Campus Design Standards

University of Colorado

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in coordination with Richelle Reilly

Design Standards
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Executive Summary

University of Colorado Boulder has become renowned for its beautiful campus, laden with red sandstone buildings that perch at the base of the Flatirons. Along with the natural beauty of Colorado, the campus is an epicenter of the outdoor and nature-loving community, making the University of Colorado's campus home to a wide variety of commute vehicles. With the high amount of traffic flowing through CU, there has been noticeable inefficiency in the approach to the current infrastructure standards set into place, specifically when it comes to commuting in and around campus. Most notably is the amount of crashes between different commuting vehicles and pedestrians, as well as the tension and attitudes that are exhibited between commuters. Heavy traffic is centralized in the core of campus, the problem areas stemming from the UMC all the way to the Duane Physics building.

we decided to critically evaluate the current traffic direction standards in place on campus by observing and analyzing the confusing infrastructure and dangers around campus. Our primary goal as a team was to analyze the current design standards implemented around CU to see where problem areas lay. This was accomplished through research using a student survey to hear students' voices on the topic of commuting, as well as a map of commute times to see the most efficient way to commute around campus. We also got into contact with Richelle Reilly to discuss problem areas around campus, who cemented our idea about promoting new design standards at CU. Our primary analysis was taking the feelings of the student body and comparing their opinions with the time map data, to find a solution that was doable for commuters and that would promote safety and the fostering of community. Secondly, we recommend specific design solutions to encourage commuter usage of our solution path. Together, these two can be useful tools in helping design a safe and friendly campus.

Background

All three of us have seen many collisions on campus over the few years that we have been here at CU. To us and many others, there are ways to help prevent these occurrences from happening at all. We believe that CU's design of pathways can contribute immensely in alleviating many accidents, major or minor from ever occurring at all. We are primarily providing data to CU in terms of survey data of student opinion on the topic, as well as a time map to present which paths to and from buildings on campus are the fastest. This data should help in the process of redesigning campus pathways in order to prevent and protect students from injury via accidents and collisions. Our specific design recommendations are a lesser part of our report, and are meant to demonstrate the intended effect of a change, in whatever form it ends up.

Our initial approach to this problem was to meet with Richelle. We hoped to narrow focus from our general problem area of on-campus commuting. We also hoped to find out what constraints the solution needed to fit within from the perspective of Facilities Management. We learned that for changes to be made in a reasonable timeframe, they must be relatively inexpensive or build well of existing infrastructure. Richelle provided us with some background of previous changes, and described a lack data as a major hurdle in both identifying specific problems and developing effective solutions. Through our discussion we narrowed our goals to be more research focussed, and to provide a framework in which problems and solutions can be analyzed.

Goals

Our initial goal was to incentivize bikers to use periphery paths on the edge of campus, by showing that the outside paths are quicker than the heavier trafficked inner areas. This would help increase the flow throughout campus and decrease the amount of collisions between pedestrians and bikers. However, after analyzing the time map, we concluded that the periphery was the same amount of time as biking through a heavily trafficked inner campus. Thus we had to reassess our goals for the project, and realized our primary goal was to label problem areas of the campus and report it to Richelle Reilly so that she could use our data to address the most important areas of campus.

Our primary questions for our project were:

- What are the main problem areas on campus?
- What *will* incentivize students to use alternative paths?
- How do different modes of transportation affect each other?

Our primary goals for our project were:

- Map campus problem areas
- Collect data on how students commute between classes
- Record the attitudes students feel towards each other

Research

We conducted research in two parts with different methodologies and goals. Both components of our research worked towards answering our overarching questions and guided further research.

First, we needed to understand the qualitative aspect of students' commuting between classes on campus. To find this information we developed a web based survey. The questions gave us insight to three main aspects of students feelings:

- Which paths students used most often
- How commuting made students feel
- How intra-campus paths reflected on CU as a university

The first is a component in identifying problem areas on campus, the second and third are important for motivating the University to act on this report's findings.

Second, we measured commute times along a number of major paths on campus. The measurements were averaged over multiple commutes on the path with varying traffic levels. This data is critical to understanding how well the path infrastructure is performing around campus. We were particularly interested in paths that had relatively low throughput or slow commute times compared to the number of survey respondents that felt the path to be important.

With this quantitative data we were able to produce a weighted graph of 26 critical points across campus. Using a traffic level coefficient, and Dijkstra's algorithm for pathfinding, we are

able to simulate commute times between points on campus. This allows us to recommend a fastest path for a given level of traffic, and test whether our edge recommendation is sound.

Analysis of Data

Survey:

For three weeks we collected data for the survey, and of the 104 results that were collected. We found that students were not happy with the traffic and tension between different commuters on campus.

For our survey, we asked students via Google survey to respond to questions regarding campus design of pathways.

1) How do you feel when commuting between classes on campus?

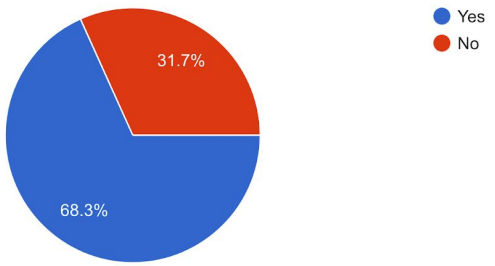
We asked this question to gauge the emotional sentiment of students to give to Facilities an idea how students feel traveling to and from classes.

“Used to love biking, but now they made several areas closed to bikes and now I’m uncomfortable biking”

“Cramped” *“Overwhelmed”* *“Stressed”*

These are just a couple of responses to this question, which highlights the anxiety of traveling to and from classes on campus.

2 a) Does campus design influence your mode of transportation?



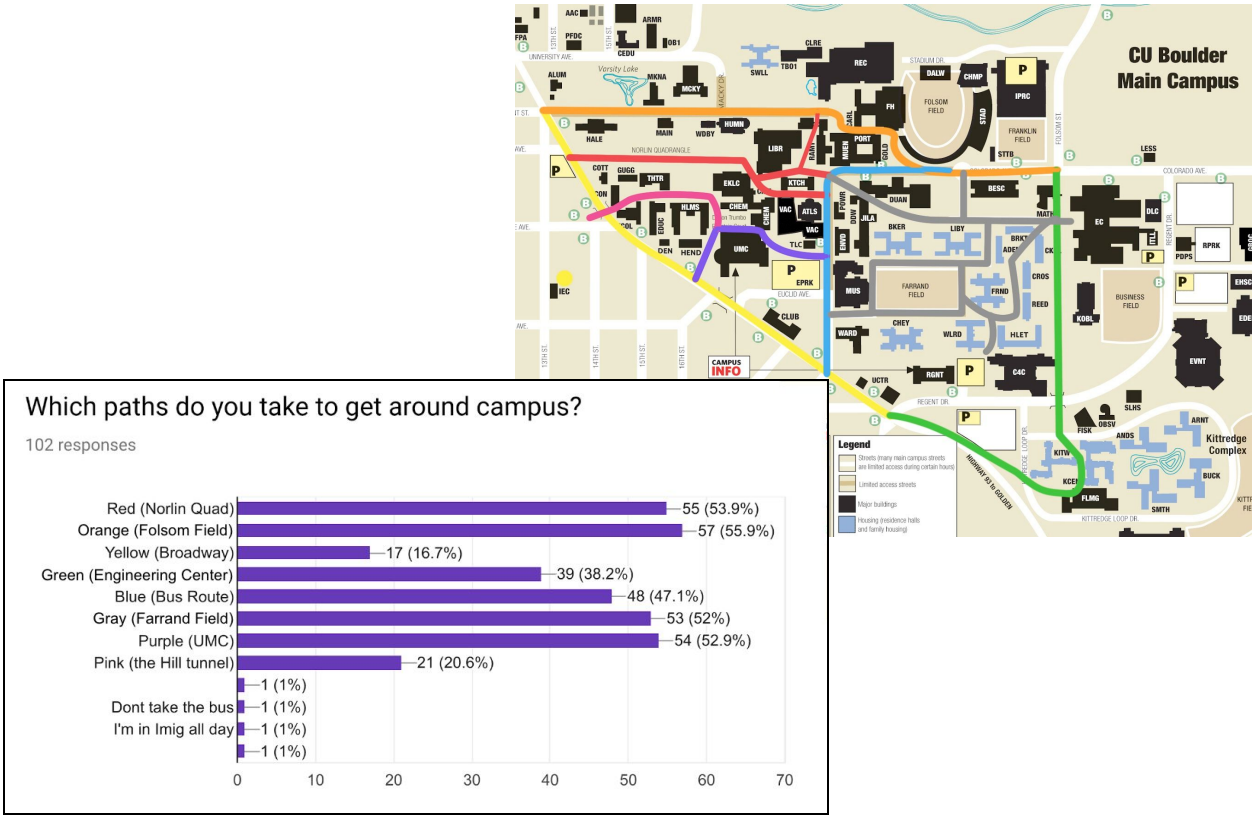
b) In what way?

We asked students if the design of campus pathways affects their mode of transport around campus. This question was for Facilities to see if their design had the desired influence in campus transport.

3) Which paths do you take to get around campus?

We gave students the map shown below of campus with paths around campus categorized into colored sections. Students were free to select any number of paths, which allows us and Facilities to see which paths are being used and whether that is what they intended. If the pathing is different from what they intended they can analyze why these paths are less favorable than the majority.

We found that students tend to travel through the center parts of campus more so than the exterior paths as shown by the chart below.



4) How does campus design reflect CU?

We asked this question to give Facilities a motivation to consider a redesign of pathways in order improve current students opinion of campus and give incoming students a sense of ease attending here.

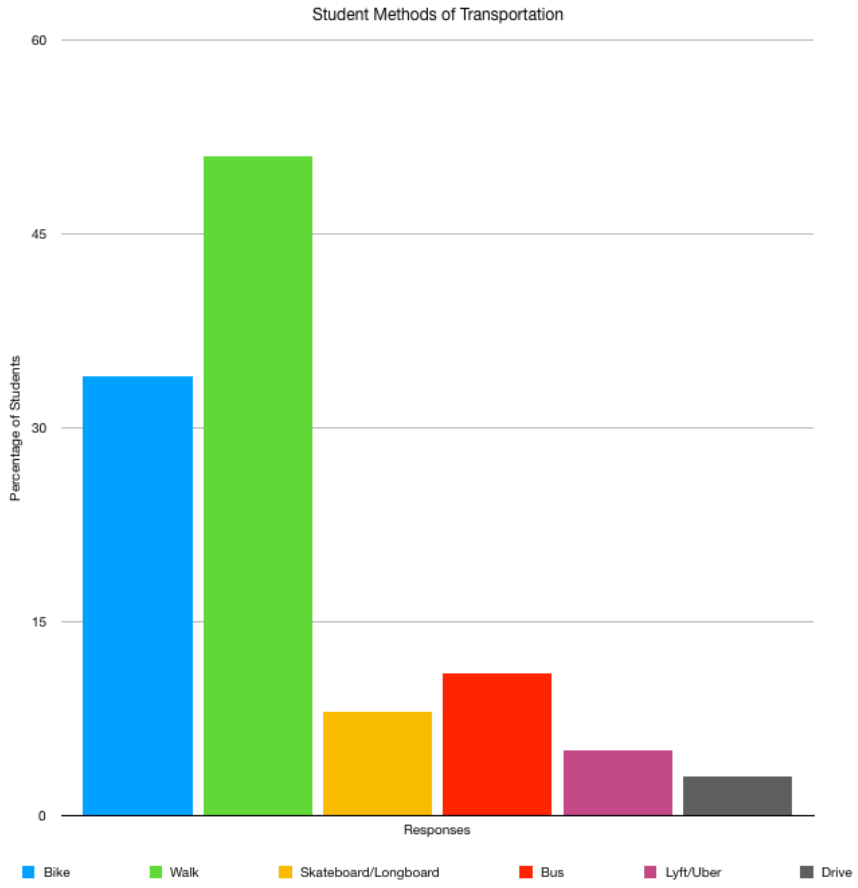
“It’s cluttered and complicated and no easy way to get anywhere”

“They obviously don’t want anyone to be driving anywhere or make it easy. Now I have to walk home in the dark multiple times a week which is scary and dangerous”

These comments are the most poignant in a general sea of stressed and confused students.

5) How do you get around campus?

We asked this question as a way to assure that we collected enough data across every mode of transport.



The chart shows us the expected majority of students walk or bike to class we hoped to see in our data. Surprisingly, there was a slightly higher percentage that chose to Lyft and or Uber to class rather than drive their car. I can see this demographic growing in the next few years into something that Facilities has to recognize and regulate.

Solution

Our time map and student path selection data have shown us that the edge of campus is not always the fastest option when commuting from two rather central buildings to one another. This changes the problem we now have to solve. Initially we wanted to direct students towards a better path on the edge of campus, but now we must decide whether to recommend periphery paths and reduce central congestion regardless of commute times, change the interior paths until the edge is the fastest for biking and passively encourage the desired behavior, or to change the interior paths to better support bike commuting on at least some main paths to make the current behavior more acceptable. This is not a simple decision, however with Richelle's consideration of cost in mind, active encouragement of periphery path usage is the best option. With inexpensive signage at critical path intersections we can make getting to the outer paths easier. And with an advertising campaign on bike racks, similar to the 'head's up' campaign, we could encourage students to use the periphery paths rather than the central paths. This will hopefully work towards reducing the congestion caused by bikes in the center of campus, where they slow down all commuters and contribute to a feeling of unease on campus.

Moving Forward

What we have completed so far has given us a broad understanding of this issue. However, with our deviation from the original goal of moving students to the edge of campus we must refocus our argument. We have 3 main goals to meet before compiling a final report for Richelle.

- Tune our pathing simulation to better reflect real traffic patterns
- Develop a dynamic website to display the final report, allowing for interaction with the simulation
- Distill our findings to an actionable recommendation for Richelle, whether that be a physical change to a path or specific further research.

The first will make our report more effective for informing decisions, allowing us to trust that addressing the critical areas identified are worth the cost of improvement. The second is to help persuade Richelle that our recommendations are valid, and for her to hopefully persuade her department into action on them. The third will be planning some specific locations that could use signage near critical points of traffic, or intersections where traffic could be re-directed effectively. This will be directly informed by the time map, but may need some more data about where students enter campus to be as effective as possible. With these three complete, we believe that this consulting report will be useful for future planning, and will have met the criteria Richelle described as important in our initial meeting.

Conclusion

Although our initial goal changed from the beginning of the semester, our project has created valuable insights that can now be used by Facility Access Management and the university's Campus Landscape Department. Our analysis of the flow of campus and our time map can be used for future infrastructure projects, and the information we have provided could be used for a variety of CU analytics.

Through meetings with Richelle and the analysis of our time map and student survey, we were able to successfully address the commuting areas at CU that inhibited a natural flow through campus. Improving the flow of commuters should have the benefit of improving the emotional experience of traversing our beautiful campus. This will benefit students every day, people on campus for special events, and hopefully recruitment through campus tours. The available improvements to a tour group's perception of the campus alone can motivate the improvements, as these groups directly translate to tuition income and national rankings based on application and acceptance rates.

We look forward to presenting a finished report to Richelle. This is an issue that directly affects us all as students on main campus, so improving Facilities Management's ability to effectively design campus infrastructure is in all of our interests. Whatever feedback we receive as to the usefulness or deficiencies of our report will be important for improving our future work, and for evaluating how effectively we met our own goals for this project.