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Adaptive Reuse: Breathing Life into America's Railways

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ADAPTIVE REUSE:

BREATHING LIFE INTO AMERICA'S RAILWAYS

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For his unconditional love and words unspoken, I dedicate this work to my brother, Cole.

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ABSTRACT

For serving as a tool of westward expansion and industrial growth, the United States owes much of its history to the existence of railroads. Many of the derelict train stations constructed in the early 20th century remain in prominent locations in their cityscape, and through the advent of high speed rail in the United States, could rediscover their importance as the transportation hubs of tomorrow. One such station is located in Chattanooga, Tennessee: The Chattanooga Terminal Station, also known as the "Chattanooga Choo Choo."

In 2016, the Georgia Department of Transportation released the results of a nine-year study on the potential for high speed rail between Chattanooga and Atlanta, Georgia. The results found that a rail corridor along Interstate 75 could handle an expected 11,725 riders per day, featuring 8 stops along the 128-mile route. This project proposes a redesign of the existing Chattanooga Terminal Station that would transform the complex into a high-speed rail station that meets the needs of the 21st century. By examining the history of adaptive reuse, various design approaches, and relevant examples, the project contributes to the conversation surrounding contemporary, sustainable architecture, while providing a compelling solution for the future of Chattanooga's Choo Choo.

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INTRODUCTION

Train stations were once served as the gateway to many communities and are among the most historically-significant buildings in the American landscape. From their inception in the mid-19th century to their demise in the 1960s and 1970s, train stations were often placed in the center of towns and designed with state of the art technology and architectural features. At the peak of railroad construction in the late 19th century, over 40,000 train stations existed throughout the United States; today less than 20,000 remain. For the remaining historic train stations to survive, they must find a relevant purpose in contemporary society.

With the development of high speed trains and the push for clean transportation, train travel in the United States is becoming relevant again. Such developments have the potential to shape the future of historic train stations, such as the Chattanooga Terminal Station. Designed by Donn Barber, a graduate of the Ecole des Beaux Arts, Paris, this Beaux Arts style station built in 1908 was made famous by the 1941 Glen Miller song "Chattanooga Choo Choo." The "Choo Choo," as it became known, and many historic train stations like it, could face demolition if a relevant use that preserves their historic integrity while offsetting a high cost of maintenance cannot be found.

This project contributes to the conversation surrounding adaptive reuse in America by utilizing the findings from the study on a rail corridor between Atlanta and Chattanooga released by the Georgia Department of Transportation to propose a complete preservation and reuse plan for the existing Chattanooga Choo Choo complex. This plan would transform the existing complex into a high-speed rail station, and

lifestyle center, containing restaurants and shopping space. While the Choo Choo's future as a hotel is secure for now, the existing station complex provides an ideal case study to test the theories of adaptive reuse and examine the ways in which a historically-significant building can make itself even more relevant in the 21st century—thereby securing its future indefinitely.

To propose the most historically-sensitive and forward-thinking redesign possible, a significant portion of the project was dedicated to examining the history of adaptive reuse and its economic and environmental benefits. The literature review provides a history of adaptive reuse architecture and an explanation of the three primary approaches to adaptive reuse design: reproduction, abstraction, and direct contrast. In addition to information about building codes and required programmatic elements, the thesis provides a background of the development and demise of the existing Chattanooga Terminal Station during its life as a train station. All the aforementioned research yields a comprehensive rationale behind the proposed redesign that is not only realistic in its ability to be constructed, but also identifies and accentuates the unique identity the Terminal Station possesses as a piece of Chattanooga history. This allows the proposed addition to the complex to seamlessly engage in the community and become relevant to the people of Chattanooga today.

In proposing a viable solution for the transformation of the historic Chattanooga Terminal Station into a modern high-speed rail hub, the thesis also examines public perception of adaptive reuse strategies and surveys sentiments toward the proposed redesign of the Terminal Station. Perhaps the project's greatest significance lies in its examination of historic buildings and their ability to change over time; thereby ensuring

that buildings like Chattanooga's Terminal Station become culturally relevant and earn a lasting place in contemporary society.

LITERATURE REVIEW

What is Adaptive Reuse?

Almost every building is constructed for a specific intended use, and one of the most prominent threats facing historic buildings is almost unavoidable—outliving its original purpose. Adaptive reuse refers to the process of reusing an existing building for a purpose other than which it was built and has become widely recognized as the foremost way to contribute to the preservation of local culture and natural resources (Condello & Lehmann, 2016). "Creative adaptation provides pride in our heritage, a link with the past, respect for the aesthetics and craftsmanship of another time, insights into our development, ample creative opportunity for architectural innovation and problem solving, enhancement of the urban fabric, greater security, stability and beauty, while conserving basic materials and meeting modern needs" (Diamonstein, 1978). Adaptive reuse has existed in various forms throughout history, extending into the pre-modern era. One of the earliest examples of adaptive reuse in the modern era can be found in Rome at the triumphal arch of Constantine. Here, reused decorations from earlier monuments abound—including reliefs of Marcus Aurelius "on the attic, reliefs of Trajan in the passageway of the arch, roundels of Hadrian on the face of the arch, and the columns, capitals, and architraves" (Brewminate, 2015). Another example of adaptive reuse can be found at Teatro Marcello. Originally constructed in 11 BC, the theater was a superb expression of the Roman ingenuity, constructed using barrel vaults and three tiers of decorative columns. After the fall of the Roman empire, it fell into disuse and "was

repurposed as a fortress in the Middle Ages and later as a palace of the Savelli family in the sixteenth century," adding the attic story that remains today" (Brewminate, 2015).

Figure 1. Façade of Teatro Marcello—note the addition. (Stock Free Images.)

The reasons for utilizing adaptive reuse have changed since Roman times, but the basic principles of rehabilitation and the conservation of a historic fabric remain. Today, however, buildings are frequently reused to align with government policy and are upcycled in ways that express creativity, succumbing to a trend that is fashionable and intriguing. The trend toward protecting old buildings for the sake of their heritage began in 19th century Europe with the writings of John Ruskin and William Morris, who founded the Society for Protection of Ancient Buildings. This trend toward preservation and reuse began in the United States during the last quarter of the 20th century, as builders started to recognize the increasing waste generated from construction and demolition. Since then, many property owners developed an idealized view of adaptive reuse, believing that simply because a building is old it must be saved. These people fail to consider the expenses of refurbishing an old building to a sustainable standard or understand that significant investment is needed to renovate and maintain an old building

if it has severe structural problems or if its external fabric began to deteriorate. Therefore it is vital to look beyond the fashionable aspects of upcycling and consider the lasting effects adaptive reuse has on the environment, economy, and culture.

Common Benefits and Concerns

According to Mohamed, R., et al., the built environment is the largest single user of energy in the world, as over 40 percent of the world's energy produced is consumed by buildings. This figure accounts for the energy used in the process of making building components, such as steel girders, windows, and cement. These materials must be transported from their factory to the construction site, creating additional greenhouse gasses and requiring more energy. In addition to the energy used in the production and transportation of building materials, "demolition accounts for 48 percent of solid waste generated during construction" (Mohamed et al., 2017). In total, the EPA estimates that waste from construction, demolition, and renovation creates one-third of the non-hazardous waste output in the USA. Because of the immense negative effects on the environment from new construction, adaptive reuse projects are often referred to as "green adaptive reuse" because they benefit from reusing a building's materials, embodied energy, and improved efficiency through improvements to the building fabric. These environmental benefits make an excellent case for the use of adaptive reuse.

The economic impact of an adaptive reuse project manifests itself through job creation, increased property value, and money saved through utilizing an existing building fabric. The possibility for job creation is highly dependent upon its location: a poorer area might see an obvious positive impact from a project, but further job creation

in the same area might be limited by the economic strength of the community and the skills of its workforce. The long-term job creation can is often inconsistent, adaptive reuse projects are consistently strong producers of short-term jobs during the construction phase. Not only does adaptive reuse create jobs, renovation of existing buildings yields labor costs between 60 and 70 percent of the total cost of the project. By comparison, approximately half of the cost of new construction projects covers the cost of labor—substantially less money for workers than adaptive reuse. This is why every million dollars spent on rehabilitating old buildings creates 4.7 more jobs than if the same amount was spent on new construction (Mohamed et al., 2017). In addition to job creation, adaptive reuse saves owners an average of 30 percent of the cost of new construction—even when the roof, windows, and doors of a building must be replaced (Thorton, 2011). However, such savings are slightly offset by an increase in architect's fees, which are an average of 3 percent higher for renovations than new construction. Perhaps the most valuable aspect of adaptive reuse is that historic buildings offer a level of craftsmanship and finish quality that is almost impossible to replicate today, and if replicated can only be done with exorbitant cost.

Even more difficult to quantify than craftsmanship are the socio-cultural benefits of adaptive reuse. Historic buildings are one of the most tangible connections a community has to its past and are embedded in a collective consciousness—offering a sense of place and provide continuity for community members. When buildings that have become integral to the fabric of a community outlive their intended use, their reuse can solidify a cultural identity and serve as a source of emotional attachment and pride among residents. This makes the built environment "a collective reflection of the historical

layers of societies upon which our lives are built, representing our links to the past and our legacy for the future" (Hulsey, 2012). As William Churchill noted, architecture is entwined with our daily lives and actions. The built environment is the largest physical human expression of our collective character. Our conservation, restoration and construction choices will be added as another layer revealing to the future our present society's collective values. (Hulsey, 2012).

Today, when a single building is reused for a new purpose, it often results in the spread of conservation throughout an entire area. This means that "we no longer concentrate only on the architectural and historic merit of threatened buildings but see the whole stock of existing buildings as potentially useful for sound economic, social and ecological reasons, and as an opportunity for urban regeneration" (Cantacuzino, 1989). The effects of contemporary adaptive reuse have been self perpetuating—evolving from the reuse of churches and houses—into the reuse of more ordinary buildings, such as warehouses and textile mills, which offer considerably more freedom for adaptation. The widespread application of adaptive reuse has shifted the focus of architects from "reverential restoration to a freer and more creative attitude to the changes that an old building may undergo" (Cantacuzino, 1989).

Consideration of the Existing Structure

With the ever-widening scope of possibilities for adaptive reuse projects, one should first determine if a building is a strong candidate for adaptive reuse by considering the overall project goal. The goal will determine whether a building should be selected for its intrinsic character or simply because it is the cheaper solution. Once one can

establish a clear identification of the goals for the space, a cost-benefit analysis should be performed. In addition to budget comparisons between new construction and restoration, it is vital to evaluate other costs or benefits, such as marketability. For example, there is marketing value to a building where a historic event occurred. After completing an analysis of costs and benefits, the appropriate team should be assembled to assess the building itself. The owner, designer, contractor, inspector, and historic conservator should examine the building for its repair history and structural integrity. The results of this inspection often determine how the building will be adapted and to what extent the reuse should preserve the existing structure.

Important items to be addressed in the inspection of the building include insulation, water infiltration, structure, and mechanical systems. To ensure the building envelope is sound, an inspector may conduct water tests and recommend sealants. However, one of the most common arguments against the reuse of an old building is that it cannot be adequately insulated. "Adding sealants, stopping drafts, weather-stripping doors and windows, correcting roof leaks, and upgrading mechanical systems are all actions that can be taken prior to adding wall insulation to improve energy efficiency. Insulation in attics with properly located vapor retarders and ventilation, or added exterior roof rigid insulation in ways that do not detract from historic eave lines (hidden behind parapets, for example), can also result in dramatic energy improvements" (Thorton, 2011). Instead of installing storm windows or unsightly weather stripping, preserving old wooden or steel windows with new glazing and sealant is often doubly beneficial—as it can enhance the overall aesthetic while increasing building efficiency. While insulation strategies are vital to promote efficiency, the embodied energy

represented by the existing building will offset the cost of heat energy lost through the walls as well.

The Different Approaches to Adaptive Reuse

The individuality, craftsmanship, and attention to detail often found in historic buildings is a significant piece of the mystique that appeals to those who desire to conserve and adapt them for contemporary use. While this it is this historical mystique that can be credited for saving historic structures from destruction, it also ignites debate on the degree to which a juxtaposition between old and new is appropriate and how such contemporary modifications should be executed in their historical context. Keith Ray, in his book, *Contextualizing Architecture*, analyzes how architects negotiate this juxtaposition. He separates adaptive reuse into three unique approaches: reproduction, abstraction, and contrasting. Ray specifically refers to these approaches regarding additions to historic buildings, however each approach embodies the array of choices architects face when negotiating the best way to reuse an entire historic building fabric.

In his analysis of reproduction, Ray notes that it may seem like the easiest choice, but that is often misleading. He says that "reproduction is more than copying. Instead, the designer must thoroughly understand the stylistic language of the original building to be able to reassemble the parts around the new space" (Ray, 1980). Failure to recognize a carefully executed design language in the original building frequently results in mockery of the historic fabric. This means that for an architect to reuse a Beaux Arts style building, for example, he or she should be versed in Beaux Arts philosophy. An understanding of this philosophy would reveal the true essence of the building—such as

the emphasis on plan, the harmonious relationship of ornament, symmetry, and axis taught by the Ecole des Beaux-Arts (Johnston and Gorton, 2007). Such an understanding will lend itself to a contemporary design that is successful for its sympathy toward the intrinsic values of the existing building. However, even if an architect is successful in their ability to design a truly accurate contemporary reproduction, Ray warns that the materials that were used at the time the building was constructed are often unattainable today and that details are often unable to be reproduced. All of this means that successful reproduction is much more difficult to execute than many realize.

A slightly more contrastive solution for adaptive reuse architecture is abstraction. This approach is intended to recreate the essence of the existing building to achieve harmony between new and old, without the degree of exactitude required in reproduction. According to Ray, "generally this is handled by designing an addition with massing similar to the original building by substituting contemporary details. Ray notes that a frequent problem faced by architects utilizing this approach is the failure to recognize the importance of ornament, which can change the scale of the new portion of the building completely. This means that like reproduction, abstraction requires rigorous attention to detail—making a failure to identify the architectural elements that create the essence of a historic building a potential for insult to the existing building. An example of architectural abstraction can be found in Savannah, Georgia at the Savannah College of Art and Design (SCAD) Museum of Art. This museum is comprised of the ruins of the oldest surviving antebellum railroad depot in the country with a 65,000 square foot addition. The contemporary addition was designed in a scale and box-like form

sympathetic to the original train station, providing ample space for exhibitions and installations from renowned and emerging artists (scadmoa.org).

Figure 2. SCAD Museum of Art—example of "abstraction" approach. (Savannah College of Art and Design)

Ray's final method of adapting an existing building for contemporary use is to sympathetically, yet directly, contrast the new with the old. This is frequently accomplished through the juxtaposition between "the solidness of the masonry walls of the historic building and the transparency of the glass and steel skin of the addition" (Ray, 1980). The simplicity of the material palate found in glass and steel construction offers an unobtrusive, delicate solution for type of adaptive reuse approach—though successful adaptations using direct architectural contrast can be achieved using different means. When executed well, sympathetic, yet direct, contrast can increase the appreciation of both architectural styles. Perhaps one of the most extreme examples of contrasting reuse is the Antwerp Port Headquarters in Antwerp, Belgium designed by Zaha Hadid Architects. Here, ZHA repurposed a derelict fire station by designing an addition to the original building in the form of an imposing volume of glass and steel that

appears to float above the historic structure. By situating the addition on top of the existing building, ZHA preserved the views of the neighboring historic facades while also highlighting the role of a tower that was originally intended for the fire station but was never realized—until now (Antwerp Port House / Zaha Hadid Architects). The addition emphasizes the north-south site axis linking the city center to the port, and the lack of a principal façade acknowledges that the building's four elevations are of equal importance as it is surrounded by water. The translucent-appearing volume's "sparkling appearance reinterprets Antwerp's moniker as the city of diamonds, and the new extension appears as a carefully cut form which changes in its appearance with the shifting intensity of daylight" (Antwerp Port House / Zaha Hadid Architects). While the design is polarizing, the direct contrast between the historic Hanseatic fire station and the contemporary addition increases the architectural appreciation of each design.

Figure 3. the Antwerp Port Headquarters—example of "contrast" approach. (Antwerp Port House / Zaha Hadid Architects, 2016)

Case Study: King's Cross Station

Frequently, architects will utilize a combination of the aforementioned methods to create the most compelling solution for reuse projects. One of the most recent large-scale projects to do so can be found in London at King's Cross Station. First open to passengers in 1852, King's Cross Station was initially designed to be simple and functional. In its original form, it contained "two train sheds both 800 feet long, 105 feet wide and 71 feet high, closed by a brick screen and two large arched windows with a square Italianate clock tower in the middle as the station's only ornament" (The History of London's King Cross Station). Passenger traffic into King's Cross quickly increased by the end of the 19th century, and additional lines and tunnels were added to increase efficiency. By the 1970s, an unsightly single-story travel center, ticket office, and concourse was opened at the front of the building, although it had little effect on efficiency.

As part of a 21st century to push to improve infrastructure in and around King's Cross, a large scale revitalization effort was undertaken and finally opened to the public in March of 2012. The design revealed the façade of the original 1852 station, while reorienting it to the west through a "new, iconic architectural gateway to the city, ready for the 2012 London Olympics" (King's Cross Station / John McAslan + Partners). The new, web-like Western Concourse is the centerpiece of the project. Its position against the Western Range of the existing station and the curved façade of the Great Northern Hotel informed the semi-circular form of the new concourse designed by John McAslan + Partners. In addition to the directly contrasting web-like structure, the project involved a series of interventions that utilized elements of architectural reproduction and contrast.

These include the restoration of the Eastern Range, Main Train Shed, and Western Range portion of the station and its 70,000 square feet of office space.

Figure 4. London Kings Cross Station (King's Cross Station / John McAslan + Partners, 2012)

"Conservation specialists were involved in the design and reconstruction of the building, working closely with English Heritage so that the historical features were sympathetically retained" (Welch, 2014). Throughout the project, careful choices were made to preserve and compliment original architectural features. For example, cornices are frequently highlighted through trough lights, and fallen or damaged bricks were marked so the building could be repaired with the same bond (Welch, 2014). The redevelopment of the grade II listed King's Cross has been credited as the catalyst for one of the largest regeneration schemes in Europe—transforming a neglected area of the English capital into a vibrant new quarter of the city.

Train Stations in America–Examining Chattanooga's Terminal Station

The United States owes much of its development during the American industrial revolution to the British. America's rail history began with the procurement of the Stourbridge Lion, which was shipped to America from England in 1828 and was later tested on the Baltimore and Ohio Railway—one of the first railroads in the country (Hakobyan). Though initial tests were not successful, innovations from the British-built Stourbridge Lion led to the creation of the first passenger train in America in 1830. From then on, railroads played an integral role in the development of the United States in the 19th century. By 1850, states east of the Mississippi River had over 9,000 miles of track—though much of this was concentrated in the Northeast. A lack of rail infrastructure was an obvious handicap to the south during the Civil War. This meant that the existing rail centers in the region were highly valued at the time, and "no other city in the Southeast based its economy and means of transportation so heavily on railroads as Chattanooga, Tennessee" (Strickland, 2009).

A favorable location along the Tennessee River meant that Chattanooga was already a trading hub, and the creation of a rail center to unite the growing Western and Atlantic Railroad from Georgia was a logical step toward growing the rail infrastructure in the United States. In 1849, the first train moved across Georgia into Tennessee. A speaker at a celebratory event remarked on the significance of the Chattanooga rail hub when he said: "With united hands, let Georgia and Tennessee join on this occasion in mingling the waters of the Atlantic and the Mississippi" then he noted that the railway will "open the way for us to the far West by Nashville and shall establish communication with the North" (National Park Service). This speaker's assumptions proved accurate as

new railroads soon began to build lines into Chattanooga, including the Nashville and Chattanooga Railroad and the Memphis and Charleston Railroad. Chattanooga became a cornerstone in the southern rail system, and it was evident that the city needed station dedicated to passenger travel.

Chattanooga's Union Depot was designed to respond to this need. Completed in 1858, only six years after London's King Cross, the two stations shared remarkable similarities. Both were designed to be highly functional and simple with a large, arched train shed containing openings on each ends to allow the exit of smoke and, in the case of Union Depot, trains on each ends. However, Union Depot was significantly smaller than King's Cross, and by 1900, the six-track shed at Union Depot, and the adjacent passenger head house, were overburdened with 30 trains scheduled per day (Strickland, 2009). The overcrowded conditions became problematic and even dangerous for passengers, and with the intersection of pedestrians, vehicles, streetcars, and trains that blocked roadways, people gave the area surrounding Union Station the nickname of "Death Trap" (Strickland, 2009).

Finally, in 1905 plans from the Southern Railway were announced to invest more than $4 million into Chattanooga. Specifically, the investment would include a new passenger facility. In May of 1906, the Southern Railway chose the final plans for the station in Chattanooga designed by Donn Barber, a well-known New York City architect. Barber attended L'Ecole des Beaux Arts in Paris, France between 1895 and 1898, and his design for Terminal Station originated directly from his time in Paris. While studying at L'Ecole des Beaux Arts, Barber entered into the school's annual design competition, which one year happened to ask competitors to design a train station. Barber's design

won the first prize, and this overall design later became Chattanooga Terminal Station (Strickland, 2009). (Henceforth, any reference to "Terminal Station" refers to Chattanooga's Terminal Station.) By January of 1906, construction on one of the largest building projects ever completed in Chattanooga had commenced. The fame of its architect and overall size and design made Terminal Station an engineering and architectural marvel during the time of its construction. It "was built as two different structures combined. One was the outside brick edifice; the other is the steel superstructure to support the dome ceiling and concourse roof. Only the steel arches inside the waiting room support the weight of the ceiling. At the time it was built, the brick arch was the largest self-supporting brick arch in the world" (Strickland, 2009).

Figure 5. Chattanooga Terminal Station circa 1910. (Strickland, 2014)

Barber's rendering from 1907 depicts his design for Terminal Station in its early stages of development. The picture clearly shows the iconic arch that leads to the domed,

pantheon-like central waiting area with an oculus at the top to allow the infiltration of natural light. One significant difference between this early design and the as-built structure is the omission of a second story in the building that exists today. It appears the decision to eliminate the second story was made late in the design process, as much of the building's structure, specifically two large staircases connected by a walkway across the front of the concourse, was already in place. "When the additional floors were eliminated from the building plans, the walkway had to be kept, as the steel was already in place.

Figure 6. Chattanooga Terminal Station—"Walkway to nowhere" circa 1910. (Strickland, 2014)

From its inception, Terminal Station's design was dedicated to passenger convenience and simplicity—the large central dome making the primary entrance obvious to all travelers. Upon entering the two sets of hand-carved wooden doors, passengers entered the waiting room capped by a massive 85 foot tall dome with four brass chandeliers and 40 lamps in each (Strickland, 2009). Travelers could immediately see the entrance to the men's smoking room, lady's retiring room, washrooms, and ticket

counter. In the north wing, a restaurant and barbershop were popular among those living in Chattanooga, not just those traveling through the station by train. Continuing straight through the domed waiting room, passengers would enter the austere-looking main concourse. This was considered a separate building from the rest of the station, but it served an important role as the cover between the train platform and the station.

Terminal Station was a lively transportation hub for decades after its completion—hosting travelers such as President Franklin Delano Roosevelt. The Station also served as the inspiration for the famous Glen Miller song, "Chattanooga Choo Choo," which became the number one song in the Billboard Best Sellers chart in 1941 and was the first song to be certified a gold record for 1,200,000 sales—eventually being inducted into the Grammy Hall of Fame (Miller, 2017). Unfortunately, even with such notoriety, Terminal Station fell prey to the nationwide decline in rail travel following World War II. The wartime surge in rail travel as a result of fuel rationing and the suspension of automobile production was over once soldiers came home and began buying cars. This, combined with the increasing competition from airlines and the introduction of the jet engine, worsened the situation for rail companies. "During the height of Terminal Station, over 60 trains were scheduled through the station. By the late 1960s, only two named trains were left" (Strickland, 2009). On August 11, 1970, the only remaining scheduled train left Terminal Station for the final time. This marked the end of Terminal Station's life as an active train station. The Terminal Station complex would sit empty for over a year—narrowly avoiding demolition until a local developer saw its potential as a hotel and restaurant. In 1973, the Terminal Station reopened as the

Chattanooga Choo Choo—a complex that included hotel rooms made from converted rail cars, a restaurant, and a separate new hotel building.

Train Station Categories and Program Requirements

With the need for passenger efficiency in mind, Amtrak has outlined its own approach to train station design by dividing stations into four categories and offering unique solutions for each. These categories are based on the type of trains the station serves, geographic location, supporting transportation infrastructure, and timeframe for growth. Category one stations serve an annual ridership exceeding 400,000 people, category two stations serve between 100,000 and 400,000 people, category three stations serve 20,000 to 100,000 people, and category four stations serve less than 20,000 people per year (Amtrak). While intended for Amtrak trains, these categories and requirements are useful for the design of all train stations, including those on the rail corridor between Atlanta and Chattanooga.

Amtrak organizes the architectural program of its four station categories by functional sequences. The sequences vary by size, location, and station category, although the sequences outlined in this research will be analyzed according to the requirements of category two stations—which is the category of the proposed Chattanooga high speed rail hub. These sequences include: entry, circulation, ticketing, waiting, and boarding. These program elements outlined by Amtrak had to be reconciled with building codes and the existing historic building—which together then informed the methodology for the design of the reused Terminal Station—and will be explained in the following chapter.

METHODOLOGY

The goal of the project was to propose a viable solution for the transformation of the historic Chattanooga Terminal Station into a modern high-speed rail hub and to examine public perception of adaptive reuse strategies and their sentiments toward the proposed redesign of the Terminal Station. The project commenced with an analysis of the various approaches to adaptive reuse and an investigation of the historic Terminal Station building, as well as its interaction with the community. After establishing an understanding of the optimal way to preserve the elements of the Terminal Station that give the building its identity and character, the process of determining how to negotiate the historic building fabric and required programmatic elements followed.

Programmatic Elements—Lifestyle Center Portion

To make the reuse of Terminal Station economically viable and integral to downtown Chattanooga, it became evident that the proposed redesign should include a lifestyle center—in addition to the programmatic elements necessary for a train station. The lifestyle center would allow the station to serve both those traveling through the city as well as Chattanooga locals. The program for the lifestyle center was developed though examination of the plans for malls and lifestyle centers. Based on studies conducted, it was decided that the redesign should include space for four retail stores, two restaurants, and two smaller cafes for waiting passengers. These numbers were selected to provide optimum use of Terminal Station for people traveling by train, and locals alike. The final

design was to include ease of access to retail and restaurant spaces by both groups, while retaining as much of the exiting building as possible.

While this duality helped to ensure the Terminal Station remained relevant in the 21st century, the core of the project still lies in its ability to serve as a complete, functional high speed rail hub. The determination of key elements of this portion of the program was aided primarily by Amtrak's *Station Program and Planning Guidelines,* the preeminent guide to train station design in the United States. Because of the significant way in which these guidelines informed the final design, an analysis of Amtrak's guide comprised a significant portion of the project methodology.

Program Design—Train Station Elements Per Amtrak Recommendations

According to Amtrak, the arrival point for rail passengers should be designed to offer optimum visibility of all vital program elements to allow passengers to reach their desired destination with ease. This means that the ticket counter and baggage check should be clearly visible from the entrance. E-ticket machines are expected to account for 60 percent of ticket sales and should be located near the ticket counter (Amtrak Station Program, 2013). Ground transportation desks should be placed within a short distance of the ticket counter as well.

Among the program items hidden from passenger view are areas for baggage handling and security. These rooms need to be located directly behind the ticket counter to allow for close adjacencies between similar program elements and provide optimum employee efficiency. For arriving passengers, bags will be taken from trains and placed on an arrival luggage conveyor to be collected by passengers at baggage claim. The final

program hence included a baggage claim and luggage conveyor with convenient access to train platforms.

To best serve the employees who operate the station, Amtrak recommends staff support spaces are to be located as close to the customer service areas as possible. For category two stations like Chattanooga's Terminal Station, these spaces should include a small kitchen, private offices, and a break room. Careful consideration should be taken to ensure these spaces be hidden from the main arrival room but are easily accessible by staff. A separate customer service office to handle passenger inquires or problems should be accessible via the arrival room and visible with clear signage.

Analyzing Existing Building and Site

After considering Amtrak's recommendations, the existing building was analyzed to reveal the architectural elements most critical to the character of the building that needed to be preserved in the redesign. The analysis began by photographing all parts accessible by the public. To procure further information, the first point of contact was the Hamilton County Regional Planning Agency. The Agency provided a copy of the recent zoning changes of Terminal Station filed by the Station's current owner. These documents were later used in the process of designing the changes to Terminal Station, and the code requirements within made the proposed redesign more true to life.

While the Hamilton County Planning Agency was unable to obtain original construction documents of the Terminal Station, they provided the contact information for Cornerstones of Chattanooga—a non-profit historic preservation organization that exists to preserve the architectural heritage and urban fabric of Chattanooga. A well-

preserved copy of an original preliminary plan drawn by Donn Barber for Terminal Station was obtained from Cornerstones for reference in the project. Cornerstones also highlighted the combination of cutting edge architecture and engineering used in the building's construction in 1909, which also contribute to its historical significance and were later considered in the proposed redesign. The original plan provided accurate measurements and knowledge of the existence of walls and rooms hidden to the public, making the redesign much more realistic and sympathetic of the original building.

Building Codes and Green Design

After completing program design and analyzing the existing building and site, a complete code analysis of the proposed building was conducted. The code analysis was developed along with the program to determine the most efficient way to utilize existing space and how to meet International Building Code requirements. The code analysis revealed the occupancy groups, construction typology, allowable height and areas, exit access distances, parking requirements, necessary water closets, lavatories, and drinking fountains—among other items necessary for a realistic redesign. Because of the varied nature of the programmatic elements within the proposed redesign, it was determined that the redesigned station would include Assembly, Business, Mercantile, and Storage occupancy groups. The overall occupant load for the redesign station complex was determined to be 574, which led to the decision to provide a total of 10 lavatories—5 per gender. The complete code analysis can be found in the appendix.

The determination of final programmatic elements through the completed code analysis led to the next phase of project planning: sustainable research. Among the

primary methods of sustainable design to be incorporated into the project were natural ventilation, photovoltaic cells, and recycled materials from demolished parts of the existing building. There was also one unique attraction at Chattanooga Terminal Station that was identified as an additional and bespoke way of returning green space to the community—the existing Choo Choo Gardens. This series of gardens has since been dedicated to Glenn Miller, the singer of the famous 1941 "Chattanooga Choo Choo" song, and was constructed on the site of train tracks in the decade after the last trains left Terminal Station. The transformation from hotel back to train terminal would require the removal of these iconic gardens. It was decided that this loss of green space should somehow be returned to the city through the redesigned Terminal Station. This would not only pay homage to a significant piece of the history of Terminal Station, but it would also solidify the status of the redesigned complex as a cutting-edge example of sustainable architecture. The solution of how to best incorporate this green space, all of the aforementioned programmatic elements, existing conditions, and code requirements will be discussed in Chapter 4.

Student Survey

This project was designed not only to identify and explain the various approaches to adaptive reuse and how they *can* be applied, but also to discover how people respond to adaptive reuse and how the proposed changes to the Terminal Station would be received if they were implemented. To do this, two questionnaires and a presentation were designed for students of the WKU Architectural Science program. With WKU IRB approval, the questionnaires were administered to a total of 33 students in the program.

The first questionnaire posed general questions to gain familiarity with various architectural principles and overall exposure to adaptive reuse. Then, a PowerPoint presentation explained the history of adaptive reuse and the basic design approaches to reusing a historic building. The presentation also included rendered images of the proposed changes to the Chattanooga Terminal Station, and explained the design rationale for the project. After the presentation, participants were administered a follow-up survey. The survey asked if they believed architects have a responsibility to make historic buildings relevant, whether they understand the adaptive reuse strategies mentioned in the presentation, and which of the approaches they like best and why. Among other questions, the questionnaire also asked for the subject's thoughts on the proposed changes to Terminal Station and whether they agree with the architectural contrast design approach taken.

RESULTS

Final Terminal Design

From the outset, the primary design goal of the project was to ensure that the most iconic elements of the Terminal Station were preserved and accentuated through the process of adaptive reuse. Because of the addition of a small lifestyle center, including shopping and retail space for those not traveling via train, the capabilities of Terminal Station were pushed to their limits. Designing all the desired programmatic elements within the existing building fabric was unnecessarily complicated and ill-suited to the flow of passengers. As such, it was decided that the best way to preserve and accentuate the existing architecture was to design additions—sympathetic in their form and harmonious in plan typology—that would comfortably house the elements necessary to fulfill the vision of Terminal Station as a modern high-speed rail hub for travelers and a lifestyle center for Chattanooga citizens. This created a duality of purpose new to Terminal Station. Refer to Appendix A for a visual guide to the redesign stages.

The most recognizable element of Terminal Station is its 60-foot tall dome, and much of the proposed changes and additions to the station are focused on harmonizing with its form and purpose as an entrance hall and center of activity. With this in mind, the approach for those traveling by train via Terminal Station was centered on the monumental brick arch and the dome inside. A new pedestrian canopy for incoming passenger traffic was designed to make minimal contact with the brick structure. The

clean lines and lack of ornamentation of the canopy prevent it from competing with this iconic portion of the historic façade, as seen in Figure 7.

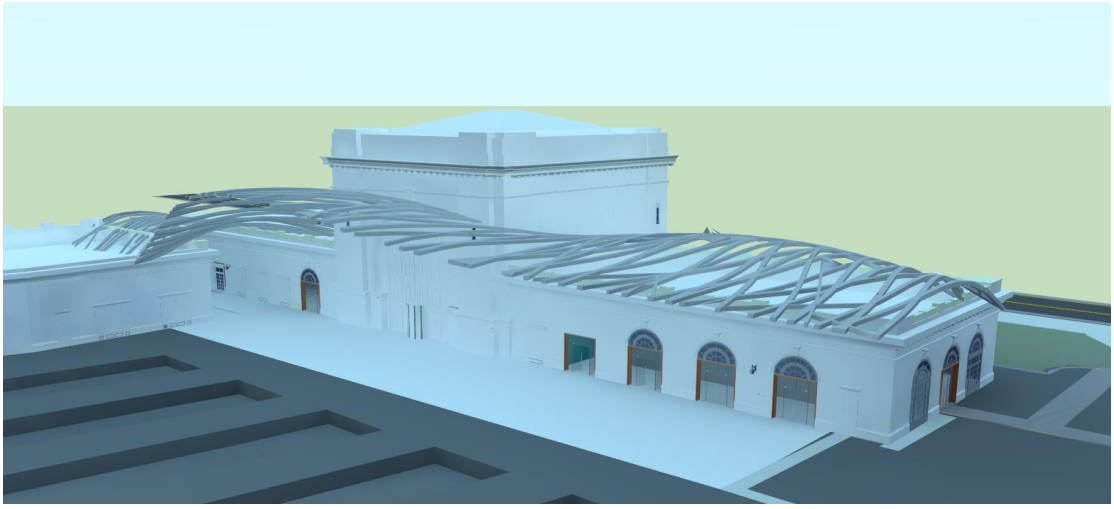

Figure 7. Terminal Station (rear perspective)—proposed "pedestrian canopy" creates the roof of the new concourse.

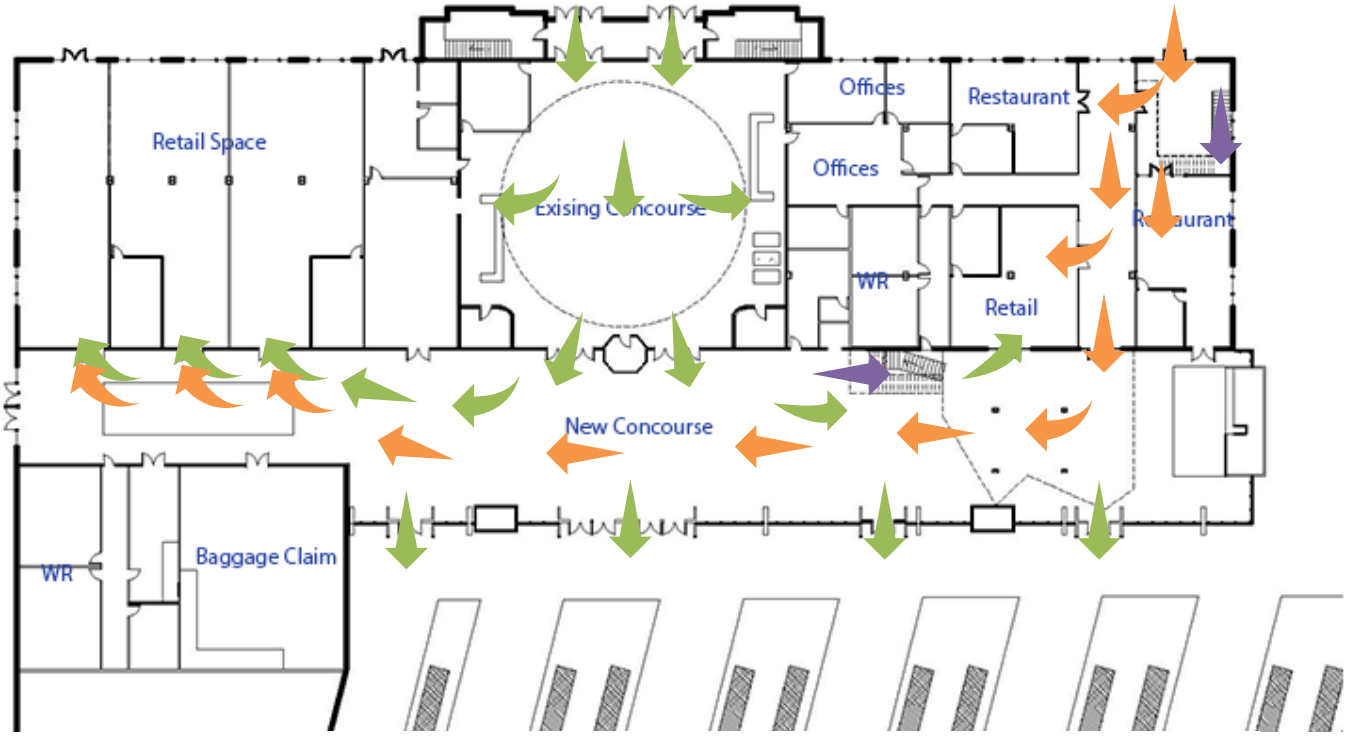

Figure 8. Terminal Station—main level plan including proposed changes.

Green arrows denote path for train passengers, orange arrows denote path for lifestyle center visitors, purple arrows denote path to upper level.

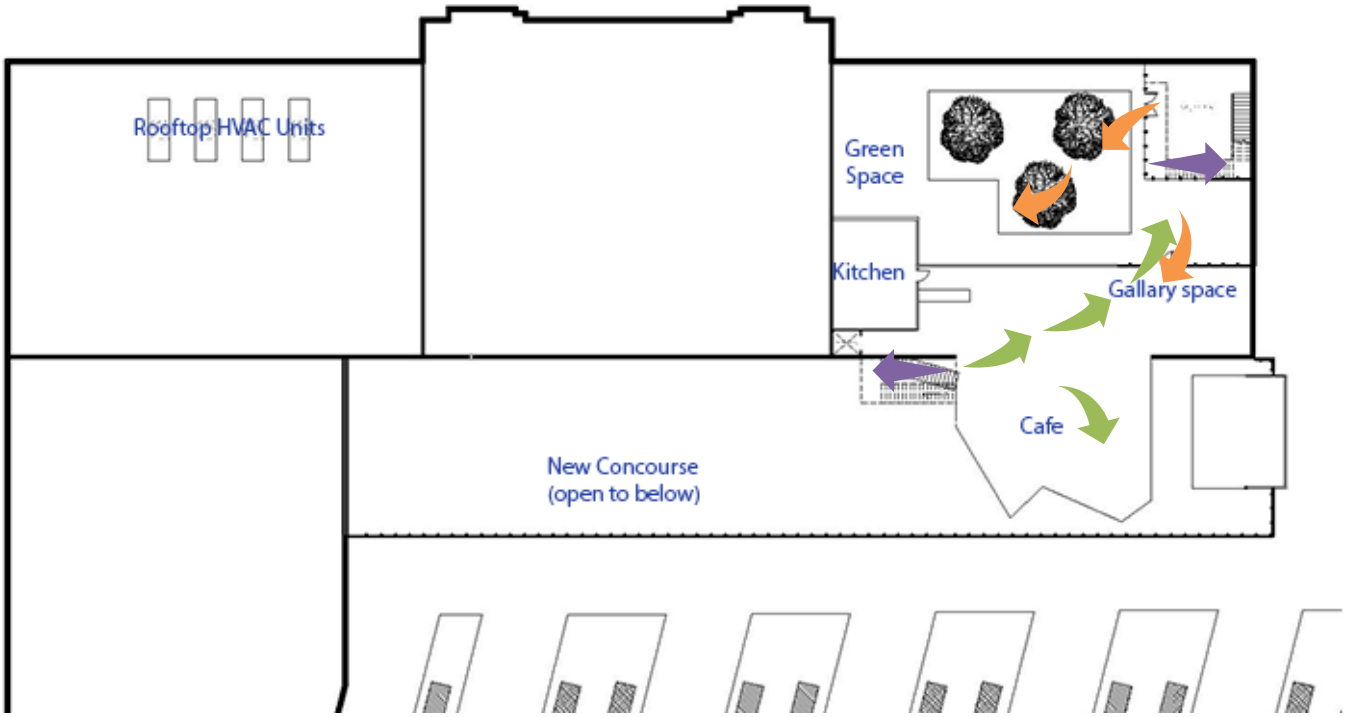

Figure 9. Terminal Station—upper level plan including proposed changes. Green arrows denote path from lower level of concourse, orange arrows denote path for lifestyle center visitors, purple arrows denote path to lower level.

Once inside, proposed changes to the original domed waiting room were minimal. Research in historic archives revealed photos of the waiting area as it was originally—with walls painted white and four grand chandeliers providing additional light when daylight from the large oculus and two oversized arched windows was not sufficient. Over the years, the chandeliers were lost and walls painted taupe, among other colors, which distracted from the beauty of the intricate beaux arts ornament. Proposed changes to this space returned the walls to their original white color and added four chandeliers—each designed in a contemporary style to directly contrast with the historic architecture. The redesigned space also seamlessly integrated programmatic elements deemed necessary by Amtrak. Proposed changes are primarily focused on customer service facilities, including ticket counters and baggage check, which were designed to fit within the original ticketing counters, and counters for ground transportation. All of these

program elements, in addition to a small café, fit seamlessly into the original building fabric and were positioned to be within clear eyesight of the original, wooden front entrance doors. Based on Amtrak's recommendations for staff support areas, a small kitchen, private offices, and a break room were strategically relocated. Careful consideration was made to ensure these spaces were hidden from the historic waiting room but were easily accessible by staff. A separate customer service office was made accessible via the waiting room and visible with clear signage. These new elements were also designed to work harmoniously and not distract from the original architecture.

Beyond the baggage and ticketing counters housed within the existing domed waiting room lies the largest newly constructed addition to the project—the concourse. At 9,500 square feet, this contemporary addition was the "soul" of the redesign. Because this portion of the project had the greatest potential to damage or severely alter the existing building, great care was taken to ensure the entire concourse was especially compatible with the existing rear façade—not only in its placement and construction, but also in its architectural language. After experimenting with different designs, it was determined that a style which directly contrasts with the existing architecture, but does not compete for attention, would provide the most timeless and sensitive solution. As such, the concourse was designed to act as one large, steel, web-like, single-span structure with an organic form. This allowed the structure to touch the existing building at minimal points—providing the impression of a structure floating that could easily be removed with little or no damage to the historic terminal. The concourse ranges from 35 to 52 feet tall at its peak. As passengers pass from the domed waiting area to the concourse, they are greeted by the tallest portion of the concourse. This portion was

designed as an arch to complement the oversized arched window of the terminal and appear as a continuation of the immense domed volume found within the existing waiting area. This portion of the concourse can be seen in Figure 10.

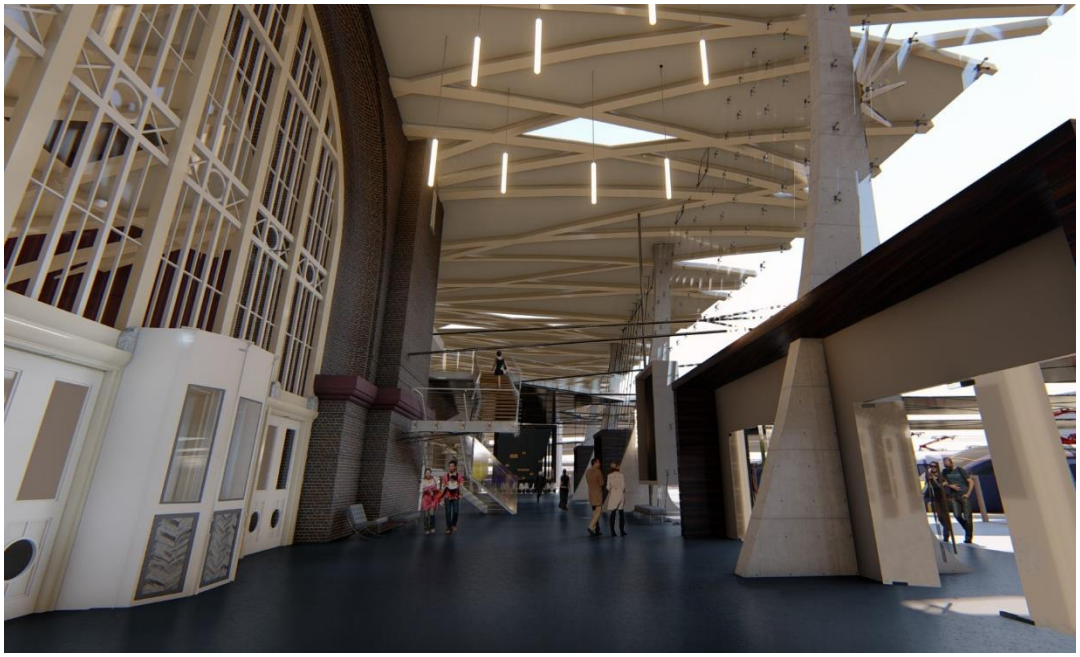

Figure 10. Terminal Station—Proposed concourse interior view.

The entire façade of the concourse was glazed and supported by elegant concrete columns. Each column is vaguely reminiscent of the supports designed to span the Dulles International Airport designed by Eero Saarinen, and their form serves as a complement to the flowing, web-like structure that appears to be floating above. The roof extends beyond the glazed façade to provide shade for the immense glass. The floors for the addition are made from recycled terrazzo that extends throughout the entire concourse. These floors also contain a radiant heat system to maximize efficiency, which will prove especially useful in conditioning the double-height space. The exterior glazed walls are penetrated by box-like structures containing either exit doors to the train platform,

information screens containing train times and destinations, or a café placed at the north end of the concourse. These boxes were clad in reclaimed wood and contrast directly with the aforementioned flowing form of the concourse roof. Extending beyond one of the four "box" portals are canopies covering each train platform. The canopies are also web-like in their form, and this web extends from the historic rear façade of the building, through the glazing, and down the platform, spanning 420 feet in total. The canopies serve as a complement to the rest of the addition and their physical connection to the historic station gives the impression that the high-speed rail platforms are not only connected to the historic building programmatically, but also emanate from it physically, as seen in Figure 11.

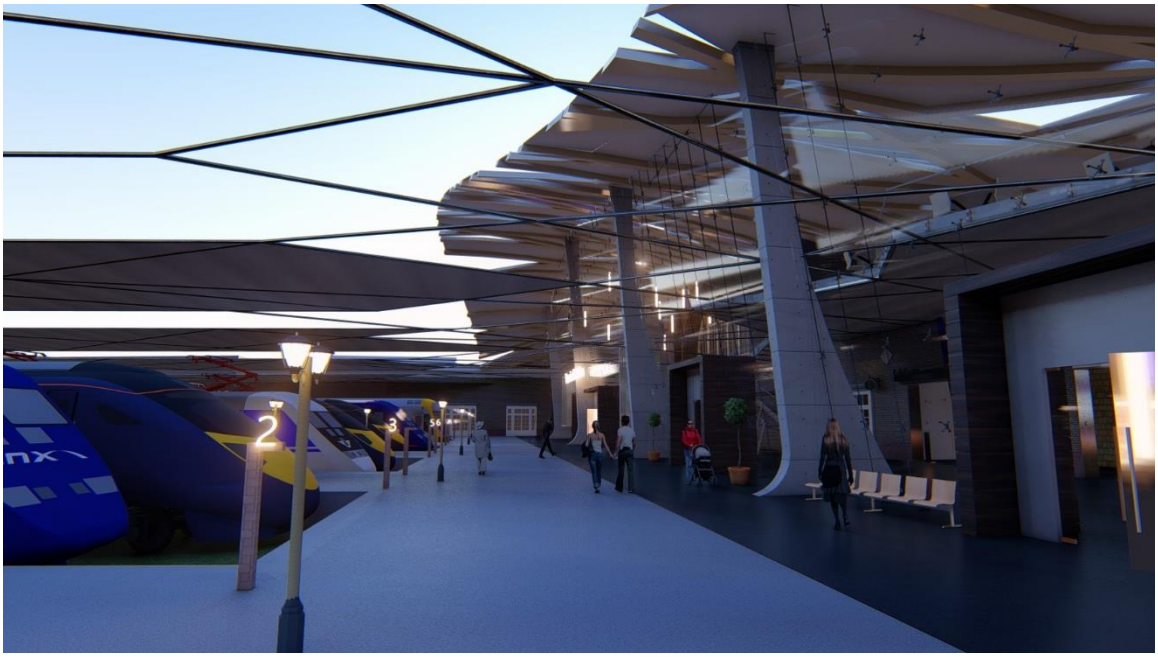

Figure 11. Terminal Station—Exterior of new concourse. Note the platform canopies that "emanate" from the façade.

A sculptural staircase leads users upstairs to a larger restaurant that overlooks the concourse. The seating in the restaurant was designed by removing part of the existing

brick parapet, one of the only elements in the entire design that requires the removal of the original building structure. This allows the seating to extend beyond the parapet and gives the impression that the floor punches through the wall and spills out onto the concourse. The floor is neatly supported by the aforementioned web-like structure that emanates from the building, through the glazing that encases the concourse, and eventually acts as the canopy over the train platforms. The elements of the proposed design discussed so far are the extent of what was intended to serve only rail passengers. The remaining elements of the proposed redesign are meant to be utilized by both train travelers and locals visiting Terminal Station for its retail/restaurants.

The duality of the redesign meant that the program had to accommodate people visiting the station for two unique purposes, while optimizing all available space and avoiding confusion for those inside. It was decided that this was best accomplished through the creation of a new entrance dedicated only to those visiting Terminal Station for its restaurants and shopping. The doors to this entrance were placed within the existing doorway on the farthest northwest corner of the front of the building and lead to a large lobby. However, merely adding doors to an existing window would not create an

Figure 12. Terminal Station—Front perspective. Note the separate new entrance for the lifestyle center.

entrance proportionate in scale to that of the prominent, existing brick arch. A box-like structure, elegant in its simplicity and glazed on all four sides, was placed over this entrance and rose 20 feet from the top of the existing northwest parapet to allow the new entrance to be noticeable and attractive from the front, but not overpowering, This creates an attention-grabbing structure which is then capped by a free-flowing roof that extends beyond the glazed walls—providing shade and serving as an architectural complement to the design language found in the back of the existing building, as seen in Figure 12.

The new entrance, with its glass doors and the glass structure above, act as a lens that punctures the building and focuses pedestrians' view on the "floating" staircase inside. Upon entering this area, one is greeted with a double height space flooded with natural light. The space is unconditioned and was designed to maximize stack ventilation (also known as Bernoulli's principle of natural ventilation) by bringing in cool air through low inlet openings and exhaust hot air through openings at the top of the glass structure (Autodesk). The structure rises 45 feet from the ground—a height which was selected to maximize the difference between air inlets and outlets, thereby increasing the effectiveness of natural ventilation. In the interior of the space, walls were stripped down

Figure 13. Terminal Station—Interior of lifestyle center entrance.

from underneath a century of plaster to expose and emphasize the history of the space. A contemporary steel and glass staircase and contemporary chandelier combine to serve as the centerpiece of the space and create an unmistakable juxtaposition of old and new; highlighting the antique masonry detail revealed in the bare brick walls, as seen in Figure 13.

Inside the space, people are met with two different doorways, each leading to two separate restaurants, or they may continue into the rest of the lifestyle center by turning right and walking down a corridor to the main concourse—which then provides access to the remaining cafes and shops. Otherwise, visitors may ascend the staircase in the glass-enclosed entrance to find the upper level green space on the roof of the existing north wing of the Terminal, shown in Figure 14. Not only does this green space serve as a means by which the Terminal Station redevelopment can revive its notorious gardens, but it also offers an efficient way to attenuate storm water by temporarily storing water on a flat roof. A depth as shallow as three inches was required to provide effective attenuation

Figure 14. Terminal Station—Greenspace on roof of northern wing.

in large storms, and water would drain away from the roof slowly without affecting the downstream drainage system (Ward, 2014).

The roof of the north wing of the Station did not require significant additional structural support because the weight of the water-soaked vegetation would be less than the weight of a heavy snowfall—for which the roof was already designed to carry (Ward, 2014). The water would also be routed into small reserve tanks which can be used for flushing toilets. All of these benefits mean that not only does the roof offer a way to return green space to the environment, it is also serves an efficient way to harvest rain water for use in the building—while providing a solution for urban drainage and to mitigate flooding.

A portion of the green space was covered by an extension of the flowing roof that covers the main concourse, providing a shaded place for rail passengers and visitors at the indoor café, shown in Figure 15. Continuing through the double doors on the eastern wall of the space will bring visitors inside the upper level of the concourse, where the café is located. Adjacent to the café is a wall for local artists to display their work. The

Figure 15. Terminal Station—Upper level cafe.

walls of the café and the small gallery space are either entirely white, glazed, or made of exposed brick from the original building. The minimal color palate and choice of materials does not distract the eye from the original architecture and ornate detailing.

Entering the café from the upper level green space marks one of three possible entrances into the main concourse, as seen in Figures 8 and 9. The second entrance is from the aforementioned corridor adjacent to the lifestyle center glazed entrance tower. The third and final possible entrance into the new main concourse is through a large arched portal, which is untouched and original to the historic building, and is located on the southernmost side of the building, off Station Street. This is the most direct entrance, and it can be utilized by both train passengers and those visiting the station for its restaurants and shopping to access the southern wing of the Terminal.

The southern wing is largely unchanged from its original form. It contains three retail spaces of approximately equal size and is also the location of the baggage claim and its ancillary facilities for the station staff. The existing walls are to be insulated with expanded polystyrene (EPS) blocks, which are easily cut and shaped to fit between the brick and new drywall walls. Located on top of the southern wing are four package rooftop HVAC units and photovoltaic panels. These elements fit naturally within the existing parapet and are not capable of being seen by pedestrians. Their location on a completely flat, unshaded surface will provide ample daylight to the solar panels as well.

The entire project took advantage of every existing architectural element to not only maximize its environmental efficiency, but also maximize its appeal to train passengers and retail/shopping visitors alike. It is this innate creativity and adaptability

that is required of successful adaptive reuse projects—and which make Terminal Station unique and will secure its future.

Survey Results

The aforementioned presentation and survey provided a way for the redesign of Terminal Station to be tested by the people who might one day interact with it. By asking general questions about familiarity with adaptive reuse and gauging personal taste, the survey also provided insight into what sort of buildings, and even specific architectural elements, people become emotionally attached to and should be saved. Some of the most significant results of the survey are outlined below.

Results of Pre-Presentation Survey and Notable Responses

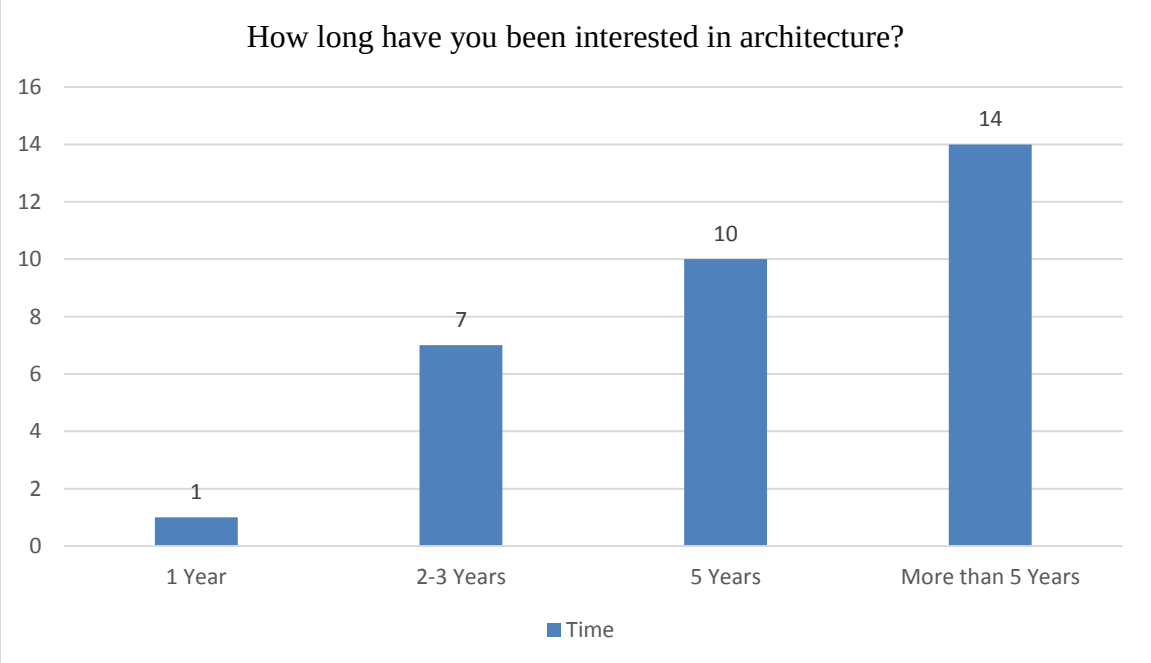

Figure 16. Pre-presentation survey Question 1. Note that 24 out of 33 students have been interested in architecture for five years or more.

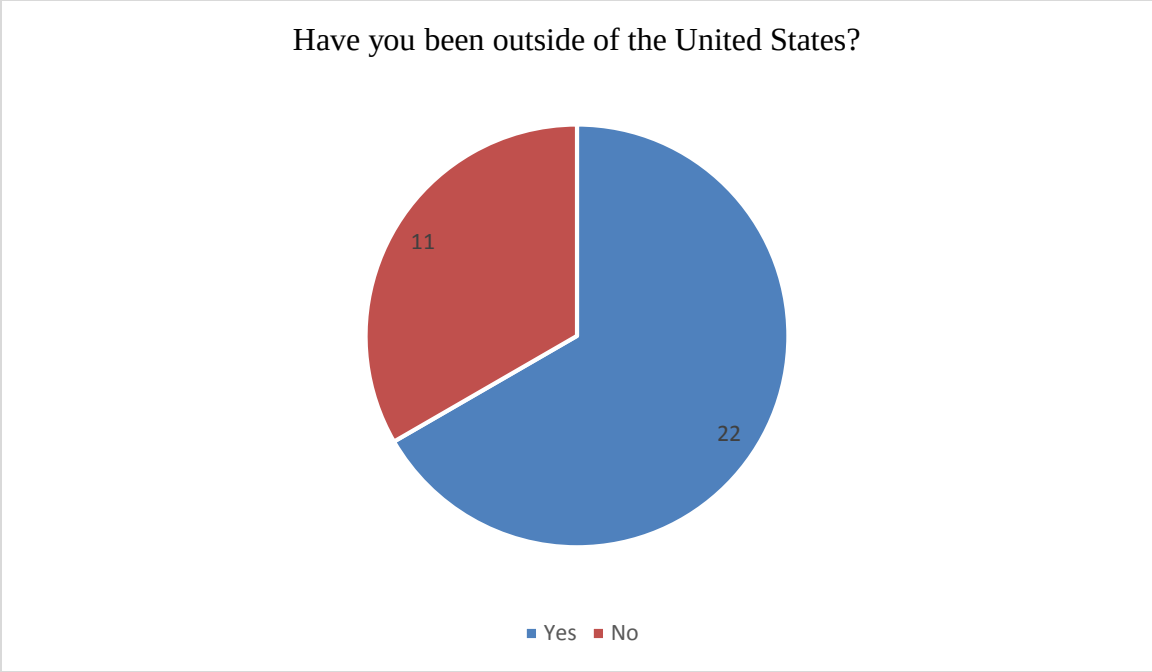

Figure 17. Pre-presentation survey question 2. Note that 67% of respondents have been exposed to architecture and design approaches outside of the United States.

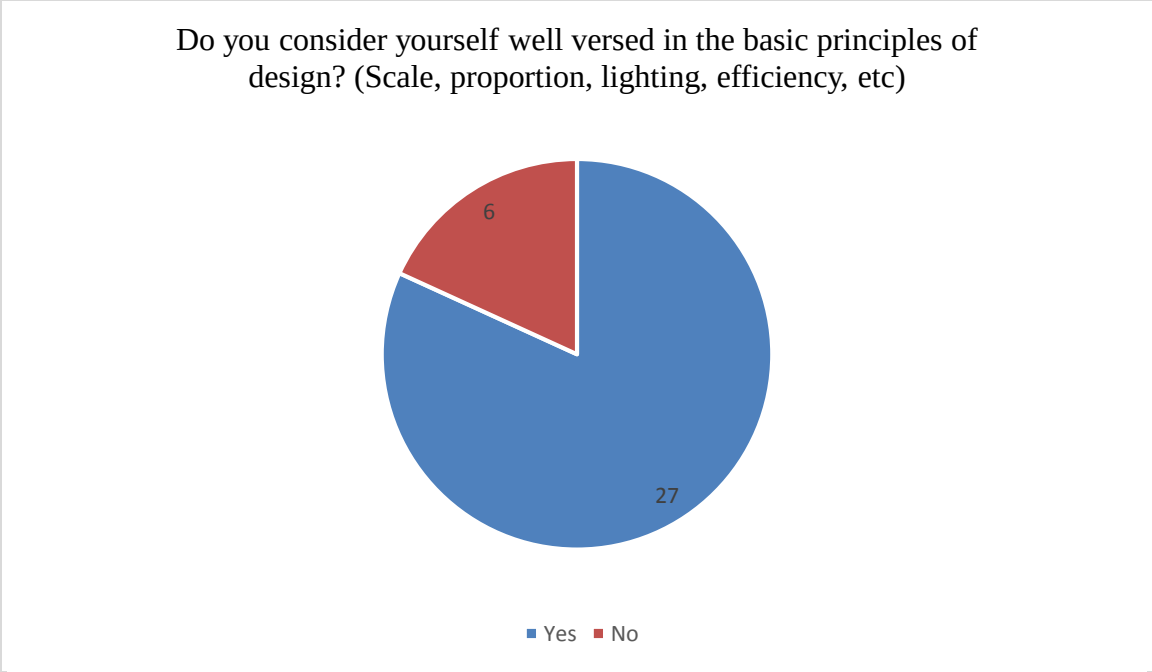

Figure 18. Pre-presentation survey question 3.

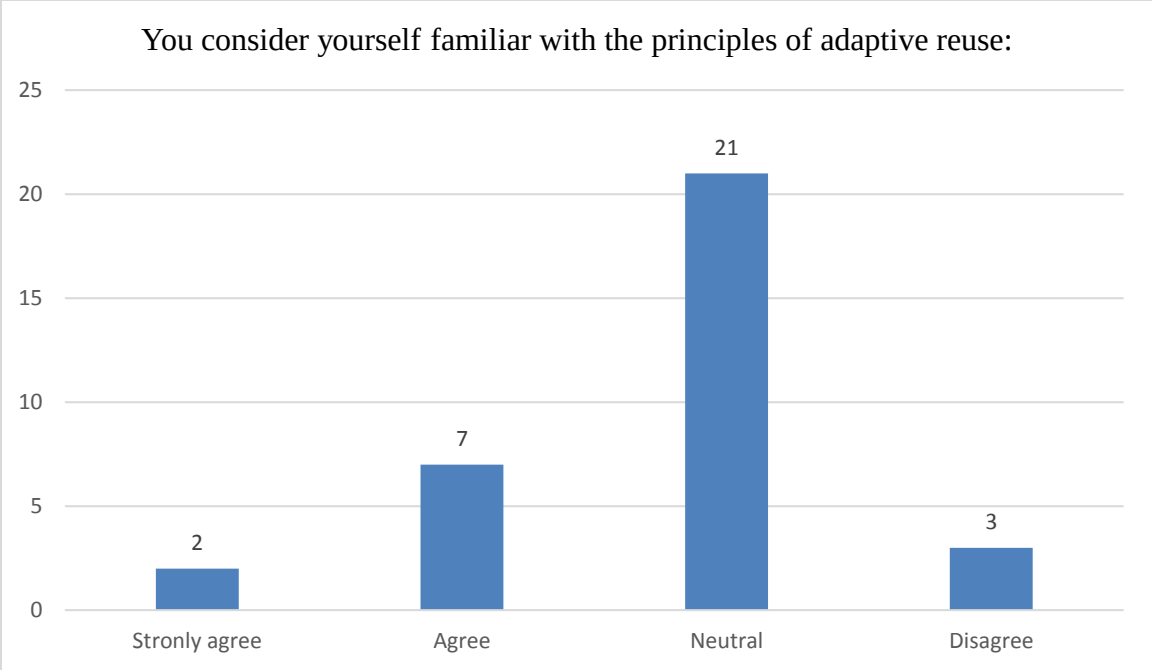

Figure 19. Pre-presentation survey question 4. Note that 73% of respondents feel neutral or unfamiliar with adaptive reuse before the presentation.

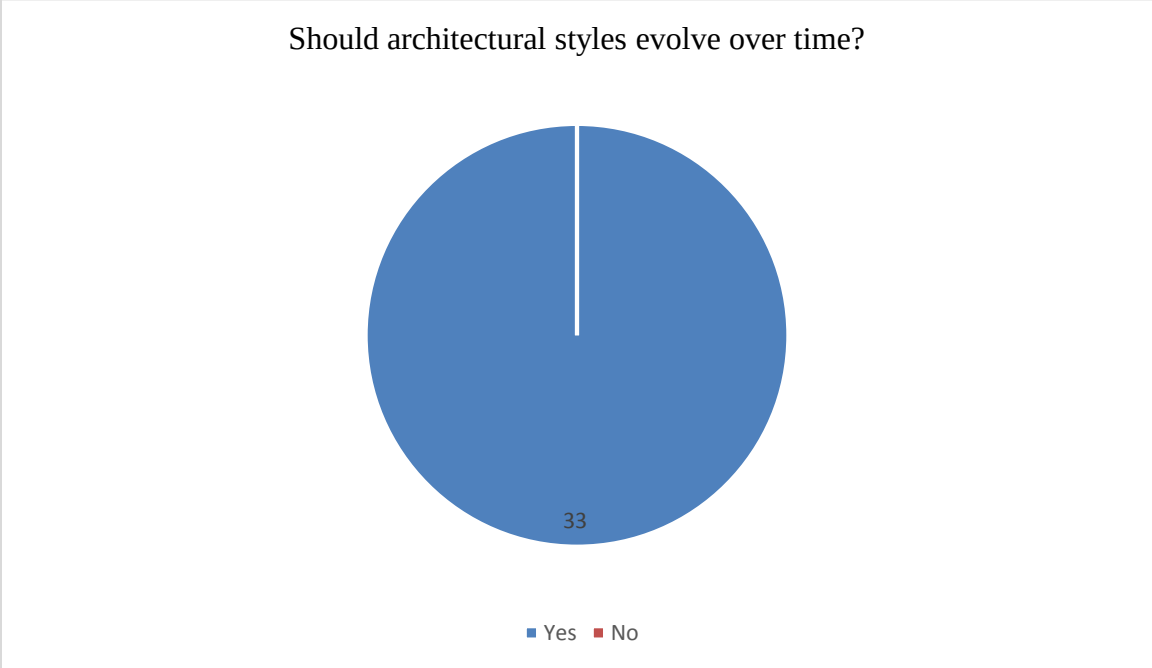

Figure 20. Pre-presentation survey question 8. Note that 100% of respondents said that architectural styles should evolve over time.

Question 9: Name one piece of architecture you consider a cultural icon. Why?

Responses ranged from well-known architectural sites around the world to buildings on the campus of WKU. Respondents mentioned buildings that were similar in design to the proposed redesign of Terminal Station, such as the Louvre in Paris, and specifically noted "its balance and harmony of contemporary and historic design." Five respondents mentioned architecture of antiquity, specifically the Parthenon, Pantheon, and Greek columns. Multiple respondents also mentioned buildings that they are more familiar with locally, such as the Muhammad Ali Center in Louisville, Kentucky, and the Industrial Education Building on the campus of WKU—home to the University's architectural science program.

Results of Post-Presentation Survey and Notable Responses

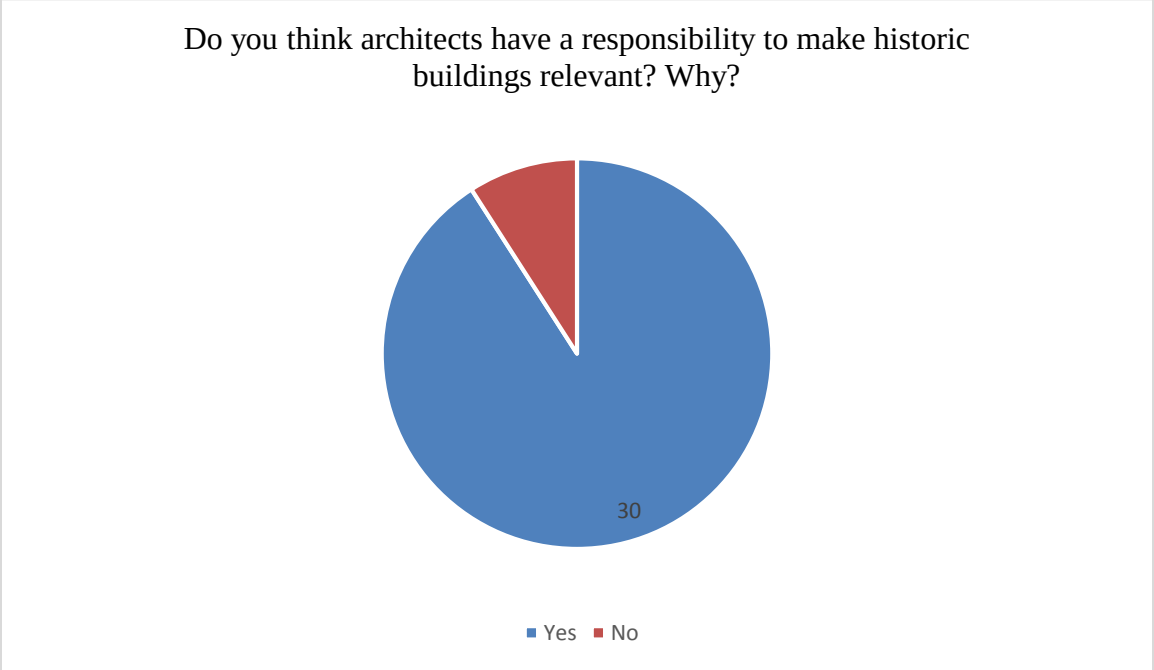

Figure 21. Post-presentation survey question 1.

The majority of responses to post-presentation survey question 1 aligned with the presentation. Respondents widely acknowledged that not all historic buildings must be preserved simply because of their age, and respondents agreed that a historic building must find a way to become relevant in contemporary time to earn its right to preservation. One respondent noted the architect's responsibility to engage in preservation practice because "if its (preservation) is going to happen, then it has to start with us (architects).

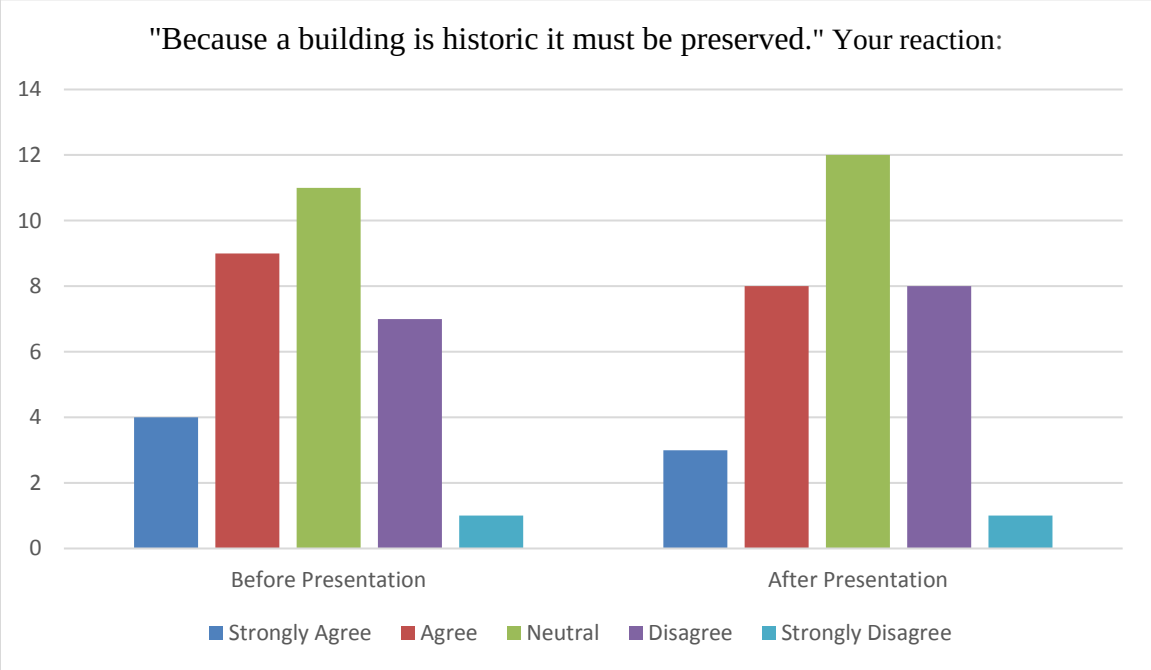

Figure 22. Post-presentation survey question 2. Note that after the presentation there was a decrease in the number of people who thought *all* historic buildings should be saved simply because they are old.

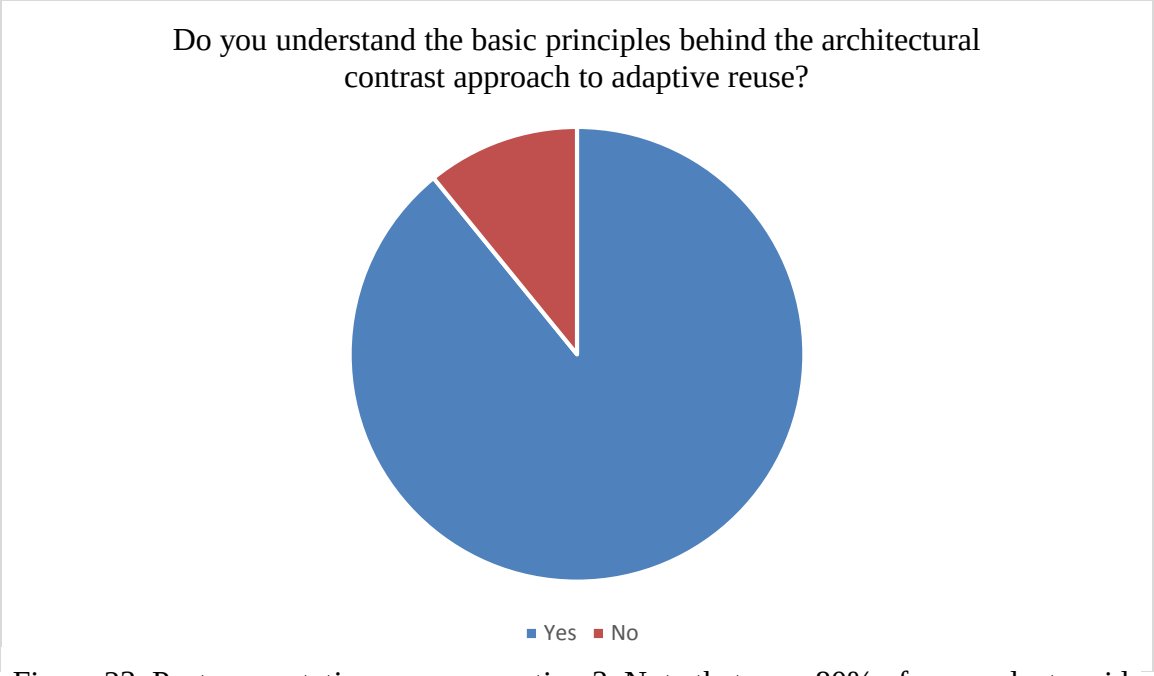

Figure 23. Post-presentation survey question 3. Note that over 80% of respondents said they understand the principles of the adaptive reuse approach utilized in Terminal Station's proposed redesign.

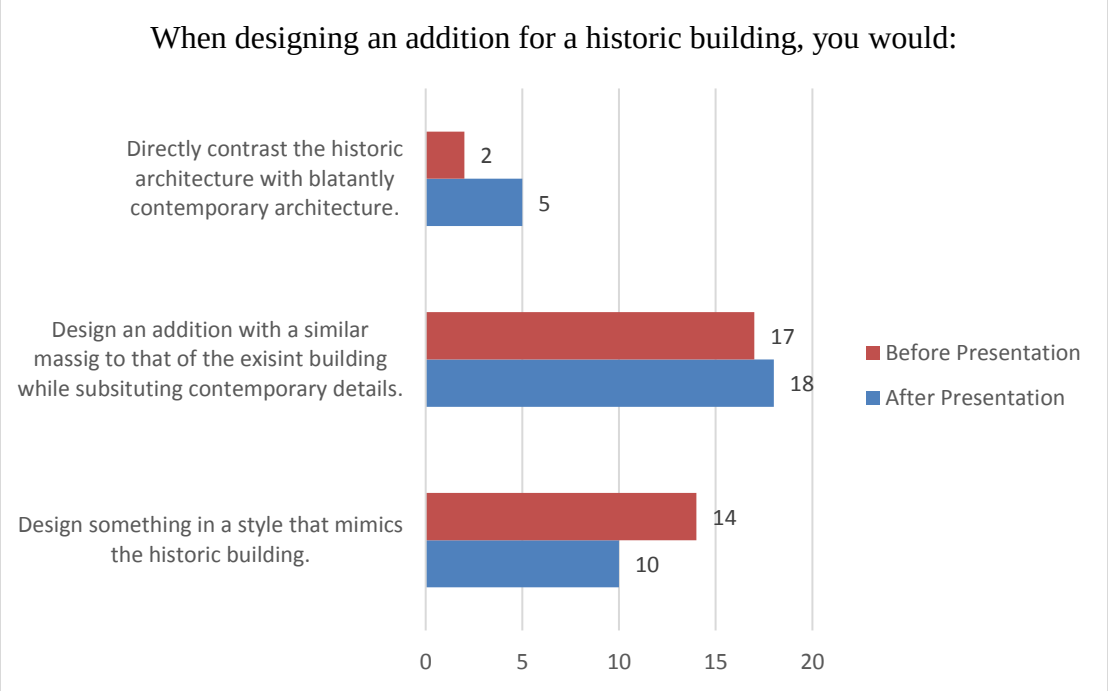

Figure 24. Post-presentation survey question 4. Note that after the presentation, less respondents said they would design something that mimics the original building.

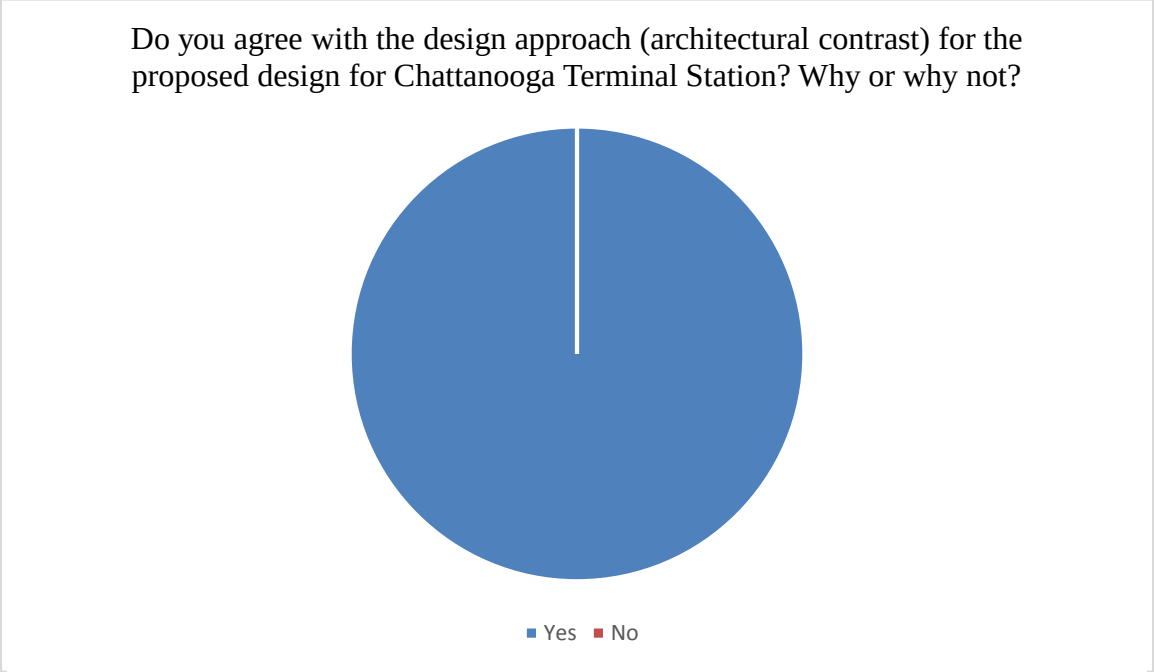

Figure 25. Post-presentation survey question 5. Note that 100% of respondents agreed with the design approach for Terminal Station.

After viewing a presentation that explained the benefits and various approaches to adaptive reuse, all respondents said they agree with the design approach utilized for the redesign of Terminal Station. Respondents appreciated the way the addition does not obscure the original façade and thought that the "steel web" accentuates the architecture of the historic building. One respondent said that "it (the redesign) accomplishes every goal while also complementing the existing structure, which is difficult to do considering the goal was to contrast it."

Post-presentation survey question 6: How has your understanding of adaptive reuse grown/changed since the presentation?

Respondents expressed gratitude for what they learned through the presentation and redesign of Terminal Station. Some responses expressed a greater interest in adaptive reuse and a desire to learn more. Others mentioned that they appreciated the architectural contrast approach utilized in Terminal Station, but also were happy to learn that adaptive reuse does not always have to be executed using contemporary design language, and said they were glad to learn that a redesign that adds to the existing building using "the existing style can also prove to be a great solution."

DISCUSSION/CONCLUSION

Much of the success of an adaptive reuse project lies in its ability to resonate with those who interact with it. The presentation and accompanying survey were especially useful tools in determining the success of the proposed Chattanooga Terminal Station redesign. The pre-presentation survey questions were designed to provide an understanding of the demographics that were being surveyed, and what level of understanding the respondents had of basic architectural principles. The post-presentation survey not only evaluated perceptions of the proposed Terminal Station redesign, providing a real-world test of the success of the design, but it also examined how an explanation of the design approaches to adaptive reuse might have changed opinions from what was thought by respondents before the presentation.

Of the 33 respondents, over 95% were architecture students. This is likely the reason why most students said they have been interested in architecture for more than five years. While having respondents with the same major did produce similar answers for questions regarding an interest in architecture, it also made a yielded a group of people who are acutely aware of the built environment and provided arguably more insightful feedback of the proposed redesign for Terminal Station. The question that asked whether respondents have been outside of the United States was intended to identify what percentage of people have been exposed to international architectural trends and other preservation techniques. 22 out of 33 respondents said they had been out of the country.

Most students said they were familiar with the basic principles of design—something which made their opinions on Terminal Station much more meaningful. However, when asked if they were familiar with the principles of adaptive reuse, 21 out of 33 respondents said they were "neutral" on their understanding of the topic, with three students responding by saying they were unfamiliar with it. One specific finding of note was that while 100% of students believed that architectural styles should evolve over time, 14 out of 33 respondents said in the pre-presentation survey that if they were designing an addition for a historic building, they would design something that mimics the original structure. This does not align with the belief that architectural styles should evolve over time. However, for the post-presentation survey, fewer respondents said they would design something that mimics a historic building—a testament to the success of the architectural contrast design approach to Terminal Station.

In their responses in the post-presentation survey, 91% of respondents said they believe architects have a responsibility to make historic buildings relevant. In addition, fewer respondents said they believe that all historic buildings must be preserved simply because they are historic than they initially said in the pre-presentation survey. This is significant because the presentation and the proposed redesign for Terminal Station both relied upon the knowledge that historic buildings, which were well-designed, deserve to be restored because they can effectively serve contemporary society without undergoing extreme alterations that render their redesign economically and environmentally inefficient. The thoughtful, simplistic, and timeless design of Chattanooga's Terminal Station made its redesign simple, and the sensitive approach to adaptive reuse reflects the building's enduring significance as a cultural icon.

The post presentation survey found that 97% of respondents said they understood the basic principles behind the contrast approach to adaptive reuse—a figure which made the following question much more meaningful: When asked if they agree with the design approach of architectural contrast proposed for the redesign of Chattanooga Terminal Station, 100% of respondents answered yes. When asked why, some of the most notable responses included mentioned that the design strikes the optimum balance of contrast and respectable change. The design was referred to as being intriguing, yet interesting; subtle, yet sufficient. Respondents said they felt that it accomplishes all of the aforementioned goals, while also complimenting the existing structure, "which is hard to do considering the goal (was) to contrast it."

The proposed redesign was successfully received because it considered the lessons learned from over 2,000 years of designers practicing adaptive reuse. The design is acutely aware of the cultural significance the Chattanooga Choo Choo (Terminal Station) holds in Chattanooga and was able to accentuate it through a sympathetic addition that capitalized on the existing functionality of the original train station that was designed over 100 years ago. Not only is the design functional, its cutting edge technologies—including radiant heating, water recycling, photovoltaic panels, and natural ventilation—promise to ensure the Station's future as not only a practical and modern transportation hub, but also as the heart of the community of Chattanooga.

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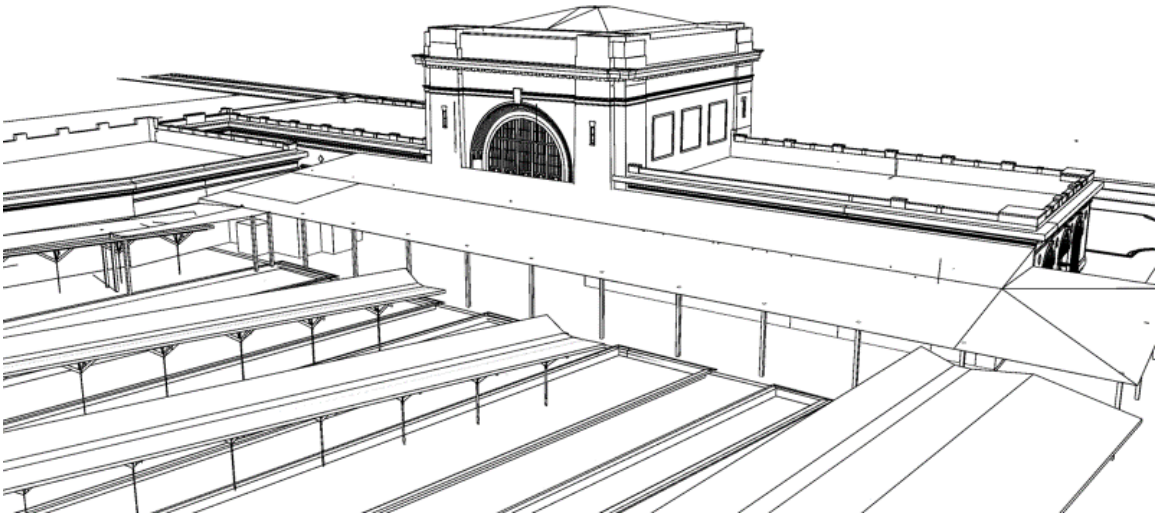
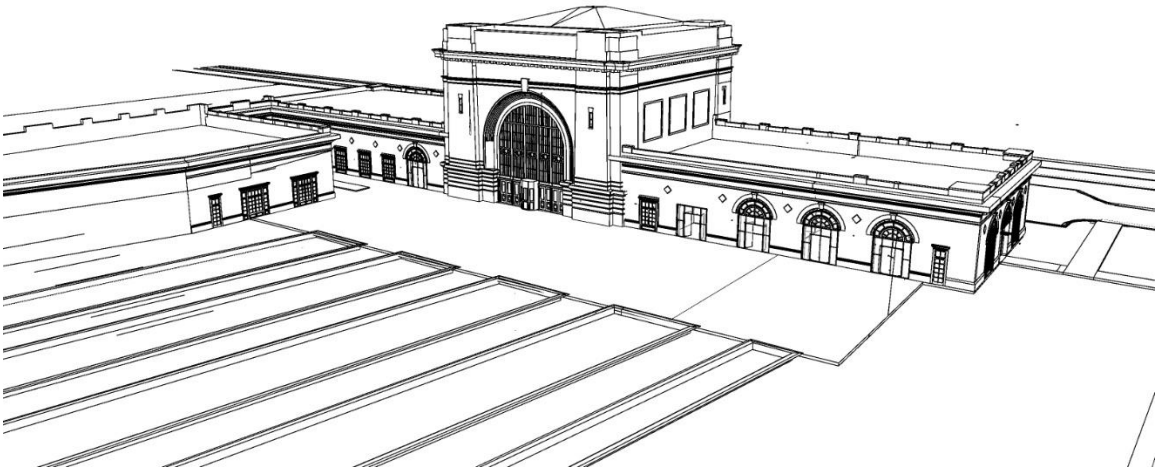
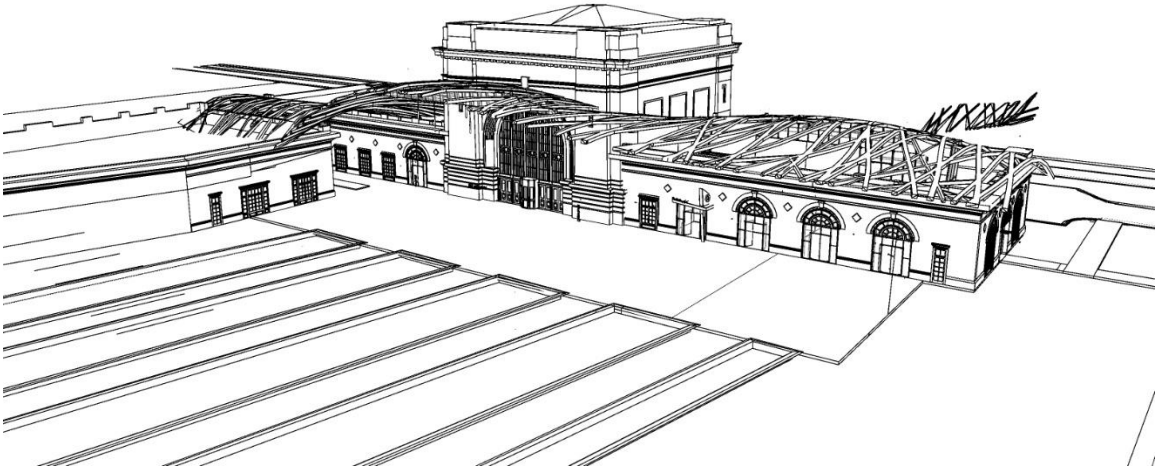
APPENDIX A: TERMINAL STATION DESIGN EVOLUTION



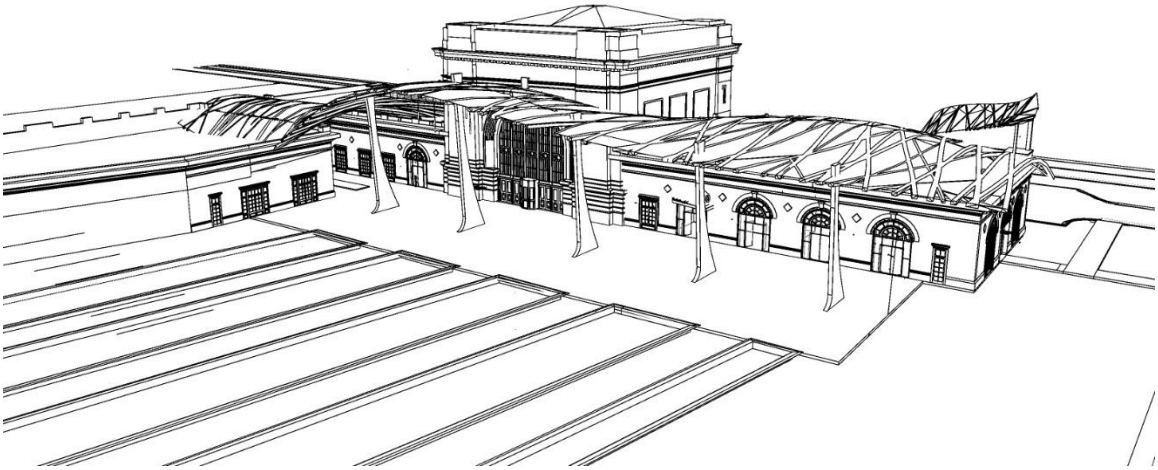
1: Terminal Station—existing rear view. Note that after the existing concourse and train canopies.



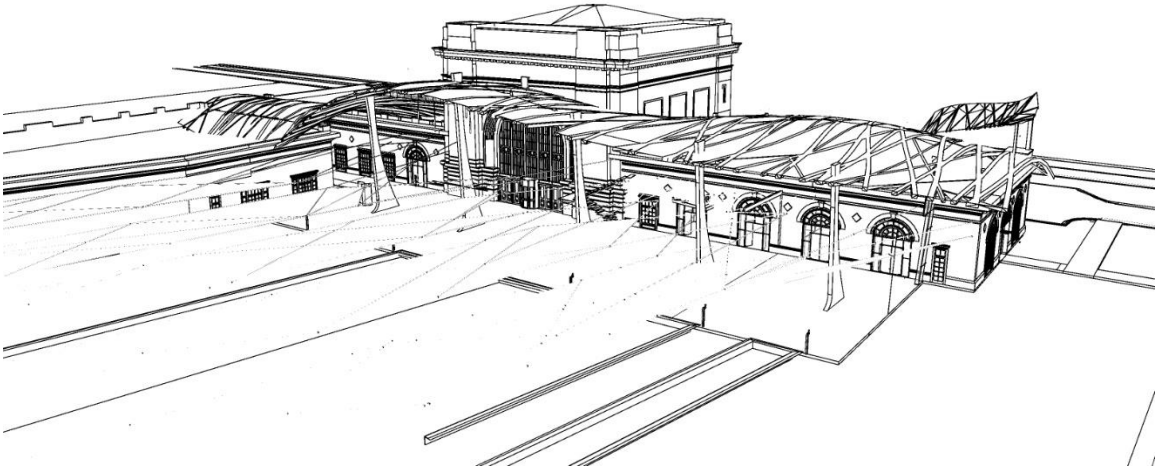
2: Terminal Station—rear view with concourse and canopies removed.



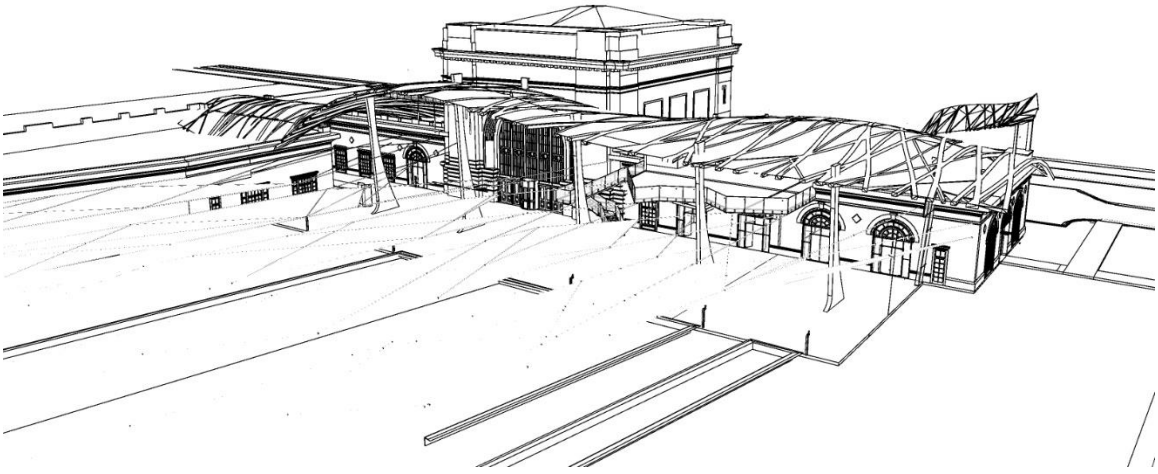
3: Terminal Station—rear view with proposed "web-like structure for new concourse below."



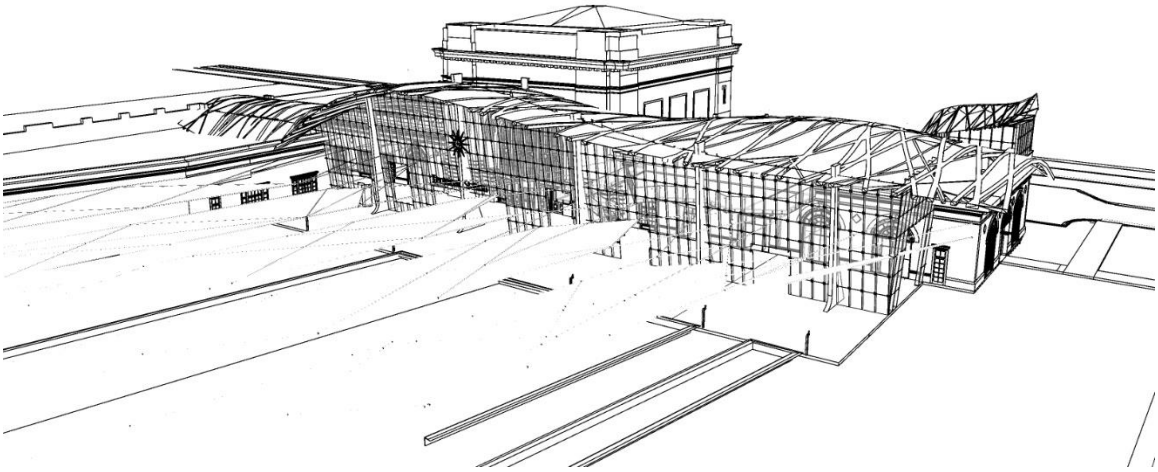
4: Terminal Station—proposed concourse with structure added



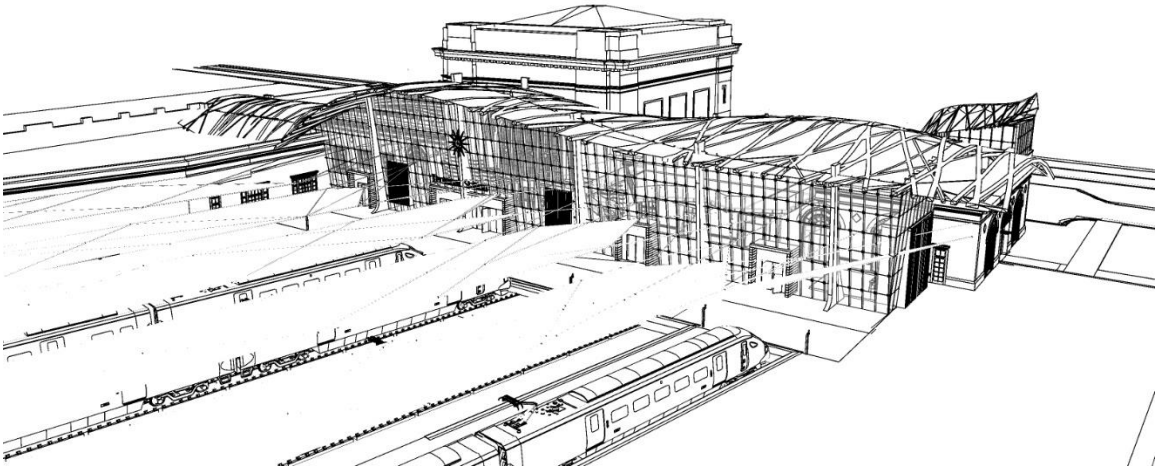
5: Terminal Station—proposed concourse with new train platform canopy. Note how the canopy organically emanates from the existing building.



6: Terminal Station—proposed concourse. Note how the addition of the upper level café "punches through" the parapet.



7: Terminal Station—proposed concourse with exterior glazing.



8: Terminal Station—proposed concourse with added doors for egress. This is the final stage of the proposed redesign.

APPENDIX B: STUDENT QUESTIONNAIRE AND IRB INFORMED CONSENT

Student Questionnaire—Pre Presentation
Prepared by: Carter Jackson

Date: _____ Minor, if applicable:_____
Occupation, if applicable: _____ Major: _____
Gender: Male or Female

1) How long have you been interested in architecture?

   1 year 2-3 years 5 years More than 5 years

2) Have you been outside of the United States?

   Yes No

3) Do you consider yourself well-versed in basic principles of design? (Scale, proportion, lighting, efficiency, etc)

   Yes No

4) You consider yourself familiar with principles of adaptive reuse:

Strongly agree Agree Neutral Disagree Strongly disagree

   a. If you are familiar, how do you think adaptive reuse differs from historic preservation?

5) Do you think adaptive reuse is more or less efficient (monetarily and environmentally) than new construction?

   Yes No

6) You believe that because a building is historic it must be preserved:

   Strongly agree Agree Neutral Disagree Strongly disagree

7) When designing an addition for a historic building, you would:
   a) Design something in a style that mimics the historic building.
   b) Design an addition with a similar massing to that of the existing building while substituting contemporary details.
   c) Directly contrast the historic architecture with a blatantly contemporary architecture.

8) Should architectural styles evolve over time?

   Yes No

9) Name one piece of architecture you consider a cultural icon. Why?

Western Kentucky University Honors Thesis
Student Questionnaire—Post Presentation
Prepared by: Carter Jackson

Date: _____ Minor, if applicable:_____
Occupation, if applicable: _____ Major: _____
Gender: Male or Female

10) Do you think architects have a responsibility to make outdated historic buildings relevant?

    Yes No

    Why or why not?

11) "Because a building is historic it must be preserved." You:

    Strongly agree Agree Neutral Disagree Strongly disagree

12) Do you understand the principles behind the architectural contrast approach to adaptive reuse?

    Yes No

13) When designing an addition for a historic building, you would:
    d) Design something in a style that mimics the historic building.
    e) Design an addition with a similar massing to that of the existing building while substituting contemporary details.
    f) Directly contrast the historic architecture with a blatantly contemporary architecture.

14) Do you agree with the design approach (architectural contrast) for the proposed redesign for Chattanooga Terminal Station?

    Yes No

    Why or why not?

15) How has your understanding of adaptive reuse grown/changed since the presentation?

INFORMED CONSENT DOCUMENT

Project Title: Adaptive Reuse and its Relevance in America's Train Stations
Investigator: Carter Jackson, Architectural Science, email: carter.jackson933@topper.wku.edu

You are being asked to participate in a project conducted through Western Kentucky University. The University requires that you give your signed agreement to participate in this project.

You must be 18 years old or older to participate in this research study.

The investigator will explain to you in detail the purpose of the project, the procedures to be used, and the potential benefits and possible risks of participation. You may ask any questions you have to help you understand the project. A basic explanation of the project is written below. Please read this explanation and discuss with the researcher any questions you may have.

If you then decide to participate in the project, please sign this form in the presence of the person who explained the project to you. You should be given a copy of this form to keep.

1. **Nature and Purpose of the Project:**
   To examine society's perceptions of adaptive reuse and evaluate their opinions toward this type of architecture after a presentation of facts.
2. **Explanation of Procedures:**
   An initial survey will be administered, a PowerPoint presentation will follow, and an exit survey will be administered. Total time should take no more than 8 minutes.
3. **Discomfort and Risks:**
   There are no known discomforts or risks involved in this study.
4. **Benefits:**
   The subjects will be provided an exposure to the costs and benefits of adaptive reuse—a field of architecture that is increasing in relevance. This is something not broadly taught in WKU courses, and could be of use for students in their own class projects and professional life.
5. **Confidentiality:**
   The identity (name, address, etc) of all participants will be kept confidential from all publications and presentations related to this research.
6. **Refusal/Withdrawal:**
   Refusal to participate in this study will have no effect on any future services you may be entitled to from the University. Anyone who agrees to participate in this study is free to withdraw from the study at any time with no penalty.

You understand also that it is not possible to identify all potential risks in an experimental procedure, and you believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

_____ _____
Signature of Participant Date

_____ _____
Witness Date

THE DATED APPROVAL ON THIS CONSENT FORM INDICATES THAT
THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY
THE WESTERN KENTUCKY UNIVERSITY INSTITUTIONAL REVIEW BOARD
Paul Mooney, Human Protections Administrator
TELEPHONE: (270) 745-2129

WKU IRB# 18-354
Approval - 4/12/2018
End Date - 5/2/2018
Expedited
Original - 5/2/2018