPa

Design compressive strength	fc,0,d =	9.692 MPa
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	13.305 MPa
Design bending strength about axis 3	fm,3,d =	11.077 MPa
Relative slenderness	λrel,2 =	2.083
Relative slenderness	λrel,3 =	0.781
Design compressive stress	σc,0,d =	0.398 MPa
Section modulus	W2 =	96.000 cm3
Axial Stress Bending around Axis 2	σm2,d =	1.161 MPa

σm2,d <= fm,2,d (1.161 <= 13.305)

Section utilization is 8.7%

Section modulus	W3 =	256.00 cm3
Axial Stress Bending around Axis 3	σm3,d =	4.235 MPa

σm3,d <= fm,3,d (4.235 <= 11.077)

Section utilization is 38.2%

COMPRESSION AND BENDING - BIG SLENDERNESS

Deviation from straightness factor	βc =	0.200
Coefficient	k3 =	0.853
Coefficient	k2 =	2.848
Coefficient	kc,3 =	0.836
Coefficient	kc,2 =	0.209

(σc,0,d / (kc_2 x fc,0,d)) + km x (σm3,d / fm,3,d) +
+ σm2,d / fm,2,d <= 1 (0.552 <= 1)

Section utilization is 55.2%

(σc,0,d / (kc_3 x fc,0,d)) + σm3,d / fm,3,d +
+ km x (σm2,d / fm,2,d) <= 1 (0.493 <= 1)

Section utilization is 49.3%

STRESS CONTROL – SHEAR
Load type: basic - permanent

Rectification Coefficient	Kmod =	0.600
Partial factor for material properties	γm =	1.300
Characteristic shear strength	fv,k =	4.000 MPa
Design shear strength	fv,d =	1.846 MPa
Cross Section Surface	A =	96.000 cm2
Actual Shear Stress(Axis 2)	τ2,d =	0.041 MPa

τ2,d <= fv,d (0.041 <= 1.846)

Section utilization is 2.2%

STABILITY CONTROL
Load type: basic - permanent

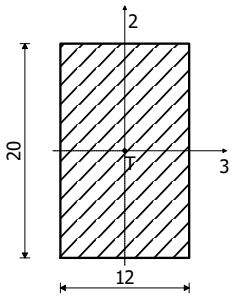
Rectification Coefficient	Kmod =	0.600
Partial factor for material properties	γm =	1.300
Length between lateral restr.points	lef =	425.58 cm
fifth percentile value of the modulus E parallel to the grain	E0.05 =	7400.0 MPa
fifth percentile value of shear modulus parallel to grain	G0.05 =	460.00 MPa
Torsional section modulus	Itor =	879.81 cm4
Moment of inetrtia	I2 =	288.00 cm4
Section modulus	W3 =	256.00 cm3
Critical bending stress	σm,crit =	26.780 MPa
Relative buckling slenderness	λrel =	0.947
Coefficient	k_krit =	0.850
Axial Stress Bending around Axis 3	σm3,d =	4.235 MPa

σm,3,d <= k_krit x fm,3,d (4.235 <= 9.415)

Section utilization is 45.0%

BEAM 111-294

Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

6. γ=0.69	7. γ=0.66	14. γ=0.57
15. γ=0.54	10. γ=0.46	12. γ=0.45
13. γ=0.44	11. γ=0.44	5. γ=0.39
4. γ=0.32	9. γ=0.27	8. γ=0.23

AXIAL STRESSES CONTROL
(load 15, at 163.8 cm from the start of the member)

The axial force design value	Ned =	-1.992 kN
Transversal Force in Axis 2 Direction	V2ed =	-3.547 kN
Transversal Force in Axis 3 Direction	V3ed =	-0.761 kN
Bending Moment around Axis 2	M2ed =	-0.490 kNm
Bending Moment around Axis 3	M3ed =	2.691 kNm

STRESS CONTROL - COMPRESSION AND BENDING
Load type: basic - instantaneous

Rectification Coefficient	Kmod =	1.100
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.046
Depth factor - axis 3	Kh_3 =	1.000
Factor considering re-distribution of bending stresses	km =	0.700
Characteristic compressive strength	fc,0,k =	21.000 MPa
Design compressive strength	fc,0,d =	17.769 MPa
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	21.235 MPa
Design bending strength about axis 3	fm,3,d =	20.308 MPa
Relative slenderness	λrel,2 =	7.598
Relative slenderness	λrel,3 =	4.559
Design compressive stress	σc,0,d =	0.083 MPa
Section modulus	W2 =	480.00 cm3
Axial Stress Bending around Axis 2	σm2,d =	1.020 MPa

σm2,d <= fm,2,d (1.020 <= 21.235)
Section utilization is 4.8%

Section modulus	W3 =	800.00 cm3
Axial Stress Bending around Axis 3	σm3,d =	3.364 MPa

σm3,d <= fm,3,d (3.364 <= 20.308)
Section utilization is 16.6%

COMPRESSION AND BENDING - BIG SLENDERNESS

Deviation from straightness factor	βc =	0.200
Coefficient	k3 =	11.317
Coefficient	k2 =	30.093
Coefficient	kc,3 =	0.046
Coefficient	kc,2 =	0.017

(σc,0,d / (kc_2 x fc,0,d)) + km x (σm3,d / fm,3,d) +
+ σm2,d / fm,2,d <= 1 (0.441 <= 1)
Section utilization is 44.1%

(σc,0,d / (kc_3 x fc,0,d)) + σm3,d / fm,3,d +
+ km x (σm2,d / fm,2,d) <= 1 (0.301 <= 1)
Section utilization is 30.1%

SHEAR STRESSES CONTROL
(load 13, at the beginning of the member)

Transversal Force in Axis 2 Direction	V2ed =	4.420 kN
Transversal Force in Axis 3 Direction	V3ed =	-0.307 kN

STRESS CONTROL – SHEAR
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Characteristic shear strength	fv,k =	4.000 MPa
Design shear strength	fv,d =	2.769 MPa
Cross Section Surface	A =	240.00 cm2

Actual Shear Stress(Axis 2)	τ2,d =	0.276 MPa
Actual Shear Stress(Axis 3)	τ3,d =	0.019 MPa
Influence Superposition from Transversal Force		
(2)	τ2,d / fv,d =	0.100
(3)	τ3,d / fv,d =	0.007

$(2)^2 + (3)^2 <= 1$ (0.011 <= 1)

Section utilization is 1.1%

STABILITY VERIFICATION
(load 6, at 2070.8 cm from the start of the member)

The axial force design value	Ned ≈	0.000 kN
Transversal Force in Axis 2 Direction	V2ed =	2.806 kN
Transversal Force in Axis 3 Direction	V3ed =	0.184 kN
Bending Moment around Axis 2	M2ed =	0.225 kNm
Bending Moment around Axis 3	M3ed =	-4.958 kNm

STABILITY CONTROL
Load type: basic - instantaneous

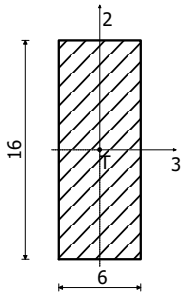
Rectification Coefficient	Kmod =	1.100
Partial factor for material properties	γm =	1.300
Length between lateral restr.points	lef =	3104.3 cm
fifth percentile value of the modulus E parallel to the grain	E0.05 =	7400.0 MPa
fifth percentile value of shear modulus parallel to grain	G0.05 =	460.00 MPa
Torsional section modulus	Itor =	7146.4 cm4
Moment of inetrtia	I2 =	2880.0 cm4
Section modulus	W3 =	800.00 cm3
Critical bending stress	σm,crit =	10.588 MPa
Relative buckling slenderness	λrel =	1.506
Coefficient	k_krit =	0.441
Axial Stress Bending around Axis 3	σm3,d =	6.197 MPa

σm,3,d <= k_krit x fm,3,d (6.197 <= 8.959)

Section utilization is 69.2%

BEAM 26-56

Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

13. γ=0.78	12. γ=0.73	5. γ=0.68
15. γ=0.64	7. γ=0.56	4. γ=0.52
9. γ=0.48	14. γ=0.40	11. γ=0.39
8. γ=0.38	6. γ=0.28	10. γ=0.21

AXIAL STRESSES CONTROL
(load 13, at 25.1 cm from the start of the member)

The axial force design value	Ned =	-5.724 kN
Transversal Force in Axis 2 Direction	V2ed =	-3.072 kN
Transversal Force in Axis 3 Direction	V3ed ≈	0.000 kN
Bending Moment around Axis 2	M2ed ≈	0.000 kNm
Bending Moment around Axis 3	M3ed =	2.914 kNm

STRESS CONTROL - COMPRESSION AND BENDING
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.201
Depth factor - axis 3	Kh_3 =	1.000
Factor considering re-distribution of bending stresses	km =	0.700
Characteristic compressive strength	fc,0,k =	21.000 MPa
Design compressive strength	fc,0,d =	14.538 MPa
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	19.957 MPa
Design bending strength about axis 3	fm,3,d =	16.615 MPa
Relative slenderness	λrel,2 =	1.894
Relative slenderness	λrel,3 =	0.710
Design compressive stress	σc,0,d =	0.596 MPa

Section modulus	W3 =	256.00 cm3
Axial Stress Bending around Axis 3	σm3,d =	11.382 MPa

σm3,d <= fm,3,d (11.382 <= 16.615)

Section utilization is 68.5%

COMPRESSION AND BENDING - BIG SLENDERNESS

Deviation from straightness factor	βc =	0.200
Coefficient	k3 =	0.793
Coefficient	k2 =	2.454
Coefficient	kc,3 =	0.872
Coefficient	kc,2 =	0.249

(σc,0,d / (kc_2 x fc,0,d)) + km x (σm3,d / fm,3,d) +
+ σm2,d / fm,2,d <= 1 (0.644 <= 1)

Section utilization is 64.4%

(σc,0,d / (kc_3 x fc,0,d)) + σm3,d / fm,3,d +
+ km x (σm2,d / fm,2,d) <= 1 (0.732 <= 1)

Section utilization is 73.2%

STABILITY CONTROL

Load type: basic - short-term		
Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Length between lateral restr.points	lef =	387.01 cm
fifth percentile value of the modulus E parallel to the grain	E0.05 =	7400.0 MPa
fifth percentile value of shear modulus parallel to grain	G0.05 =	460.00 MPa
Torsional section modulus	Itor =	879.81 cm4
Moment of inetrtia	I2 =	288.00 cm4
Section modulus	W3 =	256.00 cm3
Critical bending stress	σm,crit =	29.449 MPa
Relative buckling slenderness	λrel =	0.903
Coefficient	k_krit =	0.883
Axial Stress Bending around Axis 3	σm3,d =	11.382 MPa

σm,3,d <= k_krit x fm,3,d (11.382 <= 14.670)

Section utilization is 77.6%

SHEAR STRESSES CONTROL
(load 13, at 25.1 cm from the start of the member)

Transversal Force in Axis 2 Direction	V2ed =	8.073 kN
Transversal Force in Axis 3 Direction	V3ed =	0.158 kN

STRESS CONTROL – SHEAR

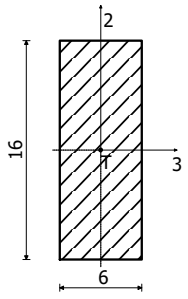
Load type: basic - short-term		
Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Characteristic shear strength	fv,k =	4.000 MPa
Design shear strength	fv,d =	2.769 MPa
Cross Section Surface	A =	96.000 cm2
Actual Shear Stress(Axis 2)	τ2,d =	1.261 MPa
Actual Shear Stress(Axis 3)	τ3,d =	0.025 MPa
Influence Superposition from Transversal Force		
(2)	τ2,d / fv,d =	0.456
(3)	τ3,d / fv,d =	0.009

$(2)^2 + (3)^2 <= 1$ (0.212 <= 1)

Section utilization is 21.2%

BEAM 139-209

Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

12. γ=0.87	13. γ=0.87	5. γ=0.75
15. γ=0.71	4. γ=0.62	7. γ=0.62
9. γ=0.53	14. γ=0.48	8. γ=0.46
11. γ=0.44	6. γ=0.34	10. γ=0.25

AXIAL STRESSES CONTROL
(load 13, at 37.9 cm from the start of the member)

The axial force design value	Ned =	-21.818 kN
Transversal Force in Axis 2 Direction	V2ed =	-2.355 kN
Transversal Force in Axis 3 Direction	V3ed ≈	0.000 kN
Bending Moment around Axis 2	M2ed ≈	0.000 kNm
Bending Moment around Axis 3	M3ed =	-0.893 kNm

STRESS CONTROL - COMPRESSION AND BENDING
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.201
Depth factor - axis 3	Kh_3 =	1.000
Factor considering re-distribution of bending stresses	km =	0.700
Characteristic compressive strength	fc,0,k =	21.000 MPa
Design compressive strength	fc,0,d =	14.538 MPa
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	19.957 MPa
Design bending strength about axis 3	fm,3,d =	16.615 MPa
Relative slenderness	λrel,2 =	2.044
Relative slenderness	λrel,3 =	0.766
Design compressive stress	σc,0,d =	2.273 MPa
Section modulus	W3 =	256.00 cm3
Axial Stress Bending around Axis 3	σm3,d =	3.489 MPa

σm3,d <= fm,3,d (3.489 <= 16.615)
Section utilization is 21.0%

COMPRESSION AND BENDING - BIG SLENDERNESS

Deviation from straightness factor	βc =	0.200
Coefficient	k3 =	0.840
Coefficient	k2 =	2.763
Coefficient	kc,3 =	0.844
Coefficient	kc,2 =	0.216

(σc,0,d / (kc_2 x fc,0,d)) + km x (σm3,d / fm,3,d) +
+ σm2,d / fm,2,d <= 1 (0.869 <= 1)
Section utilization is 86.9%

(σc,0,d / (kc_3 x fc,0,d)) + σm3,d / fm,3,d +
+ km x (σm2,d / fm,2,d) <= 1 (0.395 <= 1)
Section utilization is 39.5%

STABILITY CONTROL
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Length between lateral restr.points	lef =	417.50 cm
fifth percentile value of the modulus E parallel to the grain	E0.05 =	7400.0 MPa
fifth percentile value of shear modulus parallel to grain	G0.05 =	460.00 MPa
Torsional section modulus	Itor =	879.81 cm4
Moment of inetrtia	I2 =	288.00 cm4
Section modulus	W3 =	256.00 cm3
Critical bending stress	σm,crit =	27.298 MPa
Relative buckling slenderness	λrel =	0.938
Coefficient	k_krit =	0.857
Axial Stress Bending around Axis 3	σm3,d =	3.489 MPa

σm,3,d <= k_krit x fm,3,d (3.489 <= 14.236)
Section utilization is 24.5%

SHEAR STRESSES CONTROL
(load 13, at the beginning of the member)

Transversal Force in Axis 2 Direction	V2ed =	-2.355 kN
Transversal Force in Axis 3 Direction	V3ed ≈	0.000 kN

STRESS CONTROL – SHEAR
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Characteristic shear strength	fv,k =	4.000 MPa
Design shear strength	fv,d =	2.769 MPa
Cross Section Surface	A =	96.000 cm2
Actual Shear Stress(Axis 2)	τ2,d =	0.368 MPa

τ2,d <= fv,d (0.368 <= 2.769)

Section utilization is 13.3%

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- SEGMENT_2

Input data - Structure

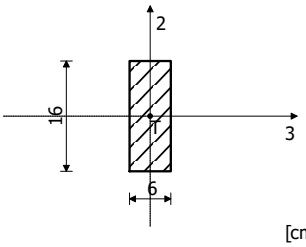
Table of materials

No	Material name	E[kN/m2]	μ	γ[kN/m3]	αt[1/C]	Em[kN/m2]	μm
1	Les-Iglavci-Masiven les	1.000e+7	0.20	5.00	1.000e-5	1.000e+7	0.20

Beam sets

Set: 1 Section: b/d=6/16, Approx. eccentricity

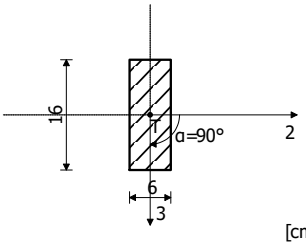
Mat.	A1	A2	A3	I1	I2	I3
1 - Les-Iglavci-M...	9.600e-3	8.000e-3	8.000e-3	8.803e-6	2.880e-6	2.048e-5



[cm]

Set: 2 Section: b/d=6/16, Approx. eccentricity

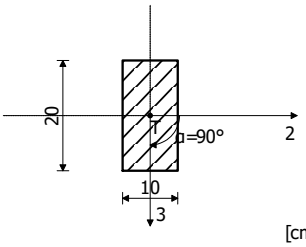
Mat.	A1	A2	A3	I1	I2	I3
1 - Les-Iglavci-M...	9.600e-3	8.000e-3	8.000e-3	8.803e-6	2.048e-5	2.880e-6



[cm]

Set: 3 Section: b/d=10/20, Approx. eccentricity

Mat.	A1	A2	A3	I1	I2	I3
1 - Les-Iglavci-M...	2.000e-2	1.667e-2	1.667e-2	4.578e-5	6.667e-5	1.667e-5



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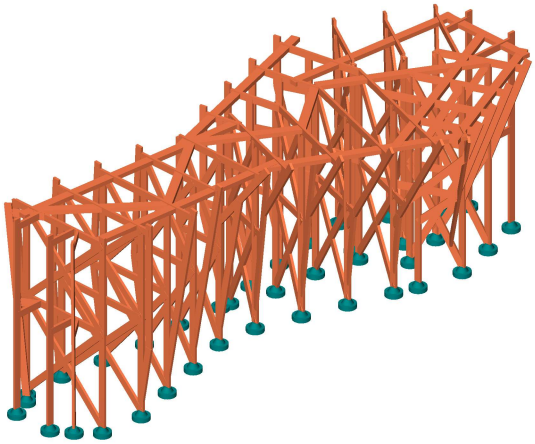
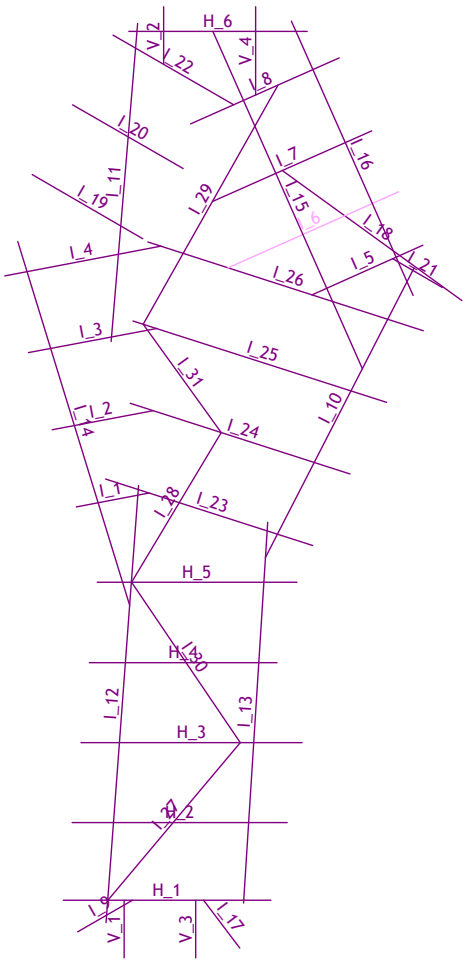
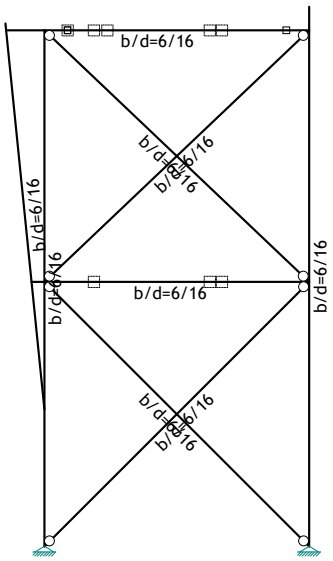


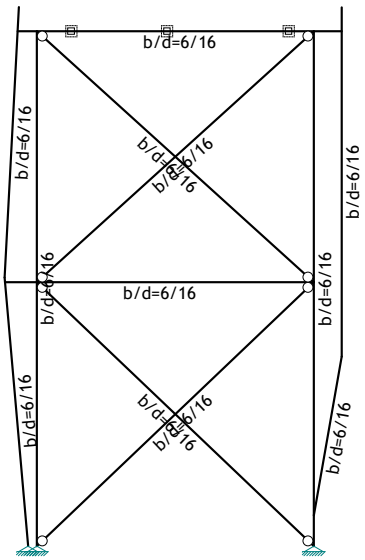
Isometric



Frame disposition



Frame: H_1



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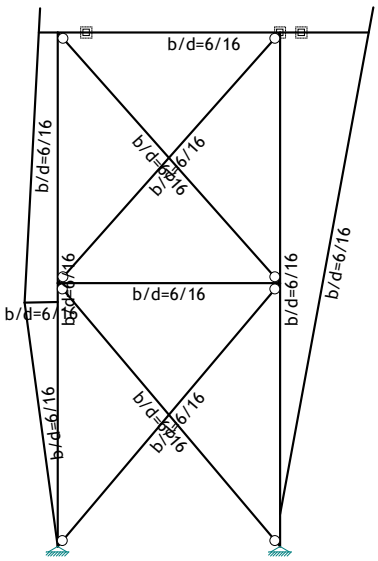

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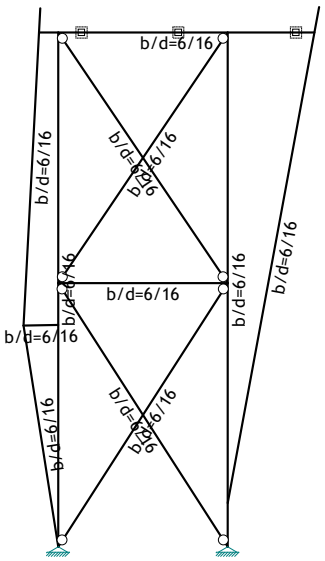

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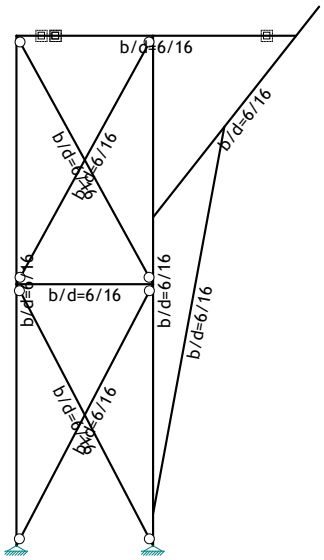

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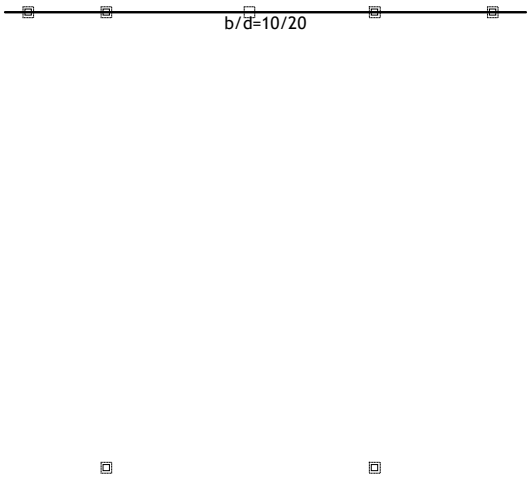

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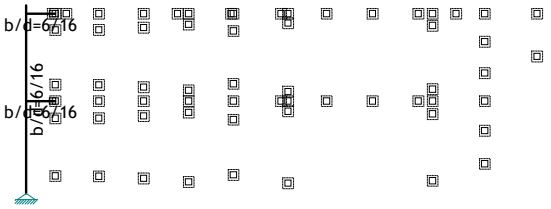
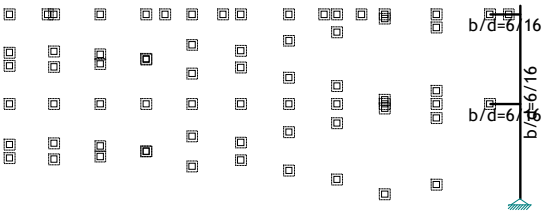


Frame: V_1



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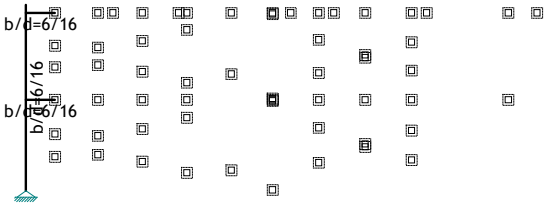

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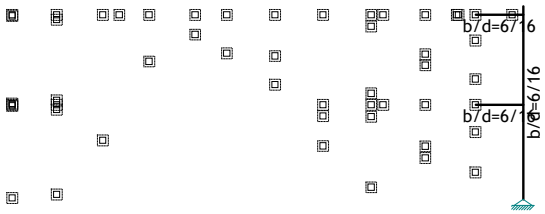

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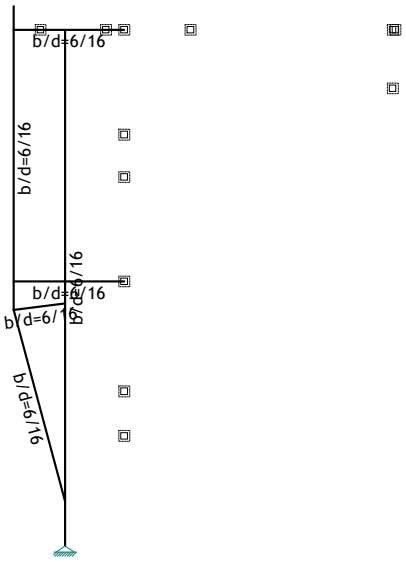

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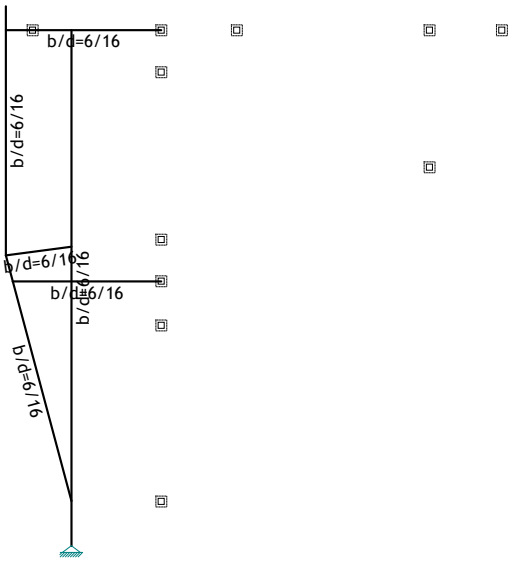

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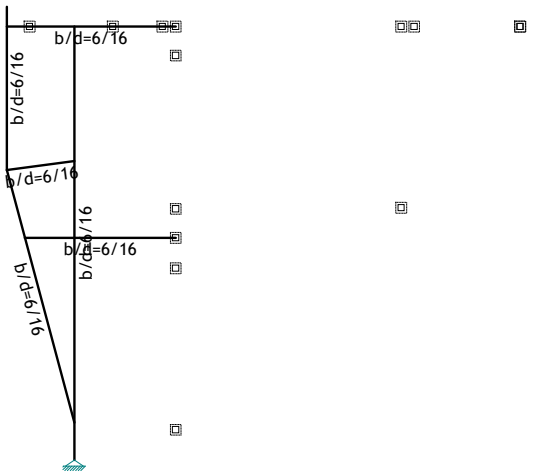

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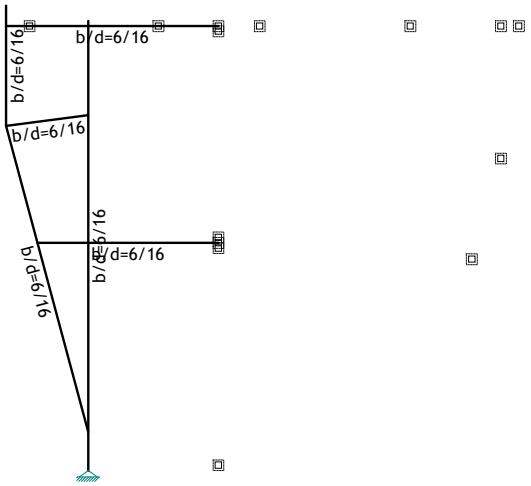

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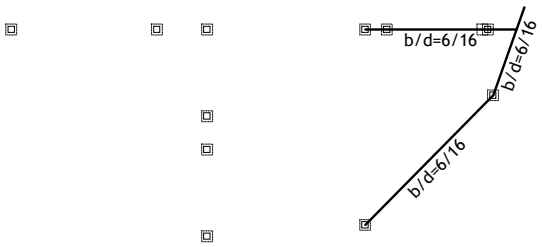
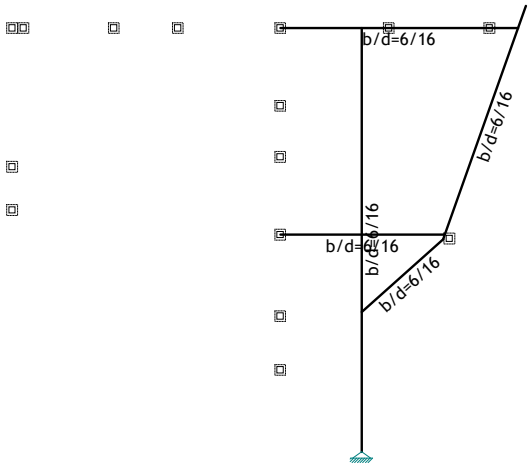
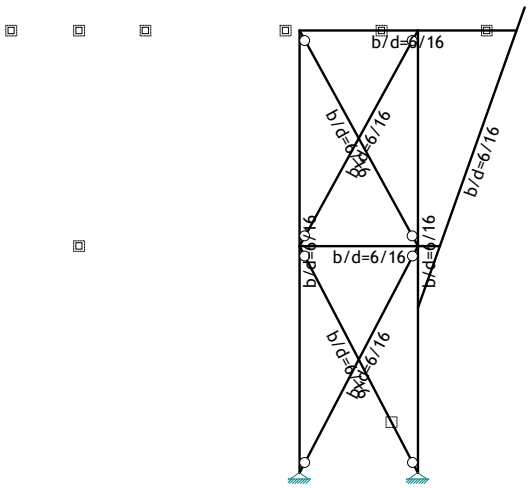


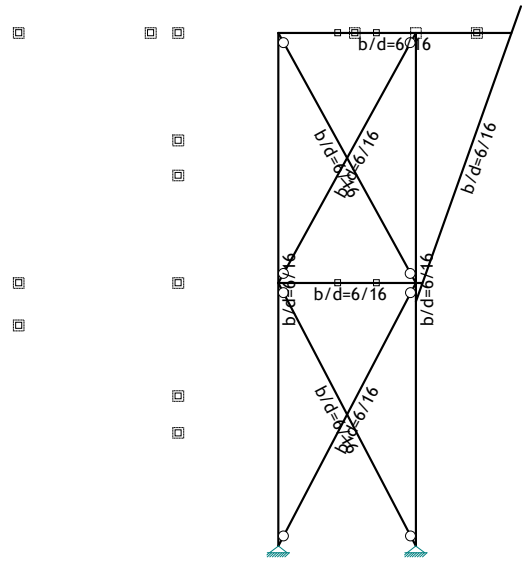
Frame: I_5



Frame: I_6

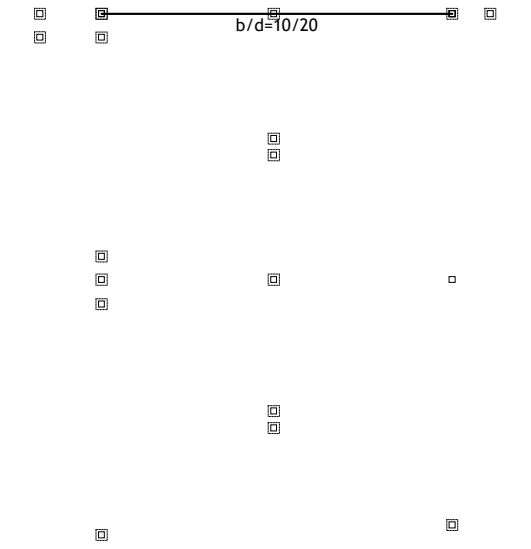


Frame: I_7

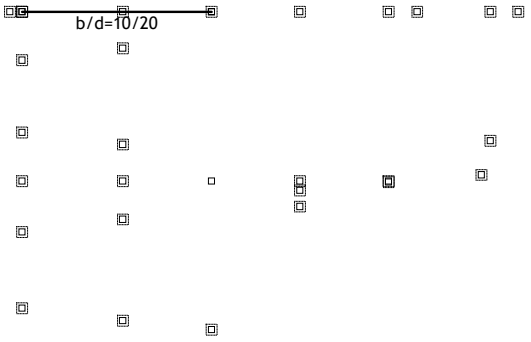


Frame: I_8

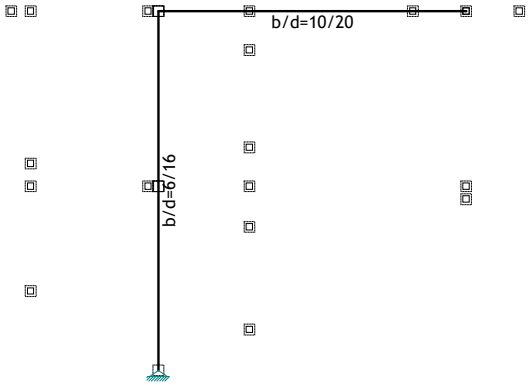
Frame: I_9



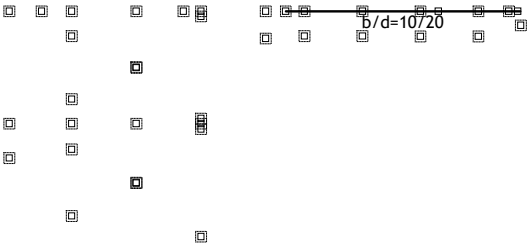
Frame: I_27



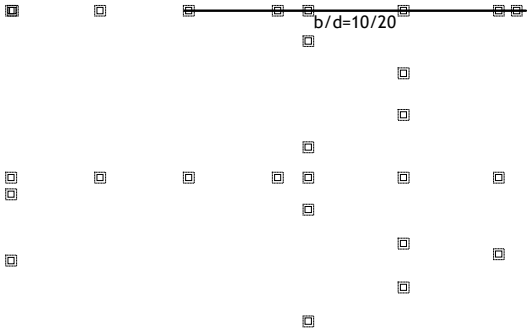
Frame: I_28



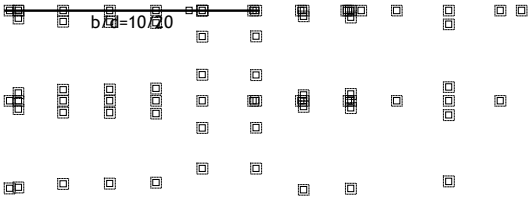
Frame: I_29



Frame: I_10



Frame: I_11



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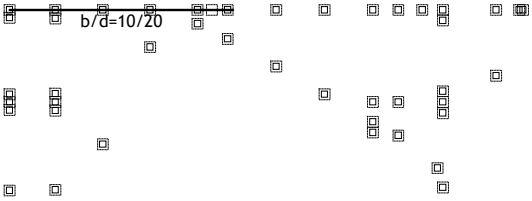
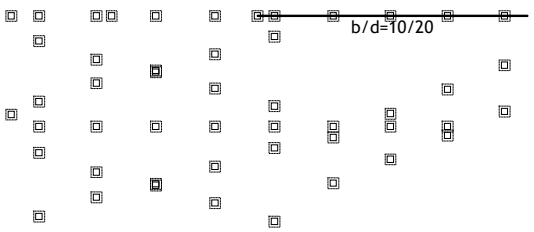
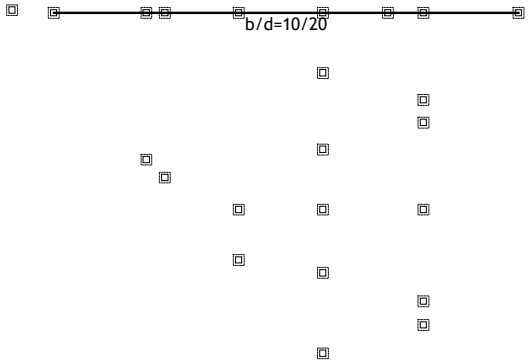


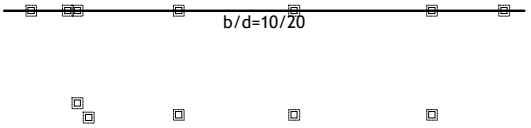
Frame: I_13



Frame: I_14

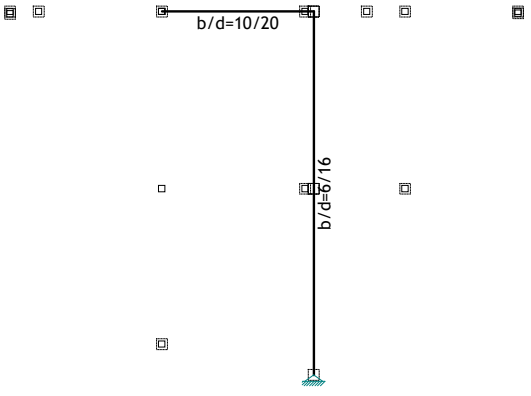


Frame: I_15



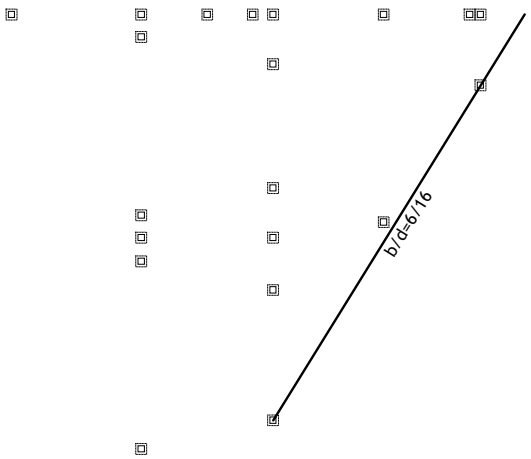
Frame: I_16

Frame: I_30

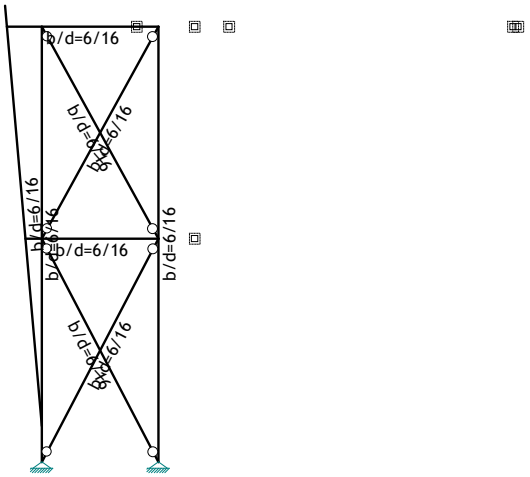


Frame: I_31

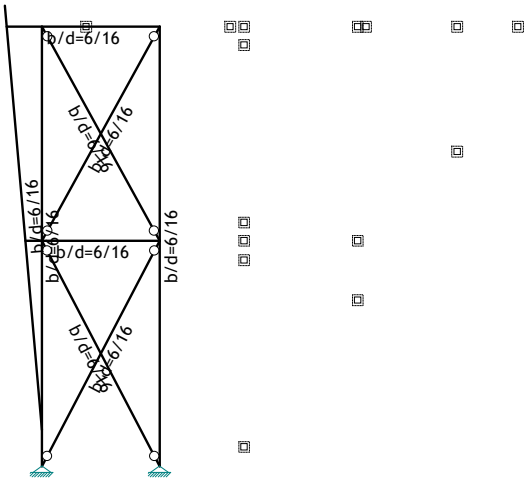
Frame: I_17



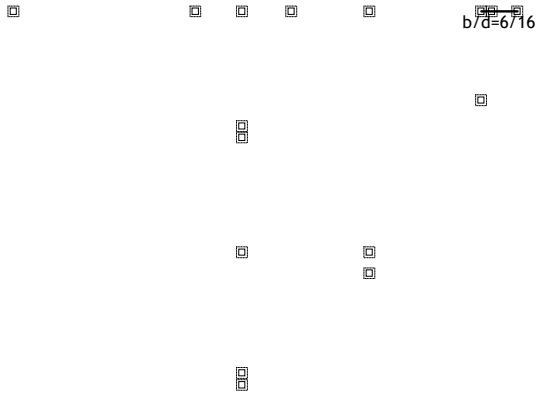
Frame: I_18



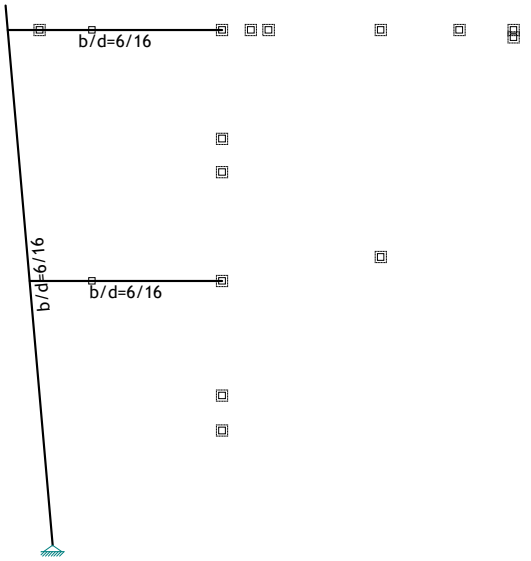
Frame: I_19



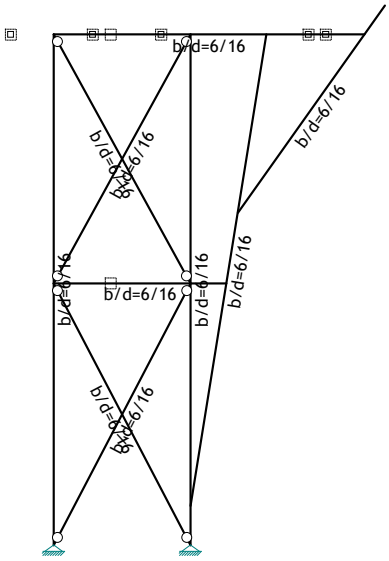
Frame: I_20



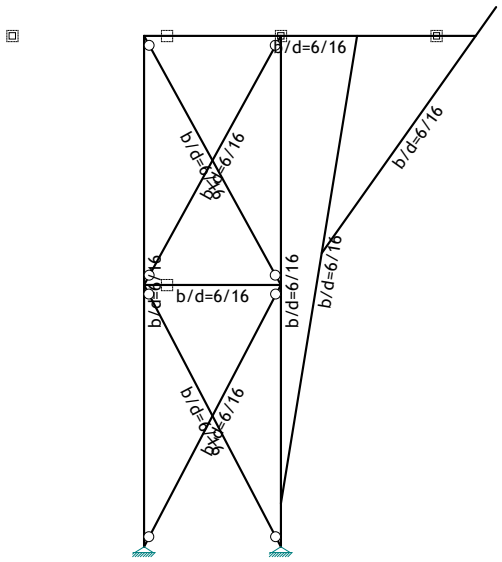
Frame: I_21



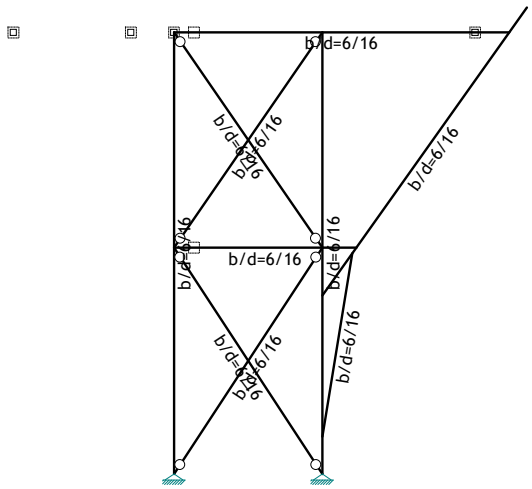
Frame: I_22



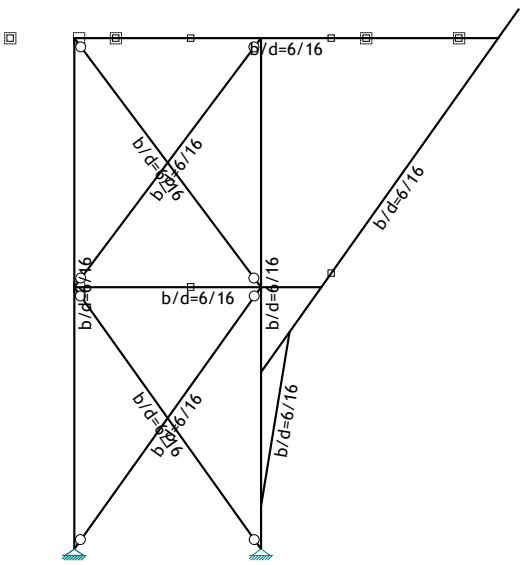
Frame: I_23



Frame: I_24

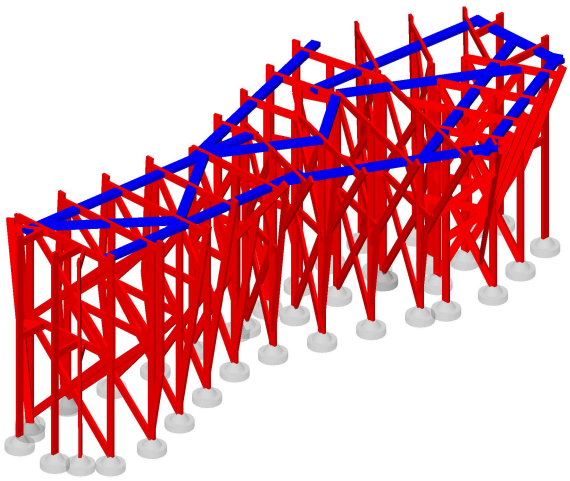


Frame: I_25

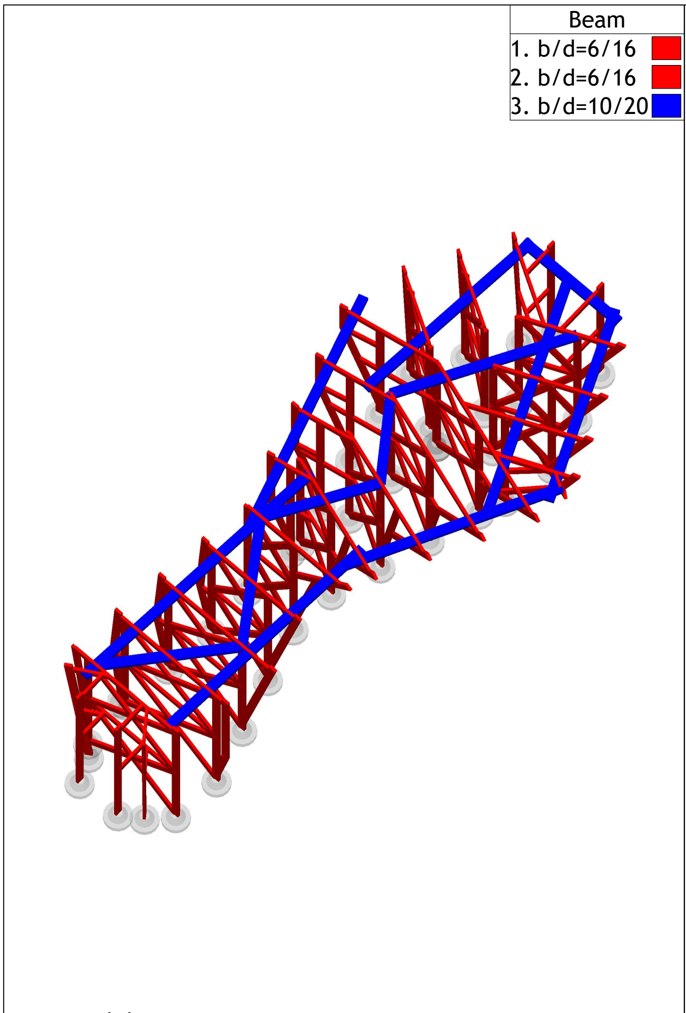


Frame: I_26

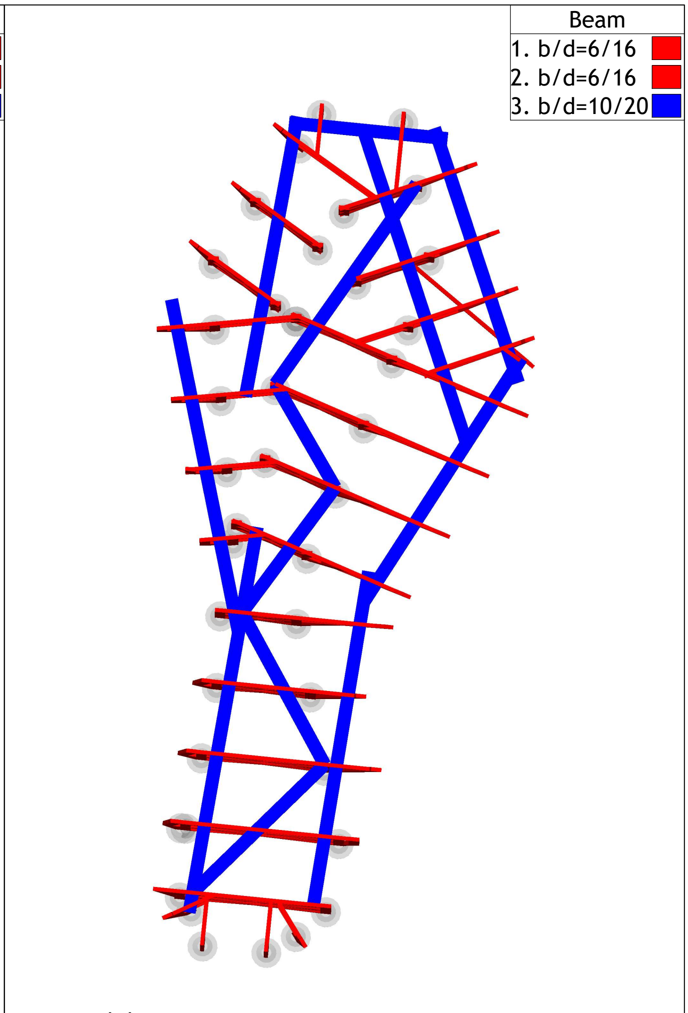
Beam
1. b/d=6/16
2. b/d=6/16
3. b/d=10/20



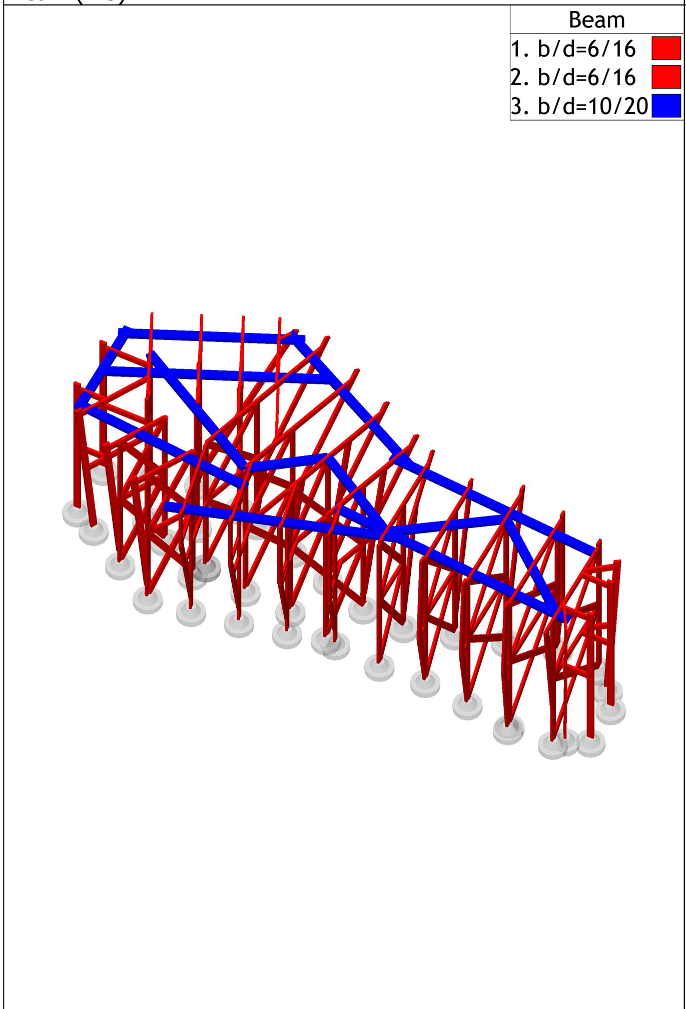
Numerical data set
Beam (1-3)



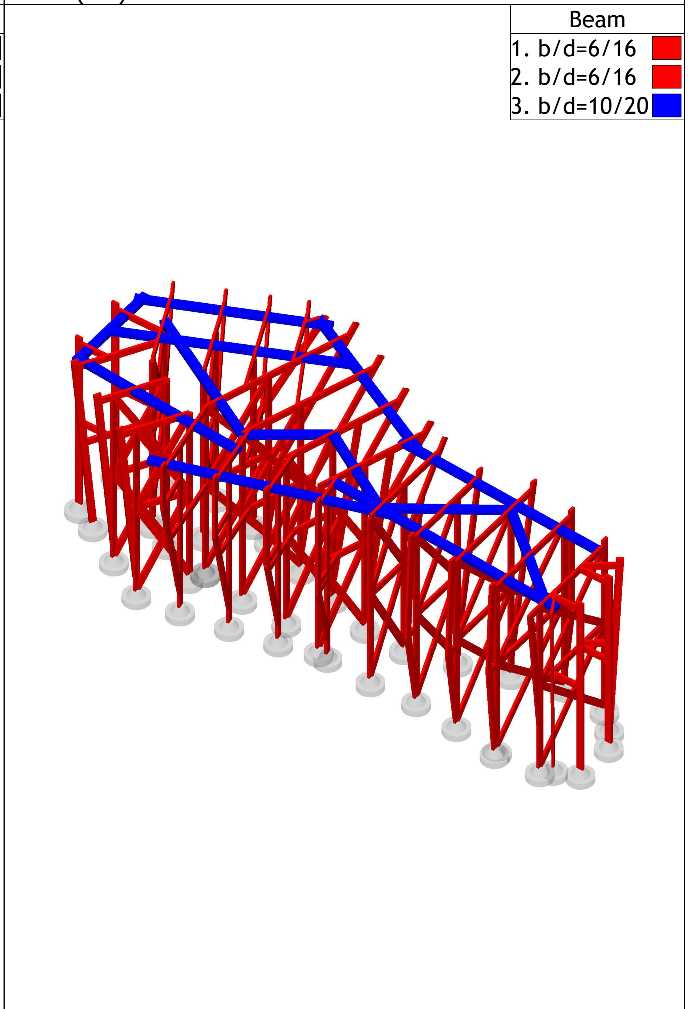
Numerical data set
Beam (1-3)



Numerical data set
Beam (1-3)



Numerical data set
Beam (1-3)



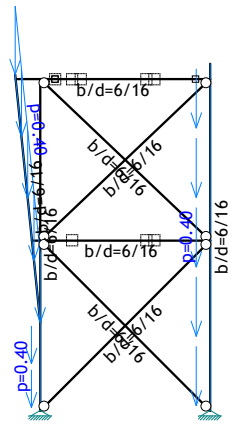
Numerical data set
Beam (1-3)

Input data - Load

Load cases list

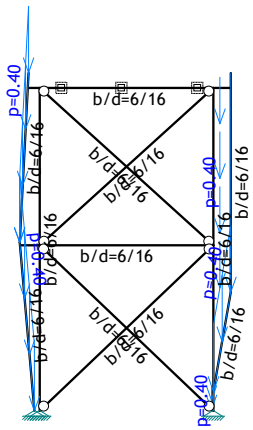
LC	Name	pX [kN]	pY [kN]	pZ [kN]
1	Dead Load (g)	-0.00	-0.00	-75.42
2	Live Load	0.00	0.00	-46.65
3	Live Load (h)	-3.47	-0.37	0.00
4	Comb.: 1.35xI	-0.00	-0.00	-101.81
5	Comb.: 1.35xI+1.5xII	-0.00	-0.00	-171.79
6	Comb.: 1.35xI+1.5xIII	-5.20	-0.56	-101.81
7	Comb.: 1.35xI+1.5xII+1.5xIII	-5.20	-0.56	-171.79
8	Comb.: I	-0.00	-0.00	-75.42
9	Comb.: I+II	-0.00	-0.00	-122.07
10	Comb.: I+III	-3.47	-0.37	-75.42
11	Comb.: I+II+III	-3.47	-0.37	-122.07
12	Comb.: 1.9xI	-0.00	-0.00	-143.29
13	Comb.: 1.9xI+1.29xII	-0.00	-0.00	-203.47
14	Comb.: 1.9xI+1.29xIII	-4.47	-0.48	-143.29
15	Comb.: 1.9xI+1.29xII+1.29xIII	-4.47	-0.48	-203.47

Load 1: Dead Load (g)



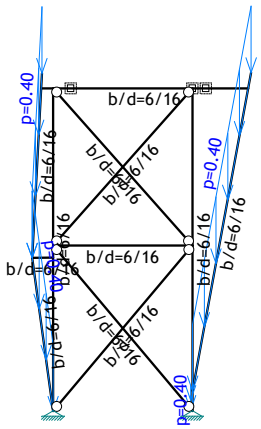
Frame: H_1

Load 1: Dead Load (g)



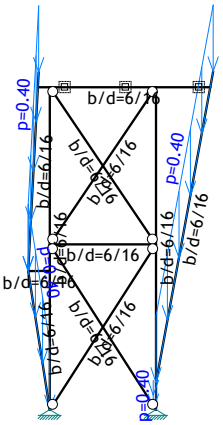
Frame: H_2

Load 1: Dead Load (g)



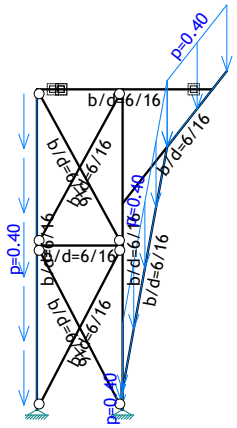
Frame: H_3

Load 1: Dead Load (g)



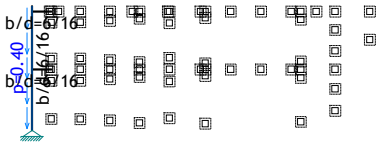
Frame: H_4

Load 1: Dead Load (g)



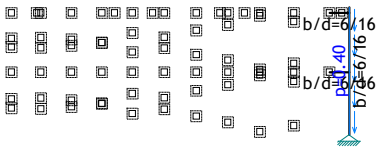
Frame: H_5

Load 1: Dead Load (g)



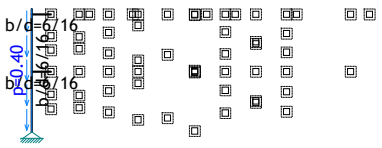
Frame: V_1

Load 1: Dead Load (g)



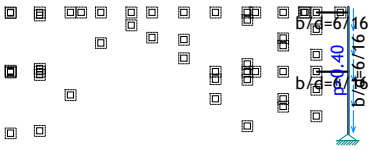
Frame: V_2

Load 1: Dead Load (g)



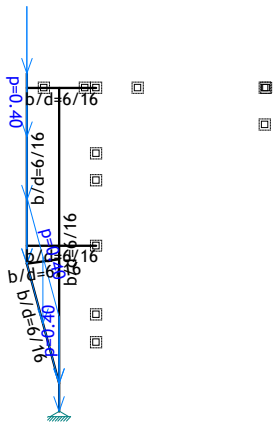
Frame: V_3

Load 1: Dead Load (g)



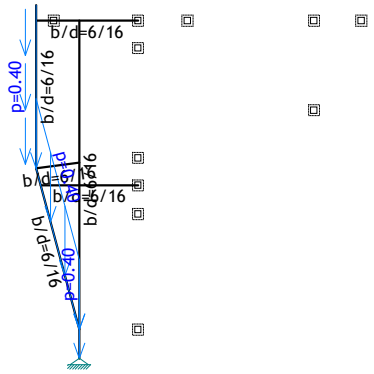
Frame: V_4

Load 1: Dead Load (g)



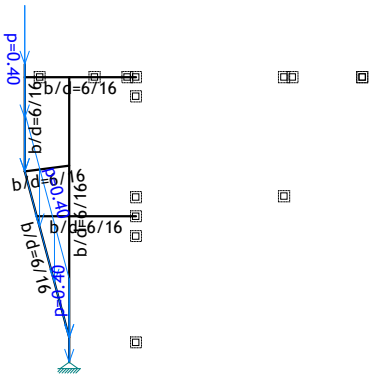
Frame: I_1

Load 1: Dead Load (g)



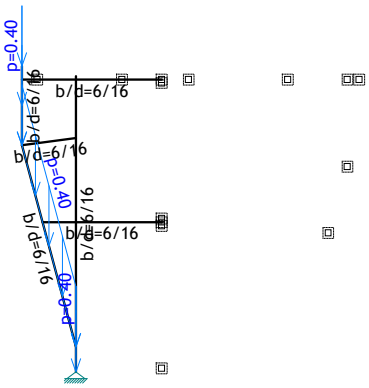
Frame: I_2

Load 1: Dead Load (g)



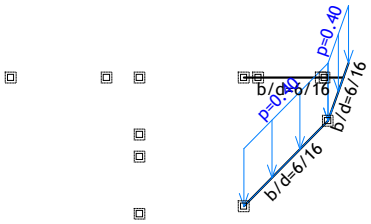
Frame: I_3

Load 1: Dead Load (g)



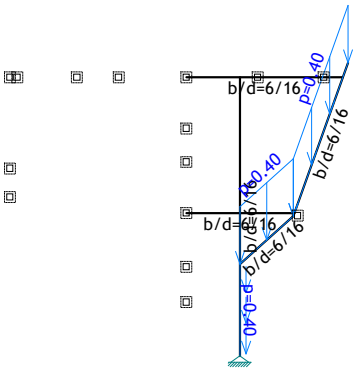
Frame: I_4

Load 1: Dead Load (g)



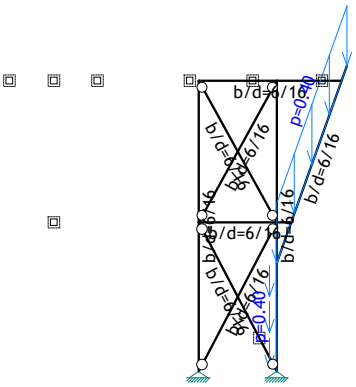
Frame: I_5

Load 1: Dead Load (g)



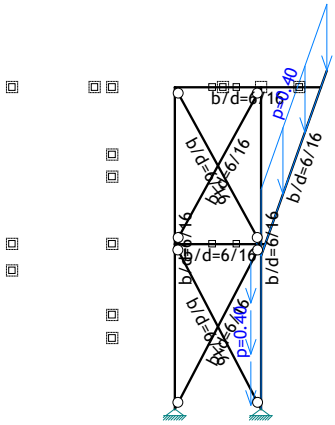
Frame: I_6

Load 1: Dead Load (g)



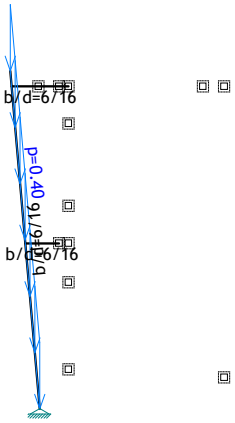
Frame: I_7

Load 1: Dead Load (g)



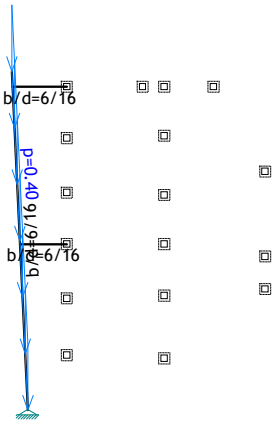
Frame: I_8

Load 1: Dead Load (g)



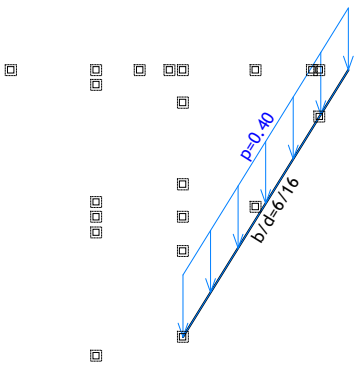
Frame: I_9

Load 1: Dead Load (g)



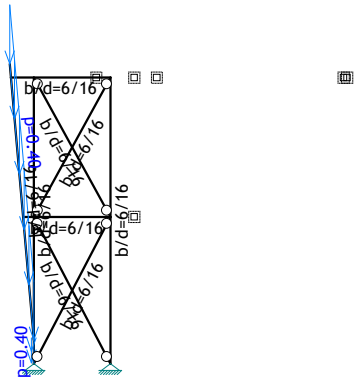
Frame: I_17

Load 1: Dead Load (g)



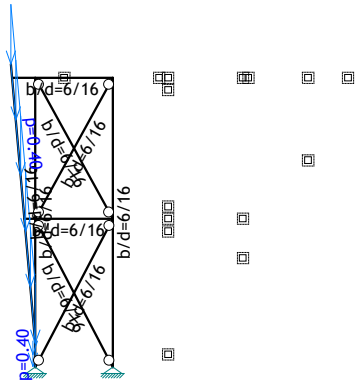
Frame: I_18

Load 1: Dead Load (g)



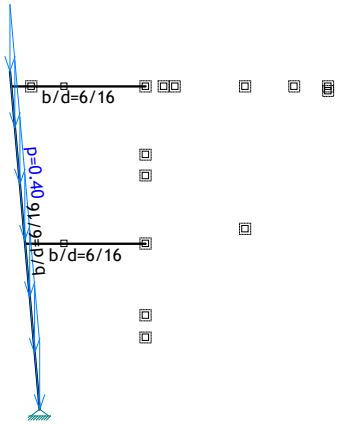
Frame: I_19

Load 1: Dead Load (g)



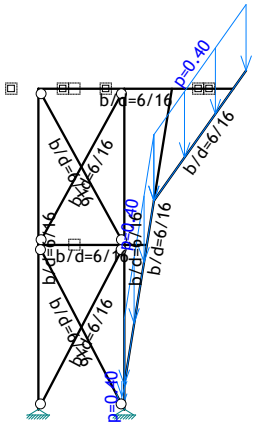
Frame: I_20

Load 1: Dead Load (g)



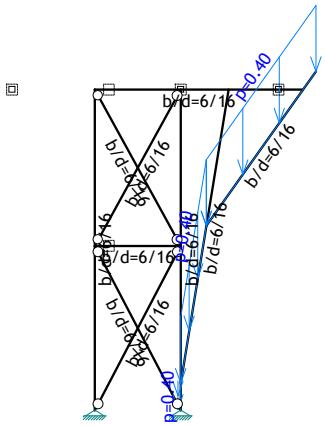
Frame: I_22

Load 1: Dead Load (g)



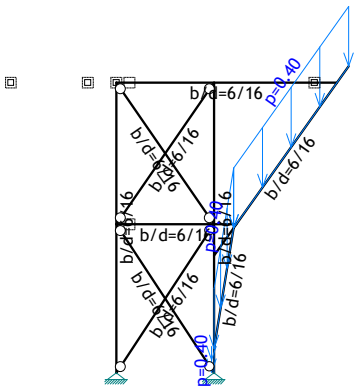
Frame: I_23

Load 1: Dead Load (g)



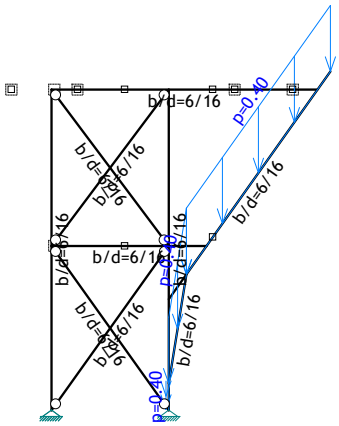
Frame: I_24

Load 1: Dead Load (g)



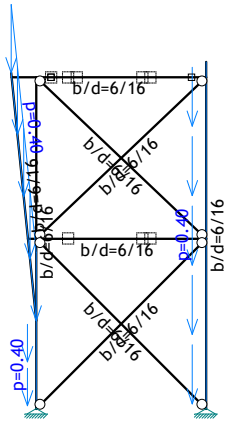
Frame: I_25

Load 1: Dead Load (g)



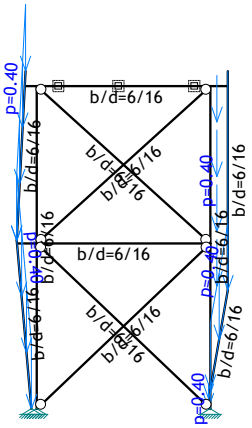
Frame: I_26

Load 2: Live Load



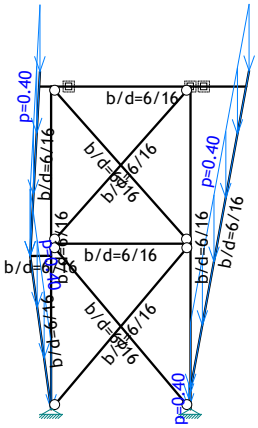
Frame: H_1

Load 2: Live Load



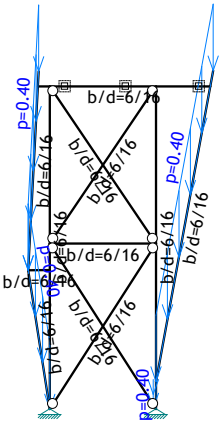
Frame: H_2

Load 2: Live Load



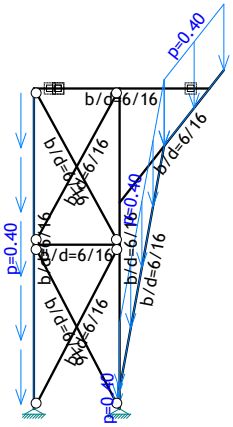
Frame: H_3

Load 2: Live Load



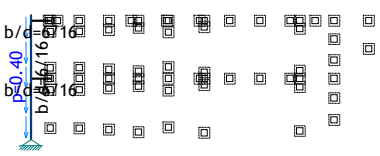
Frame: H_4

Load 2: Live Load



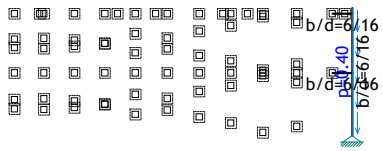
Frame: H_5

Load 2: Live Load



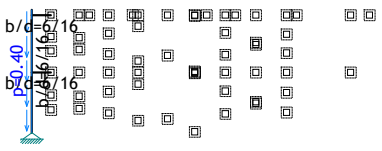
Frame: V_1

Load 2: Live Load



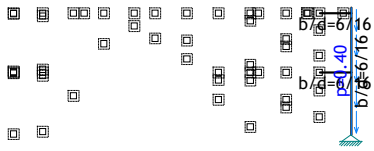
Frame: V_2

Load 2: Live Load



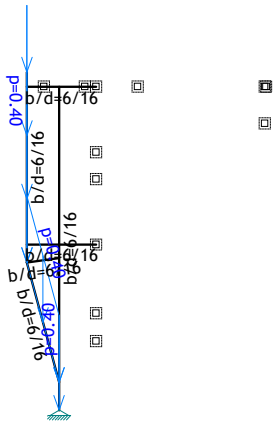
Frame: V_3

Load 2: Live Load



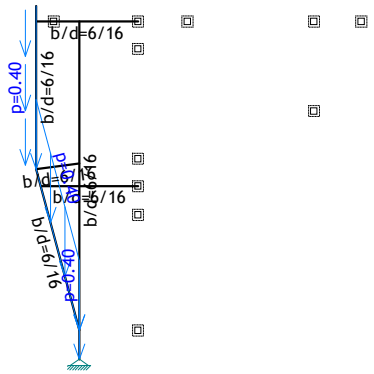
Frame: V_4

Load 2: Live Load



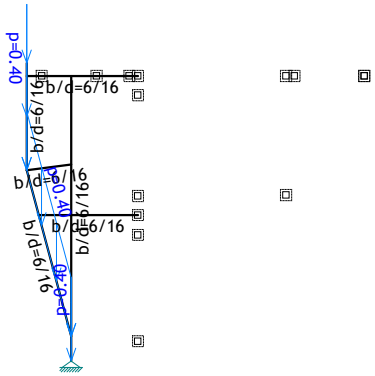
Frame: I_1

Load 2: Live Load



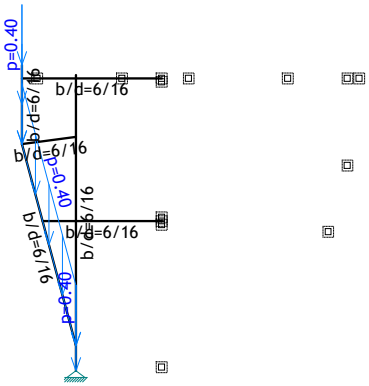
Frame: I_2

Load 2: Live Load



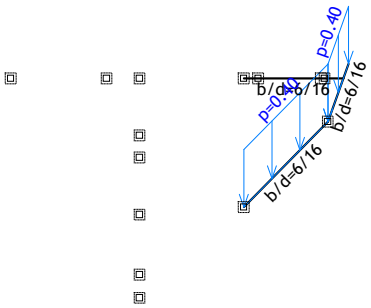
Frame: I_3

Load 2: Live Load



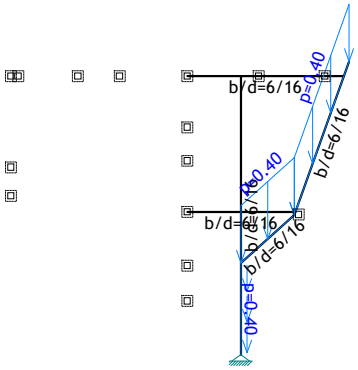
Frame: I_4

Load 2: Live Load



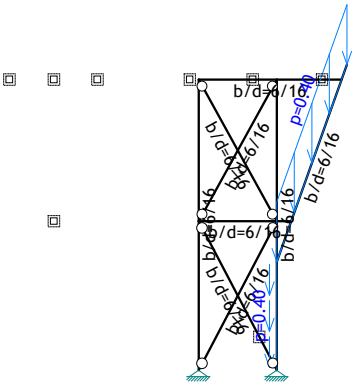
Frame: I_5

Load 2: Live Load



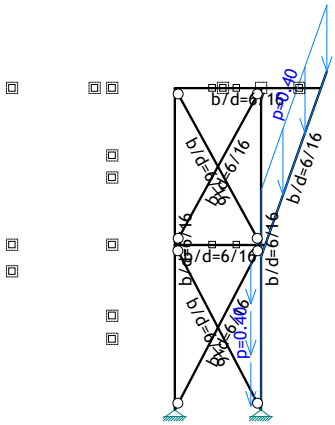
Frame: I_6

Load 2: Live Load



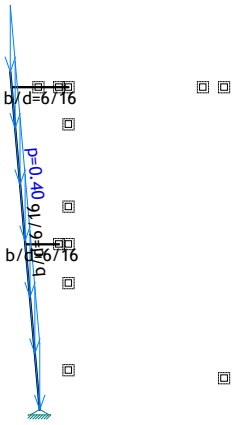
Frame: I_7

Load 2: Live Load



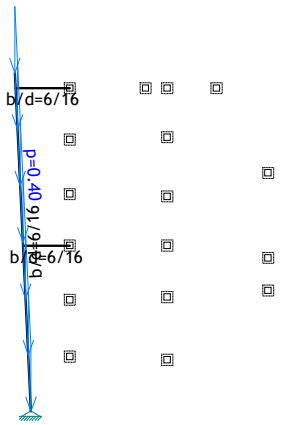
Frame: I_8

Load 2: Live Load



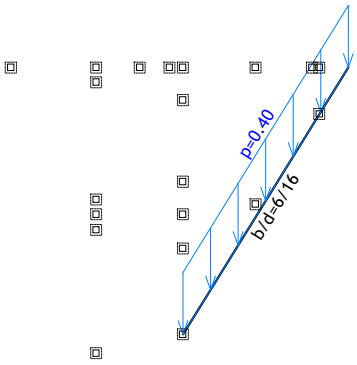
Frame: I_9

Load 2: Live Load



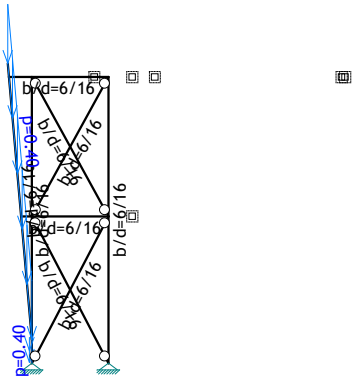
Frame: I_17

Load 2: Live Load



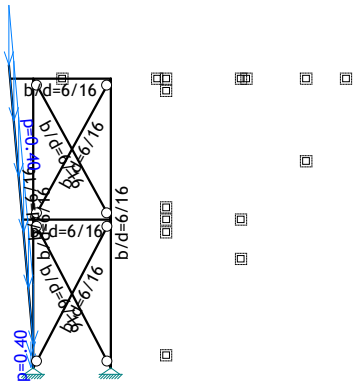
Frame: I_18

Load 2: Live Load



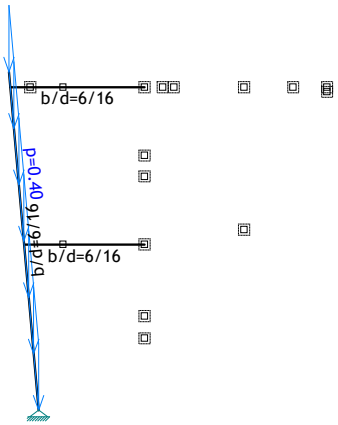
Frame: I_19

Load 2: Live Load



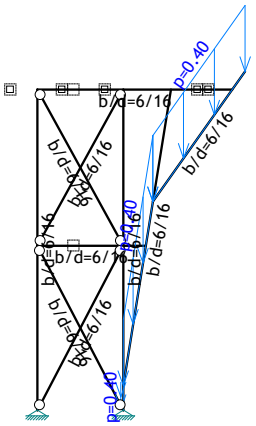
Frame: I_20

Load 2: Live Load



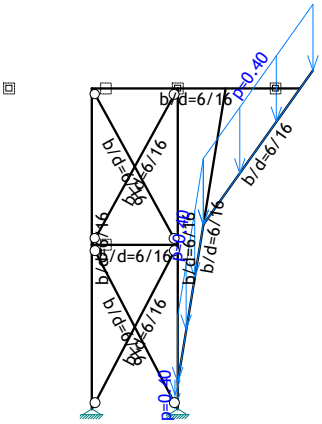
Frame: I_22

Load 2: Live Load



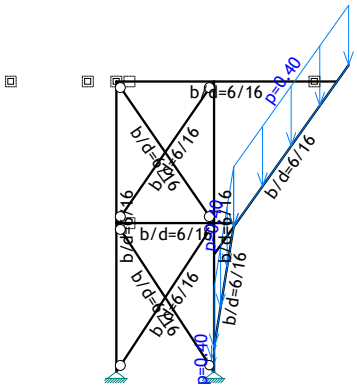
Frame: I_23

Load 2: Live Load



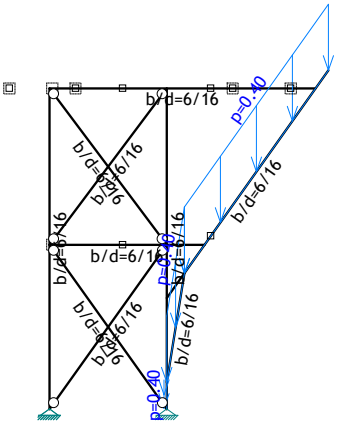
Frame: I_24

Load 2: Live Load



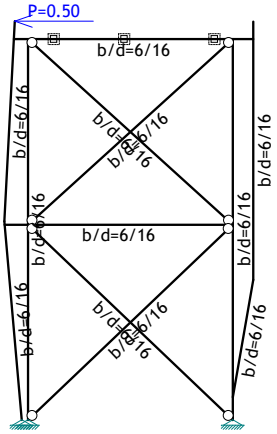
Frame: I_25

Load 2: Live Load



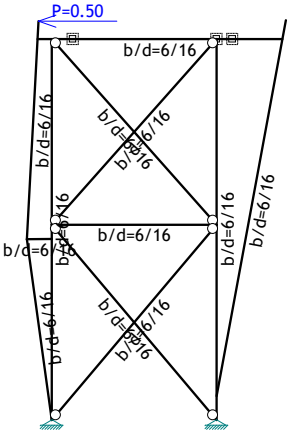
Frame: I_26

Load 3: Live Load (h)



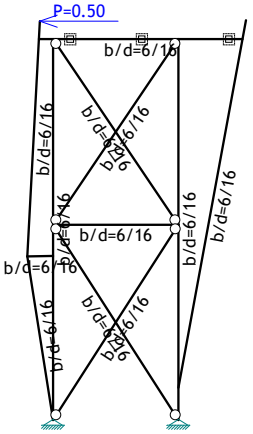
Frame: H_2

Load 3: Live Load (h)



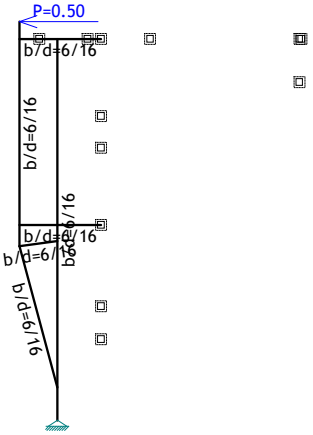
Frame: H_3

Load 3: Live Load (h)



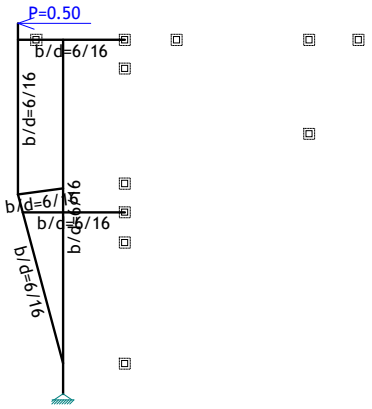
Frame: H_4

Load 3: Live Load (h)



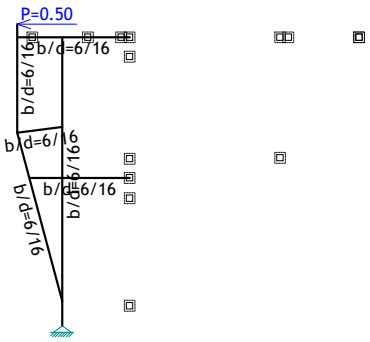
Frame: I_1

Load 3: Live Load (h)



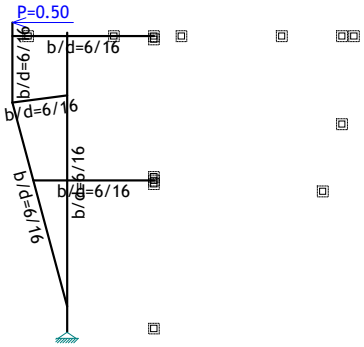
Frame: I_2

Load 3: Live Load (h)



Frame: I_3

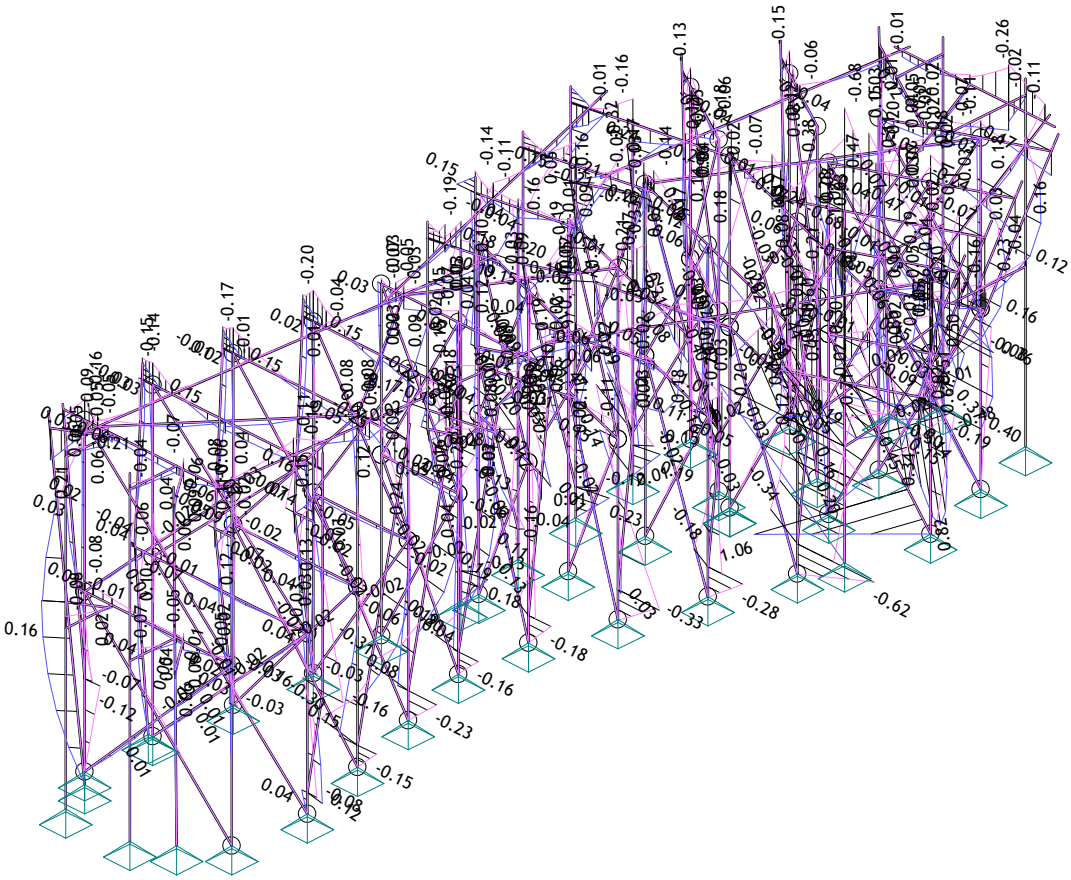
Load 3: Live Load (h)



Frame: I_4

Structural analysis

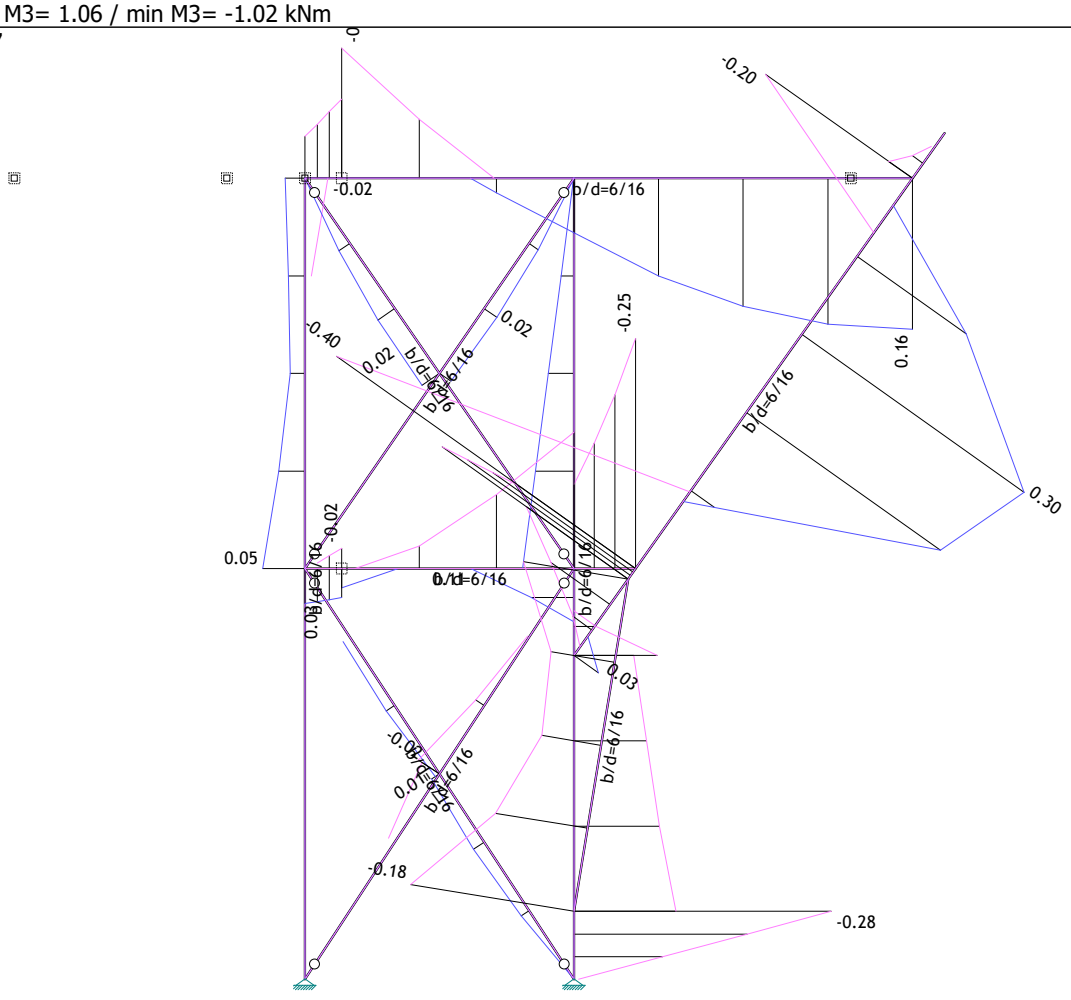
Load 16: [MSN] 4-7



Isometric

Beam Results: max M3= 1.06 / min M3= -1.02 kNm

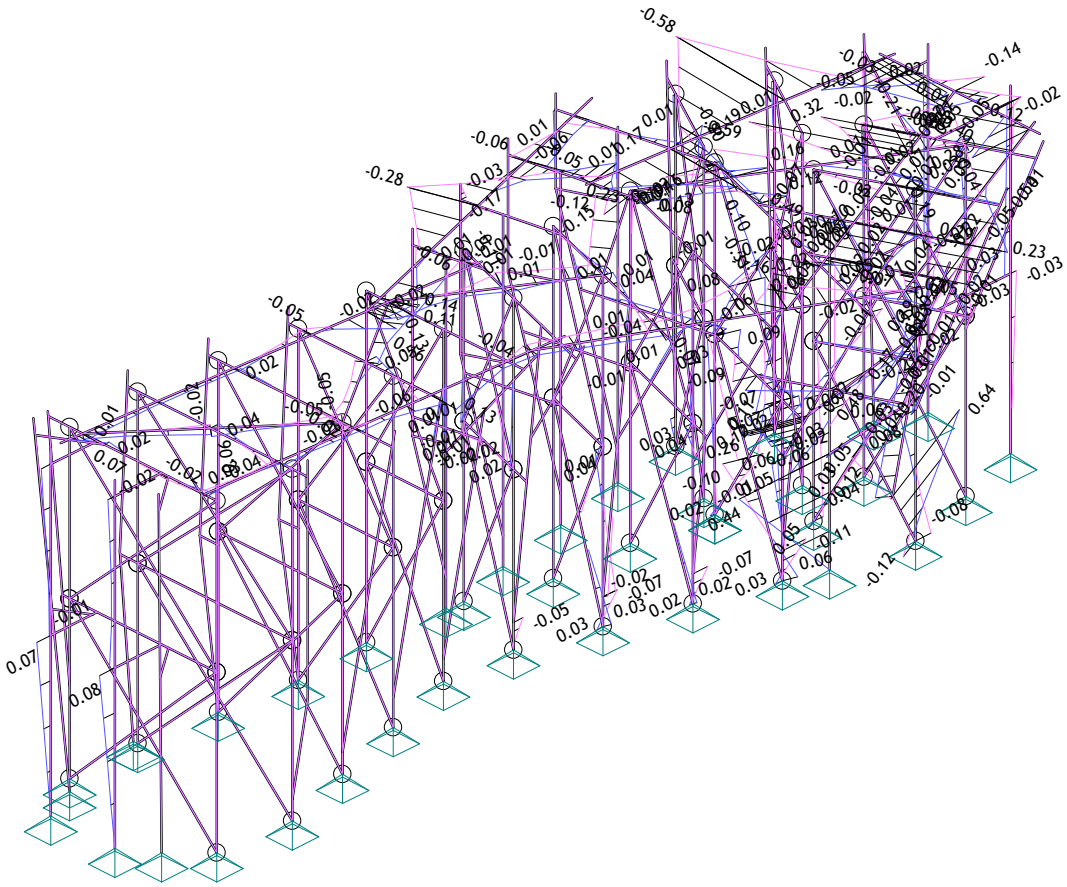
Load 16: [MSN] 4-7



Frame: I_25

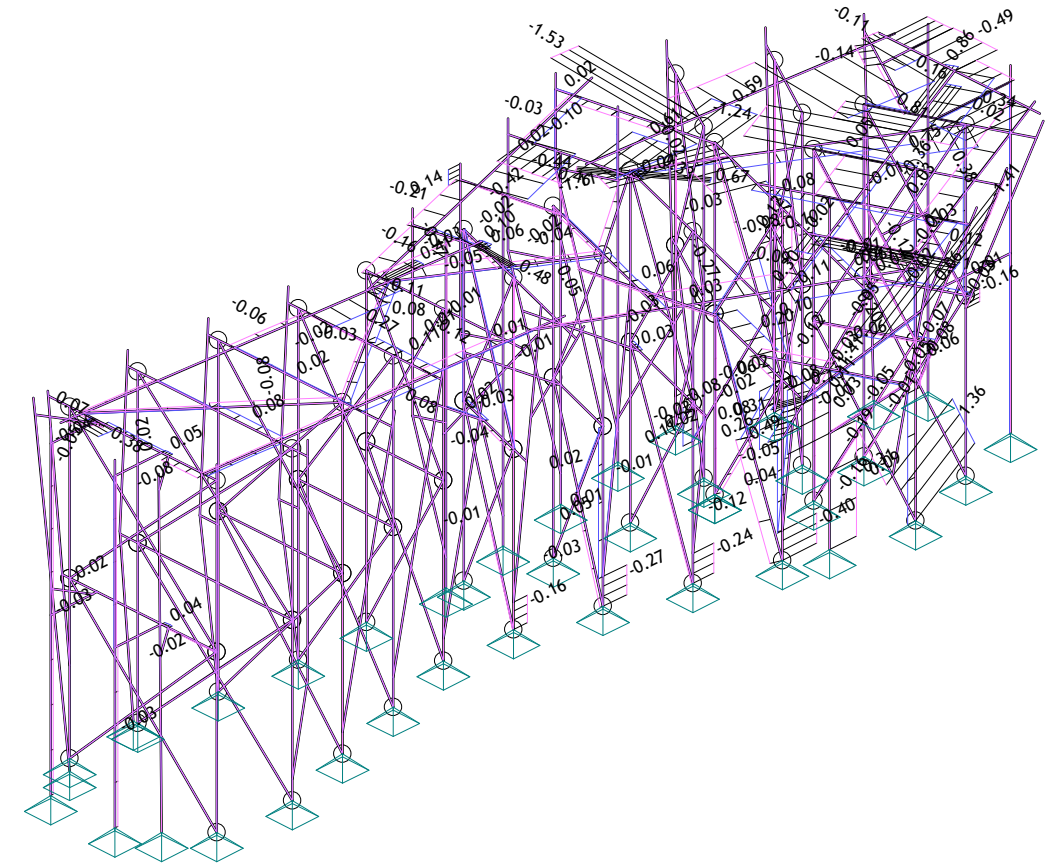
Beam Results: max M3= 0.30 / min M3= -0.40 kNm

Load 16: [MSN] 4-7



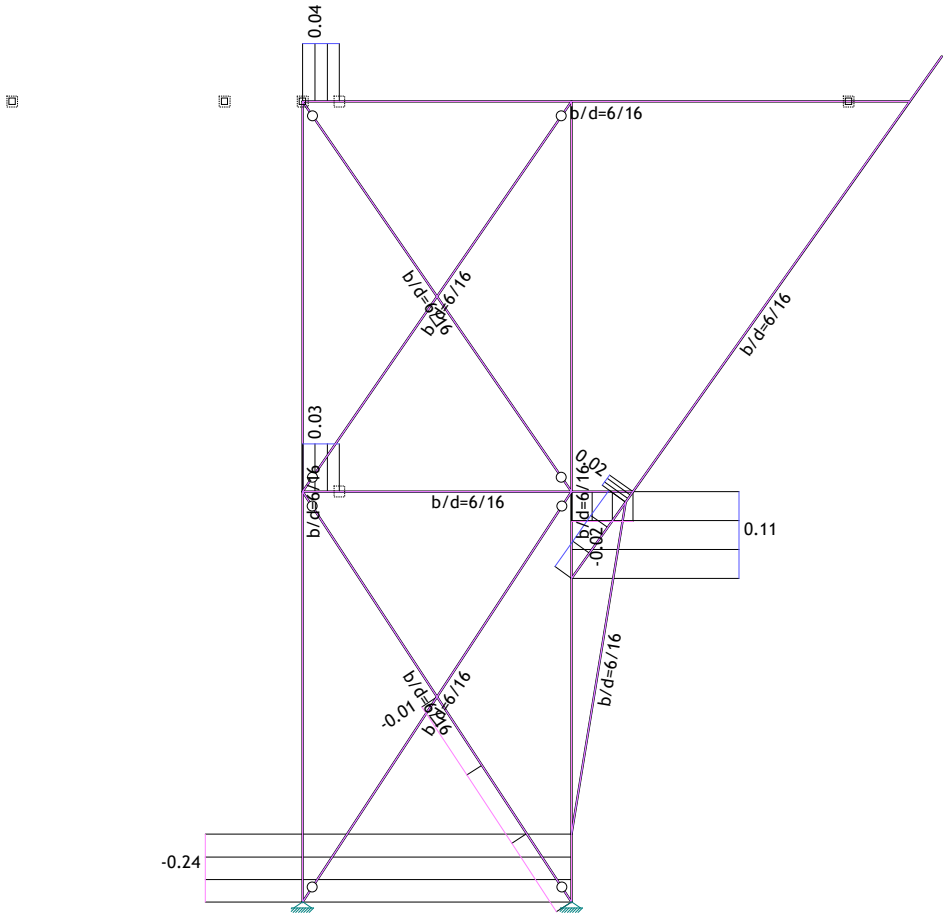
Isometric
Beam Results: max M2= 0.64 / min M2= -0.59 kNm

Load 16: [MSN] 4-7



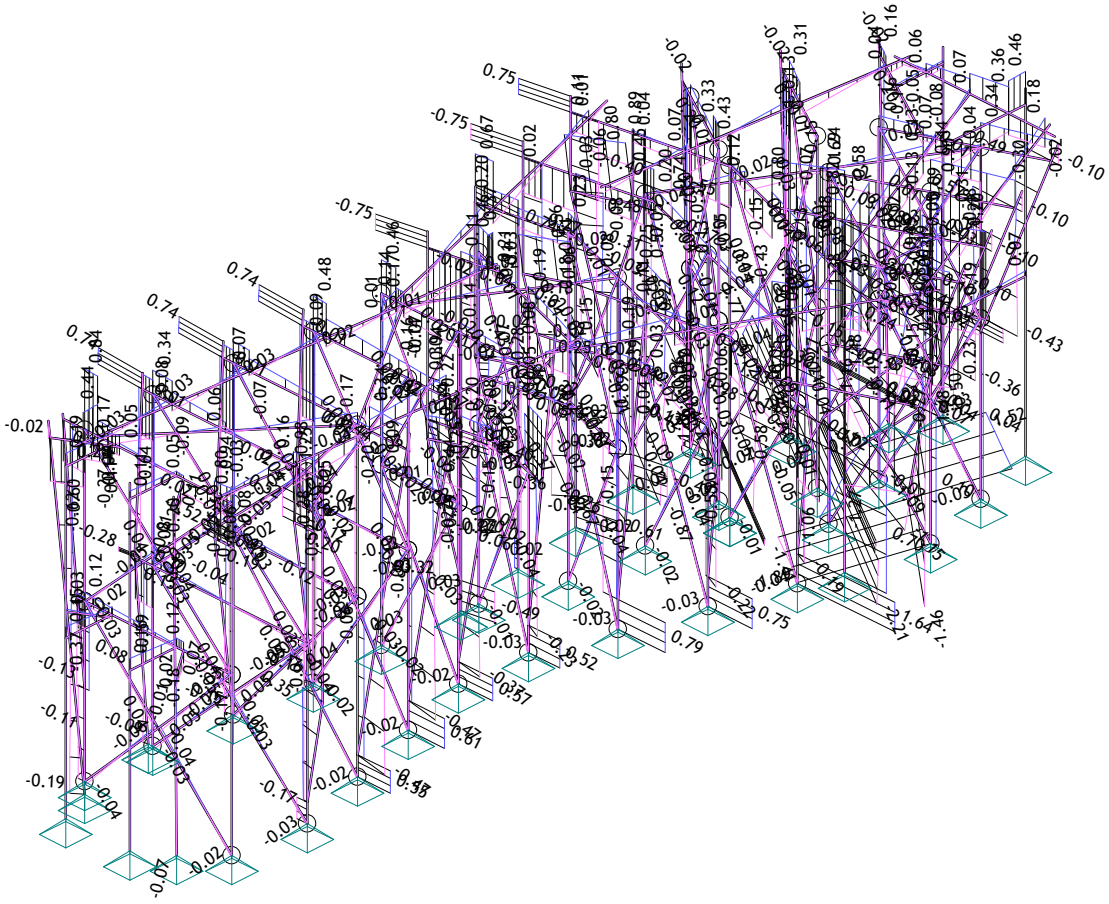
Isometric
Beam Results: max V3= 1.41 / min V3= -1.53 kN

Load 16: [MSN] 4-7



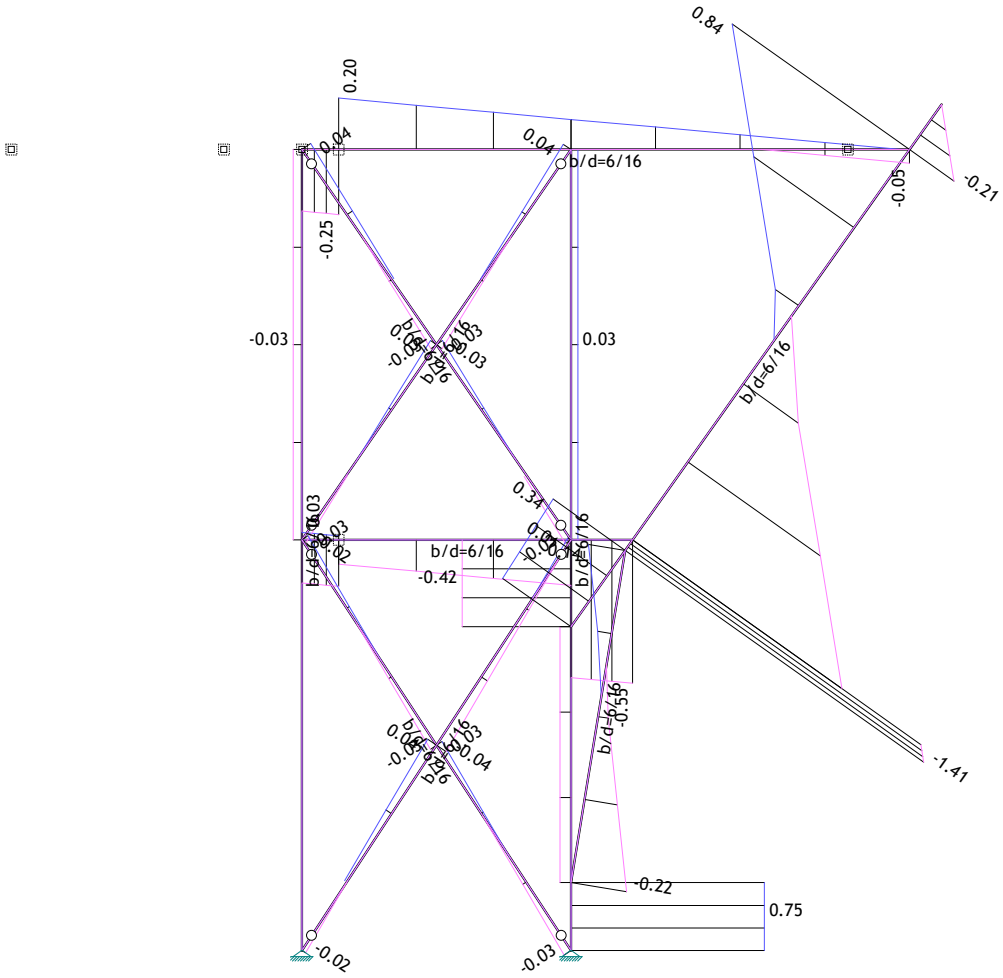
Frame: I_25
Beam Results: max V3= 0.11 / min V3= -0.24 kN

Load 16: [MSN] 4-7



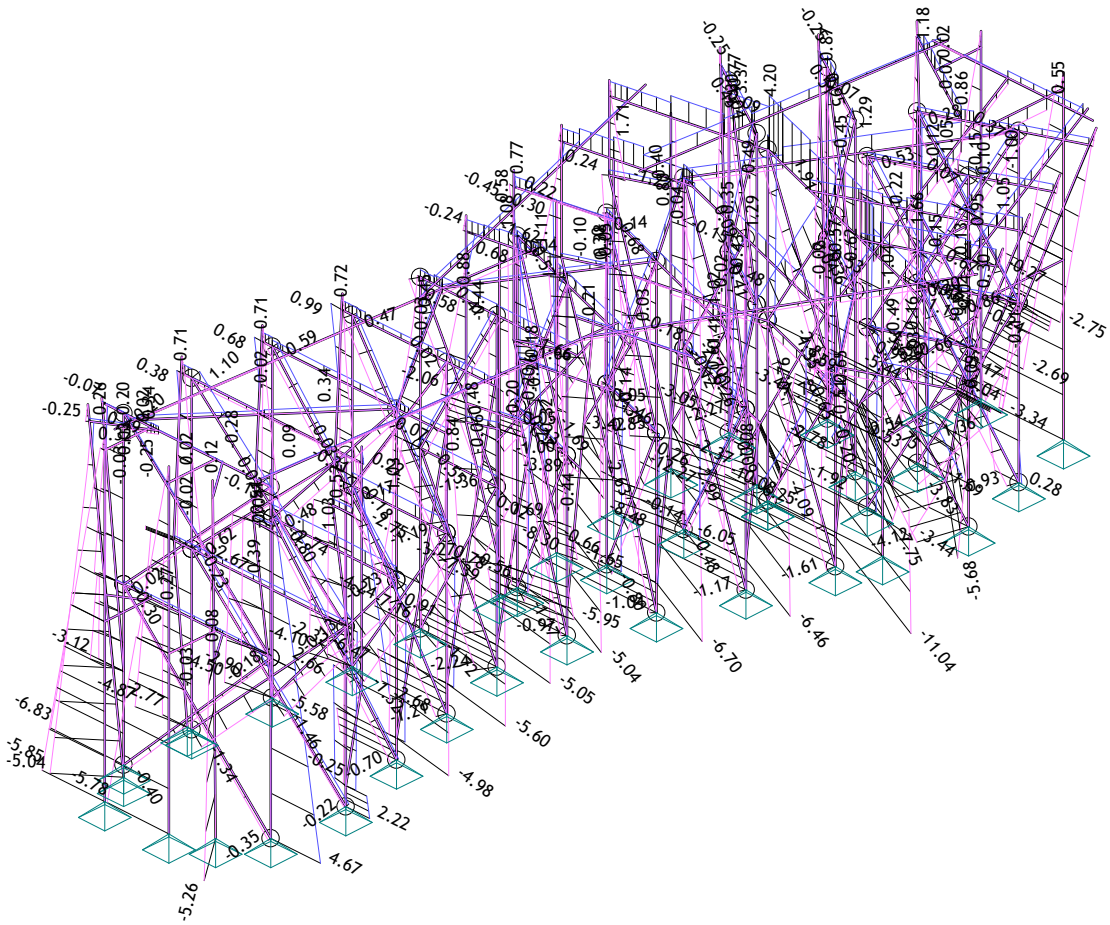
Isometric
Beam Results: max V2= 1.77 / min V2= -2.21 kN

Load 16: [MSN] 4-7



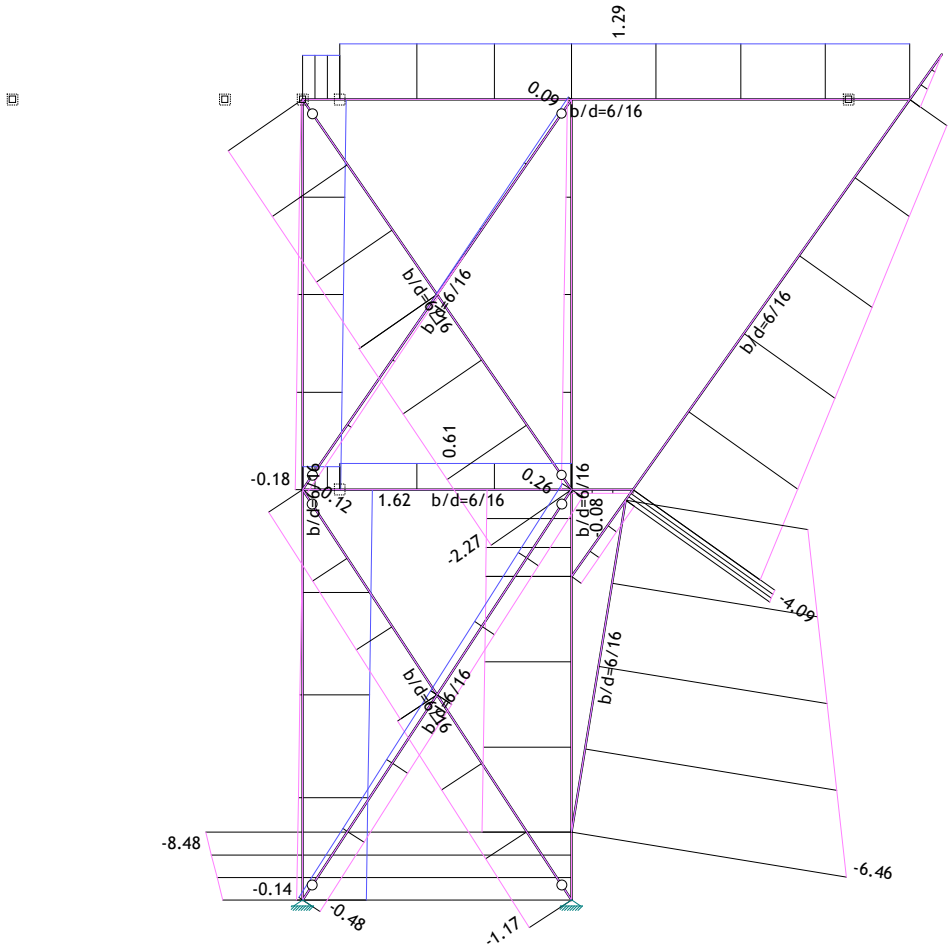
Frame: I_25
Beam Results: max V2= 0.84 / min V2= -1.41 kN

Load 16: [MSN] 4-7



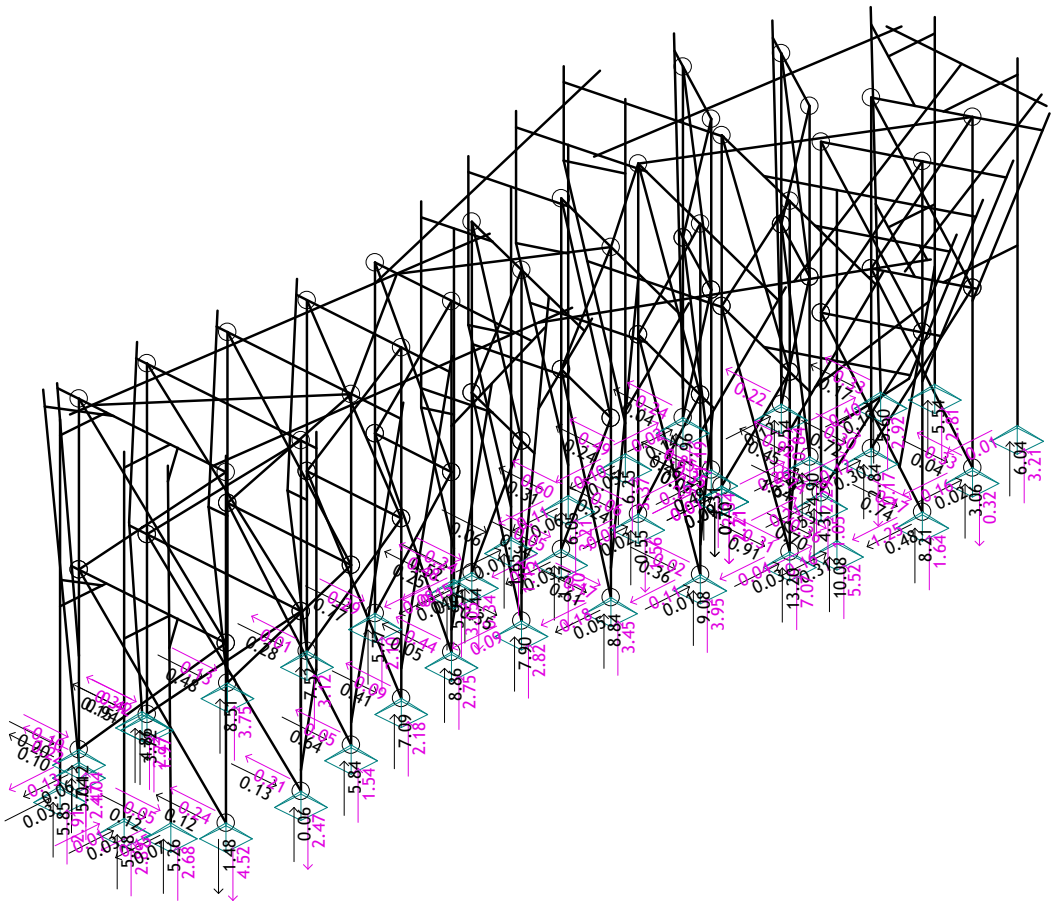
Isometric
Beam Results: max N1= 4.67 / min N1= -12.27 kN

Load 16: [MSN] 4-7



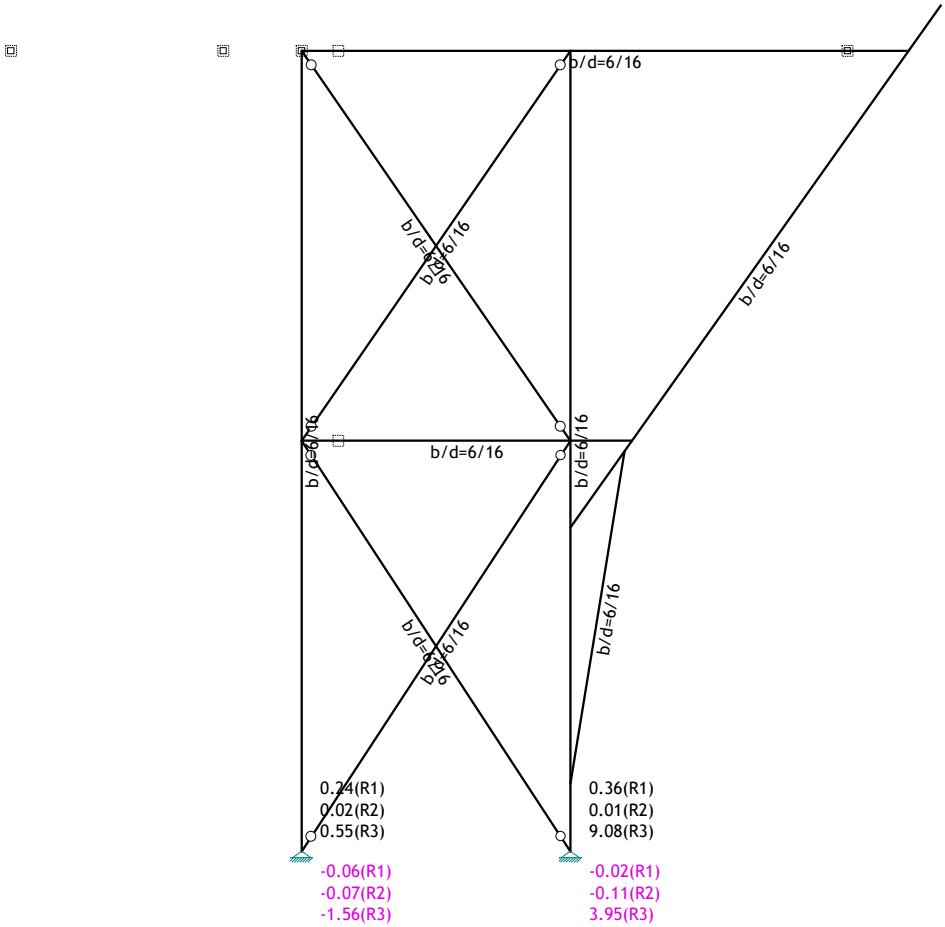
Frame: I_25
Beam Results: max N1= 1.62 / min N1= -8.48 kN

Load 16: [MSN] 4-7



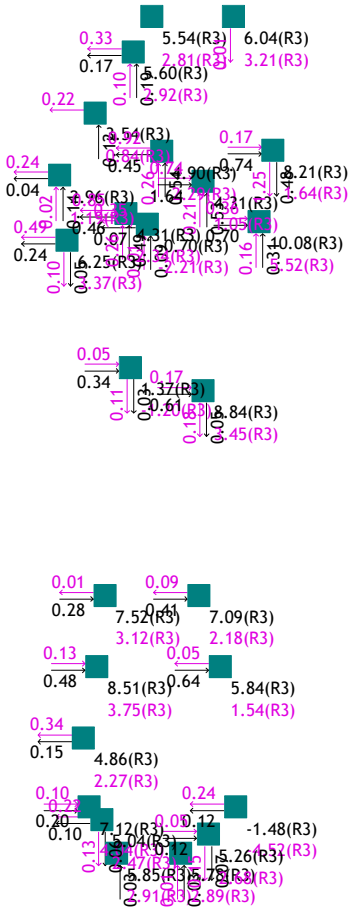
Isometric
Support Reactions

Load 16: [MSN] 4-7



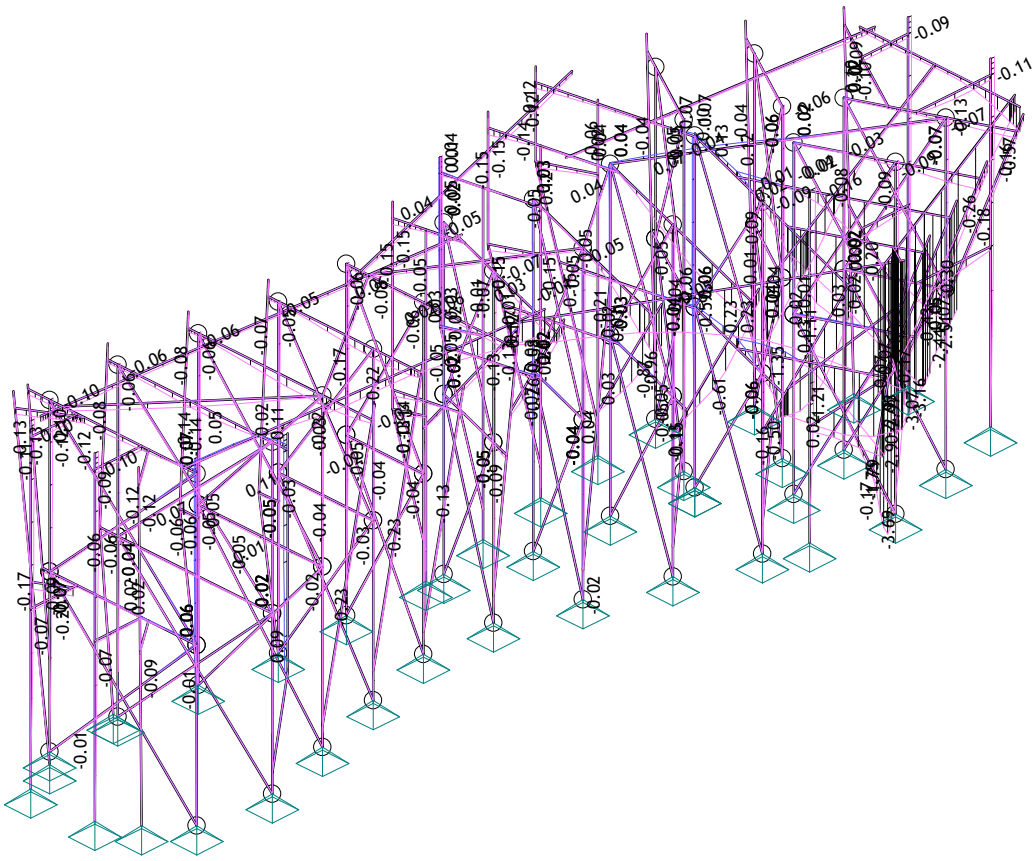
Frame: I_25
Support Reactions (Min/Max)

Load 16: [MSN] 4-7



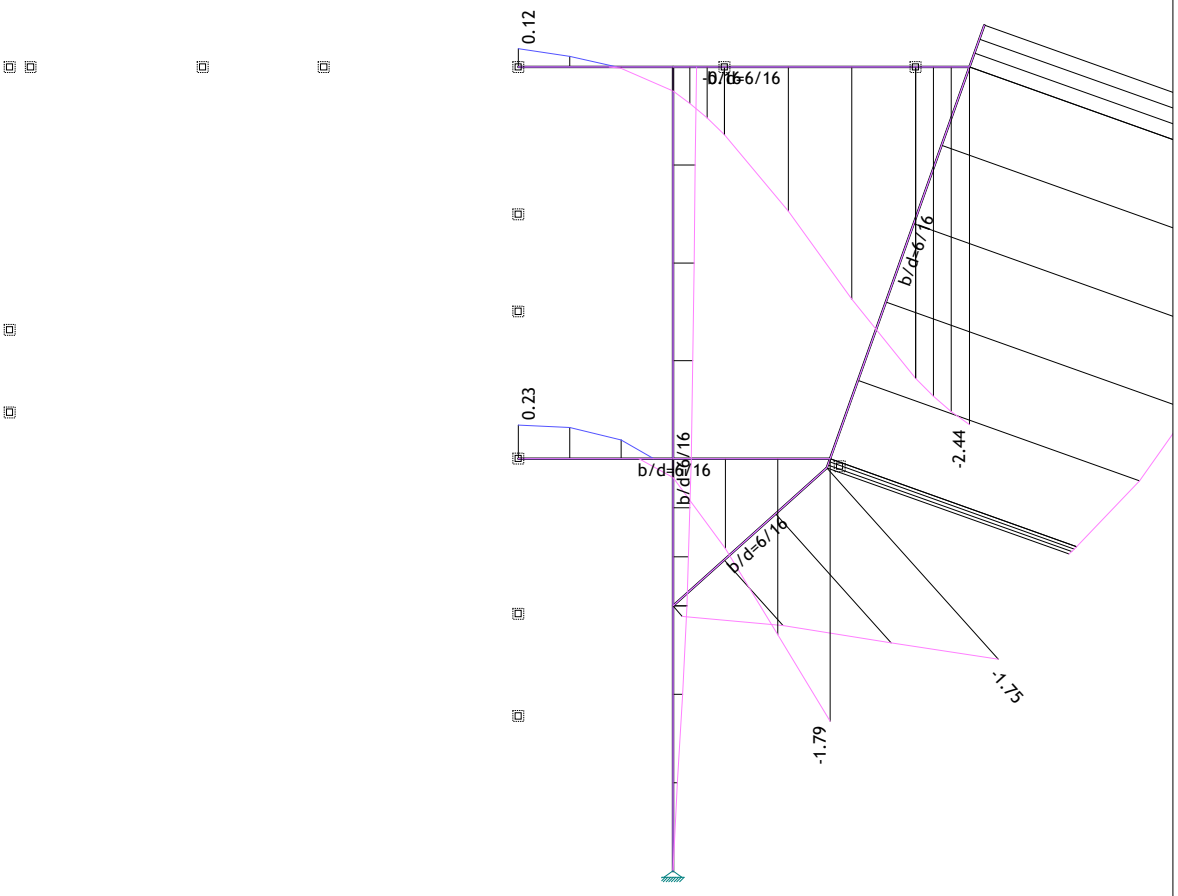
Level: [0.00 m]
Support Reactions (Min/Max)

Load 17: [MSU (T=0)] 8-11



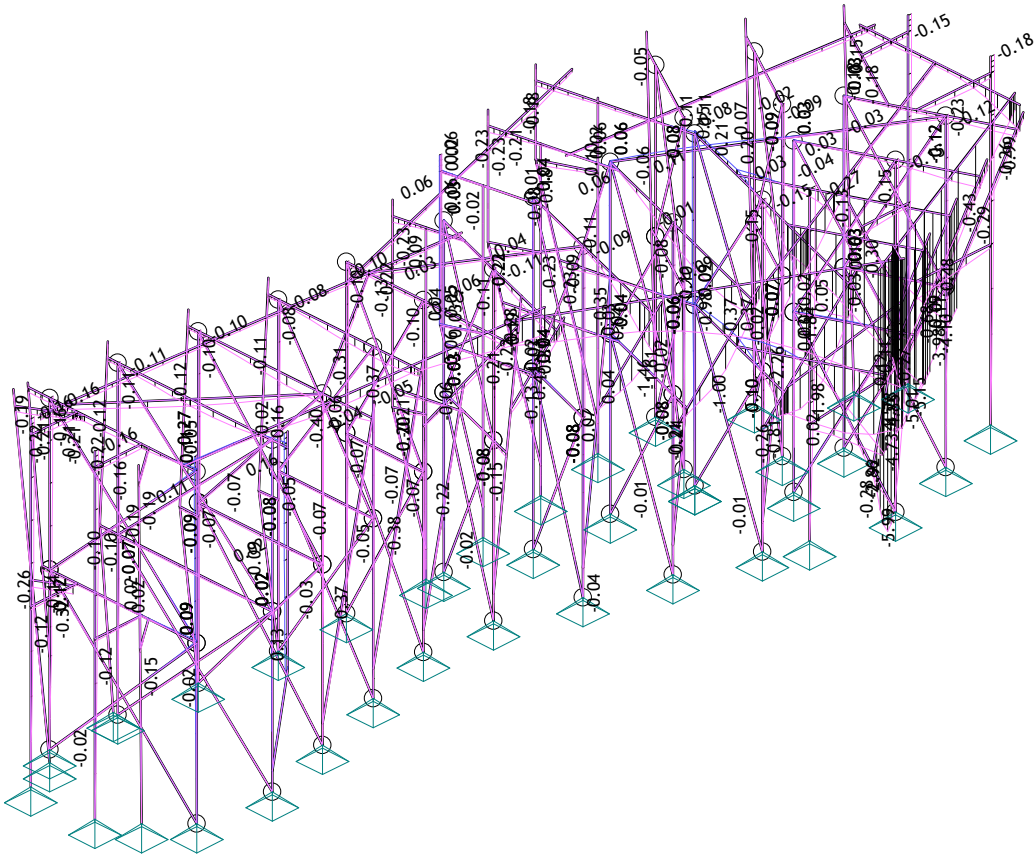
Isometric
Beam Results: max Zd= 0.23 / min Zd= -3.69 m / 1000

Load 17: [MSU (T=0)] 8-11



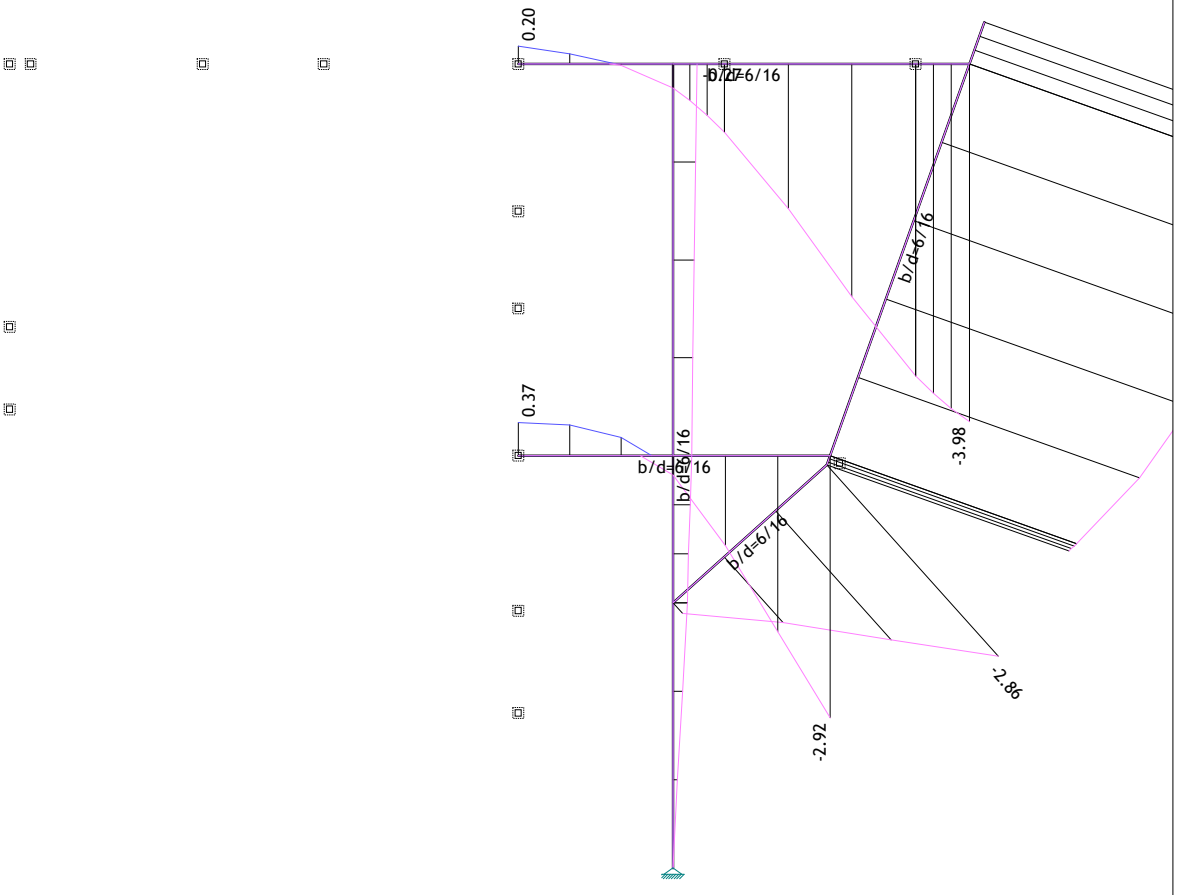
Frame: I_6
Beam Results: max Zd= 0.23 / min Zd= -2.51 m / 1000

Load 18: [MSU (T=fin)] 12-15



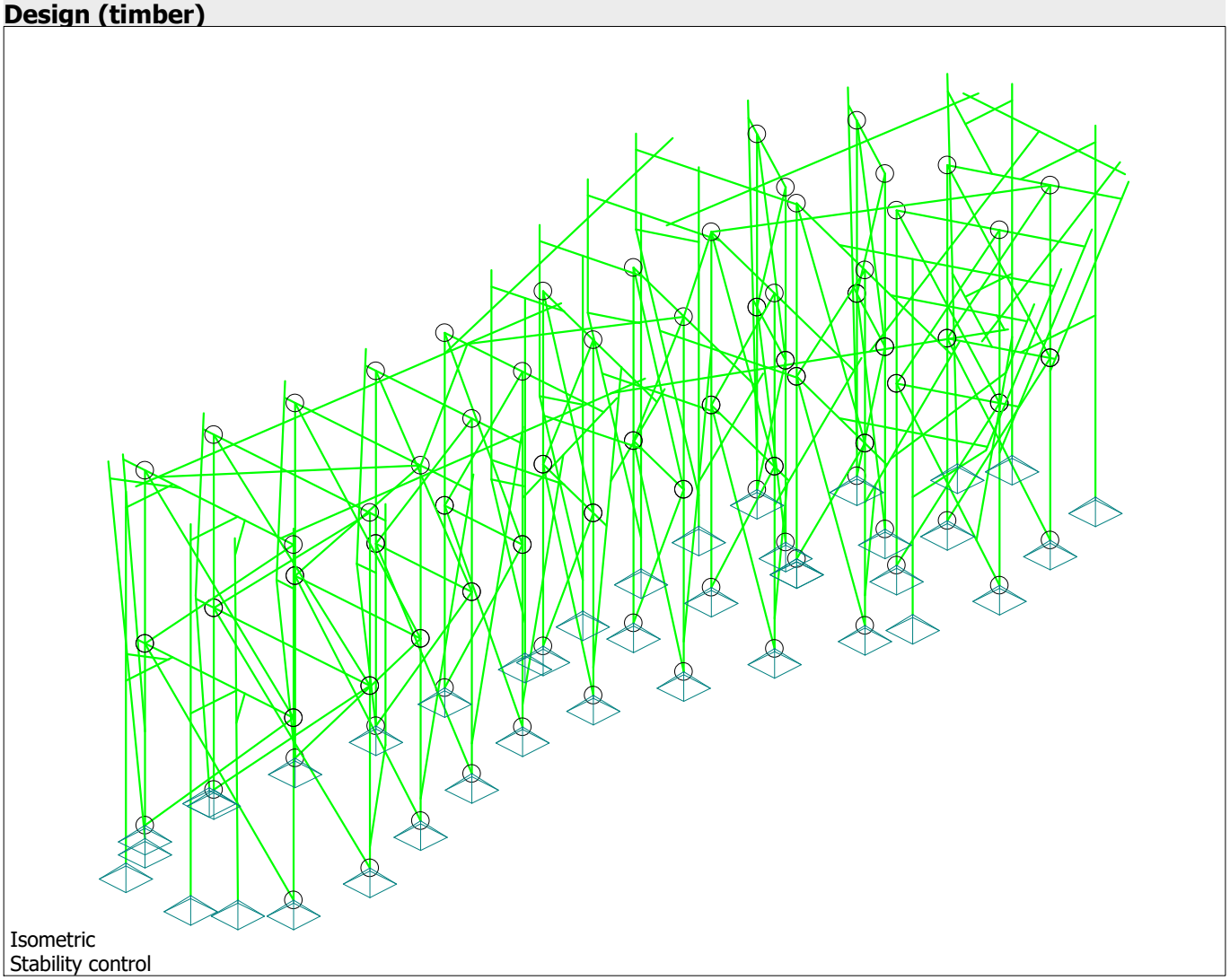
Isometric
Beam Results: max Zd= 0.37 / min Zd= -5.99 m / 1000

Load 18: [MSU (T=fin)] 12-15

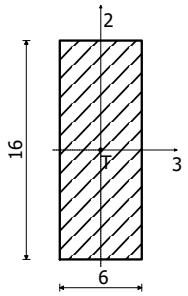


Frame: I_6
Beam Results: max Zd= 0.37 / min Zd= -4.10 m / 1000

Design (timber)



BEAM 340-266
Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

13. γ=0.27	12. γ=0.27	5. γ=0.24
15. γ=0.22	7. γ=0.19	4. γ=0.19
9. γ=0.17	14. γ=0.15	8. γ=0.14
11. γ=0.14	6. γ=0.10	10. γ=0.08

AXIAL STRESSES CONTROL
(load 13, end of the member)

The axial force design value	Ned =	-6.981 kN
Transversal Force in Axis 2 Direction	V2ed ≈	0.000 kN

STRESS CONTROL – COMPRESSION
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.201
Depth factor - axis 3	Kh_3 =	1.000
Factor considering re-distribution of bending stresses	km =	0.700
Characteristic compressive strength	fc,0,k =	21.000 MPa
Design compressive strength	fc,0,d =	14.538 MPa
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	19.957 MPa

Design bending strength about axis 3	fm,3,d =	16.615 MPa
Relative slenderness	λrel,2 =	2.238
Relative slenderness	λrel,3 =	0.839
Design compressive stress	σc,0,d =	0.727 MPa

COMPRESSION AND BENDING - BIG SLENDERNESS

Deviation from straightness factor	βc =	0.200
Coefficient	k3 =	0.906
Coefficient	k2 =	3.199
Coefficient	kc,3 =	0.801
Coefficient	kc,2 =	0.182

(σc,0,d / (kc_2 x fc,0,d)) + km x (σm3,d / fm,3,d) +
+ σm2,d / fm,2,d <= 1 (0.274 <= 1)

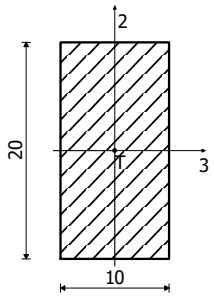
Section utilization is 27.4%

(σc,0,d / (kc_3 x fc,0,d)) + σm3,d / fm,3,d +
+ km x (σm2,d / fm,2,d) <= 1 (0.062 <= 1)

Section utilization is 6.2%

BEAM 313-342

Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

13. γ=0.11	5. γ=0.10	12. γ=0.10
15. γ=0.09	7. γ=0.08	9. γ=0.07
4. γ=0.07	11. γ=0.06	14. γ=0.05
8. γ=0.04	6. γ=0.03	10. γ=0.02

AXIAL STRESSES CONTROL
(load 13, at 57.4 cm from the start of the member)

The axial force design value	Ned =	1.099 kN
Transversal Force in Axis 2 Direction	V2ed ≈	0.000 kN
Transversal Force in Axis 3 Direction	V3ed =	0.857 kN
Bending Moment around Axis 2	M2ed =	0.553 kNm
Bending Moment around Axis 3	M3ed =	0.235 kNm

STRESS CONTROL - TENSION AND BENDING
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.084
Depth factor - axis 3	Kh_3 =	1.000
Depth factor - tension	Kh_t =	1.084
Characteristic tensile strength	ft,0,k =	14.000 MPa
Design tensile strength	ft,0,d =	10.511 MPa
Factor considering re-distribution of bending stresses	km =	0.700
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	18.019 MPa
Design bending strength about axis 3	fm,3,d =	16.615 MPa
Design tensile stress	σt,0,d =	0.055 MPa
Section modulus	W2 =	333.33 cm3
Axial Stress Bending around Axis 2	σm2,d =	1.659 MPa

σm2,d <= fm,2,d (1.659 <= 18.019)

Section utilization is 9.2%

Section modulus	W3 =	666.67 cm3
Axial Stress Bending around Axis 3	σm3,d =	0.353 MPa

σm3,d <= fm,3,d (0.353 <= 16.615)

Section utilization is 2.1%

σt,0,d / ft,0,d + km x (σm3,d / fm,3,d) + σm2,d / fm,2,d <= 1
(0.112 <= 1)

Section utilization is 11.2%

σt,0,d / ft,0,d + σm3,d / fm,3,d + km x (σm2,d / fm,2,d) <= 1
(0.091 <= 1)

Section utilization is 9.1%

SHEAR STRESSES CONTROL
(load 13, at 137.4 cm from the start of the member)

Transversal Force in Axis 2 Direction	V2ed ≈	0.000 kN
Transversal Force in Axis 3 Direction	V3ed =	1.009 kN

STRESS CONTROL – SHEAR
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Characteristic shear strength	fv,k =	4.000 MPa
Design shear strength	fv,d =	2.769 MPa
Cross Section Surface	A =	200.00 cm2
Actual Shear Stress(Axis 3)	τ3,d =	0.076 MPa

τ3,d <= fv,d (0.076 <= 2.769)

Section utilization is 2.7%

STABILITY VERIFICATION
(load 13, at 394.2 cm from the start of the member)

The axial force design value	Ned =	1.035 kN
Transversal Force in Axis 2 Direction	V2ed =	-0.215 kN
Transversal Force in Axis 3 Direction	V3ed =	0.246 kN
Bending Moment around Axis 2	M2ed =	-0.130 kNm
Bending Moment around Axis 3	M3ed =	-0.323 kNm

STABILITY CONTROL
Load type: basic - short-term

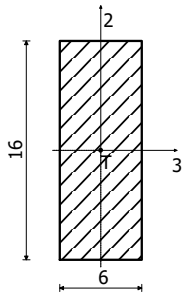
Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Length between lateral restr.points	lef =	409.58 cm
fifth percentile value of the modulus E parallel to the grain	E0.05 =	7400.0 MPa
fifth percentile value of shear modulus parallel to grain	G0.05 =	460.00 MPa
Torsional section modulus	Itor =	4545.5 cm4
Moment of inetrtia	I2 =	1666.7 cm4
Section modulus	W3 =	666.67 cm3
Critical bending stress	σm,crit =	58.427 MPa
Relative buckling slenderness	λrel =	0.641
Coefficient	k_krit =	1.000
Axial Stress Bending around Axis 3	σm3,d =	0.484 MPa

σm,3,d <= k_krit x fm,3,d (0.484 <= 16.615)

Section utilization is 2.9%

BEAM 296-200

Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

13. γ=0.79	12. γ=0.79	5. γ=0.68
15. γ=0.66	7. γ=0.57	4. γ=0.56
9. γ=0.48	14. γ=0.44	8. γ=0.42
11. γ=0.40	6. γ=0.32	10. γ=0.23

AXIAL STRESSES CONTROL
(load 13, at 292.9 cm from the start of the member)

The axial force design value	Ned =	-9.748 kN
Transversal Force in Axis 2 Direction	V2ed =	0.780 kN
Transversal Force in Axis 3 Direction	V3ed =	0.341 kN
Bending Moment around Axis 2	M2ed =	0.492 kNm
Bending Moment around Axis 3	M3ed =	-1.126 kNm

STRESS CONTROL - COMPRESSION AND BENDING

Load type: basic - short-term		
Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.201
Depth factor - axis 3	Kh_3 =	1.000
Factor considering re-distribution of bending stresses	km =	0.700
Characteristic compressive strength	fc,0,k =	21.000 MPa
Design compressive strength	fc,0,d =	14.538 MPa
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	19.957 MPa
Design bending strength about axis 3	fm,3,d =	16.615 MPa
Relative slenderness	λrel,2 =	2.140
Relative slenderness	λrel,3 =	0.803
Design compressive stress	σc,0,d =	1.015 MPa
Section modulus	W2 =	96.000 cm3
Axial Stress Bending around Axis 2	σm2,d =	5.129 MPa

σm2,d <= fm,2,d (5.129 <= 19.957)

Section utilization is 25.7%

Section modulus	W3 =	256.00 cm3
Axial Stress Bending around Axis 3	σm3,d =	4.398 MPa

σm3,d <= fm,3,d (4.398 <= 16.615)

Section utilization is 26.5%

COMPRESSION AND BENDING - BIG SLENDERNESS

Deviation from straightness factor	βc =	0.200
Coefficient	k3 =	0.872
Coefficient	k2 =	2.974
Coefficient	kc,3 =	0.824
Coefficient	kc,2 =	0.198

(σc,0,d / (kc_2 x fc,0,d)) + km x (σm3,d / fm,3,d) +
+ σm2,d / fm,2,d <= 1 (0.794 <= 1)

Section utilization is 79.4%

(σc,0,d / (kc_3 x fc,0,d)) + σm3,d / fm,3,d +
+ km x (σm2,d / fm,2,d) <= 1 (0.529 <= 1)

Section utilization is 52.9%

STABILITY CONTROL

Load type: basic - short-term		
Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Length between lateral restr.points	lef =	437.22 cm
fifth percentile value of the modulus E parallel to the grain	E0.05 =	7400.0 MPa
fifth percentile value of shear modulus parallel to grain	G0.05 =	460.00 MPa
Torsional section modulus	Itor =	879.81 cm4
Moment of inetrtia	I2 =	288.00 cm4
Section modulus	W3 =	256.00 cm3
Critical bending stress	σm,crit =	26.067 MPa
Relative buckling slenderness	λrel =	0.960
Coefficient	k_krit =	0.840
Axial Stress Bending around Axis 3	σm3,d =	4.398 MPa

σm,3,d <= k_krit x fm,3,d (4.398 <= 13.963)

Section utilization is 31.5%

SHEAR STRESSES CONTROL
(load 13, at 213.1 cm from the start of the member)

Transversal Force in Axis 2 Direction	V2ed =	-1.400 kN
Transversal Force in Axis 3 Direction	V3ed =	-0.564 kN

STRESS CONTROL – SHEAR

Load type: basic - short-term		
Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Characteristic shear strength	fv,k =	4.000 MPa
Design shear strength	fv,d =	2.769 MPa
Cross Section Surface	A =	96.000 cm2
Actual Shear Stress(Axis 2)	τ2,d =	0.219 MPa
Actual Shear Stress(Axis 3)	τ3,d =	0.088 MPa

Influence Superposition from Transversal Force

(2)	τ2,d / fv,d =	0.079
(3)	τ3,d / fv,d =	0.032

$(2)^2 + (3)^2 <= 1$ (0.009 <= 1)

Section utilization is 0.9%

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- SEGMENT_3

Input data - Structure

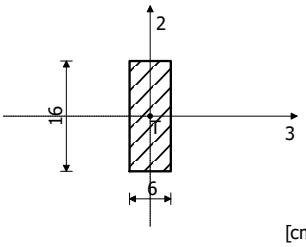
Table of materials

No	Material name	E[kN/m2]	μ	γ[kN/m3]	αt[1/C]	Em[kN/m2]	μm
1	Les-Iglavci-Masiven les	1.000e+7	0.20	5.00	1.000e-5	1.000e+7	0.20

Beam sets

Set: 1 Section: b/d=6/16, Approx. eccentricity

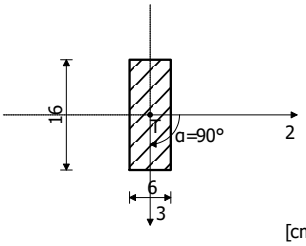
Mat.	A1	A2	A3	I1	I2	I3
1 - Les-Iglavci-M...	9.600e-3	8.000e-3	8.000e-3	8.803e-6	2.880e-6	2.048e-5



[cm]

Set: 2 Section: b/d=6/16, Approx. eccentricity

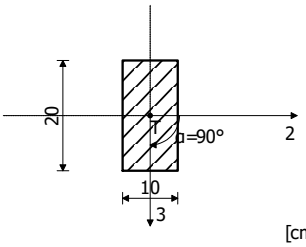
Mat.	A1	A2	A3	I1	I2	I3
1 - Les-Iglavci-M...	9.600e-3	8.000e-3	8.000e-3	8.803e-6	2.048e-5	2.880e-6



[cm]

Set: 3 Section: b/d=10/20, Approx. eccentricity

Mat.	A1	A2	A3	I1	I2	I3
1 - Les-Iglavci-M...	2.000e-2	1.667e-2	1.667e-2	4.578e-5	6.667e-5	1.667e-5



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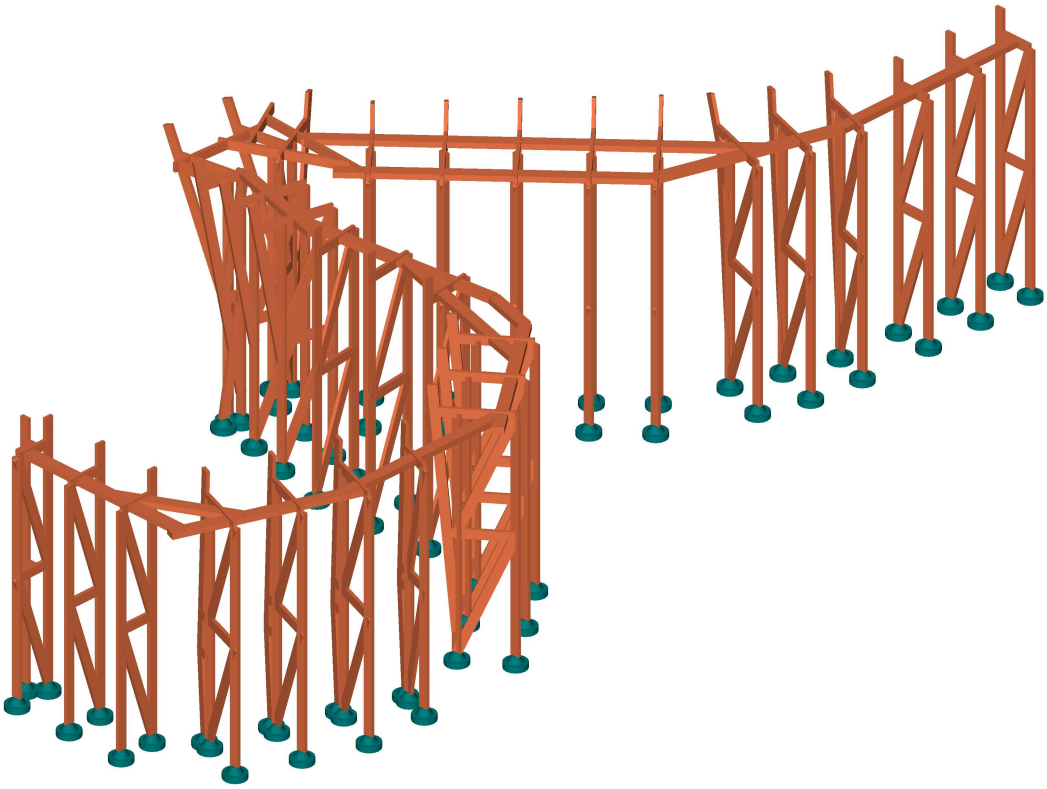
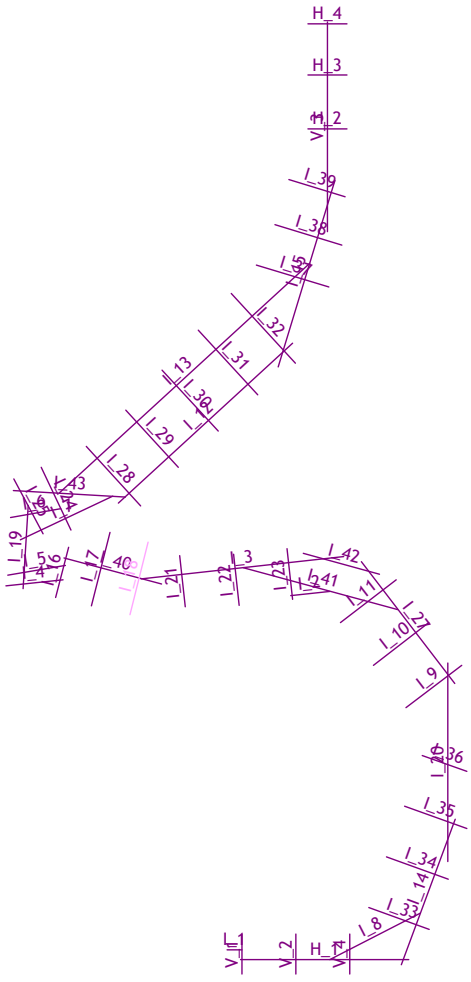
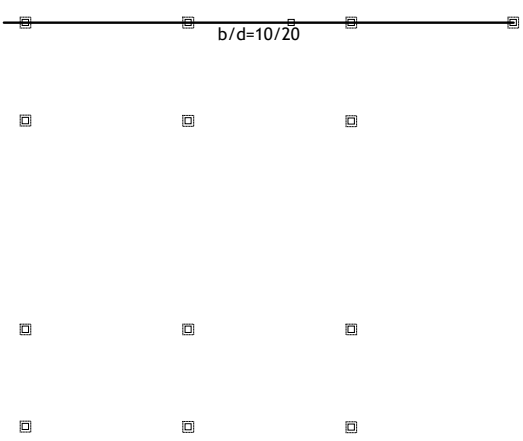


Isometric



Frame disposition



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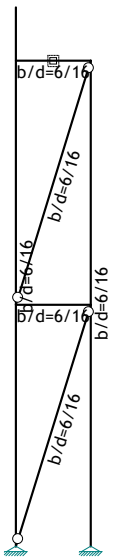

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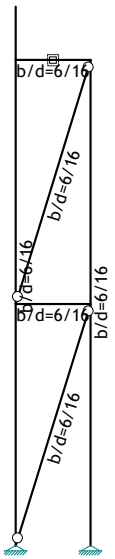
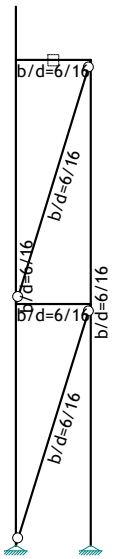
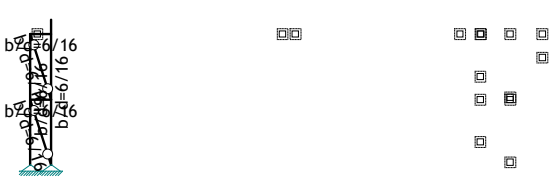


Frame: H_3



Frame: H_4

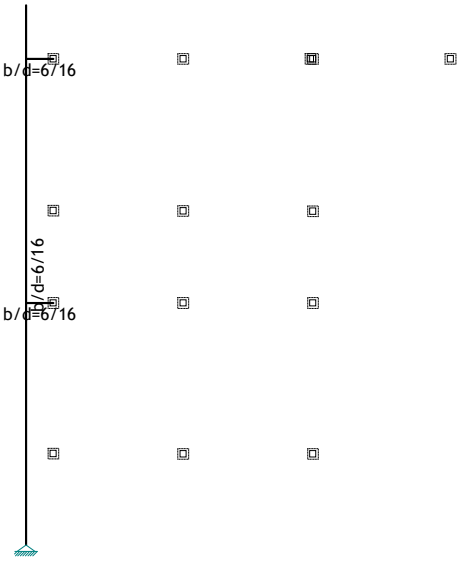
Frame: V_1



Frame: V_2

Frame: V_3

Frame: V_4



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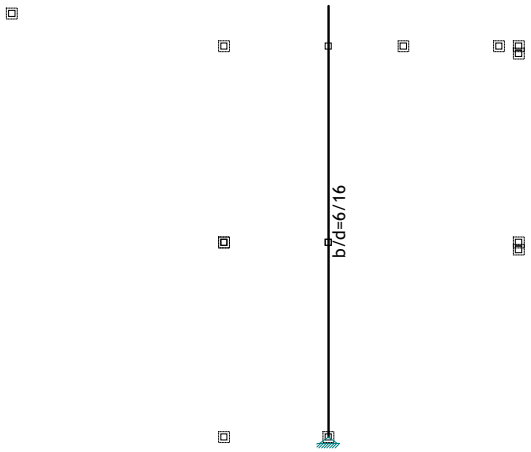

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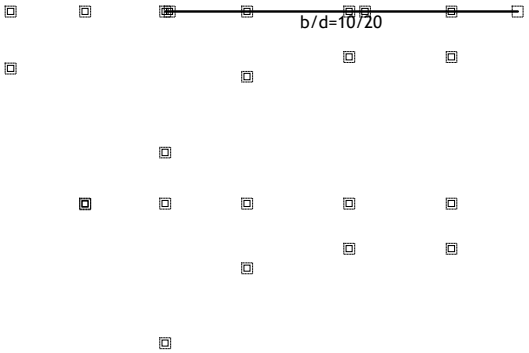

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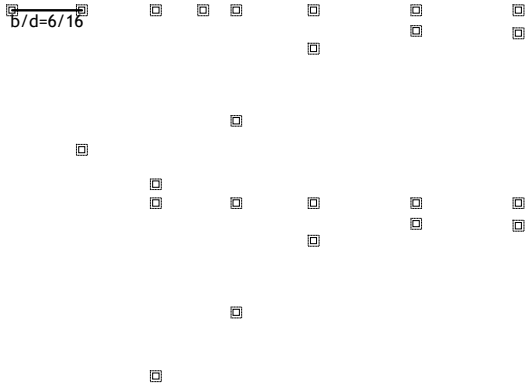

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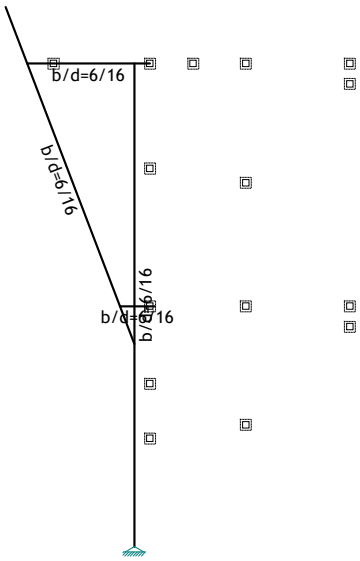

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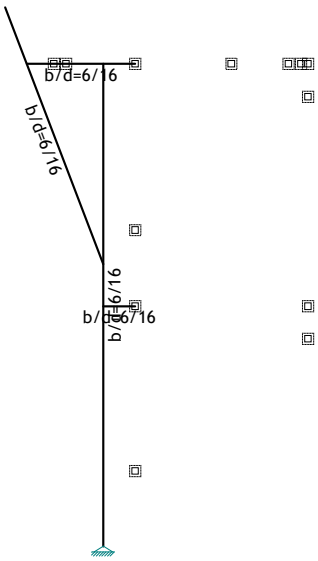

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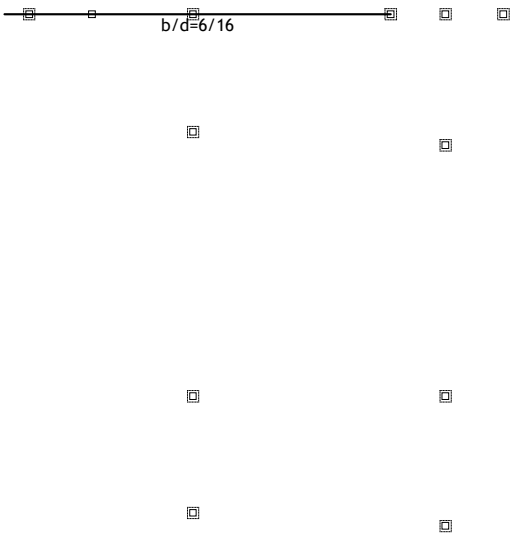

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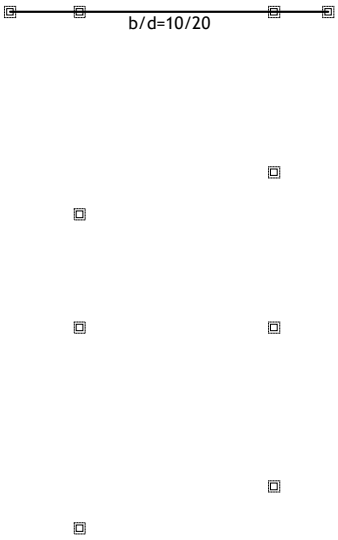

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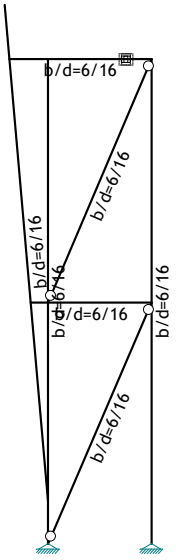

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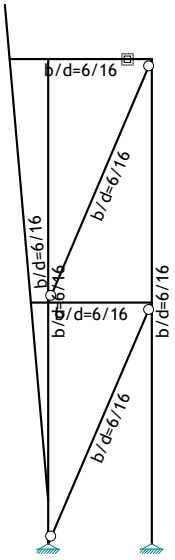

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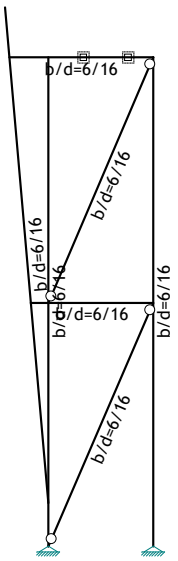

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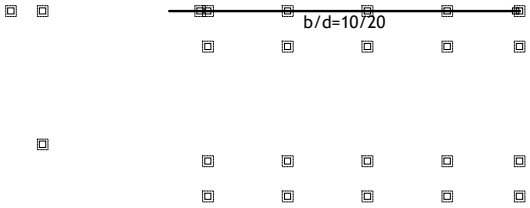

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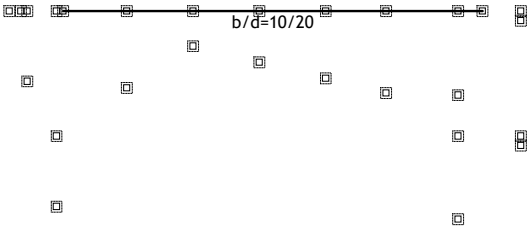

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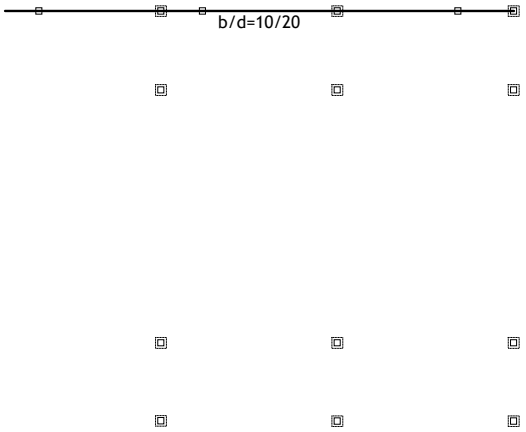

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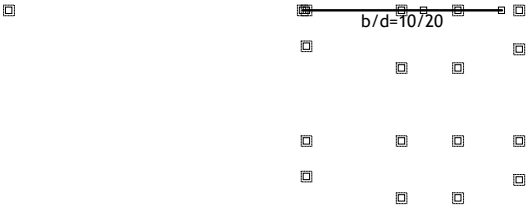

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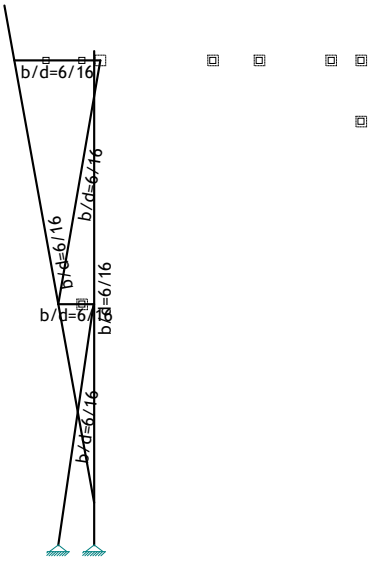

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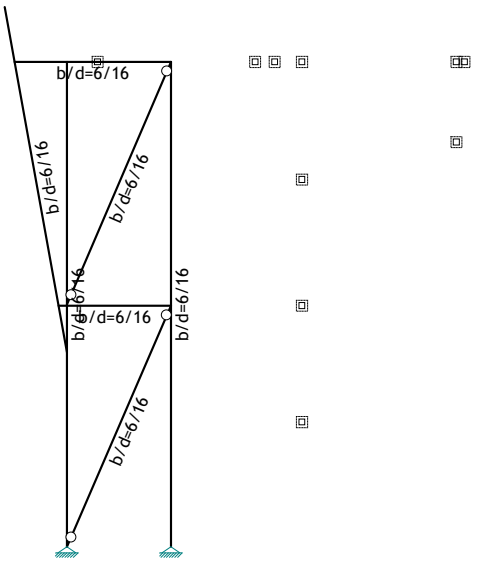
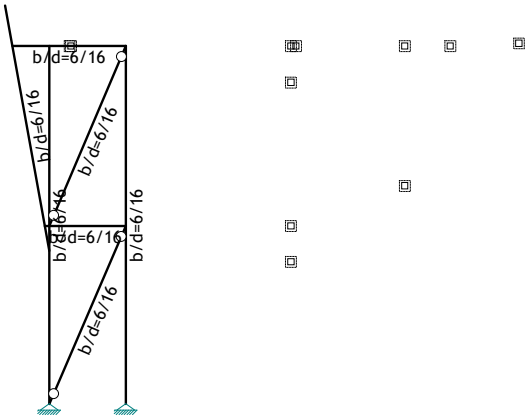


Frame: I_17



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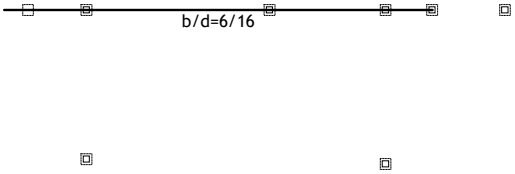
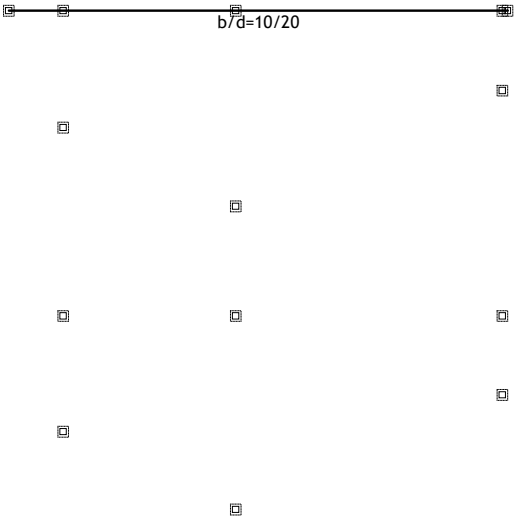
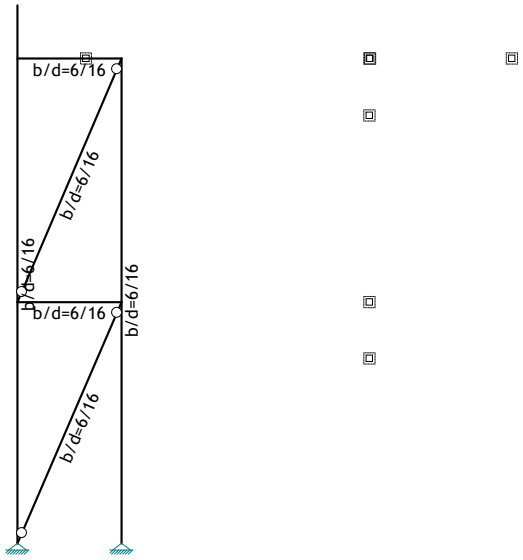


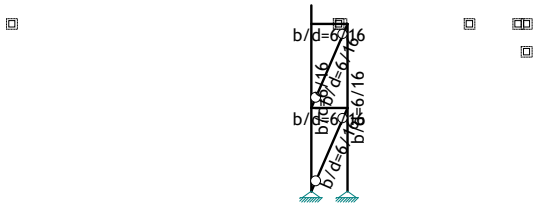
Frame: I_19



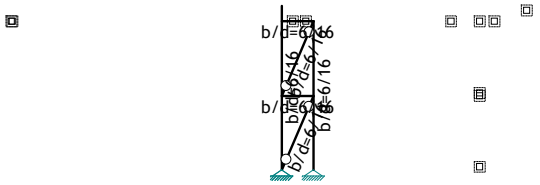
Frame: I_20



Frame: I_21



Frame: I_22

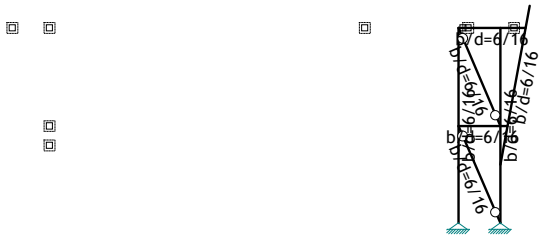


Frame: I_23

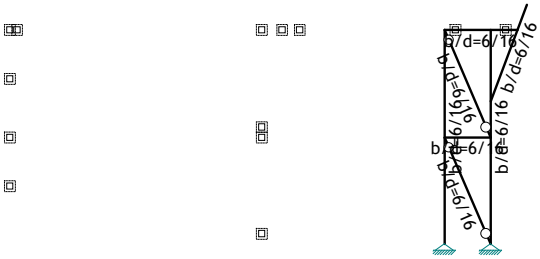
Frame: I_24

Frame: I_25

Frame: I_27



Frame: I_28



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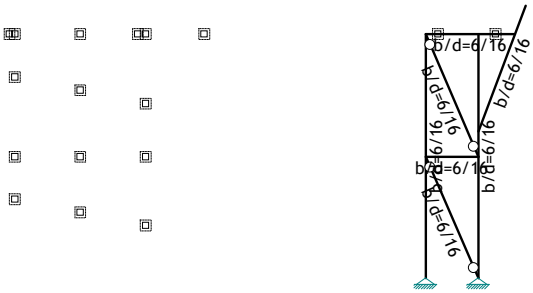
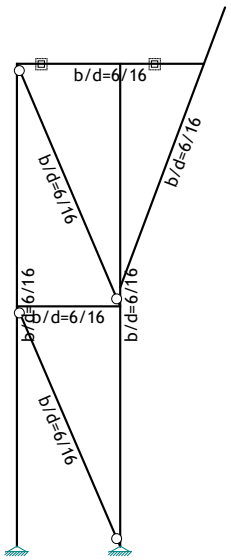
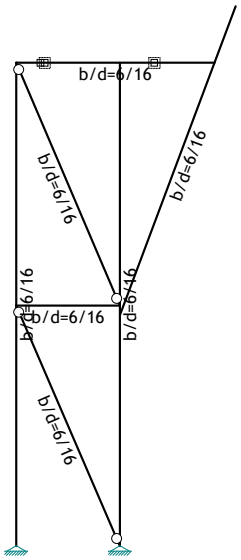


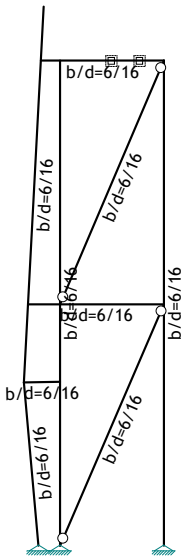
Frame: I_30



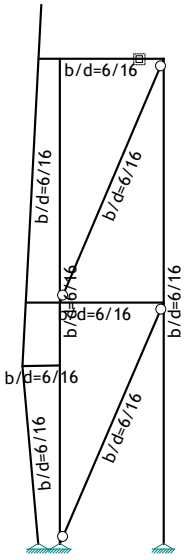
Frame: I_31



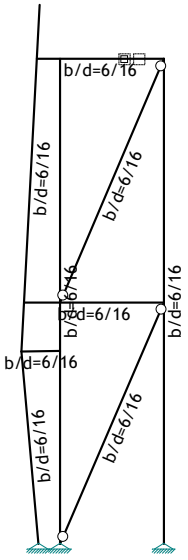
Frame: I_32



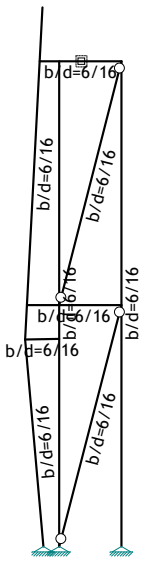
Frame: I_33



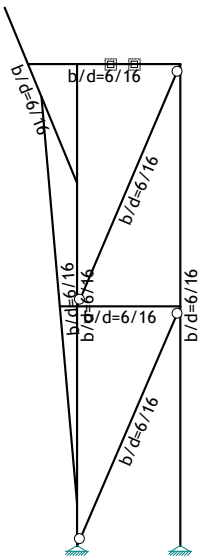
Frame: I_34



Frame: I_35



Frame: I_36



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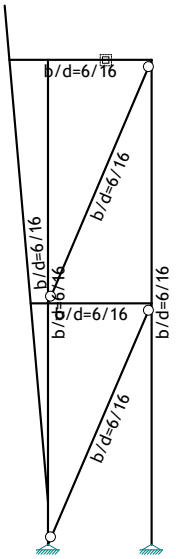
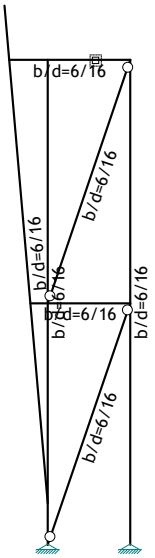
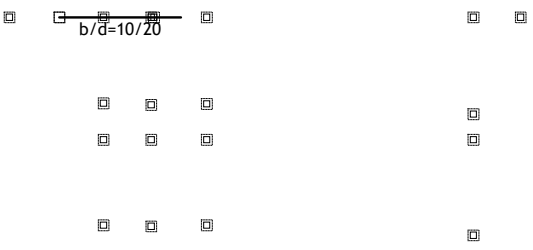


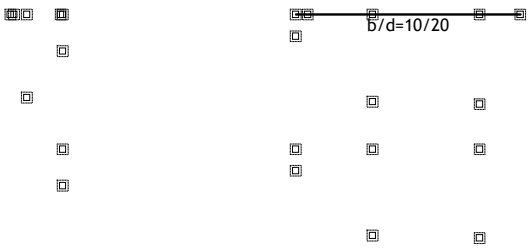
Frame: I_38



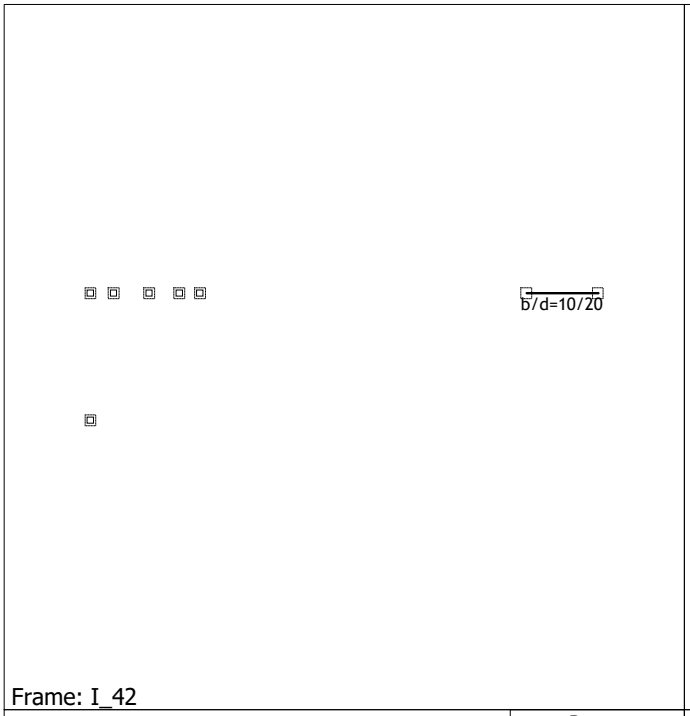
Frame: I_39



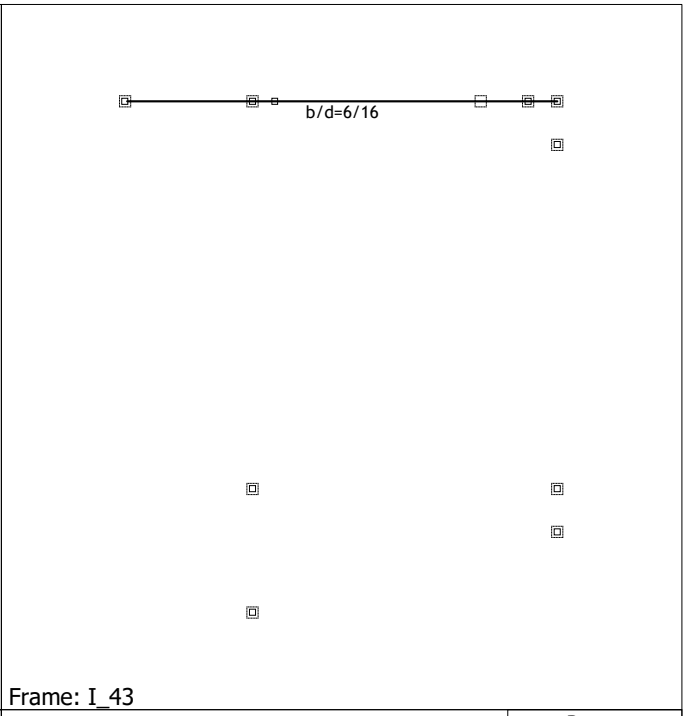
Frame: I_40



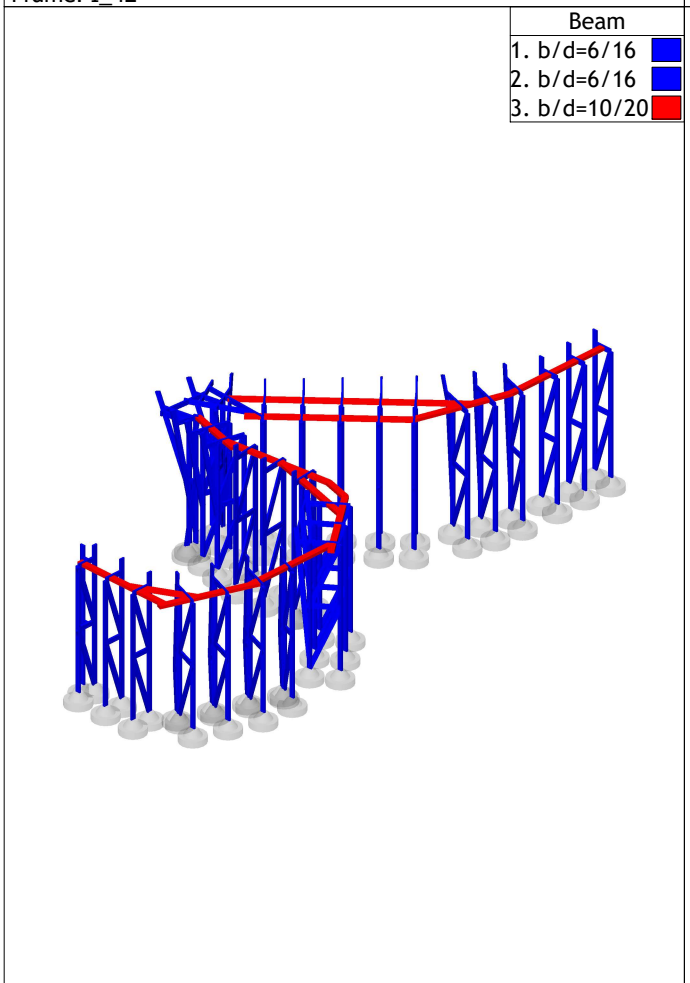
Frame: I_41



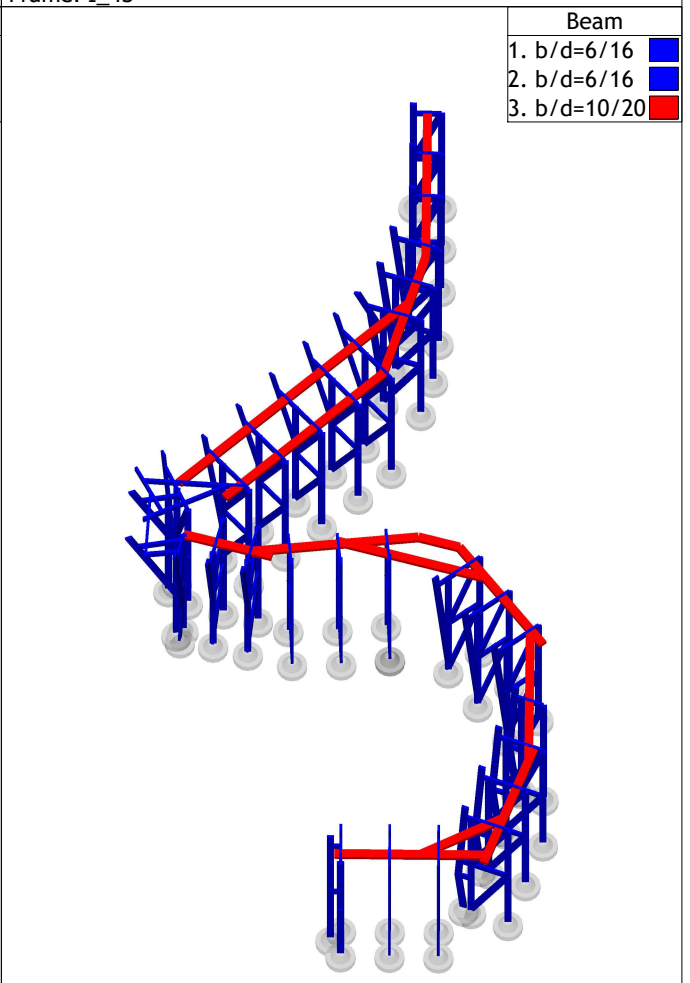
Frame: I_42



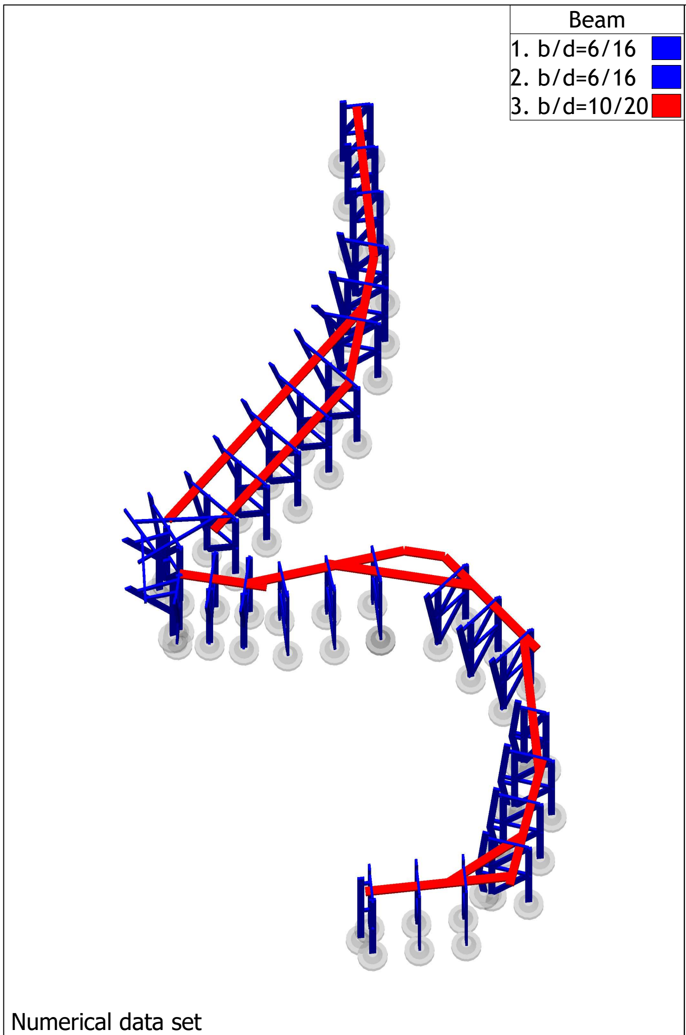
Frame: I_43



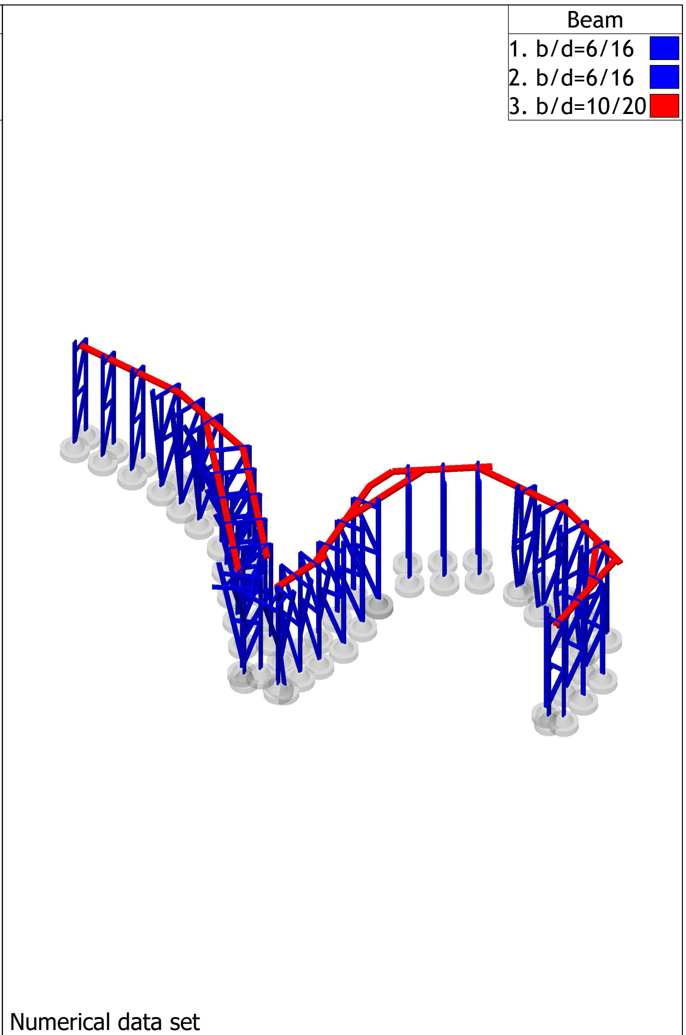
Numerical data set
Beam (1-3)



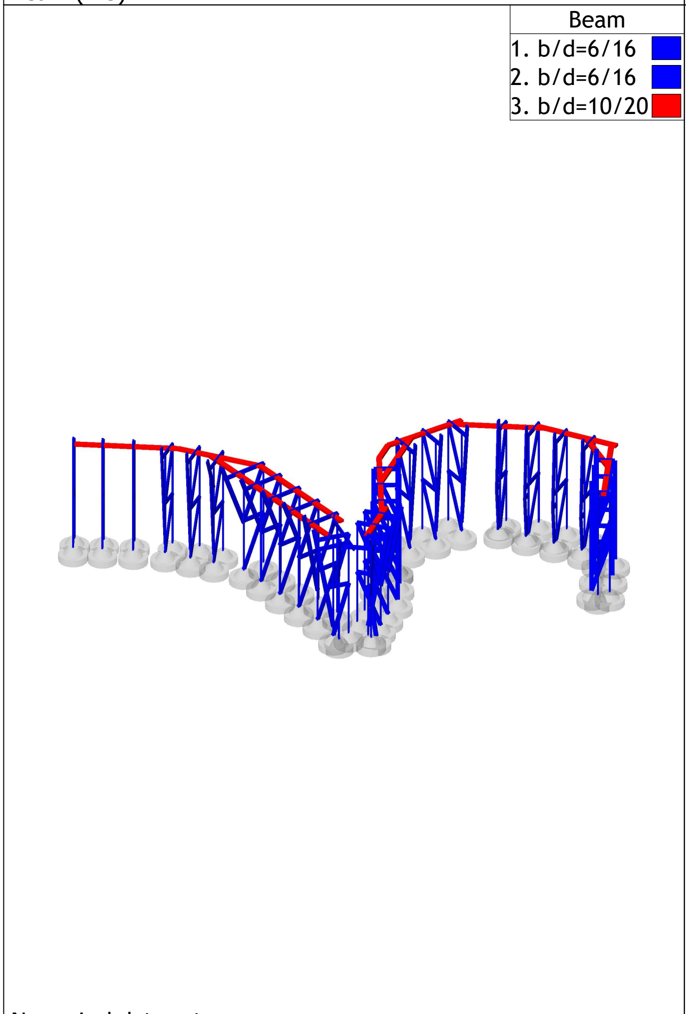
Numerical data set
Beam (1-3)



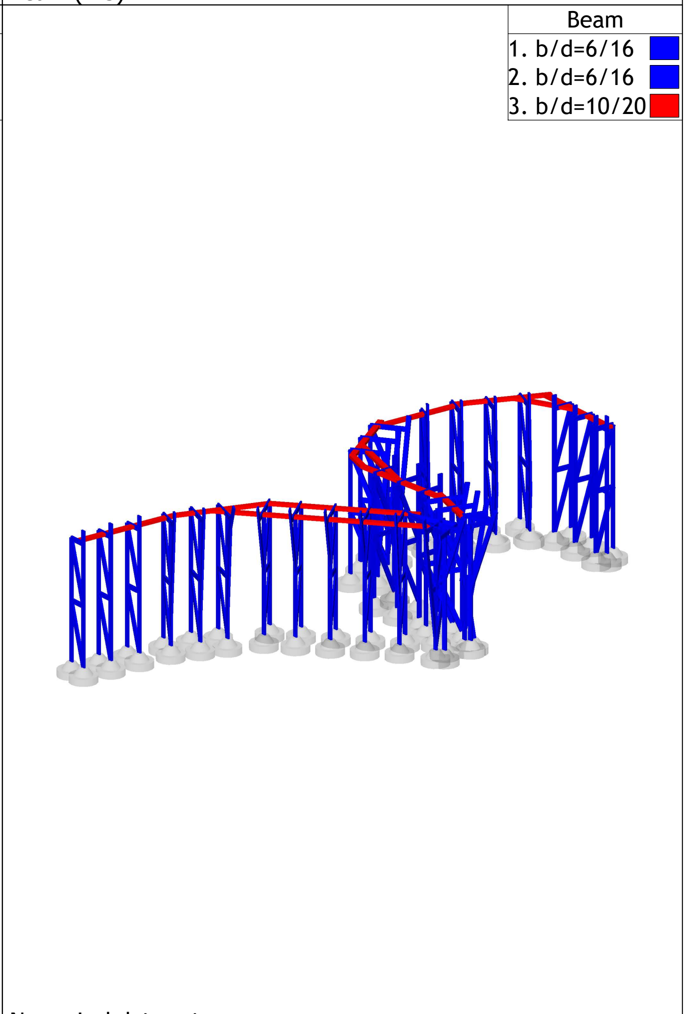
Numerical data set
Beam (1-3)



Numerical data set
Beam (1-3)



Numerical data set
Beam (1-3)



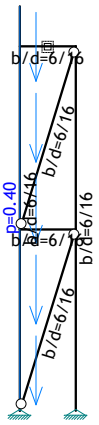
Numerical data set
Beam (1-3)

Input data - Load

Load cases list

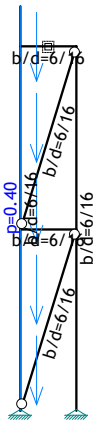
LC	Name	pX [kN]	pY [kN]	pZ [kN]
1	Dead Load (g)	-0.00	-0.00	-85.62
2	Live Load	0.00	0.00	-56.66
3	Live Load (h)	-3.69	1.84	0.00
4	Comb.: 1.35xI	-0.00	-0.00	-115.58
5	Comb.: 1.35xI+1.5xII	-0.00	0.00	-200.57
6	Comb.: 1.35xI+1.5xIII	-5.53	2.76	-115.58
7	Comb.: 1.35xI+1.5xII+1.5xIII	-5.53	2.76	-200.57
8	Comb.: I	-0.00	-0.00	-85.62
9	Comb.: I+II	-0.00	0.00	-142.28
10	Comb.: I+III	-3.69	1.84	-85.62
11	Comb.: I+II+III	-3.69	1.84	-142.28
12	Comb.: 1.9xI	-0.00	-0.00	-162.67
13	Comb.: 1.9xI+1.29xII	-0.00	0.00	-235.76
14	Comb.: 1.9xI+1.29xIII	-4.76	2.38	-162.67
15	Comb.: 1.9xI+1.29xII+1.29xIII	-4.76	2.38	-235.76

Load 1: Dead Load (g)



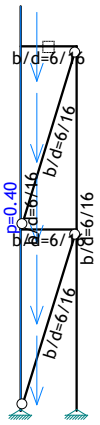
Frame: H_2

Load 1: Dead Load (g)



Frame: H_3

Load 1: Dead Load (g)

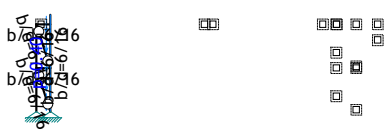


Frame: H_4

Load 1: Dead Load (g)

Frame: V_1

Load 1: Dead Load (g)

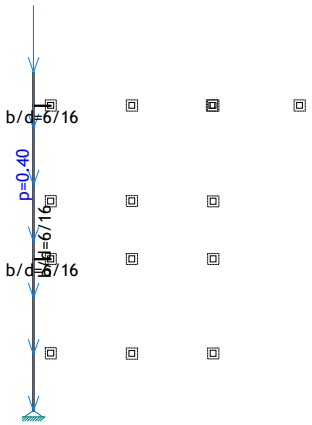


Frame: V_2

Load 1: Dead Load (g)

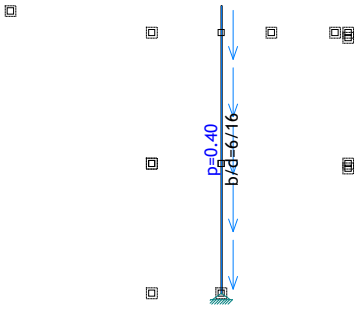
Frame: V_4

Load 1: Dead Load (g)



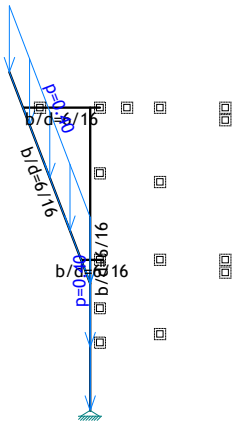
Frame: I_1

Load 1: Dead Load (g)



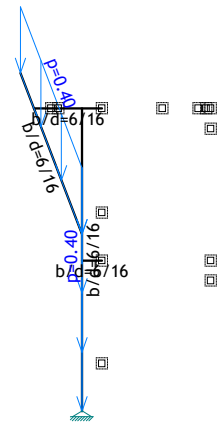
Frame: I_2

Load 1: Dead Load (g)



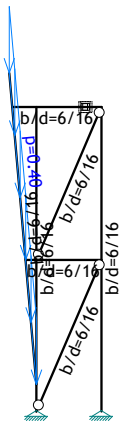
Frame: I_5

Load 1: Dead Load (g)



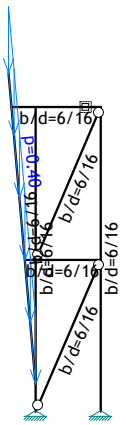
Frame: I_6

Load 1: Dead Load (g)



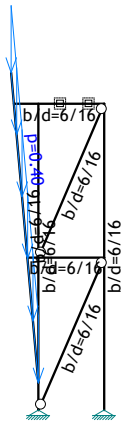
Frame: I_9

Load 1: Dead Load (g)



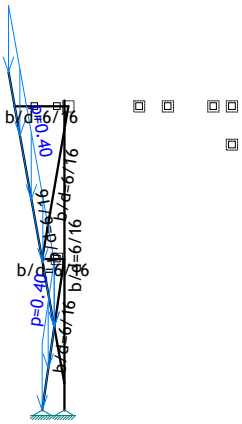
Frame: I_10

Load 1: Dead Load (g)



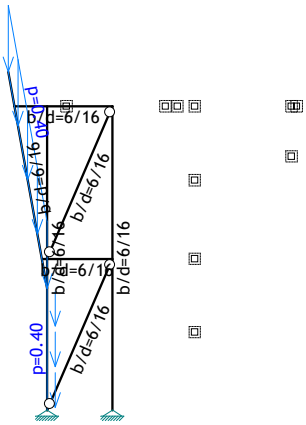
Frame: I_11

Load 1: Dead Load (g)



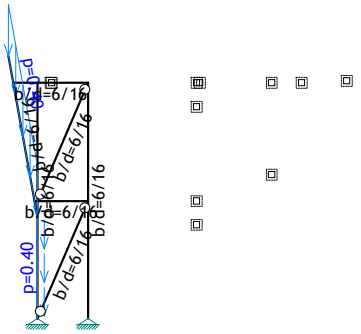
Frame: I_16

Load 1: Dead Load (g)



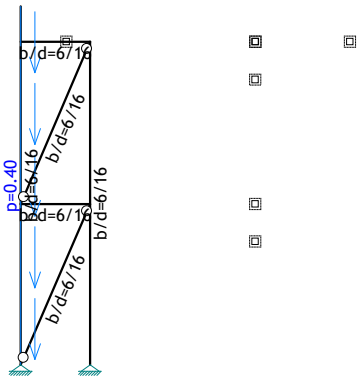
Frame: I_17

Load 1: Dead Load (g)



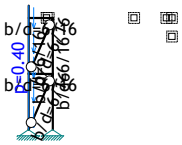
Frame: I_18

Load 1: Dead Load (g)



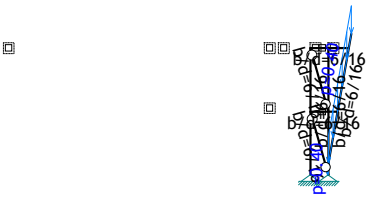
Frame: I_21

Load 1: Dead Load (g)



Frame: I_22

Load 1: Dead Load (g)

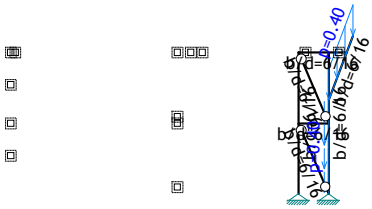


Frame: I_24

Load 1: Dead Load (g)

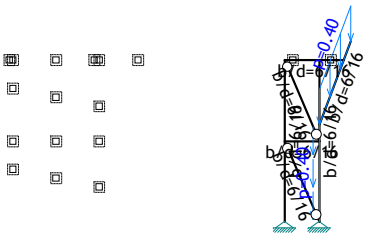
Frame: I_28

Load 1: Dead Load (g)



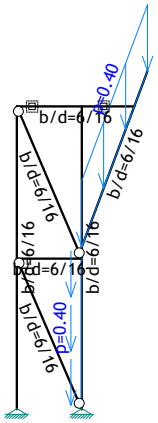
Frame: I_29

Load 1: Dead Load (g)



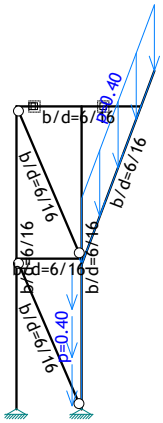
Frame: I_30

Load 1: Dead Load (g)



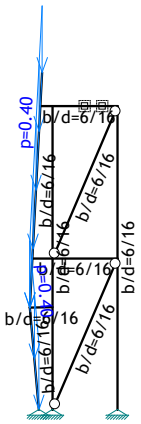
Frame: I_31

Load 1: Dead Load (g)



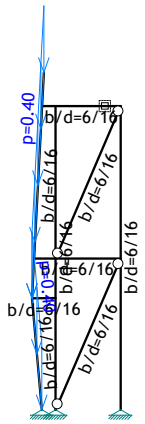
Frame: I_32

Load 1: Dead Load (g)



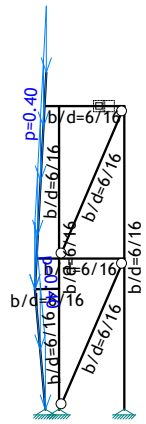
Frame: I_33

Load 1: Dead Load (g)



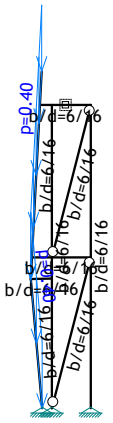
Frame: I_34

Load 1: Dead Load (g)



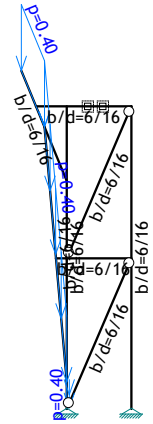
Frame: I_35

Load 1: Dead Load (g)



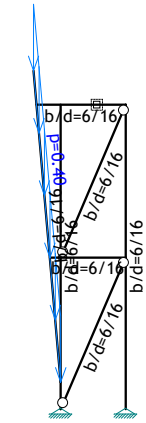
Frame: I_36

Load 1: Dead Load (g)



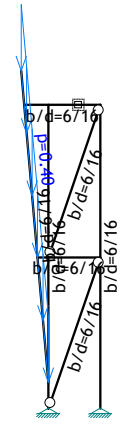
Frame: I_37

Load 1: Dead Load (g)



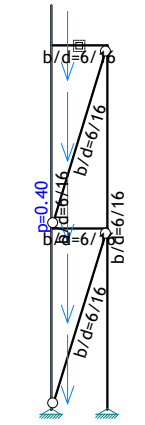
Frame: I_38

Load 1: Dead Load (g)



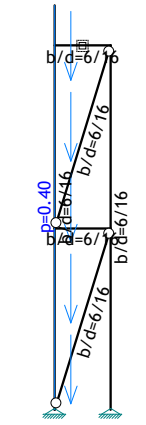
Frame: I_39

Load 2: Live Load



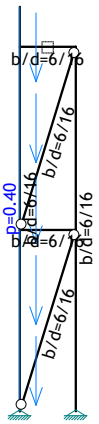
Frame: H_2

Load 2: Live Load



Frame: H_3

Load 2: Live Load

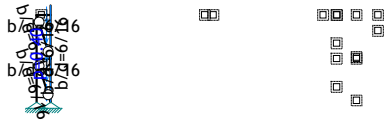


Frame: H_4

Load 2: Live Load

Frame: V_1

Load 2: Live Load

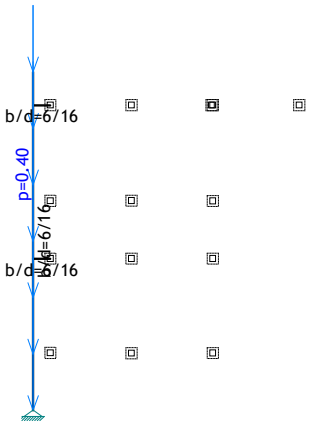


Frame: V_2

Load 2: Live Load

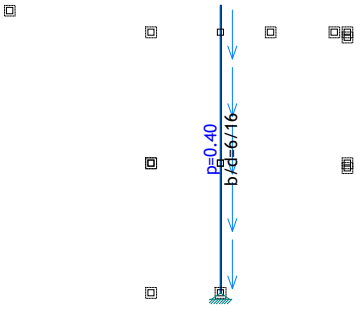
Frame: V_4

Load 2: Live Load



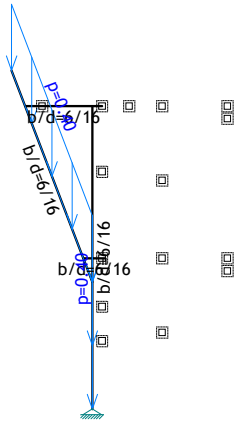
Frame: I_1

Load 2: Live Load



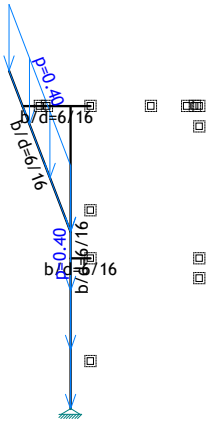
Frame: I_2

Load 2: Live Load



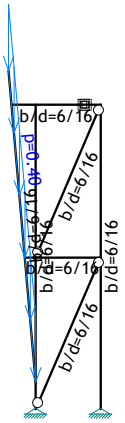
Frame: I_5

Load 2: Live Load



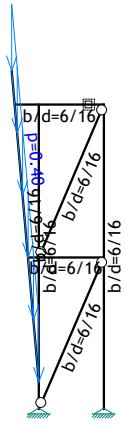
Frame: I_6

Load 2: Live Load



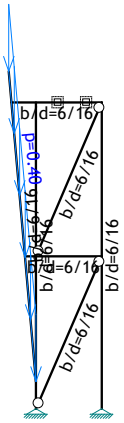
Frame: I_9

Load 2: Live Load



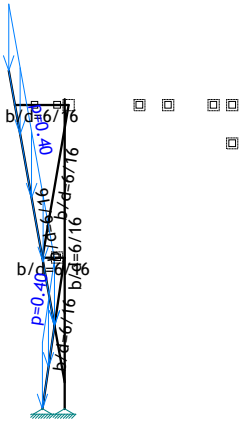
Frame: I_10

Load 2: Live Load



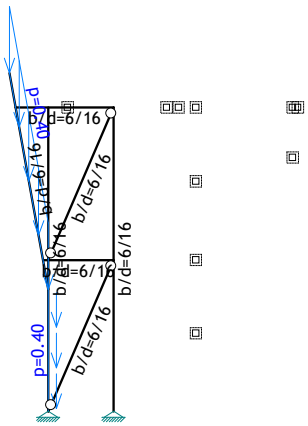
Frame: I_11

Load 2: Live Load



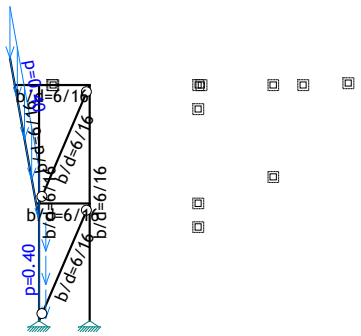
Frame: I_16

Load 2: Live Load



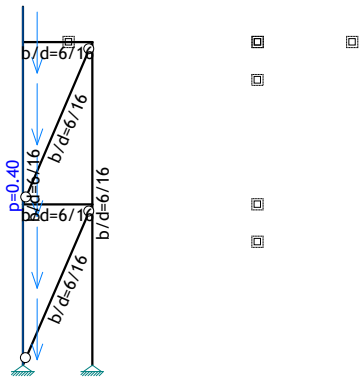
Frame: I_17

Load 2: Live Load



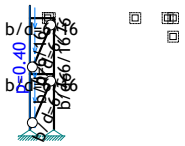
Frame: I_18

Load 2: Live Load



Frame: I_21

Load 2: Live Load



Frame: I_22

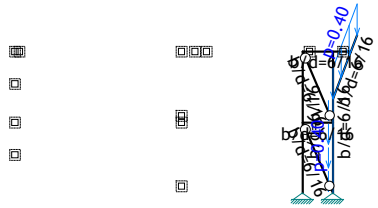
Load 2: Live Load

Frame: I_24

Load 2: Live Load

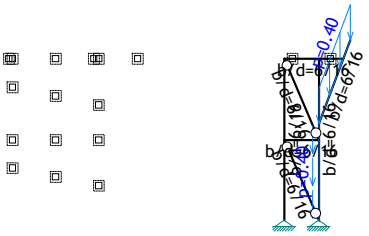
Frame: I_28

Load 2: Live Load



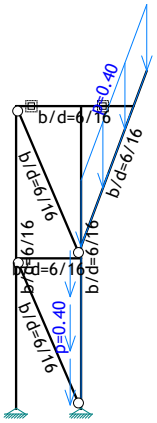
Frame: I_29

Load 2: Live Load



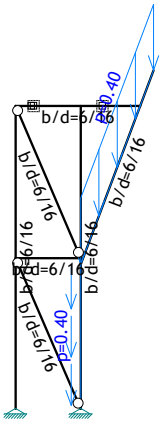
Frame: I_30

Load 2: Live Load



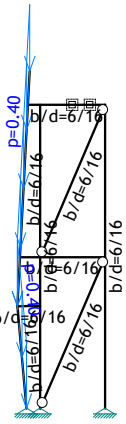
Frame: I_31

Load 2: Live Load



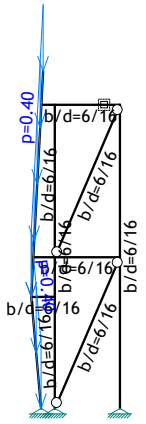
Frame: I_32

Load 2: Live Load



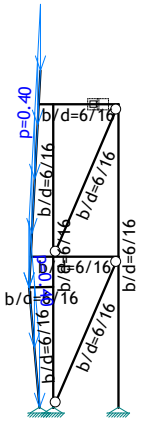
Frame: I_33

Load 2: Live Load



Frame: I_34

Load 2: Live Load

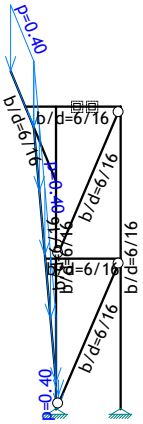


Frame: I_35

Load 2: Live Load

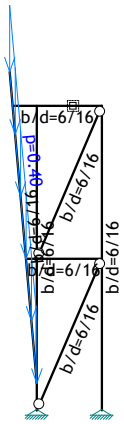
Frame: I_36

Load 2: Live Load



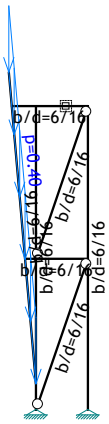
Frame: I_37

Load 2: Live Load



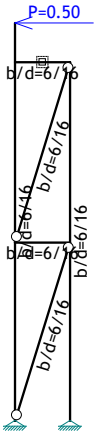
Frame: I_38

Load 2: Live Load



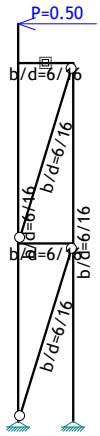
Frame: I_39

Load 3: Live Load (h)



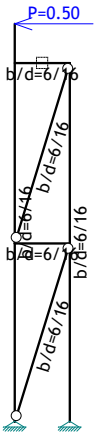
Frame: H_2

Load 3: Live Load (h)



Frame: H_3

Load 3: Live Load (h)

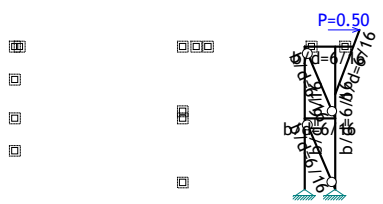


Frame: H_4

Load 3: Live Load (h)

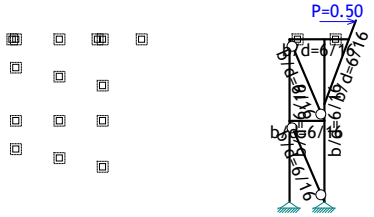
Frame: I_28

Load 3: Live Load (h)



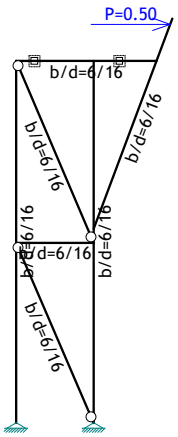
Frame: I_29

Load 3: Live Load (h)



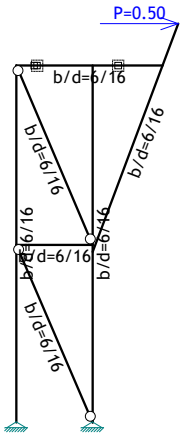
Frame: I_30

Load 3: Live Load (h)



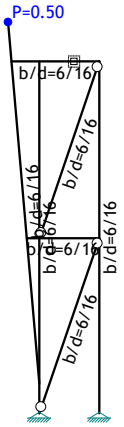
Frame: I_31

Load 3: Live Load (h)



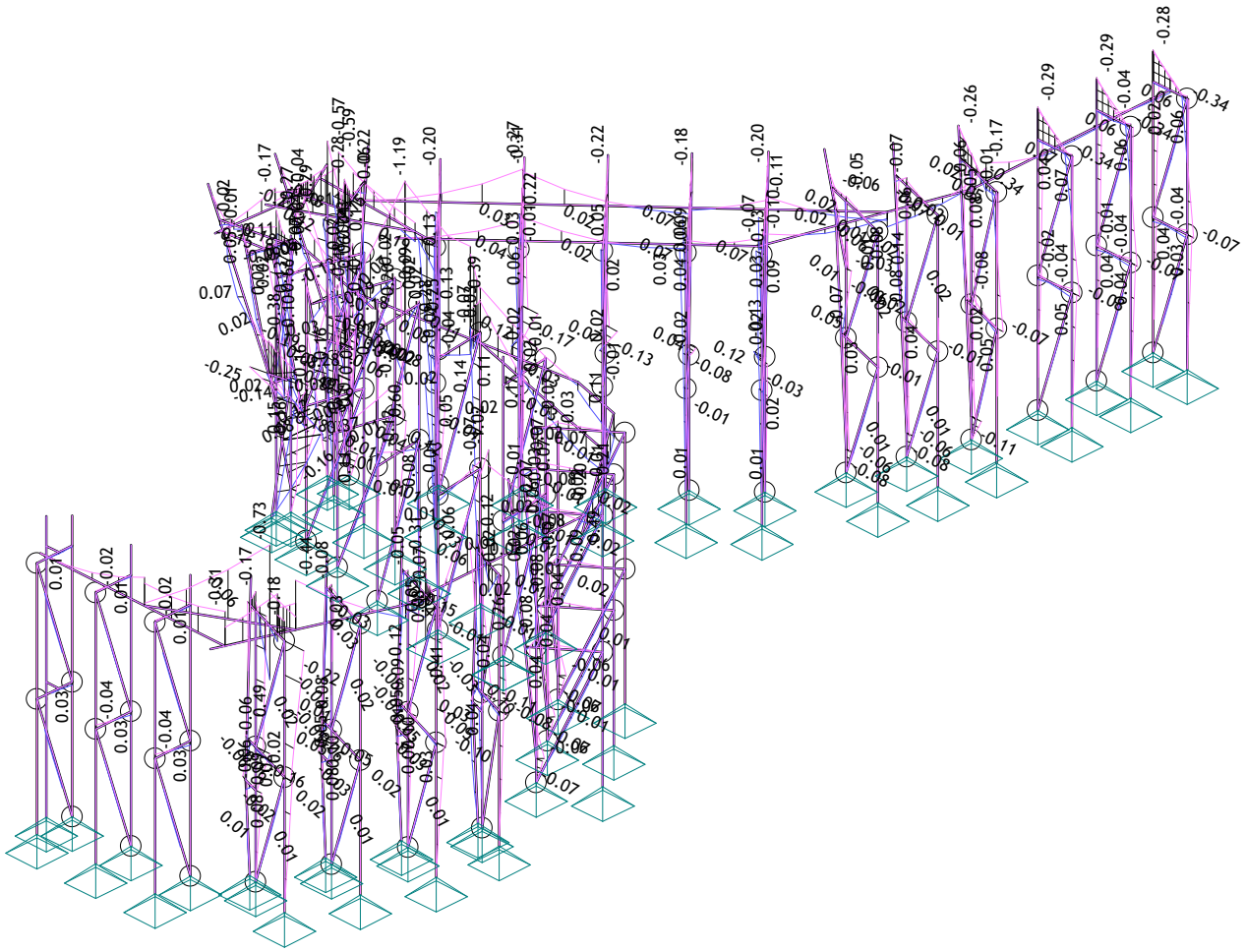
Frame: I_32

Load 3: Live Load (h)



Frame: I_39

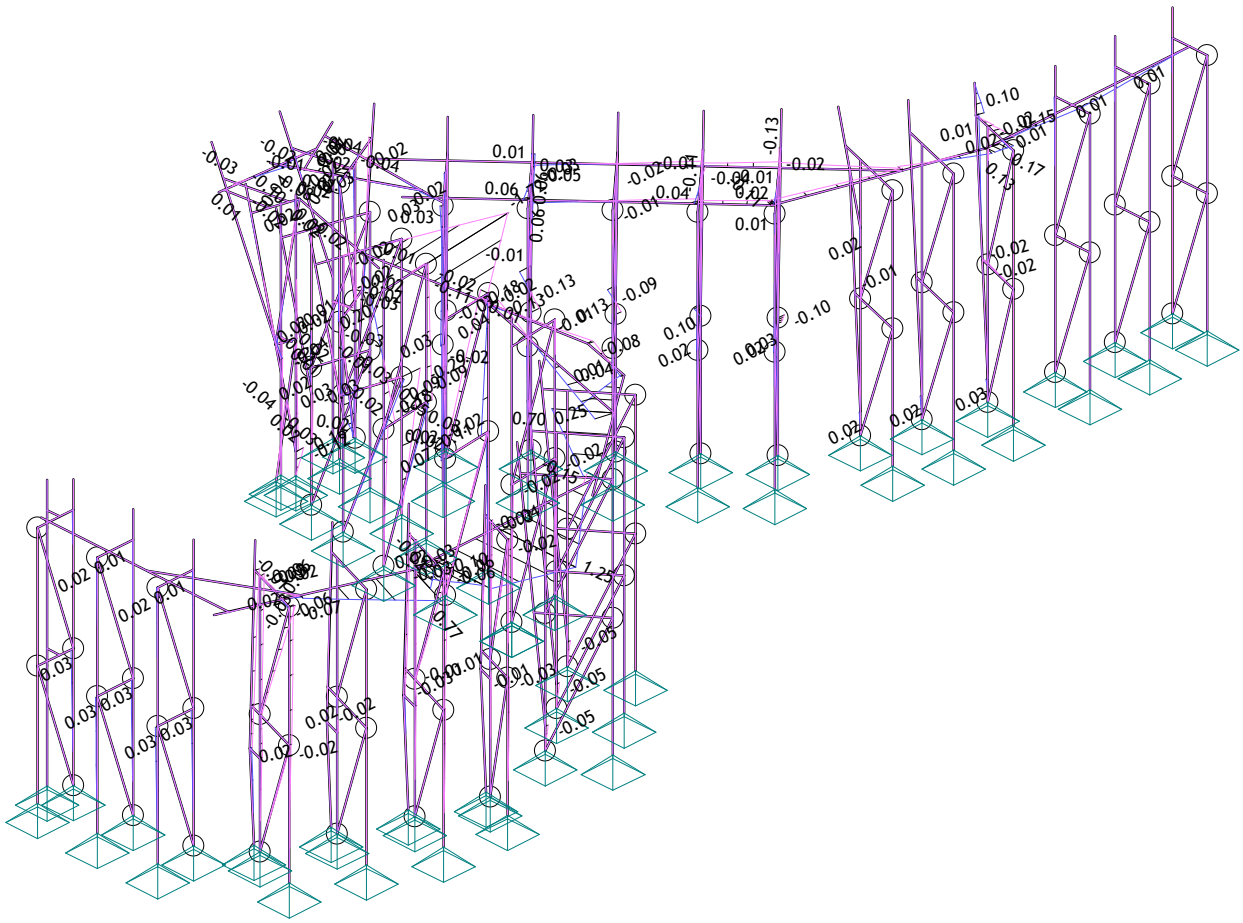
Load 16: [MSN] 4-7



Isometric

Beam Results: max M3= 0.60 / min M3= -1.19 kNm

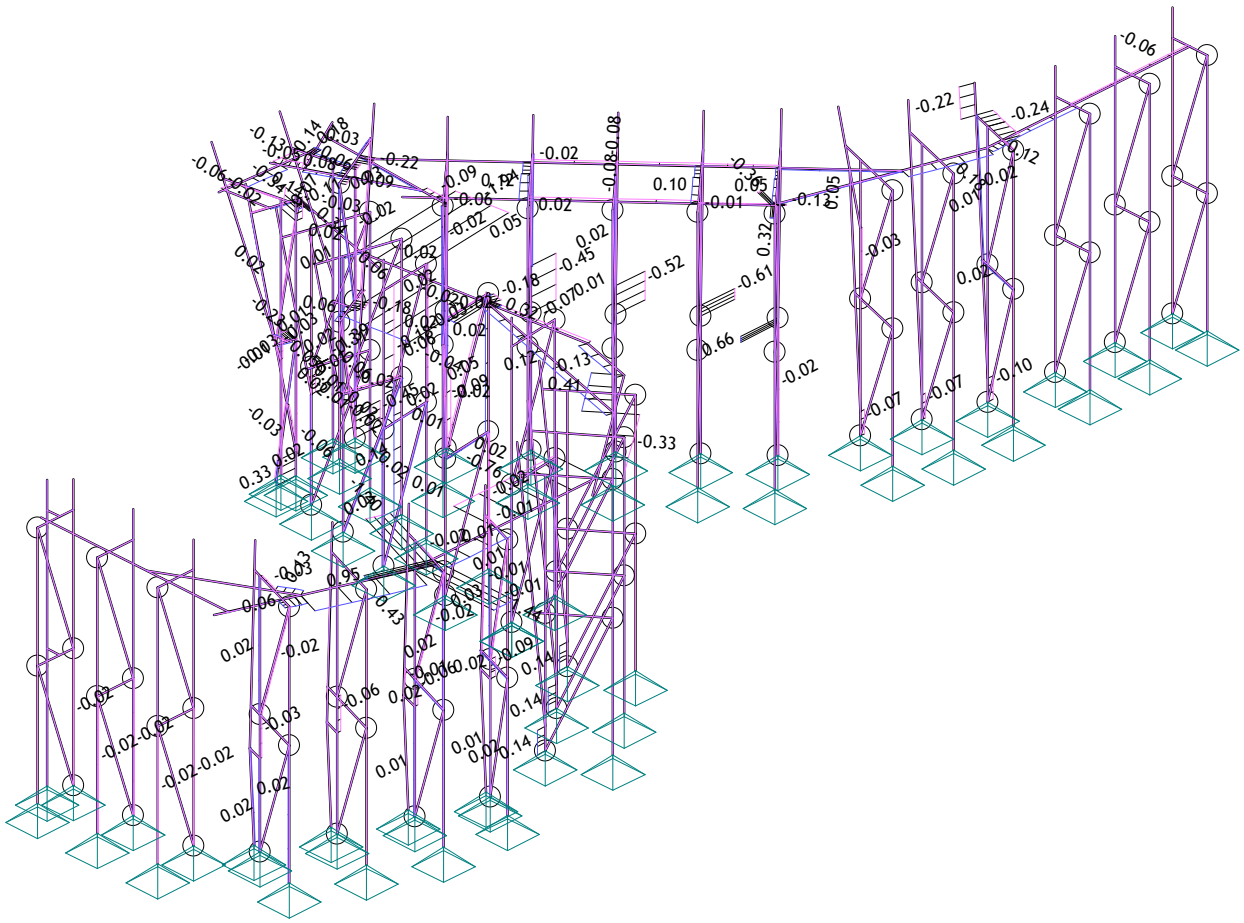
Load 16: [MSN] 4-7



Isometric

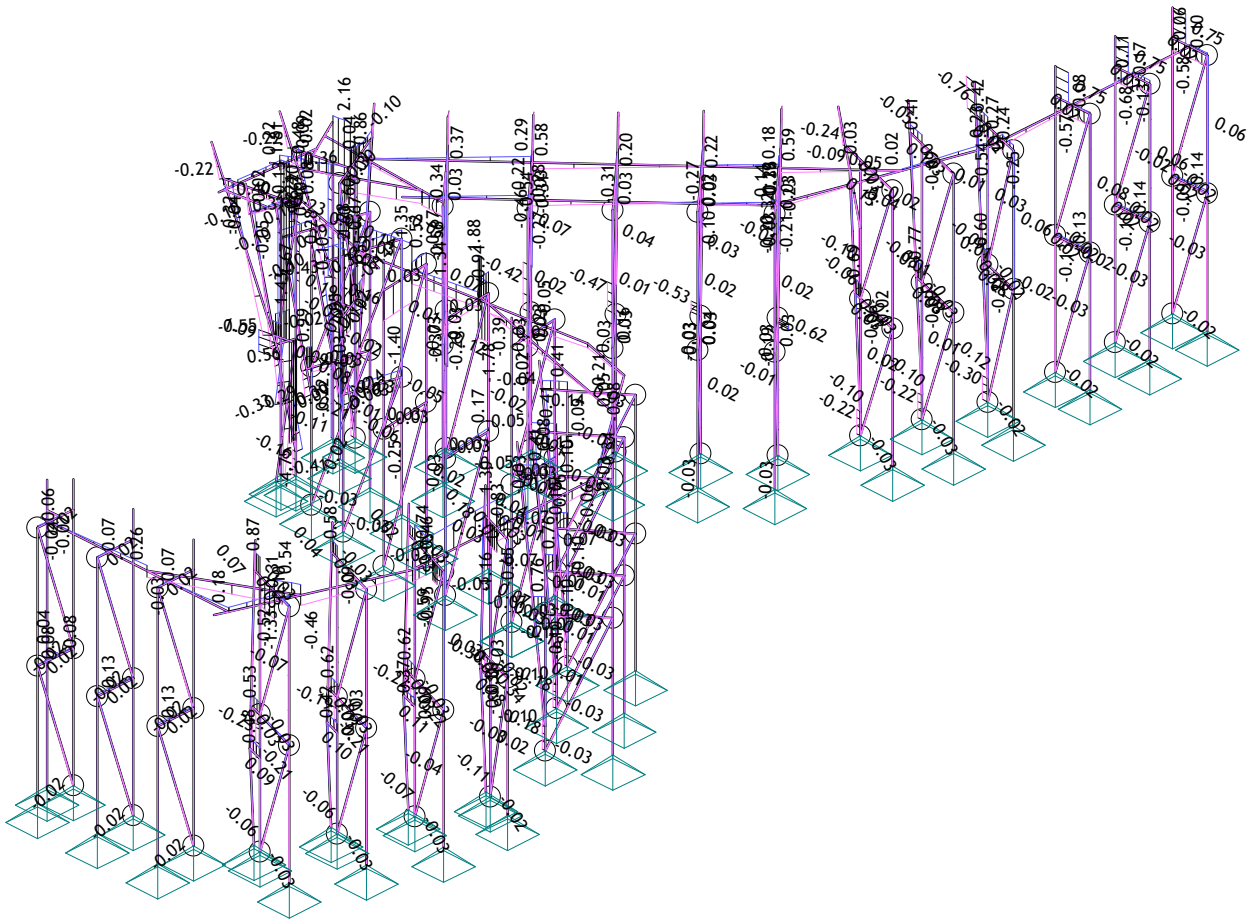
Beam Results: max M2= 1.25 / min M2= -1.72 kNm

Load 16: [MSN] 4-7



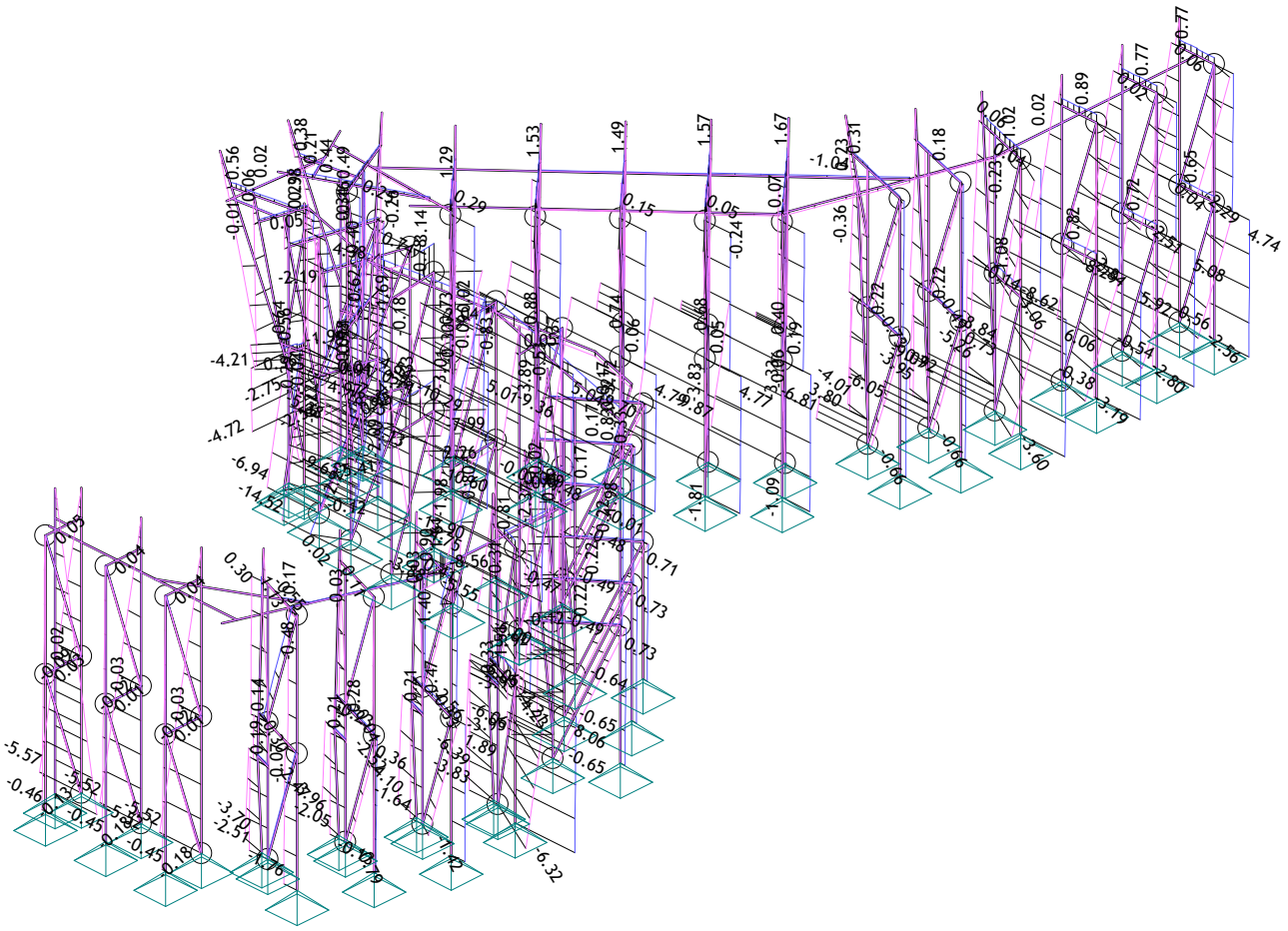
Isometric

Beam Results: max V3= 1.44 / min V3= -1.94 kN



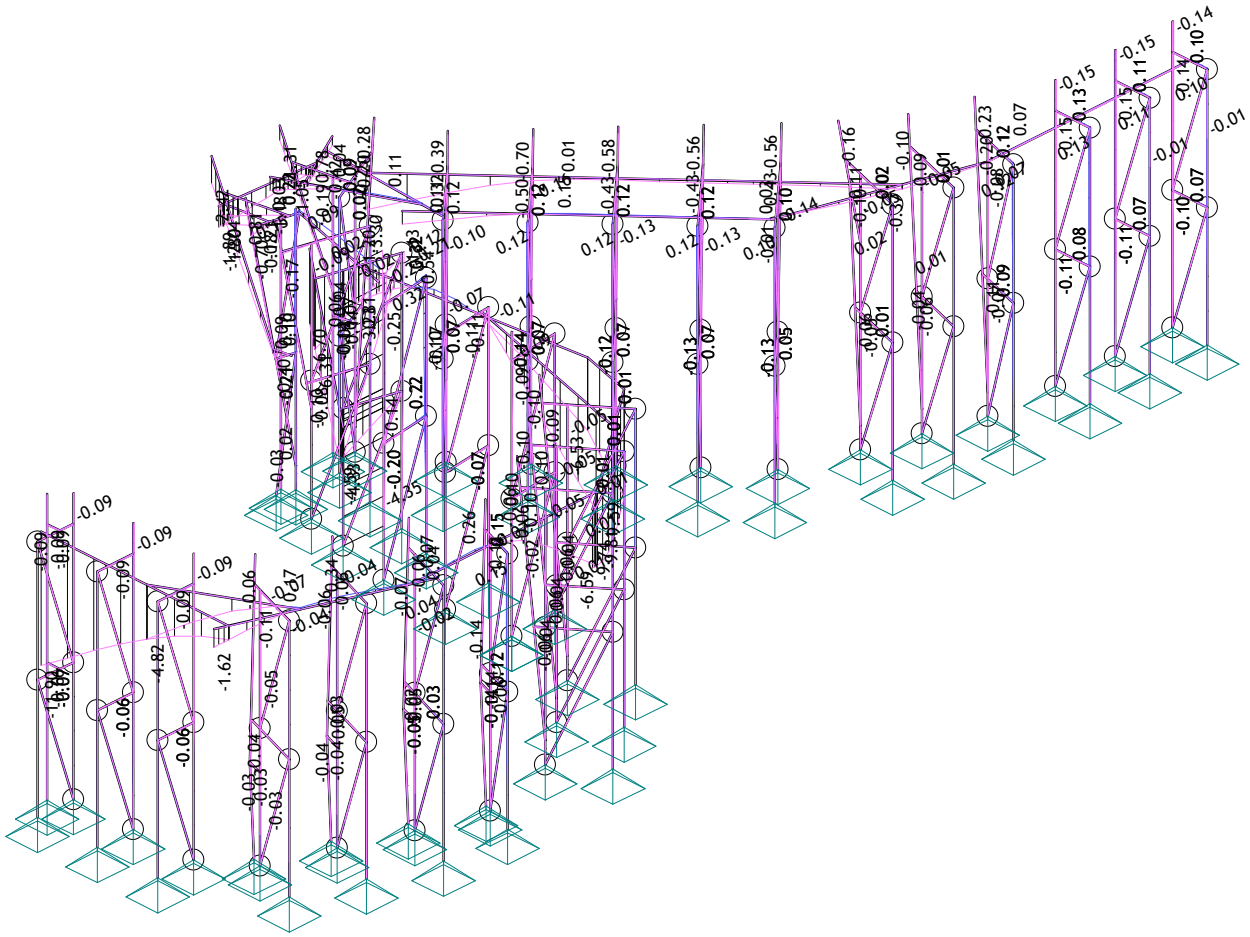
Isometric
Beam Results: max V2= 6.20 / min V2= -4.75 kN

Load 16: [MSN] 4-7

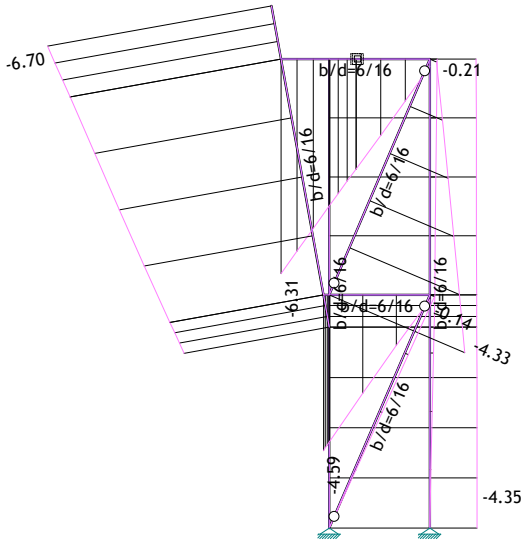


Isometric

Beam Results: max N1= 14.48 / min N1= -14.52 kN

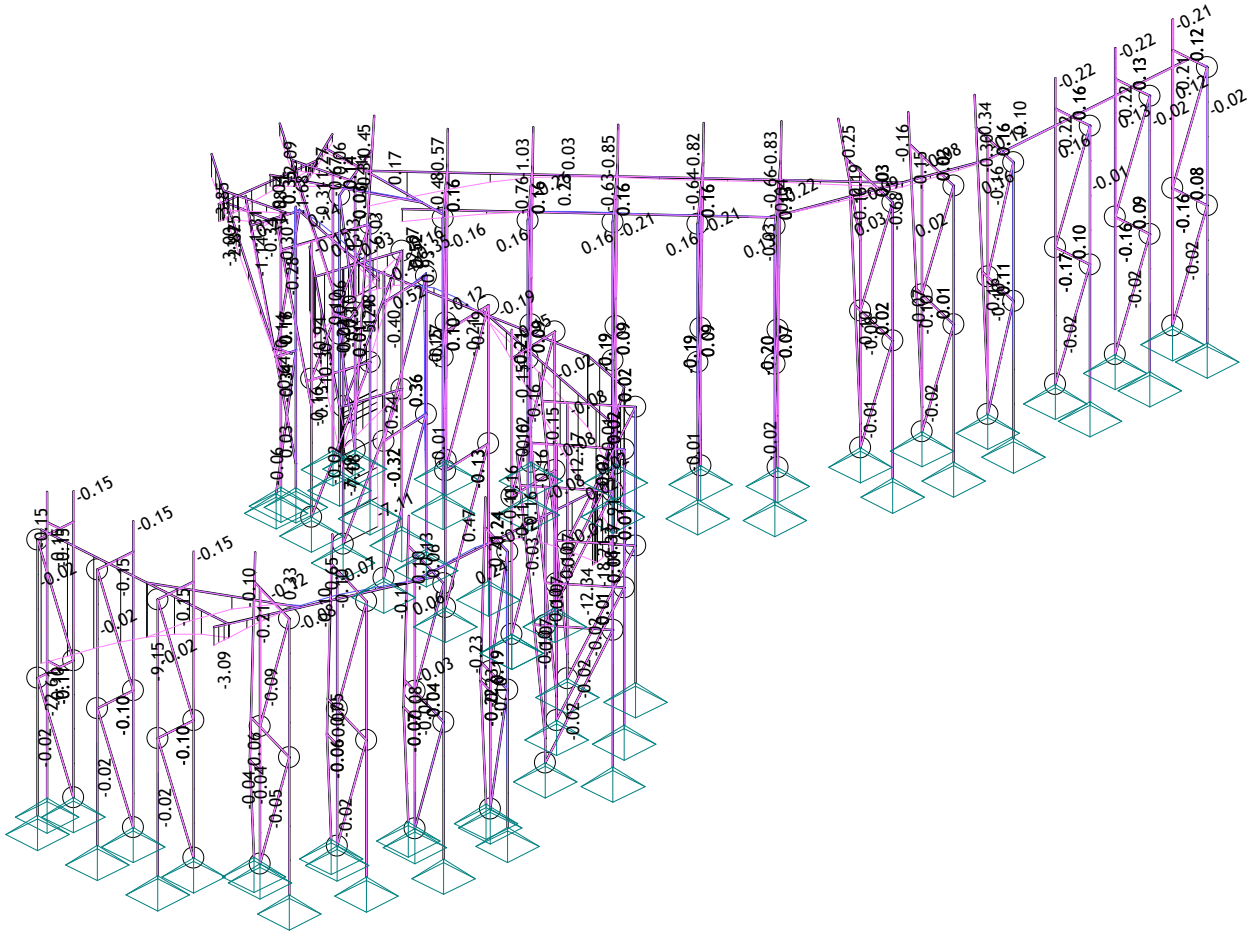


Isometric
Beam Results: max Zd= 1.20 / min Zd= -11.90 m / 1000



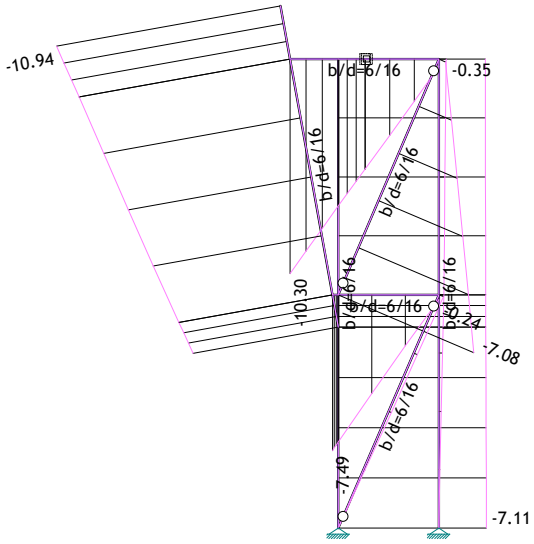
Frame: I_18
Beam Results: max Zd= 0.00 / min Zd= -6.70 m / 1000

Load 18: [MSU (T=fin)] 12-15



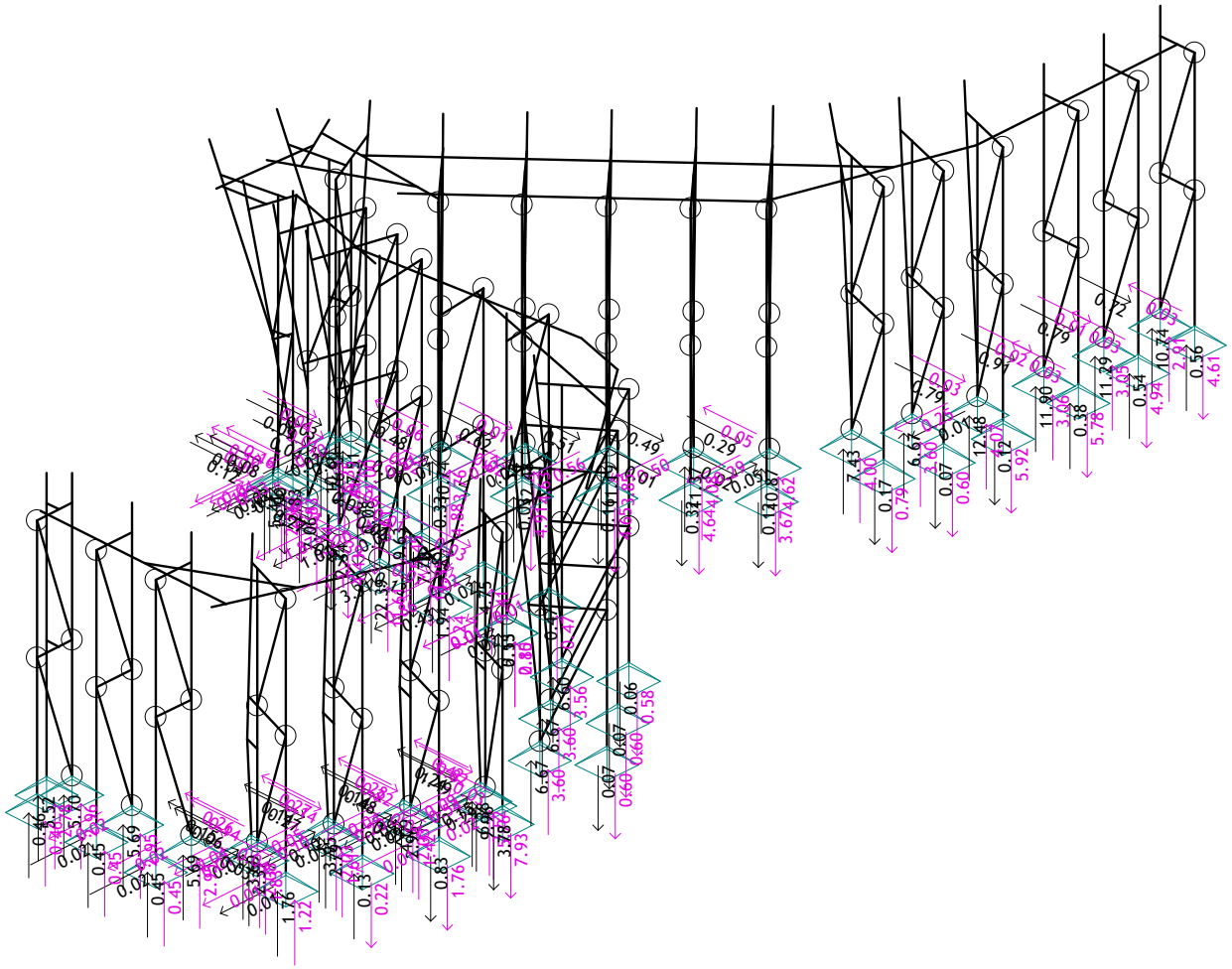
Isometric

Beam Results: max Zd= 1.13 / min Zd= -22.61 m / 1000



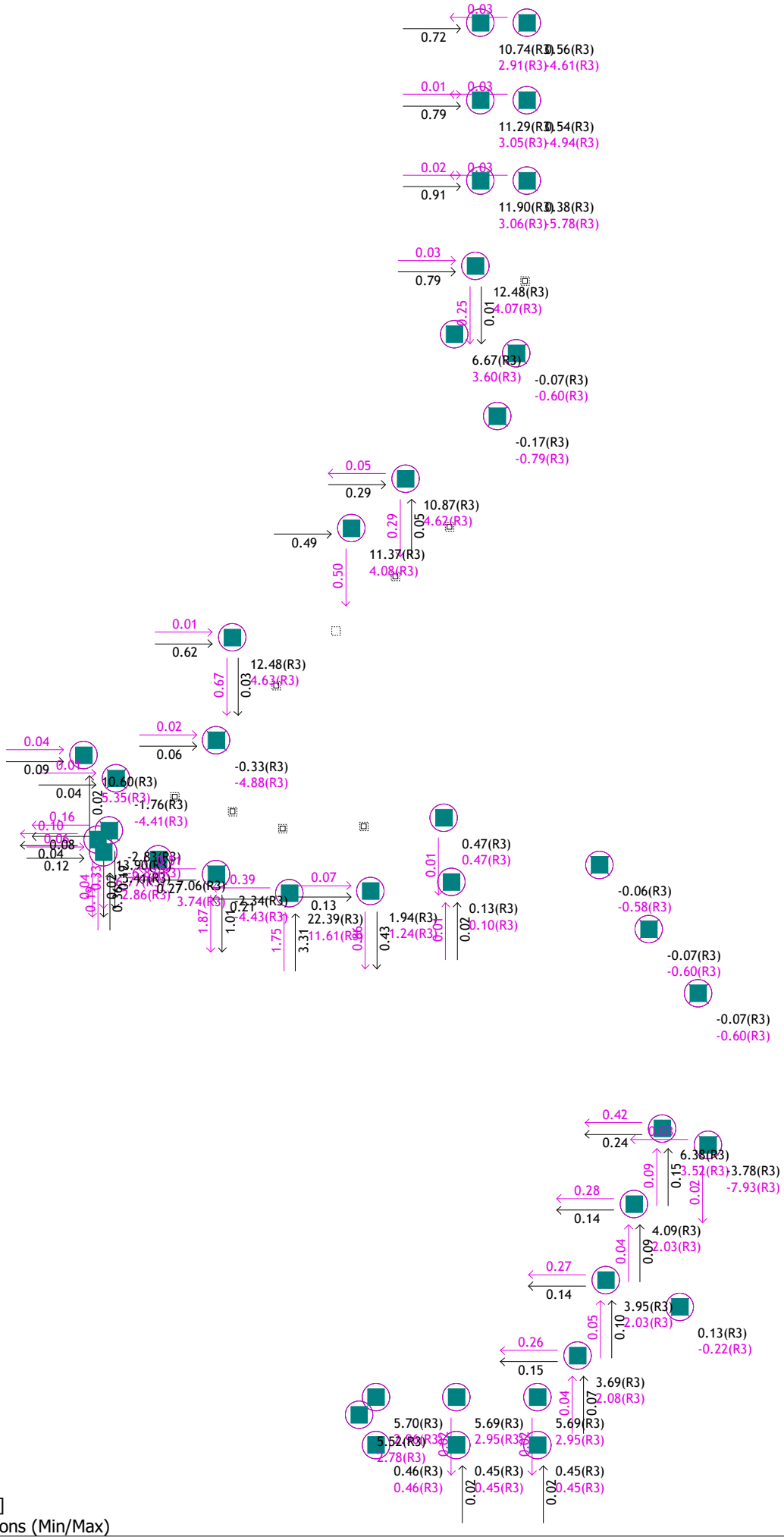
Frame: I_18
Beam Results: max Zd= 0.00 / min Zd= -10.94 m / 1000

Load 16: [MSN] 4-7



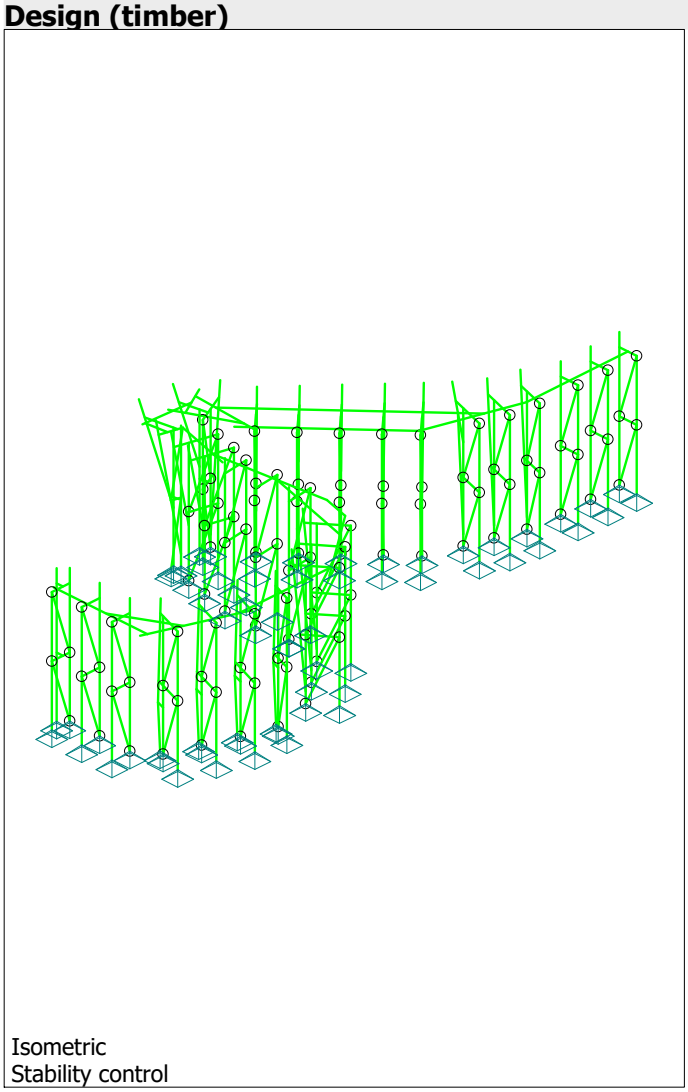
Isometric
Support Reactions

Load 16: [MSN] 4-7

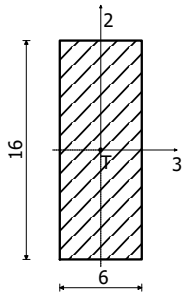


Level: [0.00 m]
Support Reactions (Min/Max)

Design (timber)



BEAM 185-59
Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

12. γ=0.56	13. γ=0.55	5. γ=0.48
15. γ=0.45	7. γ=0.39	4. γ=0.38
9. γ=0.32	14. γ=0.30	8. γ=0.28
11. γ=0.26	6. γ=0.21	10. γ=0.15

AXIAL STRESSES CONTROL
(load 12, at 207.0 cm from the start of the member)

The axial force design value	Ned =	-7.489 kN
Transversal Force in Axis 2 Direction	V2ed ≈	0.000 kN
Transversal Force in Axis 3 Direction	V3ed =	-0.105 kN
Bending Moment around Axis 2	M2ed =	-0.216 kNm
Bending Moment around Axis 3	M3ed =	0.093 kNm

STRESS CONTROL - COMPRESSION AND BENDING
Load type: basic - permanent

Rectification Coefficient	Kmod =	0.600
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.201
Depth factor - axis 3	Kh_3 =	1.000
Factor considering re-distribution of bending stresses	km =	0.700
Characteristic compressive strength	fc,0,k =	21.000 MPa

Design compressive strength	fc,0,d =	9.692 MPa
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	13.305 MPa
Design bending strength about axis 3	fm,3,d =	11.077 MPa
Relative slenderness	λrel,2 =	2.017
Relative slenderness	λrel,3 =	0.756
Design compressive stress	σc,0,d =	0.780 MPa
Section modulus	W2 =	96.000 cm3
Axial Stress Bending around Axis 2	σm2,d =	2.251 MPa

σm2,d <= fm,2,d (2.251 <= 13.305)

Section utilization is 16.9%

Section modulus	W3 =	256.00 cm3
Axial Stress Bending around Axis 3	σm3,d =	0.365 MPa

σm3,d <= fm,3,d (0.365 <= 11.077)

Section utilization is 3.3%

COMPRESSION AND BENDING - BIG SLENDERNESS

Deviation from straightness factor	βc =	0.200
Coefficient	k3 =	0.832
Coefficient	k2 =	2.705
Coefficient	kc,3 =	0.849
Coefficient	kc,2 =	0.222

(σc,0,d / (kc_2 x fc,0,d)) + km x (σm3,d / fm,3,d) +
+ σm2,d / fm,2,d <= 1 (0.555 <= 1)

Section utilization is 55.5%

(σc,0,d / (kc_3 x fc,0,d)) + σm3,d / fm,3,d +
+ km x (σm2,d / fm,2,d) <= 1 (0.246 <= 1)

Section utilization is 24.6%

SHEAR STRESSES CONTROL
(load 13, at 207.0 cm from the start of the member)

The axial force design value	Ned =	-11.079 kN
Transversal Force in Axis 2 Direction	V2ed ≈	0.000 kN
Transversal Force in Axis 3 Direction	V3ed =	-0.161 kN
Bending Moment around Axis 2	M2ed =	-0.330 kNm
Bending Moment around Axis 3	M3ed =	0.143 kNm

STRESS CONTROL – SHEAR
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Characteristic shear strength	fv,k =	4.000 MPa
Design shear strength	fv,d =	2.769 MPa
Cross Section Surface	A =	96.000 cm2
Actual Shear Stress(Axis 3)	τ3,d =	0.025 MPa

τ3,d <= fv,d (0.025 <= 2.769)

Section utilization is 0.9%

STABILITY CONTROL
Load type: basic - short-term

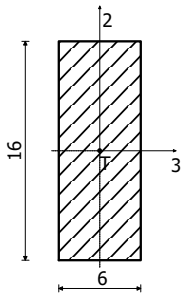
Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Length between lateral restr.points	lef =	412.00 cm
fifth percentile value of the modulus E parallel to the grain	E0.05 =	7400.0 MPa
fifth percentile value of shear modulus parallel to grain	G0.05 =	460.00 MPa
Torsional section modulus	Itor =	879.81 cm4
Moment of inetrtia	I2 =	288.00 cm4
Section modulus	W3 =	256.00 cm3
Critical bending stress	σm,crit =	27.663 MPa
Relative buckling slenderness	λrel =	0.931
Coefficient	k_krit =	0.861
Axial Stress Bending around Axis 3	σm3,d =	0.557 MPa

σm,3,d <= k_krit x fm,3,d (0.557 <= 14.313)

Section utilization is 3.9%

BEAM 188-52

Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

13. γ=0.65	12. γ=0.62	5. γ=0.57
15. γ=0.53	7. γ=0.47	4. γ=0.44
9. γ=0.40	14. γ=0.34	11. γ=0.33
8. γ=0.32	6. γ=0.24	10. γ=0.18

AXIAL STRESSES CONTROL
(load 13, end of the member)

The axial force design value	Ned =	-16.556 kN
Transversal Force in Axis 2 Direction	V2ed ≈	0.000 kN

STRESS CONTROL – COMPRESSION
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.201
Depth factor - axis 3	Kh_3 =	1.000
Factor considering re-distribution of bending stresses	km =	0.700
Characteristic compressive strength	fc,0,k =	21.000 MPa
Design compressive strength	fc,0,d =	14.538 MPa
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	19.957 MPa
Design bending strength about axis 3	fm,3,d =	16.615 MPa
Relative slenderness	λrel,2 =	2.238
Relative slenderness	λrel,3 =	0.839
Design compressive stress	σc,0,d =	1.725 MPa

COMPRESSION AND BENDING - BIG SLENDERNESS

Deviation from straightness factor	βc =	0.200
Coefficient	k3 =	0.906
Coefficient	k2 =	3.199
Coefficient	kc,3 =	0.801
Coefficient	kc,2 =	0.182

(σc,0,d / (kc_2 x fc,0,d)) + km x (σm3,d / fm,3,d) +
+ σm2,d / fm,2,d <= 1 (0.651 <= 1)

Section utilization is 65.1%

(σc,0,d / (kc_3 x fc,0,d)) + σm3,d / fm,3,d +
+ km x (σm2,d / fm,2,d) <= 1 (0.148 <= 1)

Section utilization is 14.8%

SHEAR STRESSES CONTROL
(load 13, at 45.3 cm from the start of the member)

The axial force design value	Ned =	-2.156 kN
Transversal Force in Axis 2 Direction	V2ed =	-0.207 kN
Transversal Force in Axis 3 Direction	V3ed ≈	0.000 kN
Bending Moment around Axis 2	M2ed ≈	0.000 kNm
Bending Moment around Axis 3	M3ed =	0.221 kNm

STRESS CONTROL – SHEAR
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Characteristic shear strength	fv,k =	4.000 MPa
Design shear strength	fv,d =	2.769 MPa
Cross Section Surface	A =	96.000 cm2
Actual Shear Stress(Axis 2)	τ2,d =	0.032 MPa

τ2,d <= fv,d (0.032 <= 2.769)

Section utilization is 1.2%

STABILITY CONTROL
Load type: basic - short-term

Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Length between lateral restr.points	lef =	457.28 cm
fifth percentile value of the modulus E parallel to the grain	E0.05 =	7400.0 MPa

fifth percentile value of shear modulus parallel to grain

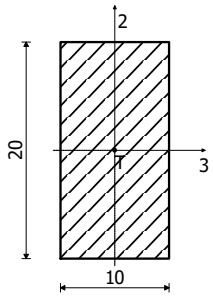
	G0.05 =	460.00 MPa
Torsional section modulus	Itor =	879.81 cm4
Moment of inetrtia	I2 =	288.00 cm4
Section modulus	W3 =	256.00 cm3
Critical bending stress	σm,crit =	24.924 MPa
Relative buckling slenderness	λrel =	0.981
Coefficient	k_krit =	0.824
Axial Stress Bending around Axis 3	σm3,d =	0.864 MPa

σm,3,d <= k_krit x fm,3,d (0.864 <= 13.692)

Section utilization is 6.3%

BEAM 191-258

Solid timber - softwood - C24
Service class 1
EUROCODE (EN 1995-1-1)



[cm]

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS

12. γ=0.40	13. γ=0.32	4. γ=0.29
15. γ=0.26	5. γ=0.25	14. γ=0.22
8. γ=0.21	7. γ=0.20	9. γ=0.18
6. γ=0.16	11. γ=0.15	10. γ=0.12

AXIAL AND SHEAR STRESSES CONTROL
(load 12, at 153.8 cm from the start of the member)

The axial force design value	Ned ≈	0.000 kN
Transversal Force in Axis 2 Direction	V2ed =	0.241 kN
Transversal Force in Axis 3 Direction	V3ed =	1.621 kN
Bending Moment around Axis 2	M2ed =	-1.261 kNm
Bending Moment around Axis 3	M3ed =	0.939 kNm

STRESS CONTROL – BENDING
Load type: basic - permanent

Rectification Coefficient	Kmod =	0.600
Partial factor for material properties	γm =	1.300
Depth factor - axis 2	Kh_2 =	1.084
Depth factor - axis 3	Kh_3 =	1.000
Factor considering re-distribution of bending stresses		
	km =	0.700
Characteristic bending strength	fm,k =	24.000 MPa
Design bending strength - axis 2	fm,2,d =	12.013 MPa
Design bending strength about axis 3	fm,3,d =	11.077 MPa
Section modulus	W2 =	333.33 cm3
Axial Stress Bending around Axis 2	σm2,d =	3.782 MPa
Section modulus	W3 =	666.67 cm3
Axial Stress Bending around Axis 3	σm3,d =	1.408 MPa

km x (σm3,d / fm,3,d) + σm2,d / fm,2,d <= 1 (0.404 <= 1)

Section utilization is 40.4%

σm3,d / fm,3,d + km x (σm2,d / fm,2,d) <= 1 (0.347 <= 1)

Section utilization is 34.7%

STRESS CONTROL – SHEAR
Load type: basic - permanent

Rectification Coefficient	Kmod =	0.600
Partial factor for material properties	γm =	1.300
Characteristic shear strength	fv,k =	4.000 MPa
Design shear strength	fv,d =	1.846 MPa
Cross Section Surface	A =	200.00 cm2
Actual Shear Stress(Axis 2)	τ2,d =	0.018 MPa
Actual Shear Stress(Axis 3)	τ3,d =	0.122 MPa
Influence Superposition from Transversal Force		
(2)	τ2,d / fv,d =	0.010
(3)	τ3,d / fv,d =	0.066

$(2)^2 + (3)^2$ <= 1 (0.001 <= 1)

Section utilization is 0.1%

STABILITY VERIFICATION
(load 13, at 153.8 cm from the start of the member)

The axial force design value	Ned =	0.529 kN
Transversal Force in Axis 2 Direction	V2ed =	-0.874 kN
Transversal Force in Axis 3 Direction	V3ed =	-0.909 kN
Bending Moment around Axis 2	M2ed =	-1.232 kNm
Bending Moment around Axis 3	M3ed =	1.443 kNm

STABILITY CONTROL

Load type: basic - short-term		
Rectification Coefficient	Kmod =	0.900
Partial factor for material properties	γm =	1.300
Length between lateral restr.points	lef =	338.17 cm
fifth percentile value of the modulus E parallel to the grain	E0.05 =	7400.0 MPa
fifth percentile value of shear modulus parallel to grain	G0.05 =	460.00 MPa
Torsional section modulus	Itor =	4545.5 cm4
Moment of inetrtia	I2 =	1666.7 cm4
Section modulus	W3 =	666.67 cm3
Critical bending stress	σm,crit =	70.765 MPa
Relative buckling slenderness	λrel =	0.582
Coefficient	k_krit =	1.000
Axial Stress Bending around Axis 3	σm3,d =	2.164 MPa

σm,3,d <= k_krit x fm,3,d (2.164 <= 16.615)

Section utilization is 13.0%

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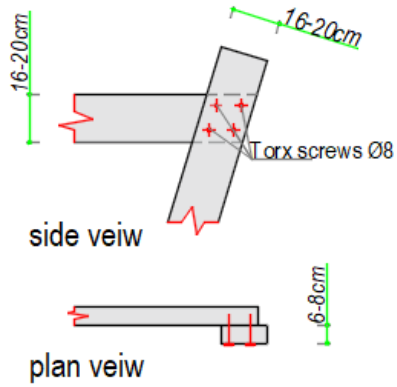
Calculated resistance connections and comment¸

- ***Sideway resistance of connections*** ***TYPE A***

Sideway connection between two timber elements

	2 x 2 Torx screws Φ8//100mm	2 x 3 Torx screws Φ8//100mm	2 x 4 Torx screws Φ8//100mm	2 x 5 Torx screws Φ8//100mm	3 x 4 Torx screws Φ8//100mm
$F_{v,Rd}$ =	**6,36 kN**	**9,46 kN**	**12,55 kN**	**15,63 kN**	**18,23**
Tag	**A-1**	**A-2**	**A-3**	**A-4**	**A-5**



Torx screws type HBS – countersunk head screw 8x100mm *(**Rothoblaas**) or similar.*

The analysis is shown in the annex 1-5

- ***In plane resistance of connections*** ***TYPE B***

Connection between two timber elements of frame in the same plane

	1 x 3 Torx screws Φ6//220mm	1 x 2 Torx screws Φ8//220mm	1 x 3 Torx screws Φ8//220mm	1 x 4 Torx screws Φ8//220mm
$F_{v,Rd}$ =	**3,56 kN**	**3,62 kN**	**5,26 kN**	**6,85 kN**
Tag	**B-1**	**B-2**	**B-3**	**B-4**

Torx screws type HBS – countersunk head screw 6X220 AND 8x220mm *(**Rothoblaas**) or similar.*

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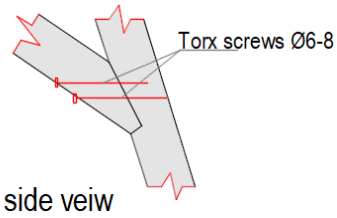


side veiw

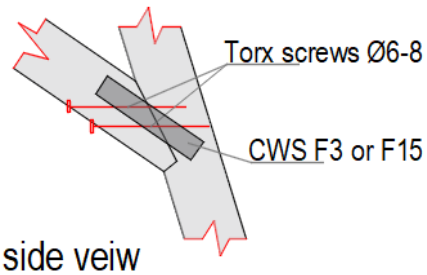
The analysis is shown in the annex 6-9

- ***In plane resistance of connections TYPE C***

Connection between two timber elements of frame in the same plane (additionally steel connections plate)

	CWS F3 + 2 x 3 turbo Φ7,5//60mm one side	**CWS F3 + 2 x 4 turbo** Φ7,5//60mm one side	**CWS F3 + 2 x 5 turbo** Φ7,5//60mm one side	**CWS F15 + 2 x 4 turbo** Φ7,5//60mm one side
$F_{v,Rd}$ =	**5,20 kN**	**6,10 kN**	**7,00 kN**	**7,6 kN**
Tag	**C-1**	**C-2**	**C-3**	**C-4**

	CWS F15 + 2 x 6 turbo Φ7,5//60mm one side	**CWS F15 + 2 x 8 turbo** Φ7,5//60mm one side	**CWS F15 + 2 x 12 turbo** Φ7,5//60mm one side
$F_{v,Rd}$ =	**10,70 kN**	**15 kN**	**17,30 kN**
Tag	**C-5**	**C-6**	**C-7**



side veiw

The analysis is shown in the annex 10 and 11

Instead of F3 use LBV 80/200 (Rothoblaas)

Instead of F5 use LBV 100/300 (Rothoblaas)

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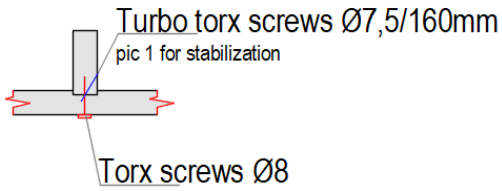
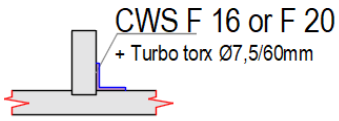
• *Resistance of connections – horizontal element to rectangular element* ***TYPE D***

Connection of horizontal to the supporting beam



side veiw



side veiw

Fixing upper horizontal

anchoring upper horizontal

	1 x 2 Torx screws Φ8//200mm	1 x 3 Torx screws Φ8//200mm	1 x 4 Torx screws Φ8//200mm	1 x 5 Torx screws Φ8//200mm
$F_{v,Rd}$ =	3,66 kN	5,31 kN	6,92 kN	8,49 kN
Tag	D-1	D-2	D-3	D-4

	CWS F16 + 2 x 4 Turbo Φ 7,5/60mm	CWS F16 + 2 x 5 Turbo Φ 7,5/60mm	CWS F20 + 2 x 4 Turbo Φ 7,5/60mm	CWS F20 + 2 x 5 Turbo Φ 7,5/60mm
$F_{v,Rd}$ =	8,10 kN	10,10 kN	9,48 kN	11,85 kN
Tag	D-5	D-6	D-7	D-8

	CWS F20 + 2 x 6 Turbo Φ 7,5/60mm	CWS F20 + 2 x 7 Turbo Φ 7,5/60mm
$F_{v,Rd}$ =	14,20 kN	16,50 kN
Tag	D-9	D-10

Instead of CWS F16 use 2 x WBR100 (Rothoblaas)

Instead of CWS F20 use 2 x WBR x 170 + WHT340 /tensile force >9kN/ ((Rothoblaas)

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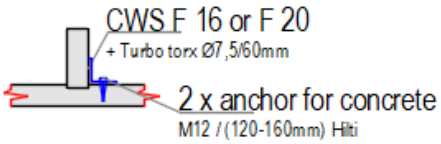
- ***Resistance of connections – fixing columns and frame vericals to the concrete floor slab TYPE E***

Fixing all columns and frame vericals to concrete slab

	One side CWS F16 + 1 x 4 Turbo Φ 7,5/60mm + 2 x anchor for concrete M12 /120-160 mm (Hilti HSA)		One side CWS F16 + 2 x 6 Turbo Φ 7,5/60mm + 2 x anchor for concrete M16 /120-160 mm (Hilti HSA)
$F_{v,Rd}$ =	8,10 kN		14,20
Tag	E-1		E-2



side veiw

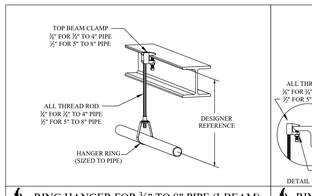
E1 = WBR100 + 2 x M10 (Hilti HAS);

E1* = WBR100 + WHT340 look attachments

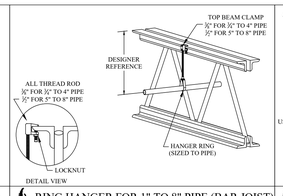
Anchoring to the walls is done with 2 x WBR100 angle + 2 x M12 + epoxy compound.

The joint itself can increase the load of 15kN

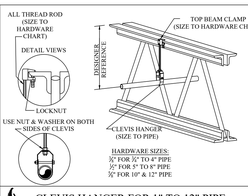
The joint in the concrete is made. It is attached only to the floor construction - this is done with 2 x wbr100 angles



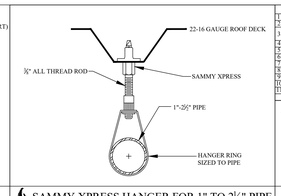
RING HANGER FOR ¾" TO 8" PIPE (I-BEAM)
SCALE: NONE



RING HANGER FOR 1" TO 8" PIPE (BAR JOIST)
SCALE: NONE

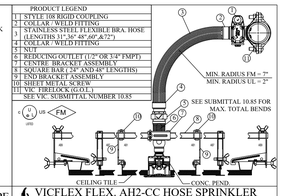


CLEVIS HANGER FOR 1" TO 12" PIPE
SCALE: NONE



SAMMY XPRESS HANGER FOR 1" TO 2½" PIPE
SCALE: NONE

PRODUCT LEGEND
1 STYLE 150 RIGID COUPLING
2 COLLAR / WELD FITTING
3 STAINLESS STEEL FLEXIBLE BRA. HOSE (LENGTHS 31",36",48",60",&72")
4 COLLAR / WELD FITTING
5 NOZZLE
6 REDUCING OUTLET (1/2" OR 3/4" FMPT)
7 CENTRE BRACKET ASSEMBLY
8 SQUARE BAR (23" AND 48" LENGTHS)
9 END BRACKET ASSEMBLY
10 SHEET METAL SCREW
11 VIC. FIRELOCK (G.O.L.) SEE VIC. SUBMITTAL NUMBER 10.85

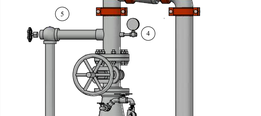


VICFLEX FLEX. AH2-CC HOSE SPRINKLER ASSEMBLIES FOR CONCEALED PEND. HEAD
SCALE: NONE

Table 17.4.2.1(a) Maximum Distance Between Hangers (ft-in.)

	Nominal Pipe Size (in.)										
	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"
STEEL PIPE	NA	12'-0"	12'-0"	15'-0"	15'-0"	15'-0"	15'-0"	15'-0"	15'-0"	15'-0"	15'-0"
CPVC	5'-6"	6'-0"	6'-6"	7'-0"	8'-0"	9'-0"	10'-0"	NA	NA	NA	NA
COPPER	8'-0"	8'-6"	10'-0"	10'-0"	12'-0"	12'-0"	12'-0"	15'-0"	15'-0"	15'-0"	15'-0"

FIGURE A.17.4.3.4 Distance from Sprinkler to Hanger.



FIRE SPRINKLER RISER EQUIPMENT LEGEND:

1 - EXISTING 6" FIRE PROTECTION INCOMING WATER SERVICE (BY OTHERS)
2 - EXISTING 6x4 FLANGED CONCENTRIC REDUCER
3 -EXISTING 4" AMES 3000SS
4 - EXISTING GAUGE
5 - EXISTING MAIN DRAIN
6 - EXISTING 4" CHECK
7 - EXISTING FDC
8 - EXISTING 4" 90 TO SYSTEM

ELECTRICAL EQUIPMENT LEGEND

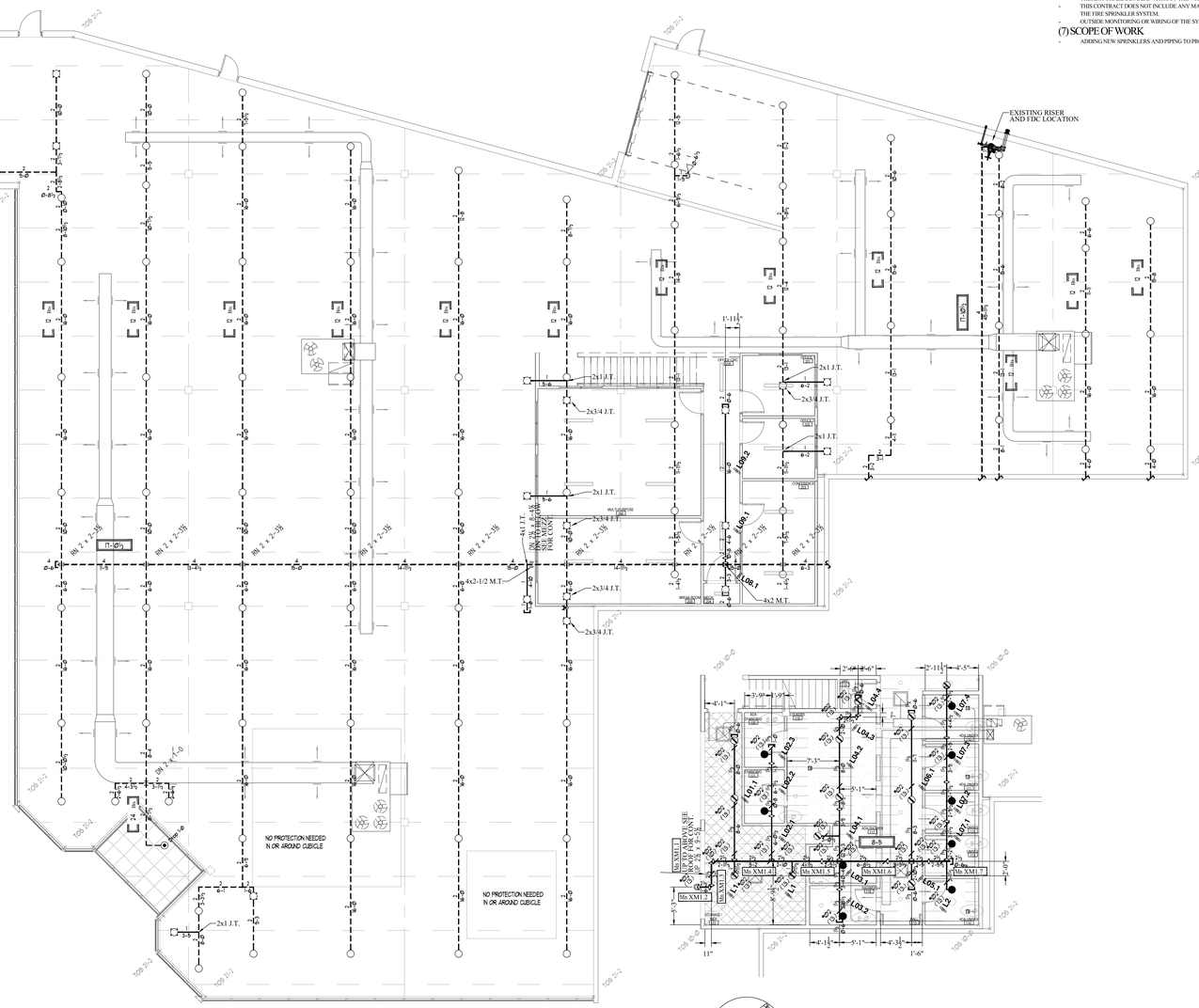
TS - TAMPER SWITCH (WIRED BY OTHERS)
FS - FLOW SWITCH (WIRED BY OTHERS)

SPRINKLER RISER MISC. NOTES

1 - ALL UNDERGROUND PIPING IS INSTALLED, TESTED, CHLORINATED, AND FLUSHED BY OTHERS
2 - OUTSIDE HORN / STROBE IS SUPPLIED BY TFP AND INSTALLED BY OTHERS. (INSIDE HORN STROBE PROVIDED BY OTHERS IF REQUIRED)
3 - ALL VALVE TAMPER SWITCHES AND FLOW SWITCHES WIRED BY OTHERS.

EXISTING RISER DETAIL

3/4" = 1'-0"
0 4 8 16



ROOF FIRE PROTECTION PLAN

1/8" = 1'-0"
0 4 8 16

MEZZ FIRE PROTECTION PLAN

1/8" = 1'-0"
0 4 8 16

FIRE PROTECTION GENERAL NOTES
NFPA 13-2019, MBC 2021

(1) ALL DESIGN, FABRICATION, INSTALLATION, AND MATERIAL CONFORMS TO ALL LOCAL, STATE, UL, AND NFPA STANDARDS.

(2) -PROJECT REQUIREMENTS

- IT IS THE BUILDING OWNERS RESPONSIBILITY TO PROVIDE ADEQUATE HEAT FOR ALL AREAS IN THE BUILDING PROTICTED BY WET SPRINKLER SYSTEMS AND FOR ALL WATER FILLED SUPPLY PIPES.
- PER NFPA 13 IF THE SPRINKLER SYSTEM IS MORE THAN 20 SPRINKLER HEADS AND CAN BE ISOLATED ALL NEW PIPING IS TO BE HYDROSTATICALLY TESTED AT NOT LESS THAN 200 PSI FOR 2 HOURS, OR AT 50 PSI IN EXCESS OF THE MAXIMUM PRESSURE, WHEN THE MAXIMUM PRESSURE TO BE MAINTAINED IS IN EXCESS OF 150 PSI.
- WHETHER OR NOT INDICATED ON THE DRAWINGS THE FOLLOWING SHALL BE PROVIDED:
- PROVISIONS FOR DRAINING ALL PIPING.
- SPARE HEAD CABINET WITH WRENCH (PER NFPA 13)
- THE STOCK OF SPARE SPRINKLERS SHALL INCLUDE ALL TYPES AND RATINGS INSTALLED AND SHALL BE AS FOLLOWS:
  - FOR PROTECTED F FACILITIES HAVING UNDER 300 SPRINKLERS - NO FEWER THAN 6 SPRINKLERS
  - FOR PROTECTED F FACILITIES HAVING 300 TO 1000 SPRINKLERS - NO FEW THAN 12 SPRINKLERS
  - FOR PROTECTED F FACILITIES HAVING OVER 1000 SPRINKLERS - NO FEWER THAN 24 SPRINKLERS
  - SPARE DRY SPRINKLERS WILL NOT BE PROVIDED.
- WET PIPE SPRINKLER SYSTEMS WILL INCLUDE INSPECTORS TEST LOCATED AT THE RISER

(3) PIPE & FITTINGS

- WET SYSTEM PIPING 1" & SMALLER IS TO BE BLACK SCHEDULE 40 WITH BLACK DUCTILE IRON THREADED CONNECTIONS.
- WET SYSTEM PIPING 1¼" & LARGER IS TO BE BLACK SCHEDULE 10 WITH FACTORY PAINTED ROLL GROOVED CONNECTIONS.

(4) DESIGN (SEE TITLE BLOCK FOR ALL HYDRAULIC DEMAND REQUIREMENTS)

TOTAL FIRE PROTECTION IS TO REMOVE EXISTING SPRINKLERS AND INSTALL NEW SPRINKLERS TO COVER NEW WALL AND CEILING LAYOUTS PER NFPA 13.

EXISTING WET SYSTEM IS DESIGNED FOR ORDINARY HAZARD II AND SHALL REMAIN.

(5) SYSTEM SIZE

WET PIPE SYSTEM 1 = 14,265 ft²

(6) GENERAL NOTES

- IN LOCATIONS SUBJECT TO FREEZING CONDITIONS, IT IS THE OWNERS RESPONSIBILITY TO PROVIDE HEAT THROUGHOUT WET SPRINKLER SYSTEM AREAS AND IN ENCLOSURES FOR DRY PIPE, DELUGE AND OTHER TYPES OF SPRINKLER SYSTEMS.
- SPRINKLER HEADS IN ALIGNMENT ONLY. NO CENTER OF TILE UNLESS OTHERWISE NOTED. SPRINKLER HEADS MAY BE DRAWN TO APPEAR TO BE CENTER OF TILE, THIS DOES NOT MEAN ACTUAL CENTER OF TILE UNLESS NOTED.
- THIS DRAWING, DESIGN AND INFORMATION CONTAINED HEREIN ARE THE SOLE PROPERTY OF TOTAL FIRE PROTECTION, INC. AND IS LOANED UPON THE EXPRESS CONDITION THAT THE SAME BE RETURNED TO TOTAL FIRE PROTECTION, INC. UPON REQUEST. NO REPRODUCTION OF THIS DRAWING, INFORMATION OR ANY PART THEREOF SHALL BE MADE WITHOUT THE WRITTEN CONSENT OF TOTAL FIRE PROTECTION, INC.
- THIS CONTRACT DOES NOT INCLUDE ANY MATERIAL OR DEVICE TO IMPROVE THE STRUCTURAL STRENGTH OF THE BUILDING TO ENABLE IT TO CARRY THE LOAD OF THE FIRE SPRINKLER SYSTEM.
- OUTSIDE MONITORING OR WIRING OF THE SYSTEMS DEVICES IS THE OWNERS RESPONSIBILITY.

(7) SCOPE OF WORK

- ADDING NEW SPRINKLERS AND PIPING TO PROPERLY PROTECT AROUND NEW WALLS AND CEILINGS.

BUILDING DATA

BUILDING USE GROUPS	A-3, A-2, M, B
CONSTRUCTION TYPES	IIB
SPRINKLER SYSTEM	NFPA 13

HEAD SPACING INFORMATION

MAKE	MODEL	SYMBOL	MIN. DIST. BETWEEN SPRINK.	MAX. DIST. BETWEEN SPRINK.	MAX. COVERAGE	MAX. DIST. FROM WALL	MAX. THROW (HSW)	MAX. DEFLECTOR DISTANCE
VIC.	V5606	●	6'-0"	15'-0"	225 SQ. FT.	7'-6"	N/A	12"
VIKING	VK3001	⊘	6'-0"	15'-0"	225 SQ. FT.	7'-6"	N/A	12"
VIKING	VK532	⊡	8'-0"	16'-0"	256 SQ. FT.	8'-0"	N/A	12"
PER NFPA 13 & SPRINKLER MANUFACTURER DATA SHEETS								

TOTAL FIRE PROTECTION
5385 PATTERSON AVE SE, SUITE C
GRAND RAPIDS MI, 49512
PH 616-735-2300 FAX 616-735-2330
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■ NFPA 13 ☐ NFPA 13R ☐ FM GLOBAL
■ SUBMITTAL ☐ INSTALL ☐ AS-BUILT

ABBREVIATION & SYMBOL LEGEND

	UNDERGROUND PIPING
	NEW FIRE SUPPRESSION PIPING
	EXISTING FIRE SUPPRESSION PIPING
○	HYDRAULIC REFERENCE POINTS
XX'-XX"	PIPE ELEVATION ABOVE FINISH FLOOR
OS XX'-XX"	PIPE ELEVATION BELOW TOP OF STEEL/DECK
TOS 42-Ø ×	ELEVATION OF TOP OF STEEL
	DENOTES HANGER LOCATION
	DENOTES TRAPEZE HANGER LOCATION
	RISE UP OR DOWN
# L01	BRANCH LINE ID
Mn MX.X	MAIN LINE ID
	ELEVATION OF FINISHED CEILING
	UNDERGROUND SPIGOT/RISER LOCATION
	STANDPIPE LOCATION
<>	GROOVED PIPE COUPLING
AFF	ABOVE FINISHED FLOOR
AUX.	AUXILIARY
BOC	BACK OF COLUMN
BTS	BELOW TOP OF STEEL
℄	CENTERLINE
COJ	CUT ON JOB
FDC	FIRE DEPARTMENT CONNECTION
NTS	NOT TO SCALE
UNO	UNLESS NOTED OTHERWISE

PLAN NORTH

MAINS B.L.'S
SCHEDULE 40 ☐ ■
SCHEDULE 10 ■ ■
SCHEDULE 07 ☐ ☐
STAINLESS ☐ ☐
GALVANIZED ☐ ☐
CPVC ☐ ☐
FITTINGS
THREADED ■
WELDED ☐
GROOVED ■
GLUED ☐
SYSTEM TYPE
WET PIPE ■ PREACTION ☐
DRY PIPE ☐ DELUGE ☐

GENERAL CONTRACTOR: PINNACLE CONSTRUCTION
1000 FRONT AVE.
GRAND RAPIDS, MI 49504
Phone: 616-451-0500 Fax:

NO.	DATE	REVISIONS	BY
0	9-23-25	SUBMITTAL PLAN	KWV

WATER FLOW INFORMATION

STATIC PRESSURE		FIRE PUMP	
RESIDUAL PRESSURE		SIZE GPM @ PSI	
PITOT READING		TYPE OF DRIVER	
FLOW IN G.P.M.		LOCATION FROM	
DATE OF TEST			
TIME OF TEST			
TEST TAKEN BY			
WITNESSED BY			
HYDRANT LOCATION			

HYDRAULIC CALCULATIONS

DESIGN AREA #						
DENSITY						
DESIGN AREA						
GPM REQD @ TEST						
PSI REQD @ TEST						
OVERHEAD C-FACTOR						
SAFETY FACTOR						
# HEADS CALCULATED						
SYSTEM						
AREA PER SPRINKLER						
SPRINKLER K-FACTOR						
OUTSIDE HOSE						

SYMBOL	MAKE	MODEL	TYPE	RESP.	FINISH	NPT.	TEMP.	K	MAX SPACING	QTY.
●	VIC.	V5606	CONCEALD	QR	WHITE	1/2"	200	5.6	225	20
⊘	VIKING	VK3001	UPRIGHT	QR	BRASS	1/2"	200	5.6	225	1
⊡	VIKING	VK532	UPRIGHT	QR	BRASS	3/4"	155	11.2	16x16	14
○	VIKING	VK532	UPRIGHT	QR	BRASS	3/4"	155	11.2	16x16	EXIST
⊙	VIKING	VK302	PENDENT	QR	CHROME	1/2"	155	5.6	225	EXIST
									TOTAL THIS SHEET:	35

PROJECT:
TERRA FIRMA E.L.
FIRE PROTECTION PLAN

ADDRESS:
2655 E GRAND RIVER AVE.
EAST LANSING, MI 48823

DRAWN BY:	KWV	DATE:	9-23-25
PERMIT NUMBER:	PENDING	CHECKED BY:	MM
AUTHORITY HAVING JURISDICTION:	EAST LANSING	A.H.J. PHONE #:	517-319-6871
CONTRACT NO:	25-1361	SHEET NO:	FP1 of 1

pinnacle construction group
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Grand Rapids, MI 49504
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May 14, 2026
Terra Firma Lansing
Concurrent Letter in Support of Appeal
Meridian Township Building Board of Appeals

CONTEXT

Pinnacle Construction Group acted as the Design Professional in Responsible Charge and the Record Architect for the tenant improvement located at 2655 E Grand River Avenue in East Lansing, MI known as "Terra Firma Lansing."

ISSUES

As we understand it, there are two issues that Meridian Township requires to be addressed before they will issue the Certificate of Occupancy for Terra Firma Lansing. The first is an issue regarding the interior finishes of the climbing walls as it relates to section 803 of the Michigan Building Code (MBC). The second involves the classification of the climbing walls as a "Play Structure" as it relates to section 424 of the MBC. There is a third item, the question of building construction type, that is not being directly questioned by Meridian Township but provides important context for the remainder of the items.

INTERIOR FINISHES

Classification

There has been some confusion as to whether the climbing walls should be defined as furniture/furnishings, equipment or building elements and whether they must conform to the interior finish requirements of MBC 803. Unfortunately, Chapter 2 of the MBC does not provide distinct definitions for furniture/furnishings or equipment. In our opinion the operative definition in Chapter 2 is for "Interior Wall and Ceiling Finish" and is as follows:

> **INTERIOR WALL AND CEILING FINISH.** The exposed interior surfaces of buildings, including but not limited to: fixed or movable walls and partitions; toilet room privacy partitions; columns; ceilings; and interior wainscoting, paneling or other finish applied structurally or for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes, but not including trim.

The commentary published by the International Code Council further clarifies that this section is meant to apply to "other vertical interior surfaces whether fixed or movable." Based on this, it is our professional opinion that the climbing walls must meet the requirements of section 803 of the MBC. Based on the occupancy, use and sprinkler system interior finishes of the climbing wall must meet a Class "C" rating per ASTM E84 or UL 723. Class C is the least restrictive rating, indicating a flame spread index of 76-200 and a smoke development index of 0-450.

Testing

It is our understanding, based on information provided to us by the owner, that the climbing wall finish is a Baltic Birch plywood. The specific supplied material comes from overseas and is not tested under the ASTM E84, UL 273 or NFPA 286 standards referenced in sections 803.1.1 and 803.1.2 of the MBC. It is instead tested under the

EN13501-1 standard. Under this standard it is listed as "D-s2, d0" which indicates the following:

> D – Measurement of Reaction to Fire. "D" indicates a combustible material, with medium contribution to fire
> s2 – Measurement of Smoke Generation. "s2" indicates emissions with average volume intensity
> d0 – Measurement of Fire Generation. "d0" indicates no burning droplets.

In addition to the EN13501-1 standard testing provided by the material supplier, Baltic Birch as a general material is also classified by the American Wood Council as a Class "C" finish with a flame spread index of 120 and a smoke development index of 70. The plywood is to be coated with a clear coat that has a Class "A" finish rating as determined by the manufacturer and documented with testing.
All of the aforementioned documentation has been provided to Meridian Township.

Alternative Systems
While the ASTM E84, UL 273 and NFPA 286 standards are called out directly in MBC 803, the MBC clearly states in section 104.11 that the provisions of the code in its entirety are not intended to prohibit materials, designs or methods of construction that are not specifically mentioned in the code provided they can be demonstrated to be equivalent.

Opinion
It is our professional opinion that the climbing walls are required to conform with the requirements of MBC 803. It is also our opinion that the applicant has demonstrated that the materials proposed have an equivalent level of safety to the prescriptive requirements of MBC 803.

PLAY STRUCTURE
Background
The concept of special provisions for a "play structure" first appeared in the International Building Code (IBC) in the 2000 edition. At that time it was called a "children's playground structure" and was limited to structures within a covered mall. This section was updated in the IBC 2012 to remove the reference to covered malls and specify that it now applied to "play structures installed in all occupancies covered by this code".
The section was further modified in the IBC 2018 to remove the reference to children, renaming the section to "Play Structures." This is the version of the section that is adopted in Michigan as part of the MBC 2021. It should be noted that while Michigan only adopted the language in April of 2025 there are currently 39 states using a version of the IBC 2018 or more recent.

Definitions
Chapter 2 of the MBC offers the following definitions:

> **PLAY STRUCTURE**. A structure composed of one or more components, where the user enters a play environment.

The commentary offers the following clarification:

> *Play structures are regulated by Section 424. The regulations are aimed at such structures where they are inside of other buildings, such as a mall, restaurant, school, recreational facilities or even an office lobby. The regulations are focused on the flammability of the materials used in their assembly.*

Opinion

The commentary clarification on the Play Structure definition offers the clearest picture of the intent behind these requirements. In our opinion this section, which began as an effort to limit the amount of combustible materials within a covered mall and has since been expanded to include other occupancies, is intended to limit the amount of combustible materials when a structure is located within an unrelated occupancy. The entire point of having different occupancies within the building code is to codify the dangers presented by different building functions. This is born out in the commentary's "purpose" comments that precede Chapter 3:

> *The purpose of this chapter is to classify a building, structure or part thereof into a group based on the specific purpose for which it is designed, occupied and used. Throughout the code, occupancy group classifications are considered a fundamental principle in organizing and prescribing the appropriate features of construction and occupant safety requirements for buildings, especially general building limitations, means of egress, fire protection systems and interior finishes.*

The fundamental risks involved in an assembly occupancy are spelled out in the commentary for section 303.1. The code recognizes that an assembly occupancy inherently means a denser occupant load and a higher potential for fatalities and injuries from fire. This thinking is "baked in" to the requirements that the MBC places on an assembly occupancy including, but not limited to, higher occupancy values, stricter requirements for sprinkler systems and fire alarms, reduced travel distances and an increased number of exits.

A gymnasium occupancy is specifically listed as an A-3 occupancy in the MBC alongside other occupancies intended for recreation and amusement such as bowling alleys and libraries. There are no additional requirements for libraries because they are filled with combustible books, nor are there additional requirements for bowling alleys because of the amount of wood flooring. These are known dangers inherent in the functions and are included in the thinking when placing them in the A-3 occupancy group. Similarly, a gymnasium is known to have foam pads, climbing walls, and other equipment that does not present an additional, unknown hazard.

Based on the analysis above, it is our professional opinion that a climbing wall inside a space dedicated as a climbing gymnasium does not constitute a "play structure" per MBC 424.

CONSTRUCTION TYPE

The original permit drawings submitted by Pinnacle Construction Group indicated that the building was a Type II-B, non-combustible, construction. This best matches the existing condition of the building's structure. Based on this, the core-and-shell work

designed by Pinnacle Construction Group utilized metal studs and other non-combustible materials.
Upon further review it was determined that the work complies with all of the code requirements for a Type V-B combustible building including, but not limited to, occupancy, building area, building height and sprinkler requirements. A revised set of drawings reclassifying the building as Type V-B construction was submitted to Meridian Township by Pinnacle Construction Group on April 10, 2026.
The wood framing of the climbing walls is permitted under Type V-B construction per MBC 602.5.

CONCLUSION

It is our opinion that ownership has demonstrated compliance with the two outstanding issues presented by Meridian Township and, to the best of our knowledge, has constructed their facility in keeping with the code requirements, standards and common practices of their industry. We recommend issuance of a certificate of occupancy.

Matt Dixon, AIA
Director of Architecture, Pinnacle Construction Group

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ROBERT C. ANGELL

Also admitted in Colorado

ADMINISTRATIVE HEARING EXAMINER:

OHIO DEPARTMENT OF HEALTH
STATE MEDICAL BOARD OF OHIO
OHIO STATE DENTAL BOARD
OHIO BOARD OF PHARMACY
OHIO DEPARTMENT OF MEDICAID
OHIO DEPARTMENT OF COMMERCE
OHIO DEPARTMENT OF INSURANCE
OHIO PROFESSIONAL ENGINEERS & SURVEYORS BOARD

05/14/2026

VIA EMAIL

Meridian Township Building Board of Appeals
Meridian Township
5151 Marsh Road
Okemos, MI 48864

Re: Application of IBC Chapter 4 Section 424 to sport climbing facilities

Dear Board:

Please be advised that this office represents the Climbing Wall Association, Inc. ("CWA") in connection with a member inquiry about the application of IBC Chapter 4, Section 424 to sport climbing facilities ("climbing gyms") and climbing structures ("climbing walls"). The CWA is a 501(c)(6) trade association representing the interests of the international indoor climbing industry and its stakeholders. For the reasons that follow, we believe that application of Section 424 to sport climbing facilities is unwarranted by the plain language of the regulation. Further, compliance by sport climbing facilities with the requirements of the regulation would be, and is, unduly burdensome, if not impossible.

I. Sport climbing facilities and climbing structures are not "play structures" within the meaning of the regulation.

The IBC has adopted the following definition of "play structure:" "A structure composed of one or more components, where the user enters a play environment that utilizes combustible materials." (A related regulation defines "soft contained play equipment structure" as "[a] children's play structure containing one or more components where the user enters a play environment that utilizes pliable materials[,]" such as inflatable amusement devices.)

As an initial matter, application of this regulation to sport climbing facilities is absurd on its face. Indoor climbing facilities, which were first introduced in the United States in 1987, are training and fitness facilities in which participants train and practice techniques for outdoor climbing on real rock. More recently, these facilities have developed into true sporting venues, with the advent of climbing teams and competitions. Climbing – specifically speed climbing and bouldering – became an Olympic sport beginning with the 32nd Olympiad in 2020 (held in 2021 due to the COVID-19 pandemic). Against this background, not even the most tortured interpretation of "play structure" could include sport climbing gyms and climbing walls.

Climbing gyms should be classified as A-3 or A-4 occupancy under the 2021 IBC and not be subject to the additional rules found in section 424. An artificial climbing wall is not a structure in which a climber "enters a play environment." Climbers do not enter a climbing wall, they climb the face of it. The wall is a vertical surface that is ascended, not an enclosure or environment that is entered. This is the core definitional distinction. These are fundamentally different structures with different use patterns, different fire behavior, different structural loads, and different safety concerns.

Further, the history of section 424 shows that the primary concern that was being addressed from 2012 when the section was titled "Children's Play Structures" to today was free standing, multi-component indoor play environments and soft-contained climbing tubes and other structures often called "climbers." When "Children's" was dropped from the title of section 424, the IBC clearly had similar structures in mind, but scaled up for adult use. However, a climbing wall does not have an area that can meet the 300 or 600 foot thresholds found in section 424 because it is a vertical surface with limited or no standing platforms.

The 2018 IBC Code and Commentary book, section 424, states: *"Play structures for children's activities have been regulated for some time by the code where such structures are located within covered mall buildings. The primary concern, consistent with other structures located within a covered mall building, is the combustibility of such play structures. Due to the potential fire hazards, the regulations are now applicable where such structures are located within any building regulated by this code, regardless of occupancy classification. The current provisions are essentially identical to those that historically regulated children's play structures located within covered mall buildings. Where these structures exceed 10 feet in height and 150 square feet in area, the provisions of sections 424.2 through 424.5 must be followed."* Climbing walls and climbing gyms are clearly outside of the scope of this interpretation. Unlike the play structures the section was written around, climbing walls do not create enclosed circulation paths, concealed spaces, tunnels, or occupied platforms that affect visibility, egress, or emergency access. Climbers remain in open view and directly accessible from the main floor area at all times.

Another element to consider is that a commercial climbing wall in a climbing gym is not installed inside a building the way a play structure is. It is a structural fixture oftentimes connected to the building itself with no occupancy behind the climbing structure negating the need for the separation requirements in section 424. Climbing walls require licensed structural engineering, site-specific load calculations, building permit drawings, and structural inspections, all of which are regulated by strong industry standards.

II. Compliance with the regulation would be unreasonably burdensome.

Even if climbing walls could be considered as "play structures," application of the regulation to these facilities and structures would be unduly – perhaps intolerably – burdensome, especially to existing facilities. Of particular concern is paragraph 424.4, which requires that "[p]lay structures shall have a horizontal separation from building walls, partitions and from elements of the means of egress of not less than 5 feet (1524 mm). Play structures shall have a horizontal separation from other play structures of not less than 20 feet (6090 mm). This is not feasible in any climbing facility and does not support improved fire safety since the area between a climbing wall and building wall is not typically occupied other than unique and irregular maintenance needs. In an existing facility, it would require the removal of all climbing structures (climbing walls and bouldering structures) and their replacement with far fewer structures.

The availability of fewer climbing structures would obviously have a chilling effect on participation in an activity which has been recognized to be of significant fitness benefit to its participants. This benefit has been recognized by legislators and regulators alike. *See, e.g.,* Ohio Revised Code 4175.02, which provides, in pertinent part: "The general assembly finds that the sport of rock climbing is practiced by a large number of Ohio citizens, provides a wholesome and healthy family activity that should be encouraged, promotes physical fitness, and significantly contributes to the economy of this state." Application of the regulation as proposed is obviously at cross purposes with these benefits.

The CWA is committed to risk mitigation and the safe enjoyment of the sport of climbing. We are committed as well to ensuring a regulatory environment in which operators and participants can enjoy the sport without undue and inappropriate regulatory restrictions. We would welcome dialog with you regarding these matters.

Sincerely,

ANGELL LAW OFFICES, LLC
For the Climbing Wall Association, Inc.

Robert C. Angell, Attorney at Law

RCA/

cc: Garnet Moore, Executive Director, via email only

Memorandum in Support of Appeal
Terra Firma East Lansing
Appeal of Reclassification of Commercial Climbing Walls as a Section 424 Play Structure After Building Permit was Issued

To: Meridian Township Building Board of Appeals
From: Terra Firma East Lansing
Date: 5/14/2026
Re: Objection to Township's Reclassification of Climbing Walls as Section 424 Play Structure

---

I. Requested Relief

Terra Firma East Lansing respectfully supports the Township's building permit and objects to the Township's attempt to reclassify its commercial climbing walls after construction as a "play structure" under Section 424 of the building code. Both as a matter of procedure and interpretation.

Terra Firma requests that the Board determine that the climbing walls are part of an athletic/recreational assembly use as contemplated in the building permit and should not be reclassified as a Section 424 play structure. In the alternative, if the Board determines that Section 424 applies, Terra Firma requests approval based on equivalent fire and life safety as the constructed climbing walls meet the intent of Section 424 and do not create the egress, visibility, entrapment, or emergency-access hazards that Section 424 is intended to address.

II. Project History and Reliance on Approved Plans

Terra Firma East Lansing was constructed in reliance on approved plans, professional design input, township review and a lawful building permit issued by the township.

We submitted plans for the rehabilitation of a proposed lease space in a sprinklered property at Grand River Avenue in Meridian Township owned by Eyde Development. The submitted plans were for rehabilitation of a space with a change in occupancy class, formerly occupancy class M, to a climbing gymnasium, occupancy class A-3, and prepared by a licensed architect. Those plans were developed under the Michigan Code for Rehabilitation of Existing Buildings, the A-3 occupancy classification of the 2021 Michigan Building Code adopted in April 2025, and the 2012 Michigan Life Safety Code. These plans were reviewed and approved by the Township and a building permit was issued. The Township held itself out as experts in this matter, and its building official as its interpreter of the code, with the authority to issue a building permit.

The climbing walls were built according to the approved project plans. Terra Firma provided documentation during the permitting and construction process, participated in regular progress inspections, and proceeded in reliance on the understanding that the climbing wall systems were being treated as recreational equipment, within an assembly occupancy.

The proposed reclassification of the climbing walls as a Section 424 play structure was raised *after* the climbing walls and related improvements had already been constructed, just weeks before the planned opening date.

Applying the most stringent interpretation of Section 424 at this stage would require removal or major reconstruction of improvements that were built in good faith reliance on the approved plans and the township's lawful permit.

We recognize that reliance does not trump safety, or the Authority Having Jurisdiction's (AHJ)'s right to enforce the code, but the process for changing a code interpretation must also be adhered to. However, in this case, our facility does not meet the definition, scope, or intent of the stringent regulations under Section 424 and a change in occupancy classification sets a larger precedent for arbitrary reclassification to constructively deny use, such as reclassifying a hobby store that sells model planes as an Aircraft Related Occupancy under Section 412. Thematic resemblance is not enough to assign code classification. The underlying functional and hazard criteria must be used to assess the classification.

III. Commercial Climbing Gyms Are Athletic/Recreational Assembly Uses and Not Play Structures

Commercial climbing gyms are modern athletic facilities. Rock climbing is a mainstream sport and has been included in the Olympic Games since 2020. There are over six hundred commercial climbing gyms operating across the United States, and these facilities are commonly classified as assembly/recreational occupancies, including A-3 occupancies.

The Climbing Wall Association (CWA) is the standard-setting organization for the indoor climbing industry, with standards addressing design and engineering, structural inspection, operations, and certification. Terra Firma's climbing walls were designed and built to these recognized industry standards by an experienced climbing-wall builder familiar with the specialized structural, operational, and safety requirements of indoor climbing facilities.

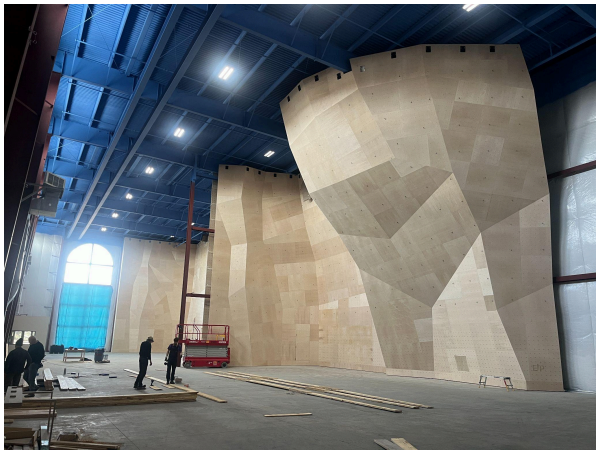
Commercial climbing walls are typically built using similar or identical materials and construction methods across the industry, following the CWA standards. To our knowledge, there are no commercial climbing gyms designed to satisfy a literal application of Section 424's 5-foot separation from building walls requirement or fire-treated wood requirements. Baltic birch is required for construction of climbing surfaces for its high strength and density. All modern commercial climbing walls are built with baltic birch plywood, which does not explicitly meet the

fire treatment requirements of Section 424. In our research, there are no fire treated baltic birch plywoods available on the market. Regular fire-treated plywood does not have the structural properties necessary to create a safe climbing surface. Further, we cannot find evidence of any commercial climbing gym that meets Section 424's 5-foot setback requirements. Modern commercial climbing gyms are generally constructed with climbing walls integrated with, adjacent to, or supported by building wall systems.

This is significant because many jurisdictions have already adopted building code language that removed the word "children's" from the former "children's play structure" section. These include California, New York, Illinois, Georgia, and Washington. In those jurisdictions, more than a dozen commercial climbing gyms have continued to be permitted and constructed that do not meet the requirements of Section 424.

Image: SenderOne in Aliso Viejo, CA opened March 2026. Note plywood climbing walls within five feet of structural walls.

This indicates that the ordinary permitting practice for commercial climbing gyms is to treat the climbing walls as recreational athletic equipment within an assembly occupancy, not as enclosed play structures.



Images: Planet Rock - Grand Rapids under construction in late 2025 using untreated wood support and baltic birch plywood and direct attachment to building walls.

IV. Section 424 Is Directed at Structures That Create Egress, Visibility, Rescue, and Fire-Safety Concerns

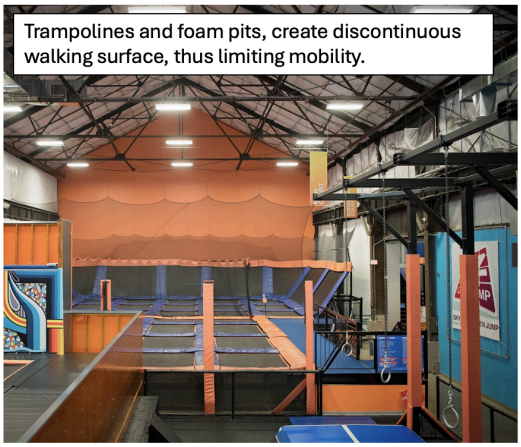
Section 424 is intended to regulate play structures that create specific fire and life-safety concerns. Historically, this section addressed children's play structures: multi-level, enclosed or semi-enclosed play environments with limited visibility, internal circulation, and constrained egress. Typical examples are shown below.

Happy Kids Indoor Playground, Grand Rapids MI (opened 2024)

Fun City, Lansing MI (opened 2024)

Although later code language removed the word "children's," the intent remains directed at structures that create similar hazards. The code commentary explains that indoor play structures are no longer used only by children. Trampoline parks, obstacle courses,

ninja-warrior-style courses, and family entertainment centers (see examples below) may include multi-level structures used by teenagers and adults. The expansion of the language reflects the broader user population and broader types of indoor play structures.



Sky Zone trampoline park, Lansing MI

Indoor ninja course in Las Vegas, NV

It does not mean that every recreational element that a person can climb on becomes a Section 424 play structure. A climbing element may be part of a play structure when it creates the hazards Section 424 is meant to address: limited visibility, enclosed or hidden occupant spaces, constrained internal circulation, impaired egress, or difficult emergency rescue.

Terra Firma's climbing walls do not create those conditions and are not comparable in terms of safety risk.

V. Terra Firma's Climbing Walls Do Not Create the Hazards Addressed by Section 424

Terra Firma's climbing walls are open athletic surfaces within an assembly space. Climbers are on the exterior face of the walls. They are not inside an enclosed structure. The walls do not create internal public circulation, tunnels, chambers, platforms, or maze-like conditions. The public does not pass through or within the climbing wall structure to exit the building.

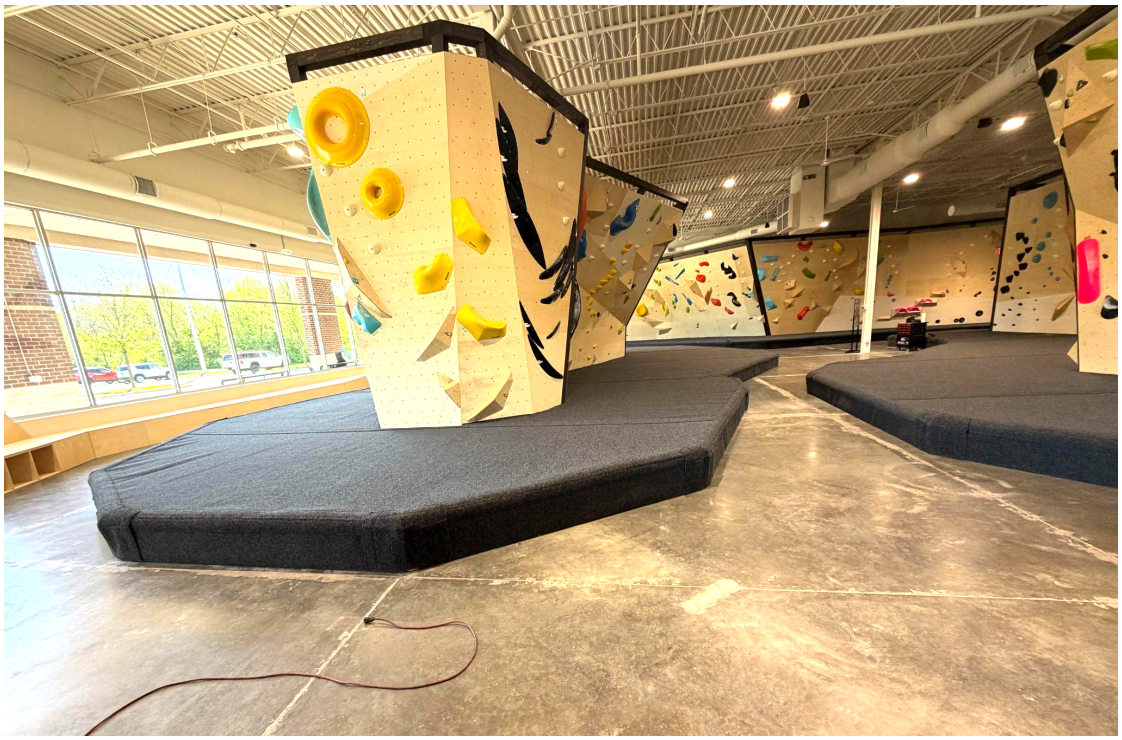


Image: Interior of Terra Firma East Lansing Showing Clear Circulation and Egress Paths

The climbing walls do not impair movement, egress, visibility, or fire department operations. Egress from the climbing area is conventional assembly egress: occupants move across the open floor area to the building exits. The climbing walls do not add barriers between occupants and exits and do not meaningfully affect sight lines between occupants, staff, and the means of egress. Further, the padding does not meaningfully affect mobility. The top layer is carpet over a pvc vinyl tightly wrapping the fall protection foam. This makes for a fairly stiff surface comparable to other gymnasium floor mats and does not extend into egress paths.

The conditions at Terra Firma are therefore fundamentally different from the conditions Section 424 was written to address.

Section 424 Concern	Typical Play Structure Condition	Terra Firma Condition
Internal occupant spaces	Occupants may be inside tubes, platforms, enclosed paths, or maze-like structures	Climbers remain on open wall surfaces
Limited visibility	Occupants may be hidden from staff or emergency responders	Climbers are visible from the open floor area
Structure-mediated egress	Occupants may need to exit through or from within the play structure	Egress occurs through the open assembly floor and building exits
Difficult rescue	Fire/rescue personnel may need to enter the structure to locate or remove occupants	Emergency personnel can access the climbing area from the open floor
Barriers to exits	The structure may obstruct or complicate exit access	The climbing walls do not create obstacles between occupants and exits

For these reasons, Terra Firma's climbing walls should not be classified as a Section 424 play structure.

VI. Code Definitions Support Treating the Space as an Athletic Assembly Use

The building code separately recognizes athletic and sport-related uses. The existence of distinct concepts such as "area of sport activity," "gymnasium," and assembly/recreational occupancies is important. If all sports-related equipment and areas were automatically "play structures," then these separate classifications and definitions would lose practical meaning.

A commercial climbing gym is an athletic/recreational assembly space. It is more analogous to a weight lifting gymnasium, Mixed Martial Arts gymnasium, fitness center, or other supervised athletic environment than to an enclosed play structure.

The plain-language and functional distinction is straightforward, MBC 2021 defines:

- **Play Structure** - A structure composed of one or more components, where the user enters a play environment.
- **Area of Sport Activit**y - That portion of an indoor or outdoor space where the play or practice of a sport occurs.

The distinction is important, while both definitions use the word “play”, the play structure definition discusses *entering* into a play environment versus an area of sport activity which discusses a *space* where play or practice of sport occurs. While not expressly linked, the A-3 occupancy cites **Gymnasiums** as an example of this type of occupancy. The word “gym” is simply a shortening of “gymnasium”. The code does not distinguish the type of gymnasium so a climbing gym would be a clear example of a use that the A-3 occupancy contemplates.

- A **play structure** is a structure that occupants enter, move through, or occupy in a way that can limit visibility, rescue, or egress.
- A **commercial climbing wall** is an open athletic surface used by climbers within an assembly space.

A broad interpretation of Section 424 that relies on the mere presence of user interaction within a defined recreational space would improperly extend the provision beyond its intended scope. For example, standard athletic facilities such as boxing rings and mixed martial arts cages involve confined areas in which a sport or “play” occurs, yet they are universally treated as athletic apparatus within assembly occupancies rather than “play structures,” because they do not constitute integrated environments composed of interconnected components designed for contained or exploratory movement. Likewise, golf simulators involve users entering a “play environment”, but they are essentially instructional and entertainment equipment within a controlled interior space, not structural environments that users enter or navigate as a physical system. These examples illustrate the necessary limiting principle: interactive recreation, restricive activity zones, or immersive experiences alone do not transform a space or apparatus into a “play structure” under Section 424 absent the defining characteristics of an integrated, constructed play environment that creates unique safety hazards of reduced egress, visibility and challenges for rescue.

VII. ICC Hotline Guidance

We understand that guidance was obtained indicating that climbing walls may be considered play structures. This however does not constitute an official position of the ICC. From the ICC website they explicitly note: *It’s important to note that staff code opinions issued by our technical staff do not represent the official position of the International Code Council. The final authority of code opinions is the responsibility of the code official. Staff opinions are not intended to influence the code official*.

Terra Firma does not dispute that some climbing walls or climbing elements can be part of a play structure. For example, a climbing element inside an enclosed multi-level play maze, obstacle course, ninja course, or family entertainment structure could create the visibility, egress, and rescue concerns addressed by Section 424. In those cases, the classification may be appropriate, but that is not the configuration at Terra Firma.

Terra Firma's climbing walls are not enclosed play environments. They do not contain public internal circulation. They do not create hidden occupant areas. They do not affect the public's ability to exit the building. They are open athletic surfaces within a conventional assembly occupancy.

The proper classification should therefore depend on the actual configuration and hazard, not on the mere fact that the word "climbing" is involved.

IX. Terra Firma Meets the Intent of Section 424

We believe the original, permitted classification of our facility was correct and that the definition of Section 424 is not applicable to our project. Terra Firma's design meets the intent of the section and provides equivalent fire and life safety to the requirements as outlined below:

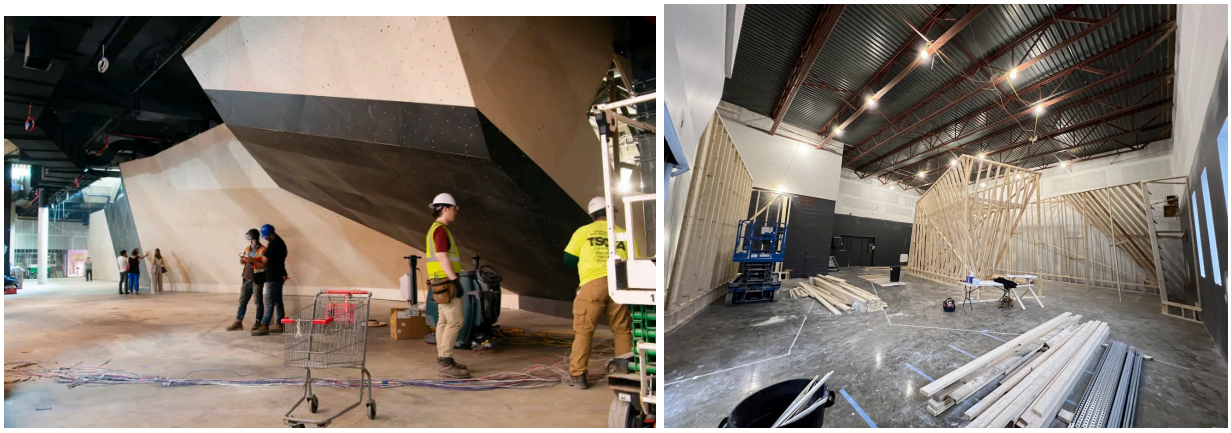
A. Section 424.2 — Materials

Section 424.2.10 requires interior finishes for structures exceeding 600 square feet in area or 10 feet in height to have a flame spread index not greater than that specified in the applicable interior finish table for the occupancy group and location.

Terra Firma has obtained a fire engineer's memo addressing the climbing wall materials and their compliance with applicable interior finish and fire/life-safety requirements. See Exhibit [X], Fire Engineer Memo.

The materials used in Terra Firma's climbing walls are consistent with materials used in commercial climbing gyms throughout the United States. The project-specific fire engineer memo provides the technical basis for concluding that the wall materials and installation comply with the adopted code or provide equivalent fire and life safety.

All materials used in the construction of Terra Firma's climbing walls are industry standard and have been used in jurisdictions which have the same Section 424 code language.



Images: Vital in NYC built in late 2025 and Summit City in Ft. Wayne, IN built in 2025. Note the untreated timber and baltic birch plywood, built under IBC 2021

B. Section 424.3 — Fire Protection

Section 424.3 requires play structures to be provided with the same level of approved fire suppression and detection devices required for other structures in the same occupancy.

Terra Firma's fire protection and detection systems were designed for the occupancy and reviewed as part of the project. The climbing walls do not create enclosed public spaces requiring separate occupant egress or rescue. Fire protection coverage and detection should be evaluated based on the actual constructed condition: an open assembly climbing area with climbing walls at the perimeter of the space. However, the space's previous use required an "ordinary hazard" sprinkler system rather than the "light hazard" sprinkler system required for an A-3 occupancy. Our drawings have been updated to reflect that this system is in place and meets an ordinary hazard classification in areas of the building containing climbing walls, which is more stringent than that which is required by code.

See revised Fire Protection Design / Sprinkler Drawings / Fire Review Documentation.

C. Section 424.4 — Separation

Section 424.4 requires play structures to have a horizontal separation from building walls, partitions, and elements of the means of egress of not less than 5 feet.

The purpose of this separation requirement is to preserve access, egress, visibility, and fire/rescue operations around structures that may otherwise create hidden, enclosed, or difficult-to-access spaces.

That concern is not present here. Terra Firma's climbing walls do not obstruct egress. They do not create internal public circulation. They do not create a maze-like or enclosed environment. Occupants exit by moving across the open floor area to the building exits, just as they would in other assembly occupancies.

A literal application of the 5-foot separation requirement would not improve life safety in this context. To the contrary, requiring a 5-foot corridor behind climbing walls could introduce hidden or confusing spaces behind the walls, reduce visibility, and create new areas that are not necessary for occupant egress or emergency access.

The existing design provides clearer, more direct, and more visible egress than a layout with concealed back-of-wall corridors.

Moreover, applying this standard is not within industry standards. Climbing walls are almost universally built against building walls and in the case of taller walls, must be structurally attached to the building. There are numerous examples of climbing walls built in jurisdictions which use the general “play structure” definition for section 424 where the walls are built directly against structural building walls.

Images: Central Rock, Troy, NY and Shift, Holland, MI Climbing Roots, Knoxville, TN and Portland Rock Gym, Beaverton, OR built in late 2025 under IBC 2021

D. Section 424.5 — Area Limits

Section 424.5 limits play structures to 600 square feet unless a special investigation acceptable to the building official demonstrates adequate fire safety.

Terra Firma has provided a fire engineer memo and supporting documentation which constitute a technical investigation demonstrating adequate fire and life safety. The climbing walls do not create the occupant hazards associated with enclosed play structures, and the fire performance of the materials is addressed through the project-specific technical documentation.

E. Section 424.5.1 — Design

Section 424.5.1 requires play structures exceeding 600 square feet in area or 10 feet in height to be designed in accordance with Chapter 16.

Terra Firma's climbing walls were designed and constructed by an experienced commercial climbing wall builder, and stamped approved drawings were provided as part of the project documentation.

The wall systems were not improvised. They were professionally designed and installed using industry-standard materials and methods for commercial climbing gyms that follow the Climbing Wall Association industry standards for climbing walls.

IX. Alternative Request for Equivalent Safety Approval

If the Board concludes that the permitted classification should be overturned and that the climbing walls should be subject to Section 424, Terra Firma requests a variance or finding of equivalent-safety and approval of the constructed materials and layout.

The constructed design provides equivalent or greater fire and life safety because:

1. The public climbing area is open and visible.
2. Climbers are not inside an enclosed structure.
3. The walls do not create internal public circulation.
4. The walls do not obstruct exit access.
5. Emergency personnel can access the climbing area from the open floor.
6. The fire performance of the wall materials is addressed by a project-specific fire engineer memo.
7. The sprinkler system design is conservative.
8. Requiring a 5-foot corridor behind the walls would not improve safety and could create hidden or confusing spaces.

The Board should therefore approve the constructed layout as meeting the intent of Section 424, even if Section 424 is determined to apply.

X. Summary

Terra Firma respectfully requests rejection of the Township's request to reclassify its facility such that its commercial climbing walls are regulated as a Section 424 play structure.

Our objection is supported by three independent grounds:

1. **Precedent and ordinary permitting practice:** Commercial climbing gyms are athletic/recreational assembly uses, commonly classified as A-3 occupancies, with climbing walls treated as recreational equipment and not Section 424 play structures. There are no known climbing gyms that explicitly meet Section 424 and it does not appear it is possible to construct one. Interpreting climbing walls as play structures would create a de-facto ban. This interpretation is directly contradicted by the construction of 53 new climbing gyms in North America in 2025, the majority of which were built in jurisdictions where IBC 2021 applies.
2. **Plain-language definition and code intent:** Section 424 is intended to regulate structures for a play environment that create limited visibility, constrained egress, internal occupant spaces, or difficult rescue conditions. Terra Firma's climbing walls do not create those hazards. Interpreting the definition of play structure to include sports and athletic facilities such as Mixed Martial Arts rings, golf simulators and climbing walls is clearly beyond the intended scope of the code.
3. **Equivalent or greater safety:** Even if Section 424 is deemed applicable, Terra Firma's constructed layout provides equivalent or greater fire and life safety than strict application of Section 424. IBC Section 104.11 (Alternative Materials, Design and Methods of Construction and Equipment) allows for the approval of materials, design, or construction methods not explicitly prescribed by the code. We recognize that such alternatives must be deemed satisfactory by the building official and meet the intent of the code regarding quality, strength, effectiveness, fire resistance, durability, and safety. The materials and design principles used for our climbing walls are industry standards and should be accepted as such having been scrutinized and approved by more than seven hundred other code officials in the United States over the past thirty years.

Terra Firma built this project according to approved plans, using experienced professionals, and in reliance on the township's prior approval. The late-stage reclassification of the climbing walls as a Section 424 play structure is inconsistent with the actual configuration of the space, inconsistent with precedence set forth by dozens of other code officials, and does not further protect fire and life safety.

For these reasons, Terra Firma respectfully requests that the Board rejects the township's request to reclassify and allow the project to proceed to occupancy. In the alternative, Terra Firma requests a variance or equivalent-safety determination approving the constructed materials and layout under section 104.11.

Bowman
FIRE & LIFE SAFETY

May 15, 2026

Alex Williams
Terra Firma Bouldering Company
2655 E. Grand River Avenue, Suite A
East Lansing, MI

Re: Climb Terra Firma
Terra Firma East Lansing

Bowman FLS #: 331176-01-001
Material Review

Dear Mr. Williams:

Climb Terra Firma is the owner of a climbing gym that is currently under construction at 2655 E. Grand River Avenue in East Lansing Michigan. Based on the information provided, the climbing gym is classified as an A-3 occupancy and is under construction in an existing building of 15,000 square feet and of Type IIB construction. The building has an existing fire sprinkler system designed for ordinary hazard occupancy.

The local fire department has recently raised some questions regarding the fire rating of some of the materials used, and their associated compliance with the applicable code requirements. In response to the request from the fire department, Bowman Fire & Life Safety has been engaged to review the following specific materials for compliance with the applicable provisions of the interior finish requirements of the 2021 International Fire Code (IFC) as shown on the Permit drawings.

1. 3/4" 13 Ply Baltic Birch Plywood - used for the facing of the climbing walls
2. Spruce Lumber - used to support the Baltic Birch facing of the climbing walls
3. The finish - applied to the baltic birch
4. Foam fall attenuation padding - used for fall padding at base of all climbing walls
5. PVC vinyl tarp - wraps the foam fall attenuation padding
6. Carpet - wraps the foam and tarp
7. Acrylic panels - decorative panels over the front desk

Interior finishes, decorative materials, and furnishings are regulated by Chapter 8 of the IFC and Section 803 of the International Building Code (IBC) as referenced by the IFC. Finishes are generally defined by the IBC based on their location and configuration within a structure, e.g. wall and ceiling finishes are defined and treated differently from floor finishes. As noted in

Section 803.1 of the IBC, wall and ceiling finishes must be tested based on NFPA 286 (IBC 803.1.1) or ASTM E84 (IBC 803.1.2). Floor finishes are classified as Class I or Class II based on the testing requirements of ASTM E648 or NFPA 253.

The information provided in the table below references the test criteria to which the material has been tested to, the test results, and the code compliance requirement(s).

MATERIAL LIST REFERENCE	CONFIGURATION	COMPLIANCE CRITERIA	TEST RESULTS	REFERENCE
#1 - Facing	Vertical – Interior Wall and Ceiling Finish	FS < 200; SD < 450 (Class C) (IBC TABLE 803.13)	FS = 120; SD = 70 (Class C) Meets applicable compliance criteria	American Wood Council
#2 - Framing	Vertical – Interior Wall and Ceiling Finish	FS < 200; SD < 450 (Class C) (IBC TABLE 803.13)	FS = 45; SD = 120 (Class B) Meets applicable compliance criteria	American Wood Council
#3 – Applied finish	Vertical – Interior Wall and Ceiling Finish	FS < 200; SD < 450 (Class C) (IBC TABLE 803.13)	FS = 0; SD = 5 (Class A) Meets applicable compliance criteria	HPVA Laboratories
#4 – Foam fall attenuation	Horizontal Floor Finish	Class I or Class II (IBC Section 804.2)	FS = 25; SD = 250 (Class A) Meets applicable compliance criteria through equivalency	Commercial Testing Company
#5 – PVC vinyl tarp	Horizontal Floor Finish	Class I or Class II (IBC Section 804.2)	Complies with NFPA 701 test criteria	Ennis Product Data Sheet
#6 - Carpet	Horizontal Floor Finish	Class I or Class II (IBC Section 804.2)	Dfl-S1 (moderate flammability with little to no smoke developed per European Fire Protection Standard EN-13501)	Primavera Resine Product Data Sheet and Internet Research
#7 – Acrylite panel	Decorative Material	IBC Section 2606	Complies with IBC Section 2606.4	Acrylite Product Data Sheet

Note that the foam fall attenuation padding was tested to ASTM E84 which is typically applied to products which are part of an interior wall or ceiling assembly. Since the conditions of a fire involving a combustible material in a vertical wall or ceiling assembly will have a higher growth and spread rate than the same material would if in a floor assembly, the foam fall attenuation

padding meets the applicable compliance criteria through equivalency, as the ASTM E84 test conditions are more severe than the applicable criteria in an ASTM E648 or NFPA 253 test.

EN-13501 is a similar test to that of ASTM E648 and a product tested to standard EN-13501 and achieving a fire rating of Dfl (note, the fl designates a floor application) will have a critical heat flux (CHF) of not less than 0.3 watts/cm^2. As noted by IBC Section 804.2, a Class II rating as determined through ASTM E648 will have a CHF of not less than 0.22 watts/cm^2. Note that flammability hazard increases as the CHF decreases.

The Acrylite material will be used as a decorative element to display the business logo. The panel will be semi-transparent and its use and requirements are most closely addressed through the application of IBC Section 2606, *Light-Transmitting Plastics.* Section 2606.4 outlines the requirements for these plastic elements and accordingly, the materials must have a self-ignition temperature of greater than 650°F where tested in accordance with ASTM D1929, a smoke density of not more than 75 when tested in accordance with ASTM D2843, and a burning rate of less than 2.5 inches per minute when tested in accordance with ASTM D635. The panels meet this criteria based on the information provided in the product data sheet.

Our review and opinions developed are based on information provided by Terra Firma Bouldering Company, product data sheets for the reviewed products, and research of the applicable codes. Our qualifications and the reviewed product data sheet/test reports are attached for reference.

If you have any questions or comments, please do not hesitate to contact us.

Sincerely,

Bowman Fire & Life Safety, Inc.

Steve Sheldon
Principal Fire Protection Consultant

Reviewed by

Jarrod Cherwinski, PE
Senior Fire Protection Engineer

Attachments: Resumes for S. Sheldon and J. Cherwinski
American Wood Council Report
Applied Finish Test Report
Acoustic Foam Test Report
Coated PVC Test Report
Carpet Test Report
Acrylite Test Report

Bowman

Experience
33 Total Years, 14 Years with Bowman

Education
B.S. Mechanical Engineering, California State University Chico, 1988

Registrations
Fire Protection Engineer:
Arizona (#28898), California (#FP1798), Idaho (P-15219), Nevada (22399), New Mexico (#20080), Oregon (#90629PE), Washington (#43962, Wisconson (#44135-6), Wyoming (#15089)

Professional Affiliations
National Fire Protection Association (NFPA), Member; NFPA 17/17A Technical Committee, Principal Member; NFPA 101 - Storage, Industrial, Technical Committee, Alternate; NFPA 120/122 Technical Committee, Principal Member; Society of Fire Protection Engineers (SFPE) International, Member; SFPE, Arizona Chapter, Past and Current President; Arizona BTR Enforcement Advisory Committee; International Code Council (ICC), Member; Arizona Burn Foundation, Board of Directors, 2005 - 2014; City of Mesa Building Board of Appeals, 2005 – 2013

Steve Sheldon, PE, LEED GA
Principal Fire Protection Engineer

Steve's extensive background and experience includes code consulting, fire protection design, hazard evaluation, construction administration, property loss prevention and risk management. His tenure in the fire protection engineering profession spans more than 30 years, and he has served as the fire protection engineer of record and/or project manager for numerous renovation projects. He is also involved in the local community as demonstrated through his past participation on the Board of Directors for the Arizona Burn Foundation, his past role as an adjunct professor teaching a class on the application of building codes, and through his participation on several boards and advisory committees related to fire protection, code compliance, and professional engineering.

Steve has worked on public and private sector projects including military, residential, industrial, higher education, mining, manufacturing, storage, and many others. Typical project tasks include performing evaluations, design, and construction-related services for all types of fire suppression and alarm systems, code analysis, life safety and building surveys, mitigation of non-code compliant conditions, and commissioning fire protection and life safety systems.

Experience

Arizona State University Durham Language & Literature Building Renovation | *Tempe, AZ*
A complete renovation and revitalization of a six-story building on ASU's Tempe campus constructed in 1964. This was a phased design-building project and the work of Fisher Engineering included fire protection and fire alarm design, code consulting, and construction administration support services.

University of Arizona Arts Building Renovation | *Tucson, AZ*
A partial renovation of much of the classroom, museum, and exhibit spaces along with a partial make-over of its entry and façade. Fisher Engineering worked with the architect and UofA's project stakeholders to access existing conditions, and provide fire protection and fire alarm design services to the project. This project presented a number of challenges due to several unknowns, and the need to coordinate existing systems with renovation related changes.

Arizona State University Gammage Auditorium Addition/Renovation | *Tempe, AZ*
Gammage Auditorium is one of the most iconic buildings on ASU's Tempe Campus. The building was constructed in 1962. It represents the last publicly commissioned project designed by legendary architect, Frank Lloyd Wright, and is listed on the National Register of Historic Places. As originally designed, the number of restrooms did not meet the needs of the patrons, and there were a number of accessibility deficiencies. In 2015 restroom facilities and accessibility provisions were added or modified. Fisher Engineering worked with the architect to determine and document existing conditions that would be affected by the project, and we assisted with confirming code compliance.

Jarrod Cherwinski, PE

Senior Fire Protection Engineer

With over 20 years of experience in the field of fire protection engineering, Jarrod has extensive knowledge and expertise in the design, inspection and analysis of fire protection systems, interpretation and enforcement of fire codes, life safety/building code surveys for commercial, industrial, aviation, and power generating facilities. He has been the fire protection engineer for projects related to the design, evaluation, and construction oversight of the fire protection and life safety systems for a wide range of Federal and commercial clients. He led and participated in numerous fire protection/life safety surveys/evaluations of all types of facilities, both business and industrial, including GSA's leased buildings.

Jarrod's fire protection expertise includes a wide range of facilities including K-12 education, higher education, commercial, historic preservation, industrial, assembly, and residential/housing.

Experience

Dresden Elementary School | *DeKalb County, GA*
Fire sprinkler design for a new 1-story, approximately 120,000 sq. ft. elementary school.

Canton Charter Academy | *Canton, MI*
Fire protection engineering survey and facility assessment of an existing 1-story, approximate 50,000 sq. ft. elementary school.

Forsyth Academy | *Winston Salem, NC*
Fire protection engineering survey and facility assessment of an existing 1-story, approximate 37,000 sq. ft. elementary school.

Army Reserve Center | *Birmingham, AL*
Fire sprinkler and fire alarm design and building code/life safety consulting services for a new Reserve Center that consists of four buildings totaling 71,200 sq. ft.

Building Fire Protection Facility Assessments, US General Services Administration | *Various Locations throughout the U.S.*
Regularly conducts annual surveys of all types of Government facilities throughout the U.S; including office buildings, high-rise office buildings, warehouse facilities, and industrial facilities.

Michigan Central Station, Ford Motor Company | *Detroit, MI*
Life safety design/consulting, fire sprinkler design, fire alarm design, and a performance-based design for the renovation of the historic Michigan Central in Detroit's historic Corktown neighborhood.

DTW Vehicular Tunnels – Fire Protection and Life Safety Inspections | *Detroit, MI*
Fire protection and life safety inspections of the fire sprinkler, fire alarm, gas detection, and ventilations systems for the North and South Tunnels of Dingell Drive at Detroit Metropolitan Wayne County Airport.

Experience

22 Total Years, 4 Years with Bowman

Education

M.S., Fire Protection Engineering, Worcester Polytechnic Institute, 2014

B.S., Mechanical Engineering, Michigan Technological University, 1999

Registrations

Fire Professional Engineer: Idaho (14621), Michigan (52535), Minnesota (61120), Tennessee (116430), Wisconsin (101043)

Areas of Expertise

National Fire Protection Association Codes, Standards & Recommended Practices

Model Building and Fire Prevention Codes

Factory Mutual Guidelines

Facility Condition Assessments

Project Management

System Design

Hydraulic Calculations

Associations

National Fire Protection Association (NFPA), Member

Society of Fire Protection Engineers (SFPE), Professional Member

SFPE, Michigan Chapter, Past President

Design for Code Acceptance

1

Flame Spread Performance of Wood Products Used for Interior Finish

Wood and wood-based products are widely used as interior wall, ceiling, and floor surfaces in all types of buildings.

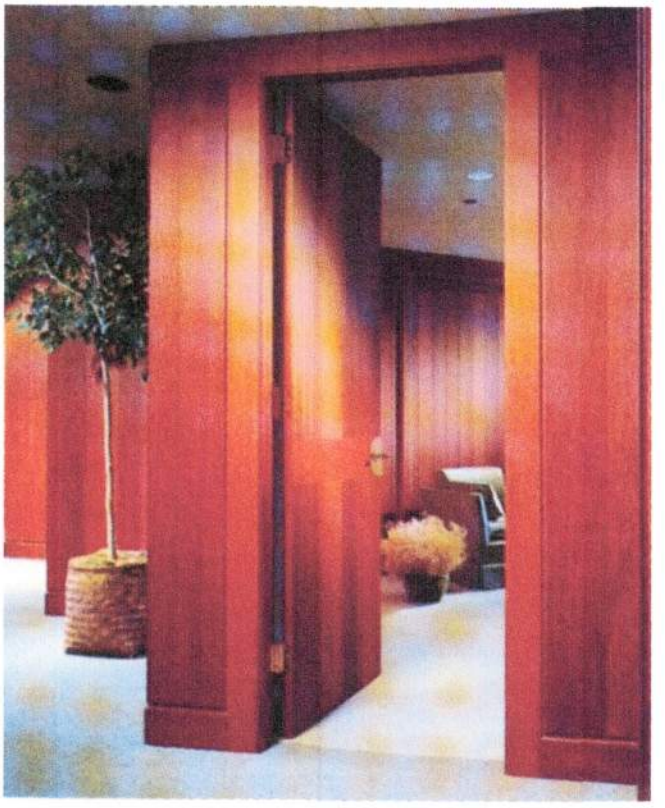
Appearance, acoustical qualities, and interior design versatility have made wood surfaces highly desired by architects, designers, and building occupants. This publication briefly describes building code flame spread regulations on products used in interior finish and presents performance data on a range of wood products.

Flame Spread Requirements

Most code requirements for wood interior finish materials are expressed in terms of flame spread index numbers. These values are determined in a standard fire test which evaluates the surface burning characteristics of a material. Different maximum flame spread indices are permitted depending upon building occupancy, location of the material in the building, and the presence of sprinklers. Flame spread indices in this publication are provided for wood materials that qualify for various building design requirements.

Test Method

The standard fire test used to evaluate flame spread characteristics of wood building materials in the United States is ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*.



The test procedure exposes candidate materials in a horizontal, rectangular tunnel that is 17-3/4" in width by 12" in height and 25' long. The tunnel is equipped with two gas burners at one end that direct a flame onto the surface of the test material under a controlled air flow. Flame spreads along the surface of the material as the test progresses. Distance of the flame travel and the rate at which the flame front advances during a 10-minute

exposure determine the calculated flame spread index (FSI).

To provide standard conditions for each test, the tunnel is calibrated such that the flame front reaches the end of the tunnel in approximately $5^1/_2$ minutes when tested on the wood calibrant (23/32" red oak flooring conditioned to an average moisture content of 7±0.5%), and to achieve an FSI of 0 when tested on $^1/_4$" fiber cement board. Flame spread indices for tested materials can range from 0 to over 1000.

At various times throughout the history of ASTM E84, changes have been made to the standard, affecting aspects such as test specimen conditioning and calculation procedures used to determine FSI values from raw data. Because of these changes, FSI values for particular products may change over time and it is not possible to directly calculate FSI values from some of the older ASTM E84 test data available; however, the classifications reported in these older test reports are deemed to be reasonable estimates.

Applicable Code Provisions

Section 803.1.2 of the 2018 *International Building Code* (IBC) defines classifications (Class A through Class C) for fire performance and smoke development. Each class corresponds to a specified range of FSI values, as shown in the following table:

Material Classification Based on FSI

Class	FSI Range
A	0-25
B	30-75
C	80-200

Table 803.13 of the IBC provides flame spread classification requirements for wall and ceiling finishes, based on occupancy, location, and presence of automatic sprinklers. Requirements for business and mercantile occupancy are as follows:

Flame Spread Class Requirement for Business and Mercantile Occupancy

Location	Non-Sprinklered	Sprinklered
Exit Stairway	A	B
Exit Corridor	B	C
Rooms	C	C

ASTM E84 makes mandatory reference to ASTM E2579 for wood specimen preparation and mounting, and ASTM E2404 for preparation and mounting of paper, polymeric, textile or wood veneer facings intended to be applied on-site over a wood substrate. As such, ASTM E2579 and ASTM E2404 are indirectly referenced by the IBC and would therefore be considered part of the code insofar as they do not conflict with the code. ASTM E2579 requires interior finish products with a factory-applied facing or veneer to be tested as manufactured. ASTM E2404 specifies a standard wood substrate to which facings or wood veneer specimens must be applied for testing if they are intended to be installed on-site over a wood substrate. Note that materials having a thickness less than 0.036 inch applied directly to the surface of walls or ceilings are exempted from testing under IBC Section 803.2.

Wood Products

Many interior finishes, including wood-based materials, are hygroscopic, and their moisture content can affect flame spread performance. Conditioning of test specimens can play an important role in determining the classification of a specimen. ASTM E84 requires test specimens to be equilibrated under specified conditions of temperature and relative humidity (73.4±5°F and 50 ±5% relative humidity), which are within commonly accepted comfort ranges for interior spaces. Under these specified conditions, sawn wood products equilibrate to a moisture content of approximately 8% to 10%, according to the US Forest Products Laboratory's *Wood Handbook—Wood as an Engineering Material.*

Lumber, plywood, and other wood-based materials typically fall into Class B or Class C when tested and evaluated in accordance with ASTM E84. If the wood product is homogeneous, flame spread may be considered nearly independent of material thickness at thicknesses greater than 1/2".

Flame spread indices for a number of species of lumber are listed in Table 1. Flame spread indices for plywood, oriented strand board (OSB), particleboard, and medium density fiberboard (MDF) are listed in Table 2. For products such as softwood and hardwood plywood, the arrangement and type of components may also influence surface flame spread. Some such products are described by face veneer species and core composition in Table 2. All ratings are based on the ASTM E84 test method.

As can be seen from the listed indices, *most tested wood products have a flame spread index less than 200,* making them acceptable under current building codes for a wide range of interior finish uses. Flame spread indices for a range of proprietary wood-based interior finish materials, such as factory-applied overlay-

finished products, are available from the manufacturer. Certification programs for these proprietary wood-based products typically consider the variability of the test method, material inputs, and production factors, to ensure ongoing compliance of certified product configurations. Ongoing certification of quality management systems and periodic testing are performed to identify potential changes in flame spread due to variations in production methods and materials. They account for the many possible configurations of face veneer species, veneer thickness, core types, suppliers, finishes, textures, and groove profiles from a manufacturer, all without testing every possible configuration. Compliance may be demonstrated through accredited third-party product labeling, listing programs, certification, or individual test reports.

Commercially available fire retardant treatments for wood and panel products can improve flame spread performance to Class A. Such products typically carry a label indicating their rating classification. Wood products utilizing a surface coating to achieve a Class A rating must be evaluated as a system.

A smoke-developed index was also measured for some of the wood products listed in Table 1 and Table 2. This index has a value of approximately 100 for the wood calibrant. None of the products tested and presented in this document have a smoke-developed index exceeding the code-specified limit of 450.

Table 1 Reported Flame Spread Indices of Solid Wood Products

Material[1]	ASTM E84 Flame Spread Index	Flame Spread Class	ASTM E84 Smoke Developed Index	Source[2]
Alder	80	C	165	HPVA T-14189 (2013)
Aspen	105	C	45	Exova 15-002-475(C1) (2015)
Birch, Yellow	NA[4]	C[4]	NA	UL527 (1971)
Cedar, Alaska	40	B	140	HPVA T-15591 (2017)
Cedar, Alaska Yellow	50	B	115	HPVA T-12704 (2008)
Cedar, Eastern White	40	B	200	HPVA T-15318 (2017)
Cedar, Incense	45	B	150	HPVA T-15204 (2016)
Cedar, Port Orford	60	B	150	HPVA T-12694 (2008)
Cedar, Western Red	45	B	125	HPVA T-15172 (2016)
Cottonwood	NA[4]	C[4]	NA	UL527 (1971)
Cypress	75	B	200	HPVA T-14530 (2014)
Douglas-fir	70	B	80	HPVA T-14253 (2013)
Fir, Balsam	45	B	105	HPVA T-15557 (2017)
Fir, White	40	B	80	HPVA T-15088 (2016)
Gum, Red	NA[4]	C[4]	NA	UL527 (1971)
Hem-Fir Species Group[3]	60	B	70	HPVA T-10602 (2001)
Hemlock, Eastern	35	B	175	HPVA T-15320 (2017)
Hemlock, Western	40	B	60	Exova 15-002-475(A1) (2015)
Maple (flooring)	NA[4]	C[4]	155	CWC FP-6 (1973)
Maple (rough sawn)	35	B	250	HPVA T-14573 (2014)
Oak, Red or White	NA[4]	C[4]	NA	UL527 (1971)
Pine, Eastern White	70	B	110	HPVA T-14186 (2013)
Pine, Idaho White	NA[4]	B[4]	125	HPVA T-592 (1974)
Pine, Jack	50	B	165	HPVA T-15556 (2017)
Pine, Lodgepole	75	B	140	HPVA T-15029 and T-15069 (2015)
Pine, Ponderosa	55	B	135	HPVA T-15067 (2016)
Pine, Red	115	C	65	Exova 15-002-475(B1) (2015)
Pine, Southern Yellow	70	B	165	HPVA T-14254 (2013)
Pine, Sugar	45	B	110	HPVA T-15068 (2016)
Pine, Western White	NA[4]	B[4]	NA	UL527 (1971)
Poplar, Yellow	125	C	125	HPVA T-14512 (2014)
Redwood	55	B	135	HPVA T-14185 and T-14243 (2013)
Spruce, Black	45	B	250	HPVA T-14053 (2013)
Spruce, Black (4" thick, 3 layers of cross laminations)	35	B	55	HPVA T-14054 (2013)
Spruce, Eastern Red	65	B	170	HPVA T-15034 (2015)
Spruce, Western White	45	B	120	HPVA T-15032 (2015)
Tamarack	35	B	90	HPVA T-15393 (2017)
Walnut	75	B	125	HPVA T-14526 (2014)

Table 1 Footnotes

[1] Thickness of material tested is one-inch nominal except where indicated.

[2] Sources: CWC – Canadian Wood Council; Exova – Exova Warringtonfire North America; HPVA – Hardwood Plywood Veneer Association; UL – Underwriters' Laboratories. Test report numbers and year of test are indicated. Where multiple reports are cited, tabulated FSI and SDI values represent the average of values from the respective test reports.

[3] The Hem-Fir Species Group represents six species: Californian Red Fir, Grand Fir, Noble Fir, Pacific Silver Fir, Western Hemlock, and White Fir. The reported flame spread index represents a product containing a mixture of these species. When lumber is from a single species refer to the specific species flame spread index.

[4] Flame spread index cannot be directly determined from the referenced source; however, the reported Flame Spread Class is deemed to be a reasonable estimate based on changes to the analysis method of test results as reported within the referenced source.

Table 2 Reported Flame Spread Indices of Wood Panels

Material	ASTM E84 Flame Spread Index	Flame Spread Class	ASTM E84 Smoke Developed Index	Source[1]
ORIENTED STRAND BOARD (Exterior Glue) [2]				
5/16"	127-138	C	155-171	APA (1985)
3/8"	100	C	95	HPVA T-15116 (2016)
7/16"	115-155	C	75-130	APA 8901-8 (1989)
15/32"	100	C	80	HPVA T-15117 (2016)
1/2"	75-172	C	109-194	APA (1985)
19/32"	175	C	95	HPVA T-14312 (2013)
23/32"	100	C	60	HPVA T-15118 (2016)
3/4"	147-158	C	111	APA (1985)
1-1/8"	110	C	115	HPVA T-15298 (2016)
SOFTWOOD PLYWOOD (Exterior Glue) [3]				
1/4"	NA[5]	C[5]	55-200	UL R6829 (1973)
3/8"	NA[5]	C[5]	22-144	UL R6829 (1973)
1/2"	NA[5]	C[5]	55	UL R6829 (1973)
19/32"	95	C	50	HPVA T-14311 (2013)
5/8"	NA[5]	C[5]	50-85	UL R6829 (1973)
1/4" Douglas-fir Plywood	85	C	70	HPVA T-15293 (2016)
3/8" Douglas-fir Plywood	65	B	60	HPVA T-15295 (2016)
15/32" Douglas-fir Plywood	40	B	50	HPVA T-15114 (2016)
23/32" Douglas-fir Plywood	35	B	55	HPVA T-15294 (2016)
11/32" Southern Pine Plywood	75	B	115	HPVA T-15113 (2016)
15/32" Southern Pine Plywood	95	C	135	HPVA T-15297 (2016)
23/32" Southern Pine Plywood	65	B	175	HPVA T-15296 (2016)
HARDWOOD PLYWOOD [4]				
Ash 3/4" – Particleboard Core	135	C	80	HPVA T-9344 (1995)
Birch 1/4" – MDF Core	120	C	200	HPVA T-14750 (2015)
Birch 1/4" – Douglas Fir Veneer Core	115	C	40	HPVA T-14911 (2015)
Birch 1/4" – Fuma Veneer Core	125	C	15	HPVA T-9665 (1996)
Birch 1/4" – High Density Veneer Core	165	C	65	HPVA T-9234 (1995)
Birch 1/4" – Poplar Veneer Core	110	C	15	HPVA T-14697 (2015)
Birch 3/4" – Combination Core	90	C	120	HPVA T-14691 (2015)
Birch 3/4" – High Density Veneer Core	115	C	50	HPVA T-9317 (1995)
Birch 3/4" – Particleboard Core	125	C	100	HPVA T-9431 (1995)
Birch 3/4" – MDF Core	120	C	110	HPVA T-14917 (2015)
Birch 3/4" – Aspen Veneer Core	135	C	70	HPVA T-14700 (2015)
Birch 3/4" – Baltic Birch Veneer Core	120	C	70	HPVA T-14694 (2015)
Birch 3/4" – Douglas Fir Veneer Core	70	B	55	HPVA T-14704 (2015)
Birch 3/4" – Poplar Veneer Core	95	C	140	HPVA T-14689 (2015)
Birch 3/4" – Russian Birch Veneer Core	110	C	70	HPVA T-14764 (2015)
Mahogany 3/4" – High Density Veneer Core	105	C	90	HPVA T-9354 (1995)
Maple 1/4" – Douglas Fir Veneer Core	130	C	45	HPVA T-14910 (2015)
Maple 1/4" – Poplar Veneer Core	170	C	55	HPVA T-14695 (2015)
Maple 3/4" – Combination Core	100	C	85	HPVA T-14706 (2015)
Maple 3/4" – MDF Core	130	C	70	HPVA T-14763 (2015)
Maple 3/4" – Particleboard Core	85	C	75	HPVA T-14912 (2015)
Maple 3/4" – Aspen Veneer Core	180	C	75	HPVA T-14699 (2015)
Maple 3/4" – Baltic Birch Veneer Core	125	C	70	HPVA T-14693 (2015)

Table 2 Reported Flame Spread Indices of Wood Panels (continued)

Maple 3/4" – Douglas Fir Veneer Core	95	C	50	HPVA T-14703 (2015)
Maple 3/4" – Poplar Veneer Core	150	C	60	HPVA T-14702 (2015)
Maple 3/4" – Russian Birch Veneer Core	120	C	50	HPVA T-14752 (2015)
Oak 1/4" – High Density Veneer Core	155	C	65	HPVA T-9237 (1995)
Oak 1/4" – Fuma Veneer Core	60	B	50	HPVA T-14698 (2015)
Oak 1/4" – Poplar Veneer Core	140	C	60	HPVA T-14696 (2015)
Oak 3/4" – Medium Density Fiberboard Core	100	C	85	HPVA T-14916 (2015)
Oak 3/4" – Combination Core	90	C	155	HPVA T-14690 (2015)
Oak 3/4" – Particleboard Core	80	C	80	HPVA T-14914 (2015)
Oak 3/4" – Aspen Veneer Core	160	C	75	HPVA T-14701 (2015)
Oak 3/4" – Baltic Birch Veneer Core	105	C	80	HPVA T-14692 (2015)
Oak 3/4" – Douglas Fir Veneer Core	60	B	65	HPVA T-14762 (2015)
Oak 3/4" – Russian Birch Veneer Core	95	C	110	HPVA T-14751 (2015)
Walnut 3/4"	NA[5]	C[5]	NA	HUD (1973)
PARTICLEBOARD				
1/3" (No Added Formaldehyde)	130	C	135	HPVA T-14387 (2014)
3/8"	150	C	65	HPVA T-14350 (2014)
1/2"	125	C	125	HPVA T-14376 (2014)
3/4"	95	C	130	HPVA T-14296 (2014)
3/4"	135	C	80	HPVA T-14351 (2014)
3/4" Birch Particle Board	80	C	95	HPVA T-14913 (2016)
3/4" (Floor Underlayment)	110	C	80	HPVA T-14315 (2013)
1" (No Added Formaldehyde)	105	C	145	HPVA T-14386 (2014)
MEDIUM DENSITY FIBERBOARD (MDF)				
7/32"	125	C	200	HPVA T-14370 (2014)
5/8"	120	C	250	HPVA T-9567 (1996)
3/4"	120	C	170	HPVA T-14372 (2014)
6mm (No Added Formaldehyde)	135	C	200	HPVA T-14369 (2014)
1/4"	135	C	300	HPVA T-14371 (2014)
HARDBOARD				
0.118" Tempered Hardboard	155	C	150	HPVA T-14313 (2013)
0.386" Engineered Wood Siding	95	C	50	HPVA T-14297 (2013)

Table 2 Footnotes

[1] Sources: APA – American Plywood Association; DOC – US Department of Commerce; HPVA – Hardwood Plywood Veneer Association; HUD – US Department of Housing and Urban Development Manual of Acceptable Practices to the HUD Minimum Property Standards; UL – Underwriters' Laboratories. Test report numbers and year of test are indicated.

[2] Values reported for oriented strand board (OSB) are derived from multiple tests performed on panels comprised of a variety of strand species, including aspen, Douglas-fir southern pine, and mixed softwood species.

[3] Flame spread classes and Smoke-Developed Indices reported for softwood plywood are derived from multiple tests performed on panels comprised of a variety of veneer species, including Douglas-fir, hemlock, southern pine and cedar.

[4] Flame spread classes and Smoke-Developed Indices reported for hardwood plywood are derived from multiple tests performed on panels comprised of a variety of face veneer species, core species and adhesive systems.

[5] Flame spread index cannot be directly determined from the referenced source; however, the reported Flame Spread Class is deemed to be a reasonable estimate based on changes to the analysis method of test results as reported within the referenced source.

For additional information or assistance contact:
American Wood Council
222 Catoctin Circle, SE, Suite 201
Leesburg, VA 20175
http://www.awc.org/
202-463-2766

HPVA LABORATORIES
42777 Trade West Drive, Sterling, VA 20166 703-435-2900

Report On

Surface Burning Characteristics of Building Materials

As Determined By

ASTM E84 Test Method

Prepared For:

Performance Finishing Solutions

Ontario, Canada

ELNYC300XX, Envirothane 300 Crystal Clear Topcoat

Test Number: T-16197

Date of Issue:
10/11/2019

ACCREDITED
Testing Laboratory
TL - 224

I. SCOPE

This report contains the reference to the test method, purpose, test procedure, rounding procedures, preparation and conditioning of specimens, description of materials, test and post test observation data, and test results.

II. TEST METHOD

The test was conducted in accordance with ASTM E 84-19b, "Standard Test Method for Surface Burning Characteristics of Building Materials." The 25-foot tunnel method is also described by NFPA 255 and UL 723.

III. PURPOSE

The purpose of the test is to determine the relative performance of the test material under standardized fire exposure. Results are given for Flame Spread and Smoke Developed Index. The values obtained from burning the test material represent a comparison with that of 1/4" inorganic reinforced cement board and select grade red oak flooring.

The flame spread results of 25-foot tunnel tests are frequently used by building code officials and regulatory agencies in the acceptance of interior finish material for various applications. The most widely accepted classification system is epitomized by the International Code Council (ICC) and National Fire Protection Association (NFPA) Life Safety Code, NFPA 101:

Class A*	0 - 25	flame spread	0-450 smoke developed
Class B*	26 - 75	flame spread	0-450 smoke developed
Class C*	76 - 200	flame spread	0-450 smoke developed

*Class A, B and C correspond to I, II and III, respectively, in other historical codes such as UBC and BOCA.

This flame spread classification system is based on the premise that the higher the flame spread numbers, the greater the fire spread potential. The actual relationship between the numbers developed under this test and life safety from fire has not been adequately established.

IV. TEST PROCEDURE NOTES

The furnace was preheated to a minimum of 150°F as measured by an 18 AWG thermocouple embedded in cement 1/8" below the floor surface of the chamber, 23-1/4' from the centerline of the ignition burners. The furnace was then cooled to 105°F (± 5°F) as measured by a thermocouple embedded 1/8" below the floor surface of the test chamber 13' from the fire end.

Prior 10-minute tests with 1/4" inorganic reinforced cement board provided the zero reference for flame spread. Periodic 10-minute tests with unfinished select grade red oak flooring are used to calibrate the tunnel for flame spread. HPLC grade heptane is used to calibrate the tunnel's smoke system.

A. FLAME SPREAD

The flame spread distance is observed and recorded at least every 15 seconds or every 2 feet of progression. The peak distance is noted at the time of occurrence. The flame spread distance is plotted over time. The total area under the flame spread distance-time curve is determined; flame front recessions are ignored. The flame spread is then calculated as a function of the area under the curve relative to the standard red oak curve area. The value for flame spread classification for the tested material may be compared with that of inorganic reinforced cement board and select grade red oak flooring.

B. SMOKE DEVELOPED

The smoke developed during the test is determined by the reduction in output of a photoelectric cell. A light beam vertically orientated across the furnace outlet duct is attenuated by the smoke passing through the duct. The output of the photoelectric cell is related to the obscuration of the light source through the duct caused by the smoke. A curve is developed by plotting photoelectric cell output against time. The value of smoke developed is derived by calculating the net area under the curve for the test material and comparing this area with the net area under the curve for HPLC grade liquid heptane.

V. FLAME SPREAD RATING AND SMOKE DEVELOPED CLASSIFICATION

Single test calculated flame spread and smoke developed values are averaged and rounded to the nearest multiple of 5 and reported as the Flame Spread Index and Smoke Developed Index.

VI. PREPARATION AND CONDITIONING OF TEST SAMPLES

Three or four sections are generally used in the preparation of a complete test specimen which is 20" - 24" wide and 24' long. Materials 8' in length may be tested by using three sections 20" - 24" wide by 8' long for a total specimen length of 24'. A 14" length of uncoated 16 gauge steel sheet is used to make up the remainder of the test specimen; it is placed at the fire end of the test chamber. Prior to testing, three 8' long sections of 1/4" inorganic reinforced cement board are placed on the back side of the specimens to protect the furnace lid assembly. Test specimens are conditioned at a controlled temperature of 73.4 ± 5°F and a controlled relative humidity of 50 ± 5 percent.

VII. LABORATORY ACCREDITATION

HPVA Laboratories is an internationally accredited testing laboratory according to ISO/IEC 17025 and recognized by state and local building code jurisdictions. International Accreditation Service (IAS) Accredited Testing Laboratory Number: TL-224.

ACCREDITED
Testing Laboratory

HPVA LABORATORIES
42777 Trade West Drive, Sterling, VA 20166 703-435-2900

Test Number:	T-16197	Test Date:	10/08/2019

Report Prepared For:	**Performance Finishing Solutions** Ontario, Canada
Material Tested:	ELNYC300XX, Envirothane 300 Crystal Clear Topcoat

Sample Information:

Detailed Product Description: Three coats of material were sprayed onto a 1/4" cement board to a thickness of 4-5 mils.

Mounting Method: The material was applied to 1/4" cement board by the manufacturer.

Sample Selection:	Manufacturer	**Conditioning Days:**	6
Surface Exposed:	Face Side	**Sample Color:**	Clear Coating
Average Thickness (in.):	0.265	**Total Weight (lbs.):**	84.60

Test Results

Ignition Time (seconds):	DNI*	**Flame Spread Index:**	0
Max. Temperature (F):	537	**Smoke Developed Index:**	5
Max. Flame Spread Distance (ft):	0	**Class Rating:**	A

Observations:	Discoloration to 24'.
Remarks:	The sample consisted of eight 24" x 36" panels butted end-to-end. DNI* - The material did not ignite during the test. Reported weights and thicknesses include the 1/4" cement board backer.

Test Operator: CK **Reader:** CP

Report Prepared By:

Laboratory Technician II - Fire Testing

Report Reviewed By:

Chris Palumbo
2019.10.10
15:54:20 -04'00'

Sr. Manager of Product Testing

HPVA LABORATORIES
42777 Trade West Drive, Sterling, VA 20166 703-435-2900

Test Method	Project #	Date				
ASTM E84	T16197	08 Oct 2019	Time (Test Start)	9:49 AM	Test No.	1

Specimen ID

ELNYC300XX, Envirothane 300 Crystal Clear Topcoat

Specimen Description

ELNYC300XX, Envirothane 300 Crystal Clear Topcoat

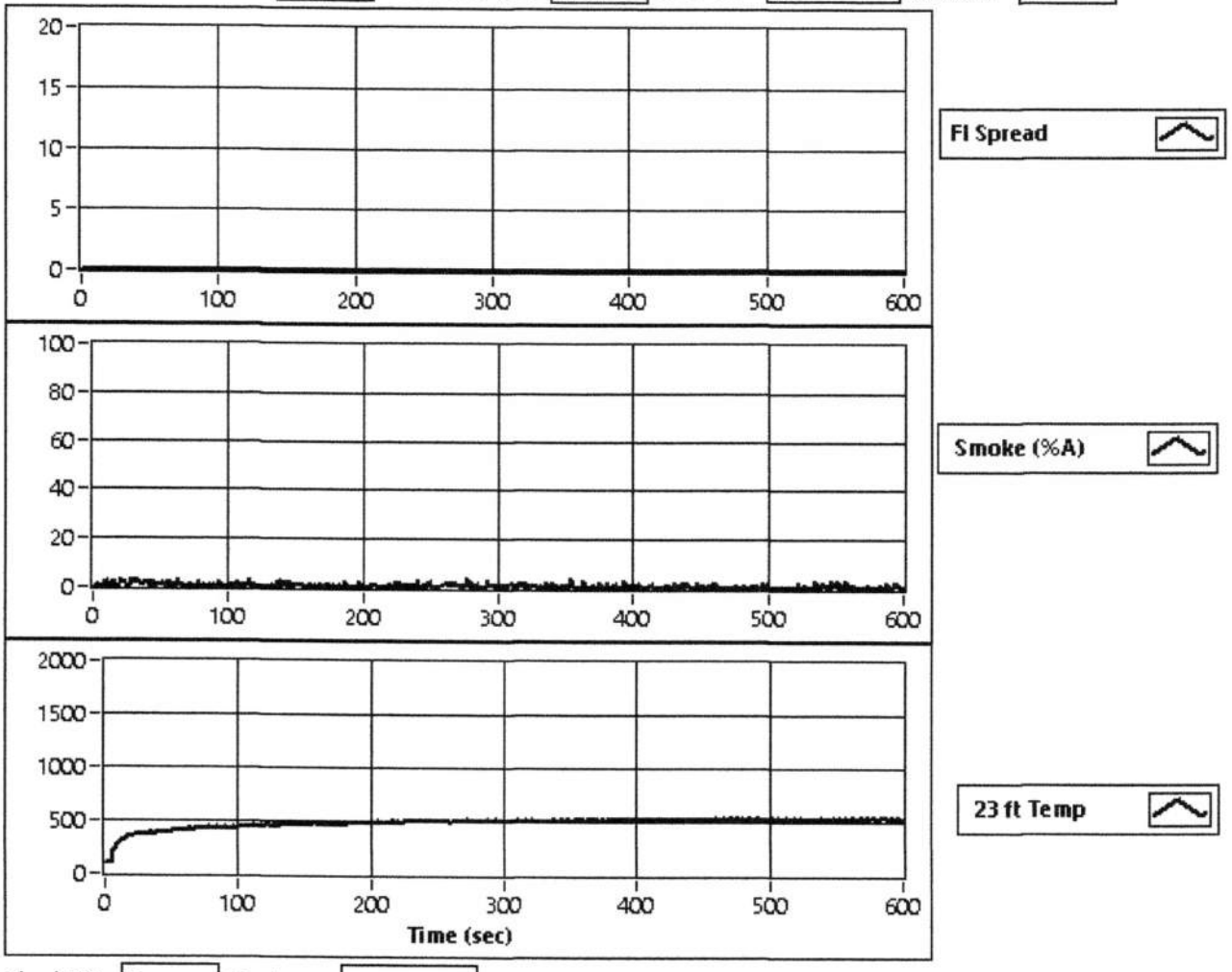
Mounting Procedure

Applied to 1/4" cement board

Fuel (CF)	Time to 980F (min)	Max Temp (F)	Time to Max Temp (min)
39.3	0	536.5	9.547

FS Area	Maximum FS	MAX FS Time (min)
0	0	0

Smoke Area (%A min)	HC Smk Area	Raw SD	Raw FSI
2.914	88.1	3.3	0



Final FSI	Final SD
0	5

Foam Factory INC.
17500 23 Mile Rd., Macomb, MI 48044
Phone (586) 627-3626 • Fax (586) 627-5830

IMPORTANT:

ASTM E84 ratings are often sufficient for meeting fire safety standards. However, due to differences between local regulations, it is imperative that you always verify acceptable use of materials with local code enforcement authorities (e.g: Fire Department) in your area before purchasing any products. Foam Factory, Inc. is not responsible for the purchase of any materials found to be incompatible with local codes and regulations.

•••

Our third-party test results can be found further down this document.

COMMERCIAL TESTING COMPANY
1215 South Hamilton Street • Post Office Box 985 • Dalton, GA 30722
Telephone (706) 278–3935 • Facsimile (706) 278–3936

Standard Method of Test for
Surface Burning Characteristics of Building Materials

ASTM E 84–09a

Acoustic Foam – 2" Wedge

Report Number 10–03102

Test Number 4133–9361
March 8, 2010

Foam Factory, Inc.
Clinton Township, Michigan

Commercial Testing Company

Dewane Jackson

(Authorized Signature)

INTRODUCTION

This report is a presentation of results of a surface flammability test on a material submitted by Foam Factory, Inc., Clinton Township, Michigan.

The test was conducted in accordance with the ASTM International fire test response standard E 84–09a, *Surface Burning Characteristics of Building Materials*, sometimes referred to as the Steiner tunnel test. This test is applicable to exposed surfaces such as walls and ceilings. The test is conducted with the specimen in the ceiling position with the surface to be evaluated exposed face down to the ignition source. The ASTM E 84 test method is the technical equivalent of NFPA No. 255 and UL No. 723.

This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire–hazard or fire–risk assessment of materials, products, or assemblies under actual fire conditions.

PURPOSE

The purpose of the test is to provide only the comparative measurements of surface flame spread and smoke development of materials with that of select grade red oak and fiber–reinforced cement board, Grade II, under specific fire exposure conditions. The test exposes a nominal 24-foot long by 20-inch wide test specimen to a controlled air flow and flaming fire adjusted to spread the flame along the entire length of a red oak specimen in 5.50 minutes. During the 10-minute test duration, flamespread over the specimen surface and density of the resulting smoke are measured and recorded. Test results are calculated relative to red oak, which has an arbitrary rating of 100, and fiber–reinforced cement board, Grade II, which has a rating of 0.

The test results are expressed as Flame Spread Index and Smoke Developed Index. The Flame Spread Index is defined in ASTM E 176 as "a number or classification indicating a comparative measure derived from observations made during the progress of the boundary of a zone of flame under defined test conditions." The Smoke Developed Index, a term specific to ASTM E 84, is defined as "a number or classification indicating a comparative measure derived from smoke obscuration data collected during the test for surface burning characteristics." There is not necessarily a relationship between the two measurements.

The method does not provide for measurement of heat transmission through the surface tested, the effect of aggravated flame spread behavior of an assembly resulting from the proximity of combustible walls and ceilings, or classifying a material as noncombustible solely by means of a Flame Spread Index.

The zero reference and other parameters critical to furnace operation are verified on the day of the test by conducting a 10–minute test using 1/4–inch fiber–reinforced cement board, Grade II. Periodic tests using NOFMA certified 23/32–inch select grade red oak flooring provide data for the 100 reference.

TEST SAMPLE

The test sample, selected by the client, was identified as **Acoustic Foam – 2" Wedge**, color Grey. The material was conditioned to equilibrium in an atmosphere with the temperature maintained at 71 ± 2°F and the relative humidity at 50 ± 5 percent. For testing, six pieces of the material, each measuring 2 feet wide by 4 feet in length, were free laid over a 2–inch hexagonal wire mesh supported by 1/4–inch diameter steel rods spanning the ledges of the tunnel furnace at 24–inch intervals. This method of auxiliary sample support is described in Appendix X1 of the E 84 standard, Guide to Mounting Methods, Sections X1.1.2.2(a) and X1.1.2.3.

TEST RESULTS

The test results, calculated on the basis of observed flame propagation and the integrated area under the recorded smoke density curve, are presented below. The Flame Spread Index obtained in E 84 is rounded to the nearest number divisible by five. Smoke Developed Indices are rounded to the nearest number divisible by five unless the Index is greater than 200. In that case, the Smoke Developed Index is rounded to the nearest 50 points. The flame spread and smoke development data are presented graphically at the end of this report.

Test Specimen	Flame Spread Index	Smoke Developed Index
Fiber–Reinforced Cement Board, Grade II	0	0
Red Oak Flooring	100	100
Acoustic Foam – 2" Wedge	**25**	**250**

OBSERVATIONS

Specimen ignition over the burners occurred at 0.05 minute. Surface flame spread was observed to a maximum distance of 4.74 feet beyond the zero point at 0.40 minute. The maximum temperature recorded during the test was 521°F.

CLASSIFICATION

The Flame Spread Index and Smoke Developed Index values obtained by ASTM E 84 tests are frequently used by code officials and regulatory agencies in the acceptance of interior finish materials for various applications. The most widely accepted classification system is described in the National Fire Protection Association publication NFPA 101 *Life Safety Code*, where:

Class A	0	– 25 Flame Spread Index	0 – 450 Smoke Developed Index
Class B	26	– 75 Flame Spread Index	0 – 450 Smoke Developed Index
Class C	76	– 200 Flame Spread Index	0 – 450 Smoke Developed Index

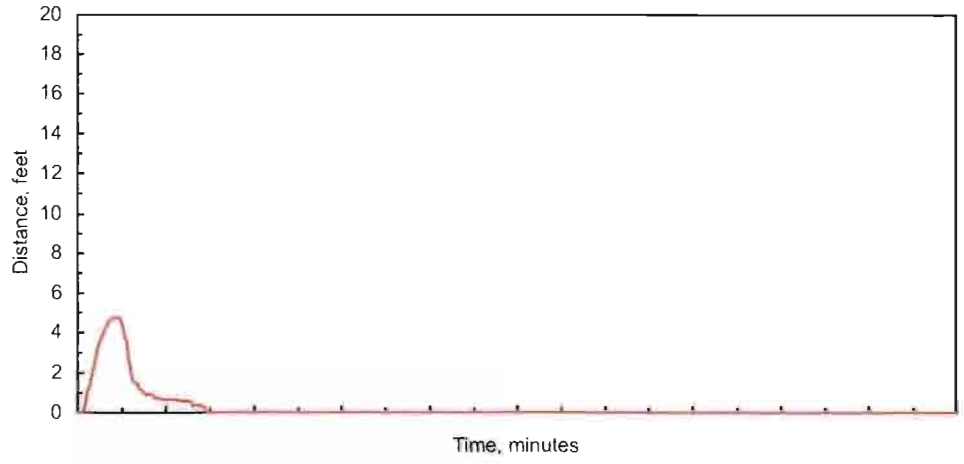
Class A, B, and C correspond to Type I, II, and III respectively in other codes. They do not preclude a material being otherwise classified by the authority of jurisdiction.

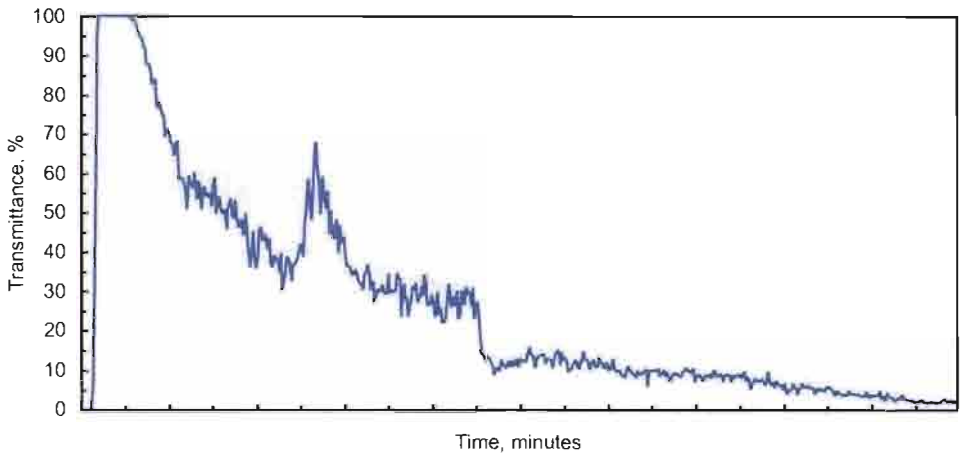
ASTM E 84 TEST DATA

Client: Foam Factory, Inc.
Test Number: 4133-9361
Material Tested: Acoustic Foam - 2" Wedge
Date: March 8, 2010

Test Results:

Time to Ignition	=	00.05 minutes
Maximum Flamespread Distance	=	04.74 feet
Time to Maximum Spread	=	00.40 minutes
Flame Spread Index	=	25
Smoke Developed Index	=	250





ENNIS FABRICS

COATED PVC
18 OZ.

1 RED

Apollo 81”, Mercury (50 yd), Mercury (100 yd), Sampson FR

2009 FOREST GREEN

Apollo 81”
Mercury (50 yd)

205 MEDIUM GREEN

Mercury (50 yd)
Mercury (100 yd)
Sampson FR

3 BLUE

Apollo 81”
Mercury (50 yd)
Mercury (100 yd)
Sampson FR

308 NAVY

Mercury (50 yd)

44 ORANGE

Mercury (50 yd)
Sampson FR

111 BURGUNDY

Mercury (50 yd)
Sampson FR

55 YELLOW

Apollo 81”
Mercury (50 yd)
Mercury (100 yd)
Sampson FR

6 WHITE

Apollo 81”
Mercury (50 yd)
Mercury (100 yd)
Sampson FR - 66 White

68 BEIGE

Apollo 81”
Mercury (50 yd)
Sampson FR

8006 BROWN

Mercury (50 yd)

9 GREY

Apollo 81”
Mercury (50 yd)
Mercury (100 yd)
Sampson FR - 99

7 BLACK

Apollo 81”
Mercury (50 yd)
Mercury (100 yd)
Sampson FR

Apollo: 81” (206 cm), Mercury 61” (155cm), Sampson: 61” (155 cm)

COATED PVC
18 OZ.

Three excellent 100% PVC products that have a cold crack of -40ºC. These coated PVC's be use in many outdoor and indoor applications such as truck covers, bags and gym mats.

SPECIFICATIONS*/ SPÉCIFICATIONS*

PATTERN NAME / NOM DE DESSIN	APOLLO	MERCURY†	SAMPSON
ADHESION / ADHÉSION	ASTM D751: 25 lbs./1 in.	ASTM D751: 25 lbs./1 in.	ASTM D751: 25 lbs/1 in.
CONTENT / COMPOSITION	100% Polyvinyl Chloride *(Chlorure de polyvinyle)*	100% Polyvinyl Chloride *(Chlorure de polyvinyle)*	100% Polyvinyl Chloride *(Chlorure de polyvinyle)*
COLORS / COULEURS	8 available *(disponible)*	50 yd *(vg)*: 14 available *(disponible)* 100 yd *(vg)*: 7 available *(disponible)*	11 available *(disponible)*
FIRE RETARDANCY‡ / RÉSISTANT AUX FEU‡	EN 176-10: 2008—PLAYGROUND *(cour de récréation)* EN 1021-1: 2006 CIGARETTE TEST *(essai à la cigarette)* EN 10210-2: 2006 MATCH TEST *(essai du match)*	EN 176-10: 2008—PLAYGROUND *(cour de récréation)* EN 1021-1: 2006 CIGARETTE TEST *(essai à la cigarette)* EN 10210-2: 2006 MATCH TEST *(essai du match)*	CPAI-84, NFPA 701, MVSS302, CAN/ULC-S109-14 EN 1021-1: 2006 CIGARETTE TEST *(essai à la cigarette)* EN 10210-2: 2006 MATCH TEST *(essai du match)*
MILDEW RESISTANT / RÉSISTANT À LA MOISISSURE	Yes *(Oui)*	Yes *(Oui)*	Yes *(Oui)*
SCRIM	Woven Polyester *(Polyester tissé)*	Woven Polyester *(Polyester tissé)*	Woven Polyester *(Polyester tissé)*
TEAR STRENGTH / RÉSISTANCE À LA DÉCHIRURE	ASTM D5733: Warp *(Chaîne)* = 140 lbs, Weft *(Trame)* = 120 lbs.	ASTM D5733: Warp *(Chaîne)* = 140 lbs, Weft *(Trame)* = 120 lbs.	ASTM D5733: Warp *(Chaîne)* = 140 lbs, Weft *(Trame)* = 120 lbs.
TENSILE STRENGTH / RÉSISTANCE À LA TRACTION	ASTM D751: Warp *(Chaîne)* = 675 lbs./inch, Weft *(Trame)* = 635 lbs./in.	ASTM D751: Warp *(Chaîne)* = 675 lbs./inch, Weft *(Trame)* =630 lbs./in.	ASTM D751: Warp *(Chaîne)* = 675 lbs./inch, Weft *(Trame)* = 635 lbs./in.
THICKNESS / ÉPAISSEUR	0.55 mm	0.55 mm	0.55 mm
THREAD COUNT / NOMBRE DE FIL	17 x 18 threads/in² (17 x 18 fils/cm²)	17 x 18 threads/in² (17 x 18 fils/cm²)	17 x 18 threads/in² (17 x 18 fils/cm²)
UV / LIGHTFASTNESS / RÉSISTANCE AUX RAYONS UV	AATCC 16 - Grade 5, 1000 hours *(heures)*		
YARN SIZE / FIL TAILLE	1000D x 1300D denier	1000D x 1300D denier	1000D x 1300D denier
WEIGHT / POIDS	18.00 oz/sq. yd *(par verge carrée)* 40.5 oz/yd *(par mètre linéaire)*	18.00 oz/sq. yd *(par verge carrée)* 30.42 oz/yd *(par mètre linéaire)*	18.50 oz/sq. yd *(par verge carrée);* 31.35 oz/yd *(par mètre linéaire)*
WIDTH / LARGEUR	81 in. (207 cm)	61 in. (156 cm)	61 in. (156 cm)
ROLL SIZE / TAILLE DU ROULEAU	50 yd *(vg)* (46 m)	50 yd *(vg)* (46 m) 100 yd *(vg)* (91 m)	50 yd *(vg)* (46 m)
CLEANING INSTRUCTIONS / INSTRUCTIONS DE NETTOYAGE	W - Clean fabrics with water-based cleaning agents or water based foam *(Nettoyer le tissu à l'aide de nettoyants ou de mousse à base d'eau.)*		

* This information is offered for your general guidance only. It's accurate to the best of our knowledge and is not intended to relieve the user from their responsibility to investigate and understand other pertinent sources of information and to comply with all laws and procedures applicable to the safe handling and use of this material. Final determination of the suitability of any product for an application rests with the user.
† The following Mercury colors are available in 100 yd rolls: 1 Red, 205 Medium Green, 3 Blue, 55 Yellow, 6 White, 9 Grey and 7 Black.
‡ This term and any corresponding data refer to typical performance in the specific tests indicated and should not be construed to imply the behavior of this or any other material under actual fire conditions.

* *Ces renseignements sont offerts à titre consultatif seulement. Ils sont précis, aux mieux de nos connaissances, et ne sont pas destinés à dégager l'utilisateur de sa responsabilité d'étudier et de comprendre les autres sources pertinentes de renseignements, ni de se conformer à toutes les lois et procédures relatives à la manipulation et à l'utilisation sécuritaire de ce matériau. La décision finale du type d'application du produit appartient à l'utilisateur.*
† *Les couleurs Mercure suivants sont disponibles en rouleaux de 100 vg: 1 rouge, 205 Vert moyen, 3 bleu, 55 jaune, blanc 6, 9 Gris et 7 Noir.*
‡ *Les résultats rapportés d'après la norme ci-dessus ne définissent pas nécessairement les risques que représente ce matériau dans des conditions réelles d'incendie.*

PVC18BCBC
0123

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beaulieu
needle felt

Primavera Resine

COMMERCIAL

ISO CERTIFIED
9001, 14001, 45001

A division of
Beaulieu International Group
BFS Europe NV
Groenedreef 15A, 9770 Kruisem
www.beaulieu-needlefelt.com

DS | C_{fl}-s1 | 22

CE
EN 14041
EN 1307

Manufacturing process Herstellungs verfahren Procédé de fabrication Proceso de fabricación	**ISO 2424**	**Needle felt**
Pile composition Polmaterial Composition des fibres Composición de la fibra	**-**	**100% synthetic**
Surface structure Oberflachenstruktur Aspect de surface Estructura de la superficie	**-**	**Dilour**
Backing Rücken Dossier Soporte	**ISO 2424**	**Resine**
Pile weight Polgewicht Poids des fibres Peso de la fibra	**ISO 8543**	**900 g/m²**
Total weight Gesamtgewicht Poids total Peso total	**ISO 8543**	**1040 g/m²**
Pile height Polhöhe Hauteur du velours Altura de la fibra	**ISO 1765**	**4 mm**
Total height Gesamthöhe Hauteur totale Altura total	**ISO 1765**	**8 mm**
Roll length Länge Longueur Longitud del rollo	**-**	**30 m**
Fire classification Brandklassifizierung Classement feu Clasificación de fuego	**EN13501-1**	**Dfl-s1**

ÉMISSIONS DANS L'AIR INTÉRIEUR
A+
A+ A B C

DNF.RO.MAR.15a/3/01-04-2024
Update: 04-2025

Primavera Resine

Code	1 m	2 m	3 m	4 m
1153				○
2226				○
2236				○
2283				○
2531				○
3353				○
3399				○
4412				○
5507				○

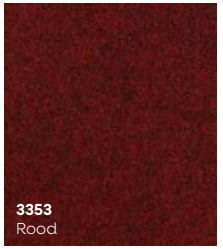
Code	1 m	2 m	3 m	4 m
5516				○
5521				○
5539				○
5546				○
5586				○
6619				○
6627				○
6651				○
7745				○

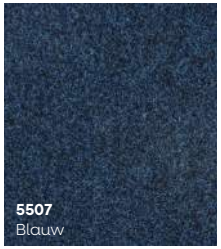
Colours may slightly vary from batch to batch. Characteristics in line with EN 1307 standards. We reserve the right to alter technical specifications.Protection foil is not suitable in humid conditions.

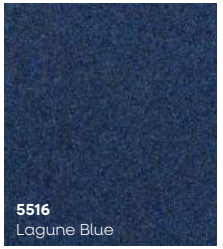
Die Farben können von Charge zu Charge leicht variieren. Die Eigenschaften entsprechen der Norm EN 1307, Änderungen der technischen Daten sind vorbehalten. Die Schutzfolie ist nicht für den Einsatz in feuchten Umgebungen geeignet.

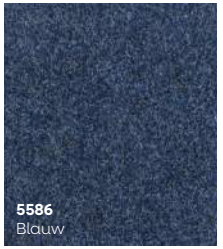
Les couleurs peuvent varier légèrement d'un lot à l'autre. Caractéristiques conformes aux normes EN 1307. Nous nous réservons le droit de modifier les spécifications techniques. Le film de protection n'est pas adapté aux conditions humides.

Los colores pueden variar ligeramente de un lote a otro. Las características están en línea con los estándares EN 1307. Nos reservamos el derecho de modificar las especificaciones técnicas. La lámina protectora no es adecuada para condiciones húmedas.









ACRYLITE®

ACRYLITE® Premium (FF)
Physical Properties for Extruded Sheet

ACRYLITE® premium (FF) is the highest quality continuously manufactured sheet on the market today. Using a proprietary, innovative process, ACRYLITE® premium (FF)sheet products are economical, provide tight thickness tolerance, high optical characteristics and low stress levels. ACRYLITE® premium (FF) sheet is readily available in a variety of standard sizes, thicknesses and colors. Clear ACRYLITE® premium (FF) sheet carries an exclusive 30-year limited warranty on light transmission – your assurance of a quality product.

Characteristics

ACRYLITE® premium (FF) is a lightweight, rigid and weather-resistant thermoplastic that is dimensionally stable, resistant to breakage and can be easily fabricated and cemented.

Because of its virtually distortion-free clarity, it is well suited for use in a variety of applications.

- Skylights
- Window glazing
- Retail displays
- Signs
- Optical displays
- Picture framing

Availability

ACRYLITE® premium (FF) sheet is available in thicknesses from .060" (1.5 mm) to .472" (12 mm) and actual sheet sizes from 48" x 96" to 72 X 120. Custom sizes are also available. All sheets are protected with polyethylene film or paper masking.

Safety

ACRYLITE® premium (FF) sheet is more impact resistant than glass. If subjected to impact beyond the limit of its resistance, it does not shatter into small slivers, but breaks into comparatively large pieces. ACRYLITE® sheet meets the requirements of ANSI Z97.1 for use as a Safety Glazing Material in Buildings (for thicknesses .080" to .500" [2.0 mm – 12.0 mm]).

Weather Resistance

ACRYLITE® premium (FF) sheet will withstand exposure to blazing sun, extreme cold, sudden temperature changes, salt water spray, etc. It will not deteriorate after many years of service because of the inherent stability of acrylic resins. ACRYLITE® has been widely accepted for use in school buildings, industrial plants, and outdoor signs.

Dimensional Stability

Although ACRYLITE® will expand and contract due to changes in temperature and humidity; it will not shrink with age. Some shrinkage occurs when ACRYLITE® is heated to forming temperature, but post-forming stability is excellent.

Light Weight

ACRYLITE® sheet is only half the weight of glass and 43% the weight of aluminum.

Rigidity

ACRYLITE® sheet is not as rigid as glass or metals. However, it is more rigid than many other plastics such as acetates, polycarbonates or vinyls. Under wind load an acrylic sheet will bow and foreshorten as a result of deflection.

For glazing installations the maximum wind load and the size of the window must be considered when the thickness of a panel is to be determined.

If ACRYLITE® sheet is formed into corrugated or domed shapes, rigidity will be increased and deflection minimized.

Cold Flow

Large, flat ACRYLITE® sheet, if insufficiently supported, may deform permanently due to continuous loads such as snow, or even their own weight. Increased rigidity obtained by forming will minimize cold flow.

POLYVANTIS

ACRYLITE® Premium (FF)
Physical Properties for Extruded Sheet

Strength and Stresses

Although the tensile strength of ACRYLITE® premium (FF) is 10,000 psi (69 Mpa) at room temperature (ASTM D 638), stress crazing can be caused by continuous loads below this value. For glazing applications, continuously imposed design loads should not exceed 750 psi (5.2 Mpa) at 73°F (23°C). Temporary loads of up to 1,500 psi (10.4 Mpa) may be imposed for short durations of time at 73°F (23°C).

Localized, concentrated stresses must be avoided. For this reason, and because of thermal expansion and contraction, large sheets should never be fastened with bolts, but should always be installed in frames.

All thermoplastic materials, including ACRYLITE® premium (FF) sheet, will gradually lose tensile strength as the temperature approaches the maximum recommended for continuous service – 160°F (71°C).

Expansion and Contraction

Like most other plastics, ACRYLITE® premium (FF) sheet will expand and contract from 3 to 8 times as much as glass or metals. The designer should be aware of its coefficient of expansion and make appropriate provisions. A 48" panel will expand and contract approximately .002" for each degree fahrenheit change in temperature. In outdoor use, where summer and winter temperatures differ as much as 100°F, a 48" sheet will expand and contract approximately 3/16". Sash rabbets must be of sufficient depth to allow for expansion as well as for contraction.

ACRYLITE® premium (FF) also absorbs water when exposed to high relative humidity, resulting in expansion of the sheet. At relative humidity of 100%, 80%, and 60%, the dimensional changes are 0.6%, 0.3% and 0.2%, respectively.

Heat Resistance

ACRYLITE® premium (FF) sheet can be used at temperatures from -30°F (-34°C) up to +190°F (+88°C), depending on the application. It is recommended that temperatures not exceed 160°F (71°C) for continuous service, or 190°F (88°C) for short, intermittent use.

Components made of ACRYLITE® should not be exposed to high heat sources such as high wattage lamps, unless the finished product is ventilated to permit the dissipation of heat.

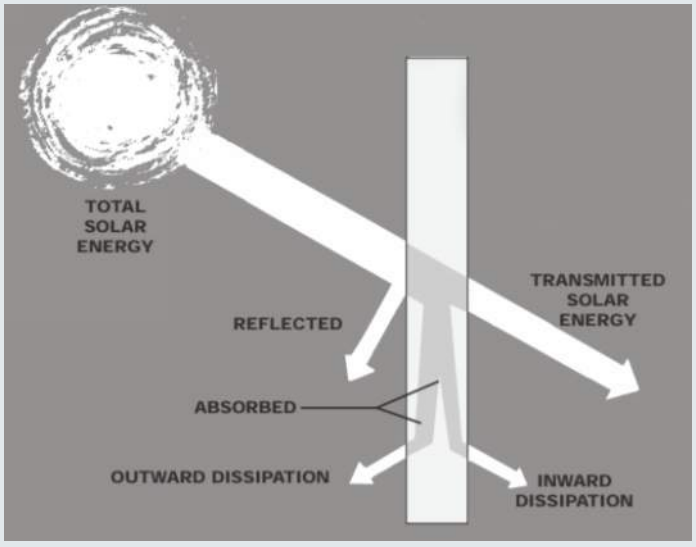
Light Transmission

Clear, colorless ACRYLITE® premium (FF) sheet has a light transmittance of 92%. It is warranted not to lose more than 2-15% of its light-transmitting ability in a 30-year period. Contact Roehm America LLC for the complete warranty.

ACRYLITE® Gallery UV filtering (OP3) sheet is formulated with ultraviolet absorbers designed to help protect pictures, photographs and posters from the damaging effects of ultraviolet light. ACRYLITE® Gallery UV filtering (OP3) sheet absorbs more than 99.7% of the radiation in the ultraviolet range below 200-390 nanometers.

Solar Energy Control

Transparent colored ACRYLITE® extruded sheet can be used to reduce glare and solar energy transmittance. Transparent colored sheets are available in a range of color densities. This wide range of transmittance values enables the architect to select a density which will provide adequate daylight and at the same time will control glare and solar heat build-up.



Distribution of Solar Energy

ACRYLITE® Premium (FF)
Physical Properties for Extruded Sheet

Chemical Resistance

ACRYLITE® premium (FF) has excellent resistance to many chemicals including:

- Solutions of inorganic alkalies such as ammonia
- Dilute acids such as sulfuric acid up to a concentration of 30%
- Aliphatic hydrocarbons such as hexane and VM&P naphtha

ACRYLITE® premium (FF) sheet is not attacked by most foods and foods are not affected by it.

It is attacked, in varying degrees, by:

- Aromatic solvents such as benzene and toluene
- Chlorinated hydrocarbons such as methylene chloride and carbon tetrachloride
- Ethyl and methyl alcohols
- Some organic acids such as acetic acid
- Lacquer thinners, esters, ketones and ethers

For a listing of the resistance of ACRYLITE® sheet to more than 60 chemicals, refer to the table on page 5.

Formability

ACRYLITE® premium (FF) sheet will soften as the temperature is increased above 195°F (91°C). As the temperature is increased the sheet passes through the thermo-elastic state to the thermoplastic state. The change is gradual rather than sharply defined. The forming temperature range is between 290°F and 320°F (143°C and 160°C). Because the sheet gradually becomes thermoplastic, certain procedures should be considered during thermoforming. If the sheet is to be hung in an oven, it is necessary to use a continuous clamp rather than several individual clamps. This will prevent the sheet from permanently deforming between clamps. If the sheet is to be heated by infrared heaters while clamped in a horizontal frame, it may be necessary to control the heaters above the center of the sheet. This will prevent the center from becoming too hot and sagging under its own weight.

The sheet will exhibit very little "memory" after forming and probably will not return to its original flat condition if reheated. ACRYLITE® premium (FF) sheet will shrink in the machine direction when heated without a frame. Sheet thicknesses of .118" (3.0 mm) and greater will shrink no more than 3%. Thinner thicknesses could shrink more.

Cutting and Machining

ACRYLITE® premium (FF) sheet can be sawed with circular saws or band saws. It can be drilled, routed, filed and machined much like wood or brass with a slight modification of tools. Because the sheet softens quickly, it is necessary to keep the cutting tool and machined edge of the sheet as cool as possible. Cooling of the cutting tool is recommended. Tool sharpness and "trueness" are essential to prevent gumming, heat buildup and stresses in the part. Heat buildup at the machined edge could lead to subsequent stress crazing and therefore must be avoided.

Laser Cutting

Laser technology is ideal for quick and accurate cutting, welding, drilling, scribing and engraving of plastics. CO_2 lasers focus a large amount of light energy on a very small area which is extremely effective for cutting complex shapes in acrylic sheet. The laser beam produces a narrow kerf in the plastic allowing for close nesting of parts and minimal waste.

CO_2 lasers vaporize the acrylic as they advance resulting in a clean polished edge but with high stress levels; annealing acrylic sheet after laser cutting is recommended to minimize the chance of crazing during the service life of the part.

Cementing

ACRYLITE® sheet can be cemented using common solvent cements or polymerizable cements such as ACRIFIX®. The most critical factor is good edge preparation of the part to be cemented. The edge of the sheet must be properly machined in order to have a square flat surface and no stresses. Annealing of the part prior to cementing is recommended. Cement and cement fumes should not contact formed or polished surfaces.

Annealing

ACRYLITE® premium (FF) sheet may be annealed at 180°F (82°C) with the heating and cooling times determined by

ACRYLITE® Premium (FF)
Physical Properties for Extruded Sheet

the sheet thickness. An approximate guideline is annealing time in hours equals the sheet thickness in millimeters and the cool-down period is a minimum of 2 hours ending when sheet temperature falls below 140°F. For example, 1/8" (3mm) ACRYLITE® sheet would be heated for 3 hours at 180°F (82°C) and slowly cooled for 3 hours.

Flammability

ACRYLITE® is a combustible thermoplastic. Precautions should be taken to protect this material from flames and high heat sources. ACRYLITE® sheet usually burns rapidly to completion if not extinguished. The products of combustion, if sufficient air is present, are carbon dioxide and water. However, in many fires sufficient air will not be available and toxic carbon monoxide will be formed, as it will when other common combustible materials are burned. We urge good judgment in the use of this versatile material and recommend that building codes be followed carefully to assure it is used properly.

The combustibility test data for ACRYLITE® sheet is: self-ignition temperature (ASTM D-1929) is 850°F (455°C), smoke density as measured by ASTM D-2843 is 6.4%, and the rate of burning as measured by ASTM D-635 is 1.0 in/min (25mm/min) for 1/8" (3mm) thick sheet. While these data are based on small scale laboratory tests frequently referenced in various building codes, these tests do not duplicate actual fire conditions.

Thermal Conductivity

The thermal conductivity of a material—its ability to conduct heat—is called k-Factor. The k-Factor is an inherent property of the material, and is independent of its thickness and of the surroundings to which it is exposed. The k-Factor of ACRYLITE® sheet is:

1.3 B.T.U. / (hour) (sq. ft.) (°F/inch) or 0.19 W /m. K

Whereas the k-Factor is a physical property of the material, the U-Factor—or overall coefficient of heat transfer—is the value used to calculate the total heat loss or gain through a window.

The U-Factor is the amount of heat per unit time and area which will pass through a specific thickness and configuration of material per degree of temperature difference on each of its two sides. This value takes into account the thickness of the sheet, whether the sheet is in a horizontal or vertical position, as well as the wind velocity. U-Factors are based on specific conditions (e.g., single-glazed or double-glazed installations) and are different for summer and winter.

Listed below are U-Factors for several thicknesses of ACRYLITE® sheet for single-glazed, vertical installations, based on the standard ASHRAE* summer and winter design conditions.

U-Factors—BTU/hour sq. ft. F° (w/m² x K)

ACRYLITE® premium (FF) Sheet Thickness		Summer Conditions	Winter Conditions
mm	inches		
3.0	.118	0.98 (5.56)	1.06 (6.02)
4.5	.177	0.94 (5.34)	1.02 (5.79)
6.0	.236	0.90 (5.11)	0.97 (5.51)
9.5	.375	0.83(4.71)	0.89 (5.05)

**American Society of Heating, Refrigerating and Air-Conditioning Engineers*

The total heat loss or gain through a window (due to temperature difference only) can be calculated by multiplying the area of the window, times the difference between indoor and outdoor temperatures, times the appropriate U-Factor (from Table above). Heat intake through solar radiation must be added to arrive at the total heat gain.

ACRYLITE® premium (FF) sheet is a better insulator than glass. Its U-Factor or overall coefficient of heat transfer is approximately 10% lower than that of glass of the same thickness. Conversely, its RT-Factor is about 10% greater.

Thermal Shock and Stresses

ACRYLITE® premium (FF) sheet is more resistant than glass to thermal shock and to stresses caused by substantial temperature differences between a sunlit and a shaded area of a window or by temperature differences between opposite surfaces of a window.

ACRYLITE® Premium (FF)
Physical Properties for Extruded Sheet

Surface Hardness

The surface of plastic is not as hard as that of glass. Therefore, reasonable care should be exercised in handling and cleaning ACRYLITE® sheet.

Electrical Properties

ACRYLITE® sheet has many desirable electrical properties. It is a good insulator. Its surface resistivity is higher than that of most plastics. Continuous outdoor exposure has little effect on its electrical properties.

Chemical Resistance

The table on the next page gives an indication of the chemical resistance of ACRYLITE® premium (FF) sheet. The code used to describe chemical resistance is as follows:

R = Resistant

ACRYLITE® premium (FF) sheet only withstands this substance for long periods and a temperature of 120°F (49°C).

LR = Limited Resistance

ACRYLITE® premium (FF) sheet only resist the action of this substances for a short periods at room temperatures. The resistance for particular application must be determined.

N = Non Resistant

ACRYLITE® premium (FF) sheet is not resistance to this substance. It is swelled, attacked, dissolved, or damaged in some manner. Plastic materials can be attacked by chemicals in several ways. The methods of fabrication and/or conditions of exposure of ACRYLITE® sheet, as well as the manner, in which the chemical are supplied, can influence the final results even for “R” coded chemicals. Some of these factors are listed on the next page:

Fabrication

Stress generated while sawing, sanding, machining, drilling, and/or forming.

Exposure

Length of exposure, stresses induced during the life of the product due to various loads, changes in temperatures, etc.

Application of Chemicals

by contact, rubbing, wiping, spraying, etc.

The table should therefore be used as only a general guide and, in case of doubt; it should be supplemented by tests made under actual working conditions.

ACRYLITE® Premium (FF)
Physical Properties for Extruded Sheet

Chemical Resistance of Clear ACRYLITE®

Chemical	Code	Chemical	Code	Chemical	Code
Acetic Acid (5%)	LR	Ethyl Acetate	N	Nitric Acid (40%)	LR
Acetic Acid (Glacial)	N	Ethyl Alcohol (30%)	LR	Nitric Acid (Conc.)	N
Acetone	N	Ethyl Alcohol (95%)	N	Oleic Acid	R
Ammonium Chloride	R	Ethylene Dichloride	N	Olive Oil	R
Ammonium Hydroxide (10%)	R	Ethylene Glycol	R	Phenol Solution (5%)	N
Ammonium Hydroxide (Conc.)	R	Gasoline	LR	Soap Solution (Mild dish soap)	R
Aniline	N	Glycerine	R	Sodium Carbonate (2%)	R
Battery Acid	R	Heptane	R	Sodium Carbonate (20%)	R
Benzene	N	Hexane	R	Sodium Chloride (10%)	R
Butyl Acetate	N	Hydrochloric Acid	R	Sodium Hydroxide (1%)	R
Calcium Chloride (Sat.)	R	Hydrofluoric Acid (25%)	N	Sodium Hydroxide (10%)	R
Calcium Hypochlorite	R	Hydrogen Peroxide (<40%)	R	Sodium Hydroxide (60%)	R
Carbon Tetrachloride	N	Hydrogen Peroxide (>40%)	LR	Sodium Hypochlorite (5%)	R
Chloroform	N	Isopropyl Alcohol	LR	Sulfuric Acid (3%)	R
Chromic Acid	LR	Kerosene	R	Sulfuric Acid (30%)	R
Citric Acid (20%)	R	Lacquer Thinner	N	Sulfuric Acid (Conc.)	N
Cottonseed Oil (Edible)	R	Methyl Alcohol (30%)	LR	Toluene	N
Detergent Solution (Heavy Duty)	R	Methyl Alcohol (100%)	N	Transformer Oil	R
Diesel Oil	R	Methyl Ethyl Ketone (MEK)	N	Trichloroethylene	N
Diethyl Ether	N	Methylene Chloride	N	Turpentine	R
Dimethyl Formamide	N	Mineral Oil	R	Water	R
Dioctyl Phthalate	N	Nitric Acid (10%)	R	Xylene	N

ACRYLITE® Premium (FF)
Physical Properties for Extruded Sheet

Physical Characteristics of ACRYLITE®

Property[a]		ASTM Method	Typical Value (0.250" Thickness) [b]
Mechanical	Specific Gravity	D 792	1.19
	Tensile Strength Elongation, Rupture Modulus of Elasticity	D 638	10,000 psi (69 M Pa) 4.5% 400,000 psi (2800 M Pa)
	Flexural Strength Modulus of Elasticity	D 790	17,000 psi (117 M Pa) 480,000 psi (3300 M Pa)
	Compressive Strength (Yield)	D 695	17,000 psi (117 M Pa)
	Impact Strength Izod Milled Notched	D 256	0.4 ft.lbs/in. of notch (21.6 J/m of notch)
	Rockwell Hardness	D 785	M-93
	Barcol Hardness	D 2583	48
Optical	Refractive Index	D 542	1.49
	Light Transmission, Total	D 1003	92%
Thermal	Forming Temperature	-	Approx. 300°F (149°C)
	Deflection Temperature Under Load (264 psi)	D 648	195°F (91°C)
	Vicat Softening Point	D 1525	220°F (105°C)
	Maximum Recommended Continuous Service Temperature	-	160°F(c) (71°C)
	Coefficient of Linear Thermal Expansion	D 696	0.000040 in/in - °F (.000072 m/m - °C)
	Coefficient of Thermal Conductivity	Cenco-Fitch	1.3 BTU/(Hr) (Sq.Ft.) (°F/in.) (0.19 w/m•K)
	Flammability, Burning Rate (0.125" thickness)	D 635	1.0 in/min. (25 mm/min.)
	Self-Ignition Temperature	D 1929	850°F (455°C)
	Specific Heat @ 77°F	-	0.35 BTU/(lb.) (°F) (1470J/Kg•K)
	Smoke Density Rating	D 2843	4.8%
Electrical	Dielectric Strength Short Time (0.125")	D 149	430 volts/mil (17 KV/mm)
	Dielectric Constant 60 Hertz 1,000 Hertz 1,000,000 Hertz	D 150	 3.6 3.3 2.8
	Dissipation Factor 60 Hertz 1,000 Hertz 1,000,000 Hertz	D 150	 0.06 0.04 0.02
	Volume Resistivity	D 257	10^{16}ohm-cm
	Surface Resistivity	D 257	10^{15}ohms
Water Absorption 24 hrs @ 73°F		D 570	0.2%
Odor		-	None
Taste		-	None

NOTES:

(a) Typical values; should not be used for specification purposes.

(b) Values shown are for 0.250" thickness. Some values will change with thickness or pigmentation.

(c) It is recommended that temperatures not exceed 160°F for continuous service, or 190°F for short intermittent use.

ACRYLITE® Premium (FF)
Physical Properties for Extruded Sheet

POLYVANTIS
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Sanford, ME 04073
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Semi-finished polymethyl methacrylate (PMMA) products from POLYVANTIS are sold on the European, Asian, African and Australian continents under the registered trademark PLEXIGLAS®, in the Americas under the registered trademark ACRYLITE®, both owned by Röhm GmbH, Darmstadt, or its affiliates.

Fire Precautions
ACRYLITE® sheet is a combustible thermoplastic. Precautions should be taken to protect this material from flames and high heat sources. ACRYLITE® sheet usually burns rapidly to completion if not extinguished. The products of combustion, if sufficient air is present, are carbon dioxide and water. However, in many fires sufficient air will not be available and toxic carbon monoxide will be formed, as it will when other common combustible materials are burned. We urge good judgement in the use of this versatile material and recommend that building codes be followed carefully to assure it is used properly.

Compatibility
Like other plastic materials, ACRYLITE® sheet is subject to crazing, cracking or discoloration if brought into contact with incompatible materials. These materials may include cleaners, polishes, adhesives, sealants, gasketing or packaging materials, cutting emulsions, etc. See the Tech Briefs in this series for more information, or contact your ACRYLITE® sheet Distributor for information on a specific product.