

WINTER DESIGN REVIEW 2020 | GROUP S-5



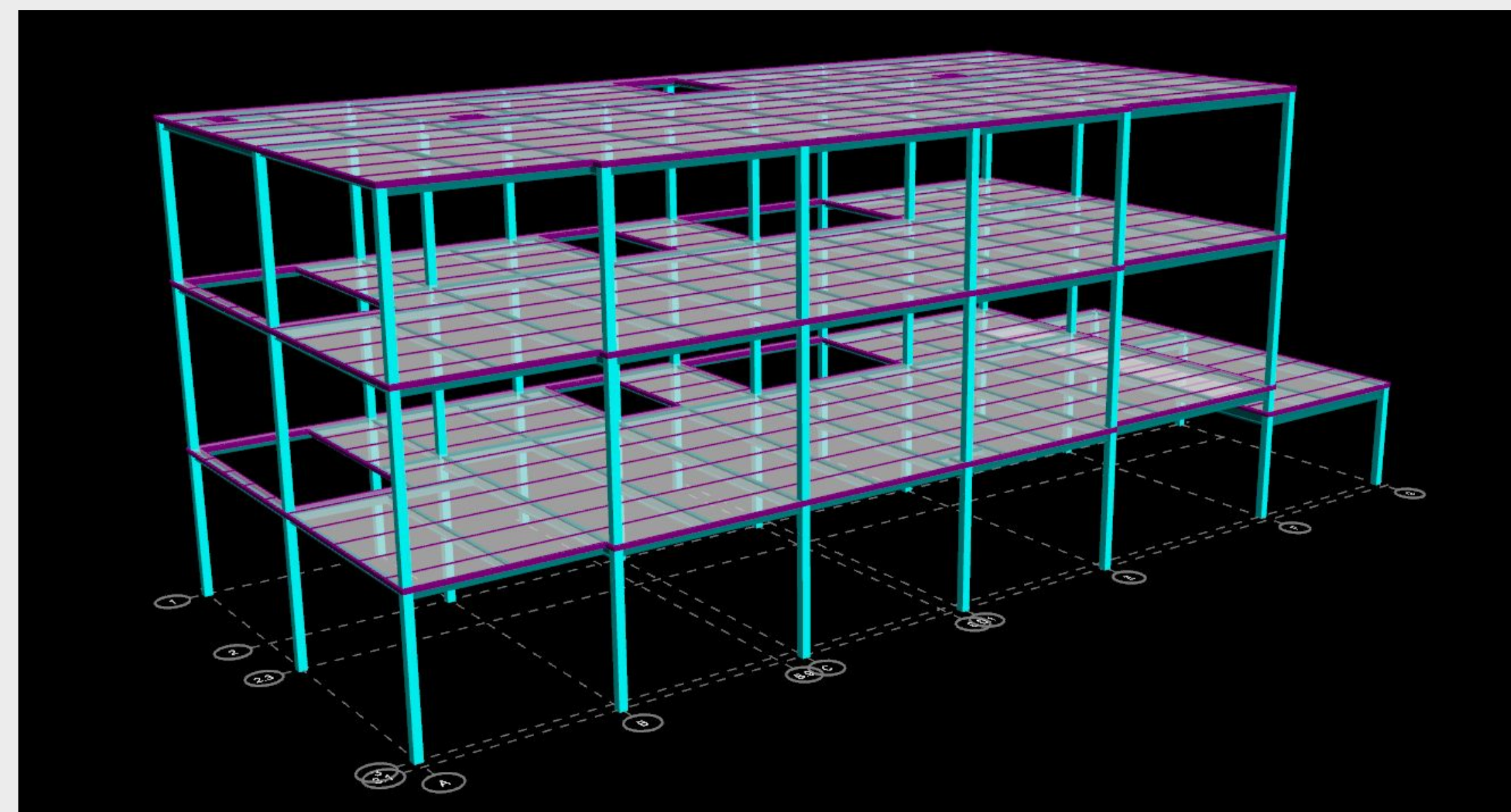
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DESIGN APPROACH:

- The design followed ASCE-7-16, AISC Steel Construction Manual, and California Building Codes.
- The building is designed to withstand gravity loads such as dead and live as well as lateral loads due to seismic and wind forces.
- The structural elements of the building include HSS columns, composite W-beams and girders, metal decking, concrete footings and steel connections.
- The total demand of the building was calculated prior to choosing the appropriate design of the beam and column sizes.
- The design is conservative and tailored to the demand of the architect and clients as well as the requirements of the codes.

PROJECT DESCRIPTION SUMMARY:

Our group is tasked with designing a two-story higher education building with a partial basement. The structural members of the gravity framing are to consist of steel beams and columns with concrete over metal deck. Masonry shear walls will be used to support any lateral forces imposed on the building. Isolated footings will be used at each individual column and a continuous foundation will be situated under the CMU shear walls. Computer modeling and analysis will be done utilizing RAM Steel.



DESIGN CONSTRAINTS & PARAMETERS:

- The structural design and layout must not conflict with the architectural plan.
- The geotechnical report states the dimensions required for continuous and isolated footings, allowable soil bearing capacity and pressures. Lateral at rest pressures, and restrictions on passive pressures are provided.
- Openings in the structure for stairways, elevators, and skylights must be respected.
- Since the exterior aesthetic of building must fit in with surrounding structures, CMU Shear Walls must be used.

PRELIMINARY DESIGN KEY POINTS:

- Determination of gravity loads per ASCE 7 and California Building Code.
- Layout of framing for the gravity force resisting system.
- Preliminary design of non-composite steel beams, girders, and columns.
- Design of composite beams and girders.
- Design of isolated footings and baseplates.
- Design of shear tab, beam to column, connections.
- Computer modeling and design verification in RAM steel.

COST ESTIMATION:

Item	Amount	Average Cost per Unit	Total Cost
Steel Beams and Girders	2955 ft	\$16/ft	\$47,280
Columns	727 ft	\$65/ft	\$47,255
Metal Decking	13,210 sqft	\$3/sqft	\$39,630
Total Concrete	215 (Cubic Yards)	\$113/yard ³	\$24,295
Base Plates	18 plates	\$50/ plate	\$900

Total Estimated Cost : \$160,000 (Preliminary Material Costs)

PLAN FOR NEXT PHASE:

- Determination of Lateral Loads per ASCE 7.
- Design of CMU Shear Walls and continuous footings.
- Design Connections of CMU Shear Wall to Diaphragms.
- Final Cost Estimation

REFERENCES:

American Institute of Steel Construction, Manual of Steel Construction, 15th Edition. Chicago: AISC, 2017.
American Society of Civil Engineers, ASCE Standard 7-16 Minimum Design Loads for Buildings and Other Structures. Virginia: ASCE/AEI, 2017.