Improving Accessibility on Campus

Group 1 Final Project Report

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Abstract

Group 1 chose to address improving accessibility on St. Francis Xavier University campus. Currently on campus it is very difficult for someone with mobility issues to move around campus. Accessible entrances and pathways were identified as issues. Our research into this issue included the Accessibility Act, conducting a survey of StFXU, interviewing L'Arche, a meeting with Leon MacLellan, researching current legislature and standards, and researching the National Building Code of Canada. Our preliminary ideas included solutions to connect upper and lower campus, creating a ramp at Schwartz and Bloomfield, creating an external lift at Immaculata, chair lifts at Safety and security, and external elevators for residences. Our group refined our ideas to focus on ramps and creating accessible routes. Due to Covid-19, we narrowed our scope to two ramps. Our final design is two sidewalks that we believe are safer than ramps. We produced AutoCAD files to illustrate our design. To analyse the sidewalks, we calculated two safety factors. Our construction plan details the implementation of our proposed design. We then analysed the total cost of the project including material, building and labour costs. Overall our project scope was reduced by Covid-19, but we believe our design could have an impact on campus.

Acknowledgements

It has been a pleasure to have had the opportunity to collaborate with many from the Antigonish community on our Improving Accessibility on the St. Francis Xavier University campus project. We would like to take this opportunity to thank everyone who has contributed to the success of this project. This project would not have been possible without the mentorship, guidance, and continual support given by these individuals. We offer our sincere appreciation and gratitude.

Professor Emeka Oguejiofor, P. Eng., who is the professor for our Design and Communications 2 class, thank you for consistently challenging us to do better. He has encouraged us and has given strong constructive feedback on all aspects of the project. He was also extremely helpful with regards to assisting with the creation of AutoCAD drawings.

Paul Doiron, P. Eng., thank you for the many years of your time you have dedicated towards being involved with the engineering design projects. We appreciated your valuable feedback on all aspects of the project including the initial project proposal, project updates and oral presentations, to name a few.

Leon MacLellan, Facilities Management Director at StFXU, for sharing with us some of the future plans that are in place in order to work towards creating a barrier-free campus.

Brian Doiron, Project Manager at StFXU, thank you for sharing helpful campus planning files with us such as AutoCADs, campus maps, and photos of the campus.

Antigonish L'Arche community, thank you for sharing many eye-opening experiences you have encountered both on and off the StFXU campus. They addressed many areas that require updated accessibility accommodations on campus that we would have never thought of ourselves. We cannot express how much we appreciated and enjoyed the collaboration of ideas we shared.

Budd MacLellan, Bird Construction Senior Project Manager, and Kerase Cameron, Bird Construction Foreman, thank you for not only taking the time to meet with us to share your knowledge on the processes of how to build ramps and sidewalks, but to give us feedback on our preliminary designs.

Dale Archibald, Architect at Archibald & Fraser Ltd., thank you for meeting with us to discuss building codes related to building our sidewalks. He provided us with extremely very informative documents regarding building codes for both Nova Scotia and Canada.

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Introduction

We chose to focus our final design project on improving accessibility at St. Francis Xavier University (StFXU). For the scope of our project, we have limited our definition of accessibility to accessibility for people with physical disabilities. We acknowledge that there are other types of accessibility barriers on campus encountered by people with intellectual disabilities, learning disabilities, mental health issues and many others. Our project aims to address the physical accessibility barriers encountered on campus. Specifically, creating accessible routes between lower and upper campus.

Problem Description

Currently on StFXU campus, there is one ramp that connects the elevated part of campus and the lower level. Further, many buildings on campus are inaccessible or not easily accessible. For example, illustrated in figure 1, pg. 2 (Appendix A for larger image), a map of StFXU campus, the Bloomfield building (13) is only accessible on the third level, with an elevator in the building. Other buildings like the Annex (10), Somers (22), and Powers (23) are not accessible to people with mobility issues. (See figure 1). The hill going north on Notre Dame avenue is too steep for many to climb safely. In the winter months, the accumulation of snow and ice makes steep hills impossible to climb and even flat sidewalks dangerous.

As an example, a student in a wheelchair going from MacIsaac Hall (14) to Bloomfield (13) may need to go all the way to the ramp in front of building 8, then back track to reach Bloomfield. If that ramp were to close, as it did during construction in 2019, people would need to leave campus and use the sidewalk on St. Ninian's Street to reach upper campus.
The lack of accessible pathways on campus unfairly affects members from the community, students, faculty and alumni. The current infrastructure on campus could potentially force them to extremes which could lead to unsafe situations, putting them at risk for further injury.

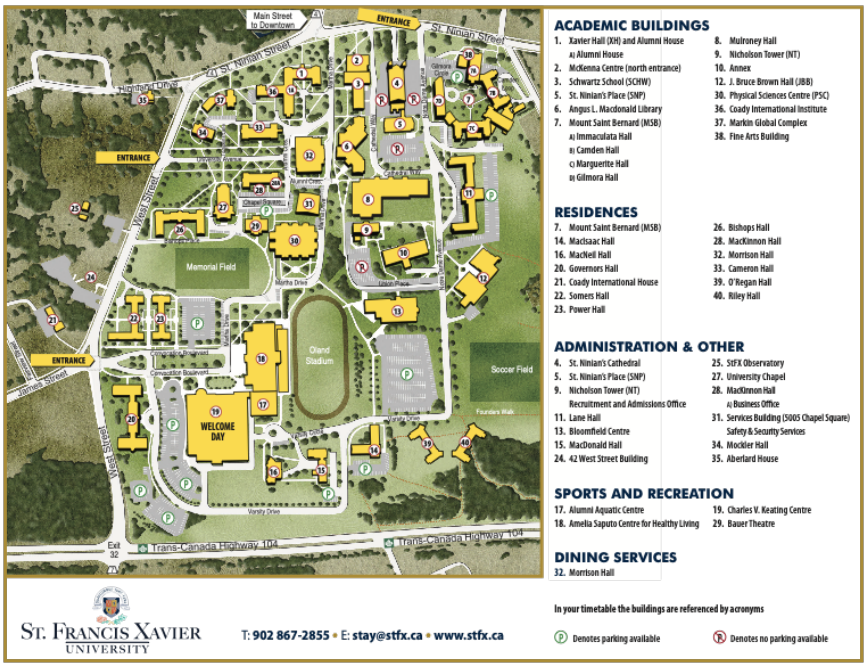


Figure 1: StFXU Campus Map. North direction is vertically up the page.

Background Research

Campus Planning

According to StFXU's website (St. Francis Xavier University, 2017), in late 2017 the campus planning committee examined how students interacted with and used the campus. They created a long-term framework plan that focused on pedestrian and vehicular traffic to target specific sections of campus that they identified as having barriers to general traffic. These sections include Martha Drive, which would potentially become a pedestrian plaza closed to most vehicular traffic. Another section identified was Notre Dame Avenue, in front of Lane Hall, that would also become a pedestrian plaza that restricted vehicular traffic during certain times of the day. The overall goal of their long-term plan was to make campus more pedestrian friendly, including moving parking primarily to the perimeter of campus to support their overall target.

These plans are not being made with accessibility in mind, as restricting parking will reduce accessibility. For example, someone who depends on a car to get across campus would require additional accommodations and mobility. This plan is taking away dignified means of

travel. Further, StFXU seems to be prioritizing aesthetics over function, for example planning a cobblestone walkway would be extremely difficult for someone in a wheelchair to traverse.

Why Now?

According to Accessibility Services Canada (Exley, 2019), nearly 20% (144,000) of Nova Scotians are currently living with a disability, and this number is expected to increase as the population of the province ages. In April 2017, the government created the Nova Scotia's Accessibility Act, also known as Bill 59. This legislation aims to make Nova Scotia more inclusive and barrier free by 2030. In particular, the legislation states that all education centers must become fully accessible to all by 2030. This includes universities, meaning StFXU must become fully accessible in the next decade, however the definition and standards of accessibility are still in development. We believe that some of our ideas could be implemented towards making StFXU fully accessible in the next 10 years.

Feedback from StFXU Community

To get feedback with regards to the accessibility on the StFXU campus we conducted a short survey and received 104 responses. The survey was filled out by mainly students, but also faculty and a few community members who also use facilities on campus. The collected data from the survey suggested that 6.73% of responders identified as someone who has a permanent physical disability or someone who has experienced having a temporary physical disability while attending StFXU. Of the responses from these individuals, most of the people said that they use or have used crutches.

Pertaining to another survey question, an alarming amount of people rated campus as not being very accessible. Based on a 1-5 scale with 1 being not accessible, and 5 being highly accessible, 94.2 % of survey participants rated accessibility on the campus as a 3 or lower (See figure 2, pg.4). Participants were encouraged to give an explanation with regards to why they chose their numerical rating. This is one of their responses:

> I am considered now a fully abled person. But in my second year, I was on crutches for the entire year. I had a wheelchair but actually couldn't maneuver it on the campus due to potholes, uneven sidewalks that have both dips and lips that made the wheels get stuck, ice and hills, on a sunny day with no snow or ice, my friend (very in shape

friend) could hardly push me around in the chair. As a result, I had to resort to crutches. My prof who had an office in the Annex was actually so troubled by the accessibility of the building, that she offered to come to my residence building for our meetings and appointments. But I still had two classes and 2 labs that weren't taught by her in that building.

It is clear from this and other responses that StFXU is clearly not meeting the accessibility standard asked for by its community members, and changes must be implemented. Campus should be accessible to all individuals, regardless of ability. Although this survey was extremely helpful with getting feedback from individuals who use the campus, most of the responses were from fully physically abled individuals. The respondents were able to identify a great number of accessibility related issues on campus, but as physically abled individuals, there was a high chance that obvious obstacles were not identified that only someone who struggles with having a physical disability would notice.

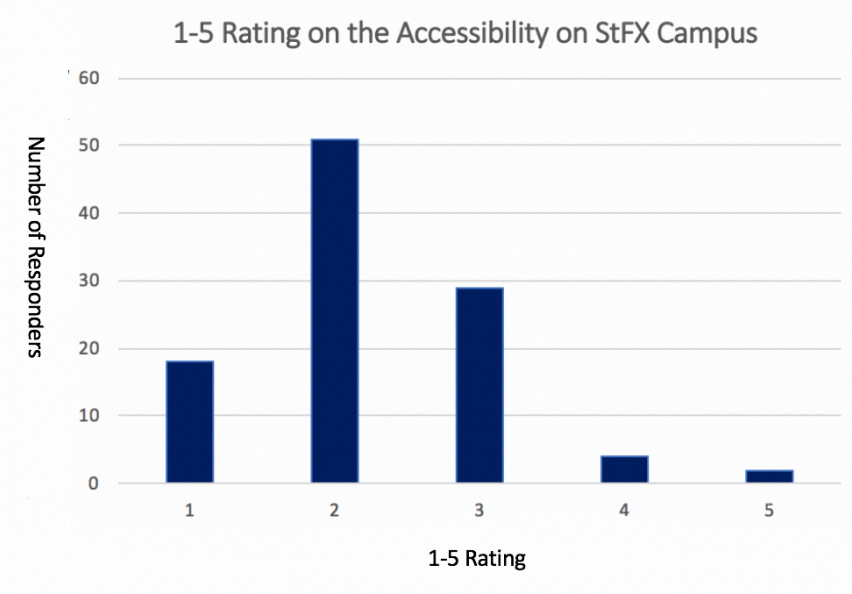


Figure 2: Accessibility Bar Graph

Meeting with L'Arche

We reached out to L'Arche to collect data from a more diverse group of individuals with potentially higher mobility concerns. L'Arche Antigonish is a community situated in the town, where people with and without intellectual disabilities share life together (Jones, n.d.). Many members within the L'Arche community also have physical disabilities that accompany their

intellectual disabilities. We met with support workers and residents on February 5th to hear their perspective on mobile accessibility at StFXU.

One concern mentioned was how the Amelia Saputo Centre pool does not have very accessible change rooms at the pool. Part of the problem is that there is no gender neutral changeroom, which makes it extremely challenging when a support worker from L'Arche, who is the opposite sex of the member of resident that they are accompanying. The change room doorways and hall are also too narrow to comfortably navigate in a wheelchair. In addition, the building's only accessible entrance is through another building with many heavy doors in between. If someone has trouble opening doors, it is nearly impossible to access this area.

L'Arche members agreed that getting across campus is very difficult for those with reduced mobility. Members supported the idea of adding ramps to StFXU. The main message from the people of L'Arche was to consult with community members who are going to use StFXU spaces during the design process of these facilities – not afterwards.

Meeting with Head of Facilities Management (Leon Maclellan)

On Tuesday, February 11th, our group met with the head of Facilities Management, Mr. Leon MacLellan, to better match our ideas to St. FX's future plans, current plans, and thoughts on accessibility. Mr. MacLellan began the meeting by explaining the lack of legislature on what standards to use. He talked about what the nationwide standards for accessibility are and believed the 'gold standard' to be the Rick Hansen standards. He also went on to discuss the problem StFXU has balancing accessibility and security. They must find a balance between making buildings and services accessible to all without compromising the security.

One of the main topics that Leon addressed was the communication between Facilities management and a student with a disability. He emphasized the importance of the student reaching out to Facilities Management so that they can make the proper arrangements to make campus more accessible for them. For example, they had a previous situation where two separate visually impaired students had guide dogs to help them move around campus. One dog was allergic to natural salt and the other allergic to artificial salt. Facilities Management had to plan out two separate salt routes across campus, corresponding to the locations of the students' classes, so that the two dogs wouldn't cross paths.

Leon mentioned their current projects, which include the demolition of Lane Hall and shortly afterwards the construction of the new Centre for Health Innovation that will be located at the same spot. After the completion of the Centre for Health Innovation, they plan to demolish the Annex.

Since the Annex is being demolished, we will direct more focus to other accessibility problems around campus. With regards to the future plans that StFXU has to make campus more accessible, there are few. StFXU currently has no immediate plans to make campus more accessible as they are waiting for the government to release the provinces accessibility standard. Without an accessibility standard, they do not have a concrete basis for an accessibility audit.

Meeting with the Bird Employees Bud MacLellan, Kerase Cameron

We met with Bud MacLellan, Senior Project Manager, as well as Kerase Cameron, a Foreman for Bird Construction, on March 13th. We discussed various construction plans they had relating to ramps and sidewalks. Specifically, Bud's team was responsible for the installation of the ramp on Hillcrest street in front of Mount St. Bernard. He mentioned the importance of digging deeper than the permafrost layer. For building a ramp, you need to dig 6 feet into the ground underneath the entire desired area and fill it with concrete to prevent shifting during the year caused by freezing and thawing of the ground. An alternative to filling a large area with concrete is to install screw piles every 12 feet. Screw piles go 6 feet deep into the ground and have diameters ranging from 40mm to 70mm, they take up less space. This would be beneficial for our project as it is cheaper and safer for locations where you are building over electrical or power lines. Bud also showed us a detailed AutoCAD drawing of the StFXU campus that showed where all these lines were. The screw piles can be placed to avoid the lines. He also emphasized that our material choice should be concrete, as it has a long-life span, requires minimum maintenance and is non-slip. When we told him our design ideas, he suggested running our ramp or sidewalk along the wall of the library as it can act as a support.

Research into Legislature and Standards

The Accessibility Act (Nova Scotia Government, 2017) has created a basic framework to plan the future of accessibility standards in the province. It is essentially a preliminary plan for the overall process and includes what decisions need to be made. The standards will surround the

identification, removal, and prevention of barriers. The standards can be general or specific and limited to a time and place and apply to different classes of groups. The Act does not include the standards themselves or any dates, it is only an outline.

The Nova Scotia government has published their own research into accessibility needs across the province since the Accessibility Act of 2017 (Nova Scotia Government, n.d.). The document, *What we heard*, was a summary of the results from focus groups, online questionnaires, public engagement sessions, stakeholder meetings, and direct submissions. 63% of respondents to the surveys had a disability. The document concluded that the goal is to be inclusive and equitable, barrier free, and safe and respectful. Top priorities are reducing barriers for education and infrastructure, which means StFXU needs to focus on removing key barriers.

A formal timeline of the government's plan has been released in a document titled "Access by Design" (Nova Scotia Government, 2018). The timeline shows that the education and built environment standards will be enacted in 2021, as they are currently in development. In 2022, these standards will be implemented. A Gantt Chart is shown in Appendix B of the planned roll out of standards over the next decade. Please see Appendix B for more details. The intended goal of the standards as stated is to achieve that "persons in Nova Scotia have equitable access to inclusive public and post-secondary education".

The most recognized and inclusive accessibility standards that currently exist are the Rick Hansen Standards. The Rick Hansen foundation has published a wealth of resources available for creating accessible spaces and certifying infrastructure as accessible. There are guides available for making specific things more accessible, such as elevators, entrances and doors, ramps and washrooms. The foundation provides a Professional Handbook which gives specific details and requirements for ramps (Rick Hansen Foundation, 2018).

These standards recommend a minimum 1:20 ramp slope, while the National Building Code requires 1:12. For our project, we aimed to achieve the recommendations set out by the Rick Hansen Foundation for ramps, which are more accessibility friendly than the NBCC codes.

Building Codes

The building code documents referenced for our design process were the Canadian Standards Associations (CSA) *Accessible Design for the Built Environment* and division B, section 3.8 of the *National Building Code of Canada* (NBCC). Both documents were given to us

by Dale Archibald of Archibald & Fraser Architects, but we later found a copy of the *Accessible Design for the Built Environment* document online that also included more sections which is referenced in this report. The NBCC document was printed in 2015 and is the most recent version of the national code and the CSA document was printed in 2012 but edited and re-printed in 2015.

Ideas

Initial ideas for our project came after walking to and around all the buildings on campus. Specific areas that were thought to be particularly inaccessible were listed and focused on in the brainstorming phase. These highlighted areas are Schwartz, the Bloomfield Center, Immaculata Hall, the Annex, Safety & Security, Service Learning, Cameron Hall, Mackinnon Hall, Somers Hall and Power Hall. In addition to these areas we identified the lack of accessible pathways connecting the upper and lower parts of campus to be a major issue. Some more ideas include a general lack of ramps and automated door operators as well as poor signage indicating accessible routes.

Connecting Upper/Lower Campus

Our more creative ideas included a skywalk from the third floor of the PSC to the path connecting Mulroney and Bloomfield and a conveyor belt machine directly below this area that would lift wheelchair users up the hill that divides upper and lower campus. These ideas ultimately proved to be impractical when compared to simple solutions like adding ramps or accessible doorways on different levels of a building.

Schwartz School of Business

The main issue at the Schwartz building is the staircase between it and the library. There is no ramp accompanying this staircase and the nearest route to get around the Schwartz/library area is the ramp in front of Mulroney. This area has the potential to solve the upper/lower campus issue we have identified.

The other issue with Schwartz is that there is no accessible entrance on the back side of the building. A simple solution to this is to install an automatic opener on the door of the back side of the building across from the cathedral that is currently always locked.

The Bloomfield Center

The Bloomfield center is one of the popular buildings on campus, yet it only has one accessible entrance. The accessible entrance is on the third floor across from the Annex. The only routes to this from lower campus are to go up the large hill on Notre Dame Avenue or taking the ramp in front of Mulroney and doubling back. A ramp could be built from the parking lot to the first-floor entrance. Making this entrance fully accessible would also require replacing the doors with wider, automated doors.

Immaculata Hall

Immaculata Hall currently only has one accessible entrance. It is inside Mount Saint Bernard down a long hallway with no signage. The outdoor entrance has no room for the addition of a ramp so our solution would be to make this building accessible is improving the signage and/or installing a lift over the stairs to the outdoor entrance.

Safety & Security/Service Learning

Safety & Security is in the same building as Service learning and they are both below ground, so it is necessary to descend a set of stairs when entering. These buildings often need to be accessed by students so installing a wheelchair lift is our most practical solution to making these services accessible.

Residences

Cameron, Mackinnon, Somers and Power Hall are all virtually inaccessible and would require external elevators to be installed to be made fully accessible. Our meeting with facilities management and research into possible accessibility standards indicates that old residences will not be required to become accessible, since they are not used for education or open to the public.

Refinement

We decided to exclude the ramp at the Annex because the annex is scheduled to be torn down before accessibility standards will be enforced in Nova Scotia. We also excluded the skywalk, external elevator and conveyor belt projects due to practicality. The conveyor belt and

skywalk ideas were impractical and overly expensive solutions to a problem that could ultimately be solved using ramps, which are also less maintenance intensive and risky.

The two ramps we designed at Schwartz and Bloomfield would create two new paths connecting the upper and lower sections of campus, greatly improving accessible routes. The external elevator idea was only relevant to Mackinnon Hall, Cameron Hall, Somers Hall, and Power Hall and was cut since they would not be subject to the government's standards.

Covid-19 Project Impact

Due to Covid-19, we had to reduce the scope of our project. We were forced to cut our automated door plan because we no longer have access to campus, and do not feel we properly address the issue without being able to identify all of the doors. For the same reason, we also cut improving signage and creating an accessibility map since we can't identify areas that require additional signage or properly map fully accessible routes.

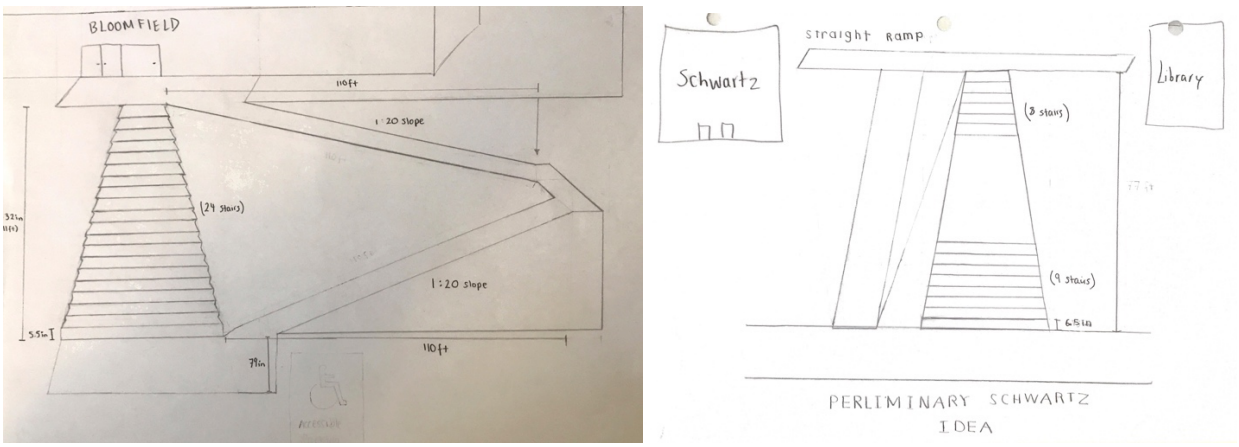
Final Design Ideas

Our ideas narrowed down to designing two ramps that would solve the upper to lower campus issue. Our first ramp is placed in front of Bloomfield, so someone in a wheelchair could access the building on both lower and upper campus. See figure 3, pg. 10 for ramp placement. Our second ramp is located between Schwartz and the library, creating another bridge between the two halves of campus. See figure 4, pg. 11 for ramp placement.

Figure 3: Bloomfield Ramp Location (Google Maps, September 2012)

Figure 4: Schwartz Ramp Location (Google Maps, September 2012)

We initially planned a zig-zag design for the Bloomfield ramp to get as much horizontal space as possible, as shown in figure 5, pg. 11 below. With more 'run', we could reduce the slope as much as possible and make it easier for someone in a wheelchair. For the Schwartz ramp, we initially planned for one long, straight ramp, as shown in figure 6, pg. 11. To have a sidewalk with a 1:20 slope, there was not enough 'run' for the measured rise if the sidewalk were to go straight. We decided to curve the sidewalk around the building, as shown in Appendix F.



Figures 5 and 6, Initial design for Bloomfield and Schwartz ramps

For the Bloomfield ramp, the ramp starts at the base of the stairs at Bloomfield and runs towards Notre Dame Ave, with a platform at that end that is halfway up the hill, where the ramp continues in the opposite direction meeting the staircase at the top platform. See Appendices C, D, and E for further detail and dimensioning.

Our second ramp is located between Schwartz and the library, creating another bridge between the two halves of campus. The first section of this ramp runs up behind the bushes in figure 4 (right side) on page 11 and ending at the top of the staircase pictured in figure 4 (left side). The section portion runs along the wall of the library pictured on the right of figure 4 (left side). See figure 4 visualize the location as well as Appendices F, G, and H for views and dimensions.

Final Design

The NBCC and CSA codes are extremely similar so for simplification purposes this section will reference only the CSA *Accessible Design for the Built Environment*.

A large focus of our design was striving to design our walkways with a slope of 1:20 since both the NBCC and the CSA documents that we referenced for accessibility standards agree that a barrier free path with a slope steeper than 1:20 shall be designed as ramps (National Research Council, 2015), (CSA, 2015). Avoiding having to design a ramp will cut costs and construction time by not requiring a railing, only requiring a fraction of the excavation, and not including the installation of screw piles. Designing a ramp also requires a flat platform every 30 m in order to give an opportunity to rest (CSA, 2015), not including such breaks simplifies the design as well as the construction process.

The CSA states in clause 8.2.2 that "the clear width of an accessible pedestrian route shall be at least 1500mm" (CSA, 2015, p. 162) or about 4.92 ft, where it is 1.1 m in the NBCC (National Research Council, 2015). All our paths are 5 ft wide (see Appendices C and F); we chose this number specifically because of our meeting with Bird Construction who explained that a width of 5 ft was standard practice, simplifying our cost analysis and construction plans. The standards also require a cross slope of no more than 1:50, which we have included in our plans to be exactly 1:50 although due to the scale of the CAD it is not noticeable (CSA, 2015). In all four ramp sections, the cross slope runs down away from the nearest buildings.

We chose to build our walkways using concrete to comply with articles 3.8.3.2 and 3.8.3.3 of the NBCC code stating exterior walks will be stable, firm, slip resistant, continuous and even (National Research Council, 2015). Concrete is also an appropriate choice according to the CSA code requiring ground surfaces produce minimal glare and are not heavily patterned, as

well as including the same characteristics previously stated from the NBCC code (CSA, 2015). We were also able to receive pricing for concrete and a good understanding of the timeline of the construction process from Bird Construction.

The National Building Code of Canada also mentions in the section on *Signs and Indicators* that signs "shall be installed to indicate the location of … barrier-free entrances, … barrier-free elevators, barrier-free parking spaces" (National Research Council, 2015, Article 3.2.8.10). This article pertains to the aspect of our project that we are no longer completing concerning improving signage around campus. We discussed the three previously mentioned locations requiring signage in our progress report but having them in the building code reaffirms our concern that St. FX campus is lacking in this aspect of accessibility. On campus there is no signage indicating the elevator locations in J.B.B, Schwartz or the Physical Science Center (PSC). Accessible entrances all around campus are missing signs and particularly difficult to find was the accessible entrance to Immaculata that our group highlighted early in the project was an issue.

Below are our final 3-dimensional CAD designs for the Bloomfield sidewalk (figure 7, pg. 13) and the Schwartz sidewalk (figure 8, pg. 14).

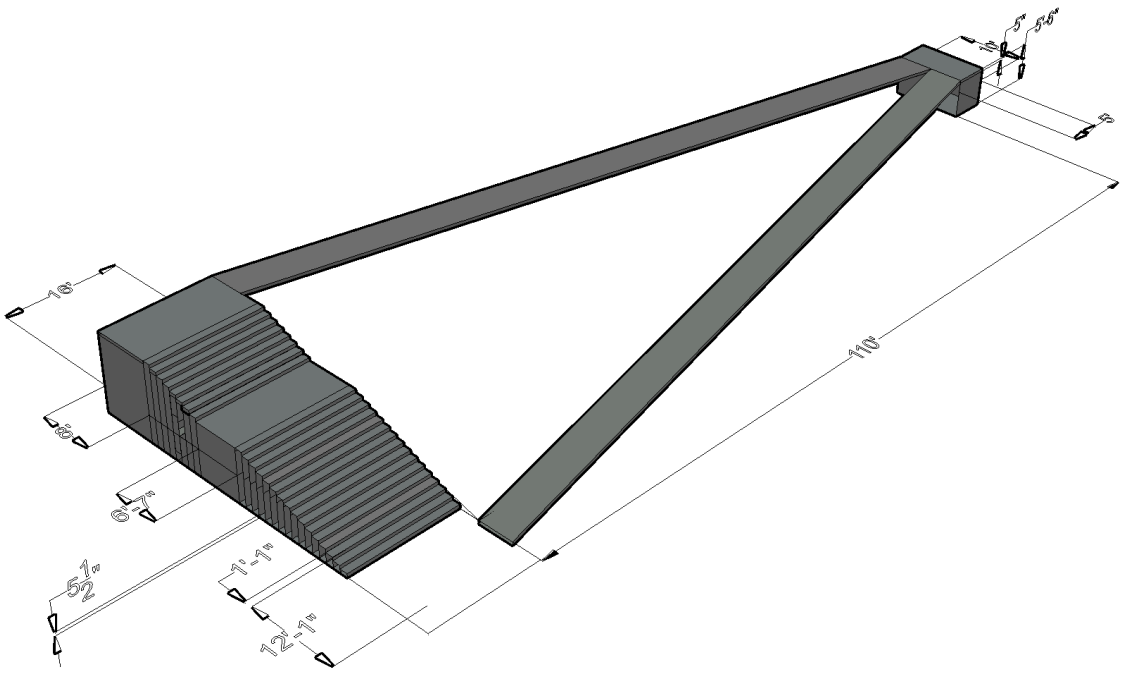


Figure 7: 3D Bloomfield Sidewalk AutoCAD

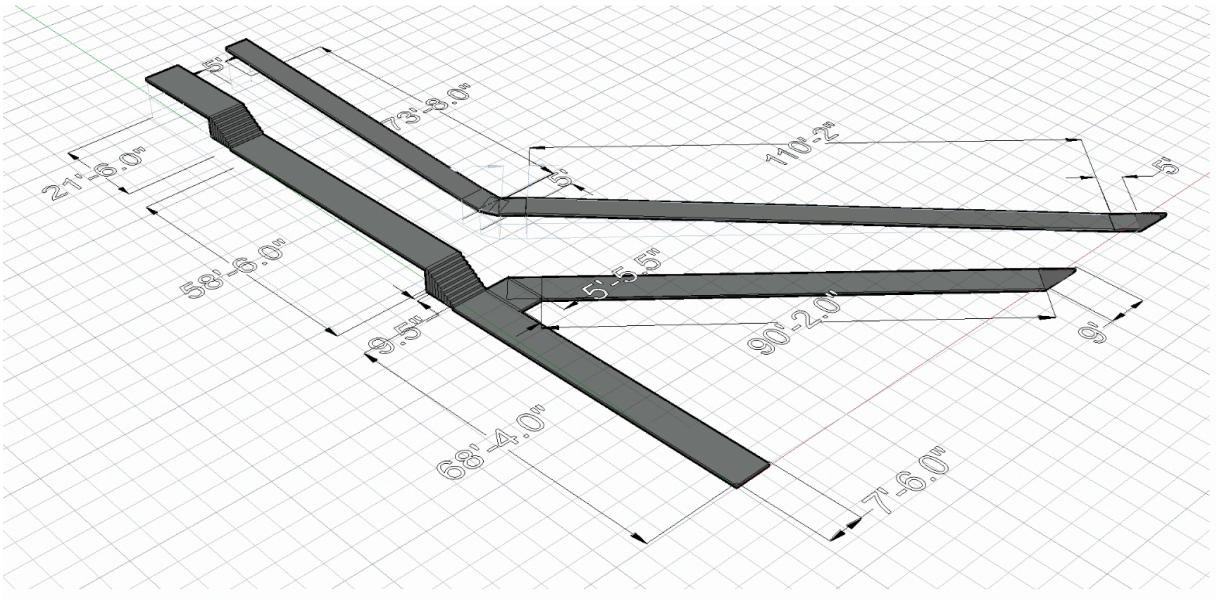


Figure 8: 3D Schwartz Sidewalk AutoCAD

Engineering Analysis

Given that our concrete mix is rated at 25 MPa, the compressive stress can be calculated.

$$25\ MPa\ \times\ 145.038\frac{psi}{MPa} = 3625.94\ psi$$

In practice, a mix of 3,625.94 psi means that the concrete can hold up to 3,625 pounds per square inch which is much greater than what we would expect from pedestrian loads.

This is the maximum stress the concrete could withstand.

$$\sigma = \frac{F}{A} =\ 3625.94\ psi$$

Our sidewalks are at a 1:20 slope:

$$\theta =\ \tan^{-1}\frac{1}{20} = 2.862°$$

Our stress value must account for the slope:

$$\sigma_{max} =\ \sigma\,(\cos\theta)^2 = 3625.94 \times (\cos 2.862)^2 = 3616.90\ psi$$

Next, we calculated our maximum expected pressure. One slab is 5ft x 5ft and can reasonably hold up to 2 people in power wheelchairs at a time. The maximum weight of a power wheelchair is 400 lbs. If we assume the maximum weight of a person to be 400 lbs, plus the option of a service dog weighing 100 lbs, then the maximum expected load per slab is:

$$L = 2 \times (400 + 400 + 100) = 1800\ lbs$$

The maximum pressure: $\sigma = P_{expected} = \frac{1800\ lbs}{(5ft \times \frac{12\ in}{ft})^2} = 0.5\ psi$

Adjusting for the slope: $\sigma_{expected} = 0.5 \times (\cos 2.862)^2 = 0.499\ psi$

0.499 psi is well below the maximum pressure the concrete could withstand.

Factor of Safety: $FS = \frac{\sigma_{max}}{\sigma_{expected}} = \frac{3616.90\ psi}{0.499\ psi} = 7251.9$

Our design can withstand 7,251 times the maximum expected pressure or stress, making it extremely safe.

According to Table 4.1.5.3 of the Ontario building code (Government of Ontario, 2006), for a sidewalk to meet the standard it must be able to withstand a minimum of 12 kPa.

$$12\ MPa\ \times\ 145.038 \frac{psi}{MPa} = 1740.46\ psi$$

$$\sigma_{standard} = 1740.46 \times (\cos 2.862)^2 = 1736.12\ psi$$

$$FS = \frac{\sigma_{max}}{\sigma_{expected}} = \frac{3616.90\ psi}{1736.12\ psi} = 2.08$$

Our concrete design can withstand twice the compressive stress more than the standards outlined in the building code.

Construction Plan

Bloomfield Sidewalk Construction Plan:

The first step in building a sidewalk is requiring a building permit. Once a building permit is acquired, a foreman will operate an excavator to clear approximately 10 small trees that are in the way or very close to the path of the new sidewalk (Figure 3, pg.10 was taken in 2012, since then many of the trees have already been removed). Next the excavator will be used by a foreman to build up the ground as most of the sidewalk is being built above the pre-existing ground level. Although we did not get the chance to make our own topographic map, contour lines were added to the top view Bloomfield AutoCAD drawing from a pre-existing drawing Paul gave to the group (see Appendix C). When building up the ground, it is required to have a hole at least 5’ wide, 117’ long each way, and approximately 1’6” deep. At the same time, type 1 gravel will be delivered on site, which will be then spread by the backhoe while unskilled

workers simultaneously rake the gravel. Taking all of this into account, with landscaping and building up the base it would typically take a team around 3 to 4 days to complete.

The sidewalk requires approximately 6” of type 1 gravel to be spread. Once this is finished, an unskilled worker will use a plate tamper to compact the gravel. Once the gravel is compacted, an engineer is required to run a compaction test, the required proctor density should be around 95%. Once the proctor density testing is completed and there is approval given to move forward with the project, approximately 6” of type 2 gravel is to be spread with the backhoe as well as the workers with rakes. Next, the gravel will be compacted again with a plate tamper and the compaction testing with an engineer occurs again.

The next step is for the framework to be built and set into place. It will not be required to use mesh or rebar in the sidewalk as we will be using a cement with built in fiber glass. Once the concrete is poured, cement finishing takes place with a non-slip broom finish. This broom is run along the sidewalk to lightly roughen the concrete surface.

The sidewalk will be left to cure for at least 24 hours. After it is cured, forms will be removed and saw cuts are made in the concrete every 10’ (every second block) to allow freeze-thaw movement. Final steps to be taken include cleaning up the area, and landscaping. With all that said an approximate timeline for this project, with efficient workers and considering no external factors that could jeopardize working days, the project could be completed in 14 days.

Schwartz Sidewalk Construction Plan:

The construction plan for the Schwartz sidewalk will be very similar to the building process of the Bloomfield sidewalk. A main difference is that we will have to tear down the brick wall that is in align at the top of the stairs. In an ideal situation, an additional design would include cutting and transforming the existing wall to include a second match arch over our sidewalk. However, our project is primarily focused on the functionality of the ramp and not as much on the aesthetics of the arch, so we did not design it in detail. For the first half for the Schwartz sidewalk, it will require digging down into the ground because the hill rises quicker than the slope of the planned sidewalk. This excavated material will strategically be used to build

up the second half of the ramp. A very similar process of spreading, compacting and running compaction tests for the type 1 and type 2 gravel will occur.

Framework will be built and installed, concrete will be poured, and concrete finishing takes place. After framework is removed, saw cuts are made. Clean up and landscaping will follow. Roughly the same timeline as the Bloomfield project applies to the Schwartz project, without any issues the sidewalk could be finished in two weeks.

Cost Analysis

We created two cost analysis spreadsheets one for each sidewalk. This calculation is based on the knowledge we have gathered over the semester, particularly from Bird Construction, and our measurements of the area. Appendix I shows the cost analysis for the sidewalk that will run in front of the Bloomfield centre next to the lower parking lot. Appendix J shows the sidewalk we intend to build in between the Schwartz Building and the Library.

Conclusion

We felt the need to act on accessibility around the StFXU campus as we recognized the need for improvement. After constant communication with the community, architects, engineers and construction employees, we have concluded that StFXU's accessibility can be improved with the addition of sidewalks at key locations. With these additions, pedestrian traffic will become more efficient for all, including those that might have mobility issues. We hope that our project will aid StFXU to help meet the requirements of the Nova Scotia Government Accessibility Act that has to be fulfilled by 2020.

Unfortunately, due to unforeseen events with the current Covid-19 pandemic we did not get to complete everything we wanted to achieve in our project. Specifically, making accessibility route maps, implementing automated doors, and improving signage. However, we do feel that our project, that being introducing sidewalks at the heart of the campus, is a meaningful real solutions to the problem.

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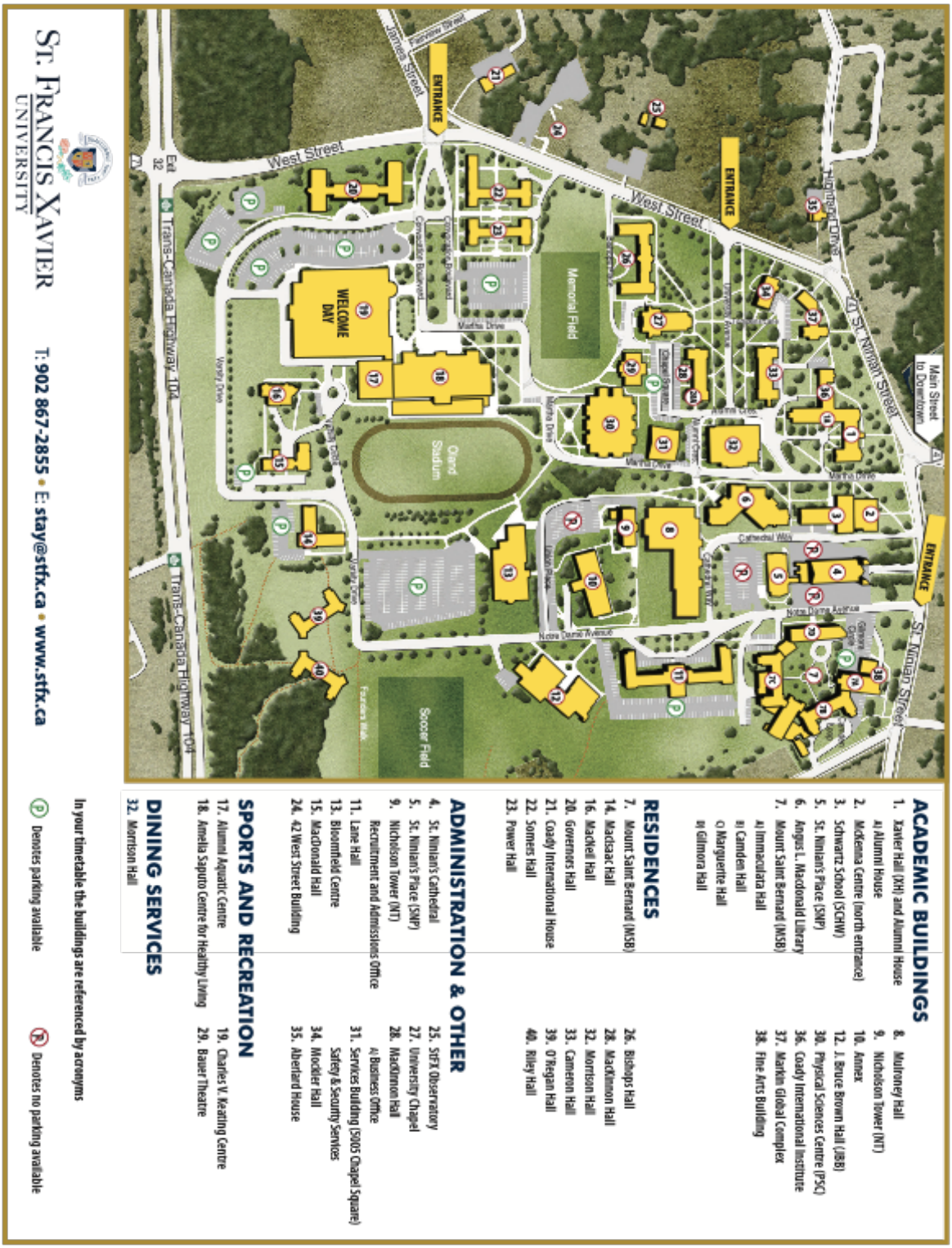
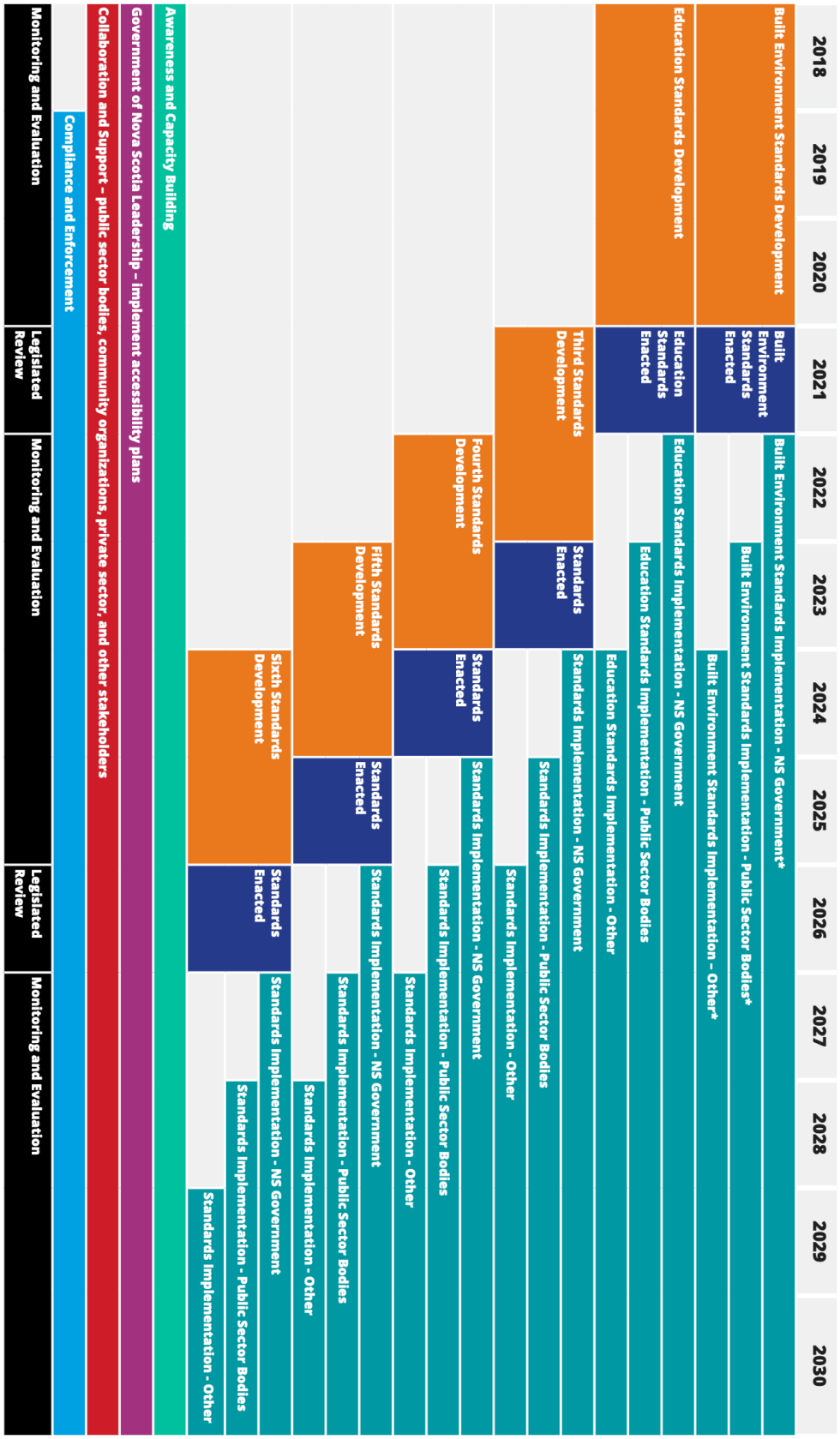
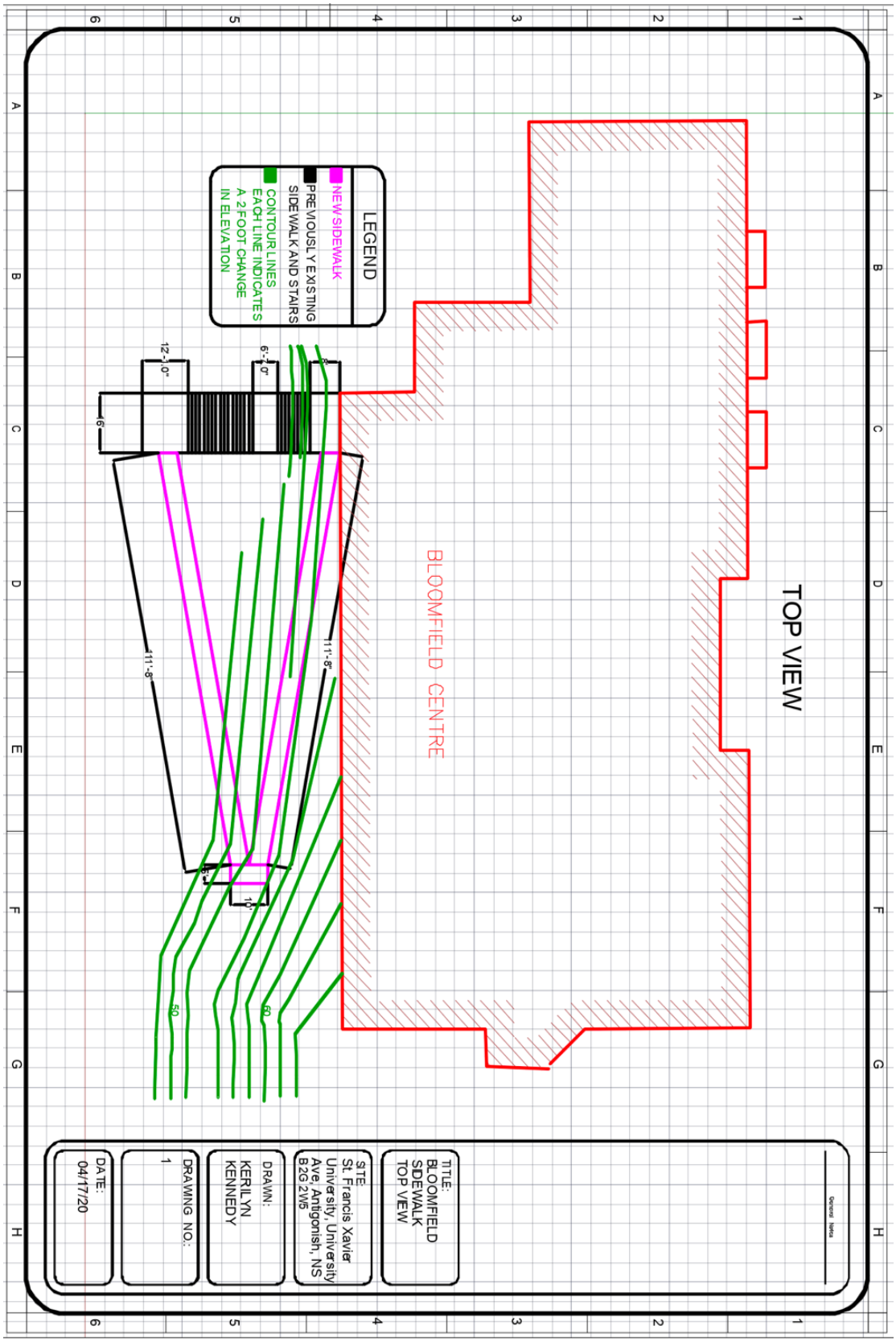
Appendices



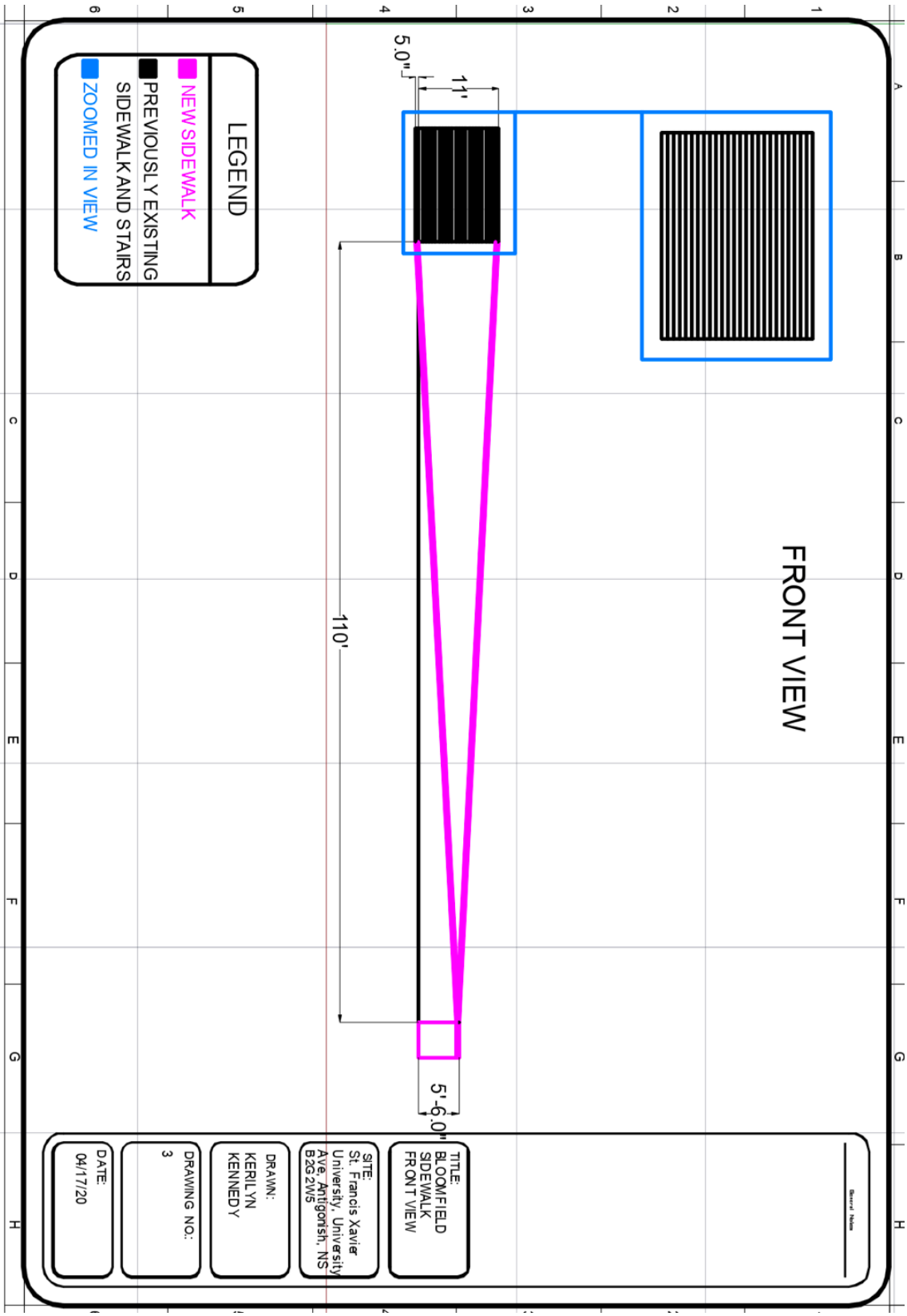
Appendix A: Map of StFXU campus, north pointing to the right of page



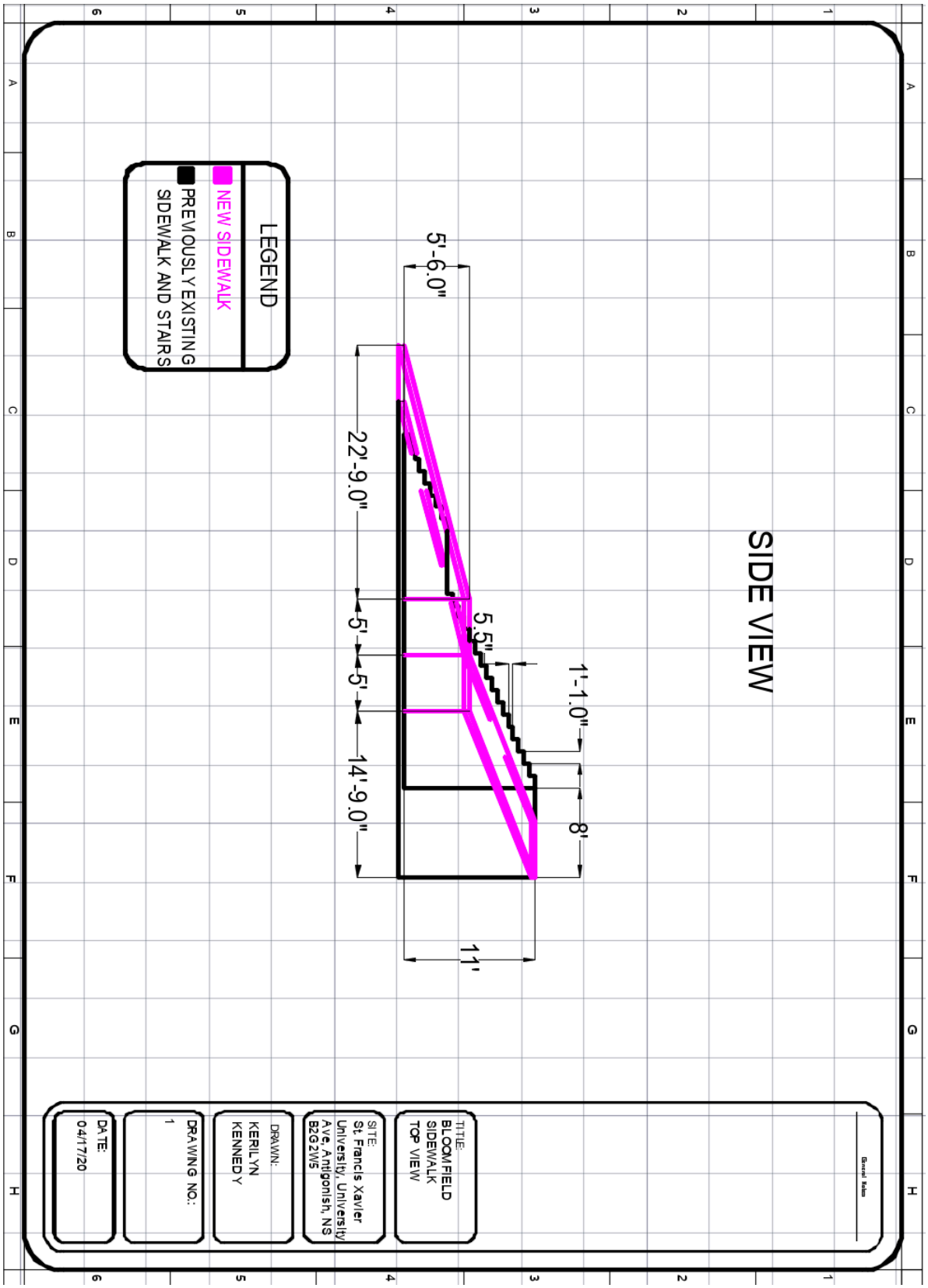
Appendix B: Timeline of Accessibility Standards from “Accessible by design”



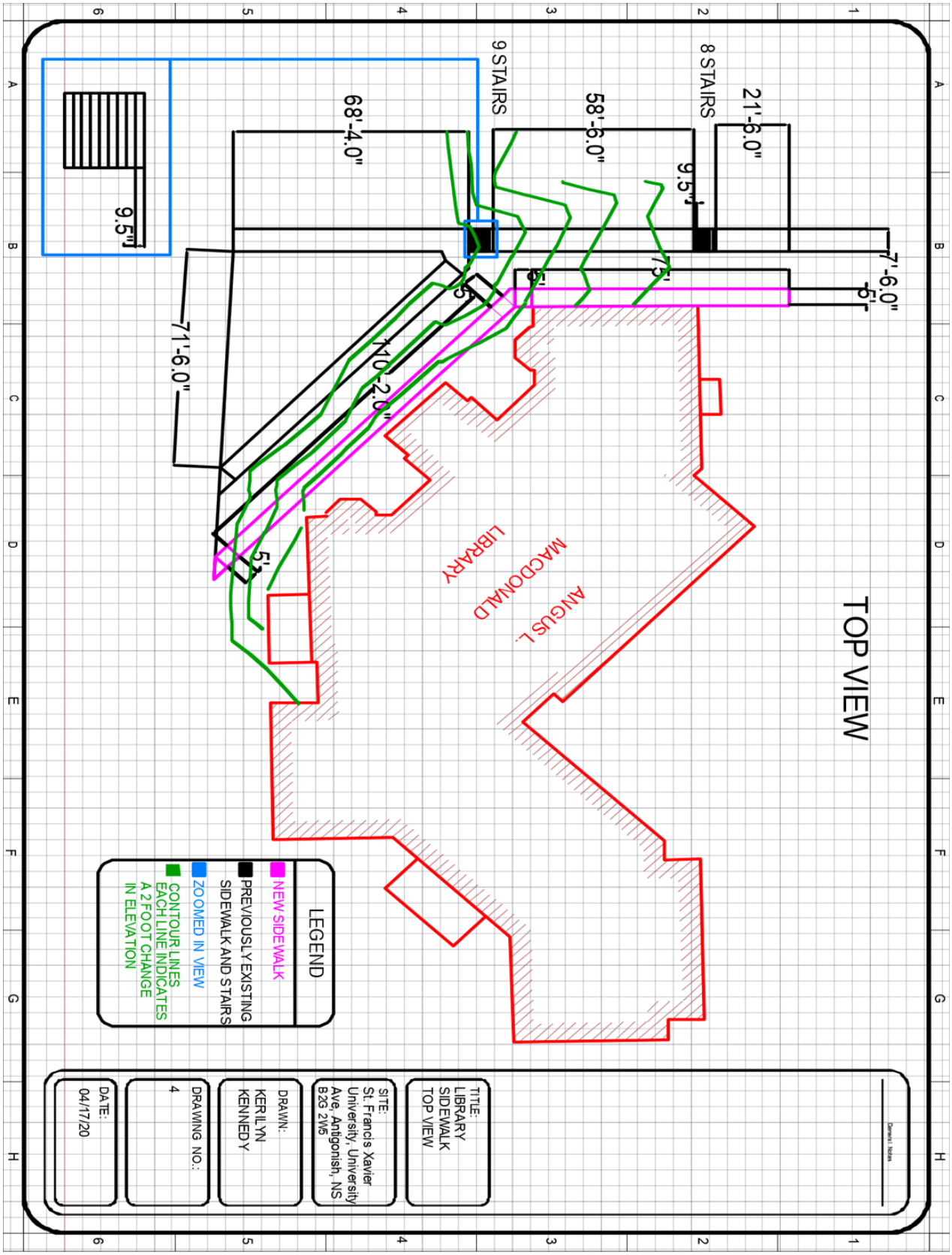
Appendix C: Top View of Bloomfield Sidewalk



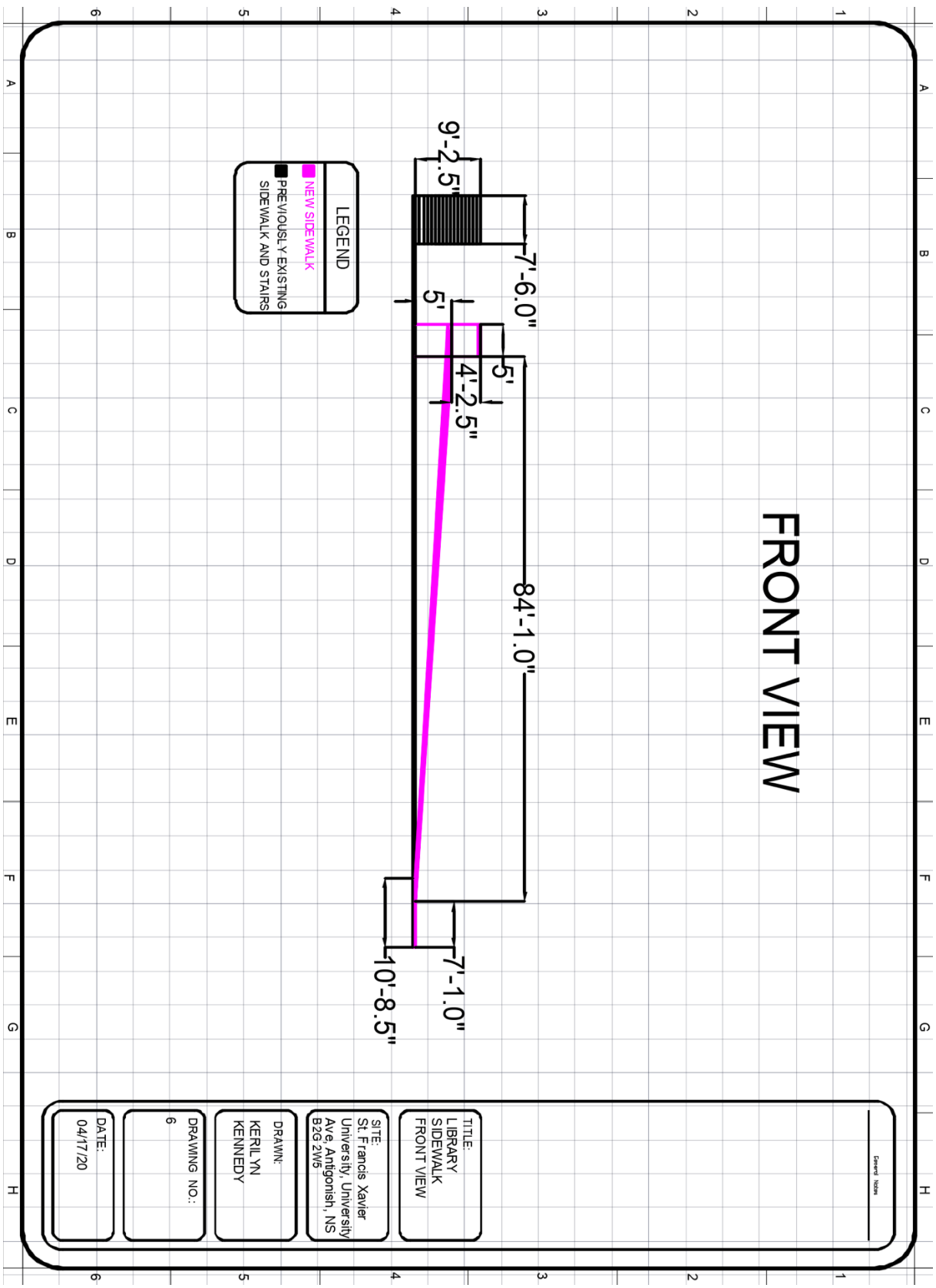
Appendix D: Front View of Bloomfield Sidewalk



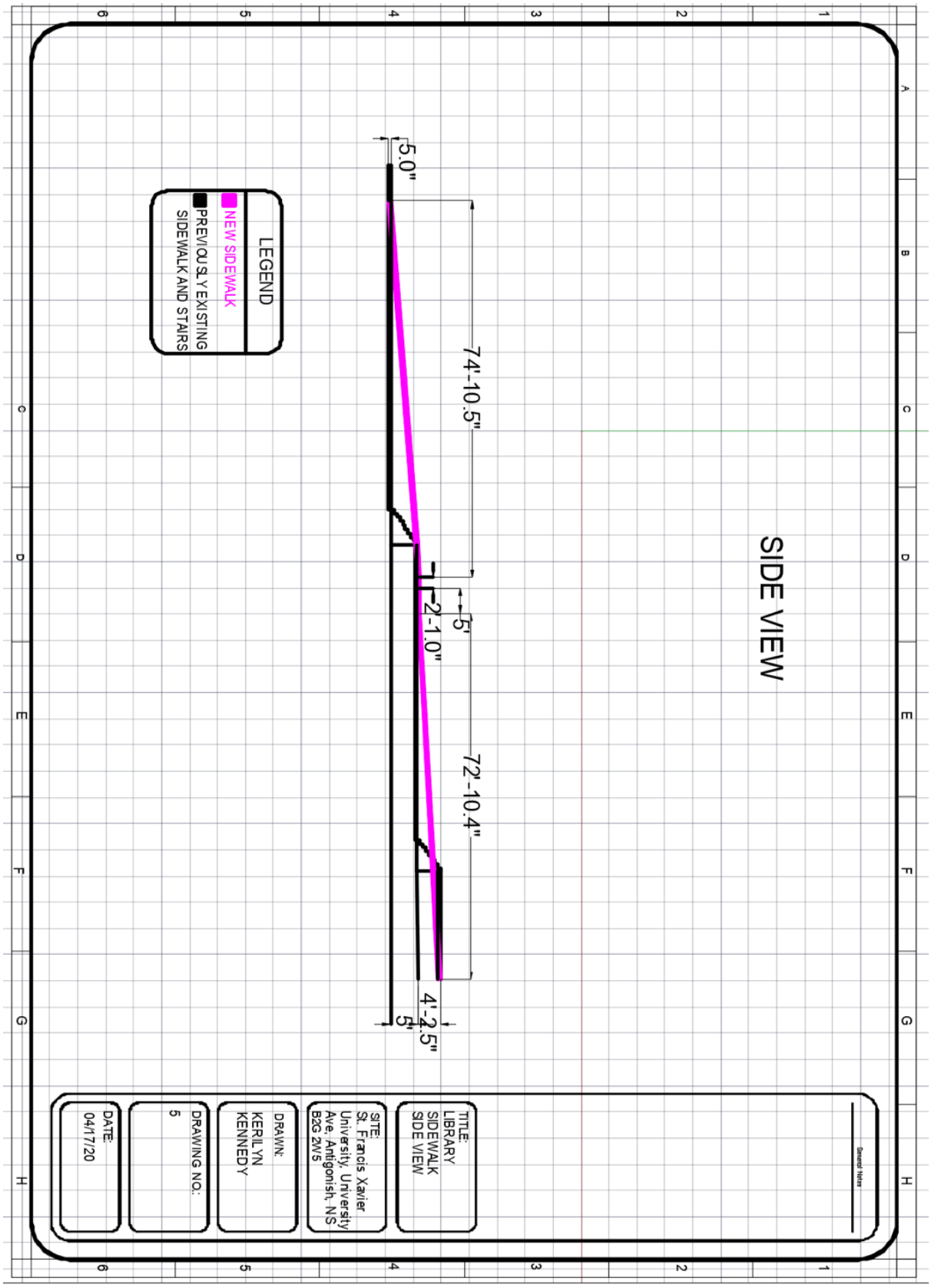
Appendix E: Side View of Bloomfield Sidewalk



Appendix F: Top View of Schwartz Sidewalk



Appendix G: Front View of Schwartz Sidewalk



Appendix H: Side View of Schwartz Sidewalk

Estimator	Project Cost Estimation
Project Name	*Bloomfield Centre Ramp*
Client Name	*ST.FX University*
Project Team	*Jacob Daniels, Luke Drohan*
	Kerilyn Kennedy, Sara Murrin

Project	Phase	Estimated	Material		Labour		Total Cost	Status
		Hours	Req.	Avg. Cost	Req.	Avg. Cost		
1	Landscape	15	10	$300	4	40	$5,400	
2	Strip footing	*25*	*1200*	*$41*	*17*	*$90*	*$6,310*	
2.1	Excavate for footing	*10*	*20*	*$10*	*7*	*$30*	*$2,300*	
2.2	Form Footings	*10*	*20*	*$30*	*5*	*$30*	*$2,100*	
2.3	Finish	*5*	*1160*	*$1*	*5*	*$30*	*$1,910*	
3	Foundation base	*38*	*2622*	*$162*	*20*	*$150*	*$14,480*	
3.1	Form base	*12*	*1160*	*$1*	*5*	*$30*	*$2,960*	
3.2	Reinforcing	*5*	*274*	*$10*	*3*	*$30*	*$3,190*	
3.3	Supplying Gravel	*2*	*28*	*$150*	*2*	*$30*	*$4,320*	
3.4	Placing Gravel	*12*	-	-	*5*	*$30*	*$1,800*	
3.5	Finish base	*7*	*1160*	*$1*	*5*	*$30*	*$2,210*	
4	Slab Surface	*44*	*2321*	*$3,002*	*15*	*$120*	*$10,360*	
4.1	Supplying Concrete	*10*	*1160*	*$1*	*2*	*$30*	*$1,760*	
4.2	Place Concrete	*12*	-	-	*5*	*$30*	*$1,800*	
4.3	Finish Concrete with fiber glass	*12*	*1160*	*$1*	*4*	*$30*	*$2,600*	
4.4	Design	*10*	*1*	*$3,000*	*4*	*$30*	*$4,200*	
Total		122	6143		52		*$36,550*	

Estimated Hours	*122*
Total Cost	*$36,550*

Appedix I: Cost Analysis of Bloomfied Sidewalk

Estimator	Project Cost Estimation

Project Name	*Schwartz Ramp*
Client Name	*ST.FX University*
Project Team	*Jacob Daniels, Luke Drohan*
	Kerilyn Kennedy, Sara Murrin

Project	Phase	Estimated Hours	Material		Labour		Total Cost
			Req.	Avg. Cost	Req.	Avg. Cost	
1	Landscape	10	5	$300	4	40	$3,100
1	Strip footing	*25*	*1024*	*$41*	*13*	*$90*	*$4,820*
1.1	Excavate for footing	*10*	*17*	*$10*	*3*	*$30*	*$1,070*
1.2	Form Footings	*10*	*17*	*$30*	*5*	*$30*	*$2,010*
1.3	Finish	*5*	*990*	*$1*	*5*	*$30*	*$1,740*
2	Foundation base	*40*	*2722*	*$162*	*20*	*$150*	*$17,180*
2.1	Form base	*12*	*990*	*$1*	*5*	*$30*	*$2,790*
2.2	Reinforcing and slope	*7*	*725*	*$10*	*3*	*$30*	*$7,880*
2.3	Supplying Gravel	*2*	*17*	*$150*	*2*	*$30*	*$2,670*
2.4	Placing Gravel	*12*	-	-	*5*	*$30*	*$1,800*
2.5	Finish base	*7*	*990*	*$1*	*5*	*$30*	*$2,040*
3	Slab Surface	*44*	*1981*	*$2,502*	*15*	*$120*	*$9,520*
3.1	Supplying Concrete	*10*	*990*	*$1*	*2*	*$30*	*$1,590*
3.2	Place Concrete	*12*	-	-	*5*	*$30*	*$1,800*
3.3	Finish Concrete with fiber glass	*12*	*990*	*$1*	*4*	*$30*	*$2,430*
3.4	Design	*10*	*1*	*$2,500*	*4*	*$30*	*$3,700*
	Total	119	5727		48		*$34,620*

Estimated Hours	*119*
Total Cost	*$34,620*