32.4 Duties

• To expand knowledge from existing projects focusing on I-girder bridges as well as seismic zones for design insights.

• To select materials and components with further selection for two cases with varying seismic sites as well as adopt CSi Bridge.

• To create the model in CSi Bridge stating layout, geometry, materials, and supports for seismic analysis.

• To perform seismic analysis in CSi Bridge applying load cases, soil conditions, and vehicle types for realistic performance simulation.

• To assess the bridge model's displacement, shear, torsion, and stress values, determining the ideal seismic case for design.

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33.1

I adopted similar information from existing bridge projects, especially those focusing on I-girder bridges in high seismic zones. I gained knowledge on the importance of structural integrity as well as material resilience for I-girder designs in seismic zones IV and V as these areas were highly susceptible to seismic activity. I studied the behavior of different bridge types under seismic loads to determine the best approach for stability as well as longevity. I investigated the foundational requirements including soil-structure interaction as well as potential ground motion impacts to ensure bridge's performance during earthquakes. I inspected similar projects to understand design choices, material selection, and construction techniques suitable for seismic resilience. I acknowledged the critical role of seismic load combinations in structural investigation & design. I learned the importance of using specialized software such as CSi Bridge, for dynamic analysis and load simulation. I reviewed seismic codes as well as standards particularly those relevant to seismic zones IV and V.

33.2

I chose each component of the I-girder bridge with seismic resilience as a priority. I picked an I­ girder design because it offered the strength as well as stability necessary for earthquake-prone areas. I chose M45 concrete and picked FE550 rebars to deliver necessary tensile strength. I picked the bridge with a 50-meter total span along with a I 2-meter width. I opted for a top slab of 0.35 meters & a concrete haunch of 0.097 meters. I selected overhangs of 0.895 meters on each side, with an outer thickness of 0.35 meters. I allocated two lanes, each 4.8 meters wide, which allowed for smooth, safe traffic flow. I incorporated three internal girders, chosen to reinforce the bridge's strength as well as support the load distribution across the width. I selected an abutment with a length of 13 meters, double-bearing support, and circular columns. I relied on CSi Bridge software to analyze the proposed bridge, confident that each component contributed to a reliable structure. I adopted a single model with two cases where Case I included seismic zone IV as well as Case 2 included seismic zone V.

33.3

I prepared model of I-girder bridge in CSi Bridge by opening the new folder & setting standard grid. I defined the bridge layout setting the total span as 50 meters and the width as I 2 meters. I used the "Define Materials" command to specify M45 concrete & FE550 rebars. I set up bridge geometry using the "Define Sections" tool, inputting a top slab of 0.35 meters, a haunch of 0.097 meters, and overhangs of 0.895 meters on each side. I utilized ''Define Superstructure" command to create I-section girders, adding three internal girders to distribute the load evenly. I applied the "Define Lane" tool to establish two lanes, eac\h 4.8 meters wide, which allowed for efficient traffic flow on the model. I also configured the abutment dimensions using the "Define Abutment" feature, entering a 13-meter length with double bearings and circular columns for added support. I used the "Assign Supports" command to set up fixed foundations, ensuring structural stability as per seismic requirements. I finalized the model setup by using the "Extrude" and "Modify Geometry" tools to visualize the structure in 3D accurately. I adopted the same process of modeling for both cases.

Illustration2: Front view

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Illustration3: Side view

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Illustration6: Case 2- deformed shape

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Illustration7: Case 1- Model Verified

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Illustration8: Case 2- Model Verified

33.5

I finally assessed the bridge model assessment outcome. For Case I, I reviewed the displacement values resulting in the highest value of l.256E-04mm (vertical), l.043E-l l m (transverse), and 9.789E-04m (longitudinal). I obtained supreme shear vertical as 5.9477kN with further attainment of greatest torsion as l .942E-05kN-m. I then reviewed the stress resulting in I 08.9293kN/m2 (top left). For Case 2, I observed greatest displacement of l.884E-04m (vertical) as well as l .565E- l l m (transverse) along witlh l .468E-03m (longitudinal). I resulted in the highest shear vertical of 8.92 I 5kN besides the highest torsion of 2.9 I 3E-05kN-m. I finally observed the highest stress as 163.3939kN/m2 (top left). I determined that Case 2 exhibited higher displacement, shear, torsion, and stress values than Case I thus Case I was the best.

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Illustration9: Case 1- displacement (vertical)

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IllustrationlO: Case 1- displacement (transverse)

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l llustrationl1: Case 1- displacement (longitudinal)

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Illustration12: Case 1- shear ( vertical)

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Illustration] 3: Case 1- torsion

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Illustration] 4: Case 1- stress

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Illustration]5: Case 2- displacement (vertical)

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Illustrationl6: Case 2- displacement (transverse)

Illustration17: Case 2- displacement (longitudinal)

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Illustrationl8: Case 2- shear (vertical)

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Illustration19: Case 2- torsion

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Illustration20: Case 2- stress

3.4 Issue and Solution

I encountered problem with analysis results when supreme displacement appeared in the bridge model. I noticed that the issue signaled potential instability under seismic loads. I also determined that this issue elevated concerns about bridge's safety, especially in high-seismic zones IV and V. I discussed displacement issue with teammates to explore probable causes as

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making it the preferred design. The determination of the best case enhanced the seismic resilience of the bridge along with the enhancement of the bridge performance stating the achievement of secondary aims.

I attained skills in seismic analysis as well as structural modeling deepening my technical knowledge in bridge engineering. I strengthened proficiency with. CSi Bridge software. I boosted my project managerial abilities directing tasks as well as timelines to meet project goals.