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Bike-Share: A Bicycle Program For Campus

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Background

Michael was uncertain whether a bike-share or rental program in any format was feasible on the ISU campus. The director of the Institute for Community Sustainability had invited Michael Brown, director of the recreation center at Indiana State University (ISU), to apply for a grant of up to $6300 as initial start-up funds for a bike-share/rental program on the ISU campus. Michael knew that submitting a proposal for a grant essentially meant that he had committed to developing and operating a bike-share program on campus.

Although a campus-wide bike-share program had potential, given the university's smaller budgets in recent years and efforts to "do more with less", Michael had realized that evaluation of new programs and projects at the university's upper administrative level typically started with consideration of cost and revenue and then preceded to other measurements such as sustainability, environmental and usage measures.

His initial and quick estimates of costs of a bike-share program on campus were more than the grant funds available to initiate the program. Start-up costs included such items as bikes, bike racks, and technological systems. Also, determining the annual operating costs, such as, bike replacement and bike repair parts, student worker wages to maintain bikes and check-out and check-in bikes was necessary. Both start-up and annual operating cost varied based on the quality and number of bikes, the amount of technology used and the number of check-out and check-in stations.

As a part of a sustainability program at ISU, a bike-share program seemed befitting. Given that the bike-share program had the potential of reducing automobile street traffic and accidents around the campus. A bike-share program also had potential of reducing the carbon foot print and creating greater awareness of sustainability efforts at ISU. With the university-wide emphasis of environment sustainability, reduction of pollutants, and greening of the campus, the time seemed appropriate for consideration of the addition of a bike rental program. As the university was making an effort to be recognized as a regional leader in sustainability, ISU funded the Institute for Community Sustainability. Through their mission to find economically

viable, sustainable solutions for local organizations and individuals, the institute wanted to achieve the following goals:

1. Create a living laboratory for experimentation with sustainable practices.
2. Educate and actively engage the Wabash River Valley community in sustainable practices.
3. Make ISU an exemplar of a sustainable university community.
4. Be a community leader in transitioning to a more sustainable industrial society.

Many students live off campus and either drive or walk a long distance to come to the university. Parking near a bike-share/rental program rack would cut walking or commuting time for students, faculty, and staff to several common destinations on campus, which typically takes an average of 10 minutes from different parking spots. Michael had needed, at least, an initial assessment to identify overall market size and specific segments within the market.

A Study of Bike-share on Campus

Michael had asked students in a senior marketing management class to conduct a study. Besides developing market-size estimates, a market-research study was completed to find objective information on assessing user need, willingness to pay, perception and evaluation of a bike-share program. This study sought to justify the viability or lack of viability of the program and to make the case to the university's decision board.

Target Market

The target market was defined as the entire university community. Segments included: undergraduate students, graduate students, faculty, and staff (with a greater focus on undergraduate students). Given a significant increase in returning students and a record graduate enrollment at ISU, the overall target market size was estimated as 12,448 (including the total undergraduate and graduate students enrolled, the full-time and part-time faculties, and staff numbering 1934. Commuter students comprised roughly 60% of the entire student population at the university. However, the market size was adjusted for individuals who already have their own bike or have access to a bike on campus. The community at large was not included with the thought that if the program was viable on campus it would be expanded to the community.

Market Research and Need Assessment

Students developed and distributed an online questionnaire to 12,000 students, several faculty and staff through the Student Government Association, of which 398 valid samples were used for the data analysis. Additionally, to validate students' findings, Michael also distributed another version of the survey and collected responses from users of the recreation center at a special health fitness & information event.

Compiling findings from both surveys (see Appendix A), it was evident that only a small percentage of students (between 13% to 22%) currently use bikes for transportation, which left the remaining share (between 78% to 87%) as a potential target market. Around 65% expressed their willingness to use a bike-share program if it was made available on campus. Most

respondents preferred a monthly or a yearly subscription based service with the option to pay using cash or credit cards. A preferred charge for daily use was around $3, and for the calendar year, $20-$50. Most (40%) wanted to use the bike-share for commuting between classes with a typical use of 4 times or more every week during the semester.

Bike-Share Program Options

The students identified three options for the bike-share program. The options varied by the amount of technology used, the type of bicycles used, the number of locations available for users to check-out and check-in bicycles and the hours available

Option I: High-Level Automated Program

The modern automated bike-share program had more than one location for self-service check-out and check-in at any location. Bike-share programs focused on quick trips of 30 to 60 minutes and charged additional for trip times over the allotted time. Bike rental programs typically operated from one location used less automation and focused on longer use times.

Overview. The bikes are premium-built for an urban environment with on-board locks and baskets that provide a high level of convenience for running errands and short-trips. The high technology automated bike-share program provides the greatest convenience to students, staff, and faculties. It allows bike-share members to check out or check-in bikes at any time of the day (24/7) from automated bike racks at strategically located campus stations by swiping an electronic membership card. The technology includes a Global Positioning System (GPS). GPS provides tremendous benefits to the operating center with accurate information on most used bike routes and drop-off locations allowing just-in-time delivery of bikes to racks when and wherever customers need them the most, thereby providing greater customer satisfaction and increased usage. Extensive information on routes, distances, calorie and carbon offset metrics and more could be further collected, researched, and made available to the public. GPS also allows lower maintenance cost by effectively tracking lost, stolen, or misused bikes. The bikes also have Dynamo powered a passive GPS, headlamp, and taillight, providing riders additional safety benefits at night, in fog, or in any other low visibility situation. Bike-share companies provide all the essential set-up and software to run an effective bike-share system and train a local team to maintain and operate the program. Alternatively an external vendor affiliated with the university could be contracted to maintain and operate the program. A summary of option I bike-share program is shown below in Table 1.

Major Characteristics	Attributes
Technology	High technology based system; Includes— GPS system to keep track of bike location, rack location, bike availability at each rack, and empty space at specific racks for returning bikes. Self-check-in and check-out any time of day seven days a week of bikes with a membership card.
Bike Features	Built to with stand heavy use in any type weather, anytime of day and left outside, have many safety features and features to accommodate different types of riders and different types of riding—city, pleasure, and to transport items and the rider. Have on-board locks

Racks	Racks are specifically designed for automated self-service and bike security; require electric power supply for locks and technology system. Four racks proposed.
Installation	The installation done by supplier of bike-share system because of technical nature of the system
On-going operation	May be done either by supplier of system or by ISU employees trained by supplier. Bikes must be transported between bike racks for balancing supply and demand for bikes and empty bike rack space for dropping bikes off.
Data Base	A real-time database maintains use of bikes by time of day, month, and year; by individual members; by rack; and by routes as well as other data. The database makes efficient management of the system possible.

Table 1. Characteristics of Option I High-Level Automated Program.

Four drop-off/pick-up locations are proposed at four popular sites on each side of the university. (See Appendix B for map) The four chosen locations, about a 15-minute walk from each other, allow quick access to pick-up/drop-off racks. Moreover, commuting students and faculty also found the four bike station locations close to one of the major entry points to the university campus. One bike rack at each location, with each rack holding eight bicycles, provided a total of thirty-two bikes for the campus. As a trial run, thirty-two bikes allowed for further adjustments to fluctuations in demand, and eventually development into a sustainable business model. A technology rack fitted with a solar-kit and an RFID reader feeds bike-rental data (drop-off and pick-ups) to a central unit. The information sent from each of the four drop-off and pick-up rack locations by time of day would determine if an employee needed to ferry bicycles from one rack location to another to provide bikes and space to drop-off at all times. Furthermore, advanced database management software at each station allows faster and efficient rental managements. Detailed breakdowns of startup cost components are shown in table 2.

Startup Supplies Needed	**Cost**
32 bikes @ $1234	$39,488
Bike shipping; 32 bikes @ $75 per bike	$ 2,400
Solar-kit per station; 4 @ $3500 (optional)	$14,000
AC platform, processor per station; 4@ $5536	$22,144
4-stations shipping @ $2500 per station	$10,000
32 docks; 32 @ $947	$30,304
Bases per bike 32@ $593	$18,976
One-time fees: Software + installation + connectivity tests + project management	$20,356
Travel expenses-installers @ $1500 per station	$ 6,000
Total startup cost with GPS	**163,668**
Estimated Annual Operating Costs	
Annual Software 4-stations @ $1000 per station	$ 4,000
Monthly Connectivity Fee 4 @ $158 per station/month	$ 3,792
Bike replacement, parts and general maintenance (10% *$163,668)	$16,366
ISU Staff Person ½ time to oversee and manage program	$20,000
Bike Repair Technicians, daily maintenance and operations	
2 students workers @ 20hrs week *40weeks *$10@hr.	$16,000
1 student worker @ 20hrs week * 12 weeks (summer) *$10@hr	$ 2,400
Total Annual Operating Costs	$62,558
1 student worker @ 20hrs week * 12 weeks (summer) *$10@hr	$ 2,400
Total Annual Operating Costs	$62,558

Table 2. Option I Startup and Operational Costs.

Revenue estimates. The revenue estimate for option I, high technology, was based on survey responses. Survey respondents indicated their willingness to pay up to two dollars for a one-time 30-minute usage and up to three dollars for a full day usage. For an annual membership, 34% indicated a willingness to pay for $50 while another 30% were willing to pay for $25. Sixty six percent of respondents were interested in a year-round program. It was assumed that bike passes were established on a one-time (30-minute use), daily, and (calendar) yearly basis with the one-time pass costing $2, the daily costing $3, and the yearly pass costing $50. If 10% of the 10,000 graduate and undergraduate students were interested in a $50 yearly pass, that would bring in an estimated $50,000 a year to the university. If an average of 25 people per day bought a daily pass for $3 that would bring in $25,800 a year (ISU open 344 days) and if an average of 20 people per day bought an one-time pass for $2 that would bring in $13,760 a year and adding $50,000+$25,800+$13,760= $89,560 revenue a year based on preliminary estimates.

Year (calendar)	Total Revenue	Start-up and Annual Operating Costs	Net Difference in Revenue-Cost
Year 1	$89,560	-$163,366 + 62,558	-$136,666
Year 2	$89,560	-$136,666 + 62,558	-$109,664
Year 3	$89,560	-$109,664 + 62,558	-$82,662
Year 4	$89,560	-$82,662 + 62,558	-$55,660
Year 5	$89,560	-$55,660 + 62,558	-$28,865
Year 6	$89,560	-$28,658 + 62,558	$1,656
Year 7	$89,560	-$1,656 + 62,558	$25,346

Table 3. Revenue estimates from Option I.

Table 3 shows the net-breakdown of costs and revenues for the first seven-years. From the sixth year onwards, ISU receives a net-surplus of funds over cost after offsetting completely the initial start-up investment costs. Payback time, the time required to reclaim the startup investment= $163,688/ ($89,560-$62,558) = 5.56 years.

Option II: Mid-Level (Rent and Ride) Program-Overview

The mid-level program proposed has only one pick-up and drop-off location for bike rentals. Durable bikes needing little adjustment or repair with a lock would be provided. The lock secures the bike when temporarily left during the day at bike racks across campus. With just one check out location fewer employees are needed to operate the rental program, thus reducing the ongoing program cost. An inexpensive software program to check bikes in and out and keep track of payments and maintenance was needed. The proposed rental program would contain 32 bikes to rent. In the absence of a high technology, high-end locking mechanism as provided in option I, high technology program and given the many property related crimes taking place around campus, mandated bike return to the Recreation Center before normal closing hours each night was required of the person checking-out the bike. Check-outs and check-ins were limited to the hours of the recreation center. During the spring, fall and summer semesters (except for

breaks and ISU recognized holidays) Monday through Friday 6:00 a.m. to 12:00 midnight, Saturday 9:00 a.m. to 9:00 p.m. and Sunday 12:00 noon to 11:00 p.m.

The general design of the bike was similar to the 26" Hyper Havoc Suspension Bike, sold by Walmart providing riders with a durable bicycle that can be used on varying terrain, including streets and nearby trails. The transition of speeds, with 21-speed levels, was also a major benefit of a similar to the Hyper Havoc bicycle. A single design style for all bikes in the program simplified purchasing and stocking replacement parts and bikes. Major characteristics of option II bike-share program is summarized below in table 4.

Major Characteristics	**Attributes**
Technology	Software for checking bikes in and out, no GPS used
Bike Features	Durable good quality bikes from one manufacturer, lock provided with bike when rented.
Racks	Existing standard common bike racks now on campus.
Installation	No additional installation required
On-going operation	Only one location, the recreation center, for checking out and returning bikes. Employees of center operate the program
Data Base	Data available for analysis limited to software from checking bikes in and out

Table 4. Characteristics of Option II Program.

With a single bike-model and a single pick-up and drop-off location, the initial start-up costs for supplies and set-up are significantly reduced as compared to option I program. Even with extra costs for better locks and other security features, the total start-up cost is estimated to be $5240. Further breakdowns of start-up cost components and annual operating costs are shown in table 5.

Startup Supplies Needed	**Costs**
32 bikes @ $130	$4,160
40 bells @ $6	$240 (alert pedestrians)
40 locks (8 extra for inventory) @ $5**	$200 (theft prevention)
40 bike lights (8 extra for inventory) @ $11	$440 (safety)
Software for check-in/check-out bikes	$200
Total Estimated Start-up Cost	**$5,240**
Estimated Annual Operating Cost	
Bike replacement, parts and general maintenance (20% *$5640)	$1,128
ISU Staff Person 1/4 time to oversee and manage program	$10,000
Bike Repair Technicians, daily maintenance and operations	
1 student worker @ 20hrs week *40 weeks *$10@hr	$8,000
1 student worker @ 20hrs week * 12 weeks (summer) *$10@hr	$2,400
Total Estimated Annual Operating Costs	**$21,528**

Table 5. Option II Startup and Operational Costs.
**The Option I bikes were purchased with bells, locks, lights and fenders. Uses racks already in place

Revenue estimates. To develop estimates of revenue the same survey results as used in analysis of option I were used in option II and III but different assumptions in demand were used because of changes in user convenience and type and features of bicycles offered by each option. Survey respondents indicated their willingness to pay for up to two dollars for a one-time 30-minute usage and up to three dollars for a full day usage. For an annual membership, 34%

indicated a willingness to pay $50 while another 30% were willing to pay $25. Sixty-six percent of respondents were interested in a year-round program. At a utilization level of 75%, if at least 24 bikes were rented each day at a price of $3 per bike, the program would generate 72 dollars a day in revenue. Table 6 shows the net-breakdown of costs and revenues for the first three-years.

Year (Calendar)	Total Revenue	Start-up + Annual Costs	Net Difference in Revenue- Costs
Year 1	$24,768.	$5,240+ $21,528	$-1,730
Year 2	$24,768	$1,730+ $21,528	$1,510
Year 3	$24,768	$21,528	$3,240

Table 6. Revenue estimates from Option II.

To ensure that bikes are returned every day, an overage charge of $5 per day for each day late is proposed. It would also help Recreation Center staff know which bikes were out overnight. The overage charges for a 30-minute rental period would be $1 for each additional 30 minutes that the bike was not returned. With Seventy-two dollars per day, given 344 days (recreation center is closed 21 days during a calendar year), would generate $24,768 revenue. Payback period for recovering the startup cost equaled $5,240 / ($24,768-$21528) = 1.63 years.

Option III: Second Life Bike (Rent and Ride) Program-Overview

This option uses second-life (gently used) bicycles to lower the cost. Second life bikes are purchased from local police departments or donated by local residents. A resident bike turn-in program could be done occasionally to receive more bikes from the residents of the community. Goodwill and online sites such as Craigslist could also be used as a potential source of bikes. Major characteristics of option II bike-share program is summarized below in table 7.

Major Characteristics	Attributes
Technology	Software for checking bikes in and out, no GPS used
Bike Features	bikes are purchased at garage sales and police department's auctions. Bike lock issued with rental
Racks	Standard common bike racks
Installation	No additional installation required
On-going operation	Single location for checking out and returning bikes, recreation center located on northeast corner of campus near large commuter parking area. Employees of center operate the program
Data Base	Data available for analysis limited to software using manual checking of bikes out and in

Table 7. Characteristics of Option III Program.

A second-life bike rental program would have minimal start-up cost and would be very affordable. However, depending on the quality of bikes procured, the maintenance cost under this program could be high. All bikes would be rented from and returned to the recreation center. Further breakdowns of supplies and incurred costs are shown in table 8.

Startup Supplies Needed	Costs
32 bikes @ $50.00	$1,600 (bike cost + parts and repairs)
40 bells (8 for inventory) @ $6	$240 (alert pedestrians)
40 locks (8 for inventory) @ $5	$200 (prevent theft)

40 bike lights (8 for inventory) @ $11	$440 (driving safety)
Excel Software	No Cost
Total Estimated Startup Cost	**$2,480**
Estimate Annual Operating Cost	
Bike replacement, parts & maintenance (20% *$2,480)	$496
ISU Staff Person 10% time to manage program	$4,000
Bike Repair and operations	
2 student @ 20hrs week @ 38 weeks*$10@hr	$15,200
1 Summer student @ 20hrs week @ 11 weeks *$10@hr	$2,200
Total Estimated Annual Operating Cost	**$21,896**

Table 8. Option III Startup and Operational Costs.

Revenue estimates. Given that the availability of bikes for rental and return were essentially the same as for option II, bike usage and survey data was considered to be the same for both option II and option III. Seventy-two dollars per day given 344 days (recreation center is closed 21 days during a calendar year) would generate $24,768 revenue. Option III, as proposed, had higher annual operating cost ($21,896) than option II, but option III had lower startup cost. The payback period for option III was less than a year. Payback Period = $2,480 / ($24,768 - $21,896 = .86 of a year. Further details of revenue estimates are shown in table 9.

Overage charges would be necessary to ensure that bikes return every day. In order to do so, the fee would need to be higher than that of a daily pass, which is $3. If a bike is kept for more than the allotted day, an additional charge of $5 would be added to the bill to deter people from keeping the bike overnight. Recreation Center staff would know which bikes are out overnight to start a search for the bikes. The overage charges for a 30-minute rental period would be $1 for each additional 30 minutes that the bike was not returned.

Year (Calendar)	Total Revenue	Startup and Annual Operating Costs	Net Difference in Revenue -Costs
Year 1	$24,768	$ 2,480 + $21,896	$392
Year 2	$24,768	$21,896	$2,872
Year 3	$24,768	$21,896	$2,872

Table 9. Revenue estimates from Option III.

Additional Source of Revenue for All Three Options: Sponsorship Opportunities

A source of revenue could be achieved from company sponsors of the bike rental program to provide the community the opportunity to be involved in the bike program process. Local companies could "sponsor" a bicycle in the bike-share/rental program. They would place the company's logo, slogan, and or advertising on the bike. The bicycles would be ISU's bikes, but the company that paid a designated fee of $300 range per bike per calendar year would be permitted to advertise using the bike as the medium. Thirty-two bikes would provide 32 sponsorship opportunities. Thirty-two sponsored bikes yield $9,000.

Conclusion

The above summarizes the descriptions of three different bike-share programs on campus. Possible breakdowns of costs and revenue estimates could be further refined according to the amount of data available. For example data on late check-in from other bike-share programs would provide away to determine the revenue from additional charges from late check-ins. Weather and time of the year have changed use patterns of bike-share programs (see Appendix B). Michael Brown thought each option had its own merits. Should Michael recommend a possible bike-share program on campus? Which option should he recommend?
An example of an existing bike-share program is provided in Appendix C.

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Appendix A

- Are you aware of any university level bike-share/ bike rental program? yes (300) and no (98)
- How likely is it that you would use a bike-share/rental program? (1-not at all likely, 5-Very likely) 45.5% likely to very likely; 35% unlikely to highly unlikely
- If a bike-share program is made available to you based on a daily or annual membership, what would you choose? Monthly (74.8%) Yearly (25%)
- If we offered daily memberships, how much would you be willing to pay for a daily membership? $3 or less (64%)
- If we offered annual memberships, how much would you be willing to pay for an annual membership that lets you use a bike whenever you wanted? (Must be returned every day) $50 (50%), $25 (80%), not interested (20%)
- What price would you be willing to pay for a one-time use of a campus rental bike (30 minute rental)? $2.75
- What would your preferred method of payment be? N=398; Included in tuition fee (26.9%), Cash or card point of purchase (60%)
- Assuming the price was acceptable; would you prefer an annual, monthly, or daily membership? Annual (45%), Monthly (29%), Daily (13%), Not interested (13%)
- Do you currently use a bike for transportation? Yes (22%), No (77.9%)
- Would you be interested in a program that ran year-round, including winter? Yes (66%) No (33.9%)
- Rank, in order of importance (1 being most important, 5 being least important), the amenities of a bike-share program on campus. Pickup locations, bike lanes, & electronic check-outs are the top-ranked important issues
- Click on 2 locations where you would want the bike racks to be located. (This is where you would check-out and check-in the bikes) Building 52 (27%), Building 60 (23%)
- What's your status at Indiana State University? Undergrad (32%), grad (25%), faculty (35%), staff (8%)

Table A1. Brief results from Bike-share/Rental questionnaire survey developed by students and completed online

[Note: Besides overwhelming positive comments, the few negative comments highlighted the lack of bike lanes, safety issues, and the small size of the campus making it congested for pedestrians. Useful recommendations from respondents included improvement or changes in pricing, location, checking options, promotional aspects, bike sizes, technology options, and payment issues.]

- How likely are you to rent a bike if it were implemented at ISU? 65.9% somewhat to very likely; 34.1%-not likely
- Do you currently use a bike for transportation? 12.9% yes; 61.5% no; 25.6% no because they do now own a bike
- 55.3% of people who currently do not own a bike are somewhat to highly likely to rent one
- If a bike rental program was available, when would you most likely use the bike: 41.3% between classes; 24.4% for recreation and errands; 4.3% overnight; 14.2% for weekends; 15.7% not interested.
- How often would you ride a bike if it were available? 20% less than a month whereas 55% would ride 4 times or more per week,
- What is the maximum amount you would be willing to pay for this service on a semester basis? 15% wouldn't pay anything whereas 61% are willing to pay $20 or more per semester.
- How far would you most likely ride a bicycle? 11.7% were not interested while 69.5% are willing to ride 2 miles or more in a bike.

Table A2. Bike/Share Questionnaire Completed at Fitness Bash at the Rec Center

[Note: The open-ended responses were mostly positive or detailed on how to make this program a success.].

Appendix-B

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Now	Dec
Hi	37	43	54	66	76	85	88	87	81	68	55	42
Lo	19	23	33	43	53	62	66	64	55	43	34	24
In	2.51	2.71	3.24	4.47	5.42	4.14	4.66	3.21	3.56	3.07	3.99	2.95

Table B. Average monthly high and low temperature in Fahrenheit and precipitation in inches

Appendix C

Faculty, Staff & Visitor Subscriptions			
Term	**Length**	**Cost**	**Note**
Annual	July 1 to June 30	$84.00	Unlimited 0-60 Min Trips Per Year
Monthly	July to June (per month)	$28.00	Unlimited 0-60 Min Trips Per Month
Weekly	Sunday to Saturday	$14.00	Unlimited 0-60 Min Trips Per Week
Daily	5:00am to 11:00pm	$4.00	Unlimited 0-60 Min Trips Per Day
Additional Charges	Up to 1 Hour	Free ($0.00)	Up to 24 Hours $32.00
	Up to 2 Hours	$2.00	Up to 3 Days $64.00
	Up to 3 Hours	$4.00	Over 3 Days = Lost Bike Fee $1150.00
	Up to 4 Hours	$8.00	
	Up to 5 Hours	$16.00	

Table C. An example of fee structures from existing bike-share program.
[Note: A brief bike-share history of SBU can be found at:
http://www.stonybrook.edu/sustainability/biking-at-stony-brook/wolf-ride-bike-share.shtml

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Appendix D

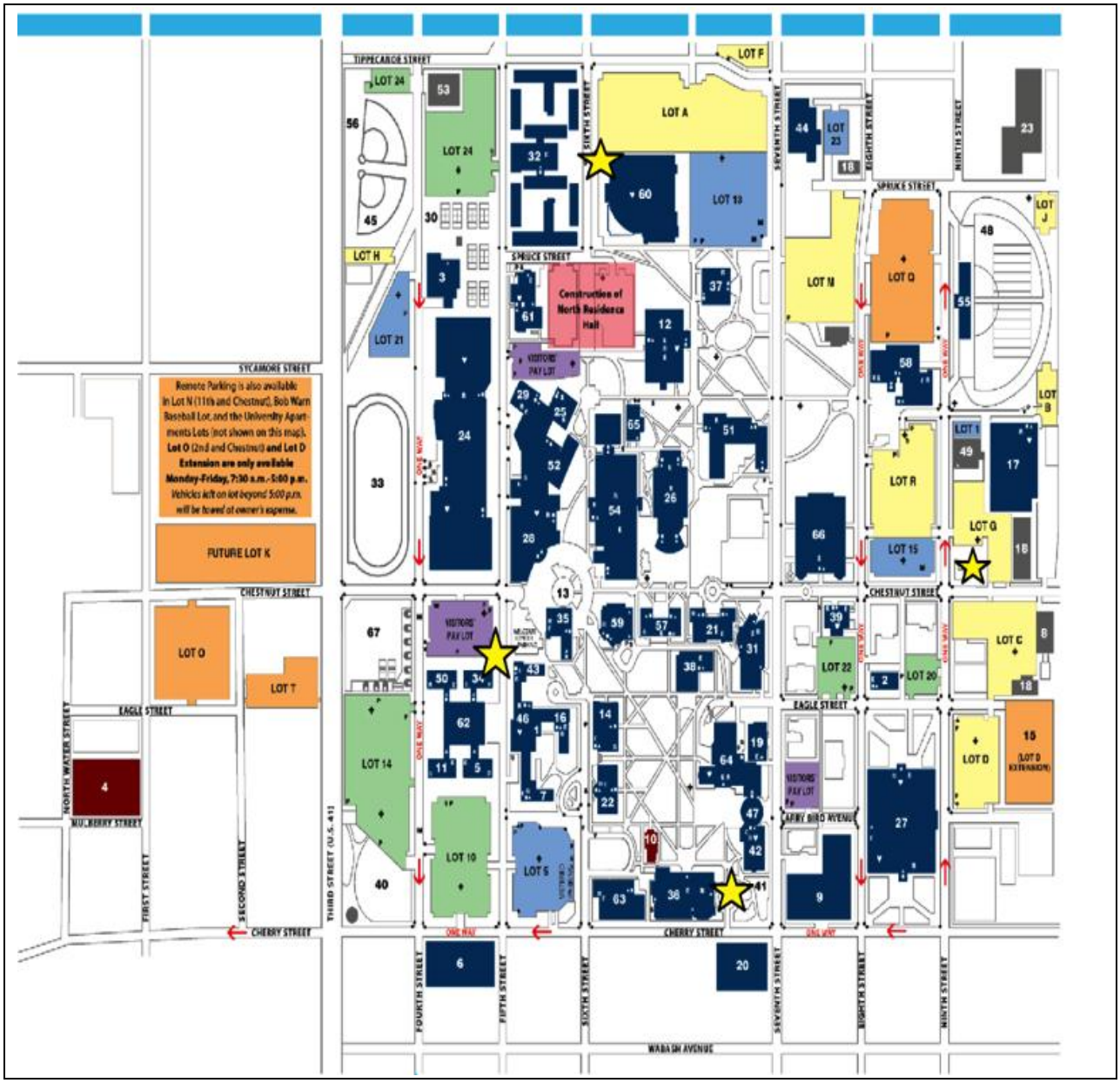

Figure D. Hypothetical bike locations based on most popular locations at ISU
[Note: On the Campus Map, stars represent selected locations. The top of the page is north and the star on the top one/fourth of the page is by the recreation center].