Economic Impact Analysis of the Kansas City, MO Bicycle Master Plan:
Summary of Findings

Michael Frisch, PhD, AICP

Joshua Boehm, AICP

Urban Planning + Design, University of Missouri Kansas City

4/10/19

Economic Impact Analysis of the Kansas City, MO Bicycle Master Plan: Summary of Findings

Kansas City is in the final stages of developing a Bicycle Master Plan. As policymakers on the City Plan Commission and City Council consider its adoption, we want to provide you with our preliminary analysis of the economic impact of implementing the Bicycle Master Plan under different scenarios. Our analysis can be best understood as the exploration of three fundamental questions:

1. Who will begin biking as a result of the bike plan?
2. What will the specific impacts of that increased biking be?
3. How will those impacts change Kansas City's economy?

Who will bike?

The bike plan addresses one of the key barriers to bicycling in Kansas City head on, noting that some 60%[1] of the population is interested in bicycling for transportation and recreation, but have safety concerns that prevent them from doing so. We believe the evidence shows that people will bike if given the infrastructure and proper incentives to do so.

Bicycling is growing here, in spite of Kansas City being very – well – Kansas City. Kansas City is characterized by high automobile ownership rates, sprawling land use, extreme temperatures, and most importantly, very limited bicycle infrastructure. Yet Kansas City's bicycle commute mode has grown in recent years.

Table 1 Kansas City, MO Bicycle Commute Mode Share[2]							
ACS Years	**2006 to 2010**	**2007 to 2011**	**2008 to 2012**	**2009 to 2013**	**2010 to 2014**	**2011 to 2015**	**2012 to 2016**	**2013 to 2017**
Bicycle	486	577	649	768	866	763	761	611
Workers	218,562	219,642	219,966	220,334	223,849	228,081	232,407	238,599
Mode Share	0.22%	0.26%	0.30%	0.35%	0.39%	0.33%	0.33%	0.26%

---

[1] Bike KC Master Plan, p. 24
[2] US Bureau of the Census. American Community Survey Table B08006
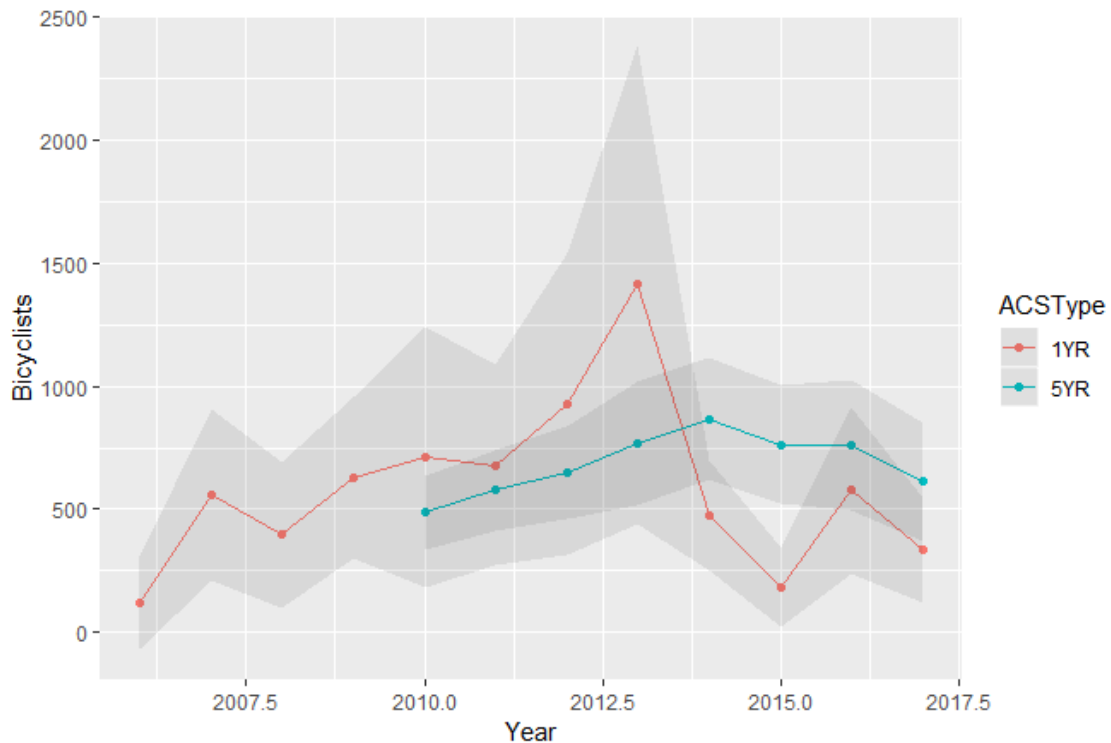
Figure 1 Kansas City, MO Bicycle Commute Bicycle Commuters According to the American Community Survey (1 year and 5 year ACS with error bands shown)

Bicycle mode share in Kansas City is already higher than models predict it should be. One of the most convincing comparative studies of bicycle commuting in U.S. cities based on the amount of bicycle infrastructure and controlling for factors such as sprawl, extreme weather, automobile ownership, gas prices, and hours of transit service[3]. Notably, the model predicts that under current conditions (limited infrastructure, sprawling land use, low gas prices, and high automobile ownership), that Kansas City's bicycle commute share should be around 0.05% of workers[4]. Yet the actual observed commute mode share for bicyclists is currently five times that, at 0.26%. Although Kansas City does face barriers to bicycling that critics may cite in opposition to the plan, many Kansas City, Missouri residents are bicycling to work in spite of those barriers. In addition to addressing the main barrier (a lack of bicycling infrastructure), the Buehler model also suggests that policymakers should work to reduce sprawl and increase the budget for transit service as a way to increase bicycle commuting. Increased gas prices, increased university enrollment, and more mild weather are also factors that would support increased bicycle commuting (although we assume those are outside of the control of local policymakers).

---

[3] Buehler and Pucher 2012 Cycling to work in 90 large American cities: new evidence on the role of bike paths and lanes. Transportation 39: 409. https://doi.org/10.1007/s11116-011-9355-8
[4] Buehler and Pucher 2012 (Calculated March 15, 2018 using Model 7; all other models predict even lower mode share)

A significant number of the Kansas City region's trips are short enough to bike. According to the recent National Household Travel Survey, in metropolitan areas under 3 million people, the average bicycle trip was approximately 2.91 miles[5]. We use this to define a "bikeable distance." According to the same survey, within the Kansas City Metropolitan Area, 37% of trips are under 2.91 miles (additionally, around 20% of trips are under the median "bikeable distance" for small metros, or 1.36 miles). Currently for the Kansas City Metro Area, 83% of trips under 2.9 miles are by a personal vehicle (car, SUV, van, pickup truck, or motorcycle). We believe it is possible to increase bicycle mode share by focusing on switching short trips from personal automobiles to biking. Better bicycle infrastructure, safer streets, and the proliferation of electric assist bicycles and bike share could all also increase the distance that people are willing to bike.

Commute trips will likely prove to be the most difficult to convert from driving to bicycling. This also explains in part Kansas City's relatively low mode share. The median commute trip in the Kansas City Metro is 9.7 miles. Only 17% of commute trips in the metro area are under 2.9 miles. Home-based social/recreational, shopping, or "other" trips are on average much shorter. They are also a sizeable share of total trips within the region.

This is meaningful for two reasons. It shows that the Kansas City region must address job sprawl so that more employment opportunities don't require cars. It also demonstrates that the Census' estimates of bicycle mode share only capture a very small portion of biking happening within Kansas City, for a trip purpose which people are the least likely to bike. Therefore, we should not judge the viability or success of the bike plan based on ACS mode share estimates alone.

Table 2 Kansas City Trip Length by Purpose					
Trip Purpose	**% of trips**	**Mean Distance**	**Median Distance**	**< 2.9 mi.**	**< 1.36 mi.**
Home Based Other	22.0%	5.9 mi.	2.6	53.0%	30.4%
Home Based Shop	21.8%	5.2 mi.	2.7	55.2%	19.8%
Home Based Social	11.6%	7.3 mi.	4.2	38.7%	25.4%
Home Based Work	**10.1%**	**10.6**	**9.7**	**22.6%**	**16.9%**
Not Home Based	34.5%	9.7	3.1	47.4%	27.8%

Our analysis of the benefits of the bike plan is based on multiple scenarios. We developed three ranges of increase in bicycling on which we modeled our effects. Each scenario respectively suggests that 2.5%, 5%, and 10% of all trips will be bicycle trips by the year 2030. The growth trend in our scenarios is logistic, because we assume that the number of connections that can be made via the bike network will increase exponentially as additional miles of completed, connected facilities are added. The Bike Plan's goal of *ACS commute* mode share of 1.5% by 2024 and 5.5% by 2034[6] fits somewhere

---

[5] NHTS 2017 National Household Travel Survey. Washington DC: US FHWA. https://nhts.ornl.gov/.
[6] Bike KC Master Plan, p. 140

between the second and third scenario. We assume that the limit to the number of short trips accomplished by bicycle may be around 40%.[7]
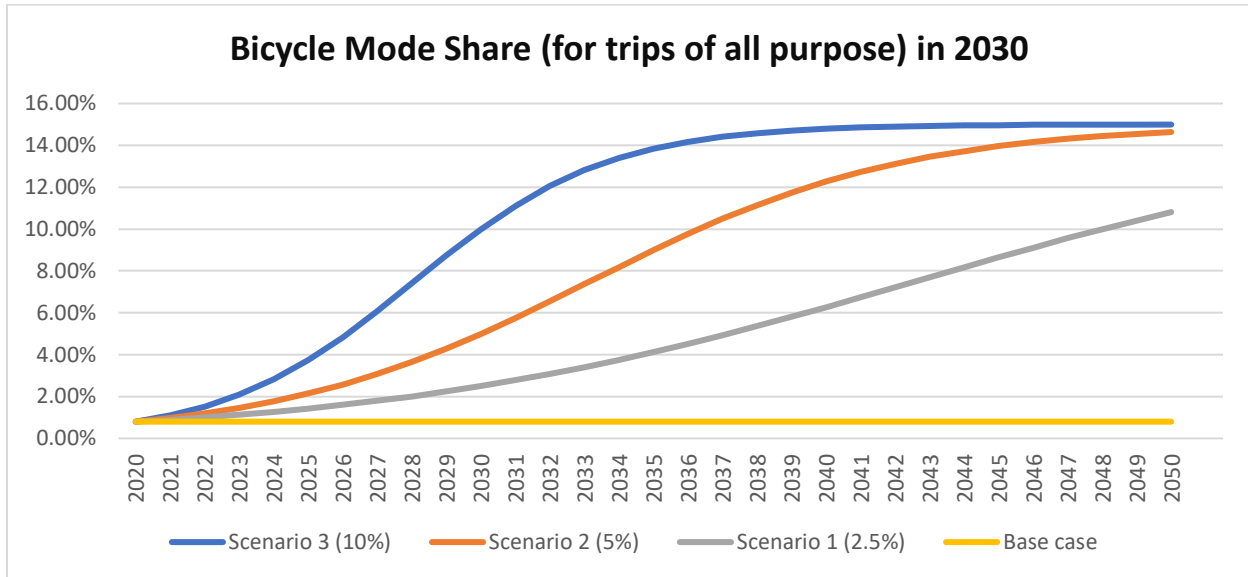
What will the effects of all of this additional bicycling be?

By implementing road diets throughout Kansas City, our streets will be safer for all users, not just bicyclists. In 2015-17, there were a total of 228 fatal crashes within the city limits of Kansas City, Missouri, or an average of 76 fatalities per year[8]. For consideration of the magnitude of this problem, there were 391 homicides in Kansas City, or an average of 130 per year, in the same time period[9]. Of the 228 crash fatalities 2015-17, 94 occurred on the proposed bicycle network (on average, 31.3 fatal crashes per year). This is by design: the bike plan intentionally addresses Kansas City's dangerous arterial streets (streets with a high Level of Traffic Stress) and proposes that those streets use protected bicycle facilities[10]. FHWA's analysis of lane reduction road diet measures finds a range between 19% and 47% in total crash volume (even as average traffic on dieted roads is increasing), for crashes of all severity[11]. *A 47% reduction in fatal crashes on the Kansas City Bike Network would save on average 14.7 lives per year by full build-out*. We modeled the economic impact of reduced crashes as an increase in the survival rate (which increases consumption, labor supply etc.). These benefits accrue regardless of how many people use the new bicycle infrastructure, since the road diet improves safety for all road users.

---

[7] Kahlmeier, et. al. 2017. Health Economic Assessment Tool (HEAT) for Walking and Cycling. Copenhagen, Denmark: World Health Organization Regional Office for Europe.
[8] Mid-America Regional Council Traffic Safety Data
[9] http://kcmo.gov/police/wp-content/uploads/sites/2/2013/10/DailyHomicideAnalysis2017-12-31.pdf
[10] Bike KC Plan, pp. 50-1
[11] https://www.fhwa.dot.gov/publications/research/safety/10053/

As the amount of driving decreases over time through various scenarios, the number of crash fatalities also increases (assuming a constant fatal crash rate of 1.68 per 100 million vehicle miles traveled).[12]

The Bike Plan gives Kansas Citians much-needed physical activity. According to the World Health Organization's Health Economic Assessment Tool research[13], there is a decrease in mortality for cyclists who take up cycling, even when considering the negative effect of breathing in polluted air. The increased physical activity will lead to 15 fewer deaths between 2021 and 2050. This increase in physical activity leads to increased labor productivity benefiting both the workers themselves and their employers.[14] The entire region benefits from this increased economic activity.

The Bike Plan makes it easier for all Kansas Citians to breathe. Reduced driving will decrease the overall number of pollutants emitted into the air, resulting in fewer emissions. Assuming 1 death due to air quality for every 100 million vehicle miles traveled and 1 per 40 million vehicle starts (trips)[15], the bike plan could reduce Kansas City air pollution fatalities anywhere from 1 to 6 deaths per year based upon our three scenarios.

The Bike Plans supports Kansas City's climate change goals. Based on reductions in Vehicle Miles Traveled over time, the bike plan could reduce annual CO_2 emissions anywhere from 44,000 to 238,000 US tons of CO_2 per year.[16]

The Bike Plan keeps more dollars in our local economy. Households that take up bicycling can often go from being a 2 car household to a 1 car household. In some cases, they can go from being a 1 car household to a zero-car household. Our analysis of the 2017 NHTS shows that the average difference in vehicles per household between households that frequently bicycle and those that do not is approximately 0.7. Analyzing data from the consumer expenditure survey, we find that 2 vehicle households spend 19% of their budget on transportation expenses, compared to 12% for 1-car households and 9% for 0-car households[17]. Since most vehicle expenses either on fuel or new motor vehicle purchases leave the regional economy, reallocating that spending local increases regional output.

---

[12] Based on MARC safety data and estimates on VMT based on the 2017 NHTS survey (MARC's travel model may produce more precise results)

[13] Kahlmeier, et. Al. 2017. Health Economic Assessment Tool (HEAT) for Walking and Cycling. Copenhagen, Denmark: World Health Organization Regional Office for Europe.
http://www.euro.who.int/__data/assets/pdf_file/0003/155631/E96097.pdf

[14] See morbidity reductions as calculated by Maizlish etal. 2013.Am J Public Health.103:703–709. doi:10.2105/AJPH.2012.300939

[15] Based upon an extrapolation of results from Lindsay, et.al. 2011. "Moving urban trips from Cars to Bicycles." Australian and New Zealand Journal of Public Health. 35, 1:54-60 and Grabow et al. 2012. Air Quality and Exercise-Related Health Benefits from Reduced Car Travel in the Midwestern United States. Environmental Health Perspectives. 120,1: 69-76.

[16]Assuming 404 grams of CO_2 emissions per passenger vehicle mile traveled
https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100U8YT.pdf

[17] US Bureau of Labor Statistics. 2018. 2016-2017 Consumer Expenditure Survey. Metadata.
https://www.bls.gov/cex/pumd_data.htm.

Economic Impacts

We used a regional economic simulation model for the Kansas City Metropolitan Area to develop estimates of the economic impact of increased bicycling in Kansas City.[18] Implementing the bike plan, with corresponding increases in bicycling as shown in Scenario 2, will lead to almost a half billion dollars growth in the regional economy by 2050. This is not counting the impact of constructing the bike lanes. This economic growth is due to increased traffic safety, increased physical activity, increased labor productivity, decreases in air pollution and more local consumption due to reduced overall spending on auto-based transportation. This increase in economic activity leads to 12,600 additional jobs (measured in job years) over the period. The regional population will also increase by 4,000. Our simulations show by 2050, KC MSA households will accumulate more than $5000 over the course of implementation and operation of the bike plan leading to a net annual gain of more than $400 per household by 2050.

Summary of Economic Impact Results

Year	Variable	Units	Scenario I	Scenario II	Scenario III
2030	Employment	Jobs	141	181	288
2030	GRP	$M (09)[19]	43	91	189
2030	Output	$M (09)	75	158	329
2030	Income	$Millions[20]	27	37	58
2040	Employment	Jobs	347	567	810
2040	GRP	$M (09)	155	310	397
2040	Output	$M (09)	276	554	709
2040	Income	$Millions	107	169	234
2050	Employment	Jobs	601	922	1084
2050	GRP	$M (09)	338	484	518
2050	Output	$M (09)	623	895	957
2050	Income	$Millions	284	418	498

Frisch and Boehm 2019.

Recommend Next Steps / Local Research Agenda

1. Work with MARC to conduct additional sensitivity analysis around the economic impact analysis of the bike plan, using their REMI model and the regional travel demand model.
2. Coordinate with MARC on the 2050 plan update, and work with MARC planners to incorporate bicycle trips into their scenarios using their regional travel demand model and REMI.
3. Conduct counts on trail/shared use path, protected, buffered, and conventional bicycle infrastructure. Use Buehler, et al.'s 2018 methodology[21] for predicting bicycle and pedestrian activity at intersections and on bike network segments based on Census and environmental data

---

[18] Regional Economic Models Inc.(REMI) 2018. Policy Impact 2 for the Kansas City Metropolitan Region. Amherst, MA: REMI. https://www.remi.com/. This is the same model MARC uses to produce the regional economic forecast.
[19] $M (09) = millions of constant 2009 dollars.
[20] Income is reported in current year dollars.
[21] Huyen T.K.Le, Buehler R, and Hankey S. 2018. "Correlates of the Built Environment and Active Travel: Evidence from 20 US Metropolitan Areas," in *Environmental Health Perspectives* Jul 30;126(7):077011. doi: 10.1289/EHP3389. eCollection 2018 Jul.

to validate bike demand forecasts, and use in route planning and prioritization in the City and the metro area

4. Ask about bicycling behavior (Do you bike? How often do you bike?) as well as relative satisfaction with bicycle infrastructure in the City's quarterly resident satisfaction survey (the latter is a recommendation of the KC bike plan).

Copyright and Disclaimer

This policy brief summarizes results from a paper in progress. Please contact Dr. Michael Frisch, frischm@umkc.edu for any questions about the study. The results represent the planning analyses of the authors.

Dr. Michael Frisch, AICP
Urban Planning + Design
Department of Architecture, Urban Planning + Design
University of Missouri Kansas City
5005 Rockhill Rd. Katz Hall 109
Kansas City MO 64110

816-235-6369
frischm@umkc.edu