Bike Rack Occupancy on the University of North Texas Campus

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The presence of bike parking facilities has been shown to play a role in improving bike ridership. People are more likely to commute by bike if there are secure and well-located bike racks available. Within the last 5 years, the University of North Texas has made a concerted effort to improve the availability of bike parking for cyclists to encourage cycling as a commute mode. However, the placement of racks around campus has been based on perceived needs rather than documented patterns. The goal of our project is to document the occupancy rate of bike racks across campus to identify areas that were underserved. We also examined how rack installation practices affected the maximum capacity of the racks and occupancy rates. We found that overall the campus had a sufficient number of racks. However, a few areas on campus were underserviced, while in other areas, the racks were not being utilized. These patterns of use were linked to the types of buildings the racks were associated with, as well as where racks were placed and installed. The findings will allow the university to better plan where to target resources.

1. Introduction

As a participant in Sustainability Tracking, Assessment & Rating System (STARS) and a signatory of the American College and University Presidents' Climate Commitment (ACUPCC), the University of North Texas (UNT) has a vested interest in reducing greenhouse gas (GHG) emissions. One of the top sources of GHG for universities is the use of a car as a primary commute mode for students (Bonham and Koth, 2010). At UNT, car commuting makes up over 36% of total emissions (2009 GHG Inventory). Therefore, enticing students to make the shift from car commuting to bicycle commuting would aid the university in reducing carbon emissions. The City of Denton has made a concerted effort toward promoting safe transit for cyclists and pedestrians. Through forums and city research they have produced the Denton Mobility Plan including a Pedestrian and Bicycle Linkage Component. Their purpose is to comply with goals set by the U.S. Department of Transportation in 1994:

(1) To double the percentage of trips made by foot and bicycle in the United States,

(2) To simultaneously reduce the number of injuries and fatalities suffered by bicyclists and pedestrians by ten percent. (Pedestrian Linkage Component, City of Denton Mobility Plan)

Although much research has been done on commuting as a whole, few studies have focused on the "built environment" (Heinen, 2009), which includes infrastructure facilities. In conjunction with the city, UNT has an interest in facilitating the goals to increase bicycle use. A large part of planning to achieve these goals is the installation and upkeep of bicycle facilities including bike lanes, wide curb lanes,

shared roadways, shoulder bikeways or urban shoulders, as well as paths, sidepaths, and trails. Along with these features, bicycle amenities such as signage, accommodations on public transit, and bicycle parking should be provided to assure a smooth transition into a 'bike-friendly' environment. Cleary and McClintock (2000) suggest that, among other factors, cycle parking was a key factor in enticing commuters to choose to ride their bikes in England. The article goes on to observe, that through meticulous planning, including the "exact location" of bike racks is vital in enticing cyclists (Cleary and McClintock, 2000). The university has made strides in recent years by adding more bike racks across campus, however their number and placement has been based on estimation and not the quantified needs of students. This study will focus on the occupancy of bike racks and the effects of installation on the UNT campus. Recognizing that only a convergence of many different and varying strategies will successfully promote sustainability through the alleviation of car use (Balsas, 2003). By understanding the reasons for high and low occupancy rates across campus, we can better serve cyclists and create a cycle-friendly environment at UNT.

2. Methodology

One important consideration concerning bike rack occupancy is the improper installation of racks. Improperly installed racks account for 4%, a total of 114, of slots to be lost across campus resulting in an underutilization of university equipment. Proper installation not only increases the number of slots per rack, but also makes the rack more attractive to cyclists. Criteria for installation were modeled after the guidelines provided by the Association of Pedestrian and Bicycle Professionals (APBP). Three elements were considered for this study:

- *Two-way access* judges whether or not there is space for bikes to park either forward or backward in a rack. Adequate space alleviates clutter.

- *Side accessibility* documents whether or not the slots on either end of each rack have adequate space to accommodate a bicycle. APBP guidelines suggest that each rack have two feet of clearance on each side.

- *Proximity to entrance* addresses visibility issues by documenting whether or not a rack is located within 50' of a main entrance to a building. APBP guidelines suggest that within 50' is the optimum distance from an entrance and more than 120' is too far.

Included in the data are also notes on the type of rack. There are two types of racks that appear on the UNT campus: *Wave* and *Toast*. The overwhelming majority are *Wave* racks with an undulating design, but a few racks are *Toast* style and present a security threat to cyclists. *Toast* racks secure only the front wheel of a bike, making it easy to steal. The APBP guidelines suggest that a bike rack should secure the frame at a minimum of one point. Also, because they are an old style rack, they are mostly rusty and/or broken.

Three pieces of information were collected in addition to existing location and installation data. *Number of bikes* refers to the count of bikes secured to each rack and is used to assess the volume of bike commuters on campus as well as where the majority of bike parking is taking place. *Extraneous parking*

occurs when racks are -or appear- full and cyclists secure their bike to surrounding structures. Such activity is a safety hazard for pedestrians and can cause damage to structures that were not built to withstand bike parking. The number of extraneously parked bikes was recorded by assigning them to the nearest rack. *Extraneous parking location* includes a description of the structure (stairwell, tree, lamppost) to which the extraneously parked bike is attached and can be used to determine the level of risk to pedestrian safety and university property.

Only the main UNT campus was considered in this study because it represents the most common commuting habits of the majority of students. Discovery Park and any separate sports facilities were excluded. The occupancy data were gathered for 246 racks on campus at 9:00am, 1:00pm, and 3:00pm on Friday, Monday, and Tuesday. Classes usually fall in a Monday, Wednesday, and Friday, or a Tuesday and Thursday schedule and data collection times were chosen to align with regular classes. It should be noted that occupancy information for some racks on Friday at 3:00pm are missing from the dataset.

3. Results

When considered campus-wide, occupancy rates cast a favorable light on UNT's efforts. There are 2616 slots on the UNT main campus. There are an average of 1222 bikes parked on campus at a time, including both bikes secured to racks and parked extraneously. Average campus occupancy is 48% across all dates and times recorded. While the campus as a whole appears to have more than enough racks for the current number of cyclists, there are differences in occupancy across building type. Buildings are categorized by use into Residential, Academic, or Service. Residential buildings have an average occupancy of 77%, academic buildings have an average occupancy of 26%, and Service buildings have an average occupancy of 25%. It was found that on average there were 8.6 bikes per rack around the dormitories and only 2.4 bikes per rack around the academic and service buildings. These data on extraneous parking also show that demand at residence halls is high. Of the top 7 buildings with the large numbers of bikes that were parked on trees, benches, and star rails, 6 of them were residence halls. Kerr Hall had the highest number of extraneously parked bikes with an average of about 20 bikes secured to other structures. College Inn had the next highest amount of extraneous parking with an average of 11.8 bikes, followed by Crumley Hall with an average of 7 bikes. While Kerr Hall has the most extraneous parking, its rack occupancy rate remains at 97%, never reaching 100%. Kerr is the largest residence hall on campus with a 960 student capacity, giving it a 6:1 resident to slot ratio. Compared with Crumley at 10:1, Clark at 7:1, and Maple at 6:1(Resident numbers taken from UNT Housing Website), it is among its peers in providing slots, however Kerr houses mostly freshman and because age is directly correlated with bike ridership, is has more cyclists than other halls.

On the low end of occupancy rates, Wooten hall has an average occupancy of 24%. However, the occupancy varies greatly when considering rack clusters. The cluster of racks on the north side of the building has an average occupancy of only 7%, while the west side of the building has an average occupancy of 72% (Table 1). Because academic buildings are used for short-term parking they have different needs than residential buildings. Accessibility is equally important, but proximity of racks to the main entrance of the building becomes more important in an area with fast-paced, revolving parking.

Table 1

Wooten Accessibility and Occupancy			
	North Side	**West Side**	**Total**
# of Usable Slots	132	32	164
% Unusable Slots	0%	3%	0.6%
Avg % Occupancy	7%	72%	24%

It was found that installation and occupancy appear to be related when looking at rack accessibility and distance from a main entrance. A total of 114 slots (4%) are lost due to improper installation (Table 2), affecting over 40 bike racks. Forty-two percent of racks are located within 50' of the main entrance of their corresponding building, 44% are between 50' and 120', and 13% are more than 120' away (Table 3). A total of 164 racks have both sides accessible and 44 have only one side accessible.

Table 2

Installation and Slot Loss				
	Academic	**Residence**	**Service**	**Total**
Ideal # Slots	1203	966	447	2616
Usable Slots	1161	910	431	2502
% loss	3%	6%	4%	4%

Table 3

Proximity of Racks at Different Proximities to Entrance				
	Academic	**Residence**	**Service**	**Total**
Within 50'	43	43	38	42
50'-120'	37	54	48	44
120'+	20	2	15	13

4. The Effects of Installation on Occupancy

Taken as a whole, UNT has done a commendable job supplying bike racks to cyclists. Occupancy rates campus-wide are moderate, meaning there are enough racks for cyclists with a few extra slots. There were only a few areas that, with the aid of our research, can be corrected to facilitate the City's plan.

4.1 Academic Buildings

Academic buildings typically do not suffer from a limited amount of racks or installation-caused slot loss. Instead, their bike racks suffer from improper placement that limits visibility to cyclists from the sidewalk. At Academic buildings, the racks are used for short-term parking with high traffic and movement, resulting in a need for greater emphasis on placing the racks near the main entrance. One specific example of this problem is *Wooten Hall* (Figure 1) where there is an obvious discrepancy in average occupancy between racks that are within 50' of a main entrance and those that are more than 120' away. In this case, the sidewalk from which the racks are accessible is a high traffic area full of bus stops. The addition of a sidewalk from the north cluster of racks to the west entrance could make this area more enticing for bike parking because cyclists could then avoid crowded pedestrian walkways.

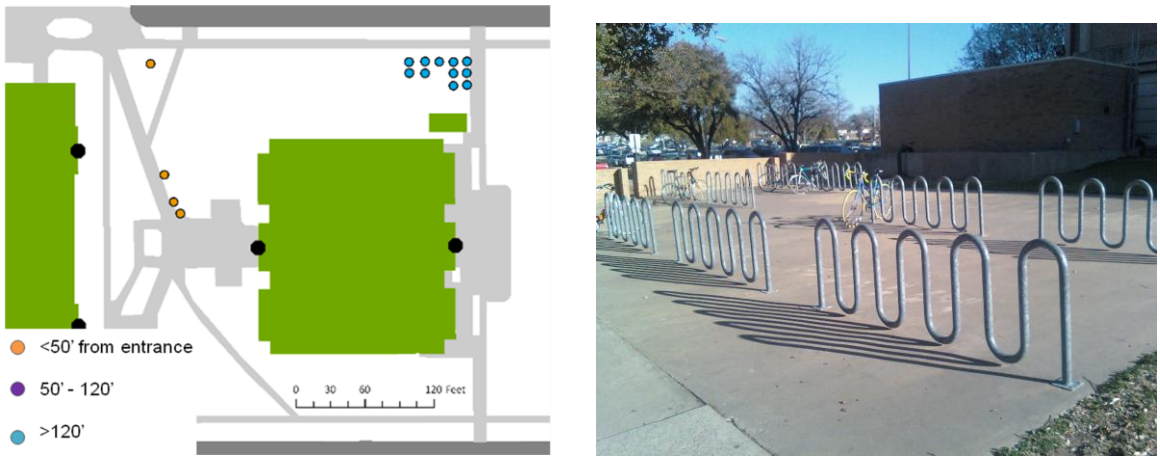

Figure 1: Improper placement results in empty racks on the north side and a high occupancy rate with incident of extraneous parking on the west.

Another consideration for Academic buildings is the use of Toast style racks. There are three buildings (*Stovall Hall, RTVF,* and the *Language Building*) that use Toast racks for all or part of their bike parking accommodations. As discussed, these racks do not provide secure bike parking and should be replaced with Wave style racks or simply removed. The bike racks at the *Language building* should be immediately replaced with Wave racks because it offers only toast style racks, which are susceptible to theft, in a courtyard that is adjacent to a busy, off-campus street.

4.2 Residence Buildings

The most important factor to consider for racks located at Residence buildings is installing them properly so that every slot is utilized. Because bikes are left on these racks for hours at a time, an

obstructed slot is equivalent to one less parking space for a resident. *Kerr Hall* stands out as the Residential building that needs the most attention. It has an average occupancy of 97%, and the most instances of extraneous parking of any building (Figure 2). Such a situation is a safety hazard to pedestrians who need to use the handrails along the stairs. The racks on the northeast corner of the building see higher occupancy rates than the racks on the south side. The northeast cluster simply needs more racks to accommodate the 960 residents and it is recommended that they are installed according to the APBP guidelines so that every slot is usable.

Figure 2: Because the racks at Kerr do not meet the needs of the residents, they resort to extraneous parking at the hazard of pedestrians.

Some other high occupancy Residential buildings are *Crumley Hall*, *Clark Hall*, and *Maple Hall*. Moving these racks to expose all slots and adding more racks will alleviate parking pressures for residents.

5. Conclusion

The overall state of bike racks campus-wide is an encouraging model of how a university should accommodate cyclists. The current successful model, with the addition of the reforms suggested in this study, lets future and current students know that their campus considers their needs for cycle infrastructure and honors their commitment to reducing carbon emissions. Further, the initiatives taken by the university could serve as a model for the City of Denton. More research is needed to determine the proper locations for bike racks in and around the city. A few businesses in the Hickory Street area have installed bike racks in front of their establishments, but more research could be done on how the city could encourage more business owners to see the benefits of installing bike racks. With a concerted effort from the university in collaboration with the city, a bike-friendly atmosphere is attainable.

References

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