ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Paper ID #35138

Learning About Equity from an Undergraduate Research of a University Campus Parking System

Miss Andrea Ramic, Angelo State University

Miss Ramic is a student-athlete classified as a senior at Angelo State University. Her major is Civil Engineering, with a focus on structural engineering. She plays on the ASU Women's Tennis team and grew up in Brussels, Belgium.

Dr. Dick Apronti, Angelo State University

Dick Apronti is an assistant professor at Angelo State University. He teaches transportation engineering courses, engineering graphics, and plane surveying. His research interests are in transportation safety and planning. Dick Apronti also has interests in projects that improve access to higher education and college retention for minorities and under-represented groups.

Angelo State University

David L. Hirschfeld Department of Engineering

Learning about Equity in Parking Design from an Undergraduate Research of a University Campus Parking System

Civil Engineering Undergraduate Research Paper

Andrea Ramić

Faculty Mentor: Dr. Dick T. Apronti

San Angelo, Texas

1. Background

Parking is one of the most contested resources on university campuses. Typically, parking spaces close to classrooms and administration buildings experience deficits in parking that often result in later arrivals being denied parking at their preferred locations. A challenge in parking space allocation is making sure there are equity considerations. Improving equity means vulnerable users of the parking lot are identified, and the parking lot designed in such a way that specific users are not disadvantaged compared to other groups. This paper discusses lessons learned about equity in designing parking lots during a faculty–mentored undergraduate research course. The purpose of the study was to estimate future parking demands for a university campus and to propose parking strategies that ensure efficient use of the parking spaces. A survey of the parking users on campus revealed concerns about accessible parking accommodations. This paper discusses the concerns raised by the respondents to relate them with the concept of providing equity in engineering design. The author concludes with some recommendations to ensure parking designs are equitable for vulnerable users.

2. Literature Review

Equity is defined by Dictionary.com as "the quality of being fair or impartial." In most engineering practice, equity is assumed to be inherent when the designer follows the design codes. For instance, in designing for traffic lights, the MUTCD recommends a pedestrian walking speed of 3.5 or 4.0 feet per second but requires the engineer to consider lower values for locations with slower walking pedestrians or pedestrians on wheelchairs (U.S. Department of Transportation Federal Highway Administration, 2009). This kind of equity-conscious design is visible in facility designs that consider vulnerable users.

A parking study at Angelo State University reviewed the accessible parking needs of most of the campus parking lots and found them to be adequate, using Figure 1 which contains a table showing the minimum number of accessible parking required for a total number of parking spaces provided. Figure 1 gives an example of the quota for accessible handicap parking where every 25 parking spaces requires one accessible handicap parking space.

Minimum Number of Accessible Parking Spaces
2010 Standards (208.2)

Total Number of Parking Spaces Provided in Parking Facility (per facility)	(Column A) Minimum Number of Accessible Parking Spaces (car and van)	Mininum Number of Van-Accessible Parking Spaces (1 of six accessible spaces)
1 to 25	1	1
26 to 50	2	1
51 to 75	3	1
76 to 100	4	1
101 to 150	5	1
151 to 200	6	1
201 to 300	7	2
301 to 400	8	2
401 to 500	9	2
500 to 1000	2% of total parking provided in each lot or structure	1/6 of Column A*
1001 and over	20 plus 1 for each 100 over 1000	1/6 of Column A*

*one out of every 6 accessible spaces

Figure 1. Minimum Provisions for Accessible Parking (Department of Justice, 2010).

The following are included in the basic minimum requirements, cited literally from the ADA Parking Standard document (U.S. Department of Justice):

- "Parking space shall be 96 inches wide minimum, marked to define the width, and maximum slope in all directions is 1:48."
- "Access aisle width is at least 60 inches, must be at the same level and the same length as the adjacent parking space(s) it serves."
- "Accessible parking spaces must be located on the shortest accessible route of travel to an accessible facility entrance."
- "The required number of accessible parking spaces must be calculated separately for each parking facility, not calculated based on the total number of parking spaces provided on a

site. One of six (or fraction of six) accessible parking spaces, but always at least one, must be van accessible."

The stipulations in the federal document ensure that parking facilities that meet the standards provide equity to vulnerable users of accessible spaces. An assumption one can make is that a well-designed parking lot will address some of the fundamental issues of equity.

3. Equity Challenges in Accessible Parking Design

The researcher obtained aerial pictures of the main campus buildings using Google Maps. 187 handicap accessible parking spaces (including van accessible) were identified and compared to the total parking spaces which was 5050. The results determined that the provision of accessible parking was sufficient. However, in a survey of road users about their experiences, the researcher learned that the placement of the accessible spots presented significant challenges for users of accessible parking spots. The researcher received two emails from the users sampled discussing the challenges with accessible parking on the campus.

The first correspondent read "ASU has a growing (exponentially) population of handicapped people, students, staff, faculty. Handicapped parking is limited, but not awful. Some buildings are almost inaccessible, such as the Parking Office if a person cannot walk (like me). The Library is also very limited," (Ramic).

The second email stated that "being disabled and using handicap parking, there are a number of issues with that on campus as well. My offices are in Rassman, the parking is among the slots further from the front door. Hunter Strain is similar and Cavness is the worst in that the handicap parking is on the opposite side of the building from that ADA accessible doors. I think you will find similar issues with other building such as the Academic, on campus. On the good side, residence halls are very accessible with the exception of Carr Hall. Cafeteria not so much," (Ramic).

These emails showed that even though the number of accessible spots is adequate, the positioning of the spots posed a challenge for users with needs for accessible parking. The researcher decided to review the parking standards to ascertain whether the positioning of the accessible parking lots met the minimum design standards. The 2010 ADA Standards for

Accessible Design did not contain specific guidelines regarding distance from building entrances but had the requirement that:

"Accessible parking spaces must be located on the shortest accessible route of travel to an accessible facility entrance."

The emails received from the users of the accessible parking spaces indicated that this requirement was not met, and this unfairly affected their ability to use the facility. An examination of the parking lots confirmed the issues identified by the respondents. A good design that addresses the requirements of the standards ensures an equitable provision of service to all users of the facility.

4. Recommendations

Based on the results of the study, this paper recommends a review of the parking system with regards to equity. The parking lot may need to be redesigned to provide adequate access to vulnerable groups. The paper recommends improving design processes for parking lots that require the consultation of vulnerable users of the facility. The perspective and experiences of such users can then be accommodated in the design for a more resilient and inclusive parking system.

5. Conclusion

In engineering design classes, a common theme is providing a safe and efficient design. In this paper, the researcher describes how equity is another goal of the design process. The paper describes how issues of equity exposed an inefficiency in the design of a campus parking system. A review of the challenges of accessible parking helped identify a provision in the design standards that could improve the facility's utility and provide an equitable service to all users.

References

Department of Justice. (2010). *ADA Standards for Accessible Design.*

Dictionary.com. (2021). *Equity Definition.* Retrieved from

https://www.dictionary.com/browse/equity?s=t

Ramic, A. (2021). *Supply and Demand of Angelo State University's Parking Facilities and Options for Improvement.* San Angelo, Texas: Angelo State University David L. Hirschfeld Department of Engineering.

U.S. Department of Transportation Federal Highway Administration. (2009). *Manual on Uniform Traffic Control Devices (MUTCD).*