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Smith College Campus ADA Accessibility Report

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Community Partner Project in Collaboration with the Smith College Botanic Garden

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Introduction

With Smith College being a residential campus for a diverse population of students, accessibility around campus is extremely important for the wellbeing of these students. All students should have access to physically accessible paths to move around campus.

The Americans with Disabilities Act (ADA) was passed in 1990. The act addresses a wide range of topics related to accessibility, including but not limited to: physical accessibility and accessible design, equal employment opportunity, discrimination prevention, and benefits. This project focuses specifically on physical accessibility across Smith College campus. The standards referenced for the rest of this report are based on the most recently updated ADA standards from 2010.

Most of the buildings on campus were built before the passing of the ADA, and because of this they are not required to meet ADA requirements unless they are subject to large-scale renovations. In order for Smith to truly be an equitable institution, it must be proactive and implement changes to make campus more accessible as soon as possible instead of just waiting for major renovations. Through this project, we will investigate the extent to which the campus is accessible to all students through evaluating select criteria for campus pathways and identifying potential areas for improvement. In our data collection, we prioritized paths on the basis of being essential for traveling across campus and accessing frequently used academic buildings, parking lots, and facilities. We also primarily focused on paths because our community partner is the Smith College Botanic Garden, who wanted to know how they could use Smith's 21st century landscaping plan to improve accessibility on campus. The criteria we chose to focus on include path width, the presence of cracks/potholes/obstacles that hinder accessibility, path slope, the presence of stairs, the presence of railings, and path material. All of these factors are important to consider when thinking about potential physical barriers that can hinder movement.

Background

Before the passing of the Americans with Disabilities Act, the accessibility needs of disabled students were largely overlooked. Automated doors, ramps, and elevators were uncommon. Since the passing of the ADA in 1990, newly built facilities including college campuses must comply with the set regulations to ensure accessibility. Physical accessibility is just one aspect of accessibility in higher education; accommodations, support, and standards ensuring access to participation in learning are all parts of ADA that work in tandem with physical accessibility efforts. All of these aspects are equally important to ensuring an accessible experience in college campuses and higher education as a whole.

The commercial and public facility standard for maximum ramp slope defined by the ADA standards is a 1:12 ratio of rise:run (BraunAbility)(ADA §403.3). Following this guideline, the maximum allowable slope is roughly 4.76 degrees, as calculated using a right triangle with side lengths of 12 and 1. Slopes that are any steeper will be difficult to navigate on a wheelchair, especially for those with low upper body strength and/or mobility. Steep ramps could increase risks of a wheelchair tipping or rolling backward. Additionally, ramp runs that are higher than six

inches are required to have handrails. These handrails must be continuous and located on both sides of the ramp (U.S. Access Board, ADA §505). Any path with a running slope of less than 1:20 (or about 2.86°) is not considered a ramp as defined by Section 106 of the ADA guidelines (ADA §106), and therefore would need to have handrails to be compliant and accessible. Handrails are vital for safety for wheelchair users and individuals in need of support.

Another important aspect to consider for accessibility is the width of the path. Based on Section 403.5.1 of the ADA guidelines, accessible paths should be a minimum of 36 inches (3 feet) across in order to accommodate those with mobility aids, with an exception being that it is permitted to reduce to 32 inches for a maximum of 24 inches of length due to doorways (U.S. Access Board, ADA §403.5.1). Because we are only examining the outdoor paths on campus, we do not anticipate any instances where doorways will be present in the middle of a path, and are therefore considering 3ft the minimum accessible width for the outdoor paths on this campus. Paths that are not wide enough are unable to accommodate wheelchair users or those who need a guide.

Paths are required to be made out of materials that are firm, stable, and slip resistant. Section 302 of the ADA defines a surface as stable if it is able to retain its original characteristics after being exposed to outside forces, a surface as firm if it is resistant to being changed by dents or erosion, and a surface as slip-resistant if it has enough friction for people to safely move without slipping (U.S. Access Board, ADA §302). This means that surfaces like bare dirt that become muddy under certain weather conditions and surfaces like gravel that are loose and moveable cannot be considered accessible surfaces. In our data collection, we recorded the individual substrates of each path we collected data for, and later grouped them into categories of accessible or inaccessible materials.

Finally, paths that have stairs in their route that pedestrians are required to use are not accessible for many people that use mobility aids. We recorded whether or not a path had stairs as one of our variables. With this in mind, we also made sure to record accessible entrances to buildings that were provided as an alternative to stairs.

Methods

In order to record data points necessary for campus path evaluation, a survey was created on an application called ArcGIS Field Maps. This application allows for data points to be recorded on top of an existing Smith College campus paths layer as guidance.

The data points collected for each path include the following:

- Whether or not the path had stairs
- Whether the path had a side railing for none, part, or all of it
- The material(s) the path was made of
- The slope of the path at its steepest section
- The width of the path at its narrowest point
- The physical condition of the path (whether it was intact, lightly weathered, or severely weathered)
- Any additional notes that seemed important that were not covered by the above
    - Often, a list of the types of materials the path was made of if it was made of several
    - Photos of problematic areas

For the physical data collection process, team members systematically walked throughout Smith campus in areas known to be frequented by students. The slopes of campus paths were measured through the use of a rangefinder, a tool that uses lasers to calculate the slope between two points and converts to degrees. The widths of the campus paths were measured using tape measures, in feet.

Results

Data overview:

The data points were collected for many of the paths on Smith College's campus (see **Figure 1**). Due to the time constraints present in this project however, there were some areas north of Elm Street, south of Green Street, and by the college athletic fields that we were not able to collect data for. Notably, we were able to cover the majority of central campus, which is arguably the most-frequented area of campus by students and faculty alike. In total, data was collected for 350 different campus paths.

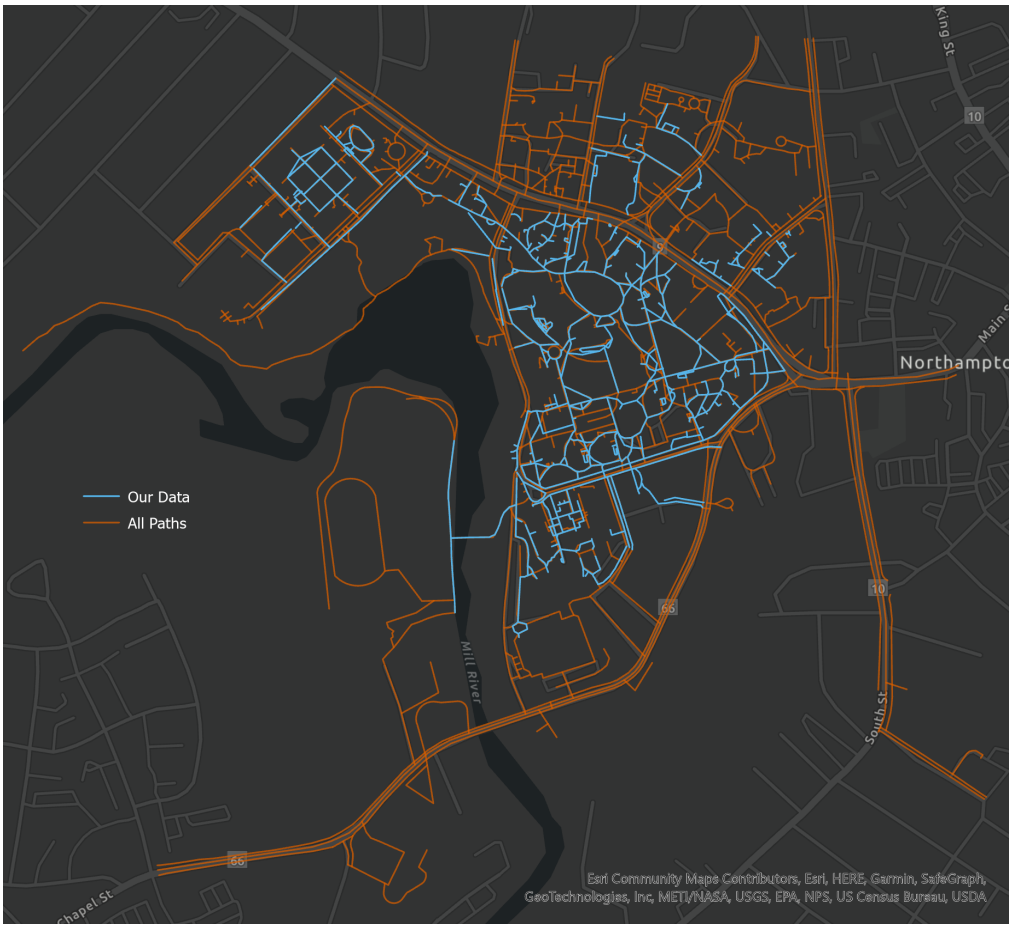

Figure 1: A map displaying a comparison of the locations where data was collected by our group with a pre-existing data layer in Smith's system showing locations of all paths on campus. It should be noted that the existing layer includes a few paths, such as Northampton roads and sidewalks, that go beyond the Smith College campus and are outside of Smith's jurisdiction, which we intentionally excluded from our data.

The following maps will break down the major criteria we accounted for in our survey, and accessibility level according to each one of these criteria; this includes path material, width, and slope. These maps should be viewed independently of one another until the "Overall Accessibility Index" section, where consideration of all of the criteria we broke down are grouped together and paths will be considered accessible or inaccessible in a way that brings together all of our criteria. Prior to this index, inaccessible and accessible paths will be detailed, but only in accordance with the individual criteria.

Path Materials:

Material accessibility guidelines were determined through the ADA, with materials being considered accessible if they are hard, flat, and non-slippery, due to their ability to hold up against wheelchair use, in addition to lessen injury risk from falling (ADA §302). Materials are generally considered inaccessible if they are made out of loosely packed substances, such as gravel, or contain many cracks or divots.

To visualize what materials paths were made out of on campus, and the accessibility of those materials, we made three separate maps. The first of these maps (**Figure 2**) is showing the different types of materials deemed accessible, including asphalt, boardwalk, bricks, concrete, and stone slabs. As an important note, there were other accessible materials listed in our initial FieldMaps survey, but because we did not encounter paths with these materials, they are not included in the legend.

The second map (**Figure 3**) shows the materials deemed inaccessible, cobblestone and gravel. Importantly, there were other inaccessible materials listed in our initial FieldMaps survey, but because we did not encounter paths with these materials, they are not included in the legend.

The last of the three maps (**Figure 4**) shows which paths were made of accessible materials and which paths were not. This map was created in order to show a summarized overview of areas on campus composed of inaccessible versus accessible materials. According to this map, most paths were made out of accessible materials.

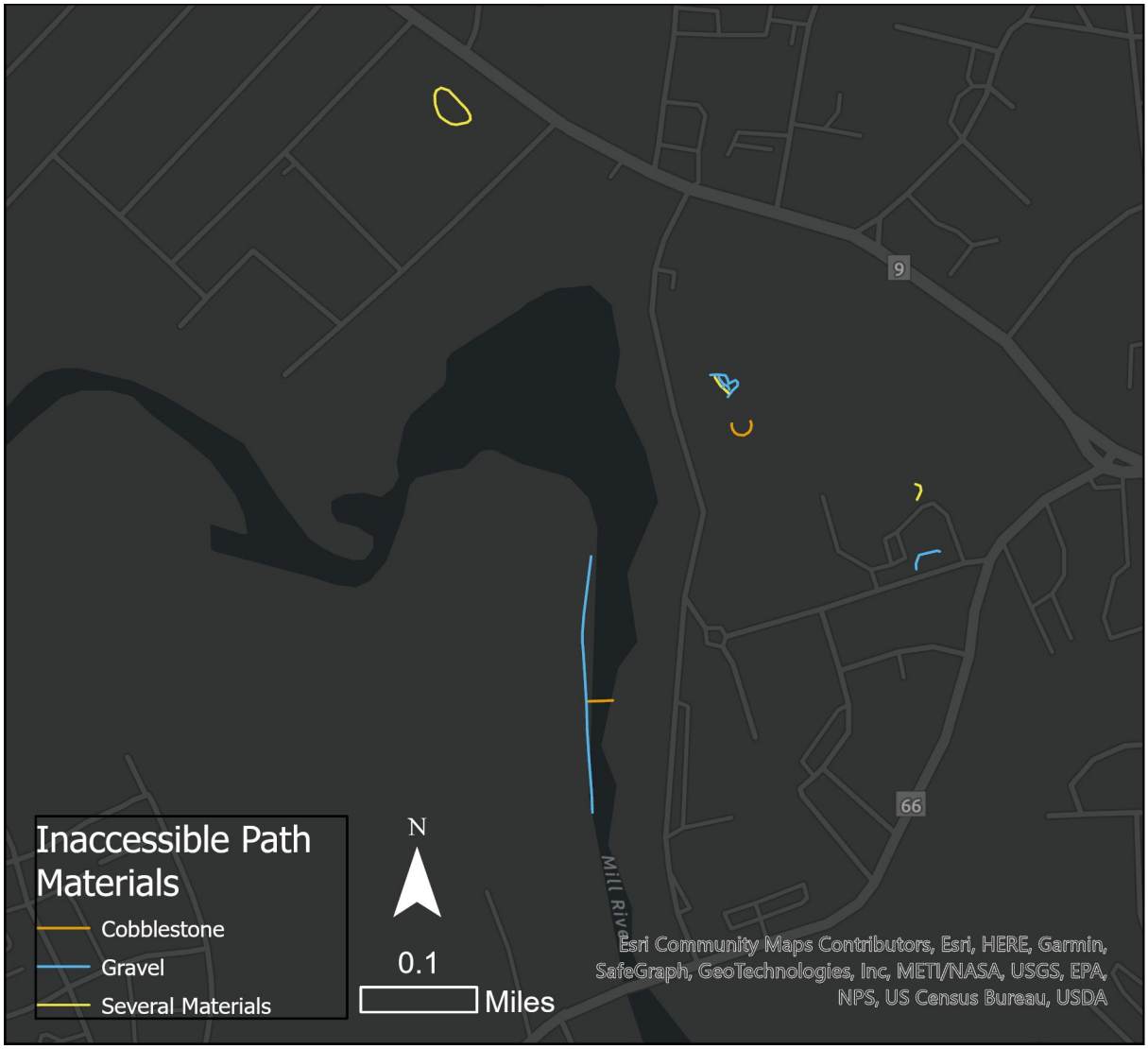

Figure 2: A map displaying the paths documented on campus that were made out of inaccessible materials. Please note that because all campus paths are not shown, these areas appear disconnected. This is in an effort to highlight these few areas that are made from inaccessible materials. Paths made out of cobblestone are shown in orange, paths made out of gravel are shown in light blue, and paths made out of multiple different types of inaccessible materials are shown in yellow.

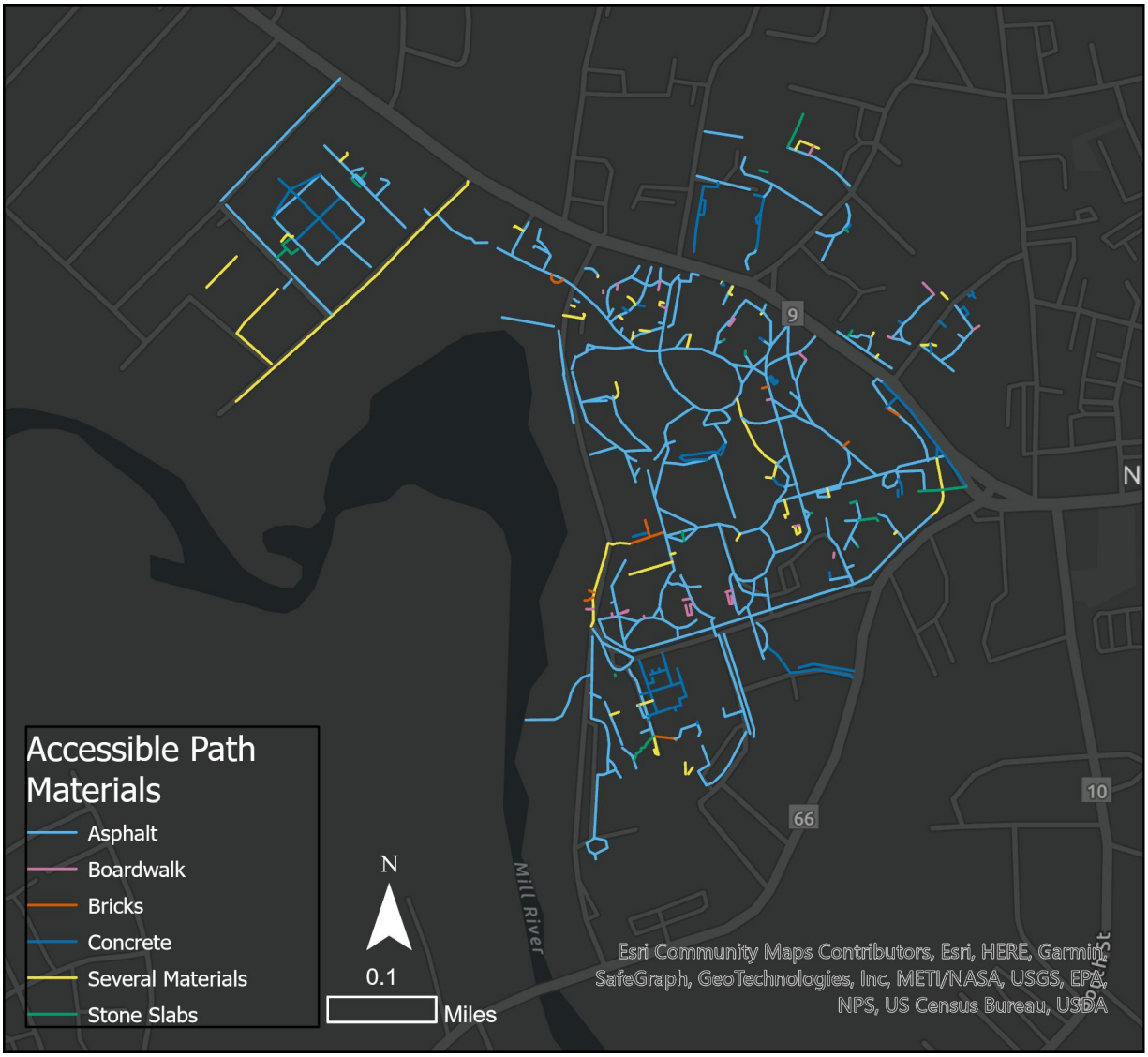

Figure 3: A map displaying only paths that were created from accessible path materials, differentiated by color. Materials listed include asphalt, boardwalk, bricks, concrete, several materials (as in, path was compiled from multiple materials), and stone slabs. Asphalt is shown in light blue, boardwalks are shown in pink, bricks are shown in red, concrete is shown in dark blue, stone slabs are shown in green, and several materials are shown in yellow.

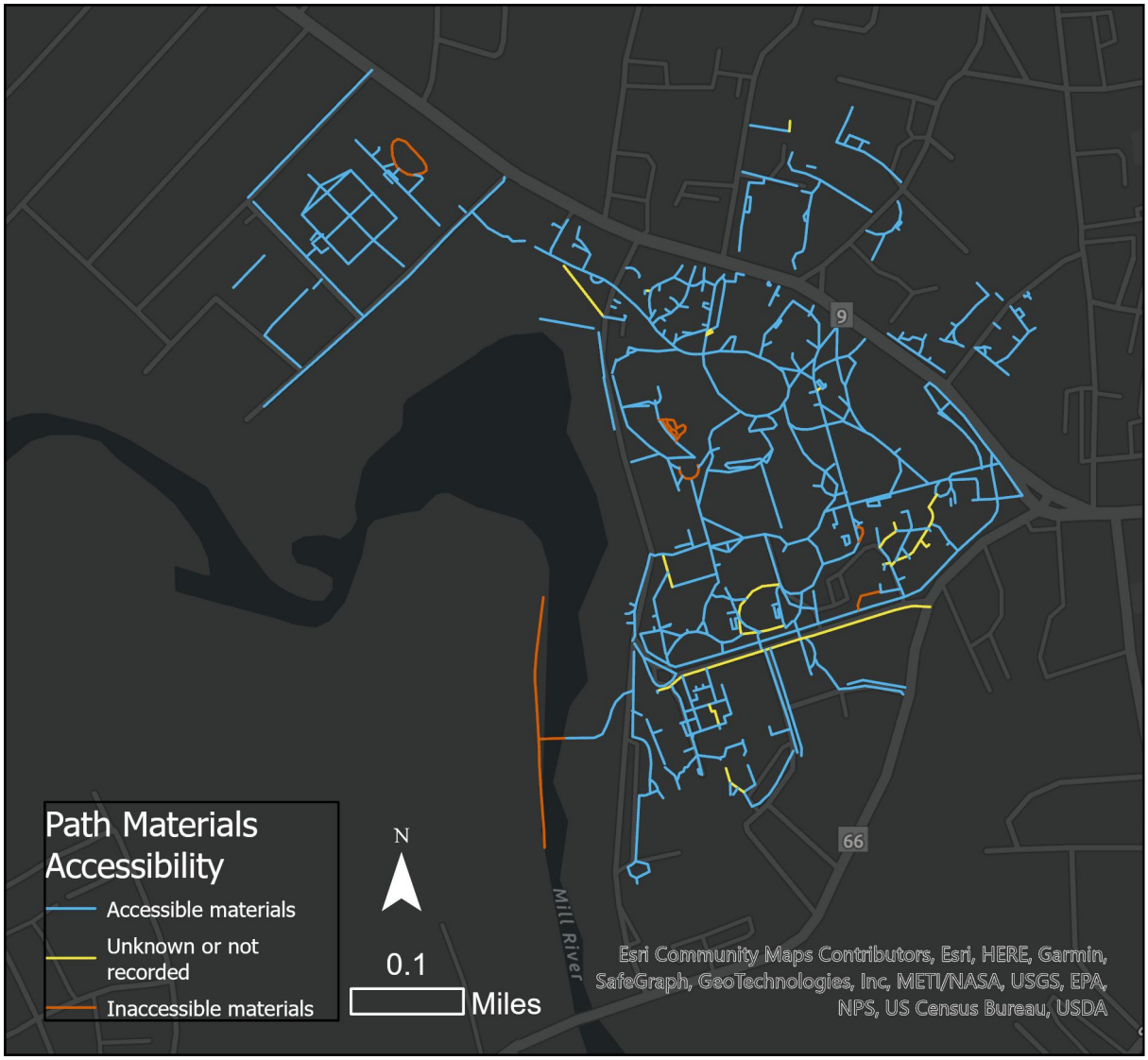

Figure 4: A map documenting whether paths on campus are made out of accessible or inaccessible materials. Paths made out of accessible materials are shown in light blue, paths made out of inaccessible materials are shown in orange, and paths whose materials are unknown or not recorded are shown in yellow.

Path width:

According to the ADA, paths are required to have a clear width of 3 feet as a minimum (ADA 403.5.1). In the data collection we performed on Smith Campus, we did not account for the two exceptions to this minimum clearance, which are detailed in sections 403.5.2 and 403.5.3 of the ADA. Width is important for accessibility reasons including wheelchair use, walking assistance, or any other mobility device.

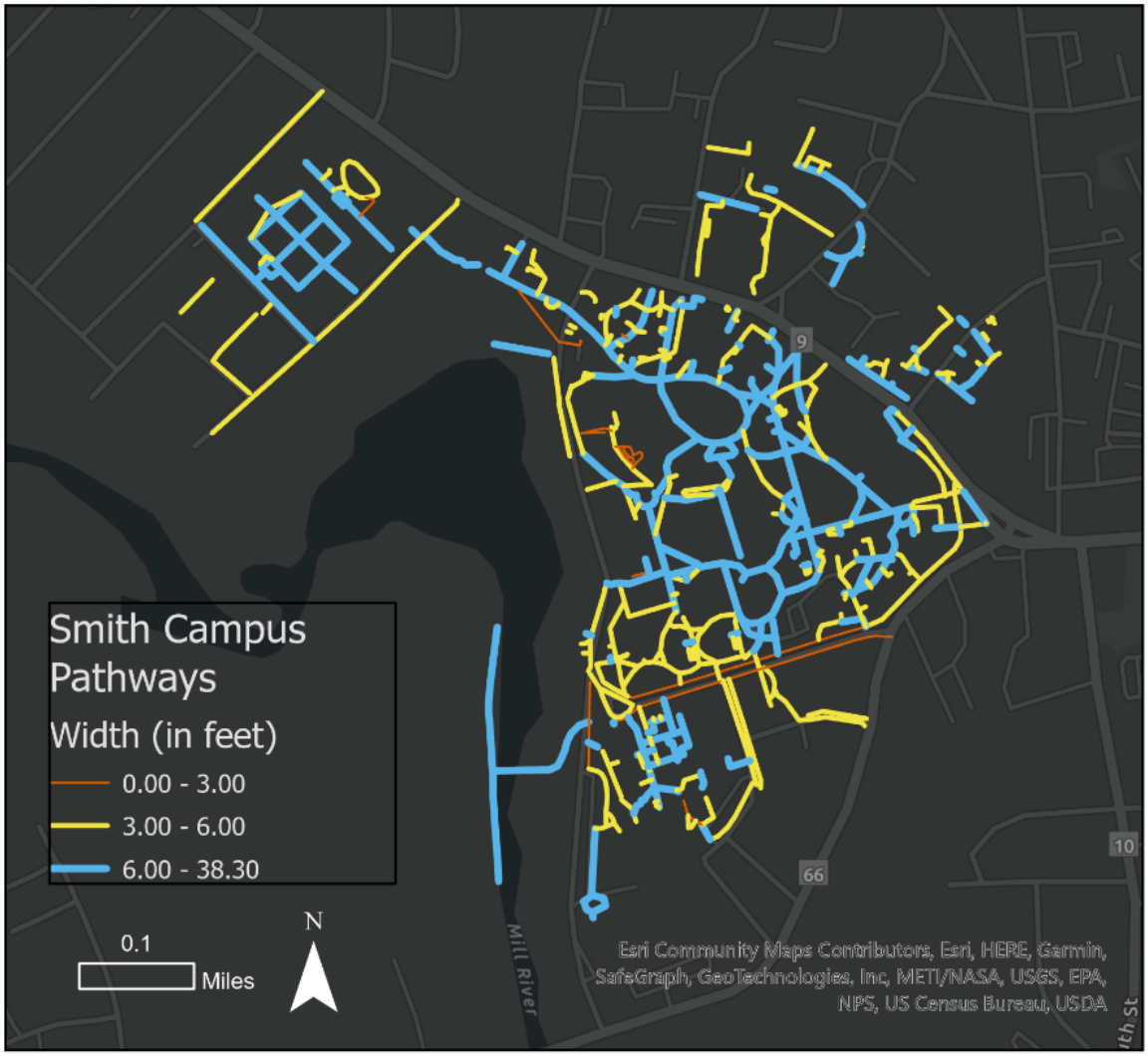

Figure 5: A map displaying width of paths around campus. The paths colored in orange are those that do not comply with the ADA restriction of >3 feet. Path width is shown additionally with the line weight, with blue paths being the widest, yellow being mid-range, and orange being the thinnest and inaccessible routes.

Of the 350 paths we collected data on, there were 8 that did not comply with the ADA restrictions. These inaccessible paths are colored in orange (**Figure 5**)**.** The rest of the paths can be considered accessible on the basis of path width.

Slope:

According to the ADA, a running slope is to be uniform along the run, although slight variations may occur with certain materials. Paths with slope over 2.9 degrees are considered an accessible ramp with the presence of side railing, and those over 4.81 degrees are inaccessible. (U.S. Access Board, ADA §405.2). For each path, the steepest slope observed was taken. This means that the entire path is generalized to be accessible or inaccessible based on the steepest slope, as we believe this is a good initial indication of overall path accessibility. It is important to note that for longer paths in particular, the entire path may appear inaccessible according to our legend, but it is due to the steepest slope potentially only in one region and may not reflect the whole path.

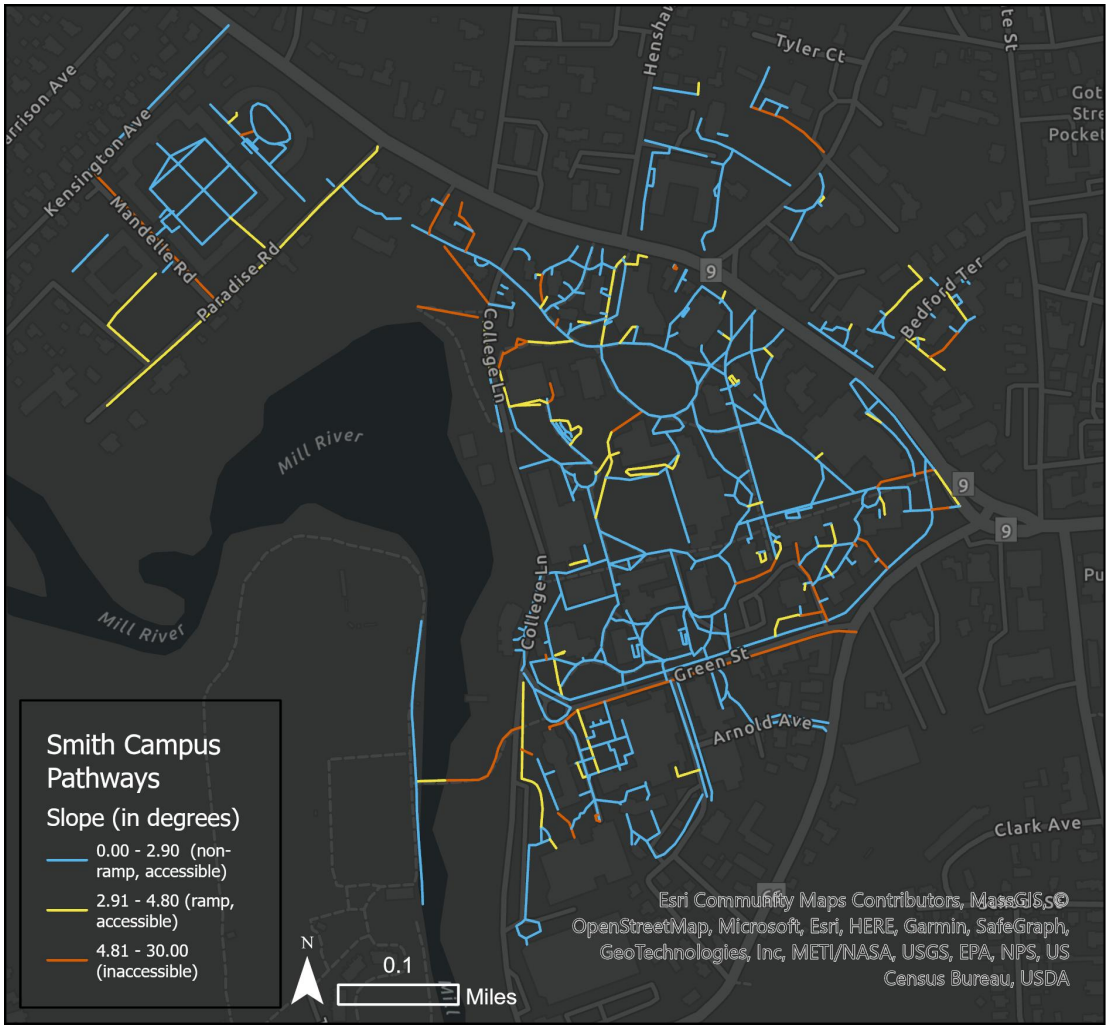

Figure 6: A map displaying slopes of paths around campus. Blue and yellow paths are both considered accessible slopes under the ADA, but orange slopes are too steep to be accessible under the ADA.

According to ADA standards, ramps and curb ramps are required for accessible routes spanning changes greater than ½ inch. Additionally, if portions of accessible routes have a slope greater than 5%, they are also required to be treated as ramps (U.S. Access Board, ADA §405). As seen in **Figure 6**, we grouped paths with slopes between 2.91 and 4.8 degrees as paths that would be considered ramps. As such, these paths under ADA standards are required to have railings. There were 29 ramps with no railings, 12 ramps with partial railings, and 9 paths with railings along the whole path. Without railings, many of these sloped paths become inaccessible. Most paths (256 out of 350) were considered non-ramps and accessible based on slope. There were 29 paths considered inaccessible based on slope.

Within the data collection process, a ramp with partial railings versus railings on the whole path was classified through whether the *portion of the path with the slope qualifying it as a ramp* had railings or partial railings. In other words, the part of the path that is a ramp was evaluated for having railings. As such, these paths as seen on the map below (**Figure 7**) would not necessarily need railings along the whole stretch, but rather along portions where the slope qualifies it as a ramp. This is due to our mapping method, where steepest slope determines the path slope accessibility as a whole.

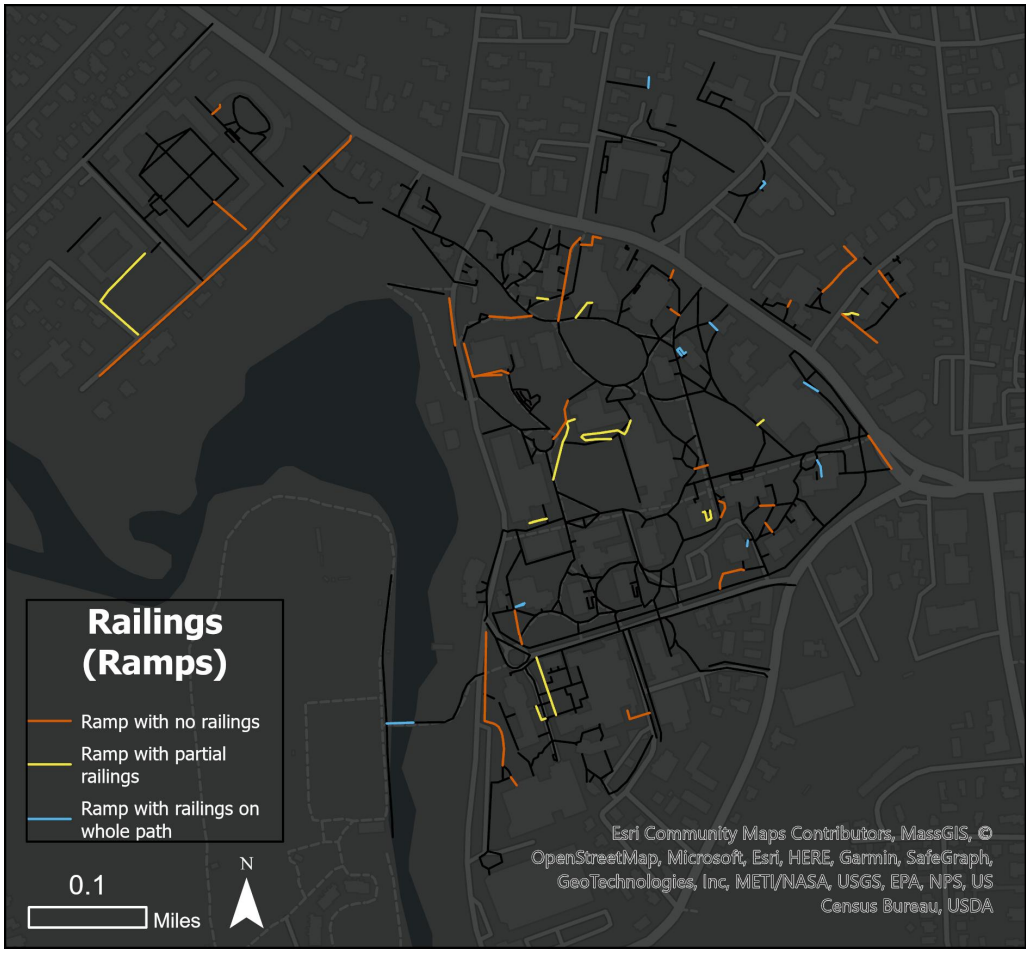

Figure 7: A map displaying paths considered to be ramps under ADA slope standards, with ramps with no railings in orange, ramps with partial railings in yellow, and ramps with full path railings in blue.

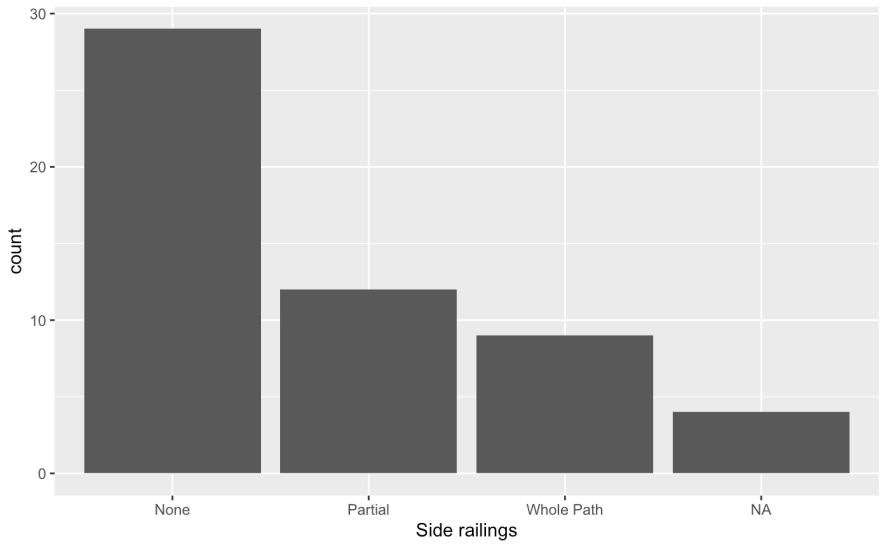

Figure 8: A bar chart showing the distribution of presence of side railings among the 54 ADA compliant ramps. 29 have no railing, 12 have a partial railing, and 9 have a railing along the whole path.

We extracted the accessible ramps, and determined the distribution of the presence of railing. This is summarized in the bar chart above (**Figure 8**).

It is clear that the many paths considered to be ramps do not have railings. This alone is not enough to determine the nature of this relationship, but it is worth exploring further. One recommendation for further study could be to overlay the slope map with a topographic map of Smith College campus, and examine where railings are not present and where they could be most needed. It would also make sense for further inquiry to look at the entrances of buildings in particular, as these are especially important areas for railing placement.

Also important to consider is the priority level for railings versus addressing extreme slopes on campus. For very steep slopes, there first needs to be a more accessible alternative before making side railings. If the slope is too steep, adding side railings won't make the path more accessible.

Figure 9 *(right)***:** An image of the path leading down to the athletics field. This path is a problem because it both has a slope of 9.8 degrees, way above an accessible measurement, and it lacks a railing.

Path Conditions:

Given that the majority of campus paths are outdoors and thus entirely unprotected from weather conditions, there is undeniably the possibility of problems arising due to wear-and-tear. Some of the most notable problems that can arise from this are cracking and potholes, which can make an otherwise accessible material (such as asphalt or concrete) inaccessible by making it no longer flat (See **Figure 10**).

Figure 10: Examples of weathering that is problematic for accessibility. Left: Potholes on the bridge to the Smith athletic fields. Right: Uneven sidewalk outside of the Smith bookstore.

In our data collection, we collected data on paths that were already weathered to this point of inaccessibility, as well as those that were somewhat weathered so that these might be monitored in future to prevent any cracks from growing to the point of being an accessibility issue. The results of this data can be seen in **Figure 11** on the next page (pg. 15).

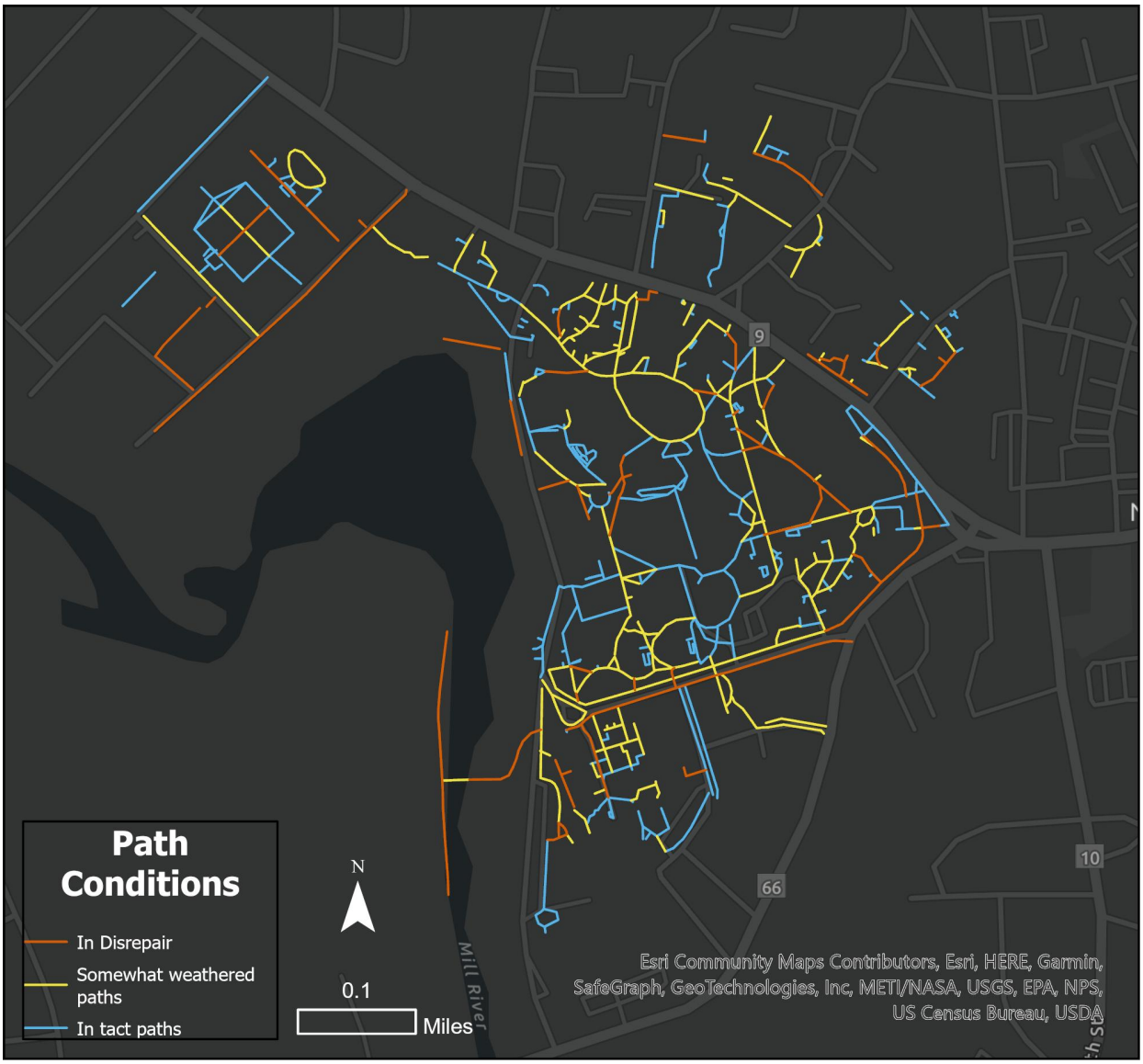

Figure 11: A map displaying the weathering conditions of the paths around campus. The paths displayed in orange, labeled as “In Disrepair” on the map legend, are the ones weathered severely enough to pose an accessibility issue.

Of the 350 paths for which data was taken, 49 were considered “In Disrepair”—that is, weathered severely enough that the paths were no longer ADA compliant. Of the remaining paths, only 183 were fully intact, with the remaining 118 still being noticeably weathered (though not to the point that it was actively hindering accessibility).

Stairs

One of the most straightforward inaccessible features that a path can have is stairs. According to the ADA, an untreated level change of more than ¼" is not permissible, and a level change with beveling to a 1:2 slope on the upper portion is permitted for elevation changes up to ½" (U.S. Access Board, ADA §303). In most cases, stairs will have vertical elevation changes on the order of a few inches, making them completely inaccessible to wheelchair users. Of the paths that we took data on, 78 of them had stairs. These were most common at building entrances—notably, almost every building had alternative, accessible entrances that could be used instead of the stairs, so even though this seems like a large number of paths, there are very few instances where traversing stairs would be required for entry.

Figure 12: A map showing which paths have stairs (orange) and which do not (blue) of the paths we took data for.

Overall Accessibility Index

To get a better overall sense of where accessibility problem areas on campus are, we compiled a simplistic Overall Accessibility Index that incorporates all of our accessibility variables into a single value. We weighted the variables on a scale of 0-2 (so that those with an intermediate value, such as being somewhat weathered or having only a partial railing, could be given a value of 1), with the higher numbers corresponding to the less accessible values. The values were assigned according to the values given in **Table 1**:

Table 1: Value Assignments for Overall Accessibility Index.

Variable	Values (higher value = less accessible)
Railing	Whole Path → 0 Partial → 1 None → 2
Width	≥3.0 → 0 <3.0 → 2
Condition	Intact → 0 Somewhat Weathered → 1 In Disrepair → 2
Material	Accessible → 0 Inaccessible → 2
Slope	<2.9 → 0 2.9–4.7 → 1 >4.7 → 2
Stairs	Yes → 2 No → 0

A map of the overall accessibility index can be seen on the following page.

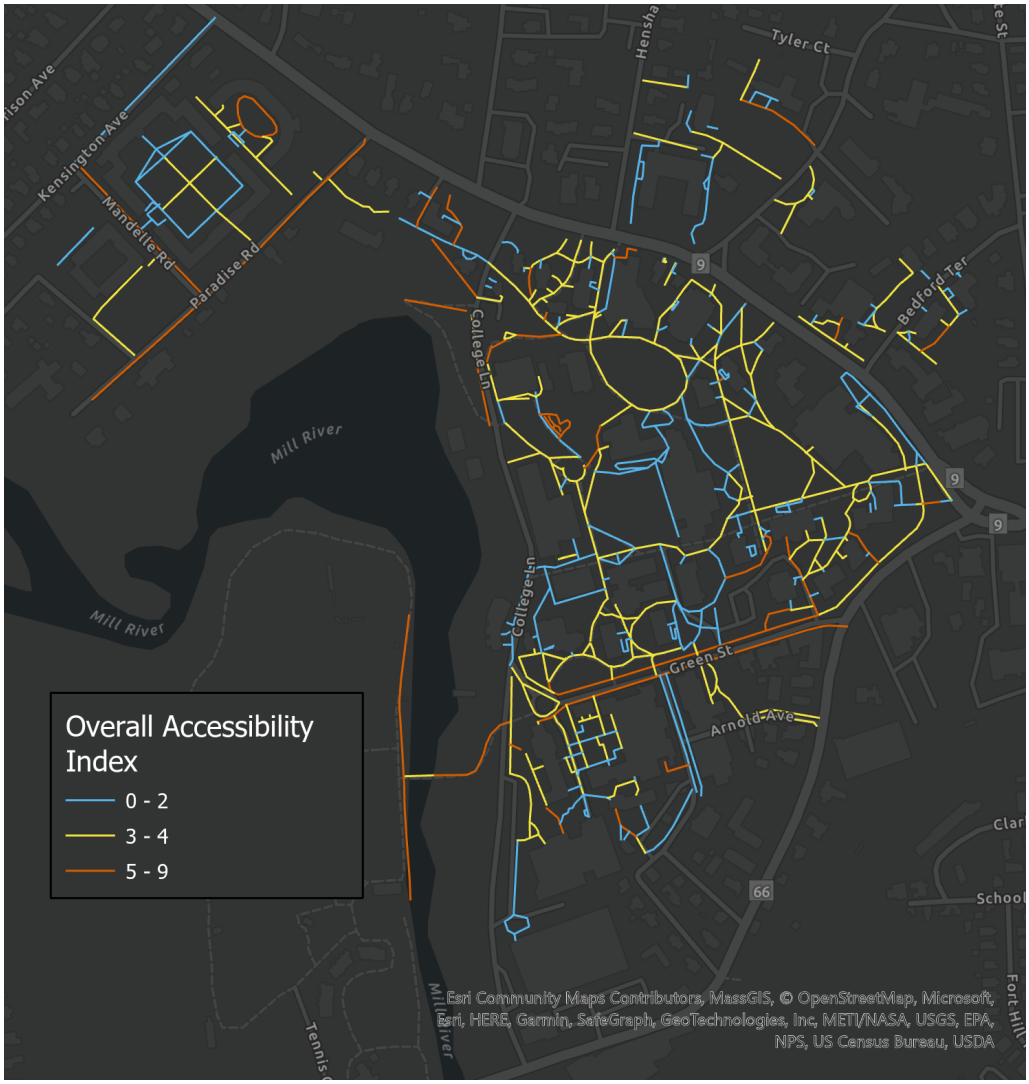

Figure 13: A map of the overall accessibility index for the various paths on campus, with values of 0-2 displayed in blue, values of 3-4 displayed in yellow, and values of 5-9 displayed in orange. Notably, there is a lot of yellow present throughout the different areas of campus.

Because the calculation here was done relatively simply, there is a degree of ambiguity present in the overall calculated values. For example, one would assume that an accessibility index value of any number above 0 would always mean there is an accessibility issue when this is not necessarily the case—for example, a non-ramp path that is otherwise fully accessible would still have a score of 2 if it had no side railings, even if it was flat enough that railings would not be needed following ADA standards. To account for this, **Figure 13** groups paths with a value of 0-2 together in the lowest category. Following similar logic, one can assume that paths with an index value of 3-4 likely have at least one major accessibility issue (or possibly two minor ones), since each additional issue recorded would add a value of 1 or 2 to the score. Finally, any path with a score above 4 likely has several accessibility issues, so these are also grouped together in the map above, as they should likely all be treated as the highest priority in terms of refurbishment/redesigning.

Discussion

Current Conclusions

Taking all variables from our data into account, the least accessible areas around campus are those on Green Street, leading into the quad, and the area near the Lyman plant house and Haven/Wesley. Path width and material are not prominent issues across campus, but many paths are too steep to be ADA compliant. Steepness is especially problematic near Hubbard, Weinstein, and the path to the quad/athletic fields. Some possible ways to remedy this would be to reconstruct paths to move in a back-and-forth manner across slopes, such that they cover more horizontal distance relative to their elevation change, and ensuring that all existing paths that would be considered a ramp under the ADA have railings. Additionally, many paths on campus are weathered severely enough that they have become inaccessible. This issue might be addressed by prioritizing those paths for reconstruction or refurbishment, such that disjointed surfaces can be replaced and large cracks or potholes can be filled in on existing paths prior to the construction of anything new, and ensuring regular inspection of the paths that already show minor degrees of weathering so that they can be repaired promptly if it worsens.

Limitations

It must be considered with the results compiled that accessibility is being referred to in relation to only ADA accessibility standards. There are other considerations for accessibility that may not be explicitly accounted for through the ADA standards, such as the convenience of accessing a ramp instead of an entrance that is preceded by stairs. This is another area where future data collection could center; for example, measuring the distances between the major inaccessible entrance to a building and the ramp entrance.

An additional limitation occurs in the way that our maps display some of the major accessibility issues. For the slope map in particular, we measured the steepest slope on the path and deemed the accessibility level based on the steepest slope. This means that paths that were longer may appear to be entirely inaccessible according to our legend, but it may only be one specific area of the path that is inaccessible. However, we believe that measuring the steepest slope of paths in general gives an important indication of the accessibility of the path as a whole. A similar issue arises with the way other maps were created, as the specific problem areas are not visible, but rather the path accessibility as a whole is generalized based on their presence. Moving forward, it would be logical to further break down paths to show which areas specifically within them pose the greatest accessibility risk.

There is also some error in data collection that should be considered. Unknown data points are most likely due to user error in entering in on the Field Maps survey for certain criteria. Ideally, this would not occur, but due to the fact that data points on Field Maps can be edited after being submitted it would be possible for future groups working with this data layer to go through and add in the missing data.

Future Work

To gain a fuller picture of Smith College campus accessibility, more data needs to be collected. As seen in Figure 1, there are many paths around campus that we did not collect data on due to time constraints: areas North of Elm Street, the athletic fields, and to the South of campus near Facilities. Data collection in these areas will give a better idea of how compliant Smith College is to the ADA restrictions as a whole.

One potential avenue for further analysis is to make a more nuanced accessibility index. This would account for factors like paths that do not necessarily need railings to be accessible, and the foot traffic of the paths. A version of this layer will remain in the Smith system, so that future GEO 150 students can build upon our data.

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Figure 9: Image of downhill entrance, Lily Gould, Dec 13, 2023.

Figure 10: Images of bridge entrance and bookstore sidewalk, Lily Gould, Dec 13th, 2023.