# Karl Stirner Arts Trail Bridge Restoration

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# INTRODUCTION

## The Karl Stirner Arts Trail

Since its opening in 2011, the Karl Stirner Arts Trail (KSAT) has brought the Easton community together through the connection between culture and nature. The trail is 2.5 miles long, is located along Bushkill Creek, and includes a bike trail and dog park. The trail route follows the creek to Third Street and ends at Lafayette's downtown arts campus. The trail was named after renowned sculptor Karl Stirner, an Easton native who ushered many up-and-coming artists into the city for several years. According to the official trail website, "the Karl Stirner Arts Trail is dedicated to advancing civic dialogue and infusing the community with creative capital, so as to bolster economic revitalization and foster civic and cultural pride" (Karl Stirner Arts Trail, n.d.). The KSAT not only aims to celebrate Easton's commitment to the arts, but also desires to stay focused on environmental sustainability and public stewardship.

Figure 1: 'Arch for the KSAT' at Karl Stirner Arts Trail (Price-Williams, 2018)

The Karl Stirner Arts Trail is one of many active and passive parks throughout the city that range in size and exemplify the area's values of community and identity.

According to The City of Easton's main website, "active parks are parks which have an established piece of equipment, court, or field in which to play or recreate. These are designed for families to play and enjoy the outdoors" ("City Parks" n.d.). Several of these active parks have landscaped fields, basketball courts, and playgrounds for children to play on. Passive parks "provide a bench or seating on which you can relax. There are no set pieces of equipment for play," but there are different forms of art and history such as statues or memorabilia that are showcased in these areas, which is exemplified by the trail ("City Parks" n.d.). Along the KSAT specifically, there are many art installations created by local artists. The most notable art piece is a red arch sculpture created by Karl Stirner himself that serves as an entryway into the trail (Figure 1). Art has become an important part of Easton's identity as it has enticed locals and outsiders of all ages to come and enjoy scenic exhibits. The emergence of the art scene and its influence on the community are discussed further in the social context section of this report.

**The Current State of the Bridge**

The Karl Stirner Arts Trail is currently looking to expand its footpath by integrating a bridge that crosses the Bushkill Creek near the Simon Silk Mill. The KSAT has recently acquired an inactive railroad trestle that was originally built in 1924. The KSAT Commission intends to expand its footpath to make the Bushkill area a more desirable and popular place for people to go. A problem that our project must address is that pedestrian access on the bridge is currently restricted due to barriers in on either end. Although the bridge is structurally secure, there are no railings, it is currently overgrown with vegetation and covered in debris, and the wood deck is rotting making it unsafe for trail use (Figure 3). While the trail incorporates several, various art installations, the

bridge was not constructed with the possibility of it evolving into a creative space. Therefore, it currently has no design significance to the trail or surrounding community. With these problems in mind, our solution must address the bridge utility while seamlessly integrating it into the artistic atmosphere of the trail.

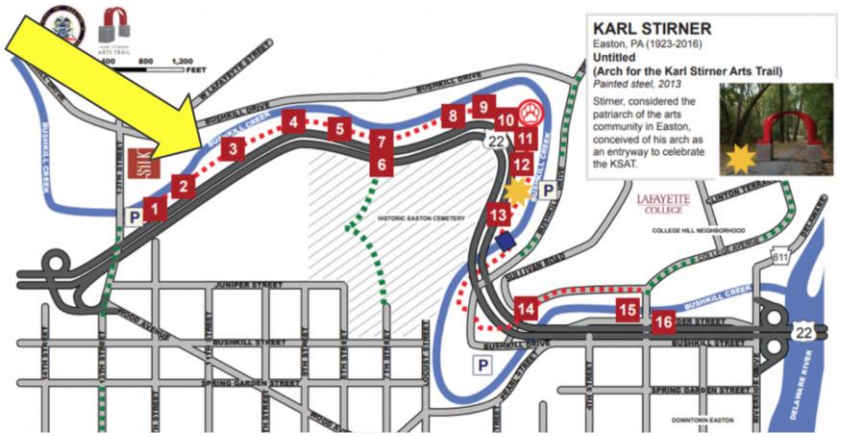


Figure 2: Map of KSAT with arrow pointing to location of bridge (Karl Stirner Arts Trail, n.d.)

Figure 3: Current state of the bridge (Bresswein, 2019)

**Project Background**

In the Fall 2019 semester, our team generated several proposals to introduce artistic elements into an addition on the bridge. Initially, we considered making the addition a work of art in and of itself that would invoke the surrounding area's nature and culture. We also contemplated adding a covered exhibition space for rotating installations. As our research and design work has evolved, we determined that the KSAT board should ultimately decide artistic utility of this structure. As a result, our team compiled a portfolio of design options to be reviewed by the KSAT's Board of Directors as a prompt to further integrate historical and artistic contexts in the bridge rehabilitation. We discuss these in greater detail in the technical analysis section of this report. These designs represent our desire to infuse cultural and community aspects while emulating and maintaining the themes and values of the Karl Stirner Arts Trail.

Some potential challenges to the trail expansion include funding and material costs for the bridge addition, the extent of Lafayette College's involvement, future maintenance of the bridge, and the constraints of its current structural integrity. To advance our design concepts, we made a set of guiding assumptions that future researchers will have to revisit: We assume the maintenance and ownership of the bridge will be a joint effort between KSAT and Lafayette College. Though the distribution of work between these two entities is currently unknown, we will assume KSAT holds most of the authority. Lafayette will then be, in part, responsible for policing the area due to the provision of an environmental studies site implemented in the nearby area.

**Community Contacts**

To mitigate these challenges, our team contacted members of the trail's Board of Directors. This group "includes city officials, members of Lafayette College and art experts. It receives funding from donors and through an annual art auction" (Gordon, 2015). Included in the board are two Lafayette art professors Edward Kerns and Jim Toia. They provided critical information regarding the artistic aspects of the trail and the possibility of enhancing the bridge to unite the pathway. We drew from research that civil engineering professor Michael McGuire's class conducted in 2016 which includes a LIDAR analyses of the site. This research provided us with a greater understanding of the technical aspects of the bridge. We also contacted Dave Hopkins, the Director of Public Works for the City of Easton, who explained the current and possible future ownership of the bridge and surrounding land. Finally, we produced prototype designs and cataloged all necessary materials to create a cost-benefit analysis that are explored in depth in the technical and economic analysis sections of the following report.

**Community Engagement**

This trail expansion is being championed by the KSAT Board of Directors and Friends of KSAT. Therefore, we must have active engagement with those community members interested in furthering the mission of the trail. For effective community engagement, it is important to make sure that people's voices are heard and that they are involved in the design process. One of the main principles of the Engineering Studies curriculum, effective community engagement, is the result of engineers maintaining the community as a focus within every project. Engineers should follow the community-centric model of engineering and sustainable community development which "implies

that development and engineering should be for and about community and that sustainability will not happen without community's self-determination and ownership of projects" (Lucena, Schneider, & Leydens, 5). Exemplifying this ideal, future groups should engage the community in an equitable, open dialogue about the proposed project and ensure that the Easton community will benefit from this trail addition.

Ultimately, the improvement of this bridge aims to unify the area and local communities by providing a designated place on the trail dedicated to celebrating the history of Easton and the importance of local art. Our project is unique in that the technical aspects of this problem have already been addressed in a previous civil engineering capstone course. Specifically, this report's scope focuses on the bridge's future social impact in the community and its intersection with various contexts including social, political, technical, and economic contexts. The social and political contexts focus on the non-technical aspects that would be incorporated into the design of the bridge addition as well as its process of implementation, while the technical and economic analyses examine the materials, mediums, and costs that could be utilized in carrying out our team's vision. By emphasizing these aspects, it will ensure that the bridge has a meaningful and lasting impact on the Easton community.

## SOCIAL CONTEXT

The Karl Stirner Arts Trail is an intersection of community, culture, heritage, and artistic expression. Therefore, this project will engage local culture with respect to Easton's history and critical events, the Lehigh Valley's industrial corridor and heritage, and the city's recent advocacy of modern arts. The problem this project seeks to resolve is the bridge's lack of design components that would evoke these values. "Knowing as

much as possible about the history and socio-cultural realities of people in and around the community… is vital to project success" (Lucena et al., 126). The bridge would then be secondary to the influential community works showcased within. These art pieces would likely represent a broad sampling of Easton's heritage and culture.

**The Lenni-Lenape Tribe**

The bridge crosses the Bushkill Creek downstream from the Simon Silk Mill complex. The creek then flows roughly 40 miles downstream into the Delaware River. Originally, the Delaware River Basin was controlled for over 10,000 years by the Lenni-Lenape Tribe who have historically resided in New Jersey, Delaware, southern New York, and eastern Pennsylvania, until European settlers claimed the land. Our concepts for the future bridge thus follow from the historical character of the Lenape as being peacekeepers who are known for mediating disputes between neighboring tribes. ("The Nanticoke Lenni-Lenape," 2007).

Considered the "grandfathers" or "ancient ones" by surrounding tribal nations, the peace-loving Lenni-Lenape have persevered through the trials of colonial intrusion, proving their resilience and maintaining their roles of the Delaware River peace-keepers. Every four years since 2002, the Lenape people have signed the Treaty of Renewed Friendship. The Lenape Tribe and several organizations "including environmental groups, churches, historical societies, and sincerely committed individuals, who wish to actively support the Lenape culture and to help sustain their people, language, and way of life", come together and celebrate renewed brotherhood ("Rising Nation River Sojourn", 2018). The Lenape Tribe ventures on a "historic and monumental three-week canoe journey" down the Delaware River prior to each signing. Their canoe journey **"**is a joint

effort to raise awareness, awaken the spirit, and bestow the past, environmentally, culturally and historically, to the future" ("Rising Nation River Journey", n.d.). The Lenape people desire to defend and protect their traditions and beliefs while putting the past behind them.

However, many do not know of the rich native heritage found in the river corridor. Their efforts to preserve the native heritage and have residents of the area acknowledge the history and valiance of the Lenni-Lenape tribe proves to be a great foundational context of the Lehigh Valley. Just as the bridge addition intends to expand the trail and increase foot traffic and viability of the trail, this project will also bring awareness to the often forgotten or ignored history of the Easton area. Future advancements on this project should involve the active tribal government to accurately symbolize and adorn the Lenape history depicted on the bridge. The Lenape people were the metaphorical bridge between native establishments and colonial expansion, as well as the connection between the land and humanity. Thus, it is important that their role in society be included in the design of the addition.

**American Patriotism and the Founding of Lafayette College**

Another relevant historical context is the abundance of American patriotism as a result of Easton's role in early colonialism. Prior to the American Revolution, English colonists impacted existing Delaware societies by enforcing the Lenni-Lenape resettlement. In 1736, Thomas Penn and Surveyor General Benjamin Eastburn selected the land at the connection of the Delaware and Lehigh Rivers as a desired settlement location (City of Easton, 2019). The once called "Thousand Acre Tract" of land became void of native people through the Walking Purchase of 1737 (Samuels, 2006). In the

1750s, William Parsons and Nicholas Scull began the task of finding a permanent town and fell upon the plot of land called “Lechanwitauk” or “the Place at the Forks” by the indigenous tribes. From then on, the city of Easton served as the set of many historical events in the early years of the revolution. The Great Square, now known as Centre Square, became notorious as a trading post for residents and travelers, and served as one of three sites where a public reading of the Declaration of Independence took place on July 8, 1776 (City of Easton, 2019). That historic event is celebrated as Heritage Day, and Centre Square continues its tradition of being a place of gathering.

Culminating with present-day Easton serving as what many call a “college town”, the establishment of Lafayette College serves as a pinnacle historical event in the timeline of the city. Named after the influential French general, Marquis de Lafayette, Easton resident James Madison Porter founded the idea of an institution aimed to create a curriculum of military science and tactics as well as “various other branches of education, including the German Language” (Lafayette College, 2019). The college charter was signed on March 9, 1826 and it was not until 1832 that the College purchased nine acres across Bushkill Creek. That May, classes of 43 students began in a rented farmhouse on the south side of the Lehigh River. Two years later, the college built its first building on the summit of the hill; the building is now incorporated into South College. The founders of the college deemed three fields of education a priority: English, mathematics, and civil engineering. “The resulting — and ongoing — union of arts, sciences, and engineering remains perhaps the most distinctive feature of the Lafayette curriculum,” (Lafayette College, 2019). This unique dynamic of the technical and artistic skills proved to be a milestone for the future infrastructure of the Lehigh Valley heritage.

**The Industrial Revolution in the Lehigh Valley**

The Industrial Revolution's legacy in the Lehigh Valley were and still are extensive and prevalent today. During the peak of the Revolution, "a railroad once existed along present-day Bushkill Drive" (Blood et al., 15). The trestle bridge detailed in this report was constructed in 1924 by American Bridge Company as part of this system "and the superstructure was originally manufactured by Easton Foundry and Machine Company (Reeve et al., 2016). "The trestle bridge is the only remnant of the rail system in the [Bushkill Corridor] and is a valuable artifact to the industrial history of the area" because it "carried trains over the creek" (Blood et al., 15). Our team ensures that aspects of the Industrial Revolution are featured within the bridge addition.

The railroad system was prevalent in the Lehigh Valley supplementing the fast paced expansion of anthracite coal mining. The railroad dominated over the canals in the Lehigh Valley and across America because of its lower costs and higher efficiency. "Originally chartered in 1846 to be a transporter of anthracite coal from the vast coal fields of Pennsylvania, the Lehigh Valley Railroad grew into a major carrier of both freight and passengers between Jersey City, New Jersey, and Buffalo, New York" ("History", n.d.). Over the next few decades, the railroad expanded dramatically by 1,800 miles of track and like the canal, it caused an increase in population and brought economic growth (Halma & Oplinger, 2001).

Figure 4: Lehigh Valley Railroad (Lehigh Valley R/R engine Easton, n.d.)

Anthracite coal mining operations expanded to make iron, which became the leading industry in the Lehigh Valley. “In 1840, [David Thomas] built the Lehigh Crane Iron Furnace, the first commercially successful anthracite-powered iron furnace in North America” (“Thomas Iron burned bright for 88 years”, 2005). The largest iron company in the United States, Bethlehem Iron Company, was established in Northampton County, opening several furnaces along the railroad in Easton and Bethlehem.

Steel was the most notable industry in the area throughout the 19th and 20th centuries. Charles M. Schwab, an American steel magnate, modified the already existing Bethlehem Iron Company and made it into Bethlehem Steel in 1904. This local company’s goods spanned the country in some of the most influential structures and monuments in our nation’s history. In the 1920s, “Bethlehem Steel's chief engineer said “Bethlehem Steel owned New York” [as] parts of the Empire State Building, Waldorf Astoria hotel, Madison Square Garden and Rockefeller Plaza” were all created with the help of this company (Coughlin, 2015). However, once competitors started creating steel at a lower cost, the company could not keep up with business and closed its Bethlehem facility in 1995 (Halma & Oplinger, 2001). Bethlehem Steel’s legacy carries on in the Lehigh Valley. In 2011, the home plant of Bethlehem Steel became a place named

SteelStacks that is dedicated to arts, culture, and community events. “Rather than demolish the historic mill or walk away and let it fall apart, the community rallied around the iconic plant, working hard to bring new life to the former industrial giant” (“What is Steelstacks?”, n.d.).

Figure 5: Bethlehem Steel Company (Radzievich, 2018)

The iron and steel industries played an indirect role in the rise of the silk industry in the Lehigh Valley. “Workers coming from Southern and Central Europe who were willing to work for low wages in these basic heavy industries also brought with them knowledge of the skills in the textile arts” (Lehigh Valley Silk Mills, n.d.). The Valley’s prime location between Philadelphia and New York City also contributed to the growth of the industry and by, “the turn of the 20th century, the Lehigh Valley was the world's second-largest producer of silk, with the industry becoming Allentown's largest employer in the late 1920s” (Kneller, 2015). Just one of many silk mills in the area, the R&H Simon Silk Mill, now known simply as the Simon Silk Mill, was located in Easton along the Bushkill Creek overlooking the KSAT.


Figure 6: R&H Simon Silk Mill (House on College Hill, 2013)

This thriving factory was established in 1883 by Robert and Herman Simon and was the city's first economic development initiative. "According to a historical sign on the Karl Stirner Arts Trail… the facility had an initial workforce of 250 before rocketing to 1,060 in 1899 following an expansion" (Kneller, 2015). The industry soon died down with the onset of the Great Depression, competition in the south where there was cheap labor, and the popularity of synthetic fibers that were less expensive and labor-intensive to make (Alderfer, 2018). Since their closing, many former mills in the Lehigh Valley have transformed into apartment buildings and the Simon Silk Mill is no exception. After being vacant for about thirty years, the Easton Redevelopment Authority purchased the property in 2006 with the intention of keeping the original character of the mill but revamping the inside to spur reuse. In 2015, the construction of this redevelopment project began and the completed complex now consists of apartments and small businesses, "making it a unique and dynamic community" (Alderfer, 2018).

Figure 7: Simon Silk Mill today (Apartments.com, n.d.)

The Simon Silk Mill has made a conscious effort to make connections, both literally and figuratively, to the Karl Stirner Arts Trail since its redevelopment. The idea of a pedestrian bridge connecting the trail to the complex has been pursued for several years.

Another industry in the Bushkill Corridor was the Rinek Cordage Company on Bushkill Drive. This local family business was founded in 1840 and became influential to the history of Easton ("Living History", n.d.). Rope created "was sent to the Panama Canal, among other places," making it a well-known and successful company (Tatu, 2017). The company's site is now owned by Lafayette College as part of the school's expansion efforts.

These historical and industrial contexts are critical to our proposed designs, which are explained in depth in the technical section of this report. One of our main ideas is to have a local artist paint the walkway of the bridge to feature major milestones in Easton and the Lehigh Valley's history. Also, by incorporating characteristics of the steel and silk industries into the bridge's railings, other of our designs will pay tribute to these significant, local manufacturing institutions.

**Celebrating the Arts in Easton**

The arts are also an important part of what makes Easton unique. Local bars, restaurants, and shops have made Easton somewhat of a destination spot, which, in turn, has helped to publicize the local art scene (Higgins, 2015). For instance, several of these businesses show off art pieces made by local artists. Because Easton is located relatively close to both Philadelphia and New York City, it has been a popular area for artists to live and work in.

In addition to the Karl Stirner Arts Trail, Easton has several outlets for artistic expression taking the forms of studios, shops, the Easton Mural Project, the legacy of the Crayola Company, and the Arts Community of Easton (ACE). Founded in 1999, ACE's creation came about from "artists, business owners, art institution representatives, and art lovers, seeking an organization for arts education programs, exhibitions, workshops, information dispersal, and networking" ("About", n.d.). The mission of the ACE is to promote the arts and foster an appreciation of the arts within the city. This organization also aims to enhance the quality of life in Easton by holding events and programs that bring the community together to get involved in art. One event that ACE promotes is the Riverside Festival of the Arts. This festival started in 1997 before ACE's founding by artists in the area as a way of gathering the community to the scenic riverside area and convening over a shared interest in art. The event has grown considerably and become very popular since it began, with more artists, artisans, musicians, and other talents coming each year ("About RFA", n.d.).

One of the most visible aspects of Easton's artistic expression is the city's growing number of murals as a result of The Easton Mural Project's beautification

efforts. The Easton Mural Project is a “collaborative effort” between the owners of the art gallery Brick & Mortar and Easton Main Street Initiative which aims to revitalize the downtown area (“Mission Statement”, n.d.). The Project’s mission is to create murals in downtown Easton with the purpose of improving Easton’s “visual landscape” and creating “opportunities for the promising artistic community” (“Mission Statement”, n.d.). Eventually, the goal is to expand these efforts beyond just the downtown area into the other Easton neighborhoods. The existing Easton murals are prominent and provide colorful, aesthetic enrichment on every surface they adorn.

Much of Easton’s tourism is attributed to The Crayola Factory. Opened in 1996, the Factory became an interactive museum with creative activities for families. “The wildly popular attraction has had more than 5 million visitors since it opened as the Crayola Factory [more than] 20 years ago on July 16, 1996” (Miller, 2016). Prior to this attraction, the downtown area had been deserted as it was not particularly safe and had nothing to offer. “One Crayola executive said the international leader in art supplies didn't hesitate to locate in Centre Square Easton despite the bleak economic picture” (Miller, 2016). In a way, Crayola was proof that if this large company could be successful in downtown Easton, then other businesses could be as well. Crayola contributed greatly to the city’s turnaround (Miller, 2016).


Figure 8: Crayola Experience in downtown Easton (Lauer-Williams, 2016)

Our team believes that Crayola should be included in our bridge addition design in some capacity because of its immense impact on Easton. Crayola has brought an influx of other businesses to the downtown center, and its ability to foster a love of art in people of all ages is significant. Additionally, this entity is a strong example of the industrial and artistic culture of the city and local society.

These historical entities are important to the effectiveness of our project because one of our main goals is to accurately and proudly display the history and legacy of the Bushkill Corridor. By incorporating depictions of these organizations, the bridge can directly educate trail users while showing an appreciation of who and what allowed this city to evolve into the artistic mecca it is.

## POLITICAL CONTEXT

Our project encompasses several political dimensions. They include the following: Lafayette's involvement with the land development leading to increased expansion concerns, decisions regarding the structure of the addition, the subsequent role artists will play in the addition, and any relevant legislation and policy for the reconstruction. These aspects comprise the political context and will shape the discussion that surrounds the bridge expansion project, leading to a larger, overarching exchange of ideas between Lafayette College and the Karl Stirner Arts Trail.

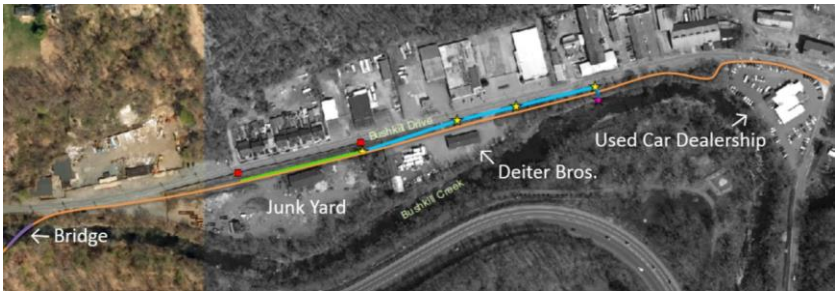

Figure 9: Aerial view of surrounding land near KSAT (McGuire, 2016)

The full extent of the KSAT expansion encompasses both the renovation of this bridge and the development of the land across the river for the extended trail path. The scope of our project is to conceptualize what form the addition to the trestle bridge might take, while also assessing what legislation or zoning policies are required for the implementation of the addition. Our team is not involved with the land acquisition and subsequent development; however, we are working under the assumption that ownership will be controlled by KSAT in conjunction with the City of Easton's Public Works Department and with support from the College through research, student involvement, and community engagement projects.

**KSAT and Lafayette College's Relationship**

Lafayette College and the KSAT have a close relationship which is apparent through the trail's current configuration of their board and advisory committees. There are four separate groups involved with KSAT: KSAT Inc. Board of Directors, the KSAT Arts Advisory Council, Lafayette College Advisory Group, and Friends of KSAT. The Lafayette College Advisory Group includes thirteen professors and faculty members across eleven departments. Two Lafayette art professors, Jim Toia and Edward Kerns, serve on the KSAT Inc. Board of Directors as Chairman and Vice Chairman respectively (Karl Stirner Arts Trail, n.d.). Friends of KSAT, a 10-member board as of 2017, is a group of volunteers that assist in trail clean-up and other events.

This positive relationship between the Karl Stirner Arts Trail and Lafayette has resulted in a number of collaborative projects, such as previous Engineering Studies capstone projects relating to the trail's potential foot-bridge additions, and the interactive musical playground that was implemented in 2018 (Cohen, Kong , Malloy, & Sangster,

2018; Bart-Addison, Geraghty, Kyler, & Rack, 2016). The musical playground installation became a success after three years of work in the capstone class and also in another course called Sustainable Solutions (Sanchez, 2018). Its quick implementation was made possible, in part, by Friends of KSAT advocating for the project. In the future, we think whoever carries on this bridge addition project should seek assistance from this group in getting the brunt of the work off the ground. The relationship between the college and KSAT has been beneficial for the artistic and cultural enrichment of the Easton community. It has also provided a powerful learning experience for Lafayette students, as resulting projects have mostly been successful.

Lafayette has preliminary plans to use land across from the bridge on Bushkill Drive as an environmental studies satellite facility. The college will likely be heavily involved with these development efforts, which could exacerbate concerns over Lafayette's expansion. Although its involvement with the trail has represented a positive involvement within the Easton community, Lafayette's expansion plans have provoked negative outrage and opposition from outspoken neighbors of the college (White, 2018). "The mixed-use project [on McCartney Street] has sparked two big concerns among residents: They said they have no idea why Lafayette buys property and they don't know how much more it wants to own in the future" (Tatu, 2018). The Easton community might oppose Lafayette managing a project away from campus that does not directly have to do with the school. These concerns will probably have no measurable effect at this early stage of this bridge project, but it could possibly impact future continuations or other efforts to renovate the bridge. Thus, it is a relevant, political consideration that should be acknowledged by future key players in this project.

Considering Lafayette's plans in the area, it is appropriate to extend the emergency phone system, similar to the Blue Light System, from campus onto the trail. This decentralized security system uses a network of telephone terminals placed at strategic points around Lafayette's campus to quickly connect people in need of help from Public Safety. "The phones are equipped with red emergency buttons for direct connection to Public Safety for police, fire, or medical emergencies and a keypad for dialing any campus number." (Emergency Phones, n.d.) This emergency phone system works well for providing the ability to contact an authority and giving the area in which they are located the appearance of protective oversight. Over the course of the trail's existence, there have been several accounts of crimes including burglary, gunfire, and deaths in the surrounding area. KSAT could benefit from implementing Lafayette's iteration of the Blue Light System to encourage use at odd hours of the day while maintaining a sense of visitor safety greater than what the trail presently has without any system in place. This suggestion might serve as an adequate olive branch to quell concerns raised about Lafayette's increased involvement in that area.

Acknowledging Lafayette's desire to expand near the bridge raises questions of ownership, the site's planned use, and the need for structures connecting it to other areas. The Director of Public Works for the City of Easton, Dave Hopkins revealed that KSAT currently owns the bridge and the land across from the trail, while the Department of Public Works will manage the bridge renovation and addition once the project progresses to that point. He noted that the property acquisition is still in motion and "will occur before 12/31/19" (Appendix 1). It is difficult to specify an exact timeline at this moment so early on in this endeavor. Eventually the property will be purchased, funding will be

secured, and then the focus will shift towards design. The limitations of the addition's structure will come into play here.

**Selecting Artists and Works**

Our designs either make the bridge into a work of art in and of itself or transform it into a multi-purpose space for exhibitions or installations. The ramifications of these designs as they pertain to the decision of artistry falls within the political context. Our designs are conceptual outlines of the themes, values, and facets of history to be considered when creating work for this creative trestle space, or work that will become the space itself. Once the project and acquisition have progressed, the Karl Stirner Arts Trail's Board of Directors should consider whether the bridge addition should be a standalone work or a shifting exhibition space. Once decided, the next choice will be which artist(s) will design and finalize the specifics of the space.

Our team met with Jim Toia and Ed Kerns to discuss the board's process for acquiring artworks to display on the trail and selecting artists to feature. Typically for public organizations, art procurement processes take the form of a competition where artists submit work to be judged against one another. Professor Toia explained that KSAT's art procurement operates more through individual selection rather can competition. Usually, the board will identify a space on the trail in need of a sculpture and then search for an artist or specific work — with expressed values and principles that are well-aligned with the trail — in order to fill that space. Other times, members of the board might stumble across a sculpture or an artist they feel the trail would greatly benefit from, so they contact them to procure and display it. In both cases, the artist and artwork are specifically selected to be presented within the trail rather than the trail

accepting submissions from any multitude of artists in the hopes of being chosen. In either case, after the artist or work has been identified and interest in the trail on their end is confirmed, then it becomes a question of funding. This means funding becomes a back-end consideration that is acquired through grants and private donors on an as-needed basis. The question of funding is discussed further in the economic analysis section of this report.

Ultimately, the artists and laborers that the KSAT Board employs will have the final say on the exact appearance of this bridge. However, their future creative freedom will be limited by the impending decisions made and will culminate in the selected range of artistic choices made available to applicable participants. This is to say that any decision made regarding the form of the bridge addition will impact the resulting artistry of the bridge itself or the artistry available through the bridge's role as mini-museum or metaphorical pedestal. Virginia Abbott, an artist from Bucks County who proposed an idea in a competition held by KSAT thought the voting process was "'really nicely done for the community…because they're having the local community vote on what goes onto the trail. It's their property, so it's what they're going to end up seeing'" (Gordon, 2015). According to Toia, the trail is "a living museum. It's something that will continue to change so that every time a viewer comes, each season there will be new work to look at" (Gordon, 2015). Our team envisions a bridge design that will be a permanent addition to the trail and maintain an everlasting reflection of the heritage of the surrounding land despite the fleeting nature of some other exhibits.

Although the KSAT Board has an extensive history of curating artists and works to display, if they seek other sources of information in excess of this document to guide

them in their development of this new bridge addition, there is a consulting firm local to Easton that specializes in creative placemaking. Metris Arts Consulting is a company that evaluates art installations and their impacts on the local community. Their research primarily focuses on gathering data and creating metrics that allows them to “address the potency of creative expression to embody and motivate change in the context of community development, civic engagement, and justice goals” (Kidd, 2019). This interaction between the viewer of an artwork and the work itself should be aspired to if this bridge and the eventual creative space it becomes is going to benefit the community at large.

## TECHNICAL ANALYSIS

The Karl Stirner Arts Trail addition focuses on the connection between art and engineering in an effort to bring the Easton community closer. Being that his project is in its early stages of development, our team is able to propose several design options that could be taken into consideration as the trail addition comes to fruition.

### Assessment of the Current State of the Bridge


Figure10: Structure of the existing bridge (Reeve, Messer, Kulback, & Smith, 2016)

Before delving into the artistic aspects of the bridge addition and creating designs that aligned with our vision for the project, we utilized a technical report organized in 2016 by the civil engineering department led by Professor Michael McGuire. In this report, students concluded that the existing bridge is structurally sound through conditional examination in terms of both technical and economic contexts while establishing a rehabilitation proposition. The students who carried out this analysis were "motivated by the desire for greater connectivity between the several geographically separated areas in the City of Easton, as well as the need for sustainable and responsible infrastructure development" (Reeve, Messer, Kulback, & Smith, 1). The "Bushkill Team" believed that rehabilitating the bridge and creating a pedestrian corridor would yield many benefits to the community.

Figure 11: Structure of the existing bridge (Reeve, Messer, Kulback, & Smith, 2016)

This group performed a "technical analysis of the existing bridge… to determine its load capacity" in order to deem it safe for pedestrians to utilize "by performing a survey of the site, completing a Conditions Assessment Report, researching environmental considerations, determining key site characteristics, and obtaining plans from neighboring townships with similar projects" (Reeve et al., 1). According to the

report, the current state of the bridge can hold 30 kips and the Bushkill team's proposed modification would allow for an additional load of 5 kips (Reeve et al., 2016). Through a visual assessment of the structure, they noticed "varying degrees of deterioration" caused by overgrown vegetation and debris including "dirt, leaves… rust, small stones, and garbage" (Reeve et al., 13). According to the report, the "two spans, abutments, and central pier appear to be in fair condition after inspecting for corrosion, distortion, cracking, and section loss" (Reeve et al., 14). The students who worked on this project noted that if rehabilitated, this bridge would be able to support pedestrians as well as bicycles on it at a fraction of the capacity that was required as part of the railroad system several years ago. The group then used a structural analysis program to "check the shear and bending capacity of the structure at varying degrees of corrosion" (Reeve et al., 14). Their results yielded the conclusion that "for the current age of the bridge, all rates of corrosion yield a structurally adequate section" (Reeve et al., 29). If the bridge is rehabilitated in the future, it will be protected from additional deterioration. Regardless, "using the current observed corrosion rate, [the] bridge will have the structural capacity to bear the design loads" (Reeve et al., 29). The process of rehabilitating the bridge can help its current state and prevent further decay but is not necessary for future additions.

Figure 12: Build-up of debris (Reeve, Messer, Kulback, & Smith, 2016)

Expanding on the information provided in the 2016 report, we created designs inspired by the social contexts relevant to our project scope. While the bridge needs some structural work, such as refurbishing or replacing some components of the bridge, we believe our design options could be applied to the site as planned (Reeve et al., 2016). In the future, we intend students who continue to carry out this project will devise a maintenance plan for the bridge that minimally impacts any surrounding ecosystems and migratory paths of native species.

**Design Possibilities**

The goals of our design options are to unify the Karl Stirner Arts Trail and the local Easton community and propose the artistic concepts to be incorporated along the bridge. We present several designs that can be mixed and matched depending on the desired aesthetic, cost, and preferred purpose of the bridge addition. As stated previously, this addition could be an artwork in and of itself, or it could serve as an exhibition space for other artworks to be displayed. The Karl Stirner Arts Trail Board of Directors and future students working on this project will ultimately make those critical decisions. These students can add more detail to our designs once the identified purpose is formulated. In the following pages we identify possible feature options that should be considered when deciding upon the ultimate purpose of the bridge.

Three broad categories encompass the possible bridge features: flooring, railing, and roofing/enclosure options. It should be known that these features will vary in material and artistic style depending on the purpose, the specifics of the finalized design, and the artist appointed by the KSAT board to execute the selected design. There is also an assumed ‘minimal revitalization’ option within each of these categories that forego any

artistic elements and design aesthetics for the pure functionality of a bridge walkway (i.e. a standard pedestrian bridge).

Figure 13: Possibility for ‘minimal revitalization’ (Imajo, 2019)

In order for walkways to be utilized effectively, they would ideally be a smooth, flat, unobstructed surface upon which people may travel safely. The necessity of a new and improved walkway on the existing bridge stems from an obvious lack of any safe, unobstructed path. The current deck does not provide a continuous area to walk, making it inherently unsafe and unsuitable as a walking path. The walkway of the bridge represents one part of the revitalization project that must be addressed to become a usable part of the trail, and as such it is an area of conceptual design opportunity.

**Flooring**

The most intricate concept out of all our addition ideas is the flooring design on the deck of the bridge. Our team has taken to calling this idea “A Walk Through History” as it resembles somewhat of a timeline through the region’s historical events and prominent industries that are detailed in the social context section of our report. Our team does not have a concrete depiction of what this art form would look like because we have decided to leave that decision up to the artist that undertakes this venture. Not only is the

design itself up for interpretation, but the materials used in its implementation are also undetermined. Ultimately, the KSAT Board of Directors would have a say in which form becomes reality based on what best aligns with the values of the trail and the significant contexts behind the design. The floor design represents our team's effort to incorporate as many aspects of the social context as possible into the bridge addition. Should the KSAT Board of Directors decide upon the minimal revitalization option for the floor, these reflections of the history and heritage of the Easton community would no longer be present in the bridge. We would then recommend incorporating these reflections of the social contexts into the other feature categories, which are detailed below.

Because this project focuses on the bridge over the Bushkill Creek, our team wanted to involve the concept of *flow* in some way. The artistic stylings of the work should incorporate elements of dynamic flow so there is a natural sense of belonging between the bridge and the inhabiting creek environment. These elements of flow could be achieved through the methodology of how the work is produced; the artistry employed for this project will bring their own individualized practices to the creation of this work and should seek to promote the dynamic pieces. An example of a mural that details this continual, fluid transitioning is one that Regan Kinney, a senior at Lafayette College, has been painting for "the Delaware & Lehigh National Heritage Corridor, a 165-mile multi-use trail that spans from Wilkes-Barre to Philadelphia" (Wilson, 2019). Kinney depicts "an idyllic moment from olde Easton: the canal, a donkey-pulled barge, farm, lumberyard, rolling hills, steel bridge, blast furnace, and railroad" (Wilson, 2019). While this mural incorporates several different aspects of Easton's history and the various industries that were prominent in the area, it does so in one continuous painting.

Continuity between the different historical aspects pertinent to Easton is a large part of our vision for flow within the floor option chosen to be carried out as part of the bridge addition.

Figure 14: Mural of old Easton (Kinney, 2019)

**Railings**

Another set of design options for this project addresses the lack of railings on the existing bridge. Railings are crucial to the rehabilitation of the existing bridge as a measure of safety because they will prevent people from falling off the side into the creek. Our team has conceptualized three main railing designs that incorporate the industries in the region that were most prominent: steel, rope, and silk. Our first design is a visual blending of the three mediums done either in a metal casting or with wood (Figure 15).

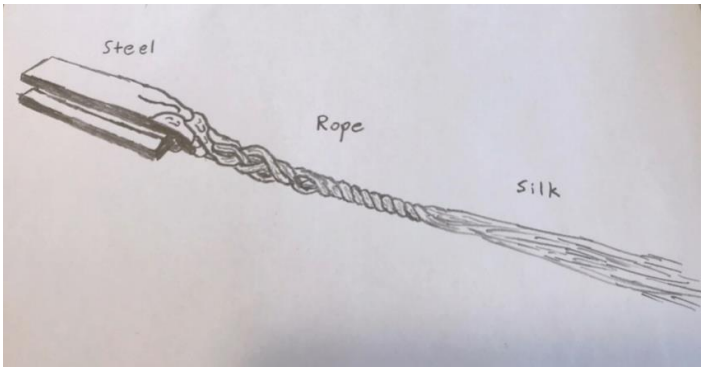


Figure 15: Materials blended together in one railing design (Condon, 2019)

The concept of flow is exhibited in this design through the fluid morphing of each material. If executed effectively this balustrade design might even seem to move. Because of the intricacy in this design, our team envisions only the top balustrade representing the blend of the three materials while the supporting balusters would be more standard in style.

Our second railing design option involves a plain balustrade held by uniform balusters sculpted to resemble steel, rope, and silk (Figure 16). Similar to the previous concept drawing, these supports could be created from metal or wood in order to ensure its stability and beauty into the future.

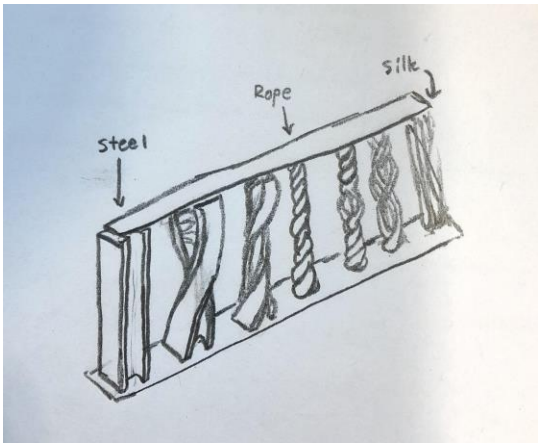


Figure 16: Materials as railing design (Condon, 2019)

This design also allows for the incorporation of flow and ample room for artistic freedom. Forms could be sculpted to appear as if they were transforming into one another across a gradient of materiality. The result would be aesthetically comparable to the previous concept in Figure 15 but would gradually change from one baluster to the next instead of continuously morphing into each other. For example, the steel I-beam could begin perfectly straight in the first pillar, have a slight twist in the second, and become even more twisted with every subsequent iteration until its form is comparable to rope. At that point the form would then 'be' rope for a few iterations and could appear to undergo a kind of unraveling into strands of silk.

The last railing design option would be more interactive than the previous two options, but it would also require more regular maintenance due to its utilization of less-weatherproof materials. This option, seen in Figure 17, uses the actual samples of steel, rope, and silk as different railing levels.

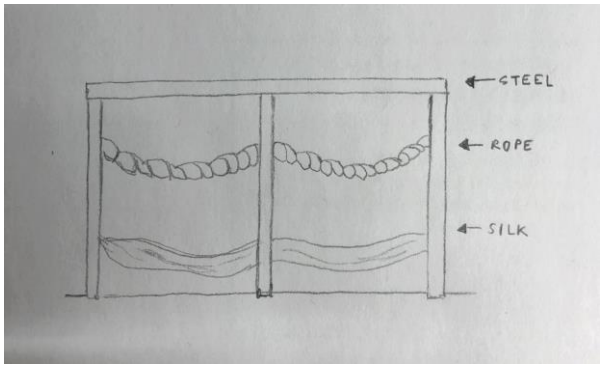


Figure 17: Materials as separate railings (Bossert, 2019)

The top balustrade would be steel followed by rope and silk in order. This option will highlight the dynamic visual and textural differences between the materials in a manner that encourages visitors to interact with them. The three distinct levels also allow

for visitors of all ages and heights to feel welcome on the bridge, as they can walk along supported by the railing that best suits their size.

**Roofing**

An additional purpose of this bridge is to serve as another entryway for the KSAT. Having a roof would be the preferred option to create a definitive entry space and serve as signage on either end of the bridge indicating an entrance of the trail. One design concept is a partially covered roof that would consist of an external metal structure, almost like a cage, to create an enclosed space (Figure 18). The space could then be used for exhibitions and outdoor artwork while protecting the displays from mild environmental interference.

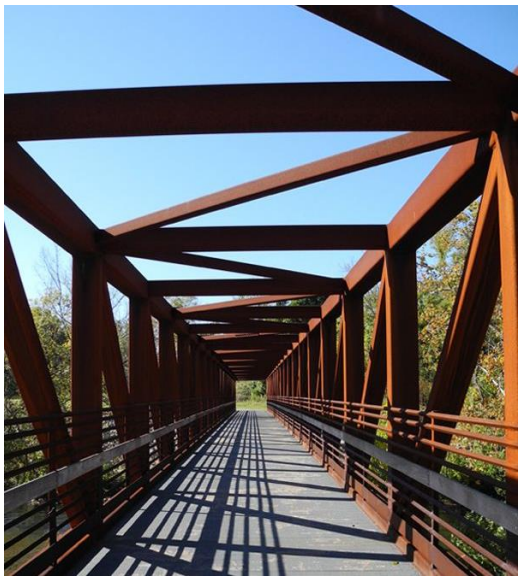

Figure 18: Partial Roof (“Wasena Park pedestrian bridge over the Roanoke River”, n.d.)

The second roof option is a completely covered walkway and exhibition space seen in Figure 19. For this option, our team considered having a fully enclosed longhouse inspired design, the general shape of which can be seen in Figure 20. It would be modeled as a longhouse with windows to allow more light into the space. This roofing

option would allow the space to be used as a traditional art gallery.

Figure 19: Space covered by complete roof ("Covered Bridges of Pennsylvania", n.d.)

Figure 20: Roof style of Lenape longhouses (Knapp, 2012)

The technical context of the bridge over Bushkill Creek consists primarily of our concept designs and the findings of the technical report provided to us by Professor McGuire, which has proven to be a valuable resource for the specific structural aspects of this bridge and its presence within the surrounding area. Our designs for the addition focused on integrating elements of the bridge's social context into the functionality of the bridge's to-be-decided purpose resulting in several design possibilities that could be utilized. One significant factor that will directly impact the selection of design possibilities chosen to be made is the cost of and funding for that decided design. We detail these considerations in the following section.

## ECONOMIC ANALYSIS

This economic analysis details the potential costs of incorporating various artistic components as well as the fundamental construction costs needed to refurbish the existing bridge. This refurbish/artistic rendering stage only pertains to the scope of the physical bridge itself and the area of land within the dimensions of the bridge. Acknowledging that the entirety of the addition's cost will need to be further elaborated in the future, this report will only discuss the known labor costs of refurbishing the bridge, the costs of

materials for each potential conceptual design, and the cost of zoning and design inspection applications. Values of each task are either provided by CE473 – Senior Capstone Design II 2016 Report, the Department of Agriculture, or calculated based on the average unit costs of desired materials. Calculated values were made using the known linear dimensions of the bridge: 160 feet long by 12 feet; the linearity skews the actual area value because there is a slight curve in the bridge, but that is not included. Therefore, the bridge surface area value used in all calculations is 1,920 square feet. The analysis will also address the benefits and disbenefits of each design alternative in four unique bridge components: preconstruction (including debris removal and bridge reconstruction), flooring, railing, and roofing.

| | Task | Average |
|---|---|---|
| Preconstruction | Debris Collection Apparatus | $ 1,500 |
| | Repair Bridge | $ 14,184 |
| | Abutments | $ 3,000 |
| | Deck removal | $ 1,000 |
| | Bollards | $ 1,400 |
| | Fencing | $ 1,864 |
| | Sidewalk Application* | $ 10 |
| | Crossover/Driveway Application* | $ 70 |
| Flooring Options | Asphalt | $ 7,104 |
| | Concrete | $ 52,858 |
| | Pre-stress Concrete | $ 47,117 |
| | Steel | $ 60,288 |
| Railing Options | Silk | $ 8,560 |
| | Nylon | $ 856 |
| | Rope | $ 2,400 |
| | Steel | $ 25,600 |
| Roof Options | N/A | $ - |
| | Semi-Covered Steel | $ 20,480 |
| | Nylon Canopy | $ 81,920 |
| | Aluminum Semi | $ 11,631 |
| | Full - Long House | $ 12,223 |
| | Required | |
| | Optional | |
| | Choose One | |

Figure 21: Pricing menu for possible construction components (Krackow, 2019)

Pre-construction, as detailed in Figure 21, is composed of various tasks and materials that are deemed critical for any advancement of the bridge that would allow for pedestrian access aside from implementing a sidewalk on the roadside and a crosswalk area. Those two tasks are optional and are at the discretion of the Karl Stirner Arts Trail Board. The values detailed below were provided by the technical report and are considered fixed in price or non-negotiable (Reeves et al., 2016). Within preconstruction, the tasks include basic tree removal and debris collection as well as refurbishing components of the existing bridge that are critical to have any additional weight built upon it. These technical values are validated by the structural analysis provided by the past Civil Engineering Capstone group. Additional costs for preconstruction that are acknowledged but not detailed in Figure 21 include renting and transporting trailers to the site for temporary construction offices, storage box rental, fencing, ribbons, grade stakes, and silt fences. Due to the lack of an established project schedule for the bridge addition, we are unable to make valid estimates for rental costs of these items. Based on the determined values, preconstruction will cost a minimum of roughly $23,000 with an additional $80 of applications and approvals.

**Flooring**

Keeping in mind the possibility of commissioning an artwork for the floor of the bridge, material options should be conducive as an artistic medium. Typically, a simple pedestrian bridge will have one of four materials as the main terrain of the bridge: asphalt, concrete, prestressed concrete, or steel. It is acknowledged that the refurbished wood decking could be a potential flooring option, however, it would not be the most viable medium for the anticipated mural design due to its short life span. The most cost-

effective material for the size of the bridge would be asphalt at roughly $4 per square foot (Forest Products, 2001). Asphalt would be a good material to use for paving the pathway because it can “be built more quickly and cost-effectively than other pavements” (“Benefits of Asphalt”, n.d.). It is also “the most recycled product in America” which makes it an environmentally friendly option (“Benefits of Asphalt”, n.d.). While there are some forms of asphalt that are not as environmentally conscious, as they release hydrocarbons that turn into pollution, warm asphalt mix would be a good choice for our project (Krow, n.d.). This type of mix should be considered in the future phases of our project as it does not need as many fossil fuels to make and emits less fumes (“Asphalt As A Paving Choice: The Pros And The Cons”, 2012). In general, however, more maintenance needs to be done on asphalt compared to concrete since it requires resealing every few years to prevent cracking (Krow, n.d.). So, although the initial unit cost of asphalt is cheap, maintaining this material, or fixing it if it is not laid properly, could end up costing a lot of money and time.

Beyond asphalt, the values of other materials jump drastically with the second most cost-effective option of prestressed concrete at roughly $25 per square foot (Forest Products, 2001). Prestressed concrete is concrete that is “compressed in areas that will be subjected to external loads or stresses” as to avoid using reinforced steel bars to provide that tensile strength (“Prestressed Concrete”, 2019). The main benefit of implementing prestressed concrete “is that it combines the high strength compressive properties of concrete with the high tensile strength of steel” and is more resistant to shocks and vibrations than normal” concrete (“Prestressed Concrete”, 2019). Using prestressed concrete to carry out the advancement of the bridge would also reduce further corrosion

of the steel components that are part of the existing structure. However, “a high degree of workmanship and control” is necessary for using prestressed concrete and it is also expensive to prepare “the equipment required for producing” it (“Prestressed Concrete”, 2019). Following prestressed concrete, as a third alternative is standard concrete at about $28 per square foot (Forest Products, 2001). The main drawback from using standard concrete is its lack of tensile strength because it requires that reinforced steel bars be put in as well to provide that. However, some advantages of using concrete include high durability, negligible maintenance cost, its ability to withstand high temperatures and resist water and wind, and freedom from defects and flaws (“Advantages and Disadvantages of Concrete”, n.d.).

Lastly, the least cost-effective option is steel at about $30 per square foot (Forest Products, 2001). It would be a great homage to the industrial history of the Lehigh Valley and the rusticated options locally make the chosen steel to be the cheapest of the steel derivatives. However, as stated in the technical report created by Professor McGuire, steel is prone to corrosion when outdoors. It is also a heavy material and can be hard to work with. But steel is tough and strong (Snyder, 2013). Additionally, steel is an aesthetically pleasing material. “Architects praise the natural beauty of steel… and exposing it in the design of their structures to emphasize grace, slenderness, strength and transparency of frame” (“Advantages of Steel”, n.d.). In line with KSAT’s mission to keep sustainability as a priority, steel is “made of 88% recycled product, is fully recyclable in the future and can be reused without further processing” (“Advantages of Steel”, n.d.). Considering the variety of durability in these materials, flooring can cost between $7,000 and $61,000 excluding the commissioned timeline design.

**Railings**

Once the base is selected, the focus should shift to the safety railings that are currently nonexistent. Railing styles can range from intricate artistic sculptures rife with social motifs of the history of the Lehigh Valley industries to standard railings. Both will span the length of the bridge. The materials, however, are refined to four options based on those potential styles: silk, nylon, rope, and steel. These alternatives can be used cohesively or individually depending on the railing design selected. Silk, serving as a nod to the neighboring Silk Mill, runs rather costly due to its luxurious status at an average of $40 per yard or $13 per foot. Silk is a viable alternative for the exterior railings due to its heat resistant and drying properties (Industrial Catalogs, 2019). However, it is far too costly to use in this industrial setting. If the railing design preferred by the KSAT Board of Directors involves the silk elements, a more cost-effective imitation is nylon. At roughly $8 per yard, nylon or rayon is the most cost effective of the four options (Industrial Catalogs, 2019). This artificial material has similar resilience to extreme weather; however, the tactile qualities are much harsher compared to silk, which would change the interactive experience of the materials tactility. A moderately cost-efficient option is 3” manila rope at $15 per foot (Industrial Catalogs, 2019). This material is very frequently used for industrial architecture and has weather-proofing qualities, but it is far rougher in both touch and style compared to the other alternatives. Fraying is a definite concern if it will be frequently grabbed, implying a potential need to have more frequent maintenance and replacement. The last railing material option is 316-grade stainless steel at $80 per foot. This grade is ideal for exterior handrails due to its sleek shine and exceptional corrosion resistance promising a long-life span with virtually no maintenance

(Feeny, 2019). However, it can tarnish overtime and is incredibly expensive. Taking all styles and materials into account, railing costs can range from $850 to $26,000.

**Roofing**

Lastly, roof alternatives should be considered. Each style has a determined material associated with it, making the cost of each style fixed within the confines of this proposal. Potential roof options include a semi-enclosed steel barrier, a nylon canopy, aluminum awning, a full Lenni-Lenape inspired wooden longhouse, or no roof entirely. As logic would suggest, the least expensive option is to have no roof, but the lack of a defined, internal space eliminates a sense of monumentality within the structure and its possible functionality as an exhibition space for non-weatherproofed works. Also, there is simply no protection for visitors in case of unfavorable weather or precipitation. The second most cost-effective design is the aluminum awning, which evokes a rustic structure that is both purposeful and inviting. Only having the roof, creek viewing would not be inhibited while still providing protection from the sun and precipitation. With the average cost of aluminum running $4.50 per square foot, this design will cost roughly $11,600 to cover the expanse of the bridge. However, aluminum has a lighter density so more would need to be used to take on more stress (Snyder, 2013). The aluminum intended for this alternative will be of low grade and high malleability can be seen in Figure 22 and is similar to the flooring option.

Figure 22: Aluminum awning (Best of House, n.d.)

Used sparingly, this design could create a defined interior space, while also allowing a 360-degree viewing platform of the Bushkill Creek and surrounding landscape. It would cost roughly $20,500. Another semi-enclosed option is a nylon canopy that would offer more of a dynamic and airy space than the other options. Offering both protection and full viewing, this option provides a very artistic dimension to an otherwise traditional structure. However, it will be the most expensive due to the cost of nylon in mass quantities. This option would run about $82,000. The last option is a full longhouse to evoke the history of the tribe that once actively resided in the Bushkill watershed. In accordance with traditional building practices, the design will be composed of 2,640 feet of cedar wood creating a fully enclosed space along the KSAT costing roughly $12,300 (NYS, 2019). This design pays direct homage to the legacy of the Lenni-Lenape while promoting a sense of protection for both visitors and potential art installations on the bridge.

Exceeding the scope of this report, we also acknowledge post-construction costs that are included in the connection of the bridge addition to the existing trail. Post-construction values may include fence removal, debris collector removal, trailer removal, storage unit removal, and silt fence removal (Reeves et al., 2016). Unlike the pre-

construction cost, the action of these items is a one-time cost, however, we are unable to determine these values due to the unknown time and companies needed to acquire these rental items.

In summary, the total range of potential combinations of flooring, railing, and roof options ranges from $10,150 to $89,462, excluding labor costs. This figure may seem high, however, in total including labor costs, a simple pedestrian bridge will probably cost around $250,000 according to projected costs for the pedestrian bridge that crosses the Lehigh River in Bethlehem (Satullo, 2019).

**Funding**

Easton was recently awarded $1.3 million in federal grants for its Bushkill Corridor Safety Enhancements Project (Lehigh Valley, 2019). The project includes:

- "Developing alternative transportation links throughout the Bushkill Drive corridor.
- Constructing 610 feet of asphalt trail from the Karl Stirner Arts Trail north to Bushkill Drive.
- Rehabilitating an historic railroad trestle from Bushkill Drive to the arts trail, to be used as a pedestrian bridge.
- Adding 1,000 feet of 8-foot wide asphalt path.
- Adding 920 feet of concrete sidewalks and curbing.
- Repairing 300 feet of concrete sidewalk.
- Installing ADA ramps, streetlights and landscaping."

While the city was granted $1.3 million in federal grants, the total project cost is estimated to be around $1.57 million (Bresswein, 2019). The city is requesting waivers to lower this cost. Other ways in which this $270,000 gap can be closed is by raising donations or making a call to the community for capable volunteers, like they have done with other projects such as the musical playground. However, the article's repetition of the rehabilitation of the historical railroad trestle leads us to believe that this is a

condition, if not a priority, of the grant. Additionally, we acknowledge the required funding for the commissioned floor mural, but we do not know the exact cost because the value of the piece is indicated by the artist at the completion of the mural. Under these circumstances, funding will probably be acquired through KSAT's channels of grants and private donors as a final economic installment prior to the integration of the bridge into the existing trail.

When it comes to the economic analysis of this project, many of the exact costs associated with the various components of our designs are unknown. Because this project is in its early stages and its focus is broader, our team has compiled ranges of costs for several features that we hope to see implemented if this project is well received by the Karl Stirner Arts Trail Board of Directors and Public Works.

## Conclusion

For several weeks, our team has worked on the old railroad bridge restoration for The Karl Stirner Arts Trail (KSAT) expansion. At the time this report was written, KSAT's Board hoped to add about half a mile to the trail on the other side of the river extending up towards the Public Safety office of Lafayette College. This additional trail would be connected to the current trail by this bridge located between the Simon Silk Mill and Lynn's Auto Repair Shop. This project is part of the Bushkill Corridor Safety Enhancements Project, which has already received $1.3 million in state grants for these efforts. Since so much of the trail is reliant upon this revitalization of the bridge, it stands to be prioritized in this budget. Overall, things are looking very optimistic for this project which will be spearheaded by KSAT, as well as Lafayette College. These two entities already have a very close relationship as there is a committee of professors that work to

carry forth the mission of the trail, as well as two professors that hold chair positions on the official board.

The bridge is not currently pedestrian friendly as it is covered in debris, has rotting wood, lacks railings, and is blocked off by a barrier on either end. However, it is structurally stable. Our minimal objective is to have a safe and walkable bridge that can be utilized by the community. However, our team wants it to be more than just a functional bridge and to be integrated within the trail and the greater Easton community.

While doing research for this project on how to successfully integrate these aspects of the city, our team delved into the historical context of Easton in an effort to understand how this city came to be in hopes of including that into the story that the art on this bridge will depict. We believe that it is important to use this bridge as a way of showing homage to the industrial heritage of the area, namely the steel, rope, and silk industries, as well as the Lenape tribe that resided here from the very beginning. This bridge would be a great means of informing the community about the history of Easton. We have used information to come up with several design ideas for railings, flooring, and roof designs that incorporate elements from each of these different historical and industrial groups. These costs, not including labor or art work, totaled to $89,462 after the completion of our initial economic analysis our group conducted.

Looking forward, there are several positives about the trail expansion as a whole that will most certainly benefit the restoration of this bridge, including the extensive funding from the state and the assured stability of the preexisting trestle bridge system. Within each context, social, political, technical, and economic, there is ample possibility for further detailing, customization, and creativity. This should make this project a

hopeful favorite among future Engineering Studies capstone groups that seek to explore intersections with art.

Considering next steps for this project, several decisions need to be made by the KSAT Board of Directors — the results of which will condition the design constraints for the bridge addition. Namely: whether the bridge is an artwork, an enclosed exhibition space, or some other hybrid; whether the bridge will have a roof, stylized railings, and artistic flooring; whether to depict the culturally significant materials or actually use them. These decisions, once made, will limit the design scope of forthcoming project continuations. From there, teams will need to carefully consider the physical constraints of the bridge's structure and relevant legislative policy while designing within that to-be-decided scope. The design of the restorative addition should be grounded in the social context, while the technical elements of the bridge's design should be based on findings from the 2016 Civil Engineering Capstone Final Report. The economics of the bridge are straightforward as the choice of materials should unfold naturally with decided design scope, and the main economic challenge of securing funding has already been surmounted with the state grant. Decisions from the Karl Stirner Arts Trail Board of Directors will determine the scale and artistic intensity of future work on this project.

When developing the design, it is important to recognize this project's strong link to the social context. Not only should the design respect the community's cultural heritage of industry, artistry, and peaceful stewardship, but it should also represent an engagement with the community as it currently exists. Future teams may want to conduct public polls to see what the community would like to see in a welcoming gateway into the arts trail, or their general expectations for the trail expansion. If the bridge does

become an exhibition space, it could be a wonderful opportunity to have regular, continual engagement with the community through events celebrating the opening of a new featured artist or series. The potential of weatherproofing for that space could allow for a greater variety of artists to be featured on the trail and subsequently enrich the public sphere. The public could also be allowed to participate in the selection process for artists featured in the possible mini-gallery, making the viewing experience and artistic enrichment all the more meaningful and wholesome. Community engagement is of crucial import to students of Engineering Studies, and this project and resulting bridge should exemplify that principle.

We also suggest working with Friends of KSAT throughout the course of this project. They were one of the major contributors to several other successful projects for the trail including the musical playground created. It was with their help and effort that that project was able to go so smoothly and so quickly. To recreate a similar project experience, we suggest continuing to reach out to this volunteer group.

This bridge is about much more than being a safe, stable walkway; it is the sole focal point connecting the untapped trail potential of the KSAT expansion with the currently existing trail, and it will lead to the beautification of a new pedestrian corridor that could eventually be as rife with history, heritage, and culture as the rest of Easton already is. All that remains between that future and now is a gap to be bridged.

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