Technology Clinic Final Report

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Part I – Introduction

The Technology Clinic is a Lafayette-based program in which students and faculty with diverse interdisciplinary backgrounds work with an organizational sponsor to solve a specific problem. The sponsors have included local businesses, local and regional governments, non-profit organizations, and the College itself. The problems tackled by Technology Clinic teams have taken many forms, including the preservation of historic sites, the development of an industrial park, and the fabrication of industrial devices. The solutions developed by Technology Clinic teams are arrived at over a period of two semesters of study and reflect the fresh and multifaceted perspectives of the College's diverse student body.

Students are nominated by the College's faculty and are then interviewed before being selected. The four divisions represented by this Technology Clinic team are the sciences, humanities, social sciences, and engineering. The students on this team are: Abigail Frueh, a double major in Psychology and Music; Dina Guirguis, a double major in International Affairs and Economics & Business; Hart Feuer, a double major in Economics & Business and German; John Veltri, a double major in Economics & Business and Sociology & Anthropology; and Michael Nilson, a Civil and Environmental Engineering major. The faculty mentors for the team are Professor Dan Bauer (Sociology & Anthropology) and Professor James DeVault (Economics & Business).

The sponsors of this project are the city of Easton and Lafayette College. Both sponsors have requested help with the problems they are facing in the development of Easton's North 3rd Street corridor. The North 3rd Street corridor is a heavily trafficked thoroughfare that lies at the intersection of downtown Easton and the Bushkill Creek, a prominent waterway in the Lehigh Valley. It now serves as a gateway between the City and the College and there are currently

plans to upgrade the area through streetscape improvements. The goal of this Technology Clinic team is to design a solution that will not only offer a more attractive entrance to Lafayette College but also a more viable corridor for the people of both the City of Easton and Forks Township. The primary focus of the team is resolving a number of traffic issues in the area as well as the development concerns associated with these issues.

Problem Redefined

The problem that the Technology Clinic dealt with during the first semester focused on an exploration of the current state of North 3rd Street and proposed possibilities for its modification and revitalization. The group looked specifically at the development of the area in addition to traffic concerns involving the corridor. Additionally, the group explored possible ways to incorporate the Bushkill Creek into the development of 3rd Street. At the group's mid-year presentation, City and College officials identified the areas they felt were most important and encouraged the Technology Clinic to focus on them. The analysis of the Bushkill Creek was taken on by another on-campus group while a Civil Engineering senior design team has explored the potential for the Mohican building. Since construction has already begun on 3rd Street, the Technology Clinic has discontinued analysis of this project. As a result, the group has come to focus on three specific areas in the second semester.

1. **Automotive Traffic and Pedestrian Safety on Cattell Street**

The first area of concern to the group was a continuation from our first semester's look at automotive traffic behavior through North 3rd Street. During the first semester, an examination of blueprints for the reconstruction of the street and a study of the traffic flow resulted in a few modifications that were made to the plans for 3rd Street. The primary changes that have been made to the original blueprints were aimed at reducing the cost of the project to an affordable

level. The group has redirected its attention to traffic issues with Cattell Street and on College Hill in general. Now that North 3rd Street is under development, it is necessary to more critically analyze the College Hill traffic issue as a whole. Most of the debate has centered around the role of Cattell Street, which is seen as a safety and quality of life issue for College Hill residents and Lafayette students and faculty. Changes may be required to ensure that the flow of traffic does not continue to hurt College Hill and risk the success of the College's 3rd Street development initiatives. Using methods such as traffic studies, surveying, and plans for traffic calming, the group has developed several options for dealing with current and future traffic issues.

2. Pedestrian Transportation up and down the Hill

The second area of focus this semester includes the problem of transportation of pedestrians and students from the top of College Hill to 3rd Street. Developments on North 3rd Street is less likely to be successful if the student body cannot conveniently access the area. The Technology Clinic developed several solutions for encouraging more effective student transport up and down College Hill.

3. Private Sector Development

The third area of focus is the development of 3rd Street. To that end, the group has selected several buildings to focus on and has devised possibilities for their development. The group has looked at a number of companies as possible candidates for location at 3rd Street. We believe these best suit the vision of the City and the College for the development of 3rd Street. Although the efforts of the group were primarily focused on outside development, some college-based possibilities have been explored. The development of the Bushkill for a bike path or other recreational uses is currently being addressed by a Civil Engineering senior design team, whose

material and proposals should also be looked at within the context of the development of North 3rd Street.

Part II - Traffic on North 3rd Street

The changes on North 3rd Street that were discussed in our mid-year presentation are currently being implemented. The new street design will increase safety for both pedestrians and vehicles alike. A narrower street and the use of textured concrete are visual identifiers for the new mid-block pedestrian crossing and will serve to warn the driver to slow down for pedestrians. The addition of signage on the approach to the crossing will further assist in warning traffic of the potential for pedestrians.

Additional changes on North 3rd Street that will be appearing in the coming future include: "No Right on Red" from East Snyder Street, one-way west traffic only on Bushkill Drive and a change to the traffic pattern between College Avenue and Snyder Street. The proposed traffic pattern change, a right only lane and a straight / left lane seems like it will create an immense amount of backups at the intersection. Most of the traffic on North 3rd Street going south is from vehicles turning left onto Bushkill Street, just south of the US Route 22 overpass. The current arrangement of one left turn lane and a shared right / straight lane seems best suited for the intersection given the existing conditions.

1. **Traffic Calming on Cattell Street**

One of the most important concerns raised at our midterm presentation involved traffic calming on Cattell Street. Several people in attendance at this presentation, including the current Mayor of Easton, expressed concern about the volume and speed of traffic on Cattell Street. As a result of these concerns, we decided to analyze the flow of traffic along Cattell Street and to determine what, if any, traffic-calming measures might be appropriate.

In order to get a better grasp of the issue, we met with District Engineer Walter E. Bortree of the Pennsylvania Department of Transportation (PennDOT) and with District Traffic Signals /ITS Manager Thomas Walter, also of PennDOT. In addition, we also consulted Patrolman Alan Legath of the Easton Police Department's Traffic Division and Barbara Kowitz, Easton's Chief Planner. We also attended several meetings of the College Hill Neighborhood Association. At one of these meetings, we presented some of the options we developed over the course of the semester in order to obtain feedback from members of the neighborhood.

The information we gathered from these meetings has helped us to refine our proposals. In the meetings with Walter Bortree and Tom Walter of PennDOT, we discussed some of the options we were considering and obtained their views. Most significantly, they both expressed the opinion that a traffic light at the intersection of High Street and Cattell Street was unlikely to be approved because of the small volume of traffic on High Street. Officer Legath was particularly helpful, providing us with several traffic studies conducted on Cattell Street and with a great deal of information about related traffic issues. Barbara Kowitz also provided a great deal of useful information and helped us to understand how to best proceed with our recommendations. Finally, our meetings with the College Hill Neighborhood Association helped us to better understand the concerns of local residents.

In what follows, we briefly describe the traffic analysis we undertook and we also present a number of options for calming traffic on Cattell Street.

Rationale for Additional Traffic-Calming Measures on Cattell Street

During the last semester, we studied both the flow of traffic and its speed along Cattell Street and we also examined traffic patterns in the area. Our analysis indicates a need for additional traffic-calming measures, not only to deal with existing traffic problems but also in anticipation of even greater traffic problems in the near future. In this section, we present the data and analysis that support this conclusion.

We began by analyzing the volume of traffic along Cattell Street. According to PennDOT, the most recent measurements of the daily volume of traffic along Cattell Street was 15,816. To determine the sources of this traffic, we obtained additional data from PennDOT and from the measurements of Officer Legath. According to a recent PennDOT study, the volume of traffic southbound at Cattell and High Street between 6AM and 6PM was 5,125. According to recent measurements made by Officer Legath, the volume of traffic southbound on Knox Avenue during the same time period was 4,933. This suggests that a substantial majority of the traffic on Cattell Street has its origins not on College Hill but rather to the north of College Hill.

To pinpoint the source more precisely, we measured the flow of traffic from 6:30 AM to 8:30 AM moving southbound from Knox Avenue onto Cattell Street and then from Cattell Street to either Lafayette Street or College Avenue. We chose this time period because we felt that most of the traffic headed south during this period was commuter traffic. We recorded an average volume of about 800 vehicles per hour at Knox Avenue; of these 800 vehicles per hour, approximately 200 ultimately found their way onto Lafayette Street either east or westbound. We recorded an average volume of approximately 750 vehicles per hour at the intersection of McCartney Street and College Avenue. If we assume that none of the 600 vehicles continuing on Cattell Street beyond Lafayette Street exited before College Avenue, this implies that 600 of the 750 vehicles recorded at College Avenue and McCartney originated north of College Hill, or

about 80 percent of the average hourly volume. This excludes that portion of the commuting traffic that exited earlier at Lafayette Street.

Given that the majority of the traffic recorded at this time period appears to originate north of College Hill, it is worth asking what is likely to happen to the volume of this traffic in the foreseeable future. According to U.S. census data, the population of the College Hill neighborhood fell from 5,444 in 1990 to 5,348 in 2000, or by about 1.8 percent. In contrast, the population of Forks Township grew from 5,923 in 1990 to 8,419 in 2000, or by 42 percent. If these trends continue, it appears that substantial increases in commuter traffic along Cattell Street are likely in the near future. Given the already heavy volume of traffic using this corridor and the projected increase just mentioned, we believe additional traffic-calming measures are likely to increase both pedestrian and driver safety.

Our argument for additional traffic-calming measures also rests on an analysis of traffic speed on Cattell Street. We measured the speed of one hundred vehicles both southbound and northbound on Cattell Street on Thursday, February 26, starting at 1:30 PM. We found that moving southbound, the 50th percentile speed was 32 mph and the 85th percentile speed was 37 mph, implying that half the drivers went faster than 32 mph and 15 percent were moving faster than 37 mph. Given a posted speed limit of 25 mph, we found that more than 90 percent of the southbound drivers exceeded the speed limit. Moving northbound, we found that the 50th percentile speed was 28 mph and the 85th percentile speed was 33 mph. Roughly 70 percent of the northbound drivers exceeded the speed limit. These results demonstrate that average traffic speeds in both directions on Cattell Street significantly exceed posted speed limits. This is a clear indication that additional traffic-calming measures are necessary.

In an unrelated study, Officer Alan Legath measured speeds for southbound vehicles on Knox Ave (just to the north of Cattell Street). He found the 50th percentile speed was 30.6 mph while the 85th percentile speed was 35.7 mph. He also found that 84 percent of the measured speeds exceeded the posted speed limit of 25 mph. This evidence reinforces the conclusion that speeds in the Cattell Street corridor are too great and that additional traffic-calming measures are necessary to promote pedestrian and driver safety.

Cattell Street is dangerous not only because of the volume and speed of traffic, but also because of poor visibility from the sidestreets. Limited visibility makes it hazardous for cars entering Cattell Street to merge onto or cross leading to more frequent and/or more severe accidents. Over the last year, a number of parking spaces have been eliminated in order to improve visibility at intersections, and this has helped reduce the problem. Nonetheless, visibility is still limited, so some measures to slow traffic on Cattell Street will probably help to reduce the number or severity of traffic accidents in this area.

2. Methods for Traffic Calming

Given our speed and volume measurements, it is clear that there is a need to calm traffic on Cattell Street for the safety of both pedestrian and vehicular traffic. The stretch of Cattell Street between High and March Streets was taken as a case study for our proposed traffic calming measures. Building off of *Pennsylvania's Traffic Calming Handbook*[1]

[1] Pennsylvania Department of Transportation (2001). Pennsylvania's Traffic Calming Handbook. Retrieved from ftp://ftp.dot.state.pa.us/public/pdf/TrafficCalming/TrafficcalmingHandbook2001.pdf (November 8, 2003).

[2] R.S. Means Company. (2004). Building Construction Cost Data (62nd ed.). Massachusetts: R.S. Means Co.

and meetings with transportation and city officials, a number of potential solutions to the speed problem were produced. While none of these proposals were specifically designed to influence the volume of traffic on Cattell Street, it is almost guaranteed that if cars are slowed down, some traffic will be diverted to alternate routes. This will also contribute to improving safety on the currently overcrowded street. The solutions considered for traffic calming on Cattell Street include:

- Traffic signals
- Median islands
- Bulb-outs on corners
- Raised intersections
- Raised crosswalks / speed tables
- Textured pavement

Sample drawings for all of the above can be found in appendix A.

Traffic Signals

A traffic signal may be the answer to the safety problems at the intersection at Cattell and High Streets. The installation of a traffic signal would allow for the safe crossing of pedestrians and vehicular traffic from High Street when necessary by use of any of a variety of modern sensors. At all other times, the traffic flow on Cattell Street would be uninterrupted, and no physical changes to the intersection would be made.

A previous study conducted by PennDOT for the City of Easton revealed that the corner did not meet the warrants necessary for the installation of a traffic signal. However, it has become apparent that the study was conducted during a part of January when very few students

were on the Lafayette campus, therefore decreasing the flow rates normally experienced most of the year. We recommend that the City request a new study at this troublesome corner. The increased vehicular traffic on High Street coupled with a guaranteed increase in pedestrian activity, especially in the late evening / early morning hours may in fact be strong enough to meet a warrant for a traffic signal.

According to Thomas Walter of District 5 PennDOT, a traffic signal would cost between $40,000 and $70,000. In order for PennDOT to perform the study required for a traffic light, a bond must be posted by the City to cover the costs of the light installation if it is found to be warranted.

Median Islands

Median islands provide a simple, creative solution to the problem of pedestrians crossing Cattell Street. The installation of an island just south of High Street on Cattell Street would allow for a pedestrian refuge, so only one lane of traffic need be traversed at a given time. Once on the island, the pedestrian may evaluate the condition of traffic on the other lane and decide when is safest to cross. This alternative would result in the narrowing of lanes and a small degree of horizontal deflection towards the curbs. A narrower road and the need for a deflection should also serve to slow traffic down.

Appropriate signage would be necessary on the approaches to the island from all directions in order to warn motorists of the oncoming change in traffic pattern. As opposed to traditional signs which may not be visible along Cattell, or that drivers may choose to ignore, another option is to install a flashing yellow light on each end of the median island to show drivers where the island is located.

The design of the median island may be either all concrete to reduce visual obstructions, or it may contain some low-growing flowers to add some beauty to the street. This change would also be accompanied by the planting of colorful flowers along the existing sidewalk or in any other new traffic calming measures that may be implemented.

A simple, all concrete medial island may cost as little as $5,000[1]. Reduction in concrete area for plantings will help to decrease the cost. Additional features, including lighting, are additional.

Bulb-outs

Bulb-outs on the corners of Cattell and High Streets would serve to reduce the width of Cattell Street without adding a barrier between the two lanes of traffic. Abiding to the constraints of emergency service vehicles, the road may be reduced down to 24-feet total for the two lanes of traffic. This would allow for approximately 7-foot bulb-outs that can be stretched as far back onto either Cattell Street or High Street as may be desired. In addition to narrowing the road, bulb-outs would guarantee that no one is parked in illegal spots too close to the corner, protect end-parked cars from most rear-end collisions, provide pedestrians an extra 7-feet to see oncoming traffic without stepping out into the street and make pedestrians more visible to oncoming traffic. As with any solution, appropriate signage must be installed on the approaches. Lighting may also be installed to illuminate the intersection (perhaps from a bollard installed on each bulb-out).

The size of the bulb-outs on Cattell Street, south of High Street, would need to be reduced to accommodate the current curb cuts for Wawa and the autobody shop. Barring these conflicts, all other bulb-outs may be at least 20-feet in length from the center of the curb curve.

Bulb-outs are reasonable in price, with an estimated cost of between $7,000 and $10,000 per pair[1]. A complete intersection may cost as little as $14,000, depending on the size of the island and what kind of texture, if any, is desired.

Raised crosswalks / speed tables on College Hill and in Lafayette College

Raised crosswalks are an ideal way to slow traffic down on a large scale on Cattell Street. Instead of having an effect at only one location, speed tables (which may function as raised crosswalks) are typically installed at a certain spacing to have the most desired effect on speeds. A combination of the tables and associated pavement markings on their approaches may slow down vehicles up to 6-mph[1]. However, these speed tables may delay emergency vehicles by 4 to 6 seconds.

A goal of Lafayette College in recent years has been to create more of a College town feel on College Hill. Additionally, it has been desired to create a clear location at which one enters the College campus. Some of the traffic calming devices discussed in this section may be used in conjunction with various locations on campus where traffic calming may be necessary. One such example is in front of Markle Hall Administration Building. Although flanked by two speed bumps, High Street in front of Markle Hall is often traveled at high speeds, creating unsafe conditions for the students and visitors that cross continually during the day. The degree to which the speed bumps have deteriorated and the current crosswalk paints are warn off provide no assistance to crossing pedestrians, as oncoming drivers can avoid the speed bumps and cannot see the painted markings. One proposal is to construct a raised mid-block raised crosswalk from the center of the Markle Administration Building to the location at which the new sidewalk will be poured across the front Skillman Library. This would effectively link the admissions building

with the rest of the heart of campus and it would provide for a very attractive and safe way for pedestrians to cross High Street. These raised crosswalks, if constructed with bricks, may cost up to $11,000 each depending on their size[1].

Raised Intersections

Raised intersections are very commonly used in Europe but are only beginning to be used in the United States. The concept of a raised intersection is to in fact raise the entire intersection of two roads by between 3- and 6-inches. This vertical deflection would force drivers to slow down in order to maintain a comfortable ride. The approach to a raised intersection is typically a 6-foot ramp at a grade no steeper than 8%. In addition to the vertical deflection, the use of colored concrete or any type of pavers will give drivers another visual means by which to identify the raised intersection and adjust their speed accordingly. Pavement lighting is also sometimes used in Europe, but this method has not been approved by the USDOT yet. As opposed to the standalone use of textured or colored concrete, even if the area is warn out, the bump will remain at its height, so its effectiveness should not decrease with time. According to *Pennsylvania's Traffic Calming Handbook*, raised intersections, like speed tables, may delay emergency vehicles by 4 to 6 seconds.

The cost for raising an intersection is typically between $15,000 and $60,000[1] depending on the specifics of the intersection and what type of work will be done. For example, brick paving the raised intersection will cost approximately $30,000 plus the cost of concrete approach ramps[2].

Textured / Colored Pavement

The use of textured or colored pavement is a least-invasive method for creating visual warnings to slow down drivers. Textured or colored pavement may be used in crosswalks or entire intersections to alert drivers of a pedestrian crossing. This method will not have as great an effect on traffic speeds as would many of the other control measures mentioned because of the act that with time, the texture or color may begin to wear away. Once this happens, the process will have to be repeated if the effects felt the first time through were substantial enough. In addition, the change would require no new actions on behalf of drivers, so they may soon return to old habits of speeding down Cattell.

Textured pavement is estimated to cost between $55 and $165 per square yard[1] bringing the total for 4 crosswalks at the corner of Cattell and High Streets to between $1,500 and $5,000. Costs increase with more intricate concrete stamping and coloring options.

Part III - Getting Students To and From 3rd Street: The Problem

One of the main problems with the development of North 3rd Street, as it relates to Lafayette College, is the difficulty involved in traveling up and down the hill. There is currently little incentive for students to frequent the area due to the lack of useful commercial establishments. These incentives are further decreased by other difficulties presented to the students, which include the physical exertion, psychological inhibition, and weather difficulties involved with transit on the hill.

1. Physical Difficulties

The path from the College to 3rd street is physically demanding for both students and faculty. The steps, though recently repaved, remain very steep and require a great deal of physical stamina. Although the majority of the student body is physically active and able, the steps still

prove to be a daunting trek. Unless it is absolutely necessary, most students will avoid the steps. The alternative to the steps is the uneven sidewalk path down College Avenue. Although this route does not have steps and is not as steep, it is longer, more out of the way, and therefore even more inconvenient to use.

The steps and the sidewalk paths are even more daunting for persons with physical handicaps or for senior citizens. It is impossible to bring a wheelchair down the steps and probably equally as difficult and dangerous to attempt to take one down College Avenue. For individuals who choose to wear high-healed shoes or boots, it becomes especially difficult to ascend or descend the stairs. Not only does this present the risk of injury, but also discourages these individuals from using the pedestrian routes to reach 3rd Street. As a result these groups are hindered from making full use of the 3rd Street corridor and the downtown area of Easton.

2. Psychological Difficulties

In addition to the physical aspects of the hill, there are psychological difficulties that deter students from traveling down the steps to 3rd Street. Students have concerns regarding their safety when venturing onto 3rd Street. Rumors of students or Easton residents being attacked or "jumped" often circulate around campus leading to the misconception that it is very dangerous. In an effort to protect themselves, some students avoid pedestrian usage of the area. Unfortunately, many students have misconceptions about the actual distance from the top of the steps to the archway at 3rd Street. Most students overestimate the amount of time is takes to walk from the top of the steps down to the 3rd Street corridor or to the Circle and as a result avoid the corridor all together. For an average student, the walk down requires 2 minutes, 45 seconds, while the walk up requires 3 minutes, 15 seconds. Casual polling will relate that this distance is sometimes thought to require upwards of 10 minutes.

3. Weather Difficulties

The staircase from 3rd Street to the College is a combination of uneven steps and inclined ramps. In the case of mild inclement weather, such as rain, the steps and ramps become treacherously slick and discourage pedestrians from making use of them. In its current state, the staircase lacks hand rails for approximately 60% of the descent, which further exacerbates the danger of utilizing the steps. Depending upon whether one resides at Lafayette over the winter interim, the entire staircase is closed for 30-90 days due to severe snow and ice conditions. Around the winter months, even mild snow and ice conditions are sufficient to completely discourage pedestrian traffic on the staircase.

During the warm months, students are persuaded against using the staircase for a different, although still significant reason. Climbing the staircase requires a significant expenditure of energy, which, in warm temperatures, amounts to an uncomfortable ascent. Assumedly, descent of the staircase is not uncomfortable—in fact it may even be enjoyable. However, knowing that one will eventually be required to climb the staircase, students opt for a different means of transportation.

4. Lack of Incentive

Currently, there exist only two abiding reasons for venturing down to 3rd Street. One of these reasons applies only to students enrolled in classes at the Williams Visual Arts Center or those students who have an interest in the studio and gallery space of the building. The other incentive for going down the hill is for commercial purposes. The City of Easton provides many establishments of interest to the students, including restaurants, transportation services, banking, city offices, and entertainment. Given the relative difficulty (or perceived difficulty) of reaching these establishments, many students choose to travel a larger distance via car to Forks Township,

Phillipsburg, or Nazareth for their commercial needs. Combined, the Visual Arts Center and the City of Easton draw only a small percentage of students from the College.

With renewed development on 3rd Street, students would gain more college-oriented establishments, making it more convenient and attractive to go to the area. Increased student presence on 3rd Street would invariably bring about new interest in the Easton commercial area, as the difficulty of reaching the area would be reduced. Exposure of students to downtown Easton may bring about renewed student interest in the area and potentially renewed incentives to cater to the students. See the Development Section of this report for additional information.

Potential Solutions

1. Shuttle Bus

The most basic option for overcoming the problems described above is to provide a shuttle bus to transport students from the College to 3rd Street and the Circle. The bus could be funded and maintained by the College and could have stops throughout the College (e.g., Williams Center for the Arts, Farinon Center, March Field) and throughout the city (e.g., The Circle, 3rd Street, Wawa, and Cattel Street). The shuttle could vary in size depending on the time of year and the number of anticipated riders.

The main advantage of the shuttle bus is that no initial investment is required. The College could use buses they already have or could acquire others especially for this use. No external changes or modifications would be required, with the exception of possibly creating specific bus shelters. In comparison to other solutions, which will shortly be described, a shuttle bus would be more inexpensive and easier to maintain. The costs would include gas and general maintenance of the van as well as the cost of drivers. And if there was a small fee

charged for riding the bus, or for an annual pass, some money required for gas and maintenance could be recovered. The shuttle would be easily understandable to students and citizens alike. Being that students and athletes are regularly transported from the College to Metzger Fields, the College is already aware of the provisions required for this sort of solution. As mentioned before, the system could easily be modified or discontinued with the change in season (e.g., summer/interim vs. fall/spring semester) when the flow of students to the downtown is significantly decreased. It would be similarly trouble-free to add additional shuttle buses for Family Weekend, Alumni Weekend, or other key times of the year.

A shuttle bus is not without its disadvantages. From an environmental standpoint, a shuttle bus is not ideal. The round-trip time for the shuttle would be longer the more stops were added on. This would decrease the flexibility of the service if there were an extensive, rigid schedule to be followed. The more stops there are, the longer students have to wait at the stops between pick-ups, especially if there is only one shuttle bus running. Should the system be unable to rapidly transport students, one could choose to walk. In general, students would be unlikely to wait for the shuttle since a strong precedent has already been set for students to drive their cars down to 3rd Street or the Circle. The shuttle would not have any additional appeal to those who already drive, and if forced to wait for an extensive period of time, it would carry even less appeal. If the shuttle was only a daytime service it would not be satisfying the needs of those students who go to the Circle to frequent the restaurants or bars in the evening. Overall, the shuttle would likely not be an appealing means of transportation for the students, faculty, and visitors of the College.

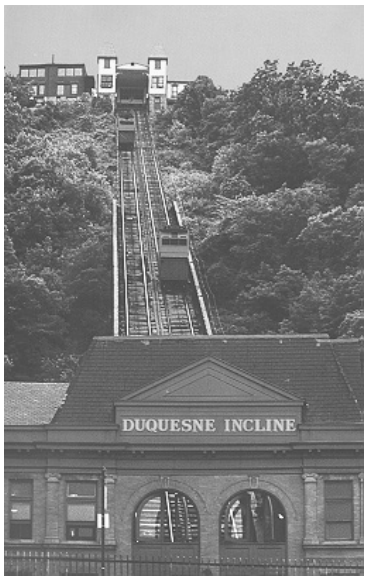
2. Elevator

An additional option for transporting students up and down the hill is to install an elevator in the place of the steps. There are two ways this could be done. An elevator shaft could be excavated into the hill, resulting in a subterranean elevator system. Another option is to run a walkway/bridge across to the open air above the archway and install an open-air elevator from there.

The immediate advantages of an elevator are that it is a much faster mode of transportation. Since it only has two points, there are no extensive wait times between stops unlike the case with a shuttle. An elevator would be more environmentally friendly than the shuttle bus and would not require a continual operator like the shuttle bus. This method of transportation would be more appealing to students because it would take them directly to 3rd Street without intervening stops and would do so in a more interesting medium than a shuttle. It would also eliminate much of the coordination hassles that a shuttle would require. An elevator is much more flexible to the immediate needs of the rider and can be immediately called when needed. If a security system were added (checkpoint-based, for instance), usage of the elevator could be limited to those intended. Since elevators already exist in the insurance plan of the college, liability issues have already been addressed. An elevator has three main disadvantages. The first is that it requires a very high initial investment. There would be a great deal of construction and excavation required. As the hill is not very conducive to an elevator, it would pose a significant challenge to contractors, assuming a permit could be

secured for such an extensive project. Furthermore, the hill has been shown to have structural voids, a problem which jeopardized the Keefe Hall project. If there were a walkway/bridge built out to a freestanding elevator shaft, the result would be an eyesore. It would ruin the clear view that visitors and students have up the hill to the statue. Beyond the initial cost of excavation and construction, such an elevator would require a great deal of maintenance to ensure that it continues to operate properly.

3. Funicular



A funicular is an overland rail-bound transport mechanism used to ascend and descend steep hillsides. They are likened to a miniature train, the track of which is a short and steep segment. Passengers are loaded into cars that are built so that the floor is a flat plane as opposed to an incline. This affords the passengers a ride similar to an elevator, except that the car proceeds up and down at an angle.

Funiculars are more prevalent in western European countries, such as Switzerland, Sweden, Austria, and Italy, where a solution to traversing remote steep inclines is needed. Conditions under which funiculars have been installed in these countries are similar to those present on College Hill. In the United States, funiculars have not been made mainstream, but their prevalence is growing. They have become indispensable at locations such as golf courses, alpine resorts, senior citizen communities, and even private homes.

In many cases, funiculars have come to replace elevators as a superior mechanism for conquering steep outdoor terrain. Typically, far less excavation or bridge-building is required for a funicular. In order to build an elevator to ascend and descend College Hill, either a significant bridge must be built spanning the distance between the landing and the airspace above 3rd Street or a very significant shaft must be bored into the hill with a subterranean pathway of a similar scope. Funiculars are especially designed for hillsides such as College Hill. Furthermore, modern funiculars are packaged with the same security and safety features of current outdoor elevators.

Feasibility of a Funicular

The advantages of a funicular could benefit the school from an efficiency standpoint and a desirability standpoint. Foremost, funiculars are fast, allowing students and faculty reliable and unrestricted access to 3rd Street. In terms of per-student cost, operation of the funicular would be

less than that of a shuttle bus, and would eliminate the additional emissions and noise of the buses. Funiculars are also very visually appealing, and bring with them an element of prestige. Particularly for an engineering school, the funicular would be looked upon favorably by visitors to the college, the community, and the students. Since they are uncommon, the campus and community interest that would be generated by a funicular would be great. The funicular could be used to enhance the quality of life for residents on College Hill, recreational users in the area, and could become an additional visitor attraction for the City of Easton. If managed correctly, a funicular would not only serve the campus as a means for intra-college transport, but as a civic attraction (See Appendix B for Funicular Route).

A funicular also comes with a few disadvantages, some of which are endemic to elevators and other mechanical transport mechanisms, and some that are unique to funiculars. Being that funiculars are uncommon, fewer firms are present in the market, and specialists from out-of-state and even out-of-country may be required to construct the funicular. The initial investment required for the installation would be significant. One firm operating out of Orono, Wisconson, estimates the project could cost between $380,000 and $450,000 depending on unaccounted for variations in the terrain. Once completed, maintenance of the funicular would become a continual expense for the College. Furthermore, an outdoor transport mechanism would require a reassessment of the College's insurance policy, and may entail an increase to cover the additional liability of a funicular.