

The railroad tracks in Tuscaloosa, Alabama cross many roads in and out of the University of Alabama's campus and surrounding community. Not only do students use these roadways, but commuting professionals, and people driving to our basketball stadium Coleman Coliseum use these roads too. Figure 1 shows a proposed overpass over train tracks for Tuscaloosa, Alabama where I attend school as an undergraduate engineering student. Figure 2 is an artist's rendition of the proposed bridge.



Figure 1: *Proposed bridge overpass*



Figure 2: *Artist's rendition of proposed bridge overpass*

An estimated 80,000 vehicles will have an alternate route once this overpass is built (Morton, 2018). This is particularly useful project since blocked roads from stalled railroad cars cause traffic jams lasting “unreasonable amounts of time” multiple times during the year, sometimes even more than once a day (Taylor, 2017). The City of Tuscaloosa has begun to ticket

trains who sit still for more than five minutes, but this has not made a noticeable difference. In addition, students traveling on foot or bicycle do not have another way around the stopped train. Many students resort to climbing over the train between the railway cars to get to class or meetings on time. A significant number of students were climbing between the railway cars in 2017 when the University of Alabama sent an email to all students highlighting the dangers of doing so. A critical overpass such as this project is needed to improve traffic, safety, and the general well-being of our community.

It is also clear that repairs to this overpass would not only interrupt future traffic flows, but also trains trying to run on a set schedule and the surrounding transmission lines. Taking these variables into account, the engineers should have picked a material that could stand the test of time. Instead, concrete columns and caps in addition to precast concrete beams will be used. Generally, this material is fine, but when compared side by side to hot-dip galvanized steel it does not fair well.

Bridges utilizing the hot-dip galvanizing process were the focus of at least five of the videos provided. From this information, I propose that the Second Avenue road and bridge project change their material of choice to steel which can be hot-dip galvanized.

All the videos suggested similar benefits of hot-dip galvanizing, but we will focus on the advantages relative to this road and bridge project. The Irondequoit Bay Seasonal Outlet Bridge video mentioned that galvanized steel is good for locations with humid conditions, it is long lasting, it protects the steel, and is not as much of an environmental concern as other coating processes. Focusing on the humidity, we can see that the humidity levels for Tuscaloosa, AL are similar to Baltimore, MD where the Inner Harbor Water Wheel and M&T Bank Stadium are located. I was lucky to grow up in Maryland and watch countless Baltimore Ravens football in this stadium. The Inner Harbor Water Wheel is nationally recognized as a wonderful example of sustainable engineering practices. Moving forward, Table 1 shows the relative humidity of both locations:

	Max (%)	Min (%)	Average (%)
Baltimore, MD	86	23	54.5
Tuscaloosa, AL	77	31	54

Table 1: *Percent relative humidity in Baltimore, MD and Tuscaloosa, AL for March 26th, 2019 (NOAA, 2019a) (NOAA, 2019b)*

While the range in Baltimore is larger, the average humidity is similar. These numbers are significant because the mechanical properties of concrete change with humidity levels. As moisture levels in the air increase so does the moisture level in the concrete. Increasing moisture content was inversely proportional to strength of the concrete and the modulus of elasticity (Shoukry, 2009). If a bridge is to possibly support 80,000 vehicles, then it's strength should not be compromised by using concrete in an area with high levels of humidity.

Furthermore, hot-dip galvanized steel is resistant to corrosion. This is also important when looking at places with a lot of precipitation and high levels of humidity. During the Stearns Bayou Bridge video, it was mentioned that the bridge has not accumulated any rust. The same was said for the Alley Cat Trailer. Grand Haven, MI is the location of the Stearns Bayou Bridge. Powhattan, KS is the location of the Alley Cat Trailer. These two towns have almost the same or fewer number of days with precipitation than Tuscaloosa, AL. Grand Haven has 115 days on average, Powhattan has 82 days on average, and Tuscaloosa has 114 days on average (Grand Haven, Michigan, n.d.) (Powhattan, Kansas, n.d.) (Tuscaloosa, Alabama, n.d.). Again, another similarity between locations successfully utilizing hot-dip galvanized steel and Tuscaloosa. From this, we can hypothesize that an overpass constructed of galvanized steel would not accumulate any rust.

Bridges of Stark County Galvanized Steel Study and Frederik Meijer Gardens and Sculpture Park both discussed that they have had to perform little to no maintenance on their projects. The only maintenance in the Frederik Sculpture Park video was that the pipes were drilled to allow condensation to drain. This was not even a structural repair. Bridges of Stark County said, "the steel structure itself has been basically untouched since its initial construction."

Concrete bridges require maintenance within the first 11 to 20 years of life (Ainge, 2012). If the bridge was constructed in 2019, 11 years would make it 2030. Between 2020 and 2030, Tuscaloosa County's population is expected to increase by almost 18,000 people (Census Bureau's State Data Center, n.d.). If the bridge could redirect 80,000 people currently and then a percentage of the 18,000 additional people, it would be horrendous to perform maintenance. Hot-dip galvanized steel is again a clear winner for the Second Avenue bridge construction material.

Finally, Reiman Gardens Conservatory and Charlotte Douglas International Airport Parking Decks both touched on the aesthetic advantages of using galvanized steel. Reiman

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Gardens Conservatory was able to work with delicate designs and the parking decks at this airport now have a wow factor. Aesthetics are important when people look not only at their surrounding natural environment, but at their built environment as well. This overpass could be a more functional and attractive structure if the material were to change from precast concrete to hot-dip galvanized steel.

Resources Used

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