C2.03 - Rural Bridge Improvement Plan

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Background

The bridge on FM Road 1981 in Collingsworth County, TX, built in 1957 and located 0.21 miles west of US Highway 83, handles an average of 100 vehicles daily, including 21% trucks. The most recent TxDOT inspection (July 2021) report shows that, the bridge is deemed to be in poor condition. Both its deck and superstructure exhibit serious deterioration, affecting essential structural components and causing fatigue cracks in the steel and concrete. The bridge poses a safety hazard for the community of Collingsworth County and must be replaced.

Project Site

The site of the rural bridge is embedded between US Highway 83 and FM Road 1981 in the county of Collingsworth, Tx. This location is important due to its proximity and access from several county roads to the main highway, facilitating community connections between Samorwood, Quail, and Wellington.

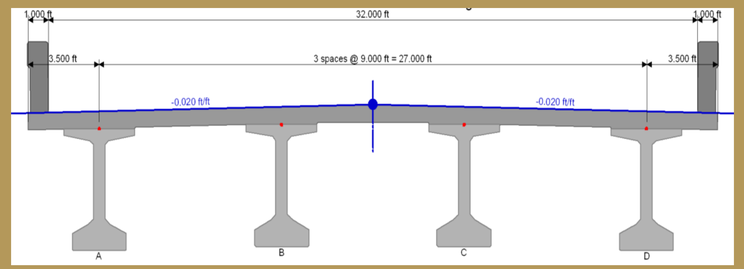
Images provided by Google Earth

Project Overview

The project aims to design and plan a sustainable replacement bridge for FM Road 1981 in Collingsworth County, Texas. The goal is to replace the old bridge with a new, durable, and safer structure that will play an essential role in providing the
community with travel options. The optimal alternative selected for constructing the bridge is the Prestressed Concrete I-Girder. We've opted to conduct additional structural analysis and develop a traffic control plan for the alternative . The Envision Manual was used for sustainability evaluation, the team conducted a cost analysis for the bridge replacement and calculated the life cycle costs for both chosen alternatives over a period of 100 years.

System Design

After selecting the TX-62 I-Girder bridge as the best selection for the new system design, the group created both a 2D and 3D model of the new bridge layout using Bentley Openroads program using TxDOT Bridge Guideline codes and standards.



The prestressed concrete I-girder (T-62): Bridge Section

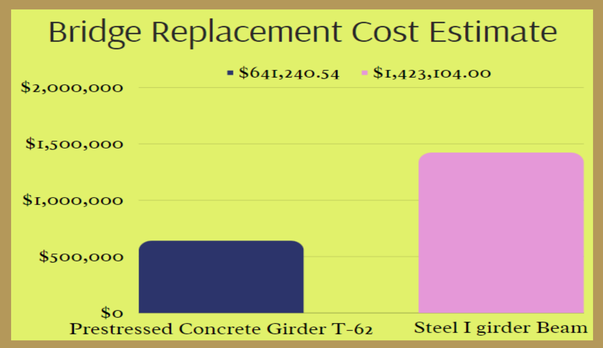
Roadway Model of bridge using Bentley Openroads Design.

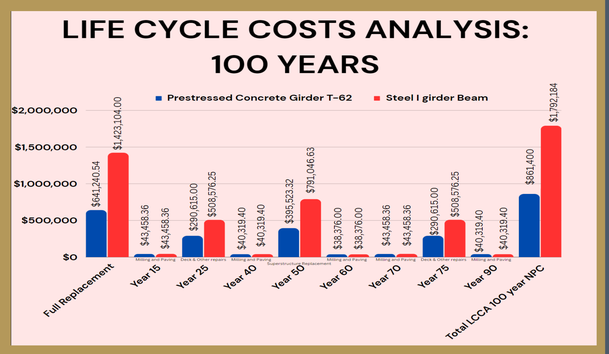
Elements of Design

Structural Analysis: Structural analysis is crucial as it evaluates the integrity and stability of our design, ensuring it can withstand various loads and environmental factors. This process helps identify potential weaknesses or flaws, allowing for adjustments to be made to enhance the safety and longevity of the structure. The PGSuper software was used to simulate mathematical models for the prestressed girder design.

Traffic Control Plan: A traffic control plan was developed to ensure the smooth flow of vehicles during construction activities, minimizing disruptions and enhancing safety. By outlining designated routes, signaling procedures, and work zone configurations, it facilitates efficient coordination between workers and the public, reducing congestion and potential accidents.

Capital and Life Cycle Costs Analysis





Bridge Replacement Cost and LCCA was estimated by Price bid items in TxDOT website.

Constraints & Standards

The Group used these following constraints and standards for the bridge design.

Constraints:

- Economic
- Time
- Risk and Resources
- Project Quality

Bridge Standards:

- TxDOT Bridge Guidelines
- AASHTO Roadway Guidelines
- TxDOT Bridge Manual for Bridge Evaluation

Sustainability Evaluation

The Envision framework was chosen since its evaluation system is designed to evaluate and award points toward sustainable infrastructure projects. Not only, does this framework assess sustainability, but evaluates the social, economic, and environmental aspects of each alternative. Based on this evaluation system, the first alternative obtained **37%**, while the second alternative obtained **35%.** Of the four levels of achievement from the Envision framework, both alternatives received a silver level of achievement.

Team Picture

Brie D. Luis H. Jazmin M. Rawand A.

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