Sidewalk Report

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Introduction(Arnav)

The primary objective of the Sidewalk Accessibility Initiative is to establish an accessibility score for Boston's sidewalk network, fostering equity, safety, and walkability for all community members. By devising an accessibility score system and utilizing it to pinpoint inaccessible pathways, the project seeks to shift toward a more proactive method of sidewalk maintenance and repair. Key aspects of the project include identifying the locations of inaccessible sidewalks across various districts and neighborhoods, pinpointing potential disparities in accessibility, evaluating routes for accessing essential services, and formulating a forward-looking sidewalk maintenance plan based on accessibility scores and prioritization guidelines.

The project team has successfully analyzed all of the initial datasets. In the next phase, the focus will be on the ramps dataset with its newly developed accessibility score, and the sidewalks dataset to calculate accessibility scores for entire sidewalks. This approach aims to incorporate all relevant factors when assessing the condition of a sidewalk.

To ensure a comprehensive understanding and informed decision-making, the project will utilize various data on Ramps, Sidewalks ,Hospitals, and Schools among others. These datasets will serve as the foundation for creating a robust, data-driven accessibility scoring system.

Base Analysis(Arnav and Xiao and Haocheng)

In our initial analysis, we examined three datasets related to Boston's infrastructure - Ramps, Sidewalk Hazards, and Sidewalks. By examining these datasets, we gathered insights into the city's accessibility infrastructure, including the locations of ramps, potential hazards on sidewalks, and the extent and conditions of sidewalks throughout the city. This analysis helped inform our overall project goal of identifying and addressing inequities in sidewalk accessibility throughout Boston.

Using the latitude and longitude from the Ramps dataset, postal code and address were extracted. We then added the locations of hazards from the Sidewalk Hazards dataset to the map, color-coded as follows:

Red: Trip hazards not due to tree roots
Blue: Trip hazards due to tree roots
Green: Fixed pinch point with less than 36” sidewalk width

Hazards

This visualization allowed us to identify areas with high concentrations of hazards and accessibility issues, providing valuable insights for our project.

Figure1: One screenshot of the map of hazards points

For example, the street in figure below is full of blue points. There are so many hazards due to tree roots. We can guess the species of trees are special here. Or the nearby park is influencing this street by strong winds.

Figure2: A screenshot of only hazards due to tree roots

In a further step, we combined the neighborhoods into this map to see what is going on in each neighborhood. To take as an example, I will show you the hazards points inside Allston. We want to compare and evaluate the total situation of one neighborhood.

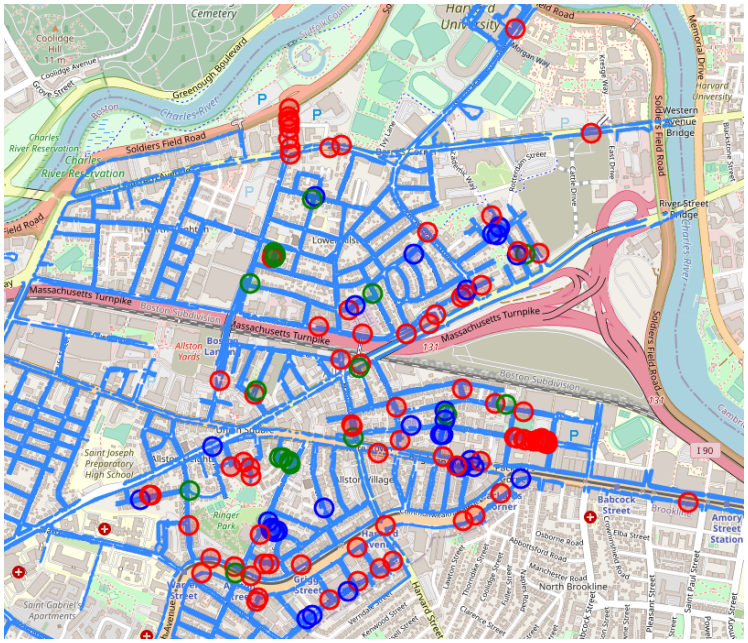


Figure 3: A screenshot of all the hazards points in the Allston area

We also developed new functions that support us to view the hazards due to tree roots occurring in Allston. Like the following part:

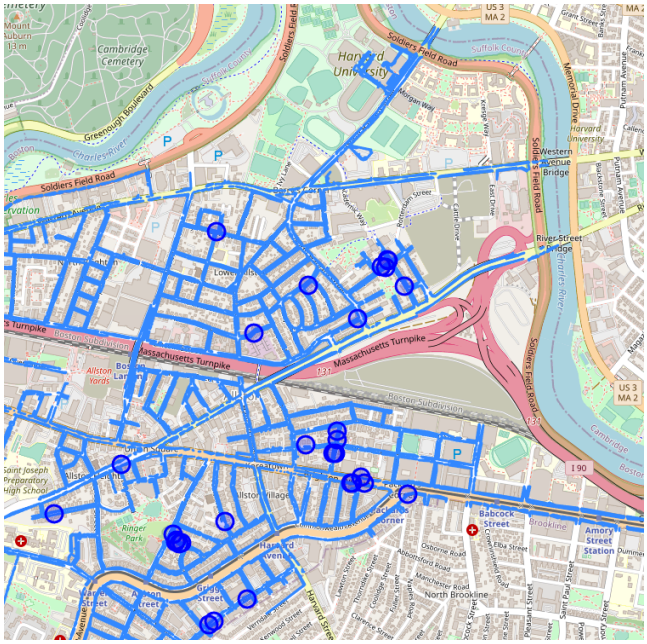


Figure 4: Only the tree root hazards inside Allston

With this analysis, the client may pinpoint the hazards that they are going to deal with fast and conveniently. In future work based on this visualization, we are going to rate the neighborhoods according to their hazards numbers and densities.

Ramps

First of all, we look into the ramps_New.json to have a general image of all the ramps.From the below Table 1, we can see that the conditions of ramps are mainly converged to Excellent and unidentified. In considering the conditions, we are definitely going to reduce the side effect caused by the number of Excellent ramps. Also, according to the requirements from the client, these unidentified and poor ramps are the most important things for them to fix.

Table 1: Various Categories of landing conditions

Landing Condition of the Ramps	**Count**
Excellent (Like new)	14770
Fair (Minor/Hairline damage with no impact to accessibility)	4897
Poor (Panel is damaged and affecting functionality- to be replaced)	6545

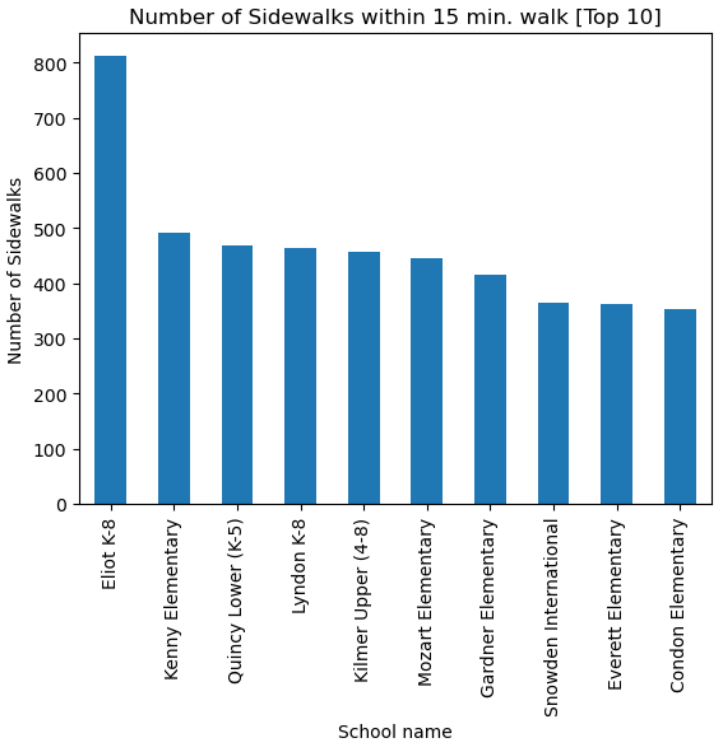


Figure 5: The number of sidewalks within 15-min walk

Facilities

We also aim to analyze the relationship between the presence of schools and the number of sidewalks in their vicinity. This analysis can be significant in identifying areas that may require more sidewalk infrastructure due to the high concentration of schools. It can also help city planners prioritize areas for sidewalk improvement projects based on the number of schools in the area. Additionally, it can be useful for parents and students to identify areas with better sidewalk infrastructure for safer walking routes to school. Overall, this analysis can provide valuable insights for urban planning and community development and should be accounted for in calculating accessibility scores.

Extension Analysis(Billy and Xiao)

After we made our initial analysis of the data and achieved an overall understanding of it we moved on to getting actual preliminary scores for the sidewalks. The way that we got these was through using gpd.sjoin() to put all of the ramps that intersect with the sidewalks into a new column for each sidewalk containing the scores of the ramps that are in their respective sidewalks. We then averaged these scores together to get our first version of the sidewalk scores. This allows us to plot them on the map after this and display:

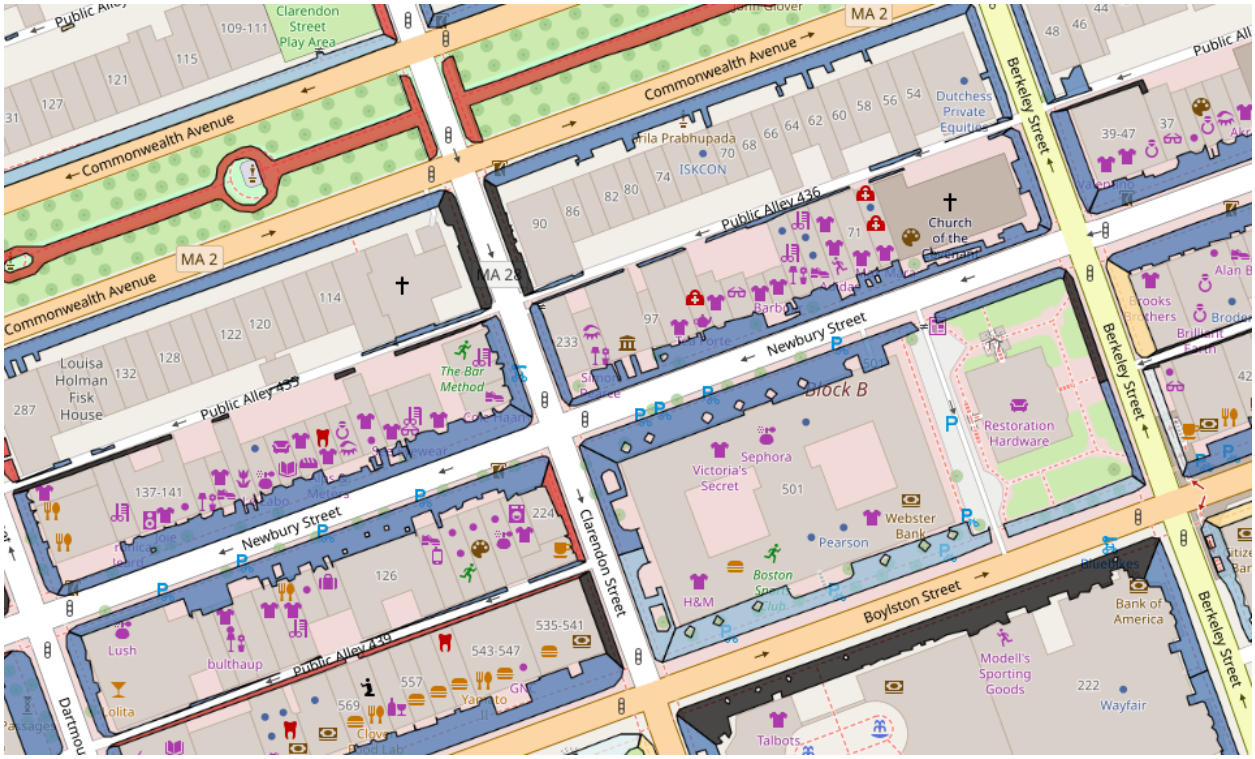


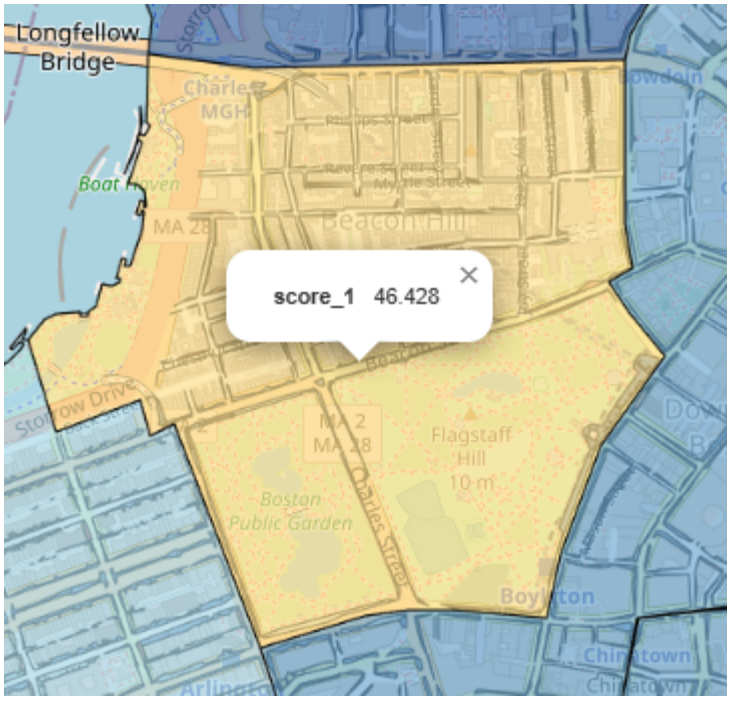
Figure 6: The sidewalks are colored with their accessibility scores
(Billy did the coding for getting the sidewalk scores calculated and mapped)

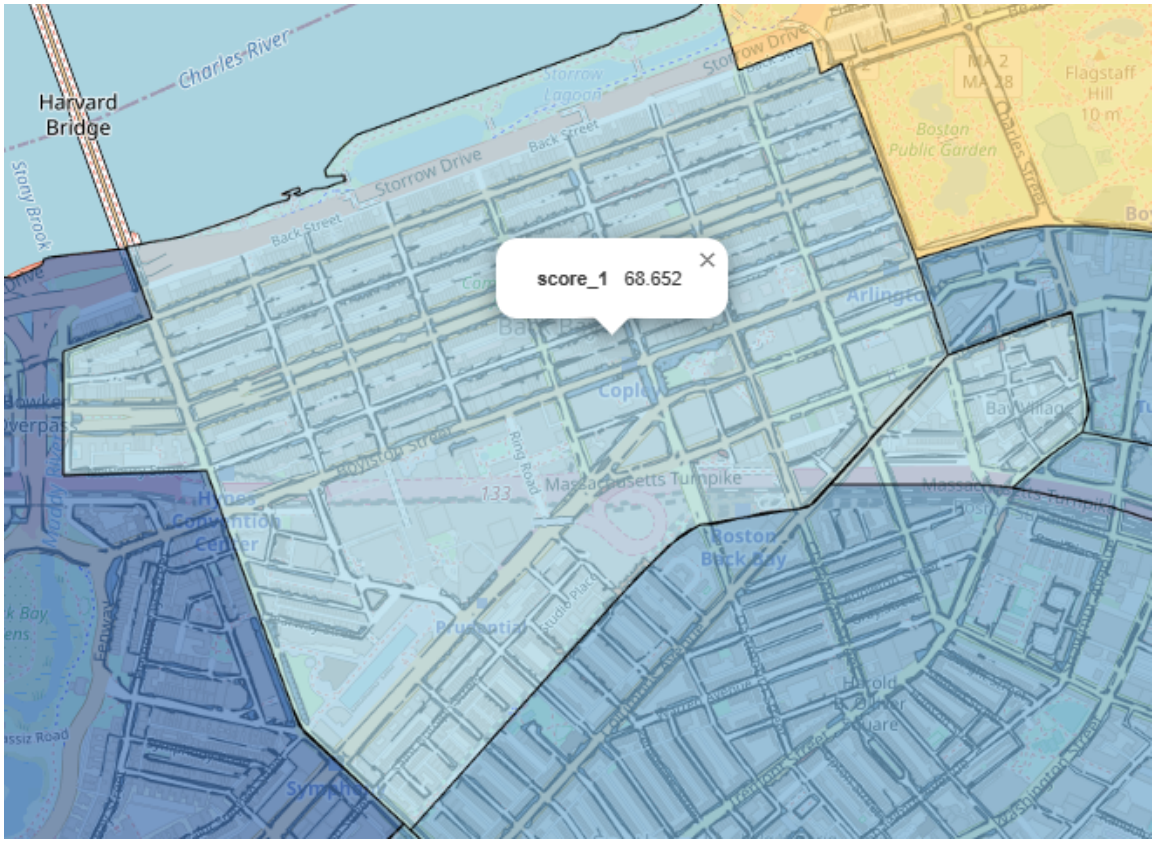
Figure 7: The sidewalks are colored with their accessibility scores with popup of scores
* You can view the sidewalk IDs on the map by hovering over a given sidewalk. In addition you can view the score for a given sidewalk by clicking on it which will create a pop up that displays that sidewalk's score.

From here we plan to get the color mapping fixed and from there once we hear back from the client on how to go about using the hazards data for scores, we will also incorporate that into the sidewalk score as well. In addition to this the client would like to be able to see what ramps are on a given sidewalk so we also plan to make it so that when you click on the sidewalk it displays not only the sidewalk score but also the individual ramp IDs that are on the sidewalk.

With these preliminary scores we can start to see the quality of the sidewalks in different neighborhoods in Boston and will begin to be able to start determining areas that need more attention.

Beacon Hill:





Back Bay

Figure 8&9: The above picture is the average ramp score of Beacon Hill, The below picture is the average ramp score of Back Bay.

With the average scores of all the sidewalks, we calculated out all the average scores of neighborhoods inside Boston. Most of them are in dark blue or sky blue which means they have a fairly good condition of ramps as a whole neighborhood. However, these two neighborhoods above: Beacon Hill and Back Bay, are the worst among all the neighborhoods. Colored with yellow and light blue meaning their average scores as low as 46 and 68. Below is the insight of sidewalks inside Beacon Hill. Most of them are colored red and orange indicating the bad condition of total scores.

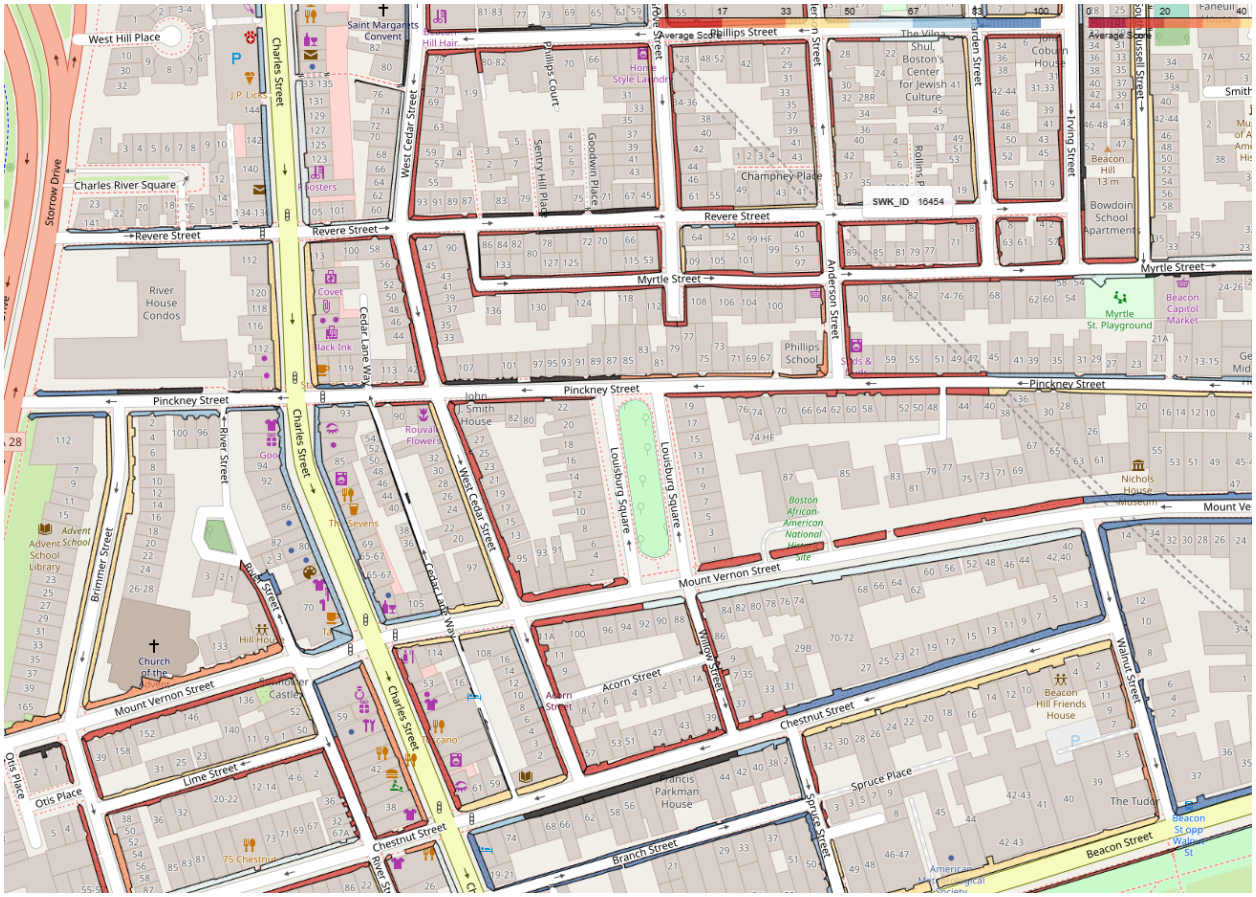


Figure 10: the sidewalks inside Beacon Hill. Most of them are red with poor conditions of ramps

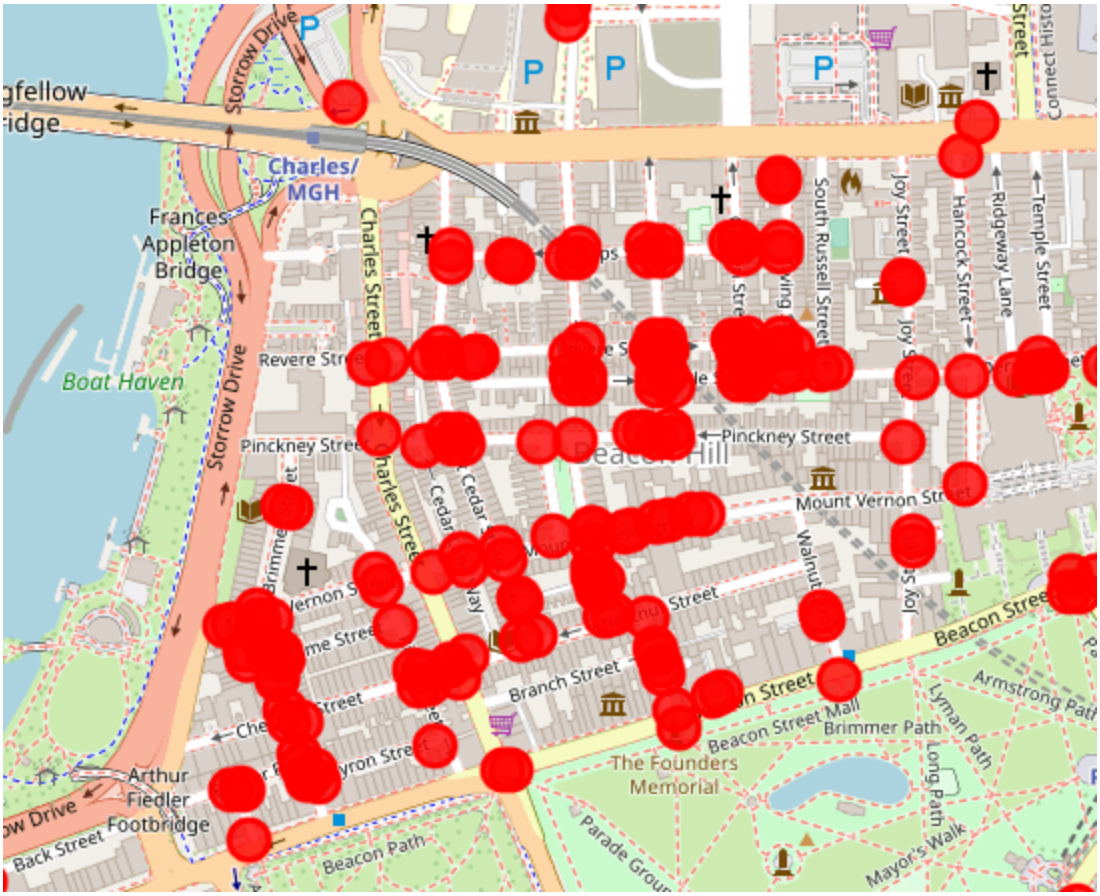


Figure 11: All the ramps with score less than 10 showed in the Beacon Hill area. (Haocheng did the map filter and pointing)

We are also going to provide a function that can show all the ramp points that are in poor condition(having a score less than 10) on the map with their precise positions. Pointing out all the poor points in the map, the government should then be able to fix them with detailed plans. Other than showing the positions of the worst neighborhoods sidewalks, we can also pinpoint all the poor ramps inside the sidewalks with relatively good conditions.Fix them to make good sidewalks better is also an important task.

Disabilities

How the disabilities feel in Boston is also one important thing mattered by the client. So we get the dataset from Analyze_Boston and try to add them into our rating system with sidewalk shapes. We made a map with colors from Blue to Red to show the density of the disability population in our city. Also, to take as an example, we show the screenshot of Allston and Brighton:

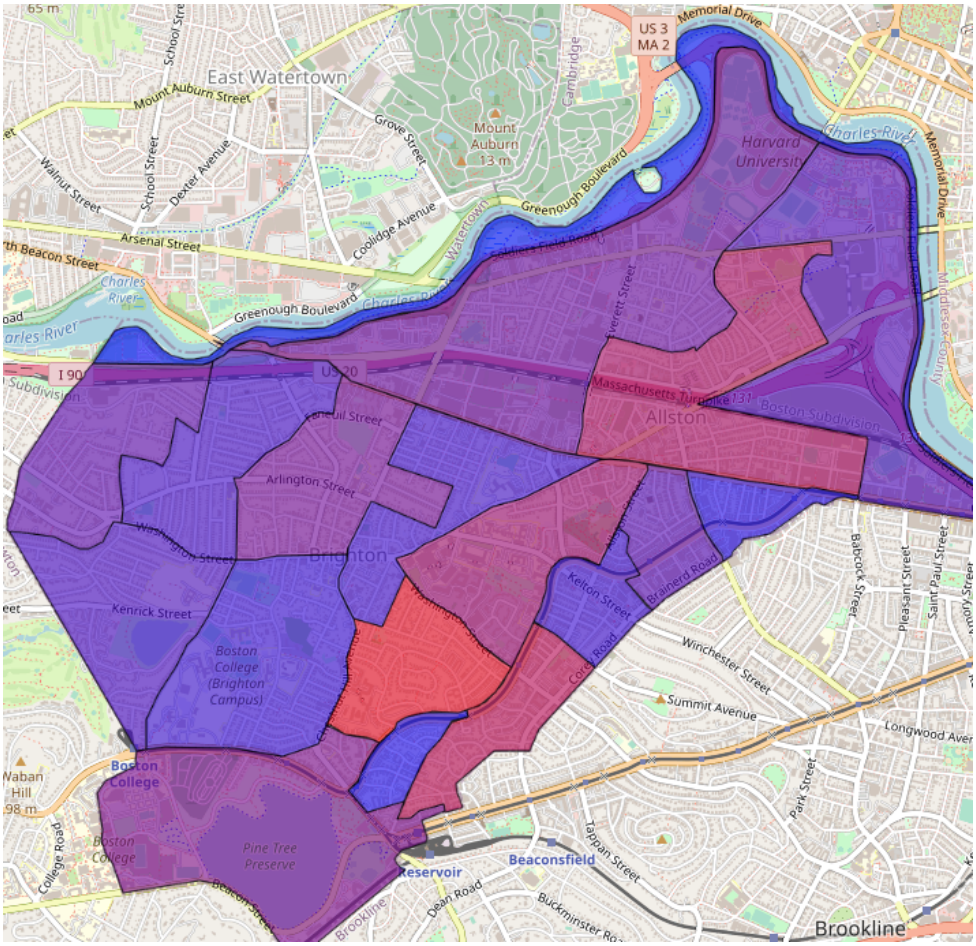


Figure 12: The population of disabilities that live in Allston and Brighton. The red areas mean there are almost 1000 disabilities here. The blue areas like the riverside, the population is close to 0.(Map made by xiao)

From the above map, definitely we can see that there are clear red areas in this part of the map, and the accessibility of sidewalks really matters, or to say matters most to people living there. After we finish our total rating system(Combining the ramp scores and hazards), we can then take population into consideration for the Government to decide which part of this City needs help ASAP.

Conclusion

The sidewalk shapes and ramp scores also with hazards are strong data with high density, we can make use of them to make further analysis, and then provide convenient functions for the client/government to find their new targets on Boston city construction. Since our work is not finished, this report is only a draft without more details for our thinkings and has no formal conclusion part

Answers to project questions
(Xiao)

Question1: How can we leverage existing data (trip hazards, pedestrian ramps, crosswalks, etc) to create an accessibility score for each sidewalk block in the City? Can we use this score to identify which sidewalks are the most inaccessible in the City?

The existing data with ramp scores has been being used by us to build a system of coloring the sidewalks. Providing visualizations of maps of Boston is really helpful for both us and the client's future work. To make use of hazards points, we can give points to them for their different reasons. Then leverage them into the present scores. Continuing in the rating system of this colored map, we can simply identify the sidewalks with filters on the map, and look into the inside conditions of sidewalks.

Question2: Can we use the results of this score to identify regions of the City that are the most accessible vs. least accessible? Can we also compare these results with different elements of social vulnerability to see how equitable/inequitable accessibility is?

Yes. Since we have built up the sidewalks with the most micro level. We can easily add the neighborhoods onto the map. Providing a further calculation, we can find which regions are the most accessible or least accessible. To make use of the social vulnerability, raise disabilities as an example, we plotted them onto different regions in the map with different colors. In the next steps. We can combine this area map with the sidewalks that we have in the rating system.

Question3: Can we create routes from residential parcels to the nearest important pedestrian destinations (transit stops/ commercial zones/ parks/ schools/ etc.) to see how many residents can get to these destinations without coming across any inaccessible features? How do these routes differ for citizens that live in different parts of the City?

We got the data from schools in Boston, we can search the sidewalks nearby through the geometry data. As we have given different scores to the road, we can simply add them as a virtual distance to the sidewalk data. After this, when we are trying to lead a path to the places that we want to go. The shortest path algorithm will help us with identifying the shortest route. Talking about the differences with present paths, obviously, the downtown areas have good sidewalk conditions, then the best path in our system will be very close to the path given by Google Map. However, if the road conditions are bad, where Google maps can't find out, we can get the user a safer and easier route.

Question4: Based on all the findings above, how should the City re-strategize its sidewalk repair strategy to be most impactful? Can we optimize repairs which would help the most people get to important destinations?

We have built up such clear and direct map figures, but the searching functions and filters are not built yet. So the map is not able to pinpoint the areas now. Let us suppose Roxubury is the most potentially impactful neighborhood, the City should prioritize its resources and efforts towards repairing sidewalks and ramps in these areas, especially in locations with a large population of elderly, disabled individuals, and people with medical conditions.

Future plans and Challenges:

https://drive.google.com/file/d/14NuWBvpZsMoNxAQ-nmCHti3Qs5nN805T/view?usp=share_link