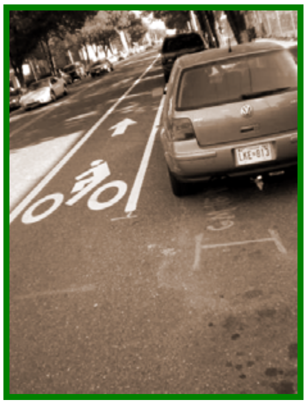

PEDESTRIAN AND BICYCLE INFRASTRUCTURE:

A NATIONAL STUDY OF EMPLOYMENT IMPACTS

Heidi Garrett-Peltier

POLITICAL ECONOMY RESEARCH INSTITUTE
PERI
University of Massachusetts Amherst

Political Economy Research Institute

University of Massachusetts, Amherst

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HEIDI GARRETT-PELTIER

Political Economy Research Institute
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EXECUTIVE SUMMARY

Pedestrian and bicycling infrastructure such as sidewalks, bike lanes, and trails, can all be used for transportation, recreation, and fitness. These types of infrastructure have been shown to create many benefits for their users as well as the rest of the community. Some of these benefits are economic, such as increased revenues and jobs for local businesses, and some are non-economic benefits such as reduced congestion, better air quality, safer travel routes, and improved health outcomes. While other studies have examined the economic and non-economic impacts of the use of walking and cycling infrastructure, few have analyzed the employment that results from the design and construction of these projects. In this study we estimate the employment impacts of building and refurbishing transportation infrastructure for cyclists and pedestrians. We analyze various transportation projects and use state-specific data to estimate the number of jobs created within each state where the project is located.

The data for this study were gathered from departments of transportation and public works departments from 11 cities in the United States. Using detailed cost estimates on a variety of projects, we use an input-output model to study the direct, indirect, and induced employment that is created through the design, construction, and materials procurement of bicycle, pedestrian, and road infrastructure. We evaluate 58 separate projects and present the results by project, by city, and by category. Overall we find that bicycling infrastructure creates the most jobs for a given level of spending: For each $1 million, the cycling projects in this study create a total of 11.4 jobs within the state where the project is located. Pedestrian-only projects create an average of about 10 jobs per $1 million and multi-use trails create nearly as many, at 9.6 jobs per $1 million. Infrastructure that combines road construction with pedestrian and bicycle facilities creates slightly fewer jobs for the same amount of spending, and road-only projects create the least, with a total of 7.8 jobs per $1 million. On average, the 58 projects we studied create about 9 jobs per $1 million within their own states. If we add the spill-over employment that is created in other states through the supply chain, the employment impact rises by an average of 3 additional jobs per $1 million.

BACKGROUND

This study was undertaken in order to understand the employment impacts of bicycle and pedestrian infrastructure. In January 2009 the Political Economy Research Institute (PERI) published a study analyzing the needs and job creation effects of public investments in a wide variety of infrastructure projects, including energy, water, and transportation.[1] However, the transportation infrastructure we considered in that study did not specifically include cycling or walking infrastructure that could be used for commuting as well as recreational purposes. In searching through the literature, we discovered that there were no studies which specifically addressed the job creation that results from building infrastructure such as bike lanes, multi-use trails, and pedestrian facilities. This study, the first of its kind, was developed to fill this need.

In this report, we estimate the jobs that are created in the construction of bicycle and pedestrian facilities. The manufacturing of the materials and equipment, the design of the facilities, and the construction and installation of each transportation project can generate a significant number of jobs in a variety of industries and occupations. Other economic impact studies have focused on the use of trails and other walking and cycling infrastructure, and the dollars that flow into a community as a result of this use. While these economic benefits can be significant, they only represent a part of the picture. A community will also experience significant employment benefits resulting from the design and construction of trails, sidewalks, bike lanes, and related projects.

Pedestrian and bicycle infrastructure offers many services both to the users of that infrastructure as well as the community at large. Cyclists, pedestrians, joggers, and others who use trails, bike lanes, and walkways to commute to work and school or for recreation and exercise, experience health benefits, reduced congestion, reduced costs for vehicle maintenance and operations, and increased travel safety.

[1] Heintz, Pollin, and Garrett-Peltier (2009)

The community benefits from bicycle and pedestrian infrastructure through increased economic activity, higher property values,[2] and improved environmental quality. A number of researchers have documented both these economic and non-economic benefits.

Research conducted by the Rails-to-Trails Conservancy and various state Departments of Transportation generally draws on user surveys to gauge the types of users and the revenues attributable to trail use. For example, in their "Economic Benefits of Trails and Greenways," the Rails-to-Trails Conservancy finds that economic benefits include tourism and recreation-related spending (which is a boon to businesses and increases local tax revenues), and a rise in real estate values. Other benefits include higher quality of life, environmental benefits such as buffer zones to protect water sources from pollution run-off, and mitigation of flood damage.[3] A 2008 user survey of a multi-use trail in Pennsylvania showed that over 80 percent of users purchased "hard goods" such as bikes and cycling equipment in relation to their use of the trail, and some also purchase "soft goods" such as drinks and snacks at nearby establishments.[4]

In some areas, such as the northern Outer Banks of North Carolina, bicycle facilities partly drive tourism. A 2003 economic impact analysis of a bicycle trail system in this area focused on economic benefits such as tourist spending on food, lodging, and entertainment.[5] Data were gathered through user surveys and bicycle traffic counts to estimate the amount of money that tourists spent during a visit, the total number of tourists, and the proportion of tourists for whom bicycling was an important reason for the visit. The researchers found that, annually, approximately 68,000 tourists visited the area at least partly to cycle. This led to an estimate that $60 million in tourism spending and multiplier effects came to the area

[2] For example, see Karendeniz (2008) for the relationship between home prices and trail proximity or Cortright (2009) for the impacts of "walkability" on home values in U.S. cities.

[3] Trails and Greenways Clearinghouse (2004)

[4] Knoch and Tomes (2008)

[5] Lawrie et al (2006)

in relation to the bikeways, and supported approximately 1,400 jobs.

According to a nationwide survey of over 1,000 households in rural, suburban, and urban areas, cycling and walking facilities are important to a strong majority of people.[6] The Bureau of Transportation Statistics, in its October 2009 survey, found that 66 percent of people said it was “very important” to them to have sidewalks, paths, or other safe walking routes to work or school. In addition, 37 percent of people said it was “very important” and 33 percent said it was “somewhat important” to have bike lanes or paths to work and school. When asked about the importance of having pedestrian-friendly streets or boulevards in their downtown or central business district, 60 percent of respondents said it was “very important”. When the sample was restricted to respondents in metropolitan areas, these percentages were even higher.

The above evidence shows that there is clearly public support for bicycle and pedestrian facilities, and that both users of these facilities as well as the rest of the community can experience benefits. As noted by the Transportation Research Board of the National Academy of Sciences:

> *Transportation planning and policy efforts at all levels of government aim to increase levels of walking and bicycling. To make the best use of limited transportation funds there is a critical need for better information about two important considerations relating to bicycle facilities. The first of these is the cost of different bicycle investment options. The second is the value of the effects such investments have on bicycle use and mode share, including the resulting environmental, economic, public health, and social benefits.*[7]

[6] Bureau of Transportation Statistics (2009)

[7] National Cooperative Highway Research Program, “Guidelines for Analysis of Investments in Bicycle Facilities,” Transportation Research Board of the National Academies, Report 552, 2006.

DATA AND METHODOLOGY

In order to estimate the employment impacts of various pedestrian and bicycle infrastructure projects, we start by following the methodology outlined by the Transportation Research Board (TRB). In its 2006 report, “Guidelines for Analysis of Investments in Bicycle Facilities,” the TRB examines three categories of bicycle facilities: on-street facilities such as bike lanes and shared streets; off-street facilities such as trails adjacent to roads or converted rail trails; and bicycle equipment such as signs, signals, and parking. The data for the TRB report were gathered from various sources including transportation professionals, a literature review, and industry information from completed projects and bid prices. Among the cost data collected by the TRB are detailed capital costs for construction of bicycle facilities, including such line items as clearing and grubbing, pavement removal, crushed stone, concrete pavement, and thermoplastic pavement markings.

Following the guidelines established by the TRB, we gathered detailed price data on various components of design and construction of cycling, walking, and road infrastructure, including paving materials, signage, structures (such as bridges), equipment such as bollards and bike racks, and services such as engineering and traffic maintenance. We partnered with America Bikes to gather transportation project data from a variety of small and large cities nationwide. Together we contacted city planning departments and personnel in Departments of Transportation. We compiled data on bid prices and costs for completed projects including bike lanes, sidewalks, multi-use paths, other bicycle and pedestrian improvements, as well as construction and resurfacing of roads that did not include bicycle or pedestrian components. The cost data were very detailed, generally including dozens or sometimes hundreds of line items per project, including specific dollar amounts for each construction project input.

This report includes data on a total of 58 projects from 11 cities nationwide. In total, we contacted transportation officials in 90 cities. Of these, 55 responded with a willingness to contribute to this research project. The data requirements for this rigorous project-by-project analysis were substantial, and this ultimately limited the number of cities that were able to provide sufficiently detailed cost data over multiple project types. Twenty were able to send in some data, and we selected the 11 cities that sent the most complete data.[8] The cities included in this analysis are:

- Anchorage, Alaska
- Austin, Texas
- Baltimore, Maryland
- Bloomington, Indiana
- Concord, New Hampshire
- Eugene, Oregon
- Houston, Texas
- Lexington, Kentucky
- Madison, Wisconsin
- Santa Cruz, California
- Seattle, Washington

We analyzed three to six projects in each of these cities. For most projects we had cost estimates from multiple sources (for example, an estimate from a city engineer as well as multiple bids from contractors) and in those cases we used the average of the cost estimates for each project.

While we followed the TRB report's methodology in collecting and assembling cost data, our analysis differs from the TRB report in three significant ways. First, this study focuses only on the capital costs of building transportation infrastructure, and does not include the ongoing maintenance and use of bicycle facilities as does the TRB report. Secondly, we evaluate not only bicycle infrastructure but also pedestrian and road infrastructure. And thirdly, we extend the TRB methodology of cost assessment by estimating employment impacts. The TRB analysis does not include job creation. We now turn to the methodology for developing our employment estimates.

Once we assembled the detailed cost data on our 58 projects, we used an input-output model to estimate the employment effects of these projects. The input-output (I-O) model allows us to assess the economy-wide impacts of various activities. In addition to the direct jobs that are created in the engineering and construction firms involved in infrastructure projects, jobs are created in the supply chain of these industries, which we call indirect jobs. These indirect jobs are in industries such as cement manufacturing, sign manufacturing, and trucking. Furthermore, as workers in the direct and indirect industries spend their earnings, they create demand in industries such as food services and retail establishments, which we call the induced effects. The I-O model captures not only the direct employment and output effects of an activity, but also the indirect and induced effects, and therefore provides a more complete picture of the impacts resulting from infrastructure spending. Table 1 contains a list of the direct and indirect industries that experience the greatest job creation as a result of building bicycle, pedestrian, and road infrastructure.

The model we used for this research is IMPLAN version 3, an I-O model built primarily from U.S. Bureau of Economic Analysis (BEA) data along with additional data sources. The BEA, through its Economic Census as well as other surveys, collects data from millions of businesses nationwide which it compiles into input-output accounts that show supply linkages between approximately 500 industries, as well as demand relationships between consumers (individuals, businesses, and governments) and these industries. We have used the IMPLAN model for past research projects including studies of clean energy investments, environmental regulation, and state taxes,[9] and our employment estimates have been shown to be consistent and accurate as demonstrated most fully through the large-scale statistical research we conducted for the U.S. Department of Energy.

For this analysis, we used the IMPLAN I-O model with 2008 data (the most recent available at the time the analysis was performed). For each of our 11

[8] By "complete" we mean that the data for each project contained very detailed descriptions and costs for the project inputs, and that multiple project types were provided by the city, allowing us to study the variation between projects within a city.

[9] See, for example: Pollin, Heintz and Garrett-Peltier (2009); Heintz, Garrett-Peltier, and Zipperer (2011); Thompson and Garrett-Peltier (2010)

locations, we used the data specific to that state. In order to be able to use the I-O model, we first had to assign industry codes to each of the projects' cost categories. The data provided to us were very detailed, and enabled us to identify the type of product or material for each item in the construction project. Once we determined which industry would manufacture or provide each item in the project, we assigned an industry code to that item. For example, we assigned individual industry codes to materials such as hot-mix asphalt and thermoplastic pavement markings. We first categorized each cost according to the North American Industrial Classification System (NAICS), an industrial coding system developed by the Census Bureau and used by Federal statistical agencies. We then used the NAICS-IMPLAN concordance to model the project within IMPLAN. Thus for each of our 58 projects, we constructed very detailed industry purchasing patterns and then used the model and data specific to that state to estimate the employment impacts of those purchases.

Using the I-O model, we estimated the direct and indirect employment effects. In order to compare effects between different areas and projects, we use a standard spending amount of $1 million. Thus in reporting our employment impacts we show the number of full-time equivalent jobs that are created for each $1 million of spending on any given project.

To estimate the induced effects we used state-specific data on imports and exports to generate state-specific multipliers. The induced effect estimates the employment and output that result when workers in the direct and indirect industries spend their earnings on items such as food, clothing, and healthcare. In previous work, we found that the induced effect was equal to 40 percent of the combined direct and indirect effects at the national level.[10] At the local (city or state) level, however, the induced effect will be lower than the national induced effect, since workers spend their earnings on goods which are imported not only from overseas but also from out-of-state. We adjusted the induced effects downwards by using the ratio of local (state) supply to local (state) demand for each of our data sets. The state-specific induced effects in this study range from a low of 28 percent (Alaska) to a high of 38 percent (Maryland). On average, the induced effects at the state level were about three-quarters the national induced effects, or about 31 percent of the combined direct plus indirect employment. As discussed below, the indirect effect is also lower at the state level than the national level, something that is explicitly captured in the model since we use state-specific data.

Finally, in order to eliminate any variation in the data that results strictly from regional price differences, we converted all of the project data into shares of the total project cost. So, for example, rather than inputting the number of dollars that were spent on asphalt for project X, we inputted the percentage of the total project cost that was attributable to asphalt. In this way we can compare projects whose budgets are of different magnitudes as well as comparing results across cities. As long as the composition of a certain type of project (in terms of materials, equipment, and services) is similar across cities, any regional price differences will not affect the results of the analysis.

RESULTS AND DISCUSSION

Employment Impacts

In the tables below, we show the employment impacts for various types of projects. In all cases, we present the level of job creation, in terms of full-time-equivalent positions, that results from spending the same amount, $1 million, on any given project. By using a consistent spending amount such as this, we can more readily see the differences in job creation that are attributable either to the type of project or to the city. Below we will discuss the sources of this variation.

In Table 2, we present the average employment impacts for different types of projects. We analyzed a total of 58 projects in 11 cities. We first estimated the employment impacts of each individual project,

[10] For example, see the discussion in "Green Prosperity" by Pollin, Wicks-Lim, and Garrett-Peltier, available at www.peri.umass.edu

then grouped similar project types. In the table we see that for all projects, the average level of job creation is 4.7 direct jobs, 2.1 indirect jobs, and 2.1 induced jobs, for a total of about 9 jobs per $1 million spending. It is important to keep in mind that these estimates are averages of the specific projects, and that they reflect only the jobs created within the state in which the project is undertaken. Below we will discuss how these estimates differ from employment impacts at the national level using the national data set.

The projects listed in Table 2 include a range of transportation infrastructure. Among them are road-only projects (such as widening an existing road or repaving/resurfacing roads that do not have either bike lanes or sidewalks), road projects that include pedestrian components such as sidewalks, road infrastructure with both pedestrian and bicycle components such as bike lanes and signage, projects that are uniquely pedestrian facilities (such as refurbishing sidewalks or improving pedestrian crossings), others that are specific to cycling (such as adding or marking bike lanes), multi-use trails which could either be alongside (but separate from) a road or off-road trails such as converted rail trails, and on-street facilities that are for both bicycling and walking but do not include road construction itself (such as refurbishing or expanding sidewalks and bike lanes).

For each project category, we list in Table 2 the number of projects as well as the direct, indirect, induced, and total employment impacts per $1 million spending. We see that the largest category in terms of number of projects is road construction with bicycle and pedestrian facilities. In fact, many of the cities we contacted informed us that the majority of their road projects now include at least some component of biking or walking infrastructure, be it sidewalks, wide shoulders, or designated bike lanes. Out of our 58 total projects, 13 (or 22%) were roads with pedestrian and bicycle facilities. The next largest group was road-only projects, which consisted of 11 total projects or 19% of the total. That was followed by pedestrian-only projects (10) and then road infrastructure with pedestrian components (9). We also collected data on nine multi-use trails in six cities. Finally, the data included a small number of bike-only projects (4) and on-street projects that had both cycling and walking components but no other road construction elements (2).

We see from the table that the greatest level of job creation is for infrastructure projects that are specific to cycling, such as creating or refurbishing bike lanes. This category results in an average of 6 direct jobs per $1 million spending, plus 2.4 indirect jobs and 3 induced jobs for a total of 11.4 jobs created for each $1 million spent on bicycling infrastructure. The lowest level of job creation is for road-only projects such as repaving or widening roads. This type of infrastructure creates 4 direct, 1.8 indirect, and 1.8 induced jobs, for a total of 7.8 jobs per $1 million spent on road-only infrastructure. The remaining projects, which consist of various elements of pedestrian and/or cycling facilities, range from job creation levels of 4.2 direct jobs and 8.4 direct, indirect, plus induced jobs (for on-street biking and walking) to 5.2 direct jobs and 9.9 total jobs including the direct, indirect, and induced effects (for pedestrian-only infrastructure). Thus, on average, these various transportation infrastructure projects create between 8 and 11 total jobs for each $1 million spent. The job creation effects are higher for bicycle-only and pedestrian-only facilities and are lowest for road-only facilities. Below we will discuss reasons for these differences.

Next we turn our attention to specific project categories in each of the 11 cities from which we gathered data. As we see from the city tables, the job creation effects of projects in some cities are quite different from the national average. We saw above that pedestrian and bicycle infrastructure creates, on average, more jobs for a given level of spending than road-only projects. We also saw that, on average, bicycle-only and pedestrian-only infrastructure create the most jobs, followed by off-street multi-use (bike/ped) trails. When we evaluate the impacts within each city, however, we sometimes find that these relationships change. For example, in Anchorage, Alaska, the city's one road-only project actually created more jobs than projects that included pedestrian and/or bicycle components. In Bloomington, Indiana, we find that the city's one road-only project created slightly more jobs per given amount of spending than either of the city's two road projects that contain bicycle and pedestrian facilities. However, we also see that Bloomington's two trail projects and one pedestrian-only facility each generated more employment than any of the three projects that included a road element, and that the employment impacts of all six projects in this city had a relatively narrow range, from about 7.3 to 9.0 jobs per $1 million. Below we discuss the reasons for the overall differences in the numbers of jobs created.

Out of the 11 cities we studied, seven cities were able to provide data on projects that were road-specific and did not contain any pedestrian or bicycling facilities. Out of these seven cities, we found that in only one city, Anchorage, Alaska, the road-only project actually created more employment than all other transportation projects. In the other six cities, cycling and/or walking infrastructure created more jobs per $1 million than road-only infrastructure. As explained in more detail below, the cycling and walking infrastructure projects analyzed for this study generally create more jobs than road infrastructure because of their relative labor intensity and lower leakages (purchases made out-of-state). In the case of Anchorage, the road project (resurfacing an existing road) was relatively labor-intensive and the materials were almost completely sourced from in-state suppliers. The bicycle and pedestrian facilities, on the other hand, involved more goods imported from out-of-state, such as some lighting fixtures and aluminum products.

Of the 58 projects studied, the lowest job total job creation was 5 total jobs per $1 million, for road-only infrastructure in Santa Cruz, California. The highest was over 14 total jobs per $1 million, for cycling infrastructure in Baltimore, Maryland. The median level of total job creation for our 58 projects was about 9 jobs per $1 million.

Discussion

There are three main reasons why employment impacts could differ between types of projects and between cities. These are:

- Labor intensity
- Leakages (spending on goods from out-of-state)
- Wage differences

Labor intensity refers to the ratio of labor to capital (materials, plant, and equipment). In labor-intensive industries such as construction and engineering, more of the total dollars spent go to wages and salaries. In more capital-intensive industries such as cement manufacturing, relatively fewer dollars are spent on salaries and more are spent on materials and equipment, in comparison to labor-intensive industries. Thus in the projects we studied, the infrastructure with higher labor intensity of production will create more jobs for a given level of spending. This is the primary reason why pedestrian-only and bicycle-only infrastructure create more jobs than road-only projects. For the former types, a greater portion of the spending is used to employ construction workers and engineers, both labor-intensive industries. In the latter, a greater proportion of the total spending is used for materials such as asphalt and stone products. Thus, for example, a bike path which requires a great deal of planning and design will generate more jobs for a given level of spending than a road project which requires a greater proportion of heavily mechanized construction equipment and relatively less planning and design. Engineering and related services are labor-intensive items, thus projects whose budgets have a higher percentage of these services will create more jobs.

The other reason for variation in the employment impacts presented here is leakages. When purchases of materials are made, some of these materials are supplied by in-state businesses, creating jobs within the city and state. However, there is some amount of "leakage", or flow of dollars out of the state, resulting from purchases of goods that come from other states or countries. When a higher percentage of goods can be provided by in-state suppliers, the leakages are lower and the total in-state employment effect is higher. For example, some of the materials needed to build a road include asphalt, stone, and iron manhole covers. If a road is being built in California and all of these products can be bought from companies in California, then jobs will be created in the state. If, however, some of these products need to be purchased from suppliers in another state, then some jobs will be created in that state and fewer jobs will be created in California. These out-of-state purchases are considered "leakages" and reduce the in-state employment impact.

The leakages appear as lower indirect effects and lower induced effects. A city such as Anchorage, Alaska, which has to source some of its project inputs from other states, will have lower indirect and induced job creation within the state. As mentioned above, even within a city such as Anchorage, there can be differences between projects in the extent to which goods are sourced from in-state or out-of-state suppliers. For the sake of comparison, after using state-specific data to estimate our 58 separate projects, we also estimated the same projects using IMPLAN v3 with the 2008 U.S. national data set. When we use the national data, jobs that are created through interstate trade are captured -- there are no leakages from purchases made from other states. Thus in our example of the road-building project in California, the national estimate would capture both the jobs created in California as well as the jobs created in Arizona, Oregon, or any other state which supplies goods for the road building project in California. However when we use the California data set, we estimate only the jobs created in California. This is an accurate estimate of the in-state job creation but understates the full job-creation effect of the project. The employment effects of using state data in comparison to national data are presented here:

As we see from the table, the direct jobs are nearly identical when using the national data set versus averaging the results of the state data. However, once we estimate the indirect and induced effects, we see a large difference. The national employment impact for indirect jobs is nearly twice as high (close to four jobs using the national data, compared to just over two jobs using the average of the state results). This difference captures the out-of-state leakages. At the national level, the only leakages are out of the country, while interstate trading creates jobs. At the state level, interstate trading creates jobs in other states, and therefore is not captured in the employment impacts of the state being studied.

The overall estimated employment effects of the projects studied here would therefore be higher if we counted indirect and induced employment creation in other states. As we see in the table above, nearly two additional indirect jobs are created in other states for each $1 million spent on these types of projects. Furthermore, because the induced effects also suffer from leakages, more than one additional job is created out of state through the induced effect for each $1 million spent on the projects studied here. If we added the jobs that are created in other states, both indirectly and through the induced effect, the 58 projects studied here would create an average of 3 additional jobs, or 32 percent greater employment creation, for each $1 million spent on transportation infrastructure.

The third reason why projects can differ in their job-creation potential is wage differences. It is beyond the scope of this study to evaluate differences in pay between various industries and cities. Therefore we cannot conclude whether or not wage differences play a role in explaining the variation in employment impacts among the projects presented here.

Comparison of state employment impacts to national employment impacts	Number of projects	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million
Average of all projects using state data	58	4.69	2.12	2.15	8.96
Average of all projects using national data	58	4.53	3.93	3.38	11.84
% above state effects		-3%	86%	57%	32%

One other point that deserves mention here is the difference between the employment estimates from the 58 transportation projects in this study and the results we obtained in our national study of infrastructure investments published in January 2009.[11] In the earlier study, we found that nationally, road infrastructure construction created about 19,000 jobs per $1 billion investment (or 19 jobs per $1 million, since the model is linear). In the 58 projects analyzed in this report, on average nine jobs are created per $1 million, or 12 jobs if we incorporate the job creation from out-of-state purchases. In the 2009 study, we used national data from 2006, while in this study we use state data from 2008. This may account for some of the variation in these estimates. However the main reason for this difference stems from the level of detail at which we analyzed the transportation infrastructure investments. In the earlier study, our estimate was derived from an employment multiplier which included all types of infrastructure construction, whereas in this study we collected very detailed costs on materials, design, construction, and other services. The resulting employment estimates are therefore much more specific to the particular projects we studied and vary from our earlier, more general national estimate.

Finally, the impacts studied in this report are specific to the design and construction of roads, bicycle, and pedestrian facilities. They do not consider the ongoing maintenance and use of these facilities. As mentioned above, other studies have estimated the economic benefits and non-economic impacts of the use of bicycling and pedestrian facilities, including revenues and jobs for local bike shops and other businesses. In addition to the use impacts, there is also employment associated with maintenance of these facilities, such as grounds-keeping. In short, the employment effects of bicycle and pedestrian infrastructure presented in this study represent only one portion of the total impacts.

CONCLUSION

The U.S. is currently experiencing high unemployment, unsustainable use of carbon-based energy, and a national obesity epidemic. All three of these problems can be partly addressed through increased walking and cycling. Providing pedestrian and cycling infrastructure for the purposes of commuting, recreation, and fitness, is arguably more important than ever before. In addition, this study finds that designing and building this infrastructure can also address the problem of unemployment, by creating jobs for engineers, construction workers, and workers who produce the asphalt, signs, and other construction materials.

We collected data from departments of transportation and public works departments in 11 cities nationwide and evaluated 58 separate projects. These projects ranged from road construction and rehabilitation, to building new multi-use trails and widening roads to include bike lanes and sidewalks. Using an input-output model with state-specific data, we estimated the employment impacts of each project and presented the results by project, by city, and by type. We found that on average, these various transportation infrastructure projects create 9 in-state jobs for each $1 million of spending and an additional 3 jobs if we include out-of-state effects. In addition, we found that the highest level of job creation was for bicycle-only infrastructure such as building or refurbishing bike lanes. These projects created up to 11.4 jobs per $1 million when we consider only in-state effects. This was followed by pedestrian-only infrastructure (such as sidewalks and pedestrian crossings) and multi-use trails, which created close to 10 jobs for each $1 million spent on the project. These findings suggest that when confronted with a decision of whether or not to include pedestrian and/or bicycle facilities in transportation infrastructure projects, planning officials should do so, not only because of the environmental, safety, and health benefits but also because these projects can create local jobs.

[11] Heintz, Pollin, and Garrett-Peltier (2009)

TABLES

Table 1. Top 20 industries: direct and indirect job creation from bicycle, pedestrian, and road infrastructure

Construction of other new nonresidential structures
Cut stone and stone product manufacturing
Concrete product manufacturing (not including ready-mix concrete or concrete pipes)
Ready-mix concrete manufacturing
Greenhouse, nursery, and floriculture production
Architectural, engineering, and related services
Asphalt paving mixture and block manufacturing
Other support services (includes traffic maintenance)
Concrete pipe, brick, and block manufacturing
Sign manufacturing
Plastics product manufacturing (other than pipes, bottles, packaging materials)
Wholesale trade businesses
Transport by truck
Employment services
Food services and drinking places
Services to buildings and dwellings
Management of companies and enterprises
Real estate establishments
Maintenance and repair construction of nonresidential structures
Accounting, tax preparation, bookkeeping, and payroll services

Table 2: National Average Employment Impacts by Project Type

Project type	Road	Bicycle	Pedestrian	Off-street trail	Number of projects	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million
Total, all projects					58	4.69	2.12	2.15	8.96
Bicycle infrastructure only		•			4	6.00	2.40	3.01	11.41
Off-street multi-use trails				•	9	5.09	2.21	2.27	9.57
On-street bicycle and pedestrian facilities (without road construction)		•	•		2	4.20	2.20	2.02	8.42
Pedestrian infrastructure only			•		10	5.18	2.33	2.40	9.91
Road infrastructure with bicycle and pedestrian facilities	•	•	•		13	4.32	2.21	2.00	8.53
Road infrastructure with pedestrian facilities	•		•		9	4.58	1.82	2.01	8.42
Road infrastructure only (no bike or pedestrian components)	•				11	4.06	1.86	1.83	7.75

Employment Impacts by City

In the tables below, we present the employment impacts of various categories of transportation infrastructure by city. Each line in the table represents a distinct project. For most projects, multiple cost estimates were averaged in order to estimate the employment impact, as described in the "Methodology" section of this report. Rather than using specific site or street names for these projects, we simply list the type of project (for example, "Road Infrastructure with Pedestrian Facilities") and list an A, B, or C after the category name if more than one project of this type is listed in a city.

Anchorage, Alaska									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Pedestrian infrastructure only			•		5.6	1.9	2.07	9.57	
Road infrastructure with bicycle and pedestrian facilities	•	•	•		3.9	1.3	1.44	6.64	
Road infrastructure with pedestrian facilities – a	•		•		5.5	1.6	1.96	9.06	
Road infrastructure with pedestrian facilities – b	•		•		5.7	1.8	2.07	9.57	9.1
Road infrastructure with pedestrian facilities – c	•		•		5.2	1.6	1.88	8.68	
Road infrastructure only	•				7.2	1.9	2.51	11.61	
Average all projects					5.52	1.68	1.99	9.19	

Austin, Texas									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Bicycle infrastructure only		•			5.9	2.4	2.73	11.03	
Off-street multi-use trails – a				•	5.9	2.4	2.73	11.03	11.1
Off-street multi-use trails - b				•	5.8	2.6	2.76	11.16	
Road infrastructure with bicycle and pedestrian facilities	•	•	•		6.2	2.8	2.96	11.96	
Road infrastructure with pedestrian facilities – a	•		•		5.3	2.3	2.5	10.1	8.37
Road infrastructure with pedestrian facilities – b	•		•		3.1	1.9	1.64	6.64	
Average all projects					5.37	2.4	2.55	10.32	

Baltimore, Maryland									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Bicycle infrastructure only – a		•			7.9	2.5	3.95	14.35	13.04
Bicycle infrastructure only – b		•			6.1	2.4	3.23	11.73	
Pedestrian infrastructure only			•		6	2.2	3.1	11.3	
Road infrastructure with pedestrian facilities – a	•		•		3.8	1.5	2	7.4	7.1
Road infrastructure with pedestrian facilities – b	•		•		3.4	1.5	1.9	6.8	
Average all projects					5.44	2.02	2.84	10.32	

Bloomington, Indiana									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Off-street multi-use trails – a				•	5	1.9	2.12	9.02	8.89
Off-street multi-use trails – b				•	4.8	1.9	2.05	8.75	
Pedestrian infrastructure only			•		4.4	2.2	2.02	8.62	
Road infrastructure with bicycle and pedestrian facilities – a	•		•		3.8	1.7	1.69	7.19	7.25
Road infrastructure with bicycle and pedestrian facilities – b	•		•		3.9	1.7	1.72	7.32	
Road infrastructure only	•				4.6	1.6	1.9	8.1	
Average all projects					4.42	1.83	1.92	8.17	

Concord, New Hampshire									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Pedestrian infrastructure only – a			•		6.7	1.9	2.71	11.31	10.39
Pedestrian infrastructure only – b			•		5.4	1.8	2.27	9.47	
Road infrastructure only – a	•				4.8	2	2.14	8.94	8.11
Road infrastructure only – b	•				3.3	2.1	1.7	7.1	
Road infrastructure only – c	•				4.3	2	1.98	8.28	
Average all projects					4.9	1.96	2.16	9.02	

Eugene, Oregon									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Pedestrian infrastructure only			•		4.9	2.8	2.42	10.12	
Road infrastructure with bicycle and pedestrian facilities – a	•	•	•		3.7	2.2	1.85	7.75	9.15
Road infrastructure with bicycle and pedestrian facilities – b	•	•	•		4.6	3	2.38	9.98	
Road infrastructure with bicycle and pedestrian facilities – c	•	•	•		5	2.4	2.32	9.72	
Road infrastructure with pedestrian facilities	•		•		4.5	2.2	2.1	8.8	
Road infrastructure only	•				3.4	1.8	1.63	6.83	
Average all projects					4.35	2.4	2.12	8.87	

Houston, Texas									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Off-street multi-use trails				•	3.7	2.4	1.83	7.93	
Road infrastructure with bicycle and pedestrian facilities – a	•	•	•		4.2	2.3	1.95	8.45	8.32
Road infrastructure with bicycle and pedestrian facilities – b	•	•	•		3.9	2.4	1.89	8.19	
Average all projects					3.94	2.36	1.89	8.19	

Lexington, Kentucky								
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 mil-lion	Induced jobs per $1 million	Total jobs per $1 million
Off-street multi-use trails				•	5.1	2	2.12	9.22
On-street bicycle and pedestrian facilities		•	•		4.9	2.2	2.12	9.22
Road infrastructure with bicycle and pedestrian facilities	•	•	•		4.3	1.9	1.86	8.06
Average all projects					4.77	2.03	2.03	8.83

Madison, Wisconsin									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Off-street multi-use trails				•	4.2	2.1	1.91	8.21	
Pedestrian infrastructure only – a			•		5.5	2.6	2.46	10.56	8.99
Pedestrian infrastructure only – b			•		3.6	2.1	1.73	7.43	
Road infrastructure with bicycle and pedestrian facilities	•	•	•		4.4	2.5	2.09	8.99	
Road infrastructure with pedestrian facilities	•		•		4.7	2	2.03	8.73	
Road infrastructure only	•				3.9	1.7	1.7	7.3	
Average all projects					4.38	2.17	1.99	8.54	

Santa Cruz, California									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Bicycle infrastructure only		•			4.1	2.3	2.14	8.54	
On-street bicycle and pedestrian facilities		•	•		3.5	2.2	1.91	7.61	
Pedestrian infrastructure only – a			•		5.6	2.9	2.85	11.35	10.35
Pedestrian infrastructure only – b			•		4.1	2.9	2.34	9.34	
Road infrastructure only – a	•				2.2	1.5	1.24	4.94	5.07
Road infrastructure only – b	•				2.3	1.6	1.31	5.21	
Average all projects					3.63	2.23	1.97	7.83	

Seattle, Washington									
Transportation infrastructure category	Road	Bicycle	Pedestrian	Off-street trail	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million	Total jobs (avg. by type)
Off-street multi-use trails – a				•	6.2	2.6	2.69	11.49	10.38
Off-street multi-use trails – b				•	5.1	2	2.17	9.27	
Road infrastructure with bicycle and pedestrian facilities – a	•	•	•		3.9	2	1.8	7.7	8.29
Road infrastructure with bicycle and pedestrian facilities – b	•	•	•		4.3	2.5	2.08	8.88	
Road infrastructure only – a	•				4.8	2.5	2.23	9.53	8.49
Road infrastructure only – b	•				3.9	1.8	1.74	7.44	
Average all projects					4.7	2.23	2.12	9.05	

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Eugene, Oregon: City of Eugene Public Works Engineering

Houston, Texas: City of Houston Public Works and Engineering Department

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