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Accessibility Quality in Public University Structures: A Comprehensive Approach to Inclusive Design

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Quality accessibility features have a substantial effect on the user experience of a public service structure; however, research on these features often focuses on code compliance, limiting quality analysis abilities. In addition, research focuses mostly on common mobility challenges, reducing information on other disabilities such as cognitive and visual impairments. As a public university, The University of Southern Mississippi's function as an institution relies on students' ability to access its services, directly connecting the institutional value to its access quality. We designed a series of survey questions to assess a structure's accessibility features and their quality, focusing on including lesser researched disabilities in the data set. Information was collected from the University's Hattiesburg, MS campus and translated into a series of numerical data used to generate "accessibility scores" for both individual structures and survey items, indicating overall building access quality and campus-wide trends related to specific access types. These trends identify gaps in accessibility focus overall and indicate specific campus needs. This research outcomes foster improvements in the University's quality of accessibility, additionally improving the quality of life for the hundreds of disabled students in attendance.

Keywords: Architectural Accessibility, Environment Design, User-experience Analysis, Disability Inclusion

Introduction

Quality access is a fundamental tenet of the institution of public architecture, requiring visitors' ability to understand and operate a structure's core functions with little to no obstruction. Every day, people struggle to access structures including class buildings, public services, homes, and parks; as of 2022, 18.6 million Americans aged 5 and older reported travel-limiting disabilities that impact their experience with accessibility features (*Travel Patterns of American Adults With Disabilities,* 2024). The diminished quality of accessibility features can be caused by a variety of design choices such as width of doors, design and location of entrance ramps, number of accessible sidewalk ramps, etc. Many of these design components are covered by code suggestions under the Americans with Disabilities Act (ADA); however, there are often gaps in compliance and data collection as emphasized by one study focusing on city/municipal research. Of the 178 largest municipalities included, 60% provided open data and at least one piece of information relating to accessible routing (Deitz et al., 2021). This reduced focus on access in municipal research greatly diminishes the overall quality of the disabled user experience due to potential oversight and resulting inaccessibility.

On the Hattiesburg campus, 7,561 students (and additional faculty and staff) commute between multiple buildings per day, putting them into contact with a variety of accessibility features including sidewalks, doors, access ramps, elevators, etc. ("Office of Institutional Research," 2024). Newer structures are designed to accommodate disabilities as outlined by the ADA, providing features in compliance with quality standards; however, the campus is composed of structures from a variety of time periods, leaving it open to diminished quality of accessibility due to the historic nature of some structures, which follow historic building practices or exist under the values of historic preservation. Interactions between these structures and the policies that surround them have an intense effect on the quality of constructed accessibility features and the related user experience due to the inharmonious relationship between historic preservation efforts and modern accessibility standards.

28.7% of American citizens have some kind of disability. 12.2% specify mobility related disabilities, but the CDC data allowed self-report of 5 other types of disability (see Table 1) ("United States, DC & Territories Category: Disability Estimates," 2022). Literature on disability and accessibility often has a specified focus on physical mobility and casts a reduced gaze on other types of disability such as cognitive and vision impairments (Carlsson et al., 2022). These studies also often examine accessibility through the yes/no view of code compliance, leaving little room for additional quality assessment. This limits the ability of the research to cater to specific types of disability and user experience data. The University reports a total population of 12,021 students in Spring 2024 across both campuses and online attendance; however, includes additional data breakdown indicating only 7,561 graduate and undergraduate students in attendance at the Hattiesburg, MS campus ("Office of Institutional Research," 2024). Extrapolating using CDC data, a total of 2,171 potential students experience any type of disability. 100% of a population can benefit from quality accessibility features; however, they are of utmost importance to the disabled population they cater towards and lack of research on specific types of disabilities leads to a poorer user experience in these populations.

Table 1. Disabled Population at the University of Southern Mississippi's Hattiesburg Campus

	Disabled Population %'s	**Hattiesburg USM Population**
Total Population	-------	7,561
Total Overall	28.7%	2,171
Cognition	13.9%	1,051
Mobility	12.2%	923
Independent Living	7.7%	583
Hearing	6.2%	469
Vision	5.5%	416
Self-Care	3.6%	273

This research analyzes qualities of accessibility features related to structure access through an extensive survey focused on observations of their design/maintenance and how these decisions affect user accessibility experience. Each structure received a personalized survey report with a list of potential solutions for noted gaps in accessibility related to not just mobility, but also to other disability-informed user experiences such as ease of navigation and visual experience. Each personalized report is generated into a series of quantitative "accessibility scores" from which common failures and overall campus trends can be identified for potential improvement. Of 92 potential structures, 8 have been included in the following analysis, representing the four different categories of structure represented in the project. In the completion of this research, quality disparities in campus accessibility were identified via survey data, information which can be used to improve the overall user experience for all users and specifically improve the quality of life of the 28.7% of students experiencing some form of disability or accessibility challenge.

Background

The literature understands disability under various models, the main three are: the medical model, the moral model, and the social model (Olkin, 2022). The social model of disability implies accessibility as the ability to overcome impairment challenges; to that effect, types of access must be defined by the range of disabilities considered in architectural design. Many research projects seek to do this; the paper "A Scoping Review of Public Building Accessibility" chooses to do so through the definition of "access activities," actions through which building occupants access a building. The research lists ten: using the parking/drop-off area, using the route to the building entrance, entering the building, using interior building pathways, using the elevator, using the service desk, using services, using hygiene facilities, and exiting the building (Carlsson et al., 2022). Similarly, researchers in a 2024 study examined workspaces, bathrooms, corridors, vertical and horizontal accesses, circulation areas, and ranges (Acioly et al., 2024). These begin to define what the goal of building accessibility should be, indicating a requirement to provide sufficient accommodation to allow occupants to complete access activities with ease and independence and noting where these activities take place.

Another method of accessibility research focuses on ethnographic study, asking disabled community members about their experience with accessibility features as a metric for their success. A 2015 paper documented how an organization of disability advocates translated their own experience into expertise on the subject. The organization uses a "move-through building assessment" to analyze accessibility features through the lens of a group of diverse individuals with varying types and severity of disability. These individuals walk through the building, testing and discussing the accessibility services as a mandated notetaker documents the interactions. These notes are used after the fact to produce a detailed report which can be shared with building managers, architects, etc. as valuable feedback for improvements (Nijs & Heylighen, 2015).

Other varieties of accessibility analysis were identified in a literature review for a study focusing on accessibility metrics. These include the general "yes/no" standard code compliance measures as well as "counting, total sums of distances, closest available, gross interaction potential, and probabilistic choices" (Sakkas & Pérez, 2006). The study goes on to elaborate on the potential applications for these types of analysis and their merits as measure of building accessibility, providing a framework to be applied to the development of the survey analysis used with the University of Southern Mississippi's campus.

Methodology

Two assessments were designed and developed into a fillable form to be answered throughout an in-person site visit. One assessment references the design of many empirical studies while the following mimics the "move-through assessment". The empirical assessment asks an extensive list of questions about the physical qualities of the building/site and its accessibility features. Questions were generated with consideration for types of access mostly based on the "access activities" listed in Scoping Review (Carlsson et al., 2022). Assessments view structures as they exist today, analyzing their level of accessibility through the lens of modern standards and use. This allows for identification and prioritization of current gaps in accessibility for potential improvement in future accessibility initiatives.

The empirical section of the assessment was adapted into a set of qualitative data using an expanded version of the "yes/no" measure of accessibility common with standard compliance measures including some features of other identified measures for accessibility including "counting" (counting the number of locations in a space where an access activity can take place) and "total sums of distances" (greater distances indicate reduced accessibility) (Sakkas & Pérez, 2006). Each applicable question from the survey was assigned a series of requirements from which an 'accessibility score' of 0, 0.5, or 1 could be generated where 0 indicates non-compliance with the requirements, 0.5 indicates compliance, and 1 indicates additional accessibility features above and beyond the requirements.

Each of these questions was analyzed through the lens of the 2010 ADA Standards for Accessible Design, which provides applicable standards informing the content of accessibility score requirements (*2010 ADA Standards for Accessible Design*, 2010). Some questions included in the survey were directed at specific types of disabilities and have no directly related ADA standards, indicating potential national gaps in accessible design considerations. Many of these questions considered under-researched types of disability and provide focus on for vision impairments, chronic fatigue, cognitive impairments, etc. ADA-supported questions included simplified scoring criteria relating to general observations as outlined by related standards. Questions supported by vague or non-specific standards (such as questions relating to distance or required number of available accessibility features) received scores based on an observed value's relation to the average of the data set (e.g. a building with an above average distance from ADA door to parking receives a score of 0 indicating non-compliance).

Table 2. List of Survey Questions and Score Values

1	Location elevation of accessible entrance? 2010 ADA: None	0: Opposite the center-elevation or main path of travel. 0.5: Accessible entrance is on the center-elevation. 1: Multiple accessible entrances.
2	Distance from parking. 2010 ADA: 206.2.1, 206.2.2, 206.3, 206.3.1	0: Above average distance/no dedicated parking. 0.5: Around average distance. 1: Below average distance.
3	Condition of sidewalks. 2010 ADA: 303.2, 303.3	0: Sidewalk considerably damaged and difficult to use. 0.5: Only mild to moderate damages, very usable. 1: Sidewalk in excellent condition, almost new.
4	Automatic doors? Type? 2010 ADA: 404.3	0: No automated doors. 0.5: Includes automated doors. 1: More than one automated door.
5	Does the button work? 2010 ADA: 309.4, 404.2.3	0: No provided button/button operational. 0.5: Hard to see, in disrepair, operates a slow mechanism, is in an awkward place, or requires multiple tries. 1: Extremely easy to see and operates a fast mechanism.
6	Doors heavy/difficult to move? 2010 ADA: 309.4, 404.2.3	0: Door is extremely difficult to move. 0.5: Door is only mildly-moderately difficult to move. 1: Door is extremely easy to move.
7	Distance to nearest elevator? 2010 ADA: 206.3	0: Distance is significantly greater than average. 0.5: Distance is around average. 1: Distance is significantly less than average.
8	Elevators operational? Describe the quality of operation. 2010 ADA: None	0: Elevators are unavailable, inoperable, or have significant mechanical issues. 0.5: Elevators are operable but run poorly. 1: Elevators are operable and run like new.
9	Distribution of elevator shafts. 2010 ADA: None	0: Too few elevator shafts and/or entirely non-centralized. 0.5: Semi-centralized and appropriate number of shafts. 1: Centralized and generous number of shafts.

10	Size of elevator car? 2010 ADA: 407.4.1	0: Extremely small elevator cart. 0.5: All elevators of minimum size. 1: At least one extra-large elevator.
11	Size/operation of classroom, laboratory, and/or office doors. 2010 ADA: 404.2	0: Difficult to move, extremely narrow and/or include inaccessible door handle styles. 0.5: Average doors that move with ease and include accessible style of door handle. 1: Doors are extra wide or include automation.
12	Size/operation of restroom doors. 2010 ADA: 404.2	0: Doors are extremely difficult to move/operate. 0.5: Average doors that move with ease and include accessible style of door handle. 1: Includes additional ADA accommodations or is privacy partition wall style.
13	Percentage of ADA stalls in restroom. 2010 ADA: 213	0: Below average percentage of ADA stalls. 0.5: Average percentage of ADA stalls. 1: Above average percentage of ADA stalls.
14	Size of ADA restroom stall. 2010 ADA: 604	0: Below average percentage of ADA stalls. 0.5: Average percentage of ADA stalls. 1: Above average percentage of ADA stalls.
15	Restroom fixtures/amenities. 2010 ADA: 213.3.7, 604.8.3, 603.4	0: Amenities are too high to reach. 0.5: Amenities meet standard reach overall. 1: Includes secondary lowered-height amenities.
16	Describe the location of room number signs. 2010 ADA: 703	0: Room signs are illegible or difficult to see. 0.5: Room signs are visible and meet standards. 1: Room signs are extremely visible or additional signage.
17	Describe the location and legibility of room directories. 2010 ADA: 216.3, 703.5	0: Directories are unavailable. 0.5: Directories are available. 1: Directories are available and obvious in multiple locations in the structure.
18	Quality of directory signage (ADA door, elevators, etc.) 2010 ADA: 216.6	0: Structure includes no directory signage. 0.5: Structure includes ADA door and restroom signage. 1: Structure includes additional directory signage.
19	Contrast between room signs and wall. 2010 ADA: 703.5.1	0: Contrast is poor and difficult to read. 0.5: Signs meet average contrast. 1: Signs are extremely large or include bold marker colors.
20	Stair edge contrast. 2010 ADA: None	0: Stairs include no edge stripping. 0.5: Stairs include edge stripping, but it is low-contrast. 1: Stairs include high-contrast edge stripping.
21	Availability and distribution of rest sites. 2010 ADA: None	0: No rest areas are available. 0.5: Some rest areas are available. 1: Rest areas are abundant.

Each building on the campus was assigned to one of five categories based on use-case: 1) Class/Student, 2) The Historic District, 3) Misc./Admin., 4) Natural/Outside, 5) Sports. Sports structures were eliminated from the data set due to their demographic of users, which is typically able-bodied. A variety of other structures were eliminated due to public access limitations, such as dormitories and non-student access structures.

Research Outcomes

Tables 3.1 and 3.2 list accessibility scores for each building in the data set including 21 applicable questions and average overall accessibility scores rating both building accessibility and campus compliance on individual questions. Most questions were able to fit in the 0, 0.5, 1 scoring range; however, some structures included elements of multiple scores and received mid-scores such as 0.25 or 0.75.

Table 3.1. Accessibility Scores

Building Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
The Hub	0.5	0	0.5	0.5	1	0.5	0	0	0	0	0.5
Lucas Administration Building	0.5	1	0.5	0	0	0.5	0	0.5	0.5	0.5	0.5
Bond Hall	0.5	1	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5
R.C. Cook Union	1	0	1	1	0.5	0	1	1	0.5	0.5	N/A
Peck House	0.5	1	1	0.5	1	1	N/A	N/A	N/A	N/A	0.5
Medicine Wheel Garden	N/A	1	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thad Cochran Center	1	0	0.5	0.5	1	0.5	0	0.75	0.5	1	0.5
Spirit Park + Southern Station	N/A	0	0.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Averages	0.67	0.50	0.56	0.50	0.67	0.50	0.40	0.55	0.40	0.50	0.50

Table 3.2 Accessibility Scores Cont.

Building Name	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**Averages**
The Hub	0.5	0.5	0	0.5	0.5	0.5	0	0.5	0	1	0.36
Lucas Administration Building	0.5	0	0.5	0.5	0.5	0	1	0	0.5	0.5	0.40
Bond Hall	1	1	1	0.5	0.5	0.25	0.25	0.5	0	0.5	0.57
R.C. Cook Union	0.5	0.5	0	0.5	0.5	0.25	0.25	0.5	0	1	0.53
Peck House	0.5	0.5	0.5	0.5	0.25	0.5	0.5	0.5	N/A	1	0.64
Medicine Wheel Garden	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5	0.5
Thad Cochran Center	1	0	0.5	0.5	0.5	1	0.5	0.5	0.5	1	0.58
Spirit Park + Southern Station	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.25	0.25
Averages	0.67	0.42	0.42	0.50	0.46	0.42	0.42	0.42	0.20	0.72	N/A

Ideally, averages for each question and overall would equal 0.5 or more, so scores are also categorized into high-, mid-, and low-range where mid-range scores equal 0.5 +/- 0.05 and any scores above are high-range and below are low-range. Mid-range scores indicate compliance with 2010 ADA standards while low-range scores indicate non-compliance. High-range scores indicate additional features supplementary to compliance.

Buildings listed in Tables 3.1 and 3.2 include a well-distributed range of average accessibility scores, indicating a potential positive trend over time. Outlier structures from use-case Category 4 (Natural/Outside), which experienced a disproportionate number of non-applicable survey questions as compared to other structure categories and received lower scores as a result, were removed (see Figure 1).

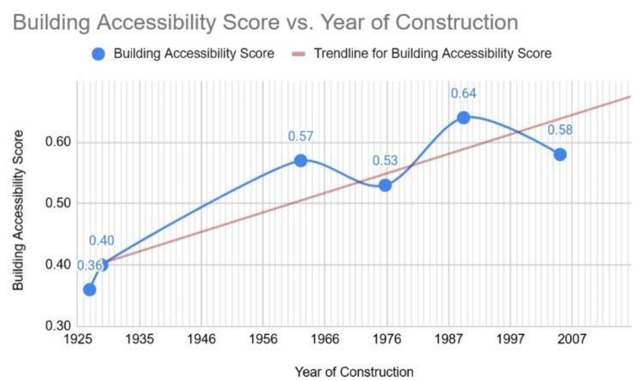

Figure 1. Building Accessibility Score vs. Year of Construction

Individual questions received an uneven distribution of score ranges, with 8 questions falling in mid- or low-range and only 5 falling in high-range. The 8 low-range questions indicate potential concerns across the wider campus, providing direction for further improvement (see Table 4).

Table 4. Questions With Low-Range Accessibility Scores

#	Question	Score
20	Contrast between stair tread edges and the rest of the tread.	0.20
7	Distance between the accessible entrance and the nearest elevator.	0.40
9	How many elevator shafts are there? Are they well distributed?	0.40
13	How many total stalls are there? Of those, how many are ADA toilets?	0.42
14	Are the ADA toilets large enough to accommodate large mobility aids?	0.42
17	Describe the location and legibility of room directories.	0.42
18	Quality of directory signage (ADA door, elevators, etc.)	0.42
19	Contrast between room signs and wall.	0.42

Discussion

Analysis revealed multiple areas of low-range scoring, indicating a need for greater focus. Specific low-range scoring buildings from the set include The Hub (0.36), Lucas Administration Building (0.40), Medicine Wheel Garden, and Spirit Park + Southern Station (0.25). Category 4, such as Spirit Park + Southern Station, structures are general outliers due to the number of nonapplicable questions in the data set, causing these scores to be lower overall (see Table 3). Outdoor spaces do not include surveyed accessibility features such as doors, restrooms, directories/related signage, etc. The Hub and Lucas Administration Building are also members of The Historic District and can be expected to score lower due to less accessible historic construction practices pre-ADA.

The trend in Figure 1 indicates an increase in accessibility over time across buildings with the exception for the Category 4 outliers. Thad Cochran Center is the only notable outlier, scoring low-range on questions 7 and 13, both low-range questions overall, as well as question 2 (see Table 3). These scores indicate that the building conforms to the overall trend of having an above average distance from ADA entrance to elevators (7) as well as a below average percentage of ADA restroom stalls (13) while experiencing a major outlier with above average distance to parking (2) (see Figure 2); however, its overall accessibility score of 0.58 maintains mid-range compliance, suggesting that it may be a temporary downturn in the trend, similar to R.C Cook Union (0.53), rather than a permanent downturn.

Figure 2. (A) Cat. 4 Structure: Southern Station (B) Thad Cochran from ADA Parking

Low-range questions (see Table 4) span four different topics: stairs, elevators, restroom stalls, and signage, indicating that these are areas in need of future focus. Of these, stair (20) and signage (17, 18, 19) questions were added to help address the gap in research outside of mobility, specifically targeting visual and cognitive disabilities in need of enhanced navigational features. Figure 3 (A) shows the atrium stair in R.C. Cook Union, exhibiting monochrome treads, and demonstrates difficulty discerning different stair treads from one another, a symptom exacerbated by visual impairments. Structures are often lacking directory signage -- indicating stair, elevator, or restroom location --, room/office directories, and contrast in signs and stair edges. Many of these structures include additional signage put up by faculty or staff to fill the gap. Figure 3 (B) shows a series of different navigational tools together, indicating a need for a more permanent design solution to improve navigational quality. These findings corroborate those from "Scoping Review," which indicated limited research focus on vision impairments and very few articles available on cognitive disabilities (Carlsson, et al., 2022).

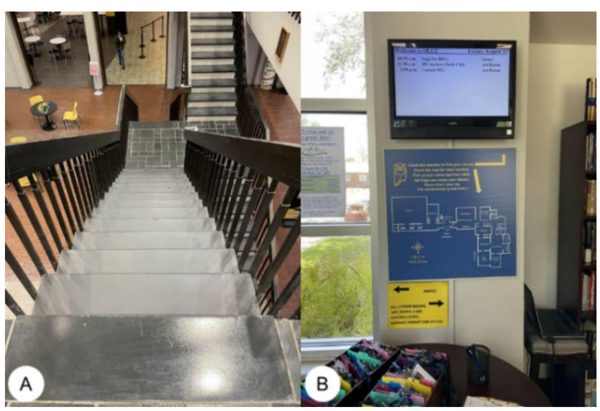

Figure 3. (A) Low-Contrast Stair Treads (B) Signage and Directories at Peck House

The goal of this analysis was to build on other analysis metrics as explained in "Elaborating Metrics." The expansion of the "yes/no" measure of accessibility as described allows it to include both additional forms of measurement in the form of other described metrics ("counting" and "total sums of distances") and additional information concerning the quality of accessibility given on a range rather than a binary. In this way, scores can be used to indicate significance of gaps in accessibility with greater accuracy and allow for the analysis of trends over time, increasing the ability to prioritize resources for improving current building access quality and developing modern codes and standards. This broad-spectrum style of assessment can also be applied to any structure as evidenced by the variety of structures examined on the university campus, allowing for further applications in any structure's accessibility analysis.

While the methodology used to approach the topic addressed many gaps in research, this work is not without limitations. Cognitive and visual impairments were included in survey design; however, the main focus of the research remained on physical mobility due to time constraints. No research was performed in relation to hearing impairments, which make up 6.2% of the disabled population ("United States, DC & Territories Category: Disability Estimates," 2022). These impairments are related more directly to classroom management and could be elaborated on further by examining specific interactions in classroom/workroom access. Overall, the work contributed to disability research as a whole; however, these limitations indicate points of necessary continued development.

Conclusion

Disability and accessibility are often under-researched and under-represented. These are trends represented by current norms, exhibited by lack of available municipal research and in our current body of research, which routinely over-focuses on specific types of disability while others are left behind. This research took one small step in expanding beyond this focus, including additional quality assessments focused on these relatively under-examined impairments and identifying specific concerns for which actionable steps can be taken to improve overall access quality. These can be shared with campus improvement committees to directly improve the lives of hundreds of disabled students in attendance at the USM Hattiesburg campus and provide a framework for accessibility analysis in all buildings.

History has seen many iterations of building codes and design practices producing various levels of access quality; however, all remaining structures exist in the context of the use they experience today. Our assessment views public service structures as institutions of service to the people first and foremost, analyzing all buildings through the lens of modern codes, standards, and users. This view allows analysis to identify and prioritize current gaps in accessibility no matter the structure, information which can later be reconciled with both improvement budgets and preservation efforts.

While this study sought to increase inclusivity in accessibility research, it is not without limitations. Gaps in cognitive and hearing impairment research were addressed at a surface level in this work, hearing limitations remain unexamined, and the largest focus remains trained on physical mobility. Future research could look deeper at these specific disability interactions and their intersections with the use of classrooms in real educational settings. It could expand outside of individual structures to examine the interactions between buildings and sites to identify gaps in classroom accessibility, fostering greater reductions in accessibility quality campus wide. Outside of educational institutions, this type of survey could be altered to provide more data to building managers and designers in all applications, focusing design and maintenance professions on improving the user experience for our most vulnerable users.

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