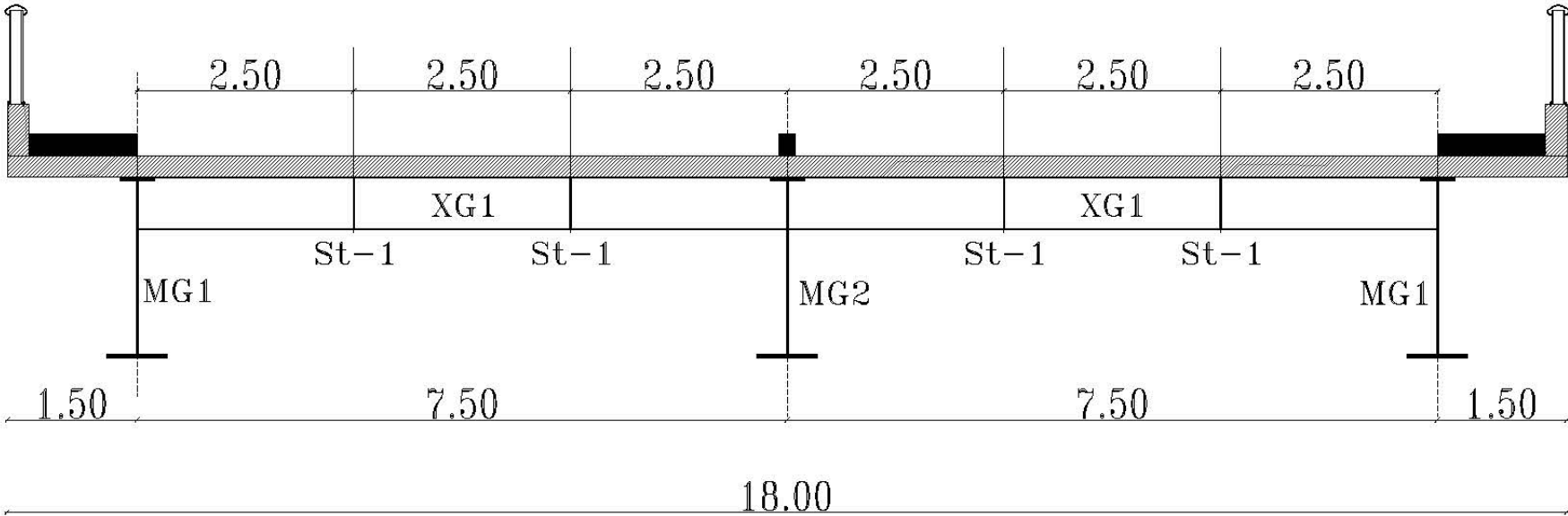It is required to design two bridges crossing a highway. The first is a roadway (Fig. 1), whereas the second is a railway (Fig. 2). The roadway bridge is a two-span continuous bridge; with span 40.0 m. The railway bridge is a simply-supported bridge; with span 35 m. Steel shall be ST52 for the main girders and ST37 for the floor system and bracing. All loads shall be in accordance with the Egyptian Code for Loads and Forces, 2011 Edition.
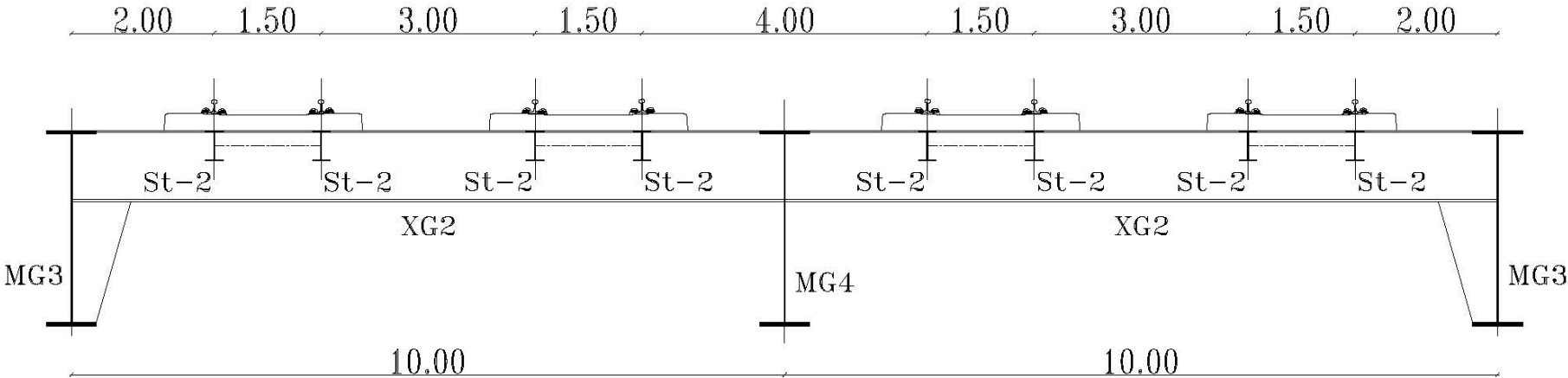
Requirements:
1. Compute the maximum straining actions on the floor elements of both bridges if the spacing between the X.G. was 5.0 m for the roadway bridge and 3.5 m for the railway bridge.
2. Design the floor beams for both bridges if the R.C. slab is of thickness 250 mm and the asphalt layer is of thickness 80 mm for roadway bridge, and railway track load equals 700 kg/m.
3. Design connections of floor beams for both bridges.
4. Design stringer bracing and braking force bracing for railway bridge.
5. Compute the maximum straining actions on the middle main girder for both bridges.
6. Choose suitable dimensions for the main girder and check the adequacy of the web to resist buckling for both bridges.
7. Check the adequacy of the chosen flange plates to resist bending stresses.
8. Choose a suitable thinkness for the flange-to-web weld.
9. Choose a suitable location for flange curtailment and check the adequacy of the new section for one of the two bridges.
10. Design the stiffeners (horizontal, vertical and bearing stiffeners) required for one of the two bridges.
11. Choose a suitable location for a main-girder splice and design the necessary connection for one of the two bridges.
12. Design the bracing system required for both bridges.
13. Check the adequacy of the main girder to sustain repeated loading (fatigue).
14. Design the bearings required for both bridges.
15. Prepare an A0 size drawing showing the layout of one of the bridges and its details (using AutoCAD or Revit is allowed).
16. Redesign the main girder (mid-span section) of the roadway bridge making use of the composite action between the steel section and the R.C. slab.

* Each student shall submit a report about an existing bridge in Egypt. The report shall be not more than two pages of text and the rest are sketches and illustrations and shall be submitted by the end of week 14 lecture. The report shall define the bridge location, geometry, structural system, and components.

Fig. 1. Roadway Bridge Section

Cairo University
Faculty of Engineering
Structural Eng. Dept.

Exercise No. 1

4th Year Civil
Metallic Bridges (1)
Second Term, 2019-2020

Fig. 2. Railway Bridge Section