Karadeniz Technical University **2024 Spring Semester**
Civil Engineering Department **Assist. Prof. Ali İhsan KARAKAŞ**

Submission Date: May 24th, 2024 by 15:00

Student No: _____ Name: _____.

CE 3010 - Steel Structures TERM PROJECT

1. **Aim of the Term Project**
   - To do manual design of the elements of an industrial building with a truss roof and a two story steel frame office building.
   - To practice structural mechanics knowledge to design steel structural elements.
   - To understand the importance of individual element design as part of a building.
   - To achieve better understanding of the requirements given in latest steel design code for modelling and designing of steel structural elements under realistic constraints.
2. **General Requirements**
   A proper report, neatly written, including contents page should be submitted. Report should include a copy of this term project paper, calculation sheets with all the details and drawings. All pages should be numbered and the report must be printed and prepared in **spiral** format.
3. **Design Brief**
   - Details of the buildings under consideration are given on the following pages. Fig. 1 shows the typical floor and roof plan layout. Fig. 2 and Fig. 3 depict east and north elevation of the buildings, respectively. Geometrical and technical values for design are listed in **Table 1** for each student.
   - **100 mm thick** in-situ concrete one-way slab spanning onto steel beams provides full lateral restraint for these beams. Unit weight of the concrete is **25 kN/m^3**.
   - Assume that the lightweight partition wall load is a live load (**Q**) type on the floor. (see **Table 1** for the weight (kN/m^2) of lightweight partition wall).
   - 1st floor will be offices with **3.0 kN/m^2** Live Load (**Q**).
   - The truss roof will be designed under dead and snow load (**S**). Dead load (**G**) including self-weights of the truss, sheeting, stability members, and purlins can be taken as **0.08x(12xL_1) kN/m^2**. (See **Table-1** for **L_1** and **S**). Dead and snow loads are given for the plan view area (horizontal area).
   - Use **LRFD** or **ASD** for your design. Assume Steel Grade **S235** material for all the design calculations.
   - Assume **U=0.8** for preliminary design of tension members.

Design the followings: Learning **O**utcomes, **LO-1 (50%), LO-3 (50%)** for each question below.

1. **Truss**: Determine maximum top chord member force (**O_{max}**), maximum bottom chord member force (**U_{max}**), maximum force (**D_{max}**) among diagonals and verticals (**V_{max}**).
2. Design the bottom chord member with maximum axial force **U_{max}** , select **2L** (back to back).
3. Design the top chord member with maximum axial force **O_{max}** , select **2L** (back to back).
4. Design the diagonal member with maximum axial force **D_{max}** , select **2L** (back to back).
5. Design the vertical member with maximum axial force **V_{max}** , select **2L** (back to back).
6. Design the columns of the roof truss, select **HEB** profile.
7. **Two story frame**: Design the Level 1 floor equally spaced secondary beams (**B1**) and the main girder (**B2**). Select the most economical **IPE** profiles considering all the limit states necessary. The beam end connections are **pinned**.
8. Design the **welded** connections in circles **A** and **B** shown in Fig. 3.
9. Draw the truss connection details A and B with a **scale of 1:5**.

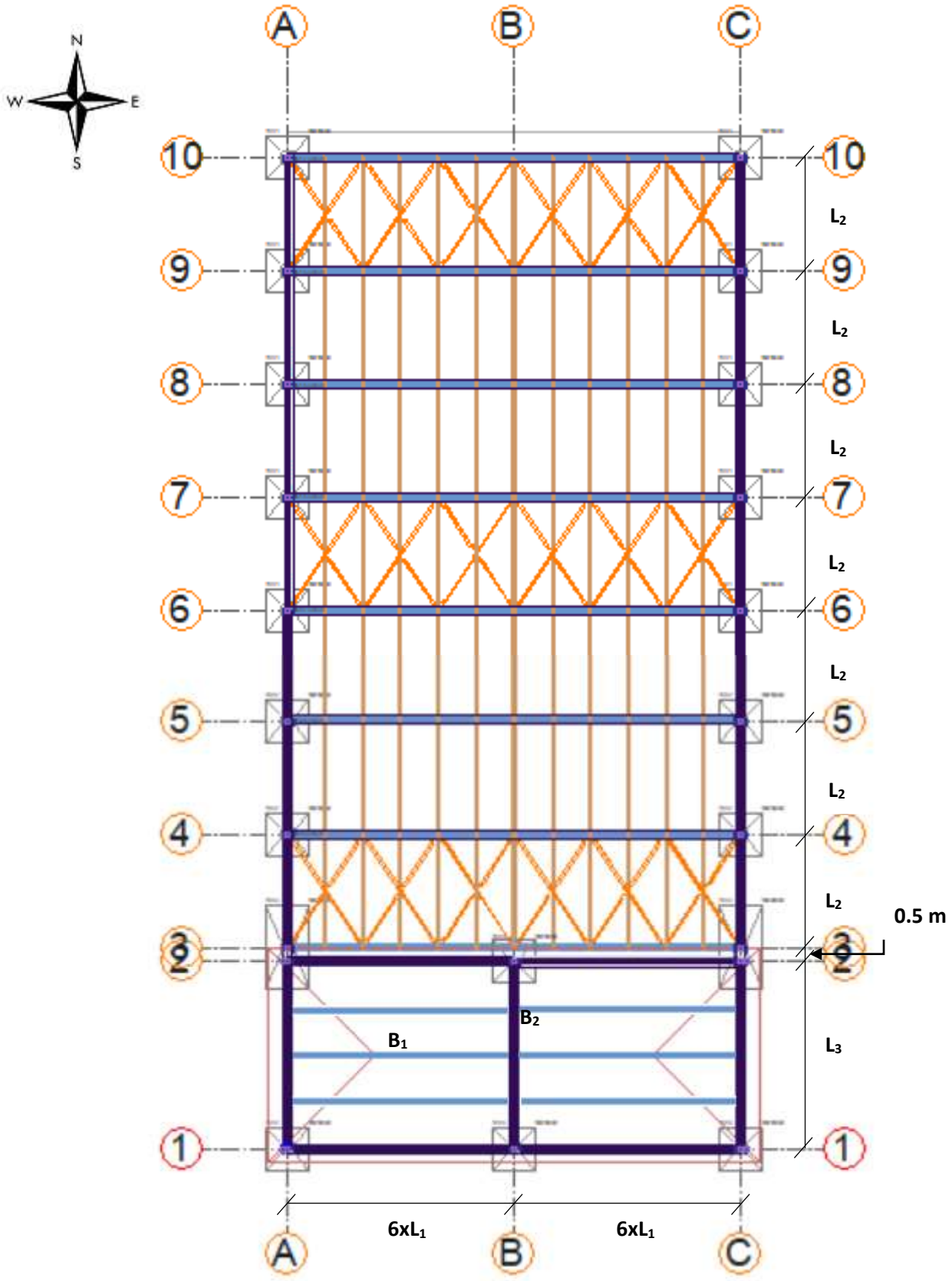

Fig. 1. Plan view layout

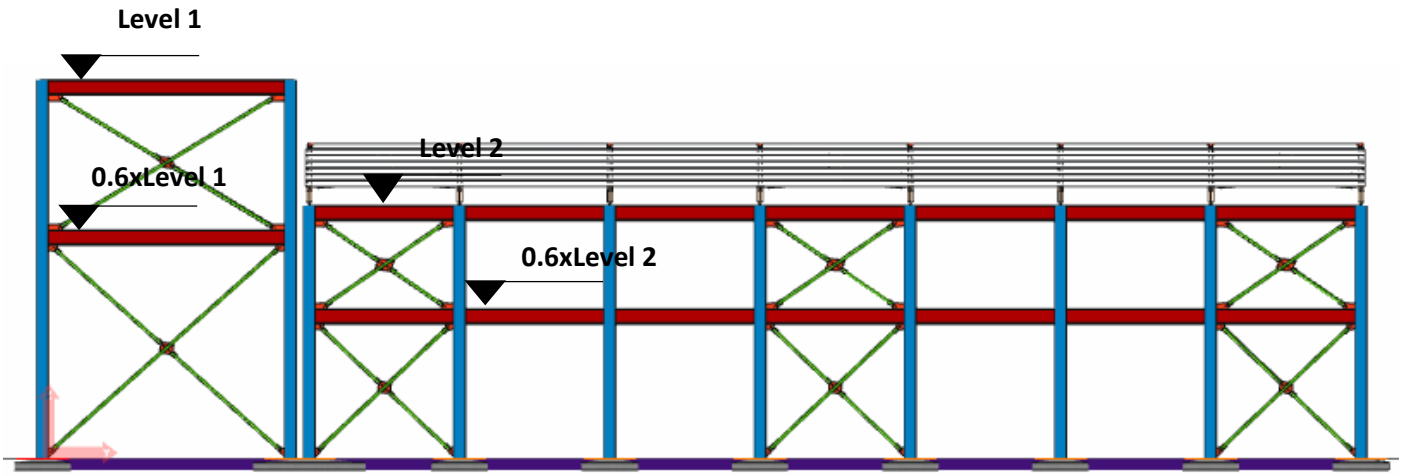

Fig. 2. Elevation view (East)

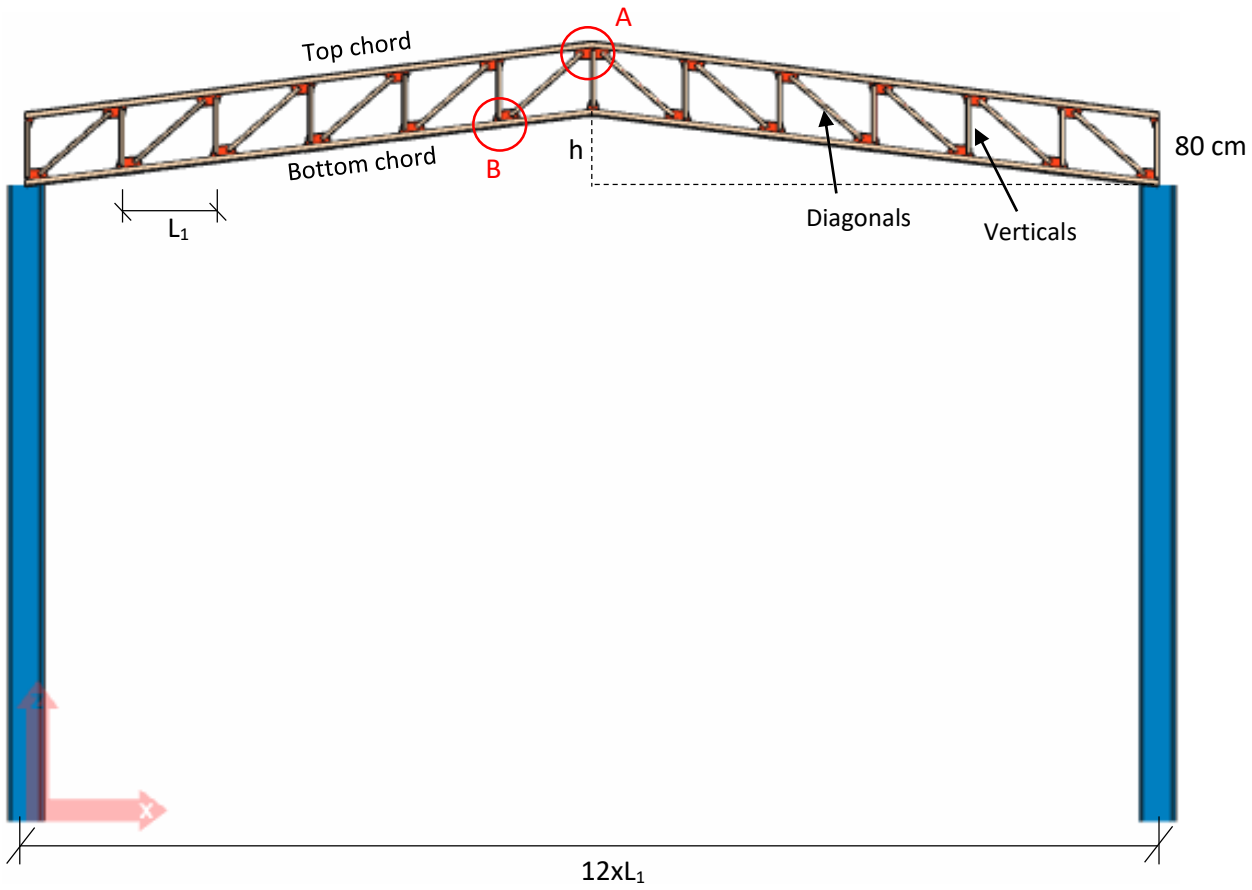

Fig. 3. Elevation view (North)

Table 1. Geometrical and technical values for design

Student ID	L_1 (cm)	L_2 (cm)	L_3 (cm)	Partition wall (kN/m^2)	Snow load (S) (kN/m^2)	Level 1 (cm)	Level 2 (cm)	h (cm)
ABCDEF	125+5xF	500+20xE	400+20xD	0.8+0.1xF	0.75+0.06xE	700+10xF	600+10xE	50+5xF

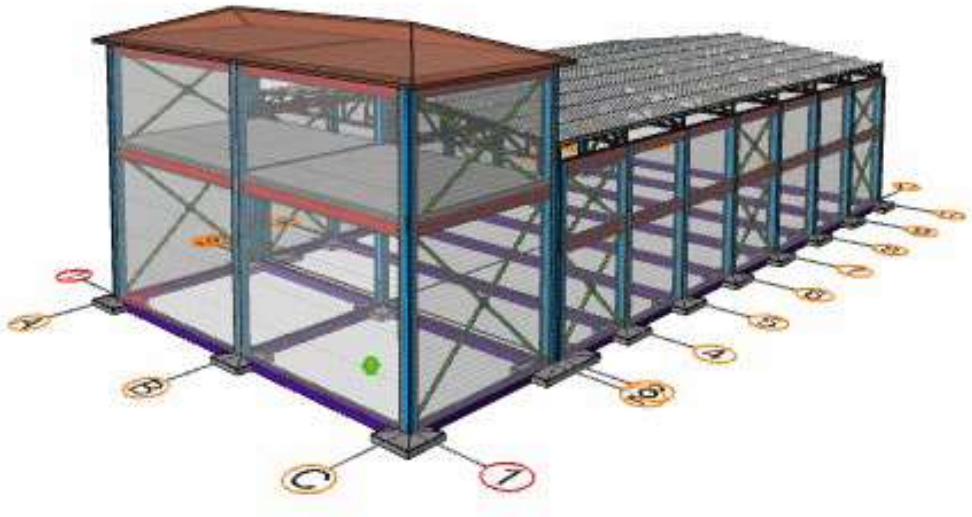

Fig. 4. Isometric view of the industrial building