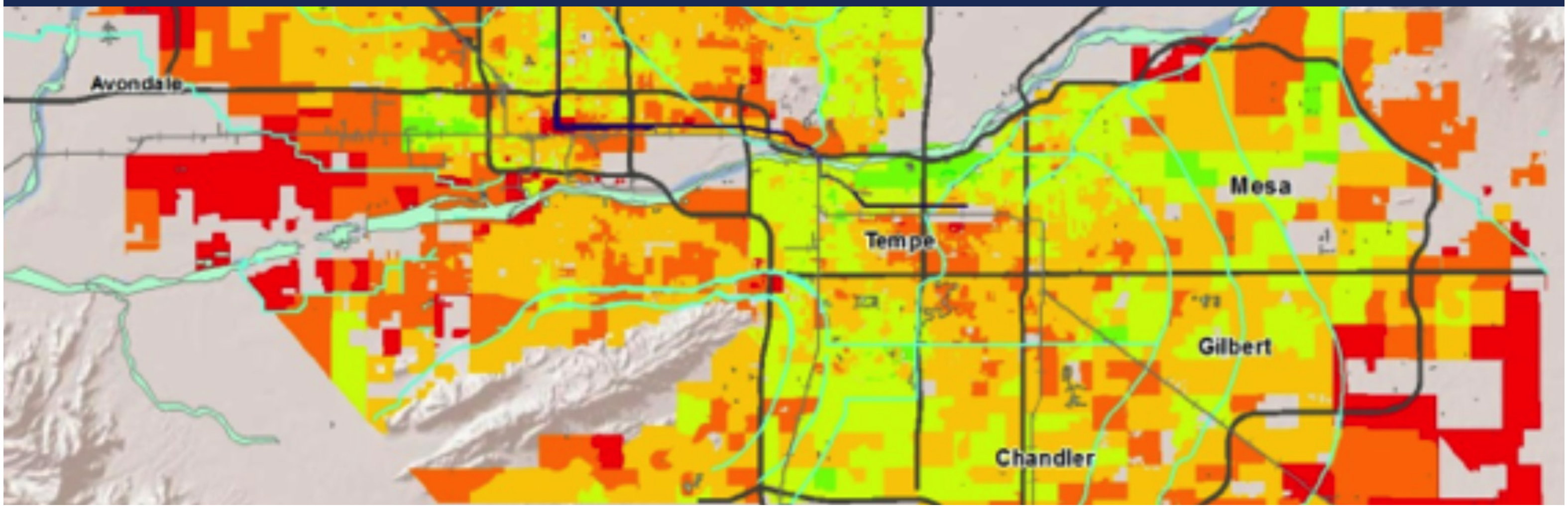
Sustainability Solutions Services



Bicycle Network Connectivity Project for SRP Service Area

A comprehensive report prepared for:

SRP
Delivering More Than Power.®

July 2014

Michael Kuby and Aaron Golub, Principal Investigators

ASU School of Geographical Sciences and Urban Planning

ASU Walton Sustainability Solutions Initiatives

ARIZONA STATE UNIVERSITY

sustainabilitysolutions.asu.edu

This report was prepared by
Dr. Michael Kuby and Dr. Aaron Golub, Principal Investigators
Shawn Monk and Matthew Messina, Research Assistants
School of Geographical Sciences and Urban Planning

Michael Dalrymple, Practice Lead
Andrew Stein, Solutions Assistant
Walton Sustainability Solutions Initiatives Global Sustainability Solutions Services

TABLE OF CONTENTS

Executive Summary

Bicycling can add great value to a community by reducing vehicle-miles traveled, improving traffic congestion, and decreasing local air pollution and carbon emissions, while promoting physical activity. Proper bicycle infrastructure and safety measures must be present, however, for these benefits to ensue, and the connectivity of the bicycle network is key to promoting an increase in safe and sustainable cycling. With this in mind, Salt River Project (SRP), a major power and water utility with an extensive network of canals in the greater Phoenix area, funded an ASU project to analyze and address challenges in regional bicycle network connectivity within and among the cities in the SRP service areas, from Gilbert to Glendale. The study also analyzed the cycling connectivity of SRP facilities to nearby neighborhoods where its employees might live, and to other SRP facilities for inter-office bicycle commuting. Strong connectivity could help SRP reach its automobile trip reduction goals and enable SRP to better serve the neighborhoods near the canals. This project used a software program called ViaCity®, which is specifically designed to detect these missing connections in order to assess the existing challenges within the combined road and bicycle infrastructure network and evaluate proposed improvements to the combined network.

Methods:

The ViaCity® software analyzes GIS data on road and bicycle networks to quantify a Route Directness Index (RDI) between origins and common destinations. RDI compares the best possible biking route to the hypothetical straight-line route to quantify how much residents of neighborhoods have to go out of their way or ride on less-safe roadways to reach their likely destinations. Neighborhoods were represented by census blocks (in the central areas) and block groups (in outer areas). Destinations included the central business districts of each city, major employment hubs, ASU and professional sports stadiums, ASU campuses, community colleges, light-rail stations, high schools, major shopping centers, and SRP facilities and canals. The best possible route from a neighborhood to a destination takes into consideration not only the distance but also the type of roads, bike lanes, multi-use paths and road crossings involved. Each type of road or bike infrastructure is assigned an impedance value representing their relative safety and/or attractiveness for bicycling, with the base value of 1.0 representing cycling on residential streets. By averaging the RDI across all types of destinations, an overall picture emerged of neighborhoods with good, average, or poor connectivity to where their residents are most likely to ride. From this baseline, proposed and recommended improvements were then analyzed for their potential positive connectivity impact. Similar analyses were conducted specifically for SRP facilities and canals.

Valley Network Connectivity Results:

Connectivity calculations to seven destination types resulted in a composite map showing that connectivity in the Valley is already fairly good (Figure A, next page). An analysis of connectivity barriers indicates that freeways and railroad tracks pose significant challenges. Additionally, SRP canals both increase and decrease connectivity, as discussed below. Analysis of improvement projects proposed by city bicycling coordinators, the research team, and students from a graduate planning class at ASU show that significant improvements in the network are also possible with modest, strategic investments. The RDI analysis found that the benefits of network improvements can be felt not only in the local vicinity but can radiate outward for miles, providing improved connectivity for distant bicyclists whose routes can utilize those improvements. The analyses also demonstrate the power (and some limitations) of the GIS network and ViaCity® software to inform the planning and budgeting process in order to maximize the positive impact of investment in improvements.

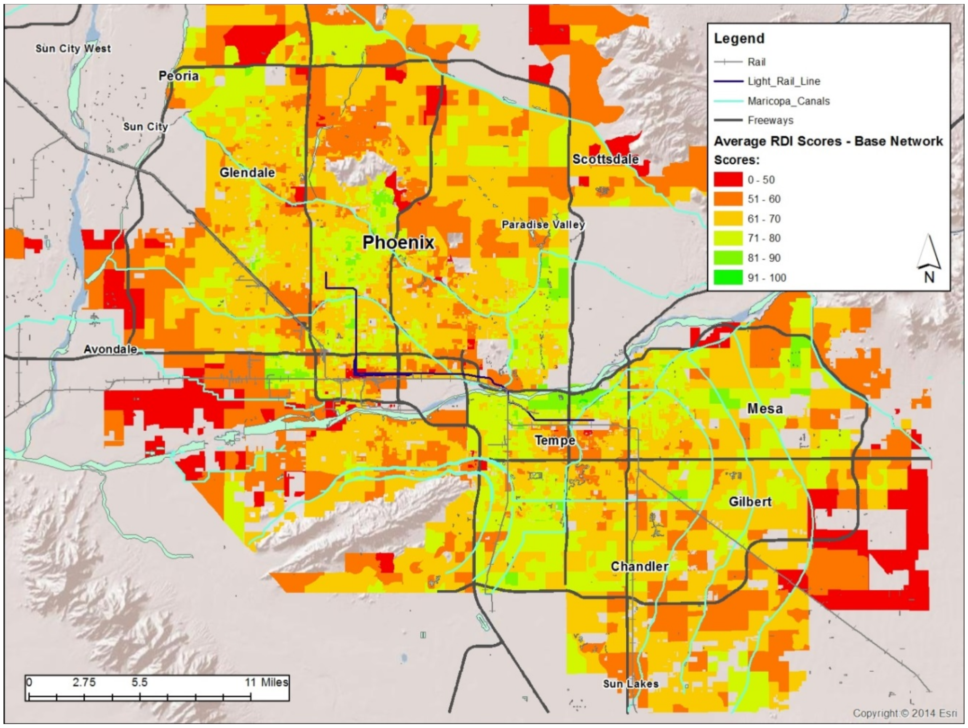


Figure A: Average connectivity for the base network.

SRP Connectivity Results:

Connectivity from neighborhoods to SRP facilities and canals as well as among SRP facilities is mixed and often dependent upon direction of approach. Of the 17 facilities identified by the SRP Office of Sustainability for analysis, the East Valley facilities proved to have the highest connectivity. The Santan Generating Facility in Gilbert, for instance, is best accessed from the southwest or north Mesa along the Eastern Canal, with extremely high RDIs. This illustrates that travel along canal paths, with their direct diagonal routes with low impedance, can provide excellent connectivity to SRP facilities situated near such canals.

The Central and West Valley RDI scores were quite variable, with two facilities in Central Phoenix hampered by barriers such as Loop 202, AZ 51, and the light rail tracks, as well as large areal barriers such as major industrial facilities and Sky Harbor Airport. In contrast, the Power Operations Building near Thomas and 64th St. in Phoenix has relatively poor connectivity to the east, north, and west, but excellent connectivity through the residential neighborhoods to the southeast and along the Arizona Canal from the northeast and northwest.

Analyzing connectivity *among* SRP offices is important for understanding where barriers may be faced by SRP employees in traveling between offices by bicycle as a substitute for driving. Results show that the two central Phoenix facilities still have the worst connectivity to all other facilities, while two far East Valley facilities again have excellent connectivity, partly due to the ability to connect to numerous other facilities via the Western Canal path.

To analyze how easy it is to access SRP canals without being forced to first detour onto a busy arterial street, the study looked at connectivity to the canal's midpoint within the 1-mile block between arterials. Certain neighborhoods were found to be able to access the canal-path midpoints by a fairly direct route from one or both sides of the canal, but many others are blocked from doing so. One issue is neighboring homes with connected fences backed up to the canals, blocking access to the canal from within the neighborhood. The areas with low RDI scores to canals could be investigated further to assess whether there are any relatively inexpensive solutions to give the neighborhoods better direct access. The canals can provide excellent connectivity for travel in a parallel direction, while at the same time creating a barrier—easily visible on the RDI maps—for neighborhoods on the “wrong” side of them relative to a destination perpendicular to the canal. A potential solution within SRP’s control is to place bridges over the canals in strategic mid-block locations so that cyclists can more easily and directly get to the other side without having to navigate around to the nearest busy arterial street.

Conclusions:

The results of the study are promising for the prospect of improving cycling connectivity in the Valley because it is clear where many barriers lie and how to resolve them. Other barriers, such as crossing freeways, involve more complicated and costly solutions. Railroad crossings represent an opportunity for city-railroad cooperation that could yield substantial benefits. While the Valley has come a long way and has a lot to be proud of in terms of its bikeability, small improvements in the network can generate significant improvements for many riders. Finally, the GIS network created by combining data on streets, bike paths and lanes, and signalized intersections across the nine cities studied is an asset that provides major value for strategic planning decisions, and should be kept current and utilized for such purposes.

Acknowledgements

The authors would like to thank John Hetrick, Director of the SRP Office of Sustainability, who came up with the idea to study bike network connectivity across the cities served by SRP canals using some kind of network analysis and approached us to see if we would be interested. Without his initiative and support—financial and in other ways as well—this project would never have happened. We would also like to thank Seth Blumen of SRP for assisting with a variety of administrative and data issues.

This project would not have been possible without the enthusiastic support of Transpo Group of Kirkland, WA, which provided us with a copy of their ViaCity software, as well as guidance and training. In particular, we would like to thank Andy Mortenson, who visited ASU several years ago to tell us about the capabilities of ViaCity, and Brent Turley, who trained us in how to use it most effectively and always answered our annoying questions clearly, patiently, and expeditiously.

At Arizona State University, we would like to thank Dan O'Neill, General Manager for the Walton Global Sustainability Solutions Services for the Julie Ann Wrigley Global Institute of Sustainability. Ariane Middel and Nalini Chhetri were generous in giving us access to their office and computer for running the models. Claire Doddman provided graphics support. Tiffinie Smith of the School of Geographical Sciences and Urban Planning and Heather Irish at Walton Sustainability Solutions Initiative helped with budgeting and contracting. Scott Kelley helped us out in crunch time with GIS network editing when Shawn was out of town.

Numerous local planners provided us with much needed street, bike infrastructure, and traffic signal data, and we are grateful to them: Arup Dutta, Jason Howard, Eileen Yazzie, and Alex Oreschak of MAG; Eric Iwersen, Robert Yabes, and Bonnie Richardson of the City of Tempe; Joseph Perez of the City of Phoenix; Jim Hash and Mike Sowers of the City of Mesa; John Powell of the City of Gilbert; Nathan Wilkes of the City of Austin, TX; and Mary Whelan, Geospatial and Research Data Manager at Hayden Library at ASU.

The City of Tempe was kind enough to allow us to hold the Bike Network Summit in the Tempe Don Cassano Community Room at the 5th & College Tempe Transportation Center, and we thank Travis Mullen, Yvette Mesquita, Shelly Seyler, Bonnie Richardson, and Eric Iwersen for help in making the arrangements.

We would also like to thank the local bike planners and bike advocates who served on the panel at the Bike Network Summit and helped make it a success: John Hetrick and James Duncan of SRP; Eileen Yazzie and Alex Oreschak of MAG; Joseph Perez of City of Phoenix; Eric Iwersen and Bonnie Richardson of City of Tempe; Susan Conklu of City of Scottsdale; Patrick Valandra and Scott Walters of Tempe Bicycle Action Group; and Robert Jenson of the Coalition of Arizona Bicyclists.

Finally, we would like to thank the graduate students in PUP 500 who did invaluable field work to add to our network improvement.

1. Introduction

Bicycling can make a valuable contribution to metropolitan passenger transportation systems. Biking is faster than walking, and can extend the distance range of non-motorized trips substantially. As such, bicycling can replace many short to medium length trips by automobile, thus reducing vehicle-miles traveled, traffic congestion, local air pollution, and carbon emissions. Bicycling makes it faster and easier to access bus and light-rail stops from greater distances, solving the "last mile" problem. In fact, for many trips, depending on the trip length, congestion, and parking situation, bicycling potentially offers the fastest door-to-door travel of any mode at a very low annual cost. If done safely, the physical exercise involved with bicycling provides health benefits to riders. Studies also show that riding becomes safer as more people take up cycling because of increased visibility. Many potential benefits of bicycling accrue not only to the riders themselves, but to the population at large, by reducing congestion, pollution, and health care costs for all.

The same characteristics that make biking a sustainable, non-polluting, and healthy form of door-to-door transportation, however, also pose a challenge to bicycle transportation. Geographers and planners talk about the "friction of distance" as a general term for the travel time, monetary cost, and energy required by different modes of transportation to get from here to there. Bicycle riders must overcome this friction literally using their own physical power, and they generally travel more slowly—both of which put a premium on taking shorter, more direct routes. Frequently, however, no direct bike lane or route exists from an origin to a destination, and bike riders face a choice between a more direct route vs. a safer and more attractive but longer route. The lack of direct, safe, and attractive bike routes exposes bicycle riders—who are far less protected than drivers and transit riders—to increased risk from accidents and near-road air pollution, and ultimately discourages bicycle use. These obstacles can prevent and deter a person's choice to travel by bike and they can come in many forms, both mental and physical. The *connectivity* of the bicycle network, therefore, is key to promoting an increase in safe and sustainable cycling.

Most cities in the Valley of the Sun have begun to make significant investments in bike connectivity over the past two decades. Several cities in the Valley are already recognized by the League of American Bicyclists as bronze, silver and gold rated "Bicycle Friendly Communities." Tempe is ranked the 18th best bicycling city in the country by Bicycle Magazine.[1] Indeed, the larger cities in the Valley exhibit higher than average bicycle use for work trips compared to the rest of the nation.[2] As the bike network is built out within the cities, there emerge key connectivity challenges which become even more important as more of the population chooses to bicycle.

The purpose of this study is to analyze and address problems with regional bicycle network connectivity within and among the cities in the Salt River Project (SRP) service areas. Network connectivity is a key component of good design, and the lack of connections can create barriers and gaps in the system which prevents people from choosing to make many trips by bike. This study applies a software program, ViaCity®, which is specifically designed to detect these missing connections and score an area's connectivity. ViaCity calculates a Route Directness Index (RDI) to determine the level of service each neighborhood experiences in attempting to reach its likely destinations by bike. In this

[1] http://www.bicycling.com/ride-maps/featured-rides/18-tempe-az
[2] Pendyala, Konduri and Ploz (2009) Non-Motorized Transportation. In: Kuby and Golub (2009) From Here to There: Transportation Opportunities for Arizona. Background Report for the 94th Arizona Town Hall. Arizona Town Hall, Phoenix, Arizona.

study, we use this method to assess the existing problems within the combined road and bicycle infrastructure network. We also evaluate proposed improvements to the combined network, highlighting the areas where bicycle connectivity improves the most, which will increase the safety of bicycling and potentially increase the bicycle mode share.

Anticipating that our work would uncover a host of connectivity challenges which cross city jurisdictions, we thought this research would make a valuable centerpiece for a forum of relevant stakeholders. Therefore, another outcome of this project was to host a “summit” to discuss the research findings and identify next steps towards their solutions. We invited members of the cycling community, staff responsible for bike planning in nearby Valley cities, as well as staff from the metropolitan planning organization, the Maricopa Association of Governments, which is responsible for regional coordination of transportation planning efforts. The half-day session allotted time for mingling and review of our study maps, as well as a two-hour panel discussion where we presented the core findings of the research and discussed the challenges and opportunities for the region in improving bike connectivity. Over 50 people attended the event and our team received valuable feedback on our results and how it can better serve the community’s efforts.