CHAPTER V
CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

After researching the planning and design of pre-stressed concrete bridges with the application of the Building Information Modeling (BIM) concept to assist in the calculations, design process, and modeling, the conclusions that can be taken from this research are,

1. This research successfully designed a prestressed concrete bridge that can withstand various types of loads that may work, both dead loads, live loads, and other environmental loads. The planning process is carried out by considering structural and safety factors, resulting in a design that can meet the technical standards required to maintain the integrity and safety of the bridge during its service life. The right selection of materials and the efficient design of structural elements also contribute to the stability and durability of the bridge.
2. The deflection that occurs on the bridge (δ_{max}) based on calculations in Midas Civil 2023 must be smaller than the allowable deflection (L/360) with the following values,

   $$\delta_{max} \leq L/360$$

   $$61.361 \text{ mm} \leq 111.111 \text{ mm}$$

   So the bridge structure can withstand all the loads without experiencing too large deflection.
3. The design of prestressed concrete uses a PCI-Girder type 2100 mm with 57 Strands and 3 Tendons, where each Tendon has 19 Strands
4. From the results of the planning and design of the prestressed concrete bridge, this research succeeded in producing a detailed engineering design (DED) that covers all technical and geometric aspects of the bridge structure will be presented in the attachment. The resulting DED includes dimensional specifications of structural elements, material selection, and clear structural detailing in 2D and 3D form. This design is ready to be used as a guide in the implementation of bridge construction in the field. A complete and accurate DED will also minimize the potential for errors during execution, thereby improving the quality and efficiency of construction.

5. The application of the BIM concept in the planning and design of prestressed concrete bridges provides convenience in calculating and modeling structures more efficiently and accurately. With BIM, any changes to the design can be instantly and automatically updated across the entire model, reducing the potential for calculation and modeling errors.

6. The application of BIM in the planning and design of prestressed concrete bridges provides some significant advantages, including:
   - BIM allows for more accurate calculations and more efficient modeling, reducing the possibility of design errors and structural miscalculations.
   - BIM allows designers to analyze various design scenarios and select the optimal solution. For example, in the planning of prestressed concrete bridges, BIM can be used to optimize the dimensions of structural elements, material types, and prestressed cable configurations, so that material efficiency and structural strength can be better achieved.
   - With BIM, load simulation and structural response to dynamic or static loads can be done better. This is very important in the planning of a prestressed concrete bridge that must be able to withstand the load from vehicles, wind, and other loads.
   - BIM technology provides the ability to view 3D models of the entire bridge, which makes it easier to understand and communicate between the design team and other stakeholders.

7. The implementation of BIM also has several challenges and advantages, such as:
   - BIM implementation requires a considerable initial investment, both in terms of software, hardware, and training of human resources who will operate the BIM system.
   - The use of BIM requires higher technical expertise compared to conventional methods. Therefore, it takes a very long time to learn the BIM-based software.
   - If the BIM-based software used comes from a different development, the data transfer cannot be done directly. An add-on tool is needed to do just that, or the data transfer is done manually.

5.2 RECOMMENDATION

Suggestions that can be given for further research related to this research include the following.

1. Future research can explore variations in the use of materials in prestressed concrete bridge components, such as the quality of concrete used or prestressing systems with other cable materials.
2. To extend this research, it is recommended to design prestressed concrete bridges with longer spans. or across areas with more complex conditions.
3. It is recommended to explore other types of prestressed concrete girders, such as T-Girders or U-Girders, to evaluate their efficiency and suitability for different bridge designs and conditions.
4. Future research can investigate the design of other bridge types, such as cable-stayed bridges, steel composite bridges, or suspension bridges.