# Transforming Mobility Barriers to Connectivity: Examining the Impact of the AeroATL Greenway Plan in Reconnecting Communities Around Aerotropolis Atlanta

Transportation Research Record
2020, Vol. XX(X) 1–15

DOI: 10.1177/ToBeAssigned
journals.sagepub.com/home/trr
SAGE

**Xiaofan Liang[1] and Perry Pei-Ju Yang[2]**
**[1]Corresponding Author; University of Michigan - Ann Arbor, Ann Arbor, US; xfliang@umich.edu**
**[2]Georgia Institute of Technology, Atlanta, US; perry.yang@design.gatech.edu**

**Abstract**
Airports are critical connectivity infrastructure that support regional mobility flows and elevate cities' positions within an interconnected global network. However, airports can also act as mobility barriers, encouraging car-centric developments that hinder locals from reaching non-airport destinations. We use Hartsfield-Jackson Atlanta International Airport (H-JAIA) and the AeroATL Greenway (the Greenway)—a newly proposed trail plan in the Atlanta Aerotropolis region—as a comparative case study to explore contrasting roles of network flow infrastructure. We quantified the barrier effect of H-JAIA on biking and walking trips using a distance-based metric (the ratio of Euclidean to modeled travel distance), evaluated the Greenway's potential impact through scenario modeling with origin–destination flow data from a regional activity-based model, and developed a public-facing web tool that allows users to select any origin and destination pair on a map and view how the Greenway would alter trip routing and experience. Our results provide evidence that H-JAIA and its surrounding environment impede local mobility flows. The Greenway has a stronger impact on enhancing trip experience than on reducing travel distance, though the specific effects vary by segment and implementation scenario. These findings were validated in a participatory modeling workshop, where community stakeholders explored the tool and provided feedback based on their lived experiences. This integration of narrative framing, data-driven methods, and interactive engagement helps strengthen community trust and build momentum for future Greenway implementation.

## Introduction

Airports are critical infrastructure with multiple stakeholders in mobility networks. They help regions improve global competitiveness and drive local economies. However, at the micro level, an airport is a large and restricted land use zone that is difficult for the nearby residents to move around and an 'infrastructure sink' that congregates resources to serve aviation and related industries alone without considering the needs of the adjacent communities.

Hartsfield-Jackson Atlanta International Airport (H-JAIA) presents a significant context that embodies the conflicting regional versus local connectivity priorities. H-JAIA, as the largest flight hub of the U.S., had 108 million passengers in 2024, making it the world's busiest airport by passenger traffic until 2024 (*1*). Yet, based on the Longitudinal Employer-Household Dynamics data in 2022, only 2% of its workers live in census tracts immediately surrounding the airport. The disconnected communities nearby the airport are also well below the median income level and host a large African American population. In 2016, Aerotropolis Atlanta, a nonprofit public-private partnership organization, and the ATL Airport Community Improvement Districts, proposed an AeroATL Greenway Plan to improve walking and biking connectivity in the Aerotropolis region. This connectivity infrastructure envisions alleviating the car-centric traffic, providing a walkable public space, and connecting communities around H-JAIA.

This paper uses AeroATL Greenway Plan as a case study to critically examine how such a connectivity infrastructure for Aerotropolis residents can contest the mobility barriers posed by H-JAIA and its surrounding built environment. Three research questions are proposed: 1) how can we define and measure the barrier effect of H-JAIA on nearby residents' mobility? 2) To what extent can the AeroATL Greenway Plan reduce walking and biking distances or improve the travel experience for Aerotropolis residents? 3) How can we enable the public to explore and evaluate individual trip scenarios with and without the Greenway?

To address these questions, we develop a simple yet scalable barrier metric based on origin–destination (OD) flow data from the Atlanta Regional Commission's activity-based model to quantify and visualize the airport's impact on local mobility. We then simulate six alternative network scenarios to assess how the Greenway may alter trip distances and trip experience. Finally, we prototype a public-facing web tool that enables users to explore these travel scenarios at the individual route level and test the tool in a participatory workshop to validate our modeling approach through local community feedback. We work with Aerotropolis Atlanta to understand contexts, set our goals, and engage with stakeholders.

This paper contributes a network-centric perspective for understanding how a major flow infrastructure—Hartsfield-Jackson Atlanta International Airport (H-JAIA)—functions as a barrier to local mobility, revealing inequities between regional and local network systems. Besides regional-scale modeling, our approach also emphasizes individual-level impacts by enabling route-specific evaluations of the Greenway interventions. We prototype a replicable "narrative–evidence–action" pipeline using only publicly available data: recognizing mobility barriers, evaluating the intervention effect of the AeroATL Greenway using scenario modeling, and developing an accessible public-facing web tool that allows community members to interact with Greenway data and assess how their own trips could be improved. In particular, the route-level engagement enabled by the web tool is rarely supported in existing infrastructure planning research and provides a novel way to understand what particular design of a Greenway segment (e.g., whether to connect a dead end) creates big difference for trip distance and facilitate public understanding and alignment between technical evaluations and lived experience. While our barrier metric is intentionally simplified to serve as an entry point for diagnosis, it enables transparent communication and supports scenario evaluation within a broader framework that prioritizes action-oriented and community-validated planning. As the United States devoting more funding into removing barrier infrastructure, as exemplified by USDOT's "Reconnecting Communities" grant program (*2*), such perspectives and methods can help policy makers and planners to contest existing inequality in connectivity infrastructure and support the development of alternative scenarios.

## Literature Review

### *Airport-centric Urbanism*

The concept of Airport City, or Aerotropolis, turns the concept "city airport" to "airport city", in which a globally significant airport locates at the city center and concentric rings of uses radiate outward (*3*). This notion resembles the classical concentric land use model where the land closest to the airports are prioritized for just-in-time logistics. More recent proposals of the Aerotropolis concept move beyond viewing the airport solely as utility infrastructure; they reimagine the airport city as a livable environment where people meet, interact, and communicate in an urban setting—a form of "public space" that connects global city networks with local communities (*4*). As such, airports become key identifiers for 'global cities' and a mean to improve global competitiveness to drive local economy (*5*). Thus, planning for airport cities is often associated with economic strategies to incorporate non-aviation industrial and commercial uses around the airports (*6, 7*).

The market-driven and economic-based development of the airport area has received criticism from planners and pushback from local communities. Researchers have raised environmental, economic, and social concerns that discredit the assumptions that the local regions will necessarily benefit from the economic overflow of the airport expansion. For instance, the Atlanta Hartsfield-Jackson International Airport exemplifies a failure where the development potential of the airport was halted by chronic noise problems, blighted and unattractive neighborhoods surrounding the airport, and the inability to coordinate regional collaborations (*8*). These neighborhoods tend to have higher proportions of people of color, renters, and low-income families (*9*). A case study on Memphis International Airport also revealed that the existence of an airport does not promise fair job growth; many black and female workers living in the Aerotropolis are underrepresented in airport-related jobs (*10*). In addition, an airport is a 'sink of infrastructure', considering the massive investment of roads, public transit, land use, information technology, institutions, and capital investments poured into one location (*11*). Therefore, the airport's surrounding communities are often overshadowed by airport demands, where infrastructure is oriented to serve people transiting in and out of the area rather than the locals' needs.

### *Critical Perspectives on Airports in a Network of Flows*

Aside from their economic functions, airports are transportation infrastructure systems for moving travelers. The flows between airports have been used to create hierarchies of cities in the world (*12*). In these networks of flows, airports are simply abstracted into nodes, but their built environments in urban space can incur dual reality. In theory, a node or an edge can be divisive or connecting depending on its typology (*13*). For example, highways and heavy-traffic roads can facilitate mobility connections among access points, but also create borders and reinforce the spatial and social segregation of activity spaces (*14*). Similarly, airports contrast with the surrounding communities' time, space, and flows arrangements. For example, airport is an incredibly mobile place, not only because it hosts transient air passengers, but also because its built environment changes at a much faster speed than the nearby communities (*15*). Many airport businesses are more dependent on remote suppliers and customers than those nearby (*16*). Still, studies have yet to apply such network perspective to analyze dynamics between airports and local communities or develop metrics to measure the impact of airports on local mobility flows. Little is known about what planning strategies can be used to mitigate airports' negative effects on local flows and the effectiveness of these strategies.

### *Scenario Planning and Participatory Modeling*

Deliberating the tradeoffs between a built environment with airport-dominated network infrastructure or locally favored connectivity scheme requires evaluating the outcomes of different scenarios. Scenario planning and participatory modeling are effective planning approaches to engage diverse stakeholders in an iterative process to create and evaluate scenarios and support the decision-making actions of the group (*17, 18*). For example, typical steps in a scenario planning project include uncertainty analysis, scenario creation, scenario analysis, and planning and implementation (*17*). Similarly, steps in an effective participatory modeling framework include defining complex problem, developing concern profiles, co-developing models and scenarios, simulation, deliberating trade-offs, and implementation (*19*). The former focuses on developing and exploring alternative planning scenarios, while the latter explicitly directs the collective efforts to interact with the model's quantitative results.

Prior applications of scenario planning and participatory modeling often model land use patterns and socio-environmental interactions as grid systems (*17, 18*). Yet, transportation scenarios often require creation of new road networks and modeling of multidimensional flow dynamics (e.g., by mode, by trip purposes, by flow volumes) that are difficult to accomplish with one set of tools. Some case studies and tools were developed to address these challenges but the evaluation of the scenarios was limited to the regional scale (e.g., city or traffic analysis zone level) (*20, 21*). Our research fills the gaps by developing an analytical process and a web tool that can evaluate the impacts of the Greenway at the scenario and the route level, which is important for community members to perceive the impact of the Greenway based on their personal experience.

## Project Context: Aerotropolis Atlanta and AeroATL Greenway

Hartsfield-Jackson Atlanta International Airport (H-JAIA) is a major economic driver for metro Atlanta. Yet, only in recent years have collaborative efforts emerged to coordinate regional economic development, particularly to unite diverse stakeholders under a shared vision and strategy that fully leverages the airport's potential.

In 2014, the ATL Airport Community Improvement Districts (AACIDs) and the Aerotropolis Atlanta Alliance were established to spearhead development strategies for metro Atlanta's southside. AACIDs, a special form of local government, are responsible for governing public services and facilities in the district, including constructing and maintaining roads and implementing design plans (*22*). In contrast, Aerotropolis Atlanta, a public-private nonprofit partnership, plays a coordinating role by facilitating regional development strategies beyond the boundaries of the CID and bringing all stakeholders together around a unified plan.

Since then, a diverse coalition has come together, including H-JAIA, the Atlanta Regional Commission (ARC), Aerotropolis Atlanta, AACIDs, local governments, state agencies, corporations, and nearby colleges, to collaborate on regional planning. Although the concept of Aerotropolis is fluid and evolving, the most recent report by Aerotropolis Atlanta defines its boundaries as including "the cities of Atlanta, College Park, East Point, Fairburn, Forest Park, Hapeville, Lake City, Jonesboro, Riverdale, Union City, Lovejoy, South Fulton, Palmetto, Chattahoochee Hills and Unincorporated Clayton County. The total area is around 176 square miles and the population is around 550,000." (*23*). Currently, Aerotropolis Atlanta has identified workforce development, mobility, and catalytic development (through new land use and investment strategies) as key priorities.

One of the flagship mobility initiatives led by Aerotropolis Atlanta is the AeroATL Greenway Plan, which envisions a multi-use trail system that connects the Atlanta BeltLine to the Flint River. The trail network aims to link major town centers, new development sites, and communities long divided by airports, highways, and railways. In 2018, ARC funded the creation of the AeroATL Greenway Plan, and by 2020, feasibility studies identified seven Greenway segments as "Model Miles" for prioritized implementation (*24*). In 2024, the project received a 50 million dollar federal grant from USDOT's Reconnecting Communities Program to support expansion efforts (*25*).

Complementary to the Greenway Plan, ARC and local Aerotropolis governments have also led regional comprehensive plans and transportation initiatives to promote a more walkable and bikeable built environment. Notable projects include Finding the Flint (2017) (*26*), which focuses on revitalizing the Flint River corridor, and College Park's Airport City Master Plan (2019)

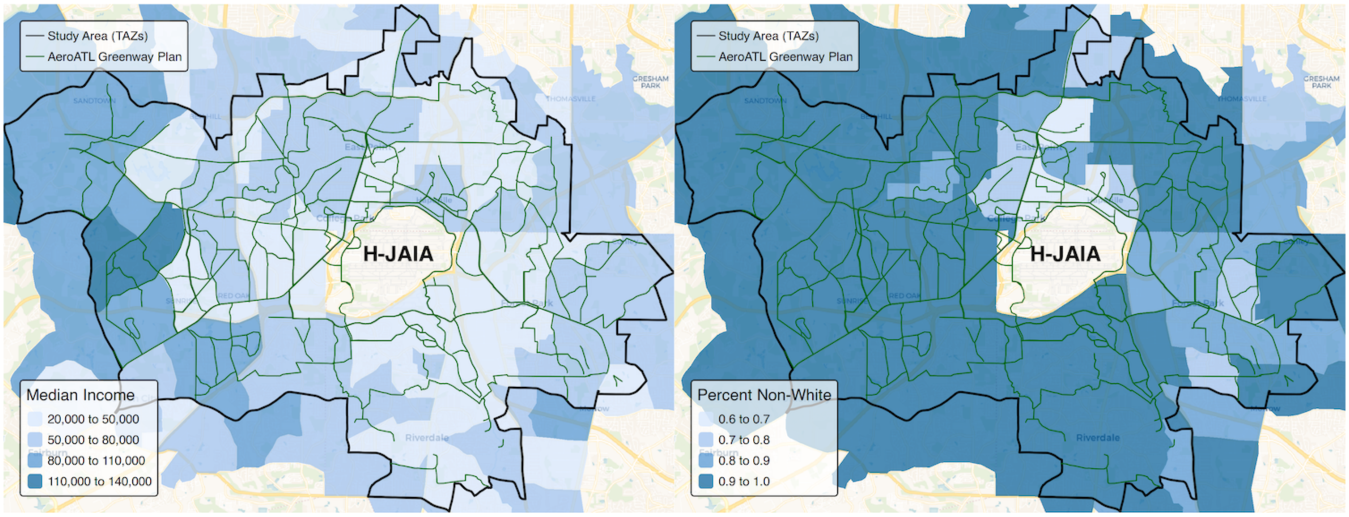


**Figure 1.** Median household income and percentage of non-white population in areas adjacent to the proposed AeroATL Greenway. Data come from U.S. Census ACS 2019-2023.

(*27*), which envisions transforming 320 acres of greenfield land into a community of live, work and play. Together, these efforts reflect the growing political and economic momentum to advance the AeroATL Greenway Plan.

The communities that stand to benefit most from the Greenway include the cities of College Park, East Point, Hapeville, South Fulton, and parts of Clayton County. Figure 1 shows the demographic characteristics of census tracts intersecting the study area (details provided in the next section). Most of these areas—particularly those closest to the airport—have median household incomes below $80,000, which is under the metro Atlanta median ($82,000). They also feature a high concentration of racial minorities, with non-white populations exceeding 90%, including a significant share of African American residents. Historically, these communities have been overlooked in urban infrastructure investments, especially for pedestrian and bicycle facilities. The AeroATL Greenway Plan offers a critical opportunity to address this infrastructure gap.

Yet, the driving narrative of the Greenway Plan has centered on expanding public infrastructure for biking and walking and enhancing overall quality of life. Few studies have systematically examined the disconnections in the Atlanta Aerotropolis area or assessed the extent to which the Greenway Plan will actually improve travel distances and experiences for residents. Signs of disconnection can be inferred from analyses of the fragmented transit network. For instance, our preliminary zoom-in analysis of the public transit system near the airport reveals that most bus routes and MARTA (subway) lines primarily move people to and from H-JAIA, but not across the airport. Public transit travel times are also two to three times longer than driving—especially as the distance between traffic analysis zones increases—highlighting weak cross-airport mobility connections (see Figure 2). This paper, therefore, proposes a full "narrative-evidence-engagement" cycle, including an easy-to-compute barrier metric to quantify community disconnection in the Greenway Plan area, evaluates the plan's effectiveness in improving residents' walking and biking accessibility, and deploys a web tool that allows individual assessment of the impact of the plan on daily trips.

## Research Design: Data and Methods

### *Study Area and Scope*

The study area for this paper includes traffic analysis zones (TAZs) that intersect with the AeroATL Greenway Plan. TAZs are spatial units designed by planning officials to record and simulate transportation modeling data. Figure 3 shows the extent of the study area centered by H-JAIA.

We use the AeroATL Greenway Plan (in short, the Greenway) Blueprint published by Aerotropolis Atlanta Alliance in 2018 to define the scope of the Greenway network (*24*). Our scenario computation focuses on the existing bike paths and segments that are planned to be implemented first (see Figure 3), which includes Model Miles (in short, MM) and Priority Network (in short, PN). Model Miles are eight short trail segments spread across seven jurisdictions in Aerotropolis, while Priority Network connects and extends all Model Miles (see Results section for exact locations for MM). Still, these Greenway segments may not connect with the existing bike paths.

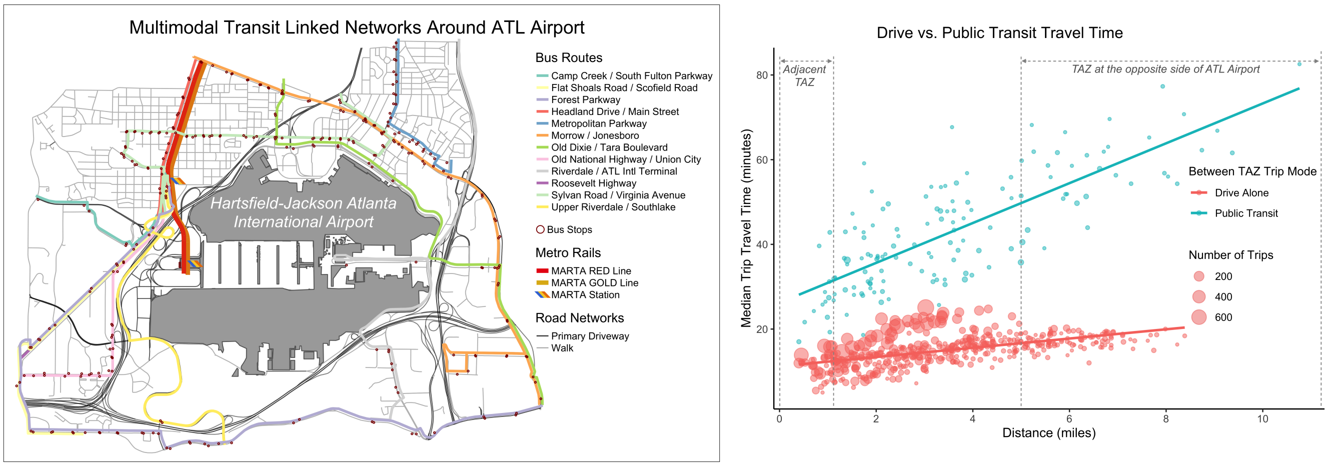


**Figure 2.** (left) Multimodal Transit Linked Networks in Traffic Analysis Zones (TAZs) around H-JAIA, which shows limited public transit options across the airport versus in-and-out of the airport. (right) Driving versus public transit travel time between TAZs around H-JAIA. Data comes from the ARC Open Data hub and activity-based model. Graphics were created in 2022.

.

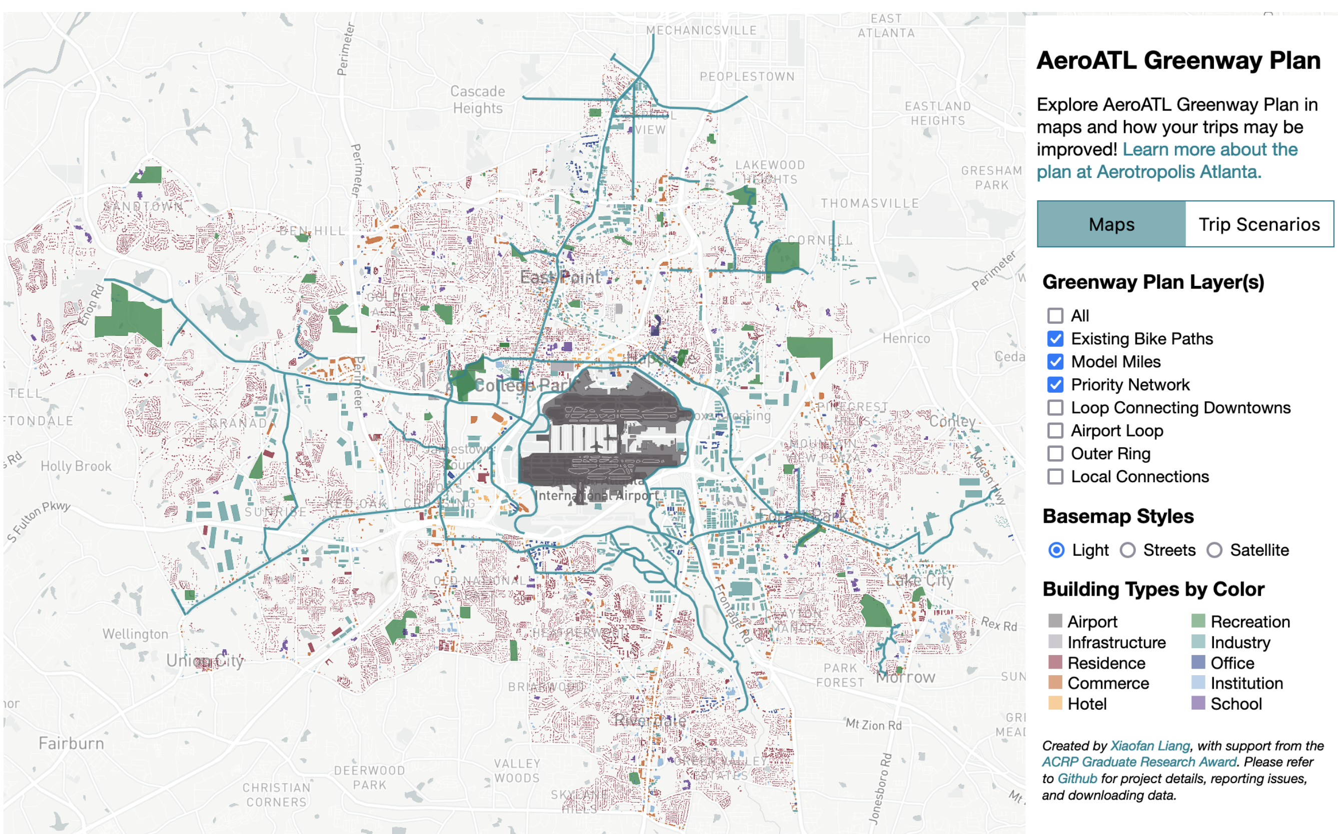


**Figure 3.** An image from the AeroATL Greenway Plan web tool that shows the study area, parcel-level land uses, and parts of the Greenway Plan (teal lines) used in scenario modeling computation (existing bike paths, Model Miles, and Priority Network.

## *Data*

All the data were clipped and filtered to be within the study area. First, we extracted origin and destination (OD) flow data (n=301772) from Atlanta Regional Commission (ARC)'s the most updated Activity-based Travel Demand Model in 2019.

Each row of the OD data represents a simulated trip with the origin TAZ, destination TAZ, trip purpose (e.g., work), trip distance, and trip mode. We use this dataset to quantify and visualize the barrier effect of H-JAIA.

Building polygon shapefiles are computer-generated building footprints from Microsoft Maps, publicly available through GitHub (*28*). This building dataset is then spatially joined with TAZ shapefiles (acquired through ARC), land use parcels (acquired through Fulton and Clayton County GIS office), and the job count data from Longitudinal Employer-Household Dynamics (LEHD) dataset. We use the building-level information to disaggregate the TAZ level ODs to building level ODs and compute routing distances between buildings under various network scenarios.

Our network scenarios include road networks from three sources: 1) the Greenway Plan, 2) existing bike path shapefiles published by ARC, and 3) road data from OpenStreetMap (OSM). We then manually integrated these three networks in QGIS for routing, such as snapping the Greenway Plan and the existing bike paths along the OSM road networks and connecting the breakpoints at each intersection across all three networks.

## *Measurement of H-JAIA's Barrier Effect*

We define a built environment's *barrier effect* as the extra cost to travel across it, measured by the ratio between its two surrounding points' Euclidean distance (i.e., shortest possible distance) versus travel distance. We adapt this term from landscape ecology research that examines how built environment such as highways and specific urban forms impede animals' movements (*29*). If the *barrier effect* is high (i.e., low ratio between Euclidean vs. travel distance) between two points, we assume the built environment between the two points inhibits efficient travels and vice versa. Thus, this metric is flexible to measure the *barrier effect* of an area in any shape.

We use the Activity-based Model's TAZ-to-TAZ OD data to represent travel demands around H-JAIA. Trips from and to the H-JAIA TAZ (encompassing H-JAIA terminals) are removed as we focus on local mobility flows independent of H-JAIA. Then we calculated the *barrier effect* between TAZ centroids in each mode (driving alone, biking, and walking) and visualized the effects on maps. If H-JAIA and its surrounding environment are mobility barriers, we expect to see a high *barrier effect* for trips across the airport or its nearby area.

## *Scenario Modeling and Computation*

In our case study, modeling AeroATL Greenway comes with two sets of scenarios: one set is related to which Greenway segments should be implemented first (i.e., we call them network scenarios), and the other set is related to what origin-destination trips are tested along the networks (i.e., we call them trip scenarios). The interactions between these two sets of scenarios create many uncertainties and nonlinear dynamics that cannot be deliberated with reasoning alone. In addition, the goal of the Greenway is to support connectivity priorities of Aerotropolis residents, which aligns with the values of scenario planning and participatory modeling.

Our scenario modeling compares six network scenarios and computes two metrics for each. We call the network with existing roads and bike paths the *base scenario*, representing the baseline for comparison. Implementation of Model Miles (adding to the base scenario) is the *MM scenario*, and the implementation of Priority Network (adding to the MM scenario) is the *PN scenario*. Since we measure the impact of the Greenway through two modes (walking and biking), each of the three scenarios has two sets of road weights, leading to six network scenarios in total.

We use two metrics to evaluate the network scenarios: 1) trip distance, i.e., whether the Greenway implementation reduces travel (routing) distance for walking and biking trips, and 2) trip experience, i.e., whether the Greenway implementation increases the percentage of trip distance on the Greenway and residential roads.

Figure 4 shows detailed steps to integrate and process data from various sources for scenario modeling and computation. Few simulated trips in ARC Activity-based Model have walking or biking mode, so we assign those simulated trips with travel distances less than or equal to two miles (40 mins walk) and three miles (15 mins bike ride) as possible walking and biking trips respectively, so that we can have sufficient data to compute the barrier effect and capture the latent demand. Since many Model Miles segments are only a few hundred meters, a scale too small to be captured by TAZ level OD flows, we disaggregated the OD flows to the building level. Each TAZ trip is first matched to buildings with the corresponding TAZ and land use for the trip purpose (e.g., office land use is matched with trips with work purpose). Then we assigned the trip to a building more likely to have a high job count. To do that, we retrieved job count on the census block group level from the U.S. Census Longitudinal-Employer Dynamics dataset and distributed the jobs to buildings in those census block groups based on building area footprint scaled by land use purpose. For example,land use in the categories 'Office, Hotel, Commerce, Airport, Residence, Institution, and School' tends to have ae a dense employment per area footprint, so the scalar is one, while land use 'Industry, Recreation' and 'Infrastructure' tends to have fewer jobs per footprint, thus having a scalar of 0.2 and 0.1 respectively. Next, to assign a TAZ trip to a specific building in the origin and destination TAZ, we computed the percentage of jobs that building hosts in the

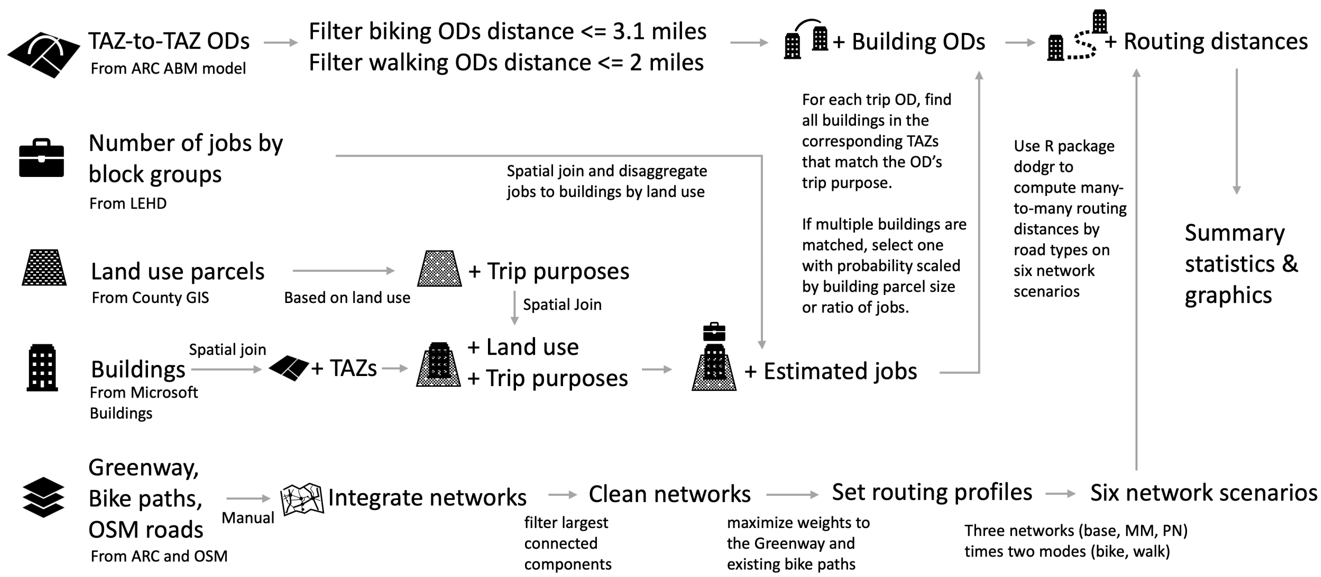


**Figure 4.** An image from the AeroATL Greenway Plan web tool that shows the study area, parcel-level land uses, and parts of the Greenway Plan (teal lines) used in scenario modeling computation (existing bike paths, Model Miles, and Priority Network.

corresponding TAZ and used that number as a probability for sampling the origin and destination building. Lastly, R package *dodgr* is used to compute trip (routing) distances (total and breakdown by road types) for each network scenario.

## *Participatory Modeling Workshop*

We hosted a one-hour, in-person participatory modeling workshop with Aerotropolis Atlanta's Community Development Collective members on June 13, 2023. We sent invitations to all members on the Collective, and those with availability showed up. Participants included ten people from local jurisdictions nearby H-JAIA, Aerotropolis Atlanta leadership, and regional planning agencies (e.g., Georgia Department of Transportation) who are key stakeholders in Aerotropolis Atlanta's greenway planning processes. The goal of the workshop is to use the interactive web tool we developed to help community stakeholders better understand how the Greenway may affect their communities' biking and walking trips and discuss how well the model outcome from the web tool aligned with their experience.

The workshop includes four steps: 1) an introduction presentation that sets the contexts, 2) a demo of the web tool, 3) a group discussion to decide on what trip scenarios to test and record the trip (i.e., origin-destination pairs) statistics using the web tool, and 4) a group sharing to convene the insights and next-steps. We asked participants to fill in a survey (i.e., worksheet) for step 3 and 4. The qualitative insights will be discussed in this paper. These workshop steps are designed to align with a framework of effective participatory modeling (*19*).

Our web tool is publicly available and has two tabs (see Figure 3 and Figure 5). In the Maps tab, users can filter different Greenway Plan segments, change basemap styles to highlight different built environment features, and hover to individual buildings to see attributes (such as building land use). In the Trip Scenarios tab, users can select any origin and destination locations on the map, and the tool will visualize the route with and without Priority Network implemented (i.e., the base network scenario vs. PN network scenario). The web tool will also report total trip distance and the percentage of trip distance on the Greenway to help users conceptualize the benefits of the Greenway. This particular design serves practical needs of Aerotropolis Atlanta to easily maintain and access the tool which is flexible enough to engage diverse stakeholders inquires and areas of interest.

We implemented the web tool through Mapbox JS. However, Mapbox JS does not support routing computation on user-customized networks (i.e., the Greenway Plan). Thus, we created a web API (with R *plumber* package) for the same R code we use in scenario modeling, containerized the API through Docker, and hosted the API on Google Cloud Run. As such, when users select an origin and destination on the web tool, a request is sent to both the Mapbox JS Direction Plugin and our custom API to retrieve routing geometry and statistics for the existing road networks and the Greenway (i.e., PN scenario), respectively (see GitHub for more details on data and the web tool implementation).

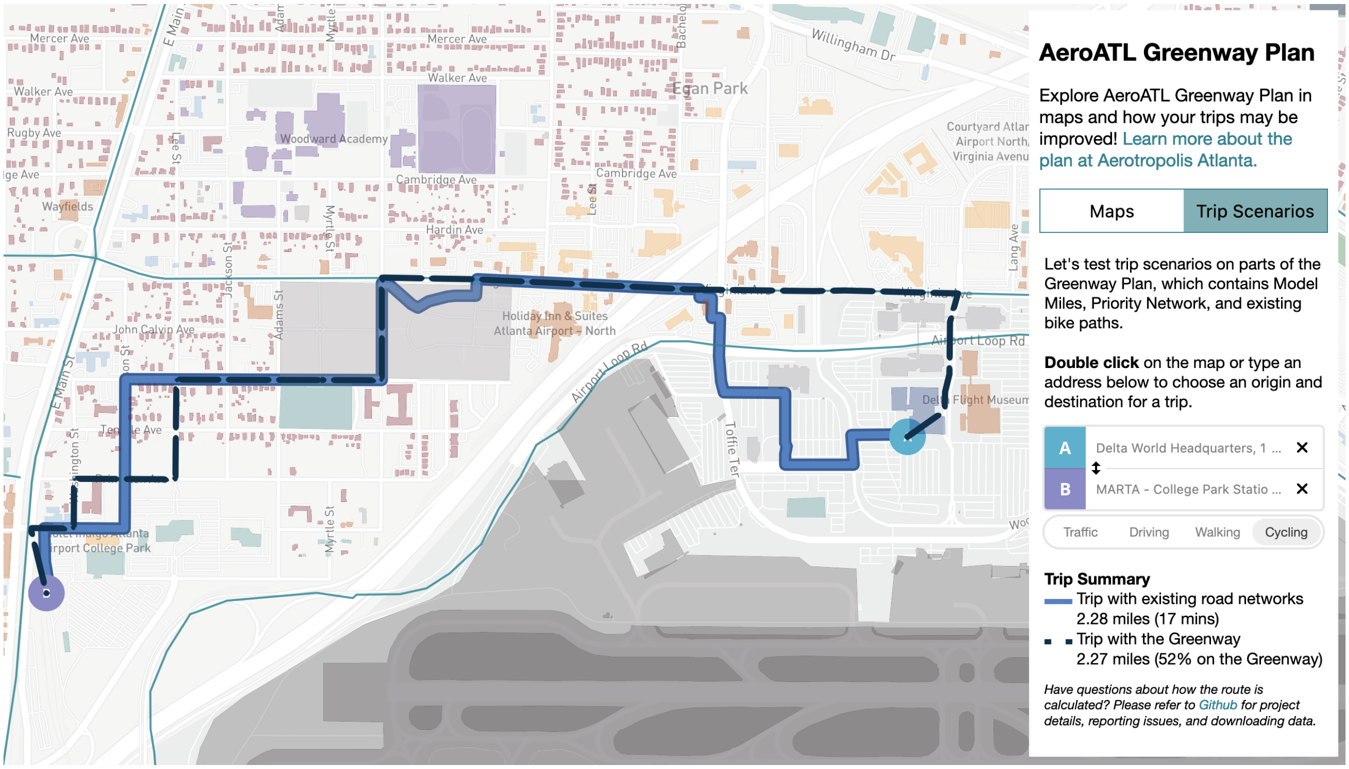


**Figure 5.** An image of the AeroATL Greenway Plan web tool (on the Trip Scenarios tab) that shows the interface for users to select the origin and destination for a trip scenario, the mode of the trip, and trip statistics in summary. The solid blue line shows the route without the Greenway, and the dashed black line indicates the route with the Greenway (PN scenario).

## Results

### *Barrier Effect of Atlanta Hartsfield-Jackson International Airport (H-JAIA)*

Figure 6 shows trips that encounter a high barrier effect in the study area. Not surprisingly, these trips concentrate around and across the H-JAIA, with travel distances two times (or longer) than their Euclidean distance (i.e., a ratio of 0.5). We found three elements that correlate with a high barrier effect based on descriptive observations of the base maps. First, H-JAIA, as a large and restricted land use, increases travel distances for trips that need to go across H-JAIA. The barrier is so big that few walking and biking trips are possible across the airport. Second, multiple highways (yellow lines in the base map) surround H-JAIA to efficiently move regional travelers in and outside of the airport. However, these highways also underpin many dark red lines (i.e., trips with a high barrier effect), indicating a lack of direct crossings for local mobility. While the first two elements are related to airport land uses, natural environments such as camp creak (Northwest of H-JAIA) and flint river (Southeast of H-JAIA) and poorly designed urban road networks can also be linear barriers that impede efficient local flows.

While Figure 6 shows fewer high-barrier trips in biking/walking mode as compared to the driving mode, H-JAIA's barrier effect is actually more prominent on biking and walking trips because few biking and walking trips were simulated in the first place. Only 7% of all trips in the study area are walking or biking based on the ARC's Activity-based Model, while more than 50% are predicted to be driving alone. Though these percentages are close to the average mode split in the Atlanta metro area, the gap still indicates uninviting built environments around H-JAIA for walking and biking purposes. In addition, 5.7% of biking and walking trips in the study area encounter high barrier effect (ratio of 0.5 or lower), compared with 4.2% of driving alone trips. These observations confirm our hypothesis that H-JAIA and its surrounding environment are mobility barriers for residents, with greater impacts on biking and walking trips than driving trips.

### *AeroATL Greenway Plan's Impact on Walking and Biking Trips*

To what extent can AeroATL Greenway Plan reduce H-JAIA's barrier effect and support local walking and biking trips? Figure 7 shows that, compared with the base scenario, implementation of the Model Miles (MM) and Priority Network (PN) in the Greenway Plan has minimal effect on the total walking or biking trip distances, but yields positive impacts on trip experience,

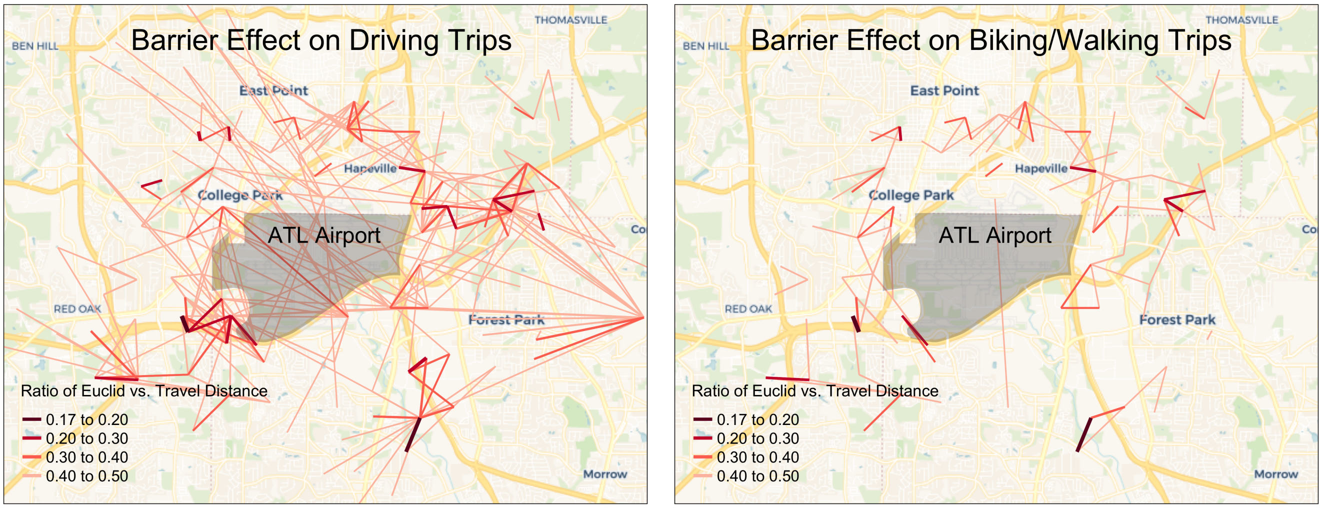


**Figure 6.** H-JAIA's barrier effect on driving, biking, and walking trips in the study area. Each line represents a trip between two traffic analysis zones (TAZs). Darker line color represents a high barrier effect, which means the travel distance is much longer than the shortest possible distance (i.e., Euclidean distance). The base map shows highways (in yellow) and rivers (in light blue)

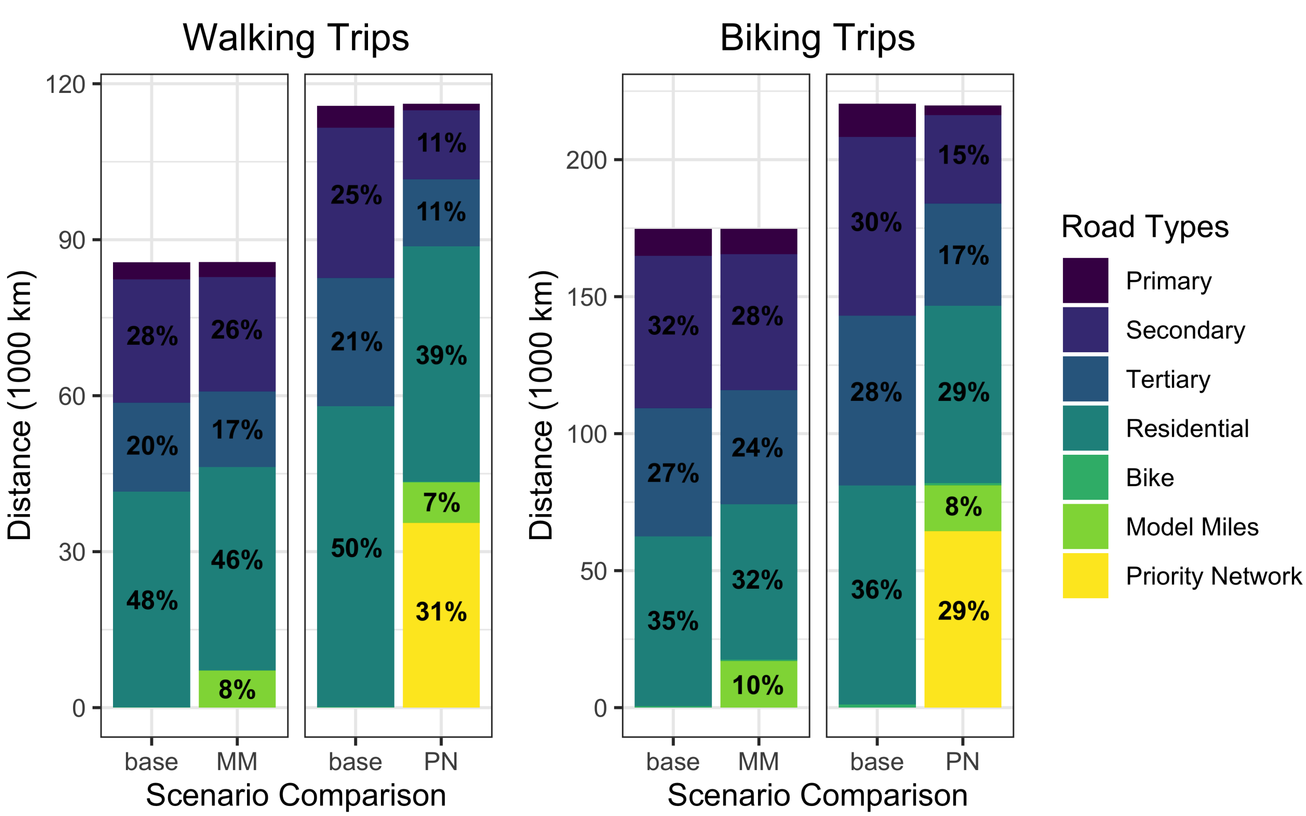


**Figure 7.** Comparing trip distance and distance by road types (trip experience) for walking and biking modes, under the base, Model Miles (MM), and Priority Network (PN) network scenarios.

especially in the PN scenario. With the breakdown of trip distance road types, we can see that under MM scenario, only 8-10% of trip distance will be covered by the Greenway. However, under the PN scenario, 37-38% of trip distance can be on the Greenway, and the proportion on primary, secondary, and tertiary roads are cut by half. Moreover, in the PN scenario, 77% of

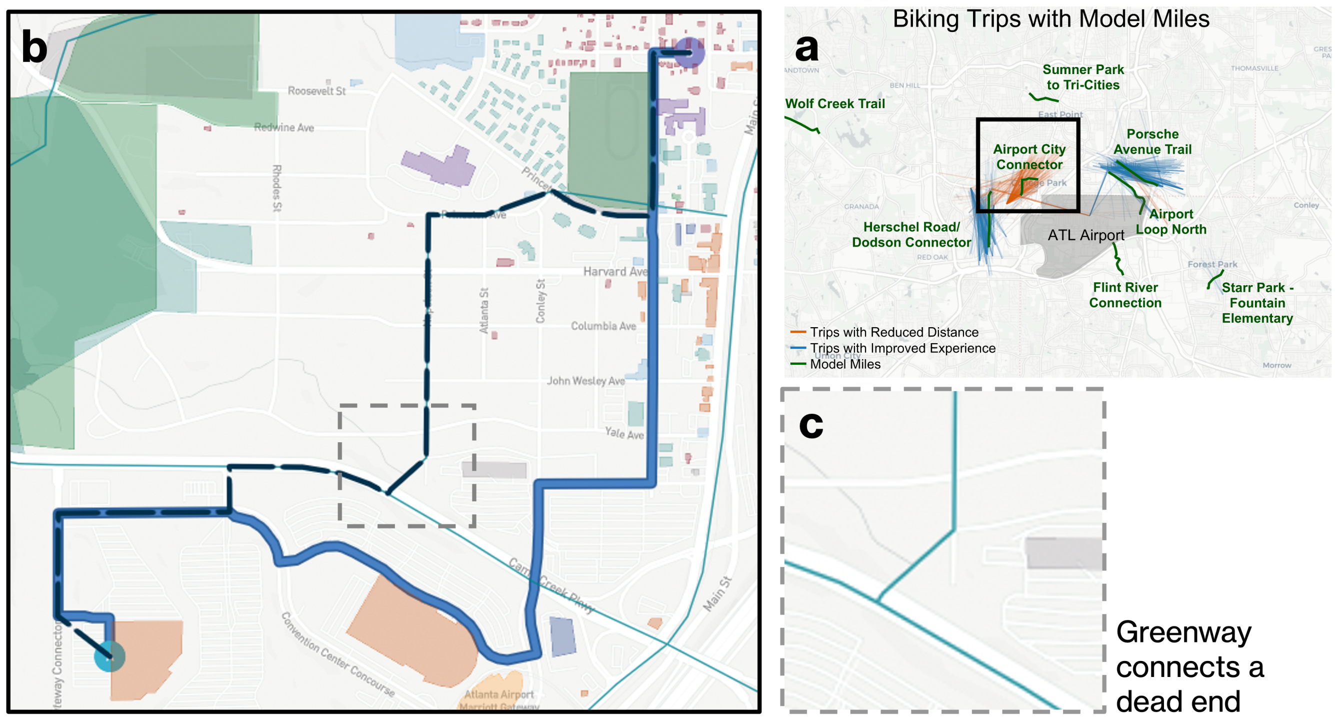


**Figure 8.** An illustration of how the web tool reveals critical point of intervention and reflection. a) Biking trips that will benefit from reduced distances or improved experience along Model Miles; b) Zoom-in view of one of the benefited trips near Airport City Connector Model Mile segment. The existing route is the blue solid line and the simulated route with Greenway is the black dash line; c) Zoom-in view of areas where Greenway makes a difference by connecting a dead end to a primary road, leading to a shorter route between downtown College Park and the convention center.

walking and 66% of biking trip distances can be on residential roads or the Greenway, which presents greater incentives for a mode switch from driving.

The greater impact of the PN scenario may have several causes. First, Model Miles are very fragmented (see Figure 8), while Priority Network (see Figure 3) unites these segments into a larger interconnected network, thus increasing trip distances that can be on the Greenway. Second, the interconnectivity of the Priority Network also incentives switching to alternative routes that favor the Greenway or residential roads.

We further mapped walking and biking trip origin-destination (ODs) pairs with significant benefits in the MM or PN scenario, defined as trips that will reduce more than 400 meters in travel distance or increase 50% more distance on the Greenway or residential roads. By isolating trips that have the greatest benefits, we can then use the web map tool to see route-level changes with and without the Greenway and understand where are critical points for interventions. Figure 8 shows an example where many trips along Airport City Connector segment reduced trip distances (color orange). A closer look with the web tool on the route level revealed that the Greenway connects a dead end to a primary road, which leads to a shorter path between popular locations. Combined with local knowledge, planners can further examine these benefit hotspots to gain insights.

## *Qualitative Insights from Participatory Modeling Workshop Survey*

We analyzed the workshop survey responses to assess whether the route-level evaluations presented by the web tool aligned with participants' personal experiences and how the web tool changed the participants' perceptions of the Greenway Plan (Figure 9). For any selected origin and destination, the tool displays a simulated route along with travel benefits—specifically, the reduction in travel distance and the percentage of the route that overlaps with the Greenway. This allows individual participants to envision how the Greenway could impact their daily trips (e.g., from home to the grocery store), based on the scenario computation method described earlier. Importantly, this was also the first time participants could actively toggle and interact with data related to the Greenway Plan, rather than passively receiving information from consultant reports. The goal of the workshop was to share our research prototypes, enable participants to assess the Greenway Plan through the lens of their lived experience, and validate our modeling approach—specifically, whether the suggested routes resonated with participants' real-world knowledge.

**Figure 9.** Pictures of the Participatory Modeling Workshop.

All participants (n=10) have reported that the trips with the Greenway are better, and they also agreed with the evaluations from the web tool. Based on the trips participants modeled with the web tool (in step 3), 80% have shorter distance (though most of the difference in distance is within half a mile) with the Greenway. Additionally, at least 80% of trip distances were covered by the Greenway. Yet, one participant pointed out that, "only places nearby the Greenway can maximize the trip benefits. You have to be in the network" (Anonymous, answer in the worksheet). In addition, one person brought up that for the same origin and destination pairs, suggested biking routes are much longer than the walking routes. This is because the routing algorithm favors biking routes through roads with less traffic but does not do the same for pedestrians. Still, this conversation challenges the model assumption, as bikers and pedestrians in real life may not follow routes suggested by the routing algorithm. As one participant said, "the final test is to actually walk or bike it to see if I am ready to traverse this way" (Anonymous, answer in the worksheet).

We also analyzed what insights participants gained about the Greenway through interaction with the web tool. Most participants (n=8, two did not say explicitly) learned that the study area has few walking and biking infrastructure, but huge potential for multimodal planning (e.g., "the tool shows me that I could walk more to my local spots because most destinations are within a mile", anonymous, answer in the worksheet). The web tool's visualization and the trip scenario comparison also help the participants gain trust and commitment to the Greenway Plan (e.g., "To see it visually, I am more onboard", anonymous, answer in the worksheet). The groups also agreed on the importance of network interconnectivity: both the existing bike lanes and Model Miles are very fragmented, and local jurisdictions should advocate for the more connected Priority Network scenario.

Overall, the combination of the workshop and the web tool has proven effective at promoting stakeholder trust and actions. Specifically, Aerotropolis Atlanta leadership found the tool effective in communicating the Greenway plan to community and business stakeholders and would like to use the web tool to help design and evaluate the next blueprint for the AeroATL Greenway.

## Conclusion

This paper introduces a case study showing the contrasting roles of two network infrastructure, Hartsfield-Jackson Atlanta International Airport (H-JAIA) and AeroATL Greenway Plan, at moderating local mobility flows. Our results show that H-JAIA and its surrounding environment impede efficient travels between origin and destinations in Aerotropolis (study area), especially for biking and walking trips. In contrast, the AeroATL Greenway Plan can contest this dynamic by improving Aerotropolis residents' walking and biking trip experience, with stronger impacts observed with Priority Network implemented, where 77% of walking and 66% of biking trip distances can be on residential roads or the Greenway, which presents greater incentives for a mode switch from driving. However, the Greenway's impact on reducing trip distances is minimal in both the Model Mile and Priority Network scenarios, suggesting that the current design largely follows existing road alignments rather than introducing new, more direct routes. Nonetheless, even when trip distances remain unchanged, the Greenway can significantly improve travel time and user experience by offering safer, more comfortable, and more accessible routes.

The impacts of the Greenway can be limited for a few reasons. First, the effect of the Greenway is highly heterogenous in space. Some Greenway segments following the existing road networks can improve trip experience, while others traversing through parks for recreational purposes have little benefits in trip distance or experience. Second, the first phase implementation (i.e., Model Miles) of the Greenway is quite fragmented because each of the local jurisdictions decided on one segment, resulting in a lack of interconnectivity between the segments.

Our study suggests that the local jurisdictions should move toward the Priority Network scenario and consolidate the specific design of the Greenway Plan. An interconnected biking and walking network brings disproportionally more benefits per distance because it opens possibilities for trips to be re-routed through the Greenway, incentivizes residents to switch from driving to biking or walking mode, and attracts locals to the Greenway for recreational purposes. In addition, the specific design of the Greenway, such as whether it connects to an intersection, follows existing roads, travels in both directions, and breaks a dead end, will make a big difference in the effectiveness of the Greenway and will help ensure a more robust routing outcome.

The web tool we developed in this study can be helpful to evaluate these designs, allowing stakeholders with diverse interests to see the impacts of the Greenway with specific trip scenarios. We found that participants expressed a high level of agreement with the routes suggested by the tool (and thus with the output of our scenario modeling), which also helped deepen their understanding of the potential for biking and walking in the Aerotropolis area. An underexplored yet promising application of the tool is its ability to assess the impact of the Greenway on future travel patterns, for example, trips between proposed catalytic development sites. This functionality could support more coordinated economic and mobility planning by informing Greenway adjustments to better serve walkable and bikeable connections, or by guiding the selection of catalytic sites that can capitalize on the presence of the Greenway.

## Discussion

This study has several limitations. Because the paper emphasizes a complete "narrative–evidence–action" cycle to critically examine whose connectivity—regional travelers or local residents—and what types of connectivity—driving versus walking and biking—are prioritized in the Aerotropolis area, we chose not to expand each sub-analysis to its fullest extent.

First, our barrier metric does not incorporate travel time, safety perceptions, or socioeconomic factors influencing mode choice. For example, van Eldijk et al. (*30*) offer a useful framework that conceptualizes transportation infrastructure's barrier effects as direct (e.g., crossing effort, reduced accessibility), indirect (e.g., changes in visit frequency or mode choice), and wider effects (e.g., impacts on social contacts). Our barrier metric focuses only on approximating the direct effect by using distance to measure how the H-JAIA acts as a barrier to crossing. It does not capture the indirect or wider effects.

Future work could address these limitations by modeling the indirect barrier effect—such as comparing trade-offs in mode choice based on travel time across driving, biking, walking, and transit—or by estimating the wider barrier effect through discrepancies between expected and observed social contact patterns, assuming the barrier did not exist.

Advancing the conceptual and methodological sophistication of barrier metrics is especially important for evaluating and classifying infrastructure projects such as those funded by the USDOT's Reconnecting Communities Grant Program. While many funded barrier infrastructures (e.g., highways) may appear similar, proposed solutions—such as adding a bike lane beneath a highway versus building an over-decked development to generate new connectivity—require fundamentally different conceptualizations of barrier effects and correspondingly distinct measurement approaches. Our study is just the first step to experiment with a network-centric workflow to unite narrative, metric, and deployment to capture the barrier effect.

Second, origin-destination (OD) data used in the scenario computation are based on an activity-based model developed in 2019—which, although still the most recent version available at the time of project completion in 2023, may not fully capture post-pandemic travel patterns. Few publicly available OD datasets (e.g., the Longitudinal Employer-Household Dynamics

[LEHD] dataset and the National Household Travel Survey) extend beyond 2022, limiting the ability to assess recent shifts in travel behavior. Future work should incorporate updates from the next version of ARC's activity-based model to reflect more current patterns. Our scenario computation metrics also did not account for factors such as perceived safety, aesthetics, or comfort, which can significantly influence routing choices and trip distribution. For instance, pedestrians and cyclists may prefer routes that feel safer (e.g., with better lighting, estimable through lighting infrastructure data) or more comfortable during summer months (e.g., shaded by trees).

Future work could connect Pyramid Scene Parsing Network to extract green views from Google Streetviews along the scenarios of route planning to understand the perceptual dimension of the greenway planning. Additionally, incorporating an agent-based model could enhance scenario modeling by accounting for temporal and traffic dynamics, as well as by expanding the analysis to include additional travel modes such as public transit—an element excluded from this study to simplify data complexity. A more advanced model could also be calibrated using observed mobility data, such as mobile GPS trajectories, rather than relying on simulated data that require assumptions about transportation mode based on travel distance.

To deepen scenario analysis and inform practical planning strategies, local planners will also need to establish a cost–benefit analysis framework that clearly articulates the factors and quantitative metrics used to prioritize specific Greenway segments. For example, the framework could incorporate indicators such as construction costs, the number and socioeconomic characteristics of residents near each segment, and the segment's connectivity potential to key economic and mobility nodes in surrounding areas. As the Greenway continues to expand, such a framework would be instrumental in guiding next-phase implementation.

Third, we were also unable to host multiple workshops due to limited funding to compensate participants and the slow rebound of in-person public engagement following the pandemic. In fact, the Community Collective Meeting where we presented was the first session to resume offline, and we had waited over six months for this coordination to materialize. An ideal extension of this work would involve hosting additional sessions, giving participants more time to develop shared concerns and co-create scenarios—elements that are crucial to the success of this type of practice.

Lastly, although the Greenway Plan is intended to enhance mobility for pedestrians and cyclists, we observed that many proposed segments overlap with primary roads. The specific design details of these segments—such as whether they consist of protected bike lanes along major roads or fully separated trails—remain unclear. If the Greenway is not carefully coordinated with existing road conditions and other transportation modes, it may compromise pedestrian and cyclist safety. This concern is particularly pressing in the Aerotropolis area, where the built environment is heavily oriented toward driving and experiences high volumes of truck and automobile traffic.

Nonetheless, our approach has merit beyond a case study, as it contributes to a network-based perspective to conceptualize the connectivity tension between regionally and locally-serving urban network infrastructure. Our metrics and methods can also be extended to analyze other urban infrastructure facing similar challenges, such as highways, railways, or even prisons or golf courses, and support the scenario planning of these infrastructure with stakeholder engagement.

## *References*

### References


1. Scott, C. Hartsfield-Jackson Atlanta International Airport Serves 108M Passengers in 2024. `https://airportchamber.com/hartsfield-jackson-serves-108m-passengers-in-2024/`, 2025.
2. USDOT. Reconnecting Communities Pilot (RCP) Grant Program. `https://www.transportation.gov/reconnecting`.
3. Kasarda, J. D. *Aerotropolis, the way we'll live next*. Farrar, Straus and Giroux, 2012.
4. Kasarda, J. D. Aerotropolis: Business mobility and urban competitiveness in the 21st century. *Urban Insight*, Vol. 2, No. 7, 2013, p. 22.
5. Wang, K.-J. and W.-C. Hong. Competitive advantage analysis and strategy formulation of airport city development—The case of Taiwan. *Transport Policy*, Vol. 18, No. 1, 2011, pp. 276–288.
6. Appold, S. J. and J. D. Kasarda. The airport city phenomenon: Evidence from large US airports. *Urban Studies*, Vol. 50, No. 6, 2013, pp. 1239–1259.
7. Peneda, M. J. A., V. D. Reis, and M. d. R. M. Macário. Critical factors for development of airport cities. *Transportation Research Record*, Vol. 2214, No. 1, 2011, pp. 1–9.
8. Kramer, D. How Airport Noise and Airport Privatization Effect Economic Development in Communities Surrounding US Airports. *Transportation Law Journal*, Vol. 31, 2003, p. 213.
9. Woodburn, A. Investigating neighborhood change in airport-adjacent communities in multiairport regions, 1970–2010. *Transportation Research Record*, Vol. 2626, No. 1, 2017, pp. 1–8.
10. Antipova, A. and E. Ozdenerol. Using longitudinal employer dynamics (LED) data for the analysis of Memphis Aerotropolis, Tennessee. *Applied Geography*, Vol. 42, 2013, pp. 48–62.

11. Adey, P. If mobility is everything then it is nothing: Towards a relational politics of (im) mobilities. *Mobilities*, Vol. 1, No. 1, 2006, pp. 75–94.
12. Derudder, B. and F. Witlox. An appraisal of the use of airline data in assessing the world city network: a research note on data. *Urban Studies*, Vol. 42, No. 13, 2005, pp. 2371–2388.
13. Andris, C., X. Liu, and J. Ferreira Jr. Challenges for social flows. *Computers, Environment and Urban Systems*, Vol. 70, 2018, pp. 197–207.
14. Jin, M., L. Gong, Y. Cao, P. Zhang, Y. Gong, and Y. Liu. Identifying borders of activity spaces and quantifying border effects on intra-urban travel through spatial interaction network. *Computers, Environment and Urban Systems*, Vol. 87, 2021, p. 101625.
15. Cidell, J. When runways move but people don't: The O'Hare Modernization Program and the relative immobilities of air travel. *Mobilities*, Vol. 8, No. 4, 2013, pp. 528–541.
16. Shen, D. and Y. Cao. Aerotropolis formation and evolution: insights from new economic geography. *International Journal of Sustainable Development*, Vol. 19, No. 3, 2016, pp. 246–256.
17. Goodspeed, R. Scenario planning for cities and regions: Managing and envisioning uncertain futures. https://www.atl.com/wp-content/uploads/2021/08/2019-ATL-annual-Report.pdf, 2020.
18. Hedelin, B., S. Gray, S. Woehlke, T. K. BenDor, A. Singer, R. Jordan, M. Zellner, P. Giabbanelli, P. Glynn, K. Jenni, et al. What's left before participatory modeling can fully support real-world environmental planning processes: A case study review. *Environmental Modelling & Software*, Vol. 143, 2021, p. 105073.
19. Zellner, M. Participatory Modeling: Reshape How You Collaborate, 2022. URL https://www.youtube.com/watch?v=ouNgarXnxjE.
20. Goodspeed, R., K. Admassu, V. Bahrami, T. Bills, J. Egelhaaf, K. Gallagher, J. Lynch, N. Masoud, T. Shurn, P. Sun, et al. Improving transit in small cities through collaborative and data-driven scenario planning. *Case Studies on Transport Policy*, Vol. 11, 2023, p. 100957.
21. Lovelace, R., A. Goodman, R. Aldred, N. Berkoff, A. Abbas, and J. Woodcock. The Propensity to Cycle Tool: An open source online system for sustainable transport planning. *Journal of transport and land use*, Vol. 10, No. 1, 2017, pp. 505–528.
22. ATL Airport Improvement Districts. https://aacids.com/about-us, 2025.
23. Aerotropolis Atlanta Blueprint 2.0. https://aeroatl.org/wp-content/uploads/2025/05/BluePrint-2.0-Final-Report_12012024.pdf, 2024.
24. AeroATL Greenway Plan. https://aeroatl.org/wp-content/uploads/2020/04/AeroATL-Greenway_Report-7-4-2018-reduced.pdf, 2018.
25. ARC and Four Communities Receive $50M Federal Grant for Multi-use Trail Connecting Atlanta BeltLine and Flint River. https://atlantaregional.org/news/community-development/arc-and-four-communities-receive-50m-federal-grant-for-multi-use-trail-connecting-atlanta-beltline- 2024.
26. Finding the Flint. https://findingtheflint.org/about, 2017.
27. Airport City Master Plan. https://whtnwmg.sfo2.cdn.digitaloceanspaces.com/wp-content/uploads/2019/08/ATL-Airport-City-Executive-Summary-5.pdf, 2019.
28. Microsoft. Global Building Foot Prints. https://github.com/microsoft/GlobalMLBuildingFootprints, 2022.
29. Forman, R. T. and L. E. Alexander. Roads and their major ecological effects. *Annual review of ecology and systematics*, Vol. 29, No. 1, 1998, pp. 207–231.
30. van Eldijk, J., J. Gil, and L. Marcus. Disentangling barrier effects of transport infrastructure: synthesising research for the practice of impact assessment. *European transport research review*, Vol. 14, No. 1, 2022, p. 1.

## Acknowledgements

We would like to acknowledge Aerotropolis Atlanta leadership Shannon James and Brian Dorelus for supporting this project.

We also acknowledge the use of the ChatGPT model 4o at proofreading the final manuscript.

## Author Contributions

The authors confirm contribution to the paper as follows: study conception and design: X.L, P.Y.; data collection: X.L; analysis and interpretation of results: X.L.; draft manuscript preparation: X.L, P.Y. All authors reviewed the results and approved the final version of the manuscript.

## Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

This project is funded by ACRP Graduate Research Award.

## Data Accessibility Statement

The project data is available at GitHub