# NATIONAL STREET IMPROVEMENT STUDY


peopleforbikes | BENNETT MIDLAND | Portland State UNIVERSITY | THE SUMMIT FOUNDATION

# FINDINGS FROM MEMPHIS

# OVERVIEW[1]

Across the country, policymakers and planning departments are making cities more livable by better accommodating people who walk and bike. Improving streets and upgrading transportation infrastructure often require reducing on-street parking or traffic lanes. While studies have shown how such upgrades improve traffic safety and mobility for city residents, the question remains how such infrastructure improvements affect economic outcomes.

This study will attempt to answer to what extent these types of corridor-level street improvements impact economic activity and business vitality in the immediate vicinity. In particular, how do street improvements impact retail sales and employment?

Memphis has conducted many street improvement projects in past years, including new protected or buffered bike lanes. This report explores two recent street improvement corridors—Madison Avenue and Broad Avenue—to understand the economic and business impact of these active transportation infrastructure investments.

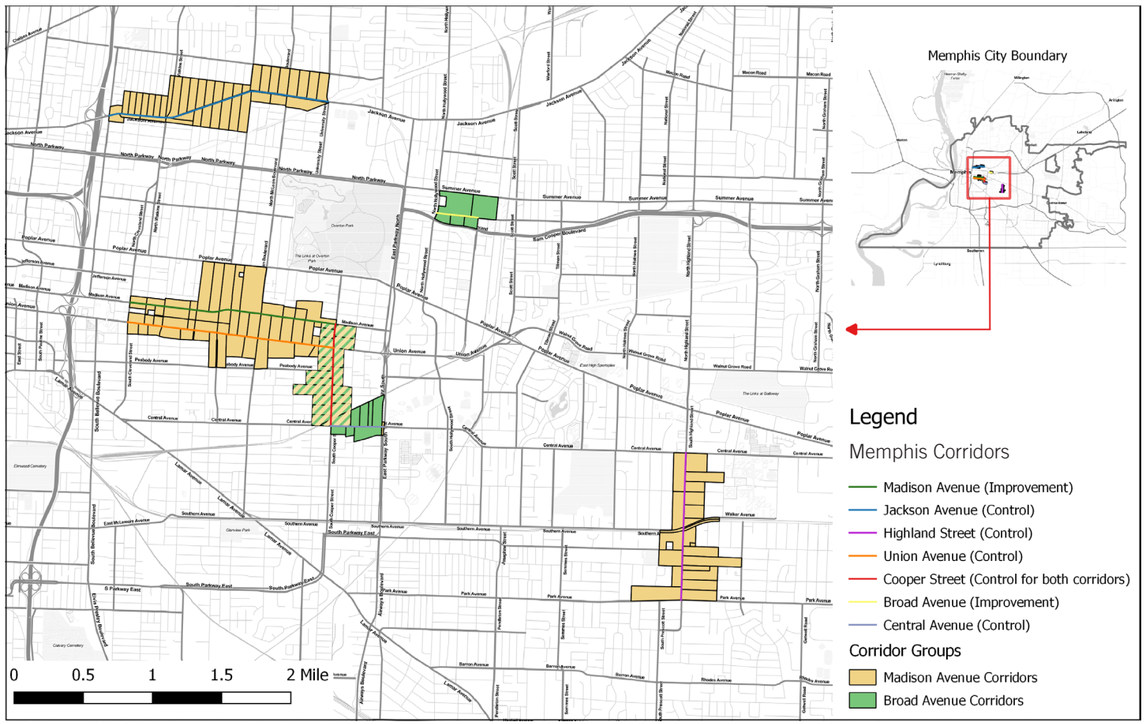
Assessing the impact of street improvements and the accompanying reduction of on-street parking or travel lanes on a neighborhood's economic activity and vibrancy is a new field of research. In 2013, the New York City Department of Transportation commissioned a first-of-its-kind study, using sales tax data to evaluate how businesses on improved corridors have been affected. This current study builds on past work by examining additional cities and incorporating new research methods and data sources.

## KEY FINDINGS

*Based on our analysis, we found the street improvement projects in Memphis did not impede economic vitality, and may have contributed to positive growth. In particular, we can conclude that:*

1. **BOTH TREND ANALYSIS AND INTERRUPTED TIME SERIES ANALYSIS REVEALED CONSISTENT EVIDENCE OF POSITIVE IMPACTS OF THE PROTECTED BIKE LAND ON BROAD AVENUE ON EMPLOYMENT IN THE FOOD SERVICES INDUSTRY, INDICATING AN IMPROVEMENT IN BUSINESS VITALITY AS A RESULT.**
2. **WHILE SOME ANALYSIS METHODS SHOWED SIMILAR TRENDS IN EMPLOYMENT AND SALES BETWEEN MADISON AVENUE AND ITS CORRESPONDING CONTROL CORRIDORS, WE FOUND CAUSAL EVIDENCE THAT THE BUFFERED BIKE LANE INSTALLED ON MADISON AVENUE TRIGGERED SIGNIFICANT INCREASES IN BOTH FOOD SERVICES EMPLOYMENT AND RETAIL SALES ACROSS MULTIPLE DATA SOURCES AND ANALYTICAL METHODS.**

*In the other analyzed corridors and industry sectors, we found either mixed or insignificant results.[2] However, the insignificant results may be significant in this context. Importantly, there is no evidence of a negative economic impact from right-of-way or parking lane removal.*




# DATA SOURCES

*For this study we used multiple data sources to estimate the effect of new bike lane infrastructure investment, each with its pros and cons.[3] As such, the analysis results using the three data sources should be viewed as complementary to each other.*

## LEHD

First, we used the Longitudinal Origin-Destination Employment Statistics (LODES) data set from the **Longitudinal Employer-Household Dynamics Dataset** (LEHD). LEHD provides geographically granular detail about jobs, workers and local economies, allowing us to examine employment by broad industry sector, wage and educational attainment. One major disadvantage of the LEHD data set is that in order to guarantee confidentiality, block level data is "fuzzed" so the numbers do not reflect the exact number of jobs at this geographical level. Additionally, though employment is disaggregated by industry, it is only provided at the most general level (the equivalent of two digit NAICS[4] codes) so we are unable to isolate restaurant workers from hotel service workers, for example. That being said, the LEHD data set is comprehensive, offers unprecedented geographic detail, and is longitudinal, allowing for consistent comparisons over time.

## SALES TAX DATA

**Sales tax data** is collected as the primary data source to allow us to estimate a more sensitive measure of economic activity than employment (as the decision to hire or fire employees for a firm is often an expensive one, and thus we would expect employment to be a delayed response to changes in economic activities). Some drawbacks of sales tax data are that some states do not have a sales tax or, in states or cities that do have one, the sales tax data is not broken down by specific industry and it is difficult to parse out accurate figures. But the benefits of sales tax data largely outweigh these issues and do offer a more sensitive metric than employment. Tennessee has a general 7% sales tax for all businesses, with an exception on non-restaurant food which is taxed at 5.5%. In Shelby County, where Memphis is located, there is an additional sales tax of 2.25%, as well as an additional 5% accommodations tax. These produce a sales tax range of 7.75-14.25% in the city of Memphis. However, medical supplies, certain groceries, and food items are exempted from tax collection, which may hamper the ability of sales tax data to accurately reflect all retail business vitality.

## QCEW

This report also takes advantage of establishment level **Quarterly Census of Employment and Wages (QCEW)** data. The QCEW gives us address level-data on individual establishments as well as detailed employment information, allowing for more accurate pinpointing of the geographic location of businesses and industrial classifications. In addition, the research team is able to use employment and wages as additional indicators of economic performance in the corridors. We obtained establishment-level QCEW data from the Tennessee State Department of Labor & Workforce Development, and were able to aggregate the employment and wages to the corridor block level and block-facing level for retail and food services industries. The aggregated employment numbers correspond closely to the LEHD data used in our analysis, but with the advantage that the numbers are not "fuzzed" for confidentiality concerns.

*1. The National Street Improvements Study is a research project by Portland State University, Bennett Midland, and PeopleForBikes. An accompanying report with more detailed information on methodology can be accessed at https://peopleforbikes.org/placesforbikes/resources/*

*2. This is typically due to control corridors that may not be fully comparable (for DID analysis), methods explained further in Section 3 ("Methodology").*

*3. Because this project makes use of a variety of different data sources, it required collaboration between the research team and representatives from multiple agencies/departments. Our principle contact was with the City of Memphis, sales tax data was provided and aggregated by State of Tennessee Department of Revenue; QCEW data was provided by Tennessee Department of Labor and Workforce Development; and LEHD data was publicly available at United State Census Bureau.*

*4. For the North American Industry Classification System (NAICS), please visit https://www.census.gov/eos/www/naics/.*

# METHODOLOGY

Three analytical methods were applied in order to isolate the impact of street improvements while controlling for other economic and regional factors. The methods are an aggregated trend analysis (following the 2013 NYC Department of Transportation study), a difference-in-difference approach, and an interrupted time series analysis. The time frame used in the analysis for LEHD data is 2004-2015, the period is 2004-2016 for sales data, and 2000-2017 for QCEW data.

In order to properly isolate the effect of the street improvements we must identify treatment corridors (corridors that actually were improved) and control corridors (corridors that are similar to the treatment corridors except they remain unimproved). Treatment corridors are corridors where new bike or pedestrian related improvements were installed, ideally made up of a minimum of 10 adjacent, or intersecting, census blocks with a minimal number of retail and food service jobs. Additionally, we chose street improvement corridors installed between 2008 and 2013 in order to guarantee we have sufficient data (at least 3 data points pre- and post-treatment) to track pre- and post-treatment economic trends. Once corridors are selected based on these criteria, further testing is conducted to discern the level of similarity between treatment and control corridors. The tests include quintile comparisons of corridor-level employment to city-wide employment, and statistical tests of average block level employment that compare control corridors to the treatment corridors.

## AGGREGATED TREND ANALYSIS

This first analytical method, aggregated trend analysis, follows a previous NYC Department of Transportation study (NYCDOT, 2013), examining whether the treatment corridors tend to have better business performance than comparison corridors after street improvements. The approach compares the trends of treatment and control corridors in addition to city-wide trends over the full time period covered by the data. If treatment corridors show greater increases in employment or sales tax receipts, then that would represent a positive impact of street improvement on business activities. This method is easy to follow and represents the aggregated trend of business activities. However, it lacks the rigor of econometric estimates and statistical tests that explicitly test whether the street improvement caused the change.

## DIFFERENCE-IN-DIFFERENCE APPROACH

The second method aims to estimate the difference in business vitality of pre- and post-improvement periods between treatment and control corridors within the same time period. This is known as a difference-in-difference (DID) approach. The approach looks at the change in the variable of interest—employment levels or sales revenues in our case—in the treatment corridor before and after the street improvement. Meanwhile, the control group has not been treated in either time period. The difference in growth trajectories between the two periods should provide us with an unbiased estimate of the effect of the street improvement.

## INTERRUPTED TIME SERIES

The third method, interrupted time series (ITS), is an econometric technique that estimates how street improvements impact corridor economic vitality from a longitudinal perspective. This approach treats the street improvement as the “interruption” and estimates the change in the level and the growth trend of business activities in the corridor after the street improvement. If the street improvement treatment has a causal impact, the post-intervention sales revenue or employment should show a different level or slope compared to the pre-intervention data.[5]

## CONCLUSION

In conclusion, aggregated trend analysis and DID analysis both utilize control corridors to determine the impacts of the street improvement corridor, while the ITS analysis uses multiple time points on the street improvement corridor itself to pinpoint economic outcomes. In general, the ITS analysis provides more robust results than the other two methods, since it is less likely to be affected by the selection of control corridors. However, this method generally requires more data points post-intervention to achieve meaningful and valid impact estimations. The DID approach is heavily dependent on finding comparable control corridors (which may not always exist), so the analytical results may be weakened when appropriate corridors cannot be identified.

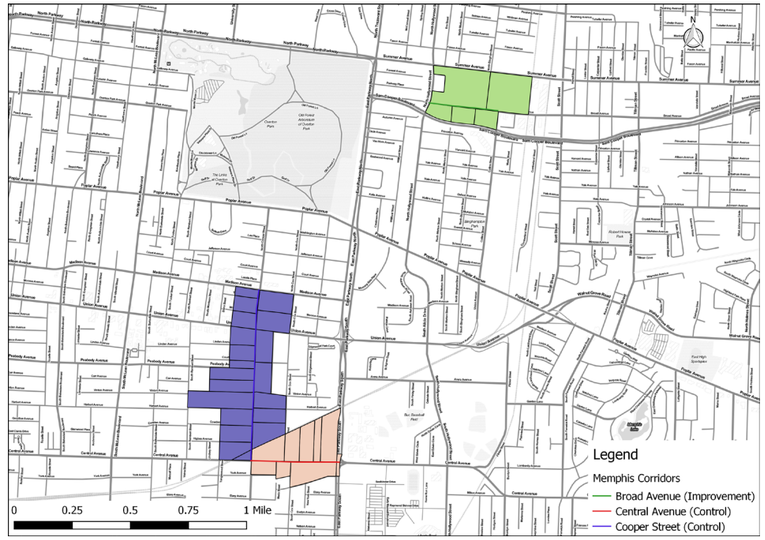
Additional data points after the completion of street improvements may help to provide further validity and rigor to the analysis of resulting economic outcomes. Moreover, further contextual information about the street improvement corridor, such as quality or level of the improvement, number of parking spots eliminated, and subsequent bicycle ridership or pedestrian increases, would help to better understand the linkages between the improvements and potential economic impacts. Extending this research to more closely examine the changes and shifts in industrial patterns will be valuable as well.

*5. The aggregated trend analysis is a visual and growth trend comparison approach where statistical significance cannot be assigned. However, for the two econometric approaches, DID and ITS analysis, we refer to statistically significant impacts whenever positive or negative impacts are stated in this report.*

# CORRIDOR ANALYSIS

# BROAD AVENUE

*A protected bike lane was installed in 2010 on Broad Avenue—a relatively short corridor, covering five blocks. The control corridors, Cooper Street and Central Avenue, are generally further away from the treatment corridor and have higher traffic volume.*




## KEY TAKEAWAYS

» The analysis reveals consistent evidence of positive impacts of the protected bike lane street improvement on employment in the food services industry, using both trend analysis and ITS methods across both employment data sources.

» The Broad Avenue corridor shows some contradictory patterns where the sales tax receipts and QCEW retail employment grew after the protected bike lane installation but the LEHD retail employment decreased. The sales tax and QCEW data are likely much more reliable in this circumstance, as it is quite likely that the fuzzed LEHD data contributes to inaccuracies at the small geographic scale of the Broad Avenue corridor.

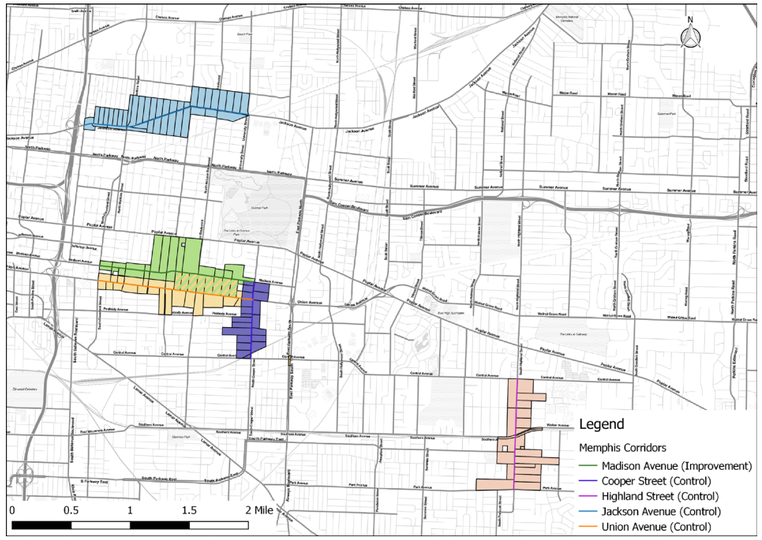
» The low number of retail establishments along Broad Avenue in the baseline period means that the large post-construction growth rates should be interpreted with caution, and with particular attention to the local context.

» In conclusion, the protected bike lane triggered a significant employment increase in the food services industry after installation, indicating an improvement in business vitality as a result.

| | | Retail | | | Food | | |
|---|---|---|---|---|---|---|---|
| **Data** | **Area** | **Baseline** | **Pre-Growth** | **Post-Growth** | **Baseline** | **Pre-Growth** | **Post-Growth** |
| **LEHD [Employment]** | Treatment | 95 | -13.89% | -21.63% | 17 | 37.50% | 77.30% |
| | Control: Cooper | 112 | -7.05% | 4.13% | 235 | -5.58% | 20.80% |
| | Control: Central | 69 | -4.32% | 2.35% | 64 | -16.32% | 26.87% |
| **Sales [Sales revenue]** | Treatment | $3,679,102 | 20.19% | 26.92% | - | - | - |
| | Control: Cooper | $62,460,876 | -8.94% | 6.55% | - | - | - |
| | Control: Central | $13,702,560 | -8.00% | 17.55% | - | - | - |
| **QCEW [Employment]** | Treatment | 3 | - | 139.20% | 21 | 36.67% | 98.15% |
| | Control: Cooper | 51 | -11.41% | 41.68% | 31 | -6.20% | 103.21% |
| | Control: Central | 33 | -5.89% | 33.35% | 70 | -6.49% | 44.04% |

# MADISON AVENUE

*Madison Avenue, located in the Midtown district, received a buffered bike lane in 2011. The control corridors are Union Avenue and Cooper Street, close to the treatment corridor in Midtown, and Highland Street, located to the southeast of the district.[6]*




# KEY TAKEAWAYS

» Our ITS analyses show positive and statistically significant impacts of the street improvement on both food employment and retail sales, suggesting a positive causal relationship.

» Analysis of sales tax receipts also shows that sales along Madison Avenue follows a parallel trend when compared with its control corridors, with no detrimental impacts to either retail or food services industry sales after the street improvement.

» The LEHD and QCEW employment data on Madison Avenue both show similar trends with its control corridors after street improvement. Cooper Street experienced a larger bump in employment in the post-construction period, but we suspect that this may be due to events unrelated to the construction of the buffered bike lane on Madison Avenue.

» DID analyses indicate non-significant or mixed impacts of the Madison Avenue street improvement on the employment and sales economic indicators.

» While some analyses indicate little impact of the street improvement on certain economic indicators, the positive causal results of our ITS analyses are significant enough for us to conclude that the buffered bike lane on Madison Avenue improved food services employment and retail sales in the corridor and had a positive effect on business vitality.

| | | Retail | | | Food | | |
|---|---|---|---|---|---|---|---|
| **Data** | **Area** | **Baseline** | **Pre-Growth** | **Post-Growth** | **Baseline** | **Pre-Growth** | **Post-Growth** |
| **LEHD [Employment]** | Treatment | 494 | 3.41% | -3.84% | 510 | 7.90% | 4.85% |
| | Control: Union | 399 | 10.45% | 1.40% | 565 | -2.20% | 12.66% |
| | Control: Highland | 190 | 1.63% | -2.64% | 421 | -3.04% | 9.68% |
| | Control: Cooper | 103 | -3.25% | 3.10% | 225 | -3.44% | 28.87% |
| **Sales [Sales revenue]** | Treatment | $148,345,969 | -10.64% | 7.85% | - | - | - |
| | Control: Union | $184,952,323 | 10.47% | -0.01% | - | - | - |
| | Control: Highland | $43,848,630 | 0.22% | 6.82% | - | - | - |
| | Control: Cooper | $58,055,872 | -7.94% | 10.81% | - | - | - |
| **QCEW [Employment]** | Treatment | 132 | -12.85% | 34.33% | 428 | 8.14% | 24.34% |
| | Control: Union | 279 | -1.05% | 39.30% | 366 | -10.09% | 69.96% |
| | Control: Highland | 45 | 34.36% | 87.94% | 124 | -0.22% | 40.79% |
| | Control: Cooper | 54 | 21.83% | 31.74% | 36 | 28.07% | 135.82% |

*6. Initially considered as a candidate for a control corridor, Jackson Avenue was ultimately eliminated because of too many dissimilarities with the treatment corridor, such as smaller amount of retail and food employment and geographical distance.*

# REFERENCES[7]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*7. A complete reference list is available as part of the accompanying report at https://peopleforbikes.org/placesforbikes/resources/*


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