Reimagine Transit

Suffolk County Mobility

Transit Choices + Concepts Report

APRIL 2021

For Suffolk County

JARRETT WALKER + ASSOCIATES

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1 Introduction

What Is Reimagine Transit?

Reimagine Transit is a Suffolk County initiative to rethink and reconsider the Suffolk County Transit (SCT) bus network and consider how its transit system is meeting the County's mobility needs. A bus network redesign is a collaborative planning effort to decide where today's bus service should go, when it should run, and how frequently it should operate, starting from a clean slate. This project is a collaboration between Suffolk County Departments of Planning and Economic Development and Public Works and will engage riders, the general public, and key stakeholders in conversation about how the County's bus network should serve its residents, businesses, and visitors.

Today's Suffolk County Transit (SCT) bus network is the result of decades of cumulative small changes and adjustments. The resulting network may not be meeting the goals and priorities of today's residents, employers, and institutions. Redesigning SCT's bus network is an opportunity to review existing and potential transit demand and need, and to design a network that meets those demands and needs most effectively. It is also a key opportunity to carefully think through and weigh competing goals for transit.

Redesign does not mean changing every bus route and stop. The key point is that thinking is not constrained by the existing network. Where the analysis suggests that existing service patterns make sense, those elements would be retained. Ultimately, the goal is a network designed for the Suffolk County of today and tomorrow, not one based on the past.

What Is the Purpose of This Report?

This Choices + Concepts Report is the first step in **Reimagine Transit.** It is meant to spark a conversation about transit needs and goals in Suffolk County. The Report helps lay out relevant facts about transit and development in the County, and draws the reader's attention to major choices that these facts force us to weigh.

The goal of this report is to assess the existing transit network and the geometry of the County today and engage the public, stakeholders and elected officials in a conversation about the goals of transit in the County.

Reasonable people can disagree about the purpose of transit in their own community. Transit can deliver many different outcomes, but some of these outcomes trade-off against others.

Learning how the community values different outcomes is an essential step in deciding where to run service, what kind of service to run, and how to define success. This report explains some of those trade-offs and helps the reader identify which choices are most consistent with his or her own values for transit.

The anticipated timeline for this process is:

- **April to June 2021:** Community review and response to this report and transit network concepts.
- **June to August 2021:** County staff and consultant team draft a new network.
- **September to October 2021:** Community review of a draft new network for SCT
- **October 2021 to January 2022:** County staff and consultant team finalize the new network, roll-out plan, and supporting elements for the new network.

At two key phases in this process Suffolk County staff and the consulting team will engage the public, current transit riders, and community stakeholders in multiple ways:

- In-person outreach at transit stops and community events, where safe and reasonable given the COVID-19 pandemic conditions.
- Online and paper surveys.
- Consultation with a committee of major stakeholders.
- Public meetings with online and telephone call-in options.

The public health conditions mean that our study team may adjust our outreach events and processes depending on changes in guidelines and conditions. General information and details on the latest events is posted at: https://www.connectli.org/ReimagineTransit.html

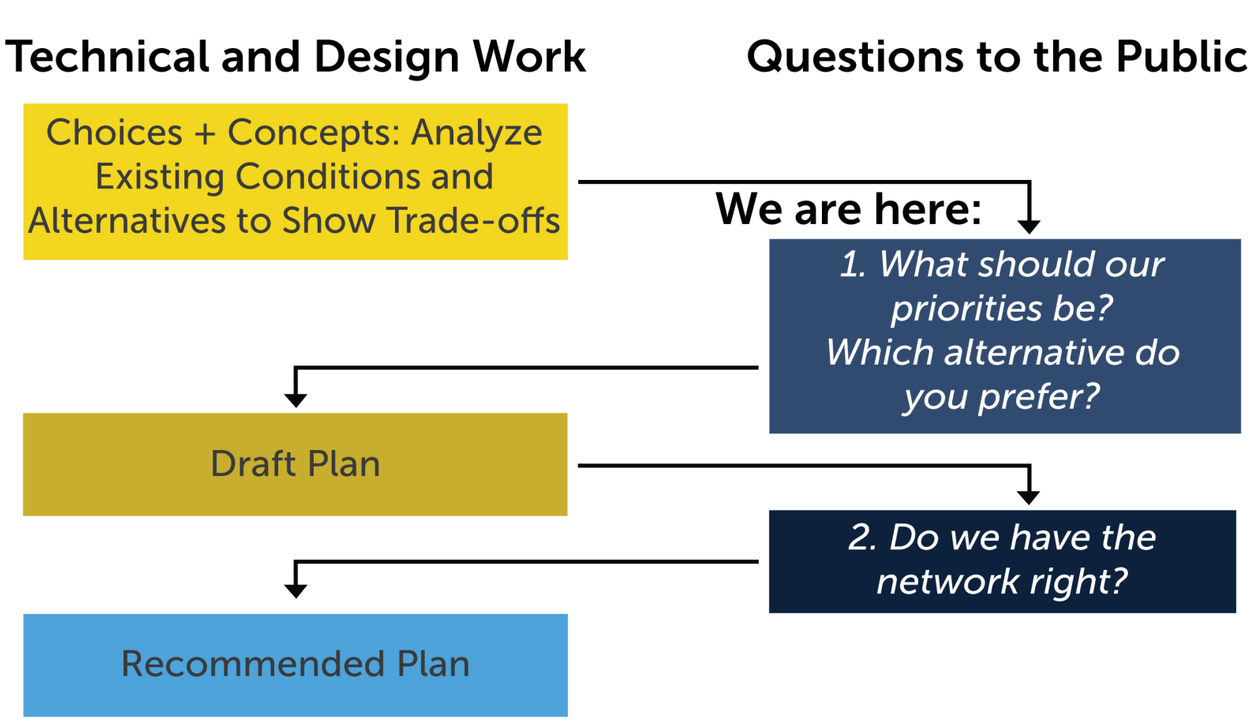


Figure 1: The process of technical work and public engagement that will inform the Reimagine Transit process for SCT.

Transit's Many Goals

Transit can serve many different goals. It is not possible to excel towards all these goals at the same time. In addition, reasonable people will disagree about which of these goals is most important.

Understanding which goals matter most in the County is a key step in updating the SCT network. Some possible goals for transit include:

- **Economic:** Transit can give businesses access to more workers, workers access to more jobs, and students access to education and training.
- **Environmental:** Increased transit use can reduce air pollution and greenhouse gas emissions. Transit can also support more compact development and help conserve land.
- **Social:** Transit can help meet the needs of people who are in various situations of disadvantage, providing them with access to support services and opportunity.
- **Health:** Transit can be a tool to support physical activity by walking. This is partly because most riders walk to their bus stop, but also because riders will tend to walk more in between their transit trips. The social contact people gain on transit can also contribute to positive health outcomes.
- **Personal Liberty:** By providing people the ability to reach more places than they otherwise would, a transit system can be a tool for personal liberty, empowering people to make choices and fulfill their individual goals.

Some of these goals are served by high transit ridership. For example, the environmental benefits of transit only arise from many people riding the bus rather than driving. The same is true of some economic and health outcomes. We call such goals **Ridership Goals** because they are achieved through high ridership.

Other goals are served by the mere presence of transit. A bus route through a neighborhood provides residents insurance against isolation, even if few people ride it. A route may fulfill political or social obligations, for example by getting service close to every taxpayer or into every political district. We call these types of goals **Coverage Goals** because they are achieved by covering geographic areas with service, regardless of ridership.

High Ridership Is Not SCT's Only Goal

If Suffolk County wanted to maximize transit ridership, it would focus its network around the busiest places where the greatest numbers of people live and work. If Suffolk County did this, it would be acting more like a business: delivering the best service in places with the most potential customers.

Businesses are under no obligation to spread their services around widely. In fact, they tend to avoid spending a lot of money to reach only a few customers.

For example, McDonald's is not obliged to provide a restaurant within 1/2 mile of everyone in Suffolk County. If it were, then the company would have to add hundreds of additional locations. Some locations would serve just a handful of homes, and most would operate at a loss because there are so few customers nearby.

People understand that less-inhabited areas will naturally have fewer McDonald's restaurants than more-inhabited areas. We don't describe this as McDonald's being unfair to places where few people live; they are just acting like a private business. McDonald's has no obligation to cover all areas with its restaurants.

Transit agencies are not private businesses. Most transit agencies decide that they do have some obligation to cover places with fewer people in them even when this would not be a "good business decision."

The officials who ultimately make public transit decisions hear their constituents say things like "We pay taxes too" and "If you cut this bus line, I will be stranded" and they decide that coverage, even in low-ridership places, is an important transit outcome. This is why transit agencies rarely act like private businesses.

Transit agencies are often accused of failing to maximize ridership, as if that were their only goal. In fact, most agencies are intentionally operating some coverage services that are not expected to generate high ridership.

Figure 2: Is an empty bus failing? That depends entirely on why you are running it in the first place.

What Are the Recent Trends?

Like many transit agencies across the country, SCT has seen a decline in ridership over the last few years. Figure 3 shows that ridership on fixed route transit services fell around 25% from a peak of 6.3 million in 2011 to 3.9 million in 2018. We measure ridership as one person boarding a bus to take a trip. To complete a one-way trip from home to work, a person may board more than one bus because they have to transfer, but it is nearly impossible to track complete trips by bus, so we use "boardings" as synonymous with ridership.

A key driver of ridership is how much service is provided to potential customers, which is measured in service hours. One service hour is one bus operating for one hour. Figure 4 shows the change in service between 2009 and 2018. SCT increased fixed route service by 7.5% between 2009 and 2015. However, there were sharp reductions in service in 2016, bringing the service level to 4% higher than it was in 2009.

The service cuts in 2016 and 2017 were in part a reaction to an increase in operating costs in the previous years. From 2012 and 2016, annual operating costs for SCT's fixed route services increased by 13%. Like many labor-intensive services, transit costs tend to rise over time as labor costs tend track with local wages. Also, health care costs for employees have tended to outpace inflation for most employers, leading to increased labor costs. In communities with relatively low ridership, rising costs are rarely met with increased fare revenues, so many communities face difficult choices in their annual budgeting.

With an increase in service hours and decline in ridership, the overall service "productivity" has declined. Productivity is a transit industry term for what lay-people might call "efficiency." If high ridership is an outcome people care about, then ridership relative to cost describes how "productive" an agency is towards that outcome.

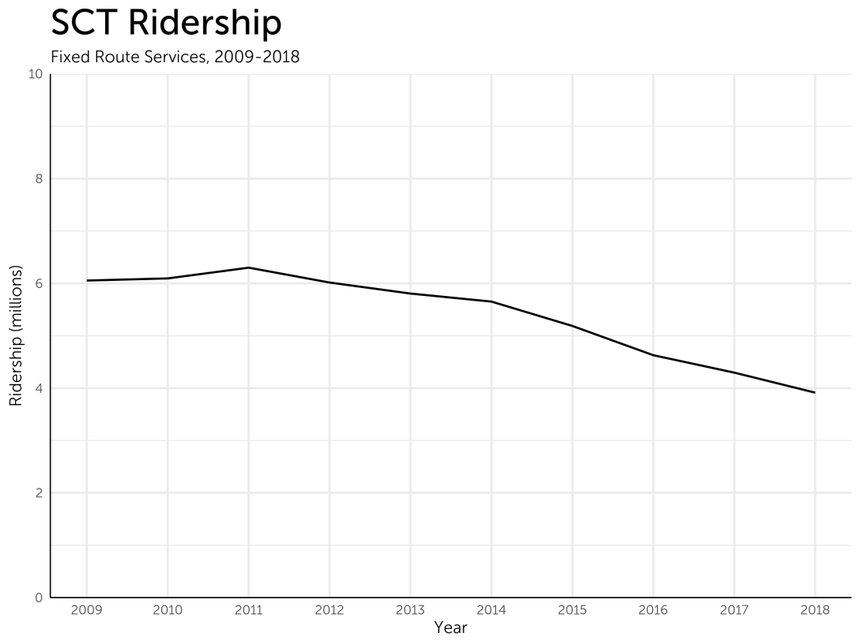


Figure 3: SCT ridership has declined substantially in the last few year.
Source: National Transit Database (NTD)

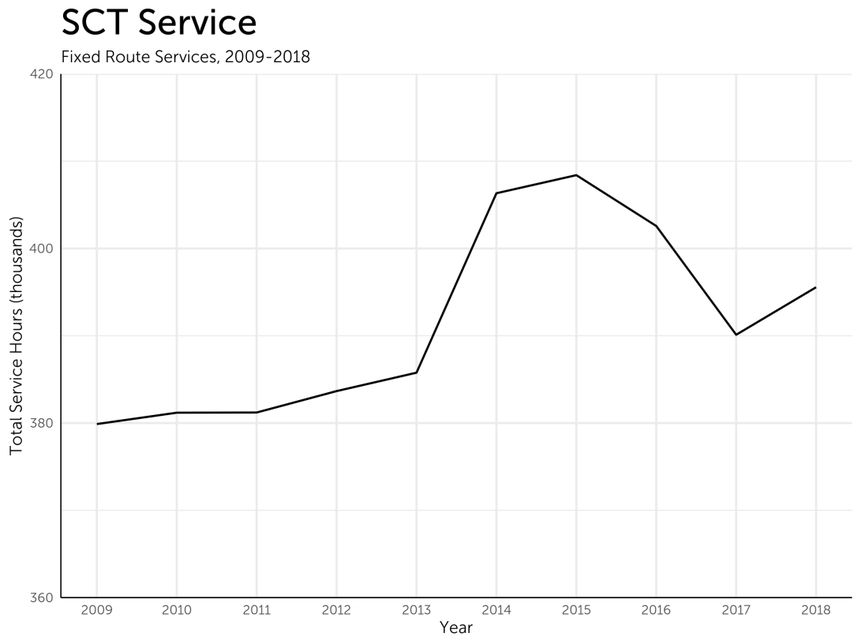


Figure 4: SCT has increased service provided, but had major cuts in 2016 & 2017.
Source: NTD

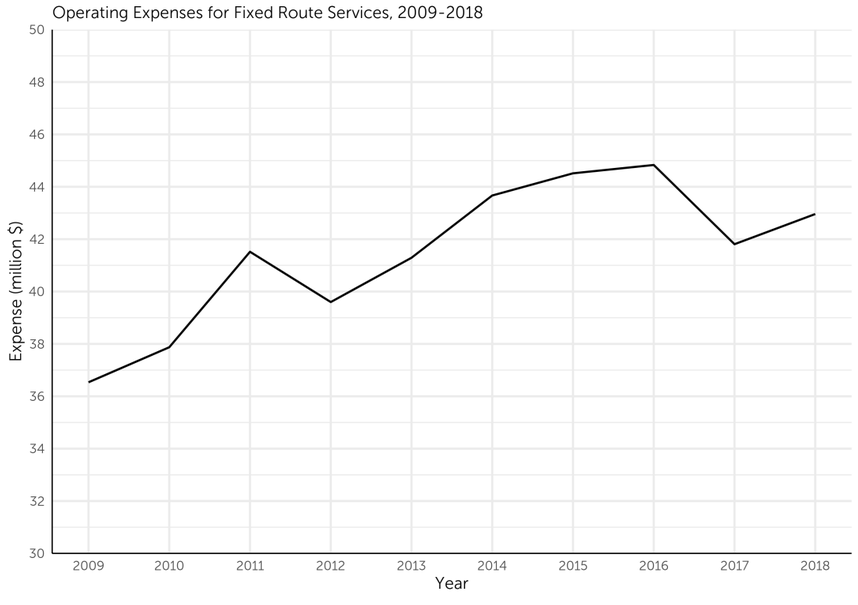


Figure 5: SCT's operating expenses have increased substantially over the years.
Source: NTD

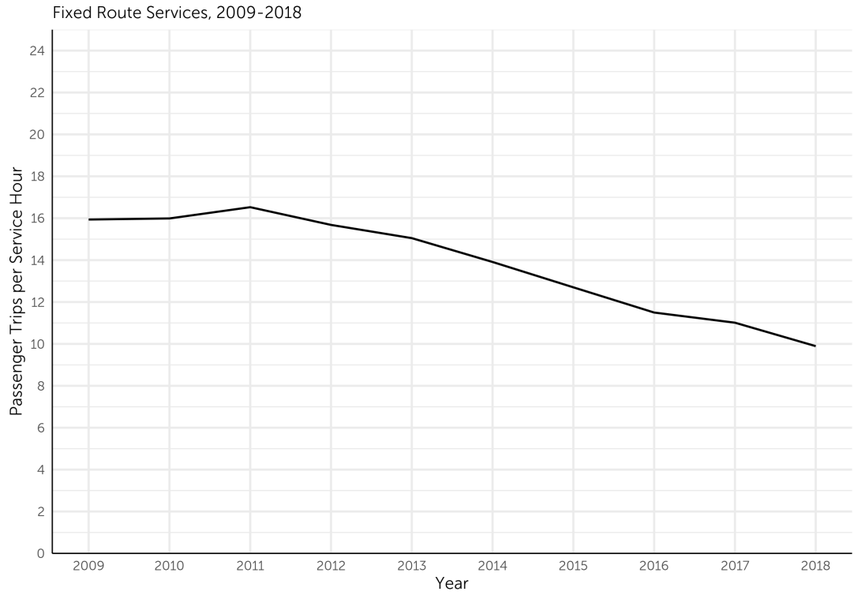


Figure 6: Productivity of SCT fixed route service has declined by 40% from 2011.
Source: NTD

The productivity ratio is:

$$Productivity = \frac{Ridership}{Cost} = \frac{Boardings}{Service\ Hours}$$

Compared to its peak in 2011, productivity has fallen 40% to 9.9 boardings per service hour in 2018, as shown in Figure 6. Declining ridership is always a concern for a transit agency or community, but ridership declines are not always attributable to things that a transit agency or community can control. Redesigning service to be more useful would certainly help, but may not be enough to reverse this trend alone.

Multiple research papers have shown that the changes in the cost of car ownership and use can have a significant effect on transit ridership. Over the course of the second half of 2014, gas prices in the US fell about 50%, remaining relatively low ever since.[1] A Mineta Transportation Institute paper looking at 2012 ridership for many cities found that gas prices were the most powerful external variable (i.e. outside the control of the transit agency) affecting ridership. It also showed that changes in gas prices affected transit ridership in all urban areas similarly. The significant decline in gas prices since 2013 is probably the largest factor explaining the recent reduction in productivity. It often takes time for behavior patterns to change, so even though gas prices fell suddenly, they may still explain some of the drop in later years.

The impact of ride-hailing (Uber, Lyft, etc.) is hotly debated, but it probably caused some ridership loss among more financially comfortable riders. Estimates vary, but a recent UC Davis study indicates that 21% of adults in major American cities use ride-hailing. This study also indicates that when people start using ride-hailing their use of transit declines by 6%.[2]

1 Alam, B, Nixon, H, Zhang, Q. "Investigating the Determining Factors for Transit Travel Demand by Bus Mode in US Metropolitan Statistical Areas," Mineta Transportation Institute. May 2015.

2 Clewlow, R, Mishra, G. "Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States," Institute of Transportation Studies, University of California, Davis. October 2017.

How Much Service Does SCT Provide Compared to Peers?

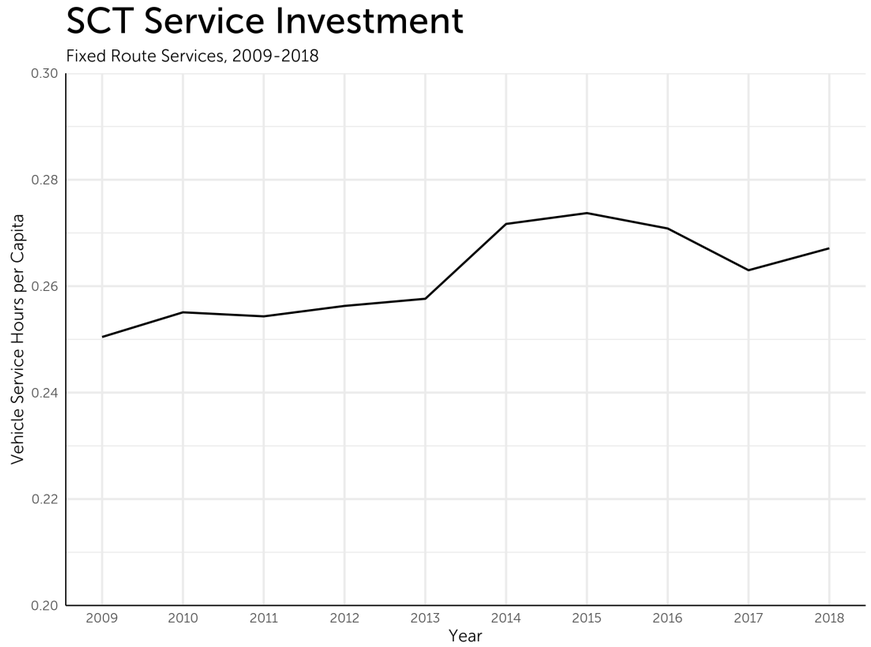
Every transit agency is unique in terms of service area, political context, and funding mechanism. The outcomes of these factors can be compared among agencies by looking at how much service a transit agency invests in relative to the population of its service area.

SCT has increased the total amount of service in the past decade (despite a reduction in ridership and productivity). Suffolk has a very large population of around 1.47 million people, which hasn't changed very much during this time. This means that SCT's per capita service investment has increased (and decreased) in the last decade in step with the overall service investment.

In 2018, the per capita service investment stood at 0.26 annual service hours. Compared to other transit agencies which serve the suburban areas of large American metro areas, this is relatively low. Within the NYC metropolitan area, for example, NICE (Nassau County) provided 0.53 service hours per capita, while Westchester County's Bee-Line provided 0.75 service hours per person. Other similarly situated counties like Montgomery County, MD; Fairfax County, VA; and Orange County, CA provide at least twice as much service per capita as Suffolk County. Rhode Island has a comparable population, population density, and GDP to Suffolk County. Rhode Island Public Transit Authority (RIPTA) provides more than twice as much service per capita as SCT.

There are several *reasons* for this relatively low level of investment, including State funding constraints that are beyond the control of the County. However, one of the *outcomes* of the low investment level is that the limited SCT service is spread very thinly. For example:

- The frequency of service on most routes is only hourly, meaning that waits for a bus are quite long in most places in the County.
- There is limited weekend service and only a few routes offer any Sunday service. Weekend service is critical for workers in retail, hospital, hotel, and restaurant jobs.



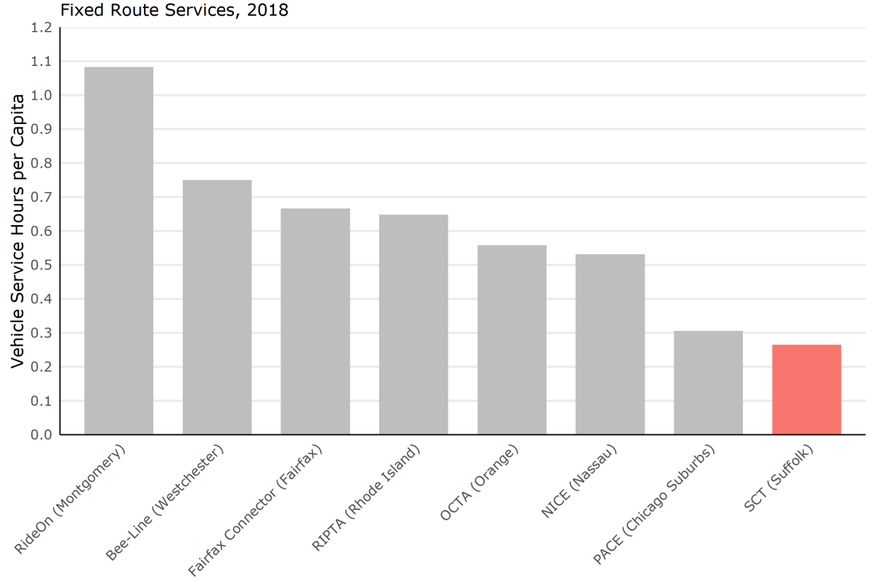


Figure 7: SCT has slightly increased how much service it has invested in the last decade, but still provides much less service per capita compared to some similar suburban transit agencies close to large cities.

Conflicting Goals

On page 6, we described why most transit agencies offer services that do not attract high ridership relative to their costs. These services provide "coverage," and their mere presence—rather than their ridership—is important to many people.

Ridership and coverage goals are both laudable, but they lead transit planners in opposite directions. Within a fixed budget, if a transit agency wants to do more of one, it must do less of the other.

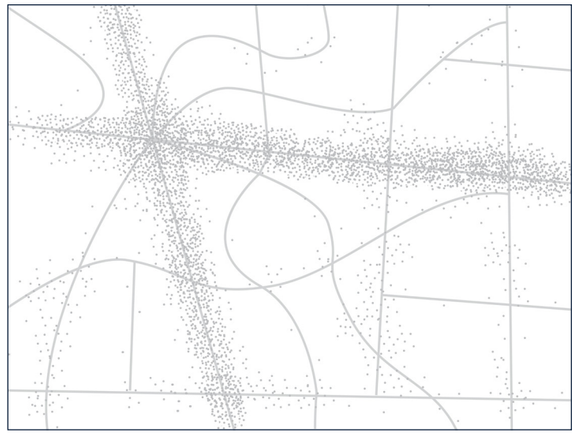
Here is an illustration of how ridership and coverage goals conflict with one another due to geometry and geography. In the fictional town at right the little dots indicate dwellings and commercial buildings and other land uses. The lines indicate roads. Most of the activity in the neighborhood is concentrated around two roads, as in many towns.

A transit agency pursuing only a ridership goal would focus service on the streets where there are large numbers of people, where walking to transit stops is easy, and where the straight routes feel direct and fast to customers. Because service is concentrated onto fewer routes frequency is high and a bus is always coming through the neighborhood soon. This results in a network like the one at bottom-left.

If the transit agency were pursuing only a coverage goal, on the other hand, it would spread out services so that every street had a bus route, as in the network at bottom-right. As a result, all routes would be infrequent, requiring long waits, even in the busiest places.

On a fixed budget, designing transit for both ridership and coverage is a zero-sum game. Each bus that the transit agency runs down a main road, to provide more frequent and competitive service in that market, is not running on the neighborhood streets, providing coverage. While an agency can pursue ridership and provide coverage within the same budget, it cannot do both with the same dollar. The more it does of one, the less it does of the other.

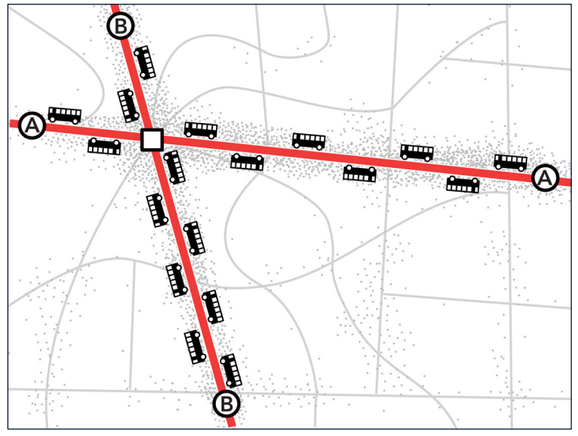
These illustrations also show a relationship between coverage and complexity. In this imaginary neighborhood, any person could keep the very simple "high frequency" network in their head, since it consists of just two routes running in straight lines. They would not even need to consult a schedule to catch a bus. The coverage network would be harder to memorize, requiring people to consult a map (to understand the routing) and a schedule (to catch these infrequent services).



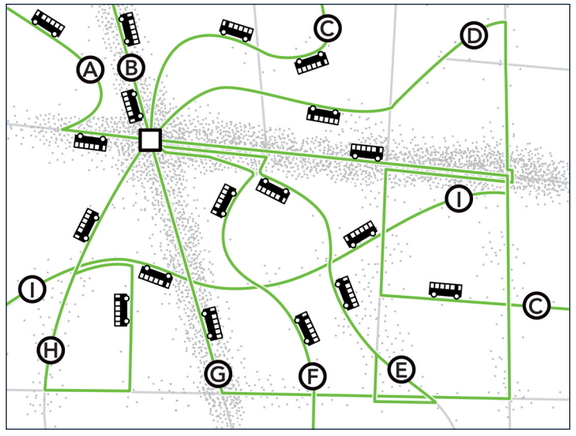
Imagine you are the transit planner for this fictional neighborhood. The dots scattered around the map are people and jobs.

The 18 buses below are the resources the town has to run transit

Before you can plan transit routes, you must first decide: What is the purpose of your transit system?



All 18 buses are focused on the busiest streets. Waits for service are short but walks to service are longer for people in less populated areas. Frequency and ridership are high but some places have no service.



The 18 buses are spread around so that there is a route on every street. Everyone lives near a stop but every route is infrequent, so waits for service are long. Only a few people can bear to wait so long, so ridership is low.

Figure 8: Ridership and coverage goals, while both laudable, are in direct conflict within a fixed budget.

What Else Is in This Report?

Transit Geometry

In Chapter 2, we summarize the basic principles of transit geometry, how they affect the access and opportunities that transit can provide to residents, workers, and visitors, and how the underlying geometry forces every community to grapple with some key value trade-offs in the design of its transit system.

Markets and Needs

In Chapter 3, we assess the markets for transit in Suffolk County, the potential for high ridership, and the areas where the need for transit is high but the density of demand is not.

By "market" we are referring specifically to the demands for transit that result in high ridership relative to cost. This way of thinking about a transit market is similar to the way a private business thinks about its market for sales – how many potential customers there are, how useful they will find the product, and how well the product competes for their business.

High transit ridership satisfies a number of commonly-held values, like:

- If a community wants its transit system to compete successfully with cars to achieve environmental benefits—such as cleaner air and reduced carbon emissions—a Ridership goal is the path to that achievement.
- For transit to act as an economic stimulus, by providing job access to large numbers of workers, it must attract ridership. These interests are therefore also served by a Ridership goal.
- If leaders are concerned about government efficiency, they may want to maximize fare revenue relative to costs and reduce subsidy per rider. They would likely be drawn to a Ridership goal.

Existing Network

In Chapter 4, we analyze the fixed route transit network performance including the frequency of service, productivity of service and how the network performs on measures like access to jobs. We also assess some key challenges and opportunities for improving transit service in the County.

Key Questions and Concepts

In Chapter 5, we summarize key value choices that only the Suffolk County community and its leaders can make about how transit should serve the County. Key value questions include Ridership versus Coverage, Walking versus Waiting, Connections versus Complexity, and how much to invest in transit.

In Chapter 6, we provide concepts for how a redesigned network for Suffolk County could look, a Coverage Concept and a Ridership Concept. We describe the two Conceptual Alternatives to illuminate the key value choices that only the community and its leaders can make about how transit should serve the Suffolk County. These value choices cannot be answered by technical experts because they are questions about what goals and values the communities prioritizes. There is not a technically correct answer to these value questions.

Balance Between Ridership and Coverage?

What should the balance between ridership goals and coverage goals be? Divide 100% between these goals:

- **Maximizing ridership by providing high-frequency, useful services to dense places.** This will put more people near the most useful services, but the number of people across the County with access to transit may reduce.
- **Maximizing coverage by extending lower-frequency services to reach more of the County.** This will increase the number of people across with access transit service, but reduce the number of people with access to frequent services.

Walking or Waiting?

There is a limit to how much a transit agency can increase ridership, within a fixed budget, without increasing walking distances to service and thereby increasing frequencies. This choice, between walking and waiting, relates to a larger choice about how to balance ridership and coverage goals.

If SCT wanted to increase ridership within its fixed budget for transit, then route spacing would become more consistent across the County's neighborhoods, particularly in the southwestern towns of Babylon and Islip. Some people who are very close to infrequent service today would be asked to walk a little farther but this would mean higher frequencies and longer spans on many routes. Within a fixed budget, increasing frequency also means consolidating service into fewer routes, thereby increasing walking distances.

Next Steps

This Choices + Concepts Report represents the first step in a two phase process of thinking about redesigning Suffolk County's bus network. This report serves as a basis of information for public meetings, surveys, and outreach for what we call the "Concepts Phase" of the Reimagine Transit. The public, stakeholders, and riders will be invited to respond to these key questions and provide other input on their preferences around how transit serves Suffolk County. This input will be gathered through open public meetings, an online survey, and a survey of riders on the bus. For more information about the surveys and public meeting dates, go to: https://www.connectli.org/ReimagineTransit.html

2 Geometry of Transit

What is the Product of Transit?

Public transit can achieve many goals, but a commonly held goal for transit is to help people access opportunities: work, shopping, medical needs, education, and all the economic, social, cultural, and natural riches that a community has. Everyone has a limited amount of time in their day and, therefore, can only spend so much time traveling to meet their needs. Maximizing the people and places that people can reach in a limited amount of time is something we can calculate in assessing how well transit is meeting this goal. Figure 9 shows how we calculate this.

What Access Achieves

When we expand access for as many people as possible, we achieve many important things:

- We **make service more useful** for the trips people are already making and for many other trips that people might want to make by transit. When transit is more useful, more people use it.
- We **increase ridership potential**, as a result of service being more useful.
- We increase transit's potential to help with **pollution and congestion**. Ridership is the key to how transit achieves these things, and improving access is the path to ridership.
- We **expand access to opportunity** (jobs, education, shopping, services) for people who need transit for that purpose.
- We **increase the economic attractiveness** of the urban area. Connecting people with opportunities is the whole point of cities, so improving those connections makes any community more effective.

Access (or Freedom)

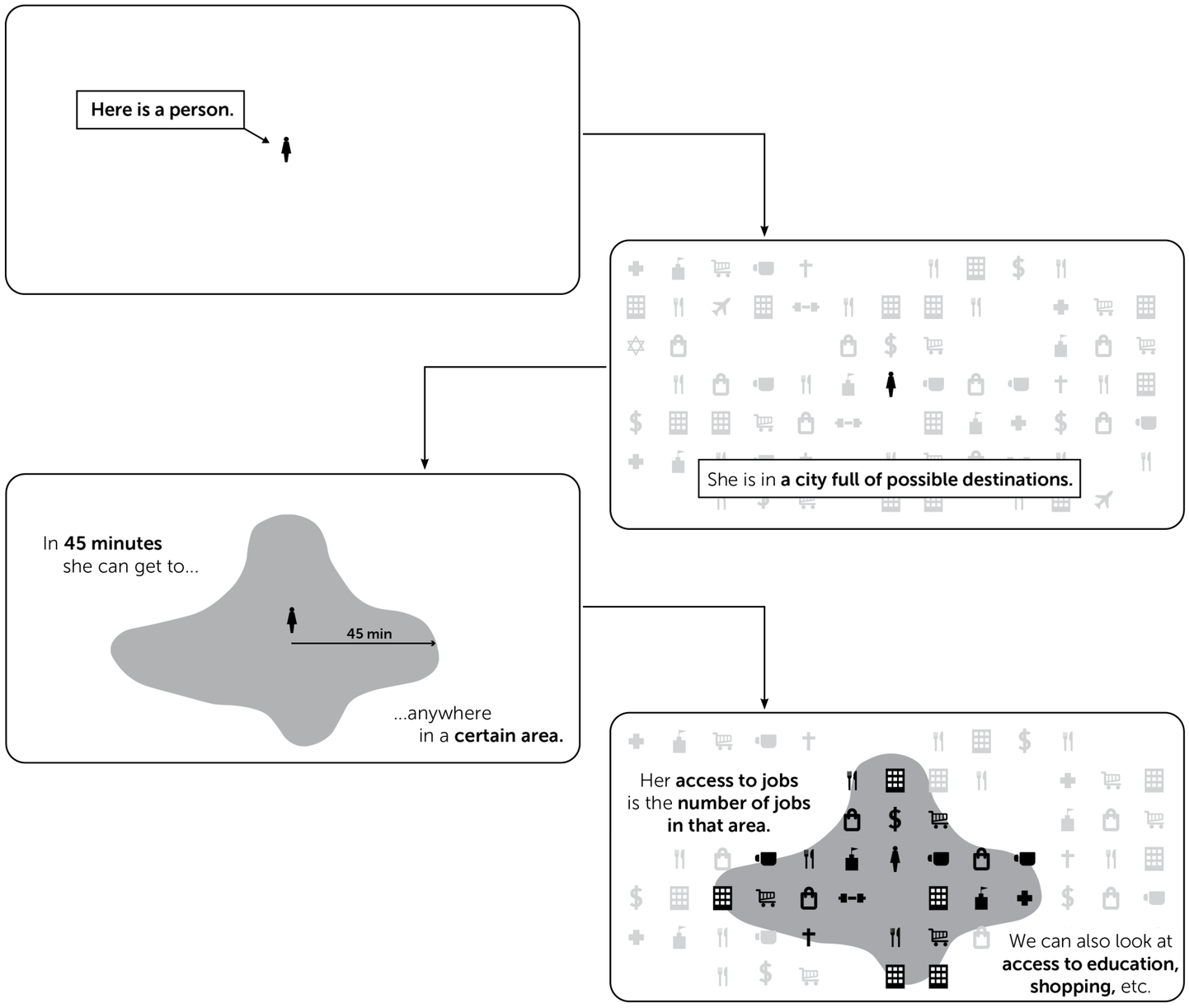
Wherever you are, there is a limited number of places you could reach in a given amount of time. These places can be viewed on a map as a blob around your location.

Think of this blob as "the wall around your life." Beyond these walls are jobs you cannot hold, places you cannot shop, and a whole range of things you cannot do because it simply takes too long to get there.

The technical term for this is accessibility, but it's also fair to call it freedom, in the physical sense of that word. The extent of this blob determines what your options are in life: for employment, school, shopping, or whatever places you want to reach.

If you have a bigger accessibility blob, you have more choices, so in an important sense, you are more free.

Figure 9: How transit service creates access to opportunity.



Access and Freedom

The increase in freedom and choices arising from greater transit access is also closely related to transit ridership. Public transit ridership arises from the combination of three things:

- **Access (or freedom).** Where can you get to on public transit in a reasonable amount of time, compared to your alternatives?
- **Pricing.** What does transit cost compared with its alternatives?
- **Preferences.** These include everything else, all the subjective factors that govern decisions about how to travel, as well as reactions to other aspects of the transit experience.

Network design and planning mostly determine access, so let's look at that concept in more detail.

How Transit Expands Access

When using transit, the extent of access is determined by:

- **The transit network.** This includes the frequency, speed, duration, and alignment of the transit lines. These features determine how long it takes to get from any point on the network to any other point.
- **The layout of the community.** For each transit stop on the network, this determines how many useful destinations are near the stop or within easy walking distance. For example, higher density around a given stop means more access, both because there are more useful destinations around the stop, and also because good access from that point is of more value to more people.

The way these factors combine and determine access is a matter of geometry. That's because freedom (and access) is about what you *could* do, not predictions of what you *will* do. Access is a basic driver of ridership, but it can also be considered a worthy goal in itself by many people. For example:

- Access to jobs helps keep people employed.
- Access from a particular location is a factor in the value of land and property. Having access to more things from a particular location makes it more valuable to locate there. Real estate firms routinely study where you can get to by car from a particular development parcel, and we can do a similar analysis using transit.

If you are deciding where to live based on whether you can get to your job, school, or relatives, you are asking about access.

Where can I reach in 60 minutes via walking and transit from the Suffolk County Offices at Hauppauge?

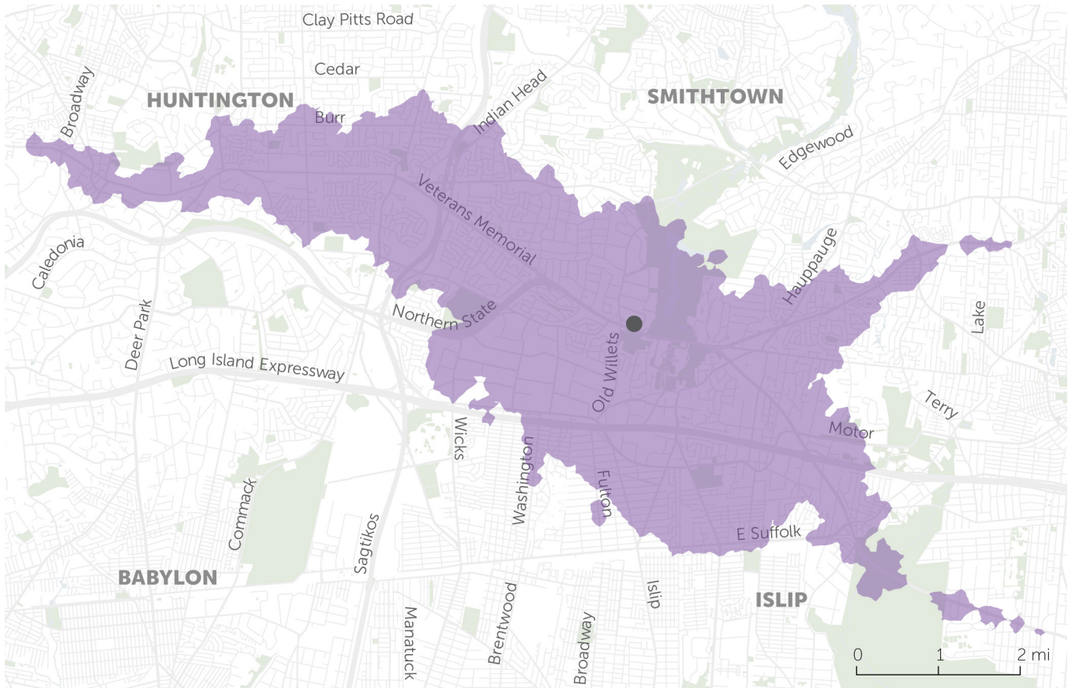


Figure 10: 60-Minute Access via Walking and Transit from County Offices in Hauppauge

Building Access: The Network and Frequency

A transit network is a pattern of routes and services, in which each line has:

- a path,
- a duration or span—what hours and days it runs,
- an average speed, and
- a frequency—how often a transit vehicle serves a stop.

Of these, **frequency is the one that is often invisible and easy to forget, yet it is usually the dominant element of travel time, and therefore, access in a given amount of time.**

A high-access network consists of high frequency deployed in patterns that connect many residents to many jobs and activities.

From Access to Ridership

Ridership arises from both access and human behavior. Human behavior is heavily impacted by pricing, and also by many other features that psychologists and social scientists study.

So while access is not, in itself, a prediction of ridership, it is a foundation of it. It is also the aspect of ridership that transportation planning mostly influences, and it can be described geometrically in a way that gives us a high degree of confidence. This is why we recommend focusing on access as a useful measure of transit outcomes.

Frequency Is Freedom

Frequent service provides several related benefits for customers. These include:

- **Short Waits.** The average wait time for a 15-minute service is just 7.5 minutes.
- **Fast Connections.** Transferring between routes lets a rider reach a multitude of places that may not be all along one route. Connections are the glue that combine a pile of routes into a useful network, and frequency makes connections easy, because the next bus is always coming soon.
- **Easier Recovery from Disruption.** Frequent service is more reliable because if a bus breaks down, the next bus is always coming soon.
- **Spontaneity.** Rather than building their life around a bus schedule, customers can show up at the stop and go.

The payoffs of frequency are non-linear, with the highest ridership benefit usually being found in 5 to 15-minute frequencies. Figure 8 plots the frequency and productivity of routes operated by 34 transit agencies across North America.

The horizontal axis shows frequency (better, more useful frequency means a lower wait time, so more frequent service is to the left). The vertical axis shows productivity—how much ridership occurs compared to the quantity of service. A dark hexagon means that lots of transit routes share a particular combination of frequency and productivity, while a light hexagon means less route examples share a particular frequency and productivity combination.

Following the pattern of hexagons, particularly the darker ones, across the plot, we can see that ridership relative to cost rises with frequency even though better frequency costs more and pulls the productivity down.

How much frequency is enough? Two points should be noted:

- For most urban purposes, **a frequency of 15 minutes or better has the best chance of being useful,** and it's at these better frequencies that the non-linear payoff begins to appear.
- Adequate frequency depends on average trip length, because **it doesn't make sense to wait a long time to travel a short distance.** Very short downtown circulators, for example, don't usually make sense unless they can be run at frequencies well under 10 minutes. If the bus isn't coming very soon, it's probably quicker to walk the whole way.

Frequent service is strongly correlated with high ridership per unit cost.

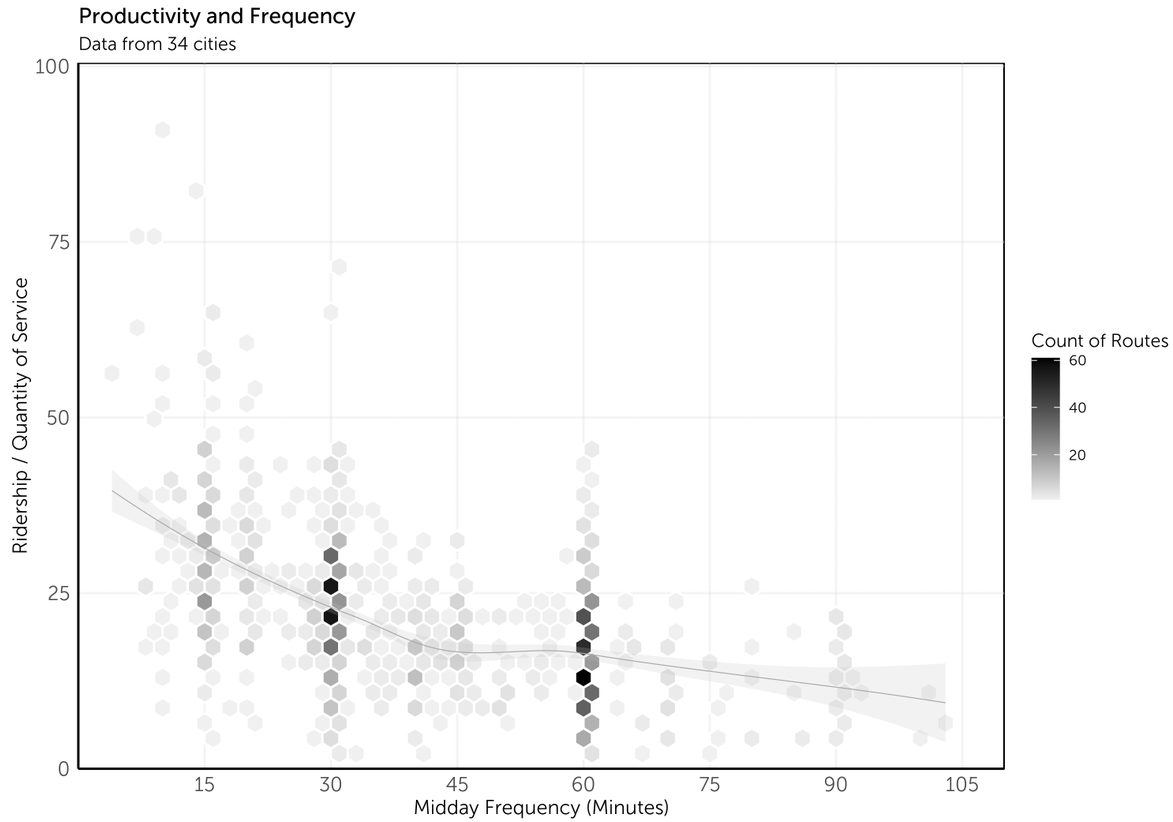


Figure 11: Transit Productivity and Frequency for Routes from 34 Cities

Development Patterns Affect Ridership

Since frequency is expensive, it can't be offered everywhere. The greatest access arises from focusing frequency in the places where it can benefit the most people.

- **How many residents or useful destinations can be easily reached from each transit stop?** This question looks for density and walkability. High density means more people will find a stop useful, and high walkability means that people over a larger area will find the stop easy to walk to.
- **Are stops with high demand concentrated along a logical line?** This question looks for linearity (can the line be straight?) and proximity (does the line have to cross empty gaps with no demand?).

These geometric facts result in a difficult political challenge around transit. A transit system designed to maximize ridership serves its community unevenly, concentrating service where demand is high, yet even in areas where demand is low, some people value transit and will ask for service to their area. This leads to complaints about equity no matter what network design is proposed. People who live in places that are dense, walkable, and linear are cheaper to serve, on a per-rider basis, than those who live in places with lower density, walkability, and linearity.

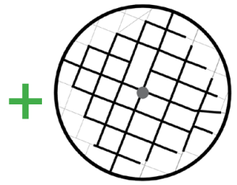
Imagine that Ms. Smith lives in an apartment in a town center (dense, walkable, linear, proximate) while Ms. Jones lives in a large house in a cul-de-sac on a peninsula in a suburban area (not dense, not walkable, not linear, not proximate).

The objective fact is that it would cost much more to serve Ms. Jones than to serve Ms. Smith. Is it fair to give them the same level of service regardless? Or is it fair to spend the same amount serving each of them, which would mean very little service for Ms. Jones? The answer depends on the goals for that transit system.

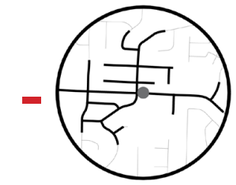
Four Geographic Indicators of High Ridership Potential

Density *How many people, jobs, and activities are near each transit stop?*

Walkability *Can people walk to and from the stop?*



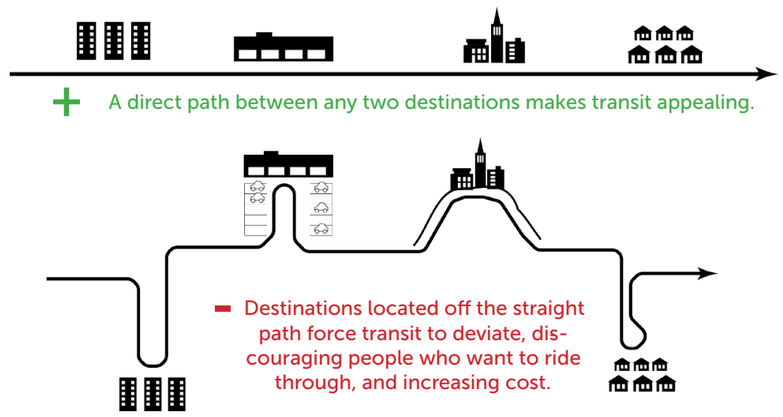
The dot at the center of these circles is a transit stop, while the circle is a ¼ mile in radius.



The whole area is within ¼ miles, but only the black-shaded streets are within a ¼-mile *walk*.

\+ It must also be safe to cross the street at a stop. You usually need the stops on both sides for two-way travel!

Linearity *Can transit run in reasonably straight lines?*



Proximity *Does transit have to traverse long gaps?*

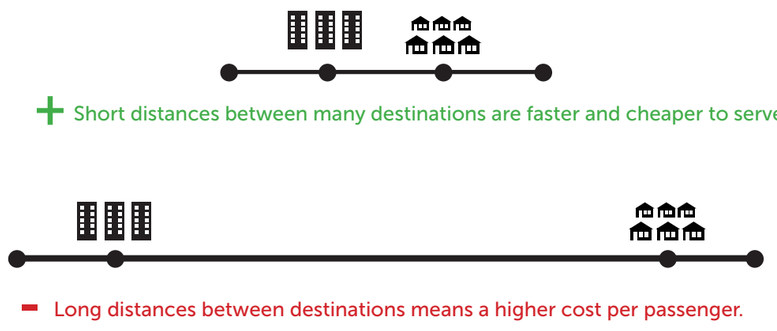


Figure 12: Community Geometry - Four Geographic Indicators of High Ridership Potential

Goals of Transit

As discussed on page 6, transit can serve many different goals including

- Economic
- Environmental
- Social
- Health
- Personal Liberty

Some of these goals are served by high transit ridership. For example, the environmental benefits of transit only arise from many people riding the bus rather than driving. The subsidy per rider is lower when ridership is maximized. We call such goals **Ridership goals** because they are achieved in part through high ridership.

Other goals are served by the mere presence of transit. A bus route through a neighborhood provides residents insurance against isolation, even if the route is infrequent, not very useful, and few people ride it. A route may fulfill political or social obligations, for example by getting service close to every taxpayer or into every political district. We call these types of goals **Coverage goals** because they are achieved in part by covering geographic areas with service, regardless of ridership.

Transit's Ridership and Coverage Goals Are in Conflict

As described on the previous pages, a network the maximizes access for most people is a network that invests in frequent service for most, but not all people. In this way, **Ridership Goals** and **Coverage Goals** conflict. Within a fixed budget, if a transit agency wants to do more of one, it must do less of the other.

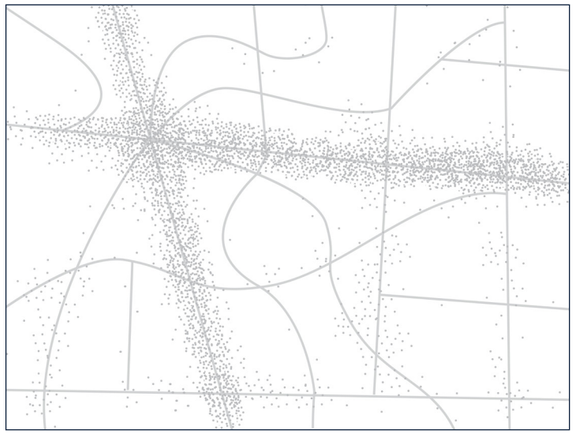
Consider the fictional town in Figure 13. The little dots indicate dwellings and commercial buildings and other land uses. The lines indicate roads. As in many towns, most activity is concentrated around a few roads.

A transit agency pursuing only Ridership Goals would recognize that it has to prioritize where to use its scarce funds and follow the ridership recipe: put frequent service along the main streets where many people are nearby and buses can run direct routes. Doing so would provide access to many destinations in a short time for about 70% of the people in the town. **A high ridership network is the network that maximizes access for most, but not all people.**

If the transit agency were pursuing only coverage, it would spread out so that every street had some service, as in the network on the bottom right. All routes would then be infrequent, even on the main roads.

The choice between maximizing ridership and maximizing coverage is not binary. All transit agencies spend some portion of their budget pursuing each type of goal. **A particularly clear way for cities and transit agencies to set a policy balancing ridership and coverage goals is to decide what percentage of their service budget should be spent in pursuit of each.**

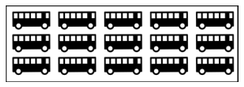
The "right" balance of ridership and coverage goals is different in every community. It can also change over time as the values and ambitions of a community change.

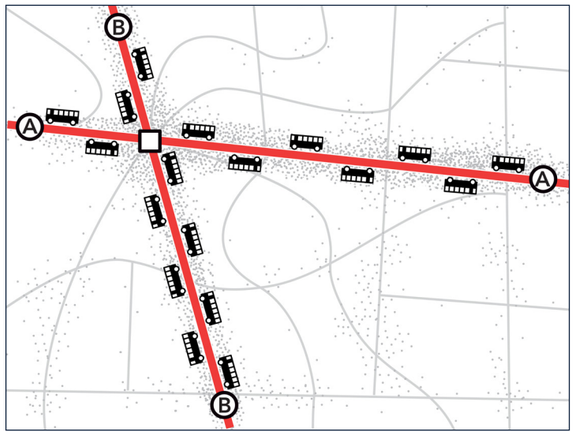


Imagine you are the transit planner for this fictional neighborhood. The dots scattered around the map are people and jobs.

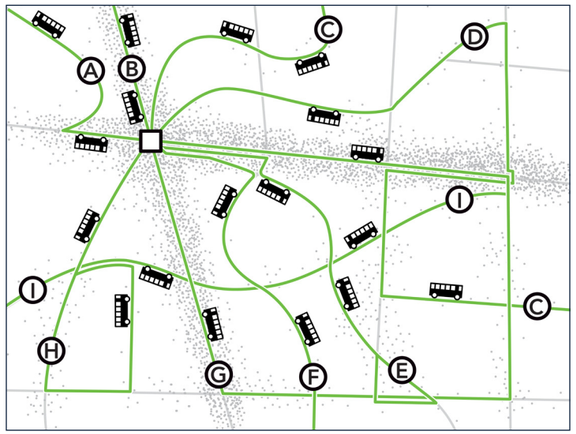
The 18 buses below are the resources the town has to run transit

Before you can plan transit routes, you must first decide: What is the purpose of your transit system?





All 18 buses are focused on the busiest streets. Waits for service are short but walks to service are longer for people in less populated areas. Frequency and ridership are high but some places have no service.



The 18 buses are spread around so that there is a route on every street. Everyone lives near a stop but every route is infrequent, so waits for service are long. Only a few people can bear to wait so long, so ridership is low.

Figure 13: Within a fixed budget, Ridership Goals and Coverage Goals lead to different network designs.

What About On-Demand Transit?

You may have heard about new service concepts consisting of small vehicles that pick you up when and where you request them, rather than running fixed routes. You may hear these called "Microtransit", "On-Demand Transit", "Demand Response Services", or "TNC Partnerships," where "TNC" (Transportation Network Company) refers to companies like Uber and Lyft.

The basic idea isn't new. Taxis have always responded to customer requests, and shared-ride demand-response services, often called Dial-a-Ride, have been used for decades by US transit agencies. Special services for the disabled, called Paratransit, also work this way.

The Trouble With Fixed Route Transit

There are obvious inconveniences in relying on fixed transit routes:

- **Long Walks.** Depending on where you are located, it may not be easy to get to the nearest transit stop. It might be far away, or require you to walk down streets where you don't feel as safe as you'd like.
- **Long Waits.** Even on frequent routes, you may have to wait 10 to 15 minutes to get a bus or streetcar. On some routes, you could wait an hour or longer. And you'll wait twice if your trip requires a transfer.
- **Travelling out of direction.** Using fixed routes means staying on the bus' path, even when it's not taking the fastest way to your destination.

The Trouble With On-Demand Transit

It may seem obvious that transit would be more convenient if it were provided on-demand, precisely when and where each person wanted to travel. It would then be more like a taxi or traditional "dial-a-ride" transit. Smartphones have raised the possibility that more transit could be this responsive, with great real-time information. Apps have made these services more responsive, so that they can be called on shorter notice.

There is an argument that transit is better when it is provided on-demand because it removes the problem of walking and traveling out of direction. It's more convenient, some might say. But that makes sense only if we don't account for the cost. The main source of operating cost for transportation (fixed route, on-demand or even local freight delivery) is the time the driver and vehicle spend on the road. Neither apps nor sophisticated dispatching software change that cost.

The costs of a fixed route are fixed, so more useful services are cheaper (per rider) to operate. SCT knows how much a bus route costs to operate, because the schedule tells us how many vehicles are needed, how many miles will be driven, for how many hours. **So the more people ride, the less expensive it becomes to provide each ride.**

In contrast, the costs of on-demand service tend to rise as more people find it useful. There is a low ceiling on how many rides per hour an on-demand vehicle can serve, even with the best possible dispatching. Imagine driving your car (or a bus) around the County, picking people up and dropping them off in different places. How many times could you do this before an hour passed?

On-demand services run by public agencies generally report averages of no more than 5 boardings per vehicle per hour. Some private operators of on-demand service have reported as high as 9 boardings per hour in mid-sized North American cities. In contrast, even low-performing fixed-route buses in many agencies handle 5 boardings per hour on average over a weekday. Moving fewer riders per hour means a service is more expensive per passenger.

For these reasons, demand-responsive services are never high-ridership services, when accounting for the full costs and the lack of scalability. These service may be relevant in low-demand areas, or at low demand times, like late at night, but as coverage services, where maximum ridership is not the goal. Use of these kinds of services will be explored in this Reimagine Transit process, but the basic geometric challenge of their use and role should be clear from the beginning of the process.

As service becomes more flexible, it takes longer to serve each passenger, as each rider's destination is rarely on the way. The longer it takes to transport each rider, the higher the cost of each ride.

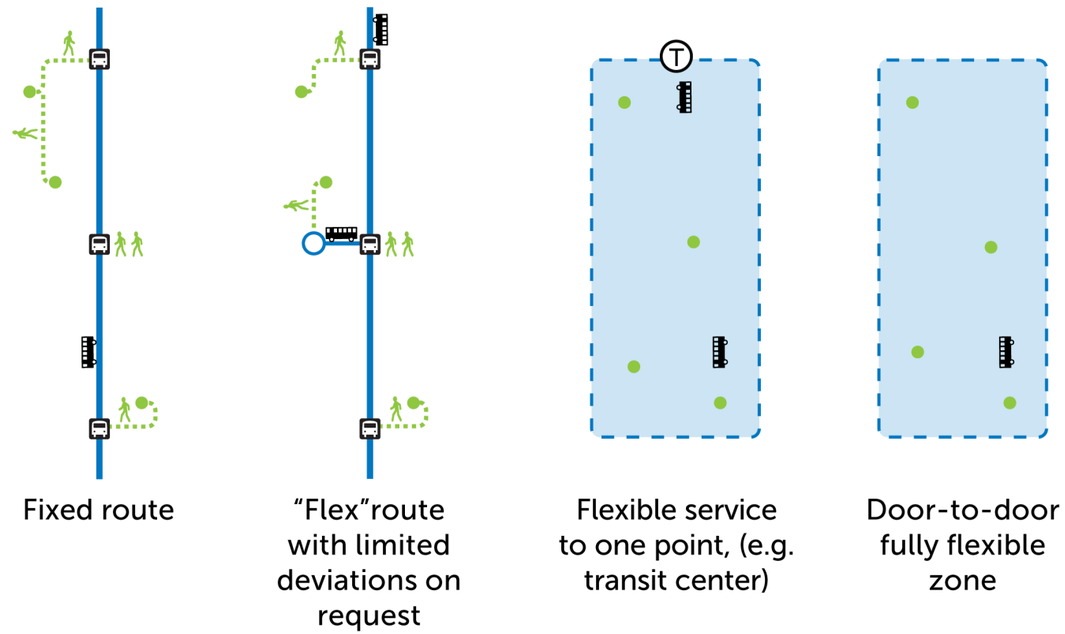


Figure 14: The spectrum of service, from a traditional fixed route to a fully on-demand service.

3 Market and Needs

Market and Need Assessment

In this chapter, we present and discuss data that inform two different types of considerations in transit planning:

- Where are the strongest markets for transit, where ridership is likely to be high relative to cost?
- Where is moderate or severe need for transit, regardless of potential ridership and cost?

These two types of considerations help us design transit networks that pick a balance between the competing goals of high ridership and wide coverage.

Market Assessment

The transit market is mostly defined by **WHERE** people are, and **HOW MANY** of them are there, rather than by **WHO** they are.

On the following pages, these maps help us visualize the transit market:

- Residential density
- Job density
- Activity density (the sum of residents and jobs)
- Density of low-income residents
- Density of zero-vehicle households

None of these data alone tell us that a place has high ridership potential and is therefore a strong transit market. Rather, we must consider them in combination.

If you asked a transit planner to draw you a very high-ridership bus route, that planner would look mostly at densities of all residents and jobs; at the walkability of streets and neighborhoods; and at the cost of running a bus route long enough to reach them. Only secondarily would that planner look into the income or age of those residents or workers.

However, the "who" attribute that has the strongest influence on transit ridership potential is income. This is especially true in suburban areas where driving and parking cars is so easy. Low income people are, as individuals, more likely to choose transit. That said, the density of all people—including low-income people—around a transit stop will still be the overriding factor in predicting whether that stop gets high ridership.

All else being equal, density matters more than income and age if you are trying to predict where transit will get high ridership.

This is not to say that who people are is not important. It is extremely important, especially when designing transit services to achieve a coverage goal.

Need Assessment

We learn about transit needs by examining **WHO** people are and what life situation they are in.

If you asked a transit planner to draw you a route that met as many needs as possible, that planner would look at where low income people, seniors, youth, and people with disabilities live and where they need to go.

While the densities at which these people live would matter because at higher densities a single bus stop can be useful to more people in need, the planner would still try to get the route close to even small numbers of people. In fact, the more distant and scattered people are, the more isolated they can be and the more they might need access to transit.

On the following pages, these maps help us visualize where transit needs are in Suffolk County:

- Density of low-income residents
- Density of zero-vehicle households
- Density of seniors
- Density of youths

These measures cannot by themselves tell us that a person has a severe need for transit. For example, some people in a zero-vehicle household can afford to hire drivers, or rarely drive but are comfortably retired. We must consider these measures in combination to understand where in Suffolk County people's needs for transit are likely to be severe.

One map included in the Need Assessment pages does not relate directly to people's need for transit, but does speak to a type of coverage goal, and that is the map of the race or ethnicity of Suffolk County residents. A person's race or ethnicity does not tell us if they need transit, or if they have a propensity to use transit. However, we know that race and ethnicity are correlated with income.

Understanding the race or ethnicity of residents in Suffolk County is crucial to understanding whether transit service changes will affect people equitably. Unequal treatment on the basis of race or ethnicity is illegal under the Civil Rights Act of 1964. Unequal treatment on the basis of other characteristics, including income and age, is also prohibited by law. Thus, an examination of where people of color live is less part of a "Need Assessment" than part of a civil rights assessment and a consideration of racial equity.

Market: Residential Density

While not all trips start or end at home, nearly everybody makes at least one trip starting or ending at home on most days. Further, places with many households are also destinations for other people, whether for visiting, worship, caring for family or home-based work.

Transit designed to get high ridership will seek to offer useful service in places with high residential densities. Coverage services will try to reach all or most residents, even in areas with low density development pattern where few people live near any given stop.

Despite being New York's fourth largest county by population, on an average, Suffolk County is not very dense because of its enormous land area. The average density of Suffolk County is approximately 1,620 people per square mile. This is lower than most other suburban counties around New York City.

West-East Distribution

Figure 15 maps the residential density across Suffolk County. From this map, we can see that the population of the County is not evenly distributed between the five western towns (Huntington, Babylon, Smithtown, Islip, and Brookhaven) and the remaining five eastern towns (Riverhead, Southold, Shelter Island, Southampton, and East Hampton).

The western towns are much closer to New York City and are much more dense: these towns house approximately 90% of the County's population despite having only around 62% of the County's land area. Figure 16 shows the residential density distribution for the denser western part of the County.

The eastern towns are much more rural in character. They have a lot more farmland (particularly on the North Fork) and natural areas including state parks, wetlands, and nature preserves. A lot of the residences in these towns are second homes or vacation homes, and do not have people living there for a large part of the year. Consequently, the population densities in these towns are generally much lower than in western parts of the County.

Denser Older Cores

The County has several hamlets and villages founded in the 17th to 19th centuries as well as later developments along the LIRR lines, which have relatively denser cores featuring well-connected street patterns and smaller lot sizes.

These developments are especially present in the southwestern towns of Babylon and Islip, but can also be found in other towns. Examples include villages and hamlets like Huntington, St. James, Port Jefferson, and Patchogue.

Some of these cores are surrounded by early suburban developments which have lower density, and yet have regular grids or similar well-connected street patterns. Such areas are easier to serve by transit.

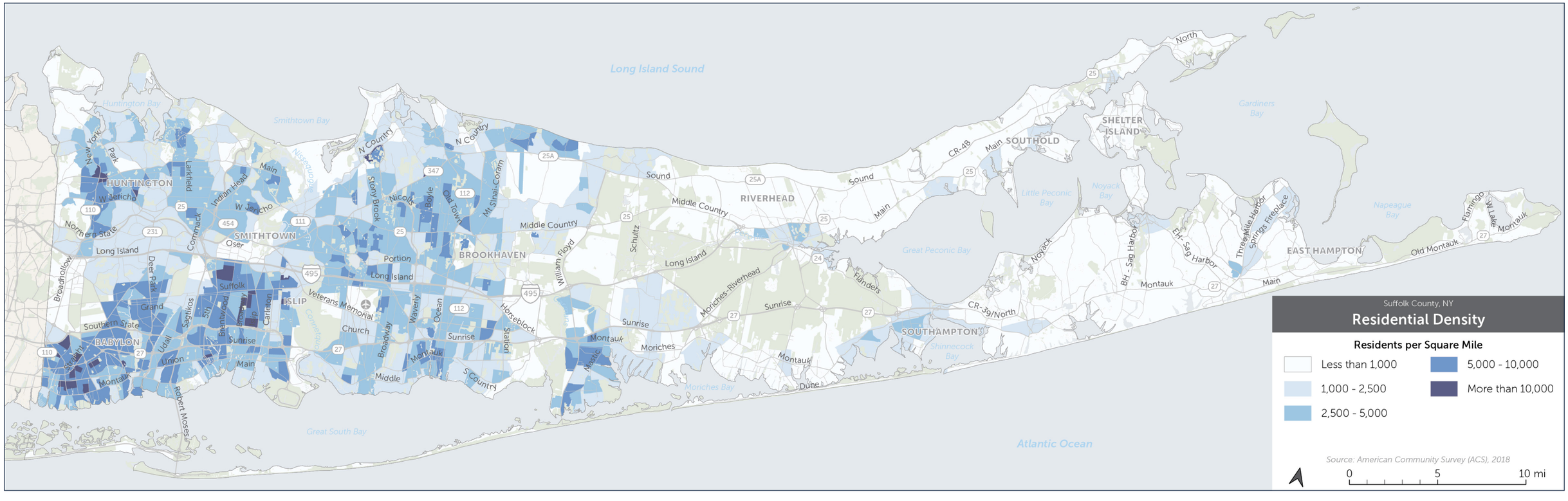


Figure 15: Suffolk County Residential Density

Suburban Development

Suffolk is a predominantly suburban county. As such, it features a lot of suburban development from the post-World War II period with larger lot sizes, a clearer separation of land uses, and less connected, circuitous street pattern. These areas tend to be more difficult to serve by transit.

For example, consider the Waterfalls and Brookwood On The Lake Apartments, two large apartment complexes in Ronkonkoma, shown in Figure 17. In order to serve these apartments and the Sachem District schools nearby, Route 57 has to make a weaving detour of 3.6 miles in each direction between Portion Road and Smith Street on Hawkins Avenue, when the actual distance between these intersections straight along Hawkins is only 0.8 miles.

Had this area developed differently, with the apartments and schools in close vicinity of Hawkins Avenue, the residents, students, and workers who need to travel to and from these buildings could have had access to direct, more reliable, and potentially more frequent transit.

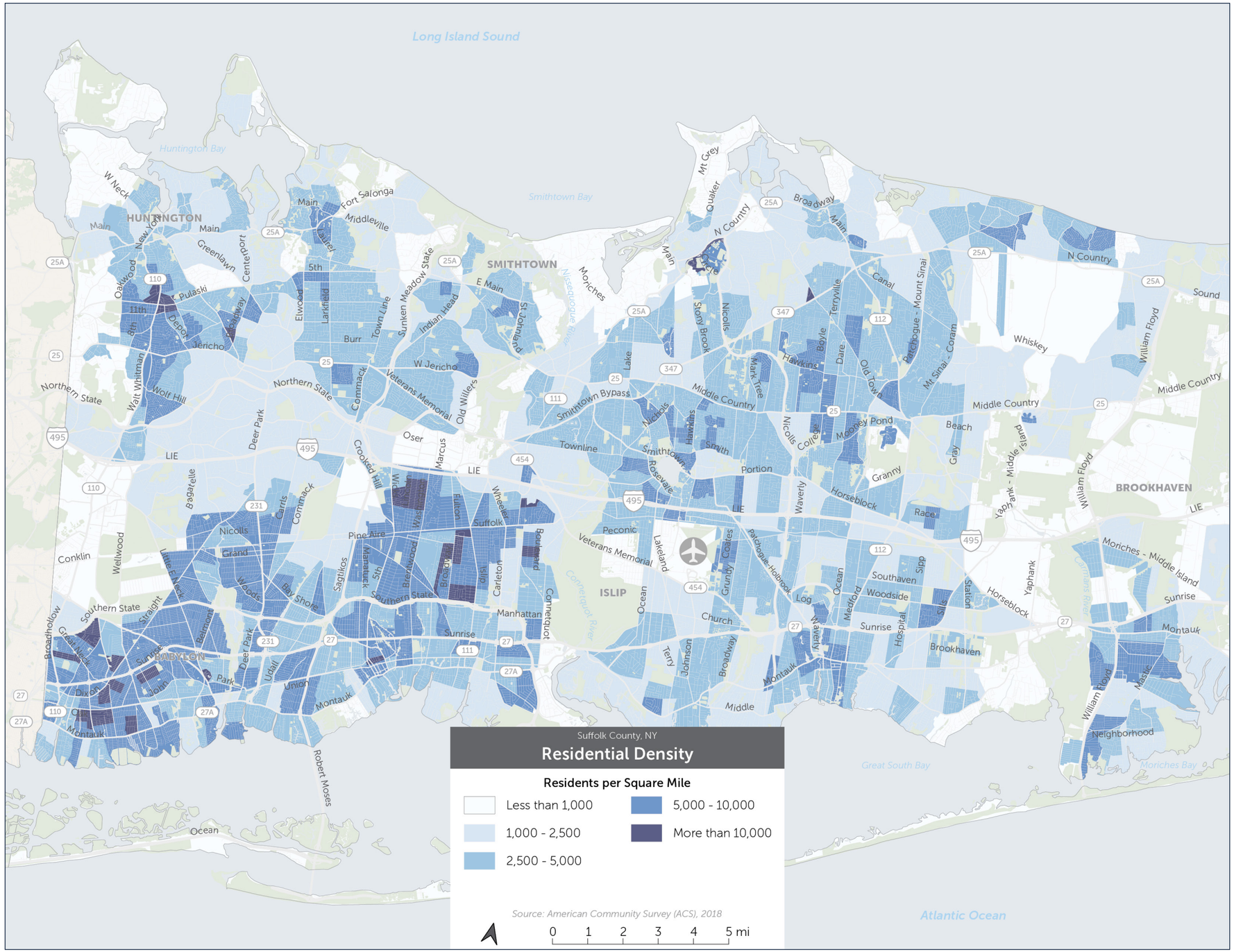


Figure 16: Residential Density in the Western Part of Suffolk County

Figure 17: Route 57 in Ronkonkoma shows the difficulty in serving suburban developments.

Seasonal Population Changes

Many residences in the eastern forks are vacation homes and second residences which are often only occupied during the warmer parts of the year, particularly in the South Fork. Beaches, nature preserves, and other sights—including farms in the North Fork—also attract many tourists during summer and fall.

This results in a huge increase in the number of people staying in these towns in the summer compared to their year-round population. In total, the population is estimated to increase by around 160% from 139,000 to 359,000 in the summer.

While this percentage growth in population during the summer is quite high, it is useful to keep in mind that the base of the population from which the increase is starting from is relatively low. So even when this summer-time population is added, the overall density of people in the North and South Forks is much lower than western parts of the County. Figure 18 shows the difference between year-round population density and estimated summer population density at the village and hamlet level.

This population increase suggests that the eastern parts of the County has higher demand for transit service in the summer compared to the winter. Yet, compared to the western parts of the County, even in the summer, the demand level would still be much lower in the North and South Forks.

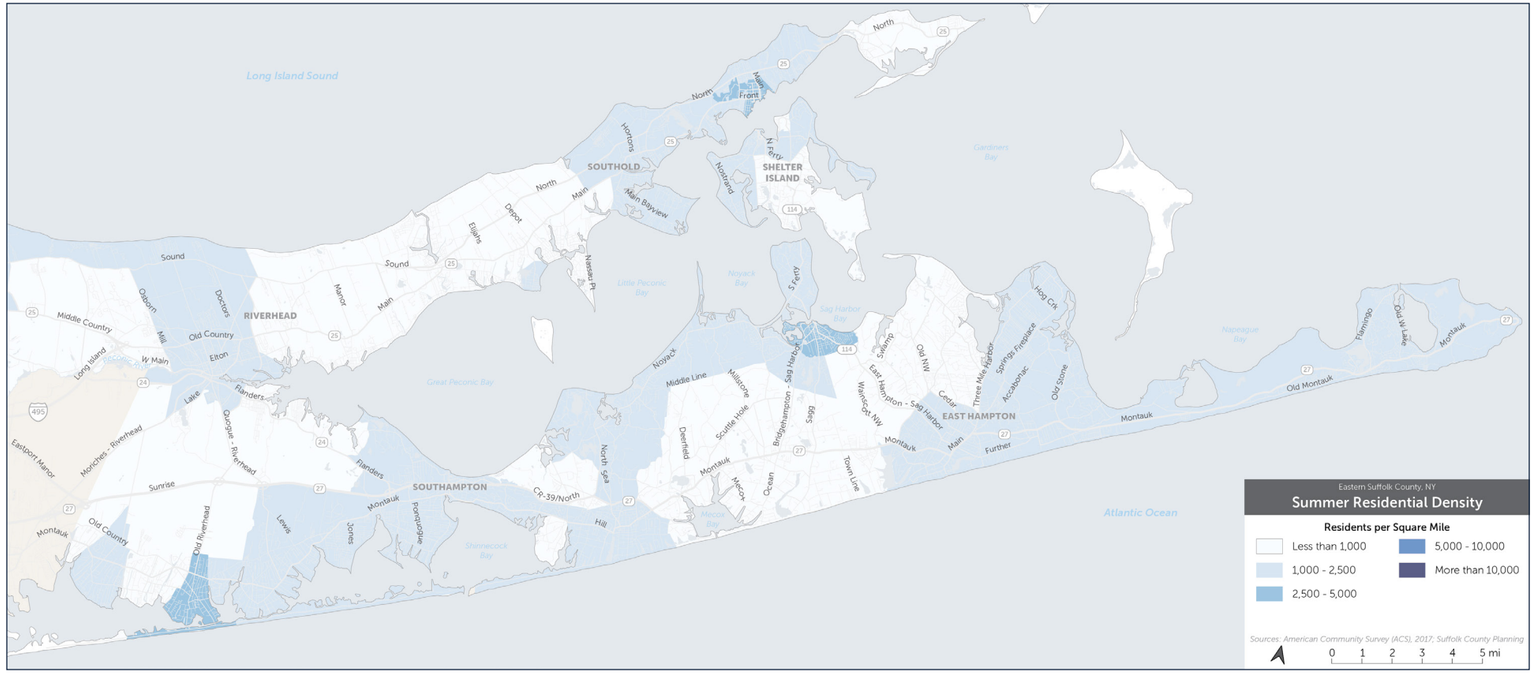


Figure 18: The population density in the eastern hamlets in the summer is still much lower than western parts of the County.

Market: Job Density

A map of job density shows us not only the places people travel for work, but also places people go for services, shopping, social needs, health care, and more.

A person's workplace may be, throughout the day, a destination for dozens or even hundreds of people. For this reason, job density is typically even more closely related to transit ridership than residential density.

Distribution of Job Density

The map below (Figure 19) shows the distribution of job density in Suffolk County. Being a suburban county, Suffolk does not have a unique "downtown" as its primary center of jobs and services. However, there are several smaller concentrations of jobs spread across the County. Similar to distribution of residents shown in the previous maps, around 90% of the jobs in the County are also located in the western five towns. The zoomed-in map on the next page (Figure 20) shows the job density in the western part of the County.

Figure 19: Suffolk County Employment Density

Village/Hamlet Centers

The older and denser developments in village and hamlet centers are often a focus of commercial activity. These areas tend to have many smaller shops with street fronts and small parking lots, and are located in denser areas with better connected street networks. All of these factors make walking between these jobs and transit stops much easier.

These areas also show up as moderate concentrations of jobs, but that is mostly due to most of the remaining area being residential, and not parking lots. Examples include the centers of Huntington, Amityville, Babylon, Bay Shore, Islip, East Northport, Port Jefferson, and Riverhead.

Universities and Hospitals

College campuses like Stony Brook University and the Suffolk County Community College have many jobs and also generate all-day travel demand as students and staff arrive and leave at different times throughout the day.

This is also the case for hospitals and medical centers. The hospitals in Huntington, Bay Shore, Amityville, Patchogue, and Port Jefferson are close to the dense, walkable town centers in these areas, which makes them even better transit markets.

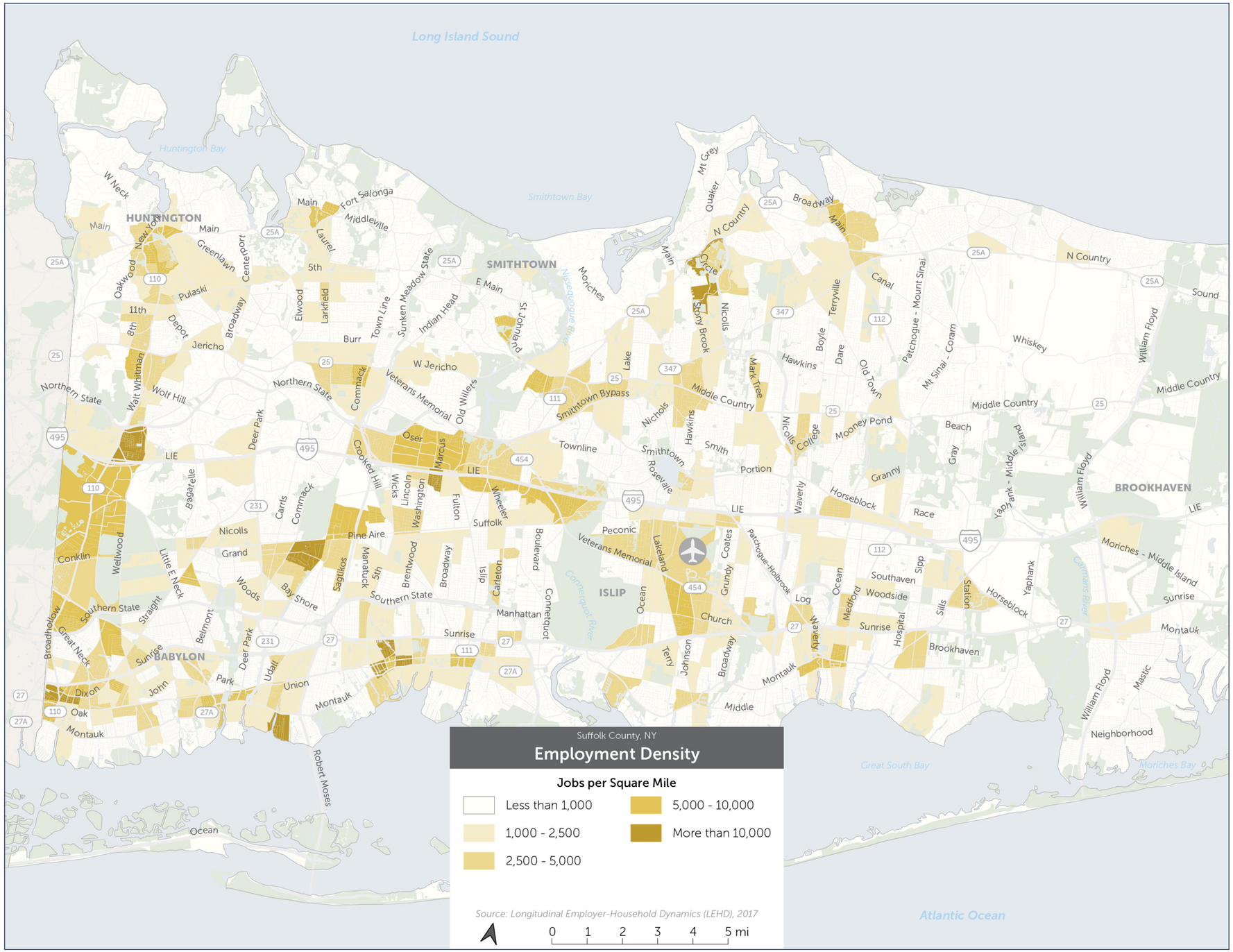


Figure 20: Employment Density in the Western Part of Suffolk County

Office/Industrial Parks

Many dense job centers in the County are single-use office or industrial parks. Many of these occupy large areas of the western part of the County. Many of these suburban office and industrial parks are designed primarily to be accessed by car, and tend to be located close to major highways. For example, there are large office parks in Melville and Farmingdale around NYS 110, in Hauppauge and Islandia near Long Island Expressway, and in Ronkonkoma and Bohemia surrounding Veterans Memorial Highway.

Because they are designed to be primarily accessed by cars, many of these office parks and industrial parks are set far back from the street behind large parking lots and the streets within these parks are spaced far apart. This makes for very long walks to any transit service on the main roads. Many of these areas also have minimal sidewalks and relatively wide roads with few safe crossings. Together, these design features limit the potential transit ridership.

For example, at the Broadhollow Road and Walt Whitman Road intersection in Melville, there are no crosswalks. Someone wanting to walk from an office on the eastern side of Broadhollow to a bus stop on the western side has to walk an extra 2,000 feet just to access a crosswalk.

Shopping Centers

Large shopping centers and big box retailers are very common in suburban areas. In Suffolk such large stores are found along major streets and highways throughout the County.

Despite having quite a few jobs, big box stores only show up as areas of moderate employment density because they are located on large parcels with extensive parking areas that well exceed the already large building footprint of the retail space. Hence they also have the problem of long walks between the street and the front entrance.

Some major shopping centers like Walt Whitman Shops, South Shore Mall, Commack Plaza, and Coram Plaza are also SCT “hubs” where several routes converge or terminate.

Figure 21: Example of typical conditions in major shopping centers, office parks, and industrial parks in western Suffolk County.

Market: Activity Density

Resident and job density are both critical measures of a place's potential transit market relative to other parts of the service area. Those two measures can be combined in a single map that shows the **activity density**—the density of both jobs and residents. Activity density helps visualize the overall potential transit market of an area. Figure 22 maps the activity density in Suffolk County, while the zoomed-in map (Figure 23) shows the activity density in the western part of the County.

Places with more residential density are shown in increasingly brighter shades of yellow; areas of high employment density, in brighter shades of blue. The areas shown with increasing shades of red are places where there are high densities of both jobs and residents, and where there is likely to be a strong market for travel for most or all of the day.

Distribution of Activity Density

When looking at jobs and residents combined, 90% of activity is concentrated in the western five towns of Suffolk. There are several areas which are different shades of blue or yellow, which indicate predominantly residential developments or predominantly office/industrial areas where there is not a mix of land uses.

Pockets of purple indicate high residential and medium job density and pockets of orange indicate high job density and medium residential density. There are several packets of purple, orange, and red, which often occur near village/hamlet centers as well as universities. These areas tend to be easier to serve a ridership-oriented network.

Mixed Land Uses = Higher Transit Ridership

In addition to high density, the **mix of uses** along a corridor affects how much ridership transit can achieve, relative to cost. This is because an area with a mix of housing, retail, services and jobs tends to generate more even demand for transit in both directions, throughout the day.

Transit serving purely residential neighborhoods tends to be used in mostly one direction and mostly during rush hours — as residents leave in the morning, and return in the evening. Transit serving residential-only areas tends to have higher costs per rider because:

- If ridership is only high during the morning and evening rush hours, the transit agency must run mostly-empty buses during the rest of the day (or must pay drivers to take split-shifts, which are less desirable because they require working both early mornings and evenings each day with a long mid-day break).
- If ridership is only high in one direction during rush hours, then the transit agency must run mostly-empty buses back in the other direction. The service may not even be advertised as two way, but the operating costs are always two-way.
- Transit agencies who run lots of peak-only service must also buy and maintain extra buses for those few busy hours of peak service each day.

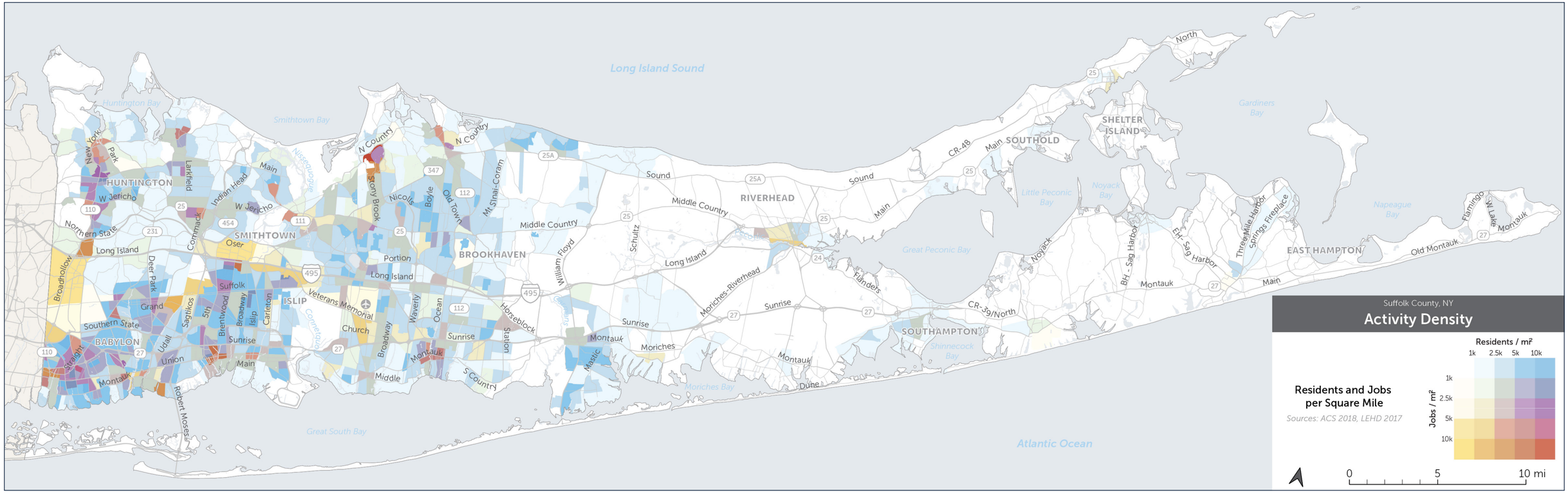


Figure 22: Suffolk County Activity Density

Buses serving a mix of jobs and residents can be full in both directions, leading to lower costs per-rider. If mixed-use areas include jobs from a diversity of sectors such as healthcare, education and retail- all extending beyond the typical 8-5 office schedule, transit also tends to see stronger all-day, two-way demand.

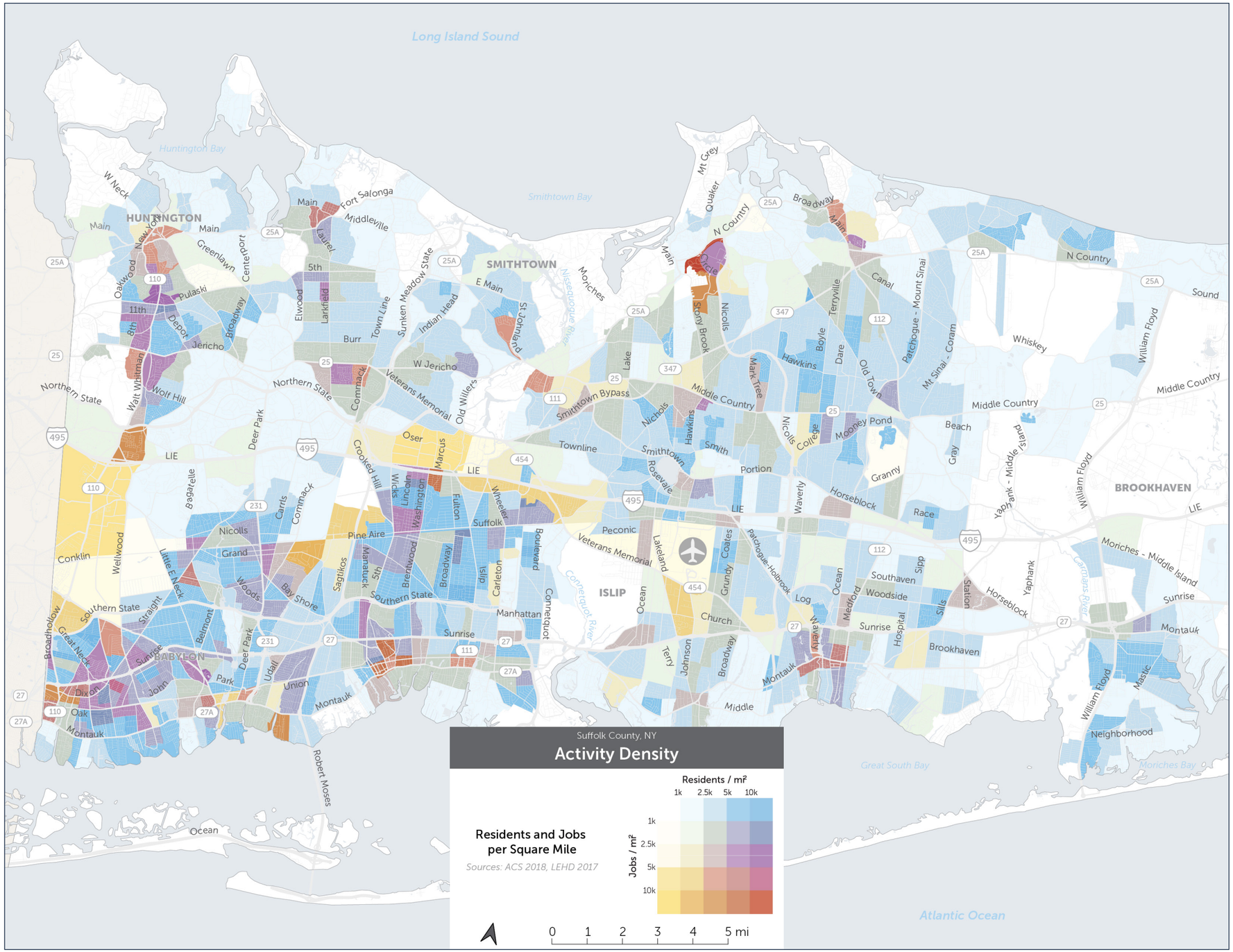


Figure 23: Activity Density in the Western Part of Suffolk County

Market: Walkability

In almost all cases, transit trips begin and/or end by walking. Therefore, the ability to walk to transit is very important.

The more jobs and residents there are near a stop, the stronger the likely transit market. However, the size of the market is also limited by the street pattern, since that determines how much of the area around a stop is truly within a short walking distance.

Areas with highly-connected street patterns provide short and direct paths between any two locations. Areas with poorly-connected street patterns, often in "walled garden" developments or close to freeways or other barriers, force long and circuitous paths between locations and discourage walking (Figure 24).

Actual walking distances to and from bus stops can far exceed "flying" distances. In a perfectly gridded street network, up to 64% of the area within a 1-mile radius can be reached by walking one mile using the street network. This number can be much lower with poorly connected street networks.

The map below (Figure 25) shows a heat map of the County color coded by the proportion of area within a one-mile radius of each location that is accessible through the street grid by walking one mile from that location. Darker areas correspond to contiguous grid-like layouts, while lighter areas represent barriers to walkability, including restrictive street patterns. Figure 26 shows the same map, zoomed-in on the western towns.

The areas with higher walkability tend to be the denser cores of villages and hamlets which were

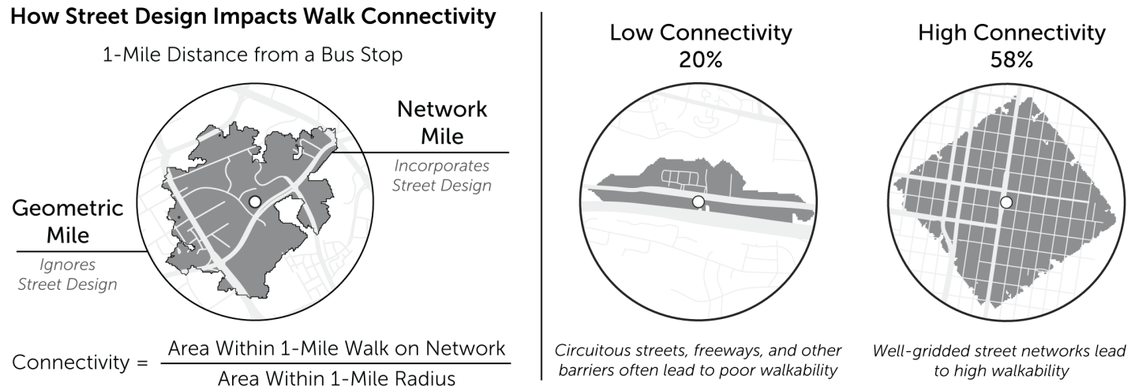


Figure 24: Walk Network Connectivity

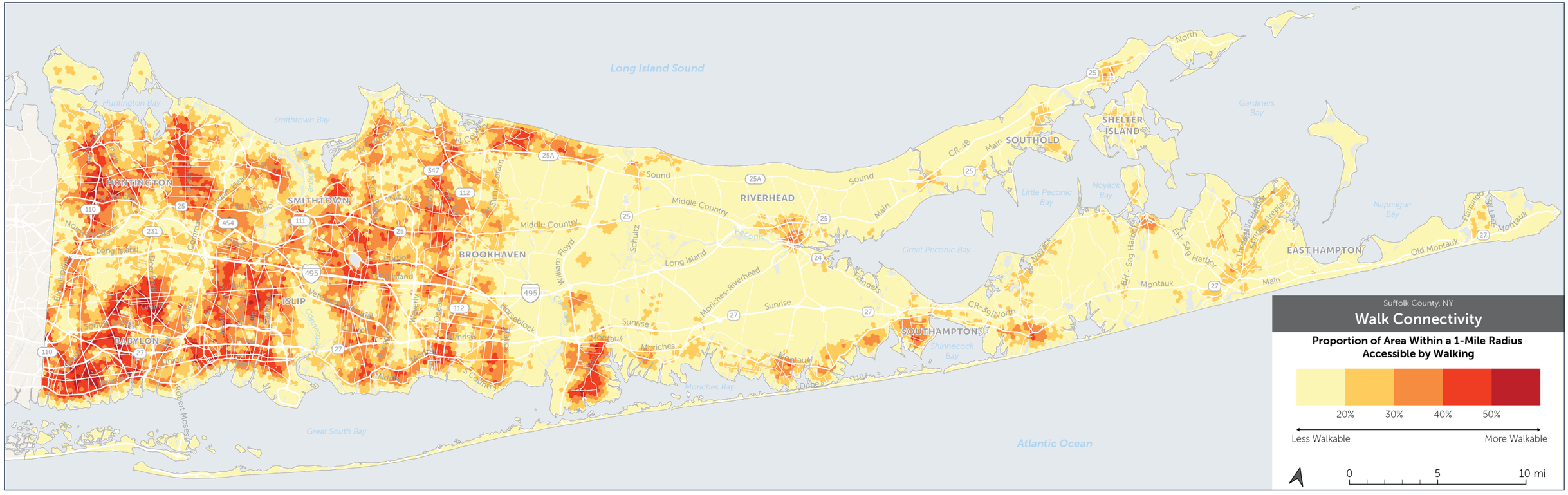


Figure 25: Walk Connectivity in Suffolk County

developed (often along LIRR lines) before major suburban development took place on Long Island in the 1950s. These places have relatively complete grids or a radial network with smaller block sizes.

These maps only show the street network connectivity, but do not measure the presence of sidewalks or safe crossings. In practice, some of the areas shown as having moderate walk network connectivity actually include major barriers to walking due to the small number of places where it is safe to cross a major street. Broadhollow Road is an example of this, where some of the moderate street connectivity areas have intersections which have inadequate or no crossings. A lack of sidewalks and safe crossings of major streets mean that even fewer people and jobs are within a short walk of transit because people may have to walk further and less directly to cross the street to reach a bus stop.

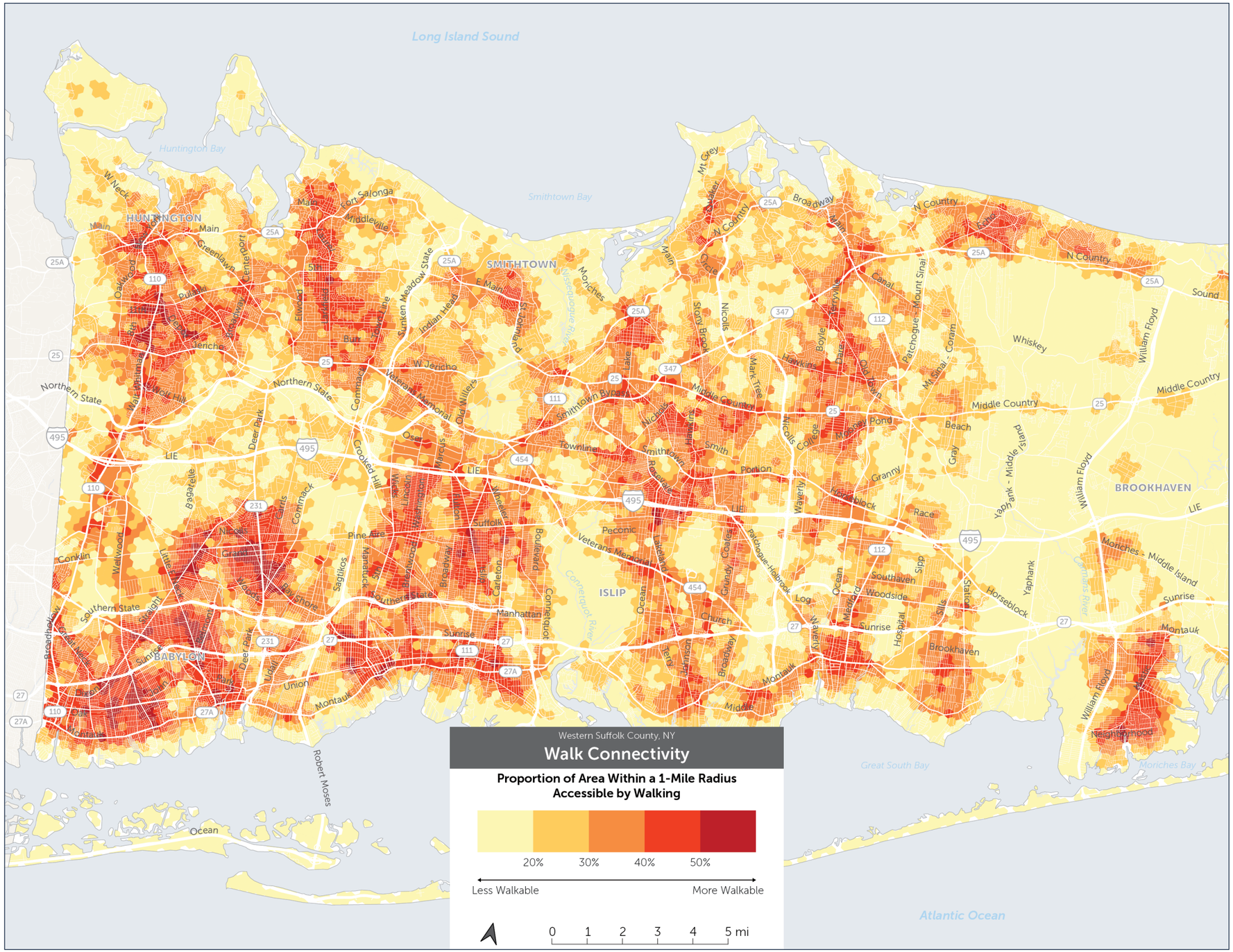


Figure 26: Walk Connectivity in the Western Part of Suffolk County

Market and Need: Low-Income Residents

Transit is often tasked with providing affordable transportation for low-income people. Federal laws also protect people with low incomes from disparate transportation impacts, which can sometimes lead agencies to provide transit service in places where poverty is high even if it does not maximize ridership.

As of 2018, approximately 7% of County residents have incomes below the Federal Poverty Level. This is much lower than the nation-wide average of 13%, but this does not tell the entire story of how many people live with relatively low incomes. The Federal Poverty Level varies by how many people live in a household and in 2018 a family of four with an income below $25,100 was considered in poverty. Since the Federal Poverty Level definition is so low, many communities looking at poverty rates use an expanded definition by using a multiple of the Federal Poverty Level, commonly 200%, or double the Federal Poverty Level. By this standard, a family of four with an income below $50,200 a year would be considered in poverty. By this expanded definition of poverty, 17% of the County's residents are living in poverty.

The maps in Figure 27 and Figure 28 show the distribution the people under this poverty level in the County and in the western part of the County, respectively. Most of the areas with a higher density of people with limited incomes also tend to be areas with high overall residential density. There are concentrations of poverty in Brentwood, Central Islip, North Amityville, and Huntington Station. These areas can be served more easily with useful service that connects many destinations because of their proximity, potential for linear routes, and overall higher density.

There are some pockets of higher poverty density in Mastic, Mastic Beach, North Bellport, Ronkonkoma, Port Jefferson Station, and Riverhead. These pockets are a bit more geographically isolated, and do not always have a well-connected street network. These pockets are harder and more expensive to serve with useful transit and would therefore be served more for coverage reasons than for ridership reasons.

In some built-environments, serving low-income people can meet a ridership goal. Transit can be an attractive option for lower-income people due to its low price and low barrier to entry. So in medium to high density areas, with walkable street networks, service to low-income people can be a powerful ridership generator.

However, an area with low-income residents doesn't necessarily get high transit ridership just because it is served by a transit route. If transit isn't actually useful for the type of trips people need to make, in a reasonable amount of time, even lower-income residents will not use it.

Most people can find other travel options, even if those other options, such as taking out a high-interest loan for a used car, cause them financial distress.

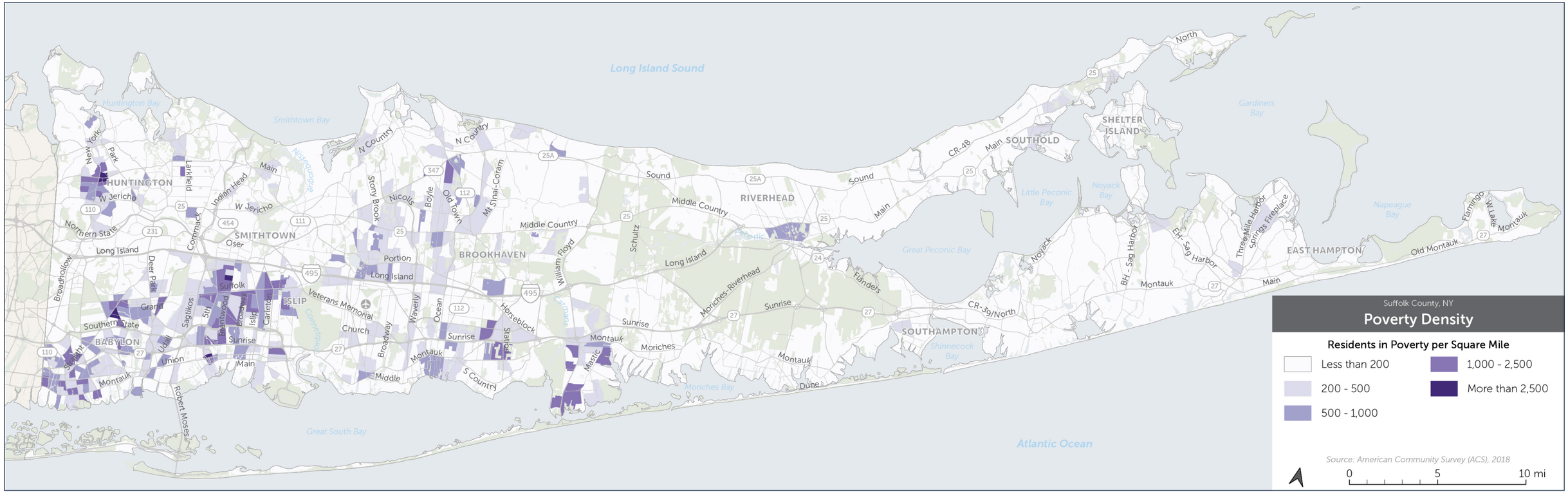


Figure 27: Density of Residents Below 200% of the Federal Poverty Line in Suffolk County

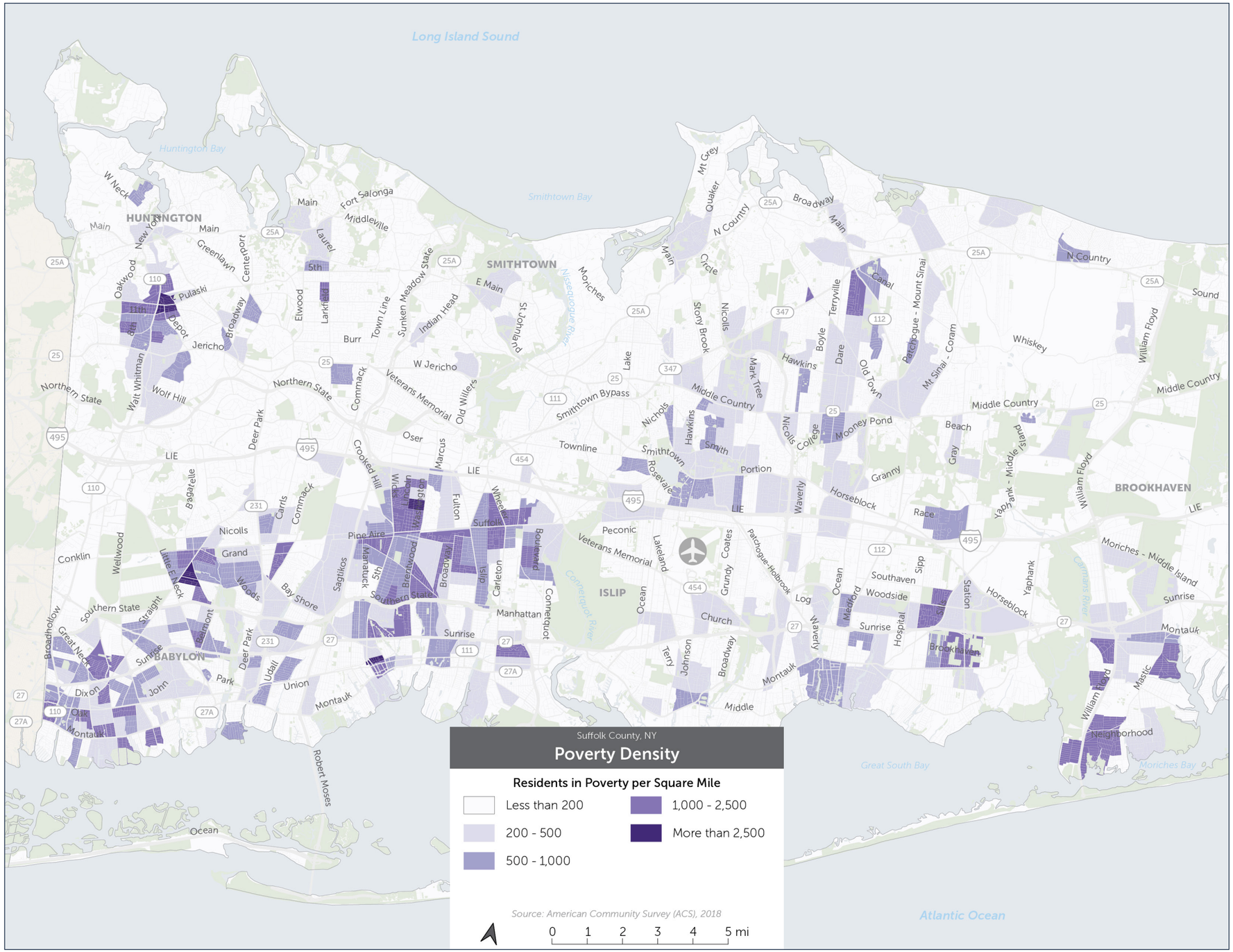


Figure 28: Density of Residents Below 200% of the Federal Poverty Line in the Western Part of Suffolk County

Market and Need: Households Without Cars

Not everybody has ready access to a personal automobile, and people who have less or no access will need to use other modes when they need to travel. This might include walking, cycling, getting a ride from a friend or family member, or, if it is available when they need to travel, and useful for their trip, transit.

If transit does not present a realistic travel option, then people without cars will find other ways of reaching the places they need to go. People in households without vehicles are not necessarily "transit dependent" but do have a greater inclination toward transit use because they don't have a car in their driveway, always ready to go.

In a predominantly suburban or rural area, it is not easy to travel to places one needs to get to without a car. Only around 5% of households in the County have no vehicles. Figure 29 and Figure 30 show the distribution of these households. Most of these households are located in the western towns, especially in areas close to LIRR stations. Areas with large apartment complexes also show up as areas with more households without cars. There is also a common pattern between these maps and the maps of poverty density. It is no surprise that households with lower incomes are likely to be households without a car.

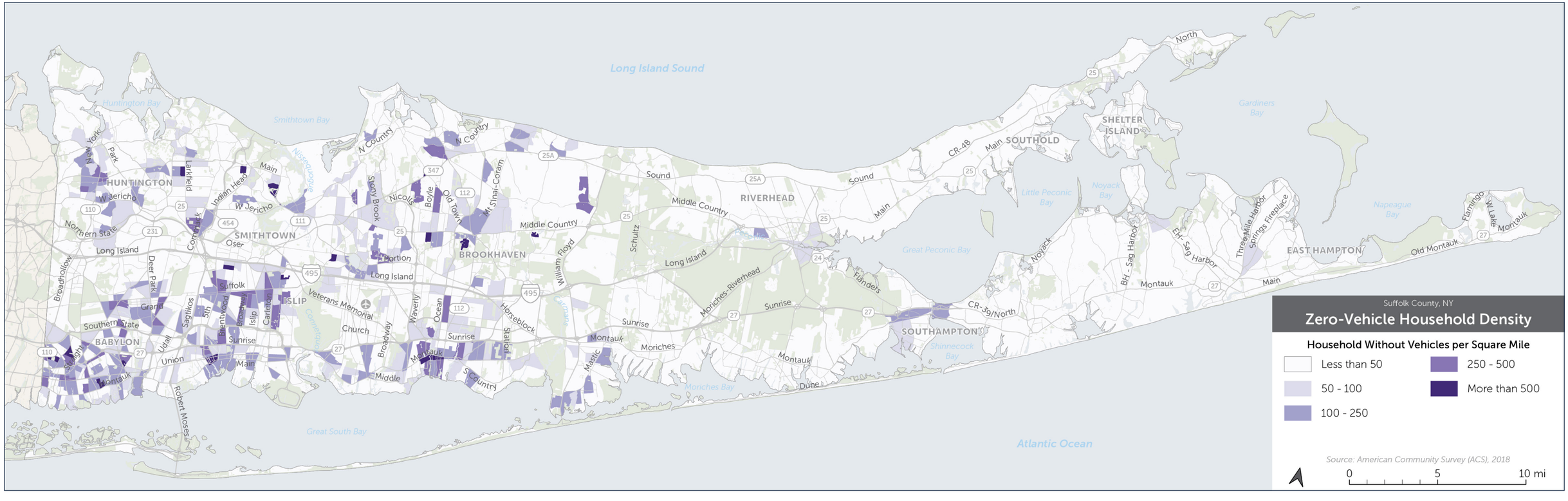


Figure 29: Density of Households Without Cars in Suffolk County

Figure 30: Density of Households Without Cars in the Western Part of Suffolk County

Need: Seniors

Seniors (persons age 65 and above) are an important constituency for transit because a major value of transit coverage is providing service for people who cannot drive, no matter where they live.

Some seniors cannot drive and are therefore more likely to use transit. As a demographic group, senior-headed households are less likely to own cars than the general population, a built-in advantage for transit in places where other characteristics for high ridership (such as density, walkability) are present.

The maps below show the distribution of seniors across the County (Figure 31) and in the western part of the County (Figure 32). Generally, areas with higher population density tend to also have a higher senior density.

However, some places with high concentrations of seniors stand out in places which have only moderate overall residential density. These tend to be retirement homes or senior-only housing communities. For example, there is a patch in Ridge (in the town of Brookhaven), which has a relatively high senior density despite only having moderate overall residential density. This is because it houses a large complex of homes primarily for seniors. Another example is Glenwood Village in Riverhead.

Seniors Have Different Preferences for Transit

Seniors' needs and preferences are, on average, different from those of younger people. Seniors tend to be more sensitive to walking distance, because a higher percentage of seniors have challenges with walking longer distances, or concerns for their personal safety.

Seniors also tend to be less sensitive to long waits for transit, because they are less likely to be employed. For the same reason, seniors are, on average, less likely to be discouraged by slow or indirect routes that take them out of their way.

Due to these factors, transit service designed primarily to meet the needs of seniors rarely attracts high overall ridership. Most riders who are employed, in school or caring for kids in school will find service with long waits to be intolerable. Thus, the amount of focus that transit agencies place on meeting the needs of seniors should be carefully balanced with the needs and desires of the entire community.

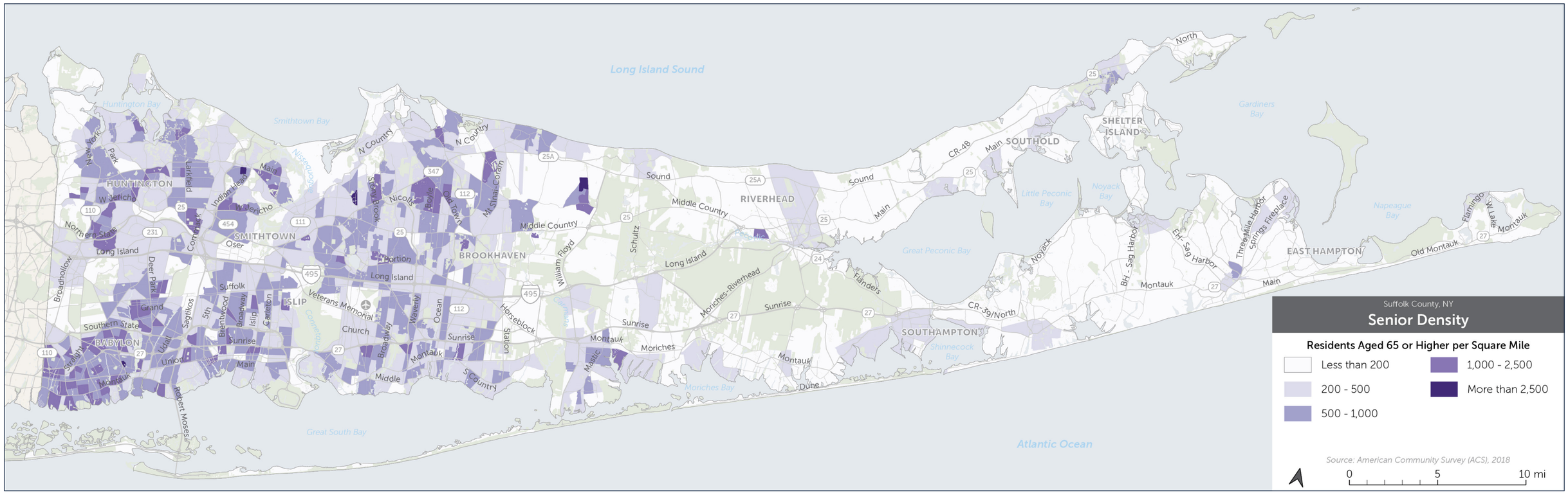


Figure 31: Senior Density in Suffolk County

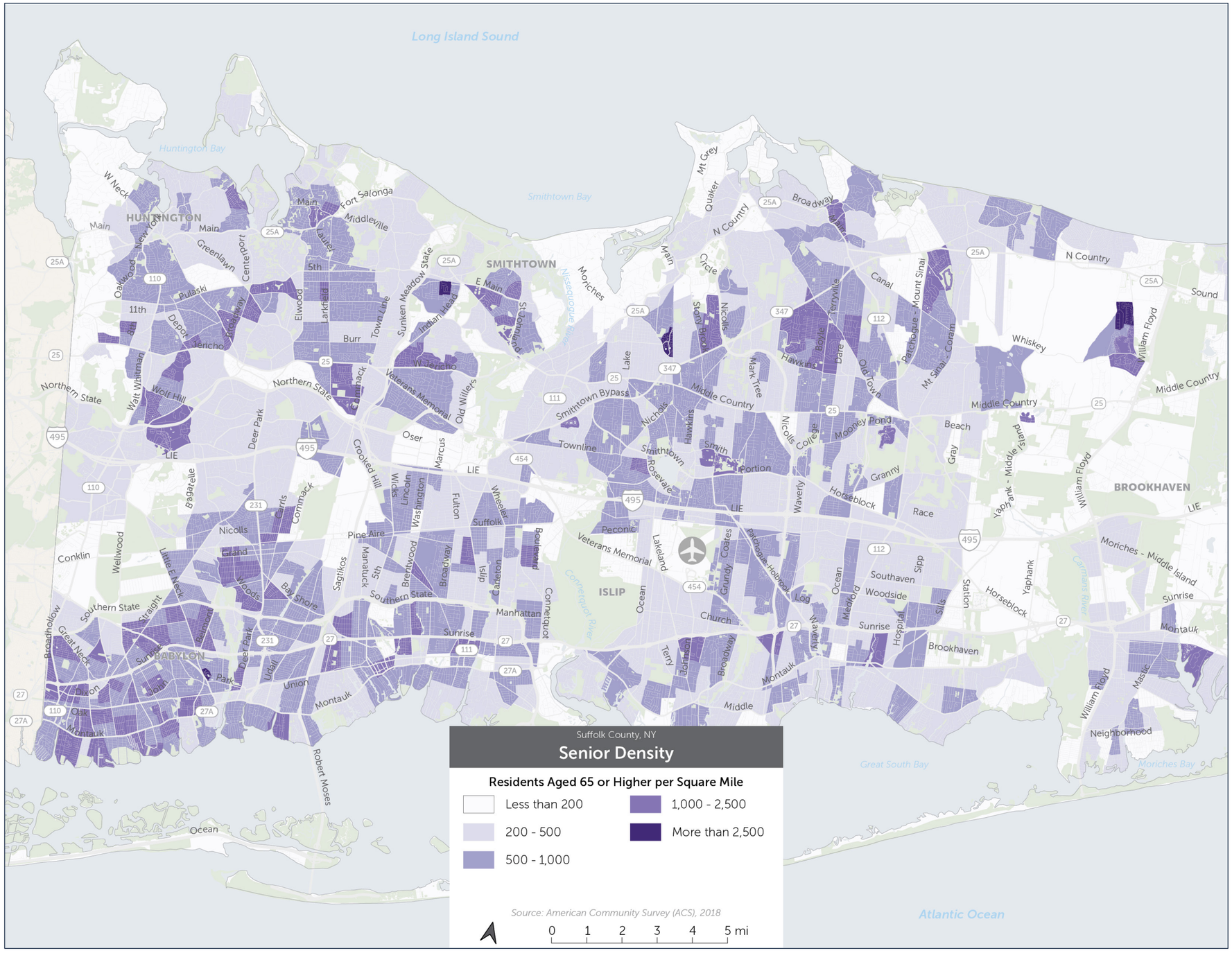


Figure 32: Senior Density in the Western Part of Suffolk County

Need: Youth

Just as transit coverage can meet the needs of seniors who cannot or choose not to drive, transit coverage can also meet the needs of children and teenagers who are too young to drive.

Young people are like seniors in that they often live on a tighter budget than people of working age. For this reason, both are very sensitive to transit fares, and parents are sensitive to paying a fare for each child.

However, young people and seniors are very different in their ability and willingness to walk to transit service. Most young people can and will walk farther to reach service than seniors. Whatever effect an increase in price has on ridership among working age people, it will have an even stronger effect on ridership among young and old people. This is why most transit agencies, along with movie theaters and other for-profit businesses, offer a discounted price for seniors and children.

Figure 33 and Figure 34 show the distribution of youth across the County and in the western part, respectively. The density of youth generally tracks with the density of residents overall. The southwestern towns of Islip and Babylon have some of the highest concentrations of youths, which show up as many close-by dark purple areas in the maps. There are also some areas with higher youth density (and higher overall residential density) in Huntington Station, East Northport, and Coram.

There are some areas with moderate or high residential density which have comparatively low density of youths, and these areas are often retirement communities or have nursing homes (for example, King's Park Manor in King's Park, The Villages in Mount Sinai, or Berkshire Nursing Home in West Babylon).

The area where Stony Brook University is located has very few youth under the age of 18. This is probably because the residents of this area are predominantly university students and do not have children or teenagers. It is worth remembering that university students also often have limited incomes and vehicle ownership.

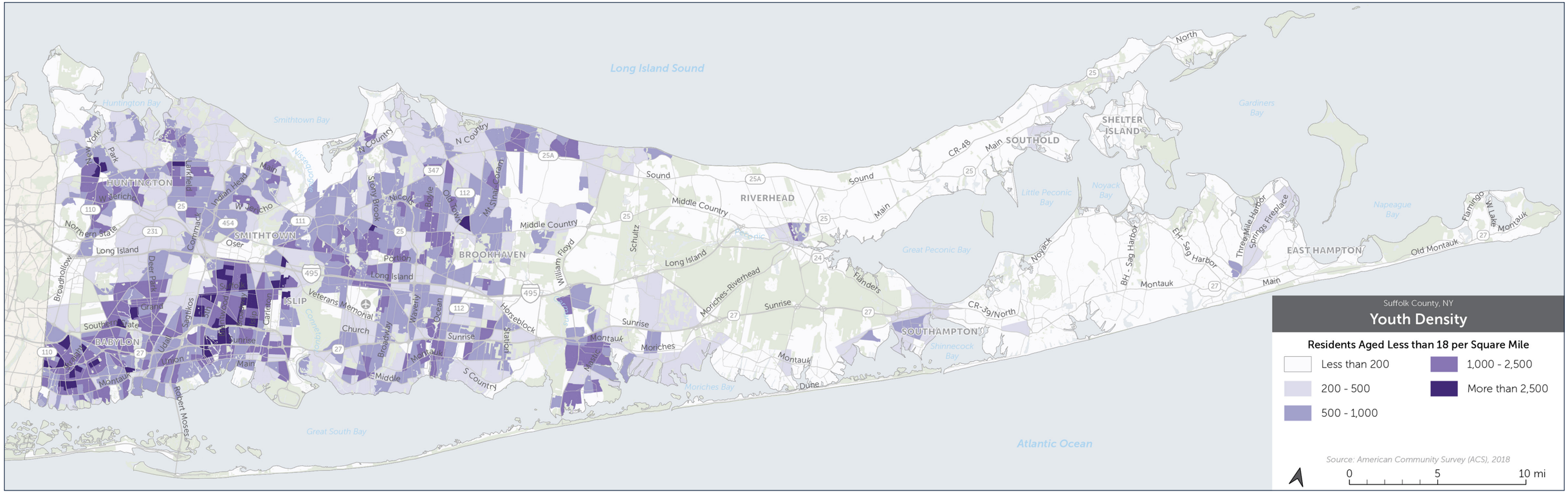


Figure 33: Suffolk County Youth Density

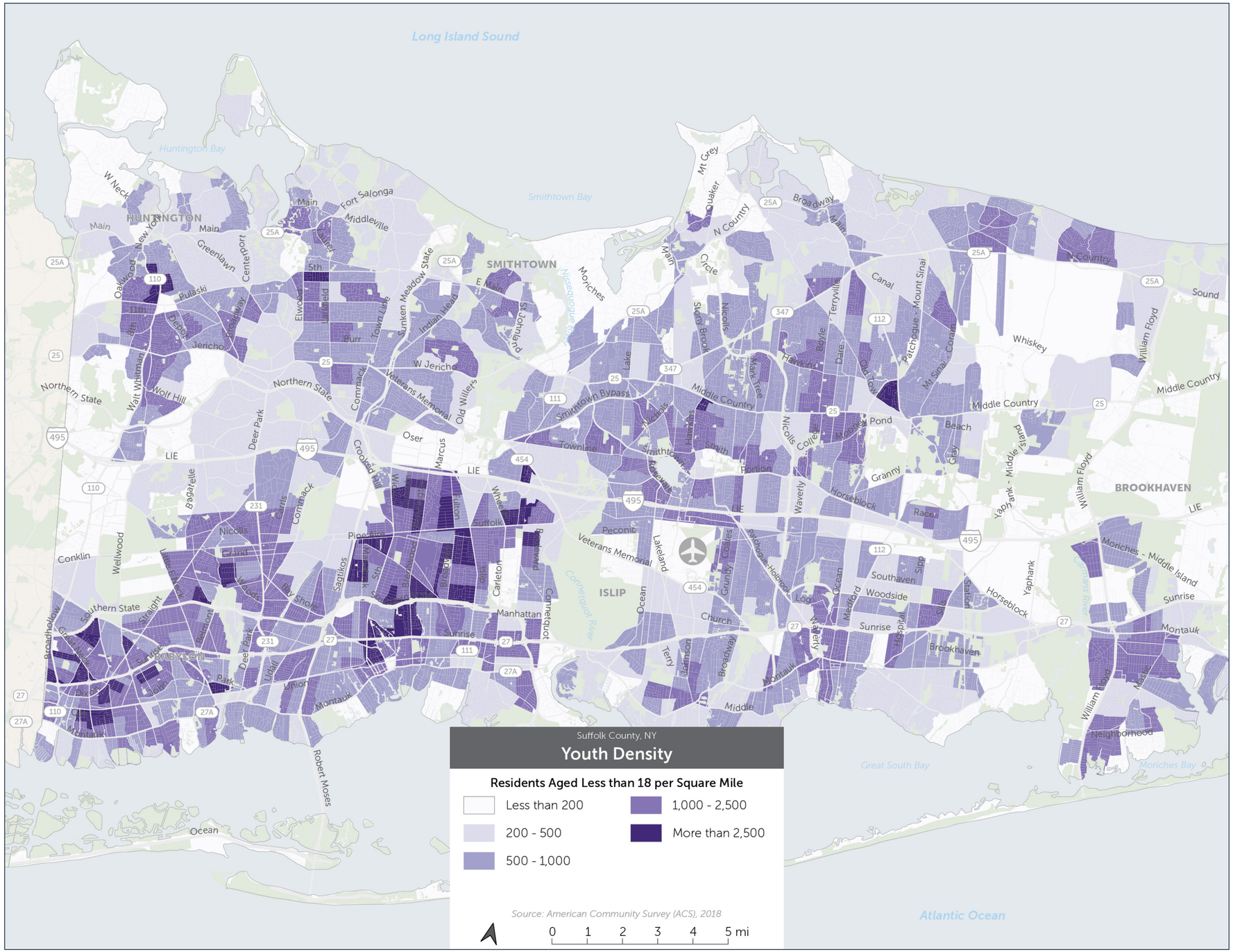


Figure 34: Youth Density in the Western Part of Suffolk County

Civil Rights Assessment: Minority Residents

While information about people's income tells us something about their potential interest in or need for transit, information about ethnicity or race do not alone tell us how likely someone is to use transit.

However, avoiding placement of disproportionate burdens on people of color, through transportation decisions, is essential to the transit planning process. Transit agencies are also required by Title VI of the Civil Rights Act of 1964 to ensure that services they provide do not discriminate on the basis of race, color or national origin.

Equity-based transit goals are often articulated in terms of improving mobility or transit access for people of color, particularly in places where the existing development patterns and transportation network contribute to disparities in access to jobs and other opportunities.

It is also important to understand where large numbers of people of color and people who do not speak English live, so that public outreach during this project can be sensitive to language and cultural barriers, and so that any service changes can be evaluated in light of impacts to protected people.

Non-Hispanic whites are 67% of Suffolk's population. People who identify as Hispanic make up the largest minority at 20%, followed by African-American/Black at 9%, and Asian at 4%. Figure 35 and Figure 36 show the distribution of people by race and ethnicity. Each dot in these maps represent 100 people, and the color of the dot represents the self-identified racial or ethnic group.

The maps show a high density of Hispanic residents in Brentwood and Central Islip. There are also smaller pockets in Huntington Station, Amityville, and to some extent in Patchogue and Mastic. Selden, Centereach, and nearby villages in Brookhaven also have some concentration of Hispanic residents.

There are two areas with significant African-American/Black populations: North Amityville and Wyandanch/northern West Babylon. A dense pocket of Asian residents is located near Stony Brook University.

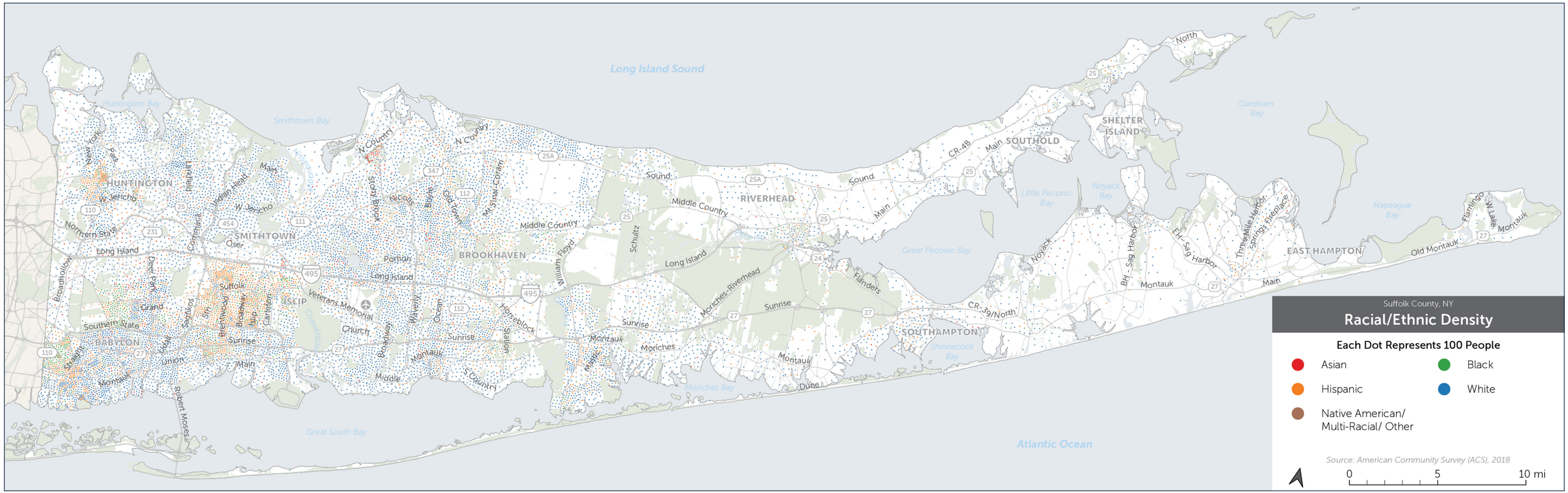


Figure 35: Suffolk County Racial and Ethnic Distribution

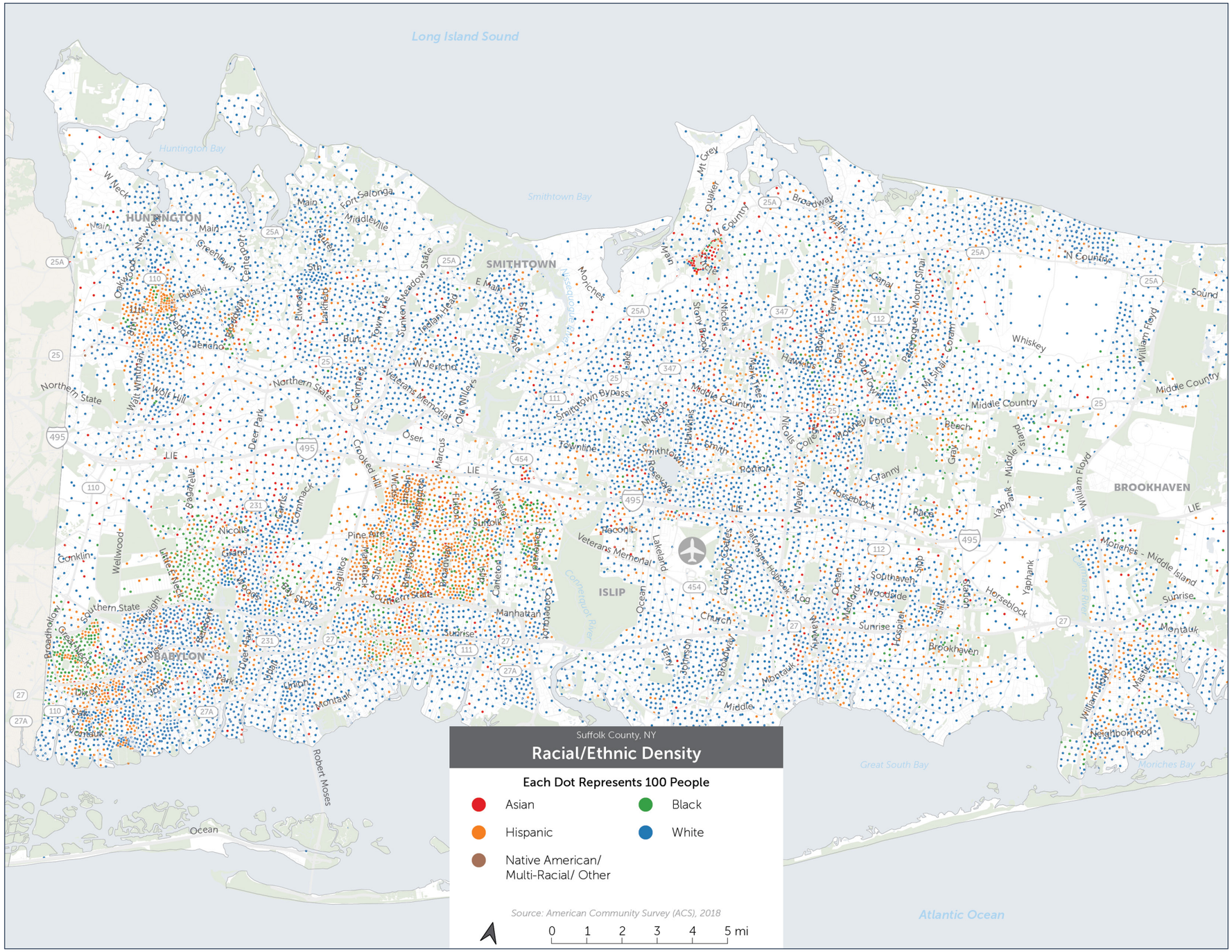


Figure 36: Residential and Ethnic Distribution in the Western Part of Suffolk County

4 The Existing Transit Network

Where Is Useful Transit Today?

In transit conversations there is always a great focus on **WHERE** transit is provided. Sometimes not enough attention is paid to when it is provided. The **WHEN** of transit service is:

- **Frequency** or **headway:** How many minutes are there between each bus? How long of a wait is required?
- **Span** or **duration:** How many hours of the day is service running? Does it run on weekends?

Low frequencies and short spans are one of the main reasons that transit fails to be useful because it means service is simply not there when the customer needs to travel.

Frequent service:

- reduces waiting time (and thus overall travel time),
- improves reliability for the customer because if something happens to your bus another one is always coming soon,
- makes transit service more legible by reducing the need to consult a schedule, and
- makes transferring (between two frequent services) fast and reliable.

Figure 37 shows the Suffolk County Transit network, while the map in Figure 38 shows the details of the network in the western part of the County. The routes in these maps are color coded by their frequency during midday on a regular weekday.

Darker colors represent routes which run more frequently. **Dark blue** represents routes running every 30 minutes, the **lighter blue** represents headways of 60 minutes, while the **tan**-colored routes run on frequencies less than every hour.

Dotted lines show routes or patterns that only run in the Summer. The routes with prefixes "H" and "N" are HART (Huntington) and NICE (Nassau County) routes, respectively, which are not operated by SCT.

A few of the routes run more frequently in the morning and evening peak periods, but the midday frequencies represent the "baseline" level of transit service available in the system throughout the day. Routes like S31, S69, and the Suffolk Clipper are not shown on these maps since they do not operate during midday.

No Frequent Midday Service

One feature most apparent from this map is that there are no routes more frequent than every 30 minutes. There are only three routes (S1, S40, and S54) and one corridor (where S60 and S76 alternate) where buses run every 30 minutes.

In the western part of the County, most routes run every 60 minutes during the middle of the day, except S20, which runs every 90 minutes. Near Ronkonkoma, Coram, and Patchogue, there are some lower-frequency routes, including 6A, 6B, 7A, 7B, S68, and the branches of S66.

In the five eastern towns, there are hourly routes (S58, S62, and S66) that connect Riverhead to the western parts of the County. Route S92 runs hourly along the forks, connecting Orient Point to Riverhead, Southampton, and East Hampton. All other routes run less than every hour.

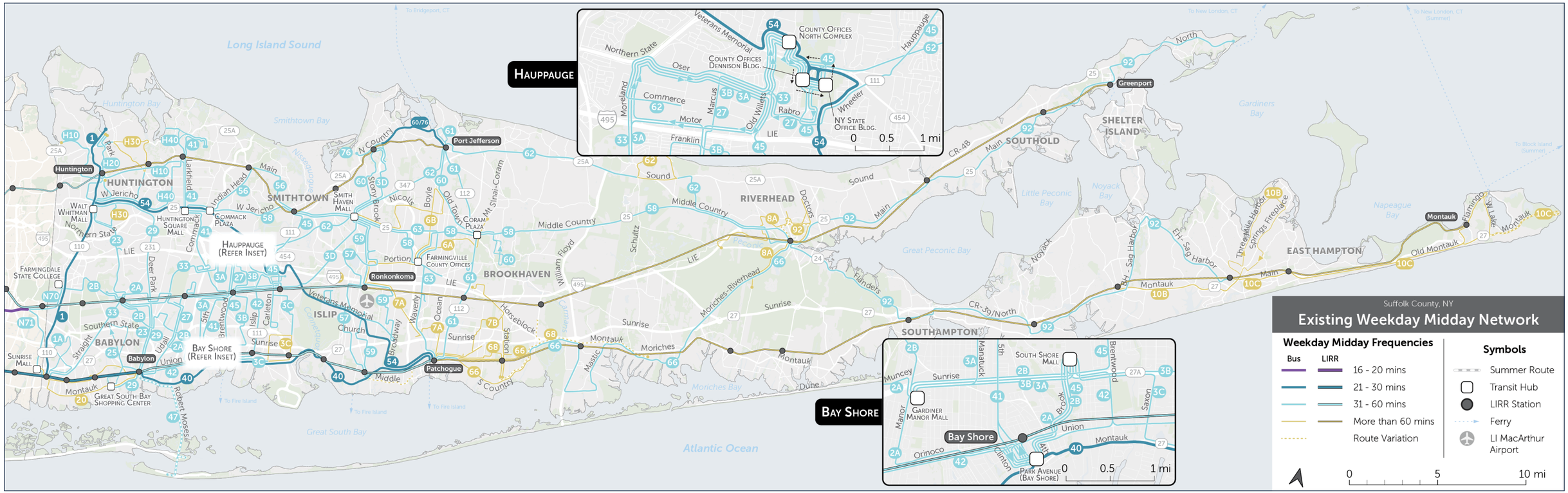


Figure 37: Map of the Existing Fixed-Route Transit Services in Suffolk County

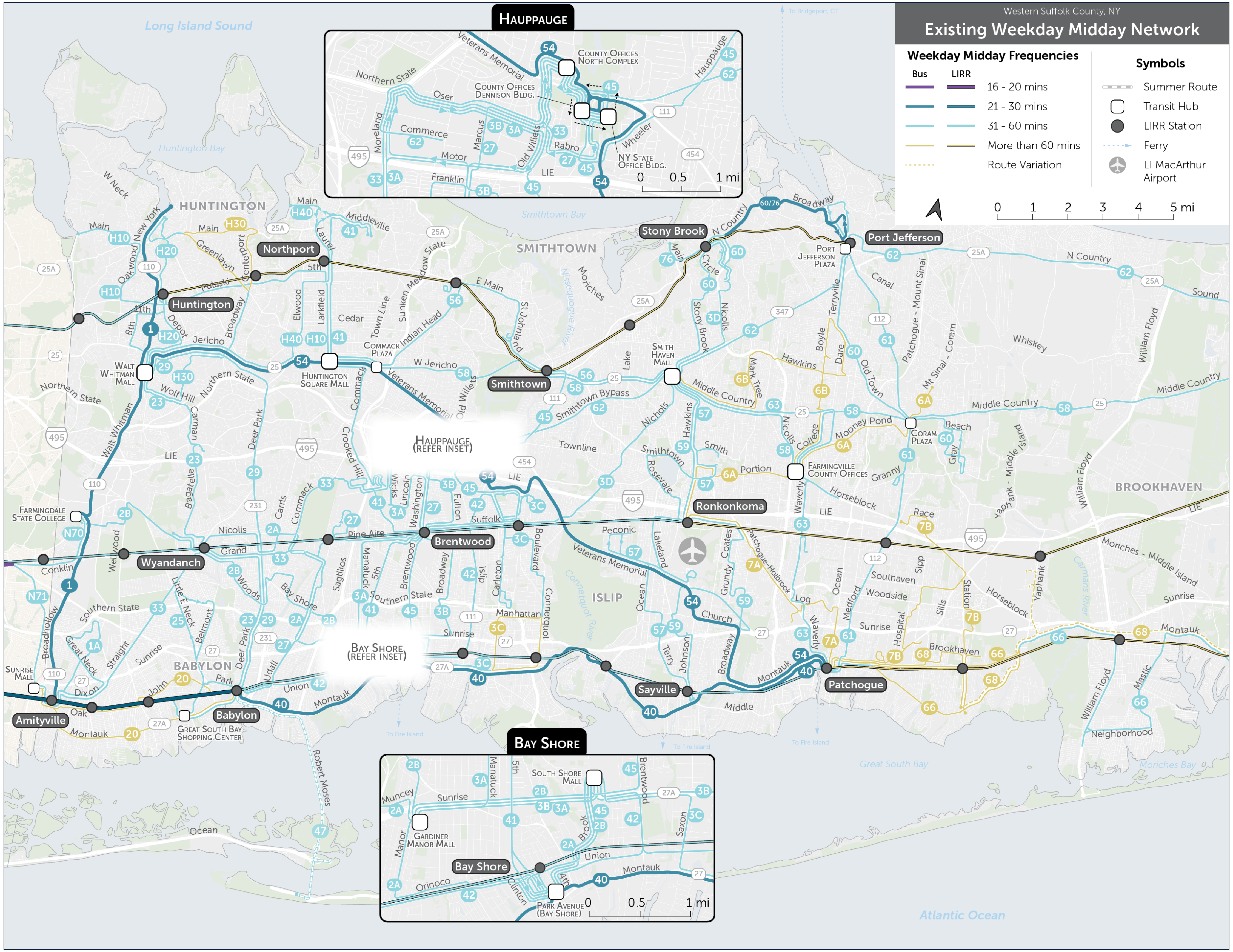


Figure 38: Map of the Existing Fixed-Route Transit Services in the Western Part of Suffolk County

Connections vs. Complexity

There are several locations in the County where multiple SCT routes come together. For example, Smith Haven Mall is served by 9 different routes. At such "transit hubs", passengers can connect from one route to another because several routes meet. These tend to be located in or near malls, government offices, or LIRR stations.

The County has no single "downtown" area which is the major center of activity. Hence there are several hubs spread throughout the County. The routes radiating out of each hub provide direct access to the destination at that hub for people living close to those routes without needing to connect to another route.

However, residents (particularly those without access to automobiles) also need to access specific jobs, and services like doctor's appointments, schools and colleges, and government offices, which may be located in different parts of the County. They may not be directly connected to a person's residence by transit. Someone traveling from one part of the County not directly connected to the other by a single route needs to transfer between routes—potentially more than once. For example, to travel from northern Coram to Hauppauge, one would need to connect twice: from S61 to S58 at Coram Plaza, and then to S62 at Smith Haven Mall.

In order to satisfy the need of useful cross-County travel, SCT spends significant resources on some long routes with the aim of offering one-seat rides. The frequent routes S1, S40, and S54 run long distances with relatively higher frequency and connect many parts of the western towns to each other. North-south routes like in S23, S29, S41, S45, and S61 also connect many places, but with lower frequencies. The east-west routes S58, S62, S66, and S92 similarly run long distances and provide cross-County travel along the island.

The result of this design is that the SCT network is a mesh of hubs interconnected in a very complex manner. Some routes are focused on providing communities access to specific destinations at one or two nearby hubs. Other routes are long and try to directly connect many places in the County to each other. This leads to a lot of overlap and duplication at the same time as service being spread very thin and hence not very frequent.

Frequency Makes Connections Useful

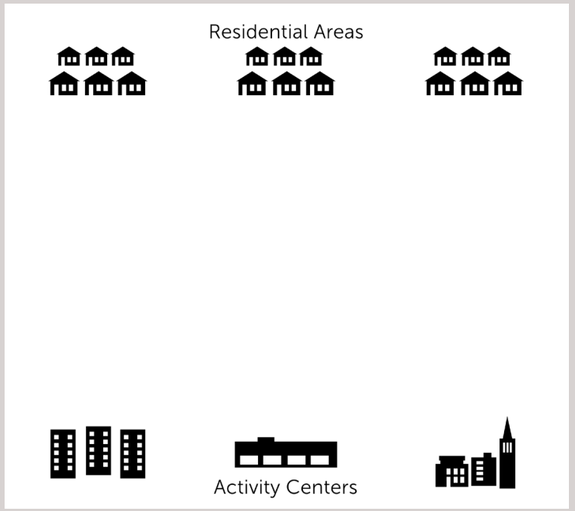
Imagine a simple town that has three primary residential areas, along the top in the diagram to the right, and three primary centres of employment or activity, along the bottom, as shown in Figure 39. People in this town want to travel from the residential areas to the activity centers and back and you have a limited budget to design a bus network.

In designing a network for this town, the first impulse is to try to run direct service from each residential area to each activity centre. If we have three of each, this yields a network of nine transit lines, as shown in Figure 39. Suppose that we can afford to run each line every 60 minutes (shown as thin light blue lines). Call this the *Direct Service Option*.

Now consider another way of serving this simple town for the same cost. Instead of running a direct line between every residential area and every activity center, we run a direct line from each residential area to a single activity center, but we make sure that all the resulting lines connect with each other at a hub, as in Figure 39.

Now we have three lines instead of nine, so we can run each line three times as often at the same total cost as the Direct Service option. So instead of service every 60 minutes, we have service every 20 minutes (shown as thick purple lines). Let's call this the *Connective Option*.

The Direct Service Option seems to be the obvious solution. But this network is more



In the **Direct Service Option**, the locations can be connected directly but you can only afford to provide service every 60 minutes on each route.

So the total travel time from any residential area to any activity center is 1/2 the frequency (30 minutes) plus the 20 minute in-vehicle travel time.

Total trip time = 50 minutes.

Imagine you are the transit planner for this fictional town with three residential areas in the north and three activity centers in the south. Some people from each residential area want to go to each of the activity centers.

It would take a bus 20 minutes to travel from any residential area to any activity center.

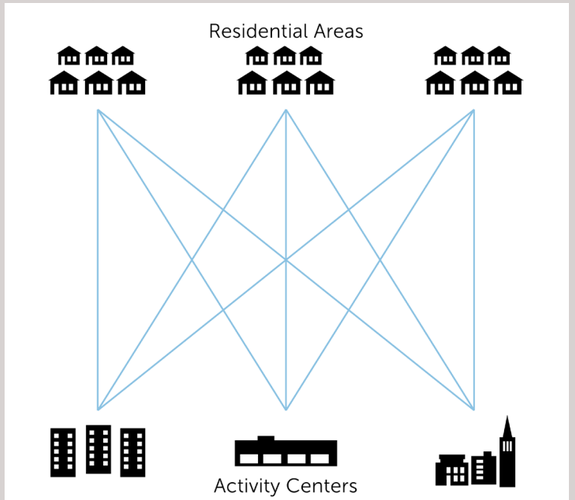
How would you connect them with transit?

In the **Connective Option**, with only three routes, we can run each route every 20 minutes, but some people will need to transfer.

If you had to transfer, the total travel time is
1/2 the frequency for the initial wait (10 minutes) +
10 minute in-vehicle travel time to the Hub +
1/2 the frequency for a transfer (10 minutes) +
10 more minutes of in-vehicle travel time for the second half of the trip.

Total trip time (if you need to transfer) = 40 minutes (20% less).

Total trip time (if you do not need to transfer) = 30 minutes (40% less).



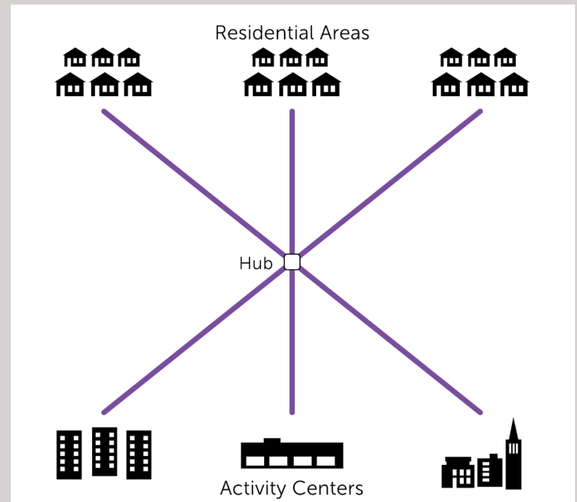


Figure 39: Example of the Connections versus Complexity Trade-off for a simple town.

complex (having nine routes instead of 6), and less frequent. A person going from any residential area to any of the activity centers will have to wait on average 30 minutes for a bus.

On the other hand, in the Connective Option, some people get direct service to their intended destination with an average wait time of only 10 minutes. The rest have to connect to a different route at the hub and wait an additional 10 minutes on average. The overall 20 minutes of average wait time is still less than in the Direct Service Option. This network is also much simpler.

Pulsing Makes Low-Frequency Connections Useful

When frequent bus lines cross, it's almost like roads intersecting: someone can transfer and travel in any direction, with just a short wait.

When low-frequency lines come together, the transfer requires much more planning, is riskier, and may just take too long. Low-frequency routes cannot act as a network the same way that high-frequency routes can, because transfers between them tend to be onerous. For example, Routes S61 and S58 both stop at the Coram Plaza. Transferring between them requires waiting anywhere between 10 and 50 minutes depending on the specific direction of travel.

In many cities, transfers between low-frequency routes are coordinated at hub stops. Buses from multiple routes come together at a stop simultaneously, and people can connect to other routes without needing to wait very long. This is called **pulsing.**

Imagine that for designing the network for the town in Figure 39, you had a much more limited budget, such that you could only connect each residential area to one activity area with a route with a 60-minute frequency.

In such a case, you could schedule your routes such that they all meet at the hub stop at the same time. People would still have to wait for 30 minutes on average at the start of their trips, but they can still get to any place in the town with only a few additional minutes of waiting while the routes pulse at the hub, as represented in Figure 40.

Routes in the SCT network are not designed to pulse. Hence, depending on the schedules, the waiting time for a person transferring from one hourly route to another at the hubs can be very long—almost an hour in some cases. Such a network of interconnected hubs with no pulsing provides direct access only from the areas (and other hubs) directly connected to the hubs.

Designing Pulses

There is a cost to pulsing. First, the routes must be designed so that they can make a round trip in the right amount of time to get back to the pulse with all of the other routes. This makes it hard to lengthen a route just a tiny bit in response to requests. It also means that any reduction in the speed of the bus can be threatening to the pulse, since that bus may not be able to do its round trip in the required amount of time.

Second, the routes must be given enough spare time to protect them against all of the predictable or unpredictable delays that happen on the roads. If two 30-minute routes are meant to pulse together, and one of them is often late and misses the rendezvous, then the transferring passengers face waits even worse than if the routes were connecting at random—they may often be waiting 29 minutes! The spare time added to schedules to protect against delays is called "recovery time," and it is essential for the reliability of a pulse. Radial networks are well-suited to pulsing, and vice versa.

Pulsing is a common solution in small to mid-sized cities with a central downtown that naturally serves as a convergence point in a radial street network. Since Suffolk County is so large, and it lacks a single "downtown", it would necessarily require multiple pulse points in its network to provide connections to the many centers of activity across the County.

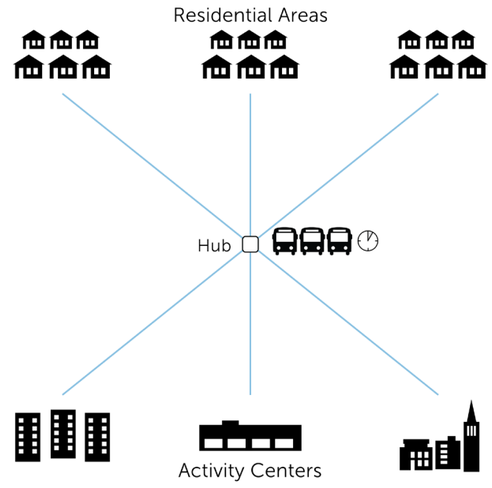


Figure 40: Low frequency routes can still enable passengers to connect among each other by offering pulsing.

When Is Service Available?

The tables on this page and the next summarize each SCT route's **frequency** (how often a bus on the route comes) and **span** of service (what days and what durations the route operates). Each hour a route operates in a direction is shown by a single block, colored roughly according to the frequency offered in that period. From left to right, the columns of blocks show service for each route during weekdays, Saturdays, and Sundays, respectively.

Less Service on Weekends, Especially Sundays

Similar to the network maps earlier, the span-frequency chart in Figure 41 shows how SCT service is spread quite thinly. Most of the blocks are light blue or tan, which means that most of the service offers worse than 30-minute frequency during the middle of the day.

Some routes have 30-minute or better frequency in morning and evening periods on weekdays, but only three routes offer 30-minute frequency during midday. On weekends, the highest frequency offered at midday is hourly service. Compared to weekdays and Saturdays, SCT provides very little service on Sundays. Only 13 routes run on Sundays.

Consistent all-week frequency is often part of a high-ridership strategy. The transportation profession has long been focused on the weekday rush hours, because those are the times when our road capacity is most-used and congested. Yet, people need to travel at all times of day and week.

Service workers, for example, often work from very early in the morning to midday, or from midday to late at night. Most people working in retail or restaurants are only offered a job if they can commit to work on both weekend days. A

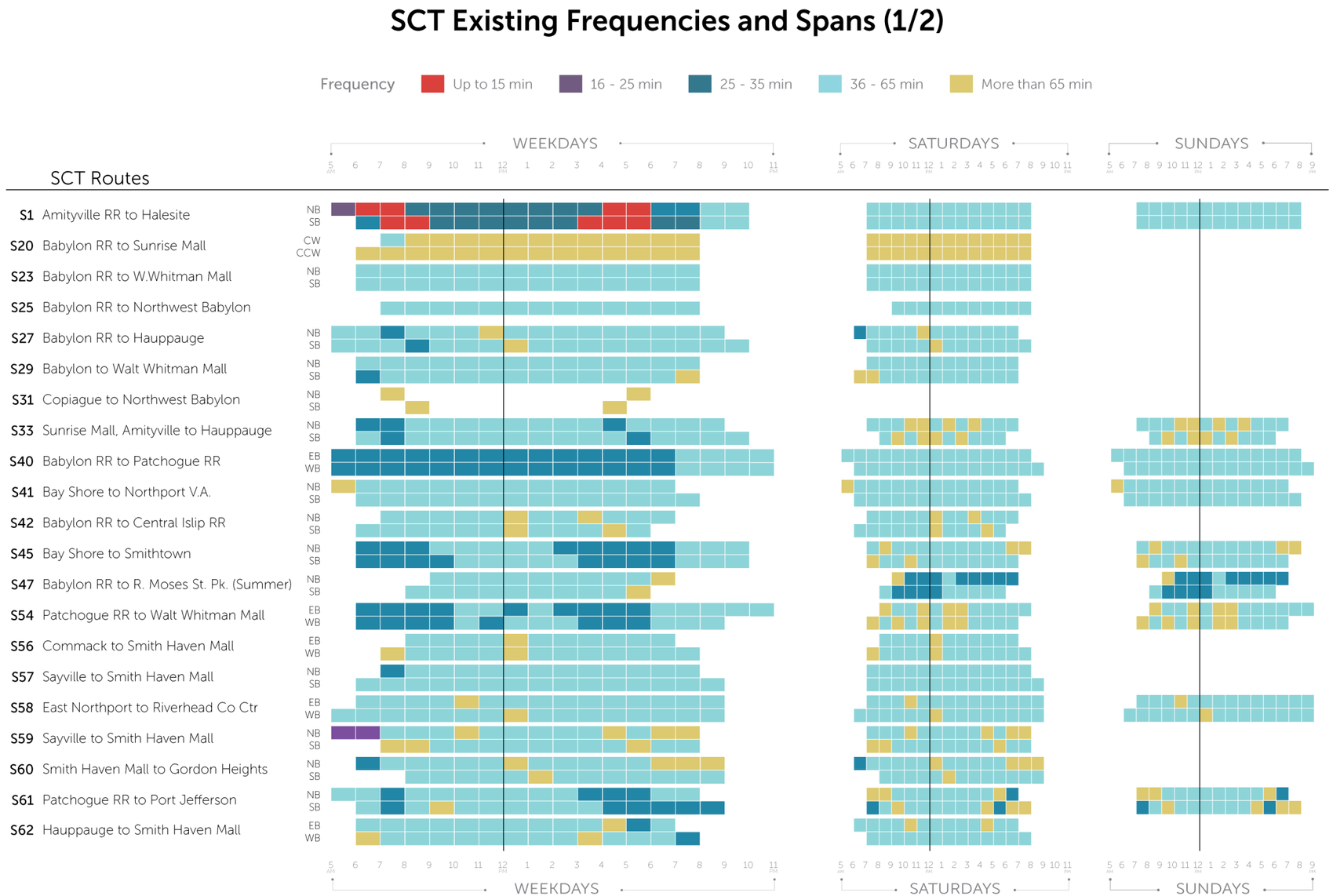


Figure 41: Spans and Frequencies of all SCT Routes

route that doesn't exist on weekends is not useful to service workers, since weekends are when many retail businesses and restaurants are "all hands on deck".

In addition, anyone taking an evening class, pursuing a hobby, going to worship, or staying late at work to finish a report needs a bus ride home outside of the traditional 9-to-5 workday.

When transit agencies cut late-night and weekend service (often their first resort, during budget crises), they typically see ridership losses at all other times of the week. The inverse is also true: transit agencies that restore late night and weekend service see ridership gains, as more households forgo cars because the transit network is there for them whenever they need it.

Irregular Schedules

The charts in Figure 41 and Figure 42 give a broad overview of the route spans and frequencies. The route schedules can become very complicated. In many cases:

- service in one direction along a route starts, ends, or changes frequency much earlier than on the other, or
- there are long gaps in the schedule during midday because of how driver shifts are arranged (evidenced to some extent as gaps in the span-frequency chart), or
- occasional deviations and alternate branching leads to a lack of consistent frequency in the "trunk" portion of the route.

Consistent frequencies and spans (across different parts of the day) make transit much more legible. For high-frequency routes, it is easy to remember that a bus arrives, say, every 10 minutes during a given time of day.

For routes with lower frequencies, people will still need to consult a schedule to know when a bus will arrive, but a consistent frequency makes this information easy to find, comprehend, and remember. For example, it is much easier to

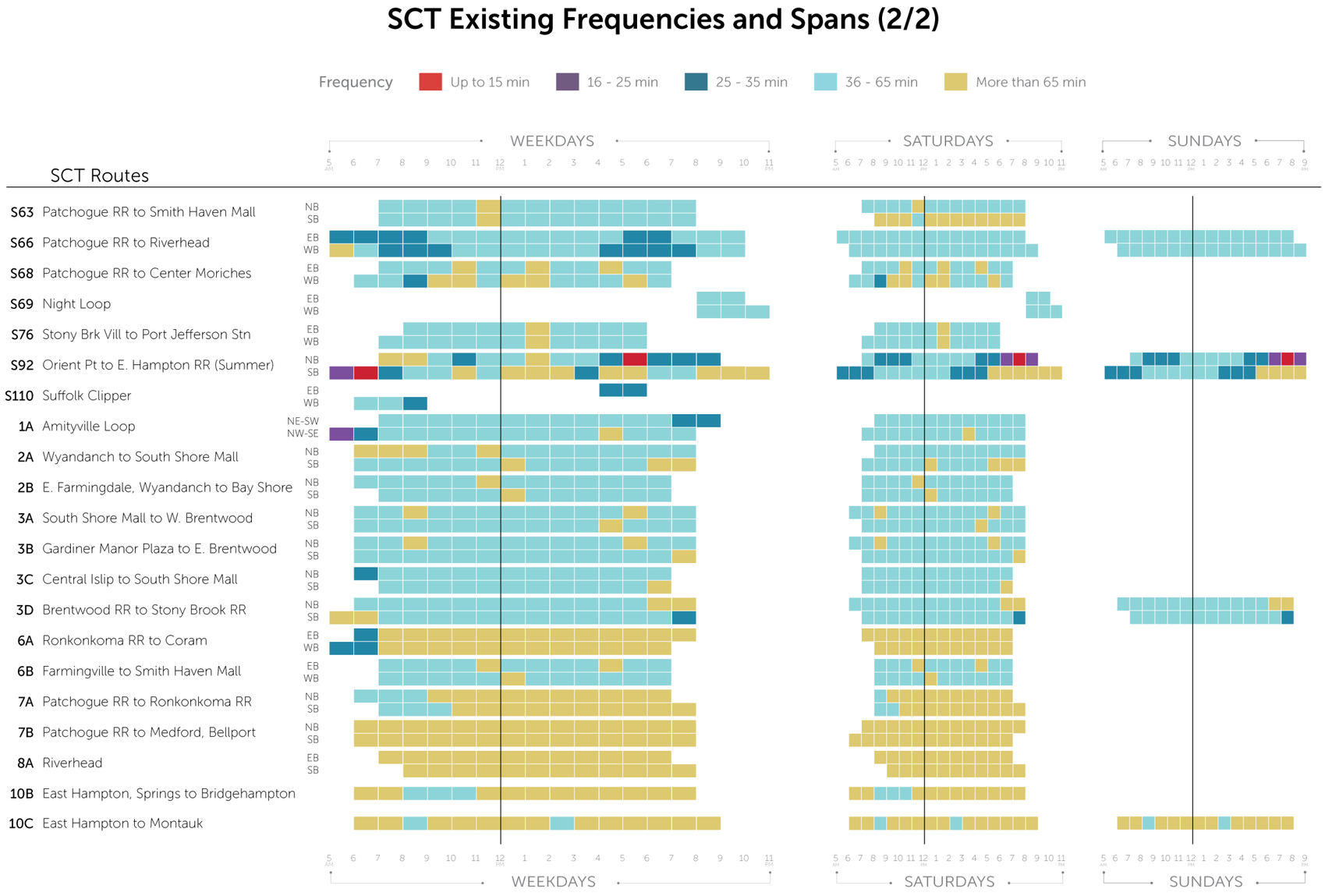


Figure 42: Spans and Frequencies of all SCT Routes

conclude that "a bus arrives at 12 minutes past the hour every hour at my stop during the middle of the day" than to try to look up specific inconsistent timings in the schedule.

Coordinating With LIRR

Since New York City is a major center of jobs for the region, transit connections to the city—and hence to Long Island Rail Road stations—are particularly important. That's why many of SCT's hubs are located at or near LIRR stations. Those SCT routes then act as feeder routes for LIRR.

One of the difficulties with providing timed connections to LIRR is that LIRR frequencies tend to be inconsistent and schedules change often throughout the year. The SCT network does not have the flexibility of adapting very fast to changing LIRR schedules.

Figure 43 shows an example of this in sections of the weekday timetables of the LIRR Montauk Branch and SCT Route S61. The S61 schedule was last changed in August 2019, while the LIRR schedule was changed on November 9, 2020. The timings of S61 reaching Patchogue do not line up with the LIRR departure times. Also, since the S61 is running on a consistent 30 minute or 60 minute headway, the LIRR would also need to be running on a similar "clockface headway" to make consistent connections. Yet, the LIRR schedule shows that the train schedule does not have a consistent headway throughout the day, and therefore it would be nearly impossible for SCT buses to consistently meet LIRR trains at this station.

Particularly when looking at serving 9-to-5 weekday commutes to NYC, SCT does not have the resources to increase frequency substantially during the morning and evening peak periods to match the increased LIRR frequencies. Only a few SCT routes have enhanced frequencies in this period.

S61 Southbound Weekday Service

Medford NYS 112 Woodside Ave.	Patchogue NYS 112 Roe Blvd.	Patchogue Railroad
6:19	6:22	6:30
6:55	7:00	7:10
7:33	7:38	7:45
8:12	8:17	8:25
8:42	8:47	8:55
9:22	9:27	9:35
10:37	10:42	10:50
11:37	11:42	11:50
12:37	12:42	12:50
1:37	1:42	1:50
2:37	2:42	2:50
3:37	3:42	3:50
4:37	4:42	4:50
5:07	5:12	5:20
5:37	5:42	5:50
6:07	6:12	6:20
6:37	6:42	6:50
7:07	7:12	7:20
7:37	7:42	7:50
8:07	8:12	8:20

Monday through Friday except Holidays, Effective November 9, 2020

Westbound

To New York, Brooklyn & Jamaica

Weekdays

For explanation, see "Reference Notes."	AM	AM	AM	PM	PM	PM	PM	PM	PM
MONTAUK	.....	.....	11:18	.....	.....	.....	2:48	.....	.....
Amagansett	.....	.....	11:38	.....	.....	.....	3:07	.....	.....
East Hampton	.....	.....	11:45	.....	.....	.....	3:12	.....	.....
Bridgehampton	.....	.....	11:53	.....	.....	.....	3:21	.....	.....
Southampton	.....	.....	12:03	.....	.....	.....	3:31	.....	.....
Hampton Bays	.....	.....	12:13	.....	.....	.....	3:41	.....	.....
Westhampton	.....	.....	12:24	.....	.....	.....	4:02	.....	.....
SPEONK	.....	.....	12:37	.....	2:00	.....	4:14	.....	.....
Mastic-Shirley	.....	.....	12:53	.....	2:16	.....	4:29	.....	.....
Ballport			1:00		2:23		4:36		
PATCHOGUE	T 10:25	T 11:25	1:07	T 1:25	2:29	T 3:32	4:43	T 5:26	T 7:39
Oakdale	T 10:36	T 11:36	.....	T 1:36	2:40	T 3:43	4:54	T 5:38	T 7:50
Great River	T 10:40	T 11:40	.....	T 1:40	2:44	T 3:47	4:58	T 5:42	T 7:54
Islip	T 10:44	T 11:44	.....	T 1:44	2:48	T 3:51	5:02	T 5:46	T 7:58
Bay Shore	T 10:49	T 11:49	1:24	T 1:49	2:52	T 3:56	5:07	T 5:51	T 8:03
BABYLON (Arrive)	T 10:55	T 11:55	.....	T 1:55	.....	T 4:02	.....	T 5:58	T 8:09
(Note) (Leave)	11:00	12:00	1:30	2:00	2:58	4:06	5:13	6:03	8:13

Figure 43: Coordinating SCT schedules to match LIRR schedules and enable easy travel to New York City can be challenging, given how fast LIRR schedules change.

How Many People Are Near Transit in Suffolk County?

Coverage goals for transit are served when transit is available to people, whether or not they ride it in large numbers. Figure 44 shows the coverage provided by the existing transit services (including SCT, HART, NICE, and LIRR) to residents and jobs in the County at midday on a weekday. The overall coverage is divided into coverage by transit of particular frequencies at midday.

70% of the County's residents are within a half a mile of some level of transit service. Of these, 12% are within ½ mile of 30-minute service, which includes the four 30-minute SCT corridors and some LIRR stations near the western edge of the County. An additional 52% of County residents are covered by routes which provide 60-minute service. The less frequent routes, particularly the ones which serve the eastern parts of the County, only cover an additional 6% of people.

Among minority residents, 13% are near 30-minute services (which is a similar proportion to the overall population), while an additional 62% are near transit which offers 60 minute frequency. This proportion is higher because there are some areas (e.g. Brentwood and Central Islip) which have relatively higher concentrations of minority residents, and they are served primarily by 60-minute routes. Residents in poverty are generally as likely as all residents to be near transit at various levels of frequency.

A large proportion of jobs are located around corridors like NYS 110 and Veterans Memorial Highway, which are served by routes S1 and S54, respectively, as well as the Babylon LIRR Line. This means that 25% of jobs in the County are near 30-minute transit service (compared to 12% of the population). However, the proportion of jobs near *any* transit service (76%) is similar to the proportion of population near any transit (70%).

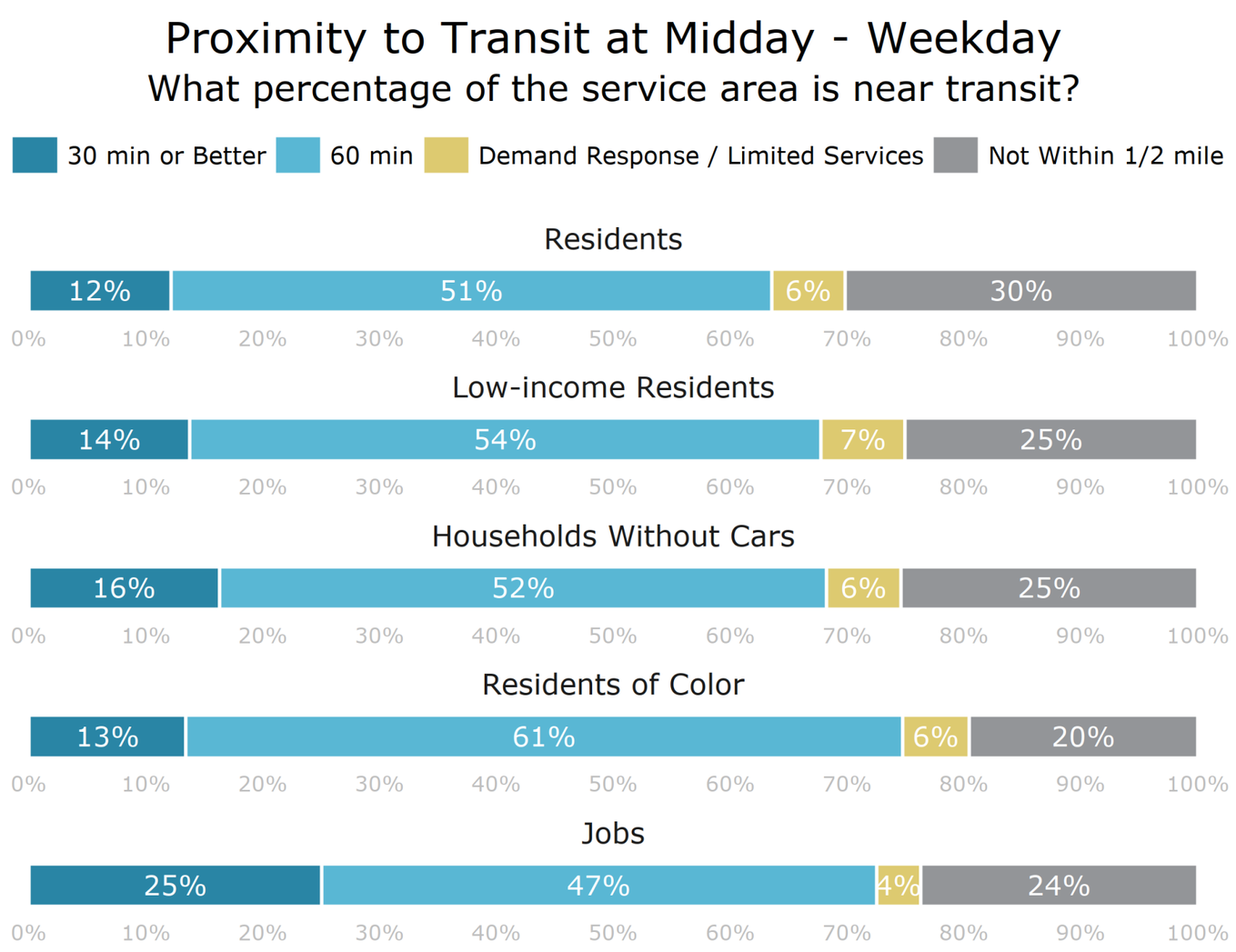


Figure 44: Proximity of Residents, Jobs, and Communities of Concern to Transit in Suffolk County

These conditions are not static and may change in coming years as a result of a changing economy and a changing County. Changes in the pattern of demand for housing or location of jobs may shift the patterns of who has access to what kind of transit, without any changes to the transit network.

Many communities have seen an increase in housing demand near transit and in walkable, urban areas. If this increasing demand is not matched by increases in the supply of housing, then people living on low incomes may move away from frequent transit or any transit service to seek lower housing costs. Land use planning, growth permitting, and affordable housing policies at local jurisdictions have as much of an impact in the long-term on access to useful transit as does the transit service itself.

Where Are People Riding Transit?

One measure of transit performance is the sheer amount of ridership it attracts. This can be made visible with a map of boardings at each transit stop, as shown in Figure 45 (entire County) and Figure 46 (zoomed on western part) below.

High ridership routes and areas can appear in two ways on this map: either as large dots or as multiple medium-sized dots that are very closely spaced. Looking for those patterns we can observe that the highest boardings occur:

- At hub stops where several routes converge or terminate and people can transfer between routes (e.g. Walt Whitman Mall, Hauppauge Offices, Smith Haven Mall, Coram Plaza)
- At or near LIRR stations, where people can transfer between SCT buses and LIRR trains to/from New York City
- Along higher-frequency routes like S1, S40, and S54
- Along route S92, which is the main transit service that connects the North and South Forks
- In and near areas of high residential and job density, for example in Brentwood/Central Islip and Mastic/Shirley
- Near hospitals (e.g. Northport VA Medical Center, Good Samaritan Hospital) and universities/colleges (e.g. Stony Brook University, SCCC campuses)

Looking at these maps, we must keep in mind that *not every stop is offering the same level of service.*

- Some of these stops are served just a few times a day. Some are served every 30 minutes.
- A small dot on a low-frequency service may simply reflect the low level of service, that is, it suggests that less people find it useful.
- A small dot on a more frequent route would suggest low demand for transit near that stop.
- A large dot on an infrequent route means that ridership is high despite a low level of service, which suggest that the nearby transit demand may be high.

The way we discern between these situations is described on page 51—we compare the amount of ridership on a route to the amount of transit service supplied to the route.

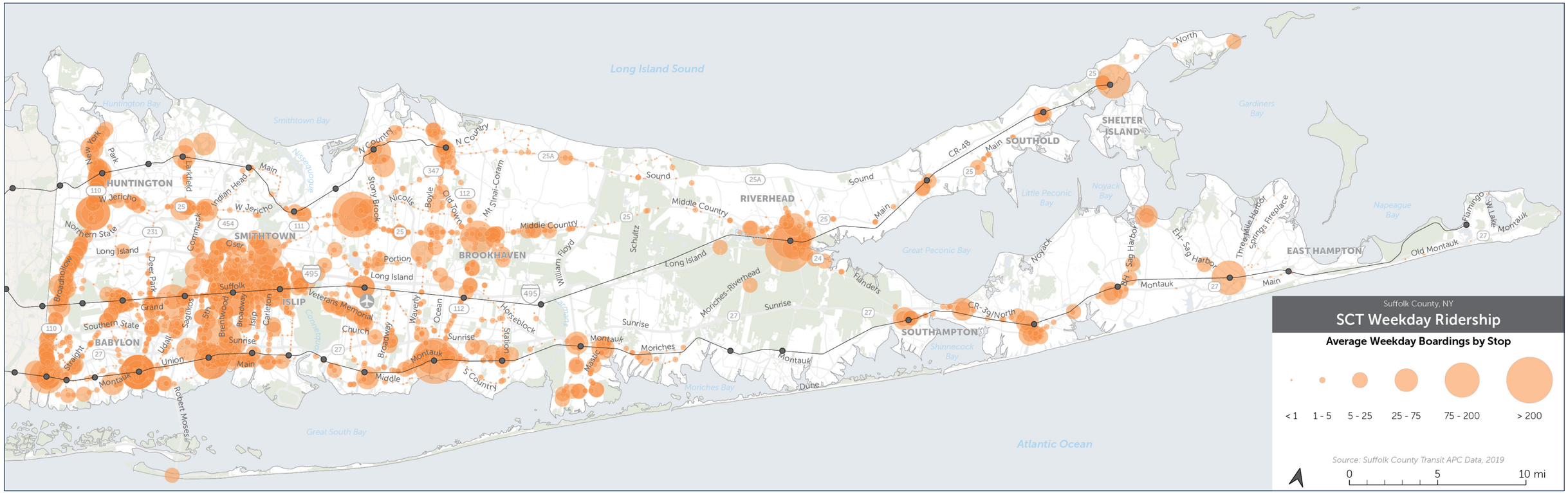


Figure 45: Average Weekday Boardings by Stop in Suffolk County,

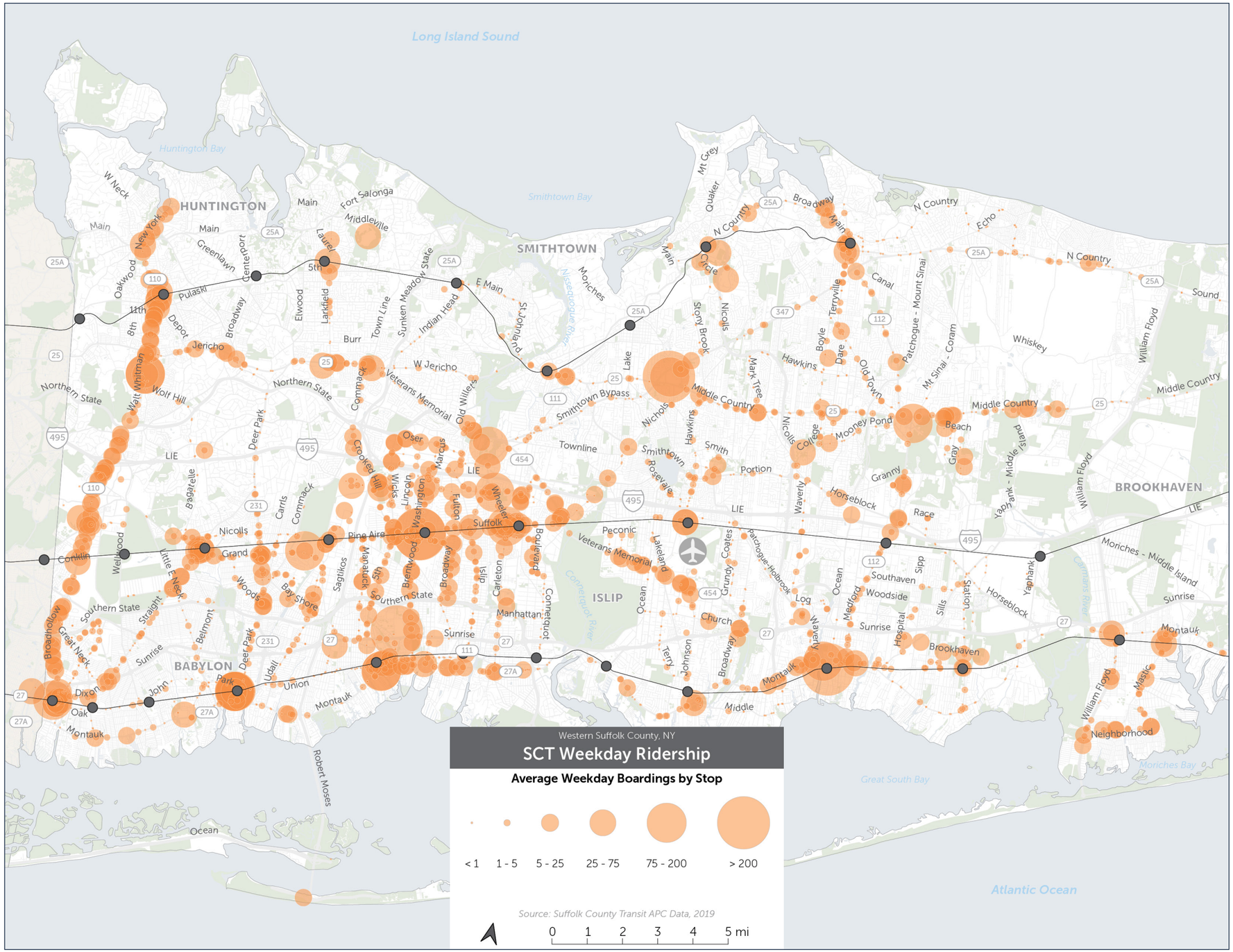


Figure 46: Average Weekday Boardings by Stop in the Western Part of Suffolk County

Productivity and Frequency Relate

People who value the environmental, business, or development benefits of transit will talk about ridership as the key to meeting their goals. If that were the primary measure of transit's success, then our attention would be focused on the highest ridership routes.

However, because any transit agency is operating under a fixed budget, the measure they should be tracking is not sheer ridership but **ridership relative to cost.** They would not be satisfied simply by a large dot on the boardings map on the previous pages until they knew what it cost the transit agency to achieve that large dot.

The cost of providing a service is in proportion to the quantity of service provided, and the primary measure of the quantity of transit available for customers to use is service hours. A service hour (also called revenue hour) is one bus operating for one hour.

The service hours on any particular route will depend on a few factors:

- The **length** of the route (a route covering more distance or running on more circuitous paths will require more vehicles to run).
- The **speed** of the bus (a slower speed means that covering the same distance takes more time).
- The **frequency** of service along the route (higher frequency is delivered by increasing the number of buses being driven on the route at once).
- The daily and weekly **span** of service for a route (how many hours it is available).

Ridership relative to cost is called "productivity." In this report, productivity is measured as boardings per service hour:

$$Productivity = \frac{Ridership}{Cost} = \frac{Boardings}{Service\ Hours}$$

SCT's operations are handled by contractors, who are paid by the County for the total *service miles* they operate, rather than how many total *service hours* they operate.

Both of these quantities track very closely to the actual dollar cost of operating transit, even though they are not perfectly correlated. For example, a very long route running on an expressway across the County has a lot of service miles, but because of its high speed, it won't have as many service hours.

We use service hours to look at productivity because ultimately transit operating costs depend on labor costs, which are paid hourly. Service hours also capture information about the speed of the route and recovery time requirements that is easier to relate to a service's frequency when compared to service miles (or dollars spent).

The chart in Figure 47 shows the productivity (Y axis) of individual SCT routes plotted against their "baseline" weekday midday frequency (X axis). The different S92 summer and winter schedules are shown as "S92SUM" and "S92WIN", respectively.

The 30-minute routes are more productive than most 60-minute routes, which mostly tend to be more productive than other less frequent routes. This is a common trend across agencies (as shown in Figure 11 on page 14): higher frequency services often tend to have not just higher overall ridership, but also, higher overall productivity.

Productivity is strictly a measure of achievement towards a ridership goal. Services that are designed for coverage goals will likely have low productivity. This does not mean that these services are failing or that the transit agency should cut them. It just means that their funding is not being spent with the purpose of attracting high ridership. High ridership arises from the alignment of useful service and supportive land use. The result is high ridership per cost of service, or productivity.

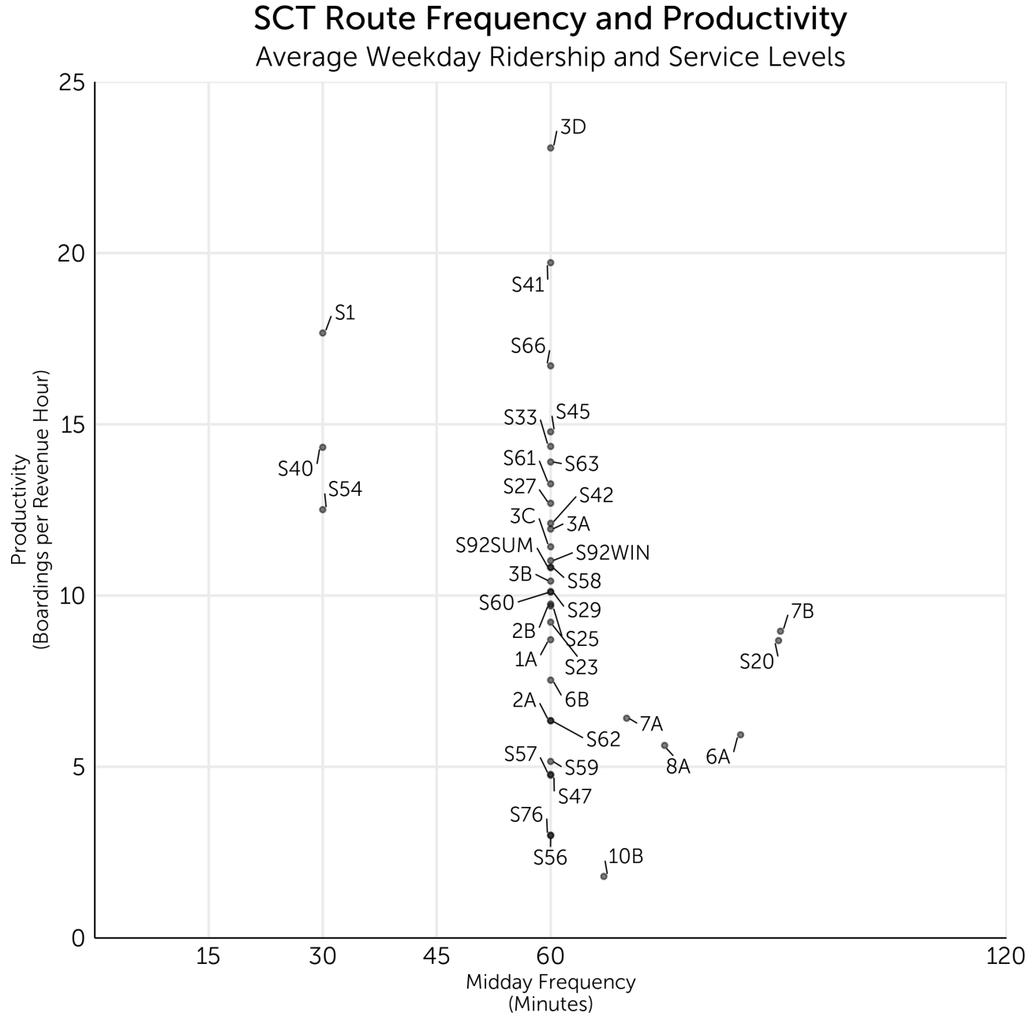


Figure 47: SCT Route Productivity and Midday Frequency

Where Is Productive Service Today?

High ridership arises from the alignment of useful service and supportive land use. All except one of the routes gets less than 20 boardings per service hour on weekdays. Some relatively higher-productivity routes include:

- Routes S1, S40, and S54 are examples of higher-frequency routes which operate on relatively dense corridors.
- Routes S27, S33, S41, S42, S45, S66, 3A, 3B, and 3C provide less frequent service in some high-density areas as well as areas which have more people in poverty (both of these are indicators of a bigger marker for transit). Routes with lower service level serving a large transit market are good candidates for service improvements in the future.

- Routes like S41, S61, S63, and 3D operate low-frequency service in some less dense areas, but connect people who need transit to major destinations like colleges, hospitals, malls, LIRR stations, and connect to other routes. They also provide north-south connections in the County.
- Routes like S58, S66, and S92 travel through substantial areas with moderate-to-low density, but are valuable in providing east-west connections across the different towns of the County.

Freedom and Access

Elements of the service like frequency and span tell us a great deal about how useful transit is, but they do not tell us everything about how service interacts with where jobs, people, and destinations are in Suffolk County. A different way of assessing transit is to ask: "How useful is transit for getting you to a lot of places quickly?"

A helpful way to illustrate the usefulness of a network is to visualize where a person could go using public transit and walking, from a certain location, in a certain amount of time. The map in Figure 48 shows someone's access to and from SCT's Bay Shore "hub" stop, at noon on a weekday. Areas they can reach in less than 60, 45, or 30 minutes are shown in light, medium and dark violet, respectively. The technical term for this kind of illustration of an "access bubble" is **isochrone.**

A more useful transit network is one in which these access bubbles are larger, so that each person is likely to find the network useful for more trips.

In these analyses, travel time estimates include:

- The walking time from the origin point to a nearby stop.
- Initial waiting time equal to ½ of each route's scheduled frequency.
- In-vehicle travel time based on an average speed of transit.
- Waiting time equal to ½ of a route's headway for any transfer to another route.
- Walking time equal to the remainder of the travel time budget after arriving at a stop. Note that for this analysis, the total walking time is limited to 30 minutes.

We always account for time spent waiting, because even if you time your departure just right and don't wait at the bus stop, a lower-frequency route often makes you wait at your destination because it can force you to arrive very early (rather than be slightly late). Very few people have the liberty of arriving when they please for all their trips, so for most people, riding transit means waiting somewhere. The more frequent the transit, the shorter the wait.

Where Can You Go from Bay Shore?

Many of SCT's routes converge at its Bay Shore "hub" at Mechanicsville Road and Park Avenue. The power of the relatively more frequent S40 route can be seen here as the two "arms" which reach East and West along Montauk Highway. Note that the western "arm" is shorter than the eastern one because the route ends at Babylon station. Compared to S40, the hourly routes are not very useful in helping people reach very far within 30 and 45 minutes, as seen in the very small medium- and dark-purple areas on the northern side, which these routes serve.

How Many Places Can You Reach Relatively Quickly?

An isochrone map, like the one in Figure 48 may tell you where transit can take you within a reasonable amount of time, but what really matters is how many destinations you can reach in that time. For that, we measure job access—the number of jobs within the 30- 45- and 60-minute purple isochrone areas.

How far can I travel in 30, 45, and 60 minutes from

Bay Shore Mechanicsville Rd at Park Ave

at noon on a weekday?

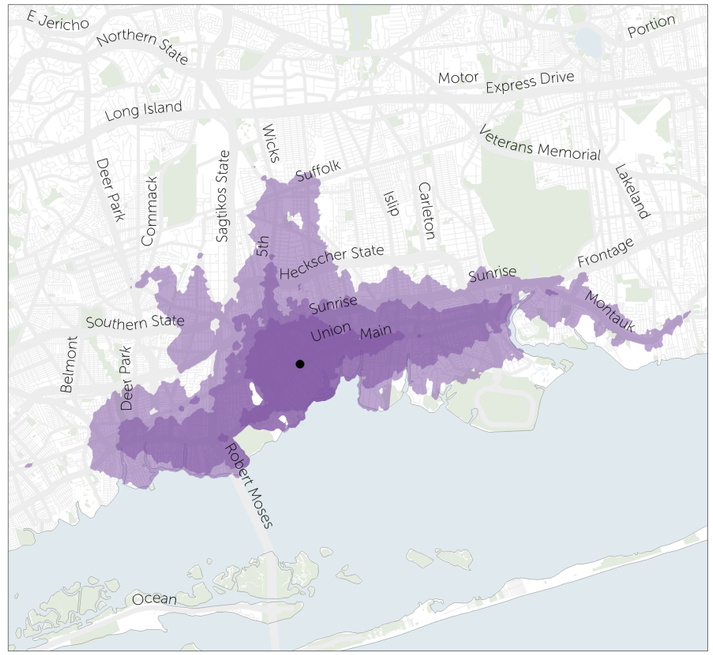


Figure 48: An isochrone shows how far someone can go, in a given amount of time, by walking and transit. Access to and from Bay Shore within 30, 45 or 60 minutes of travel by walking and transit is illustrated here.

We measure access to jobs because we have good data on job locations, but also because better access to jobs means more than potential places of employment. It also tends to mean more shopping, social, and educational opportunities can be reached, allowing for a richer life for people who choose to rely on transit. We can see that from Bay Shore, a person is able to reach about 49,900 jobs in an hour.

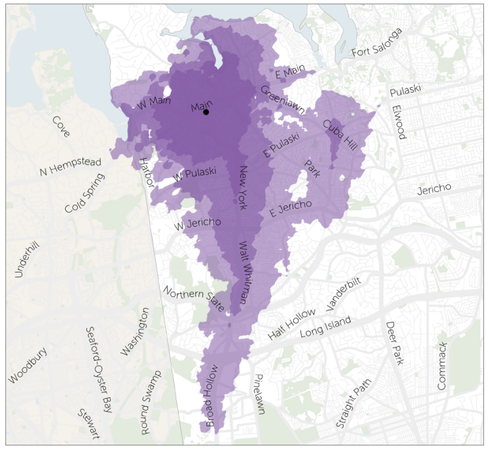
For a business trying to decide where to locate their storefront or office, they may be interested in comparing access to population, because higher access to population means a larger market of potential employees, and potential customers. From Bay Shore, a business is able to reach about 137,600 residents within 60 minutes.

The isochrone maps on the next page illustrate access to opportunity from different locations throughout the County.

How far can I travel in 30, 45, and 60 minutes from

Downtown Huntington Main St at New York Ave

at noon on a weekday?



What is reachable in...?

	Population	Jobs
30 minutes	19,120	12,130
45 minutes	50,790	24,050
60 minutes	90,010	54,020

Area reachable in

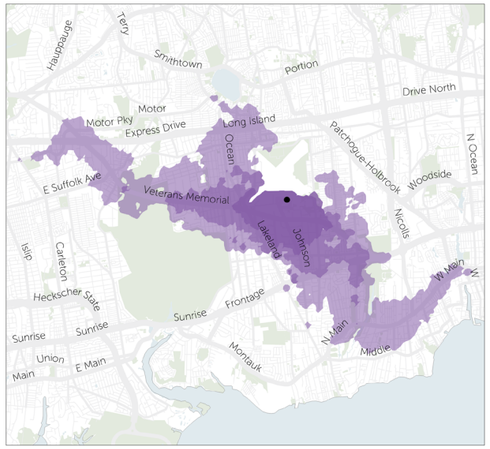
- 30 minutes
- 45 minutes
- 60 minutes

0 1 2 mi

How far can I travel in 30, 45, and 60 minutes from

Long Island MacArthur Airport

at noon on a weekday?



What is reachable in...?

	Population	Jobs
30 minutes	2,480	9,190
45 minutes	8,190	17,480
60 minutes	36,940	39,360

Area reachable in

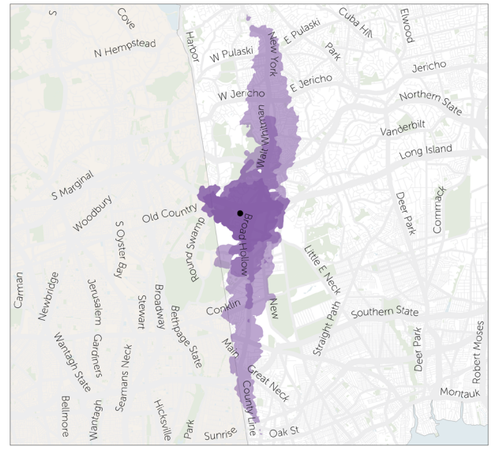
- 30 minutes
- 45 minutes
- 60 minutes

0 1 2 mi

How far can I travel in 30, 45, and 60 minutes from

Melville Office Park

at noon on a weekday?



What is reachable in...?

	Population	Jobs
30 minutes	2,910	21,400
45 minutes	8,010	37,630
60 minutes	42,810	69,510

Area reachable in

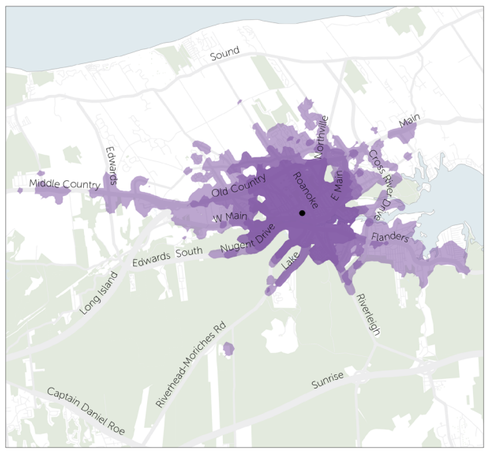
- 30 minutes
- 45 minutes
- 60 minutes

0 1 2 mi

How far can I travel in 30, 45, and 60 minutes from

Riverhead Station

at noon on a weekday?



What is reachable in...?

	Population	Jobs
30 minutes	7,050	5,190
45 minutes	9,130	6,800
60 minutes	12,910	8,940

Area reachable in

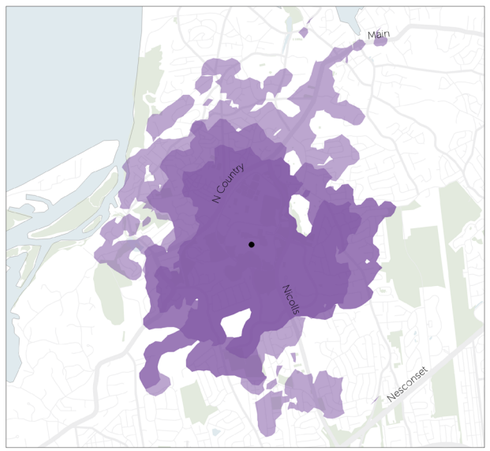
- 30 minutes
- 45 minutes
- 60 minutes

0 1 2 mi

How far can I travel in 30, 45, and 60 minutes from

Stony Brook University

at noon on a weekday?



What is reachable in...?

	Population	Jobs
30 minutes	10,210	16,730
45 minutes	13,560	20,080
60 minutes	17,530	21,900

Area reachable in

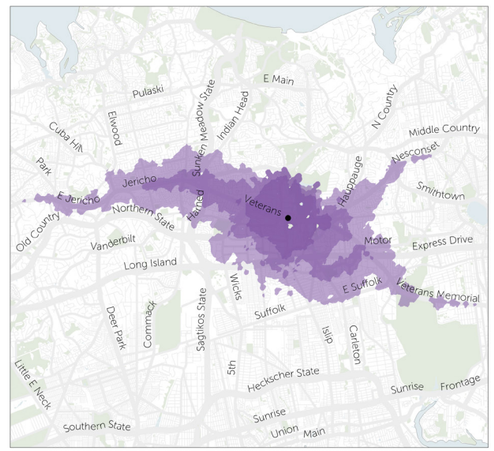
- 30 minutes
- 45 minutes
- 60 minutes

0 1 2 mi

How far can I travel in 30, 45, and 60 minutes from

Suffolk County Offices at Hauppauge

at noon on a weekday?



What is reachable in...?

	Population	Jobs
30 minutes	4,890	10,030
45 minutes	21,340	27,410
60 minutes	64,350	61,840

Area reachable in

- 30 minutes
- 45 minutes
- 60 minutes

0 1 2 mi

Figure 49: Isochrones Showing How Far People Can Go in 30, 45, and 60 Minutes Using Transit From Various Locations in the County

Existing Transit Access

Isochrones can show us the freedom and access for a given place, but to see the total freedom a network provides across the entire County, we have to run the isochrone measure for nearly every place and display the results by color.

Figure 50 and Figure 51 show this result (at a County-wide level, and zoomed in on the western part of the County, respectively).

People who live in the darkest purple areas can reach more than 100,000 jobs in an hour by walking and transit. In the lightest blue areas, residents can reach less than 1,000 jobs.

The number of accessible jobs is related to both the distribution of jobs in and around the County as well as the usefulness of transit service from a particular location. Areas close to the three 30 minute-frequency routes show up in as darker shades of purple. These areas also have a lot of jobs near them, especially the S1 corridor.

Other areas with higher job access include those within walking distance of LIRR stations with reasonably frequent midday connections to Nassau County and New York City. This is especially evident near the Babylon branch as well as the LIRR Main Line.

Outside of the western part of the County, job density is very low (only 10% of the jobs are located in the eastern five towns), and LIRR service isn't frequent enough to provide reasonable access to western areas. Hence the level of access to jobs is dictated more by proximity to denser village/hamlet centers which have more jobs.

Figure 51 shows the average number of jobs accessible to the different sub-groups of people in Suffolk. Residents of color, residents in poverty, and those without cars tend to have a slightly higher access to jobs compared to the number of jobs accessible by all residents on average in 60 minutes.

If Suffolk County wishes to maximize its transit ridership, then a key goal would be to increase the number of jobs accessible to the average person, and it would do that by increasing the number of jobs accessible to the areas that have the most people in them.

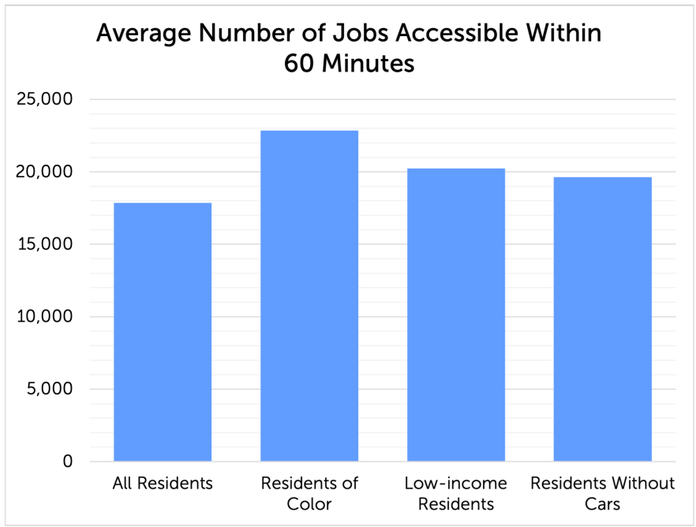


Figure 51: Average 60-Minute Job Access for Residents, Minority Residents, Low-Income Residents, and Residents Without Cars

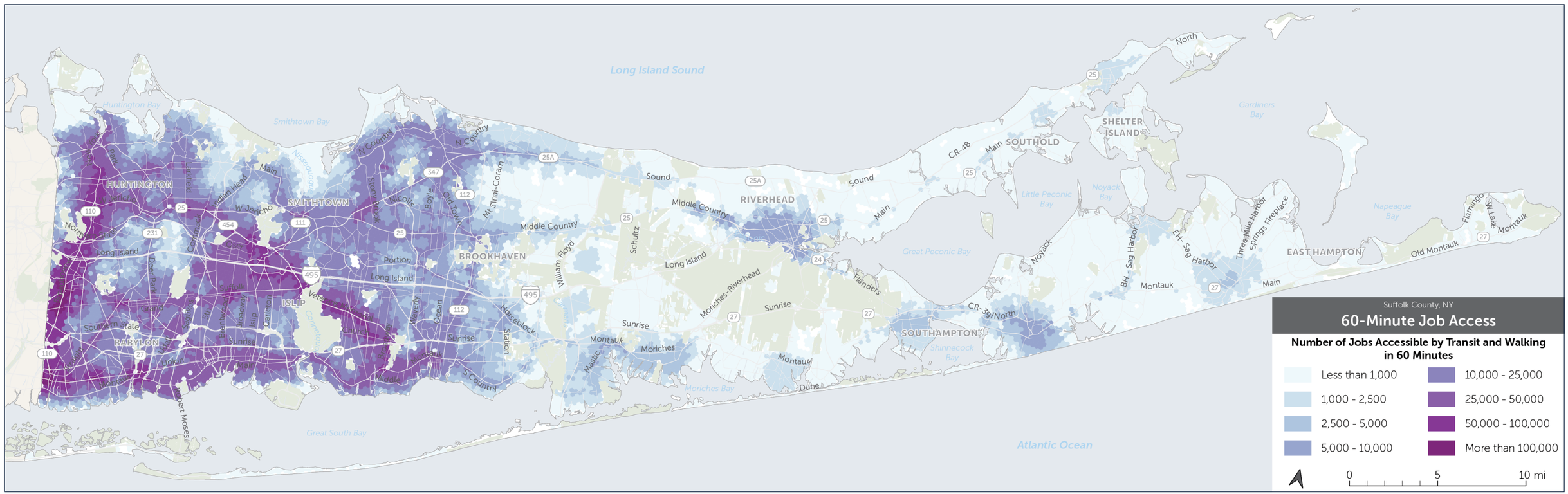


Figure 50: 60-Minute Job Access in Suffolk County

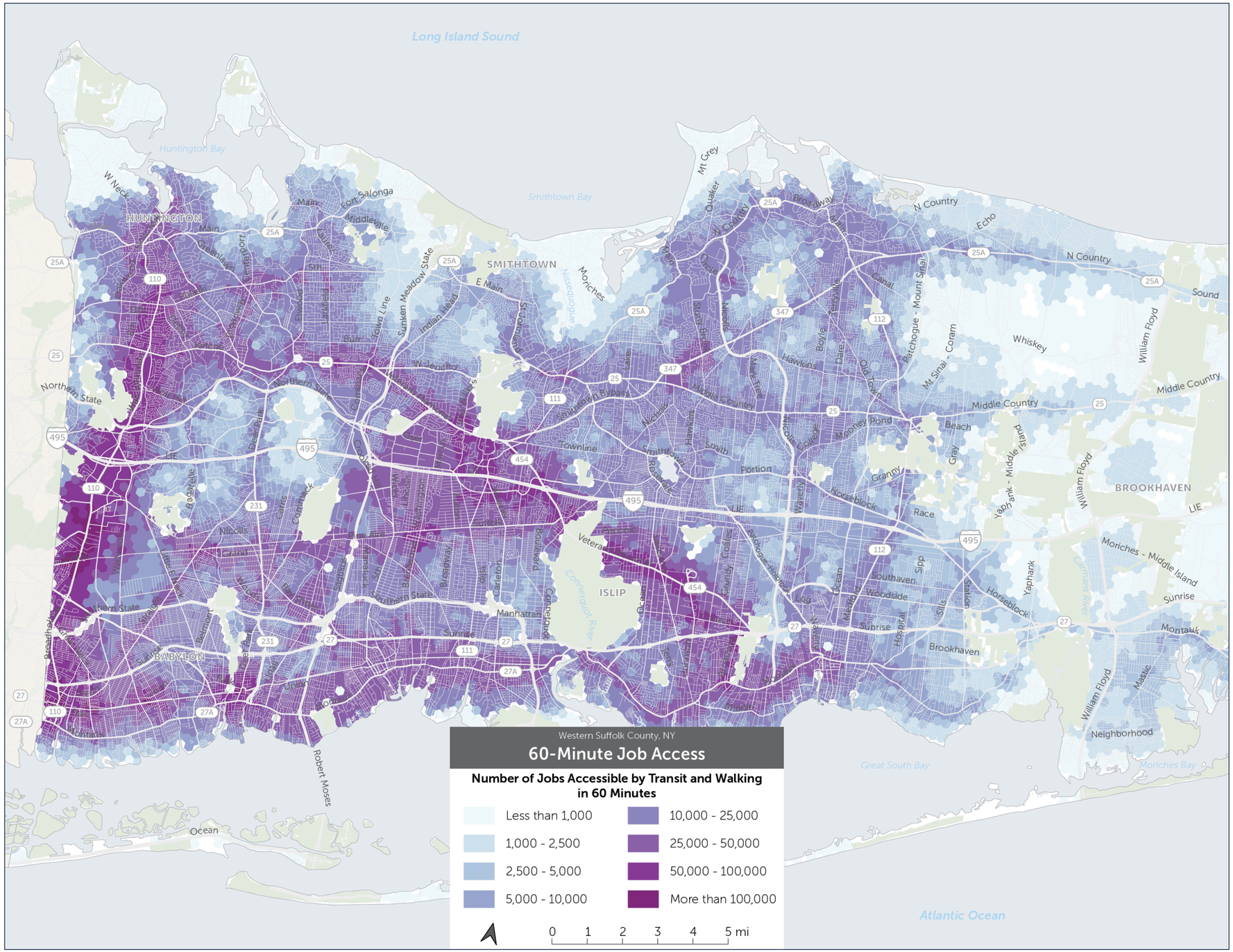


Figure 52: 60-Minute Job Access in the Western Part of Suffolk County

Deviations and Complexity

The limited budget available to SCT to cover the County's enormous geographical area means SCT has a very complex network with many routes—particularly in the middle of the County—featuring deviations, loops, and splits. Figure 53 shows some of the routes with these patterns in the SCT system.

Routes with deviations and loops on them can only feel direct to the people who are bound for or from the deviation or a place along the loop—for most other riders, they often feel like a waste of time. People almost never want to be taken out of direction when they are on their way somewhere. This is part of the reason that linearity is one of the four geographic indicators of high ridership potential, as described on page 15. This is part of the reason that the productivity of routes S57, S59, and 6B is so low.

The other reason linearity is an indicator of high ridership potential is that circuitous and deviating routes are simply longer, and therefore cost more to operate. The longer a route is, the lower the level of service it can offer for the same cost. The shorter a route is, the more can be spent on frequency or long spans. Deviations and loops are often used as a coverage tool. They bring service close to a larger number of people and places. They reduce walking distances to bus stops. In most cases, they discourage more ridership than they attract, but ridership is not the goal of a coverage service.

Routes with deviations and loops sometimes attract high ridership relative to their cost. The number of riders added thanks to a deviation is occasionally big enough to make up for the negative impacts on operating costs and on through-riders. This is the case in routes S60, S63, 3C, and 7B, which have relatively higher productivity. The deviations in these routes bring transit to social services, educational facilities, and senior housing.

Figure 53: Several SCT routes show complex route patterns like deviations, looping, route splits, and branching.

Shorter Walks or Shorter Waits?

The SCT network has many locations where several routes converge. These "hubs" often tend to be LIRR stations, or big shopping centers. Such radial route design means that anyone looking to travel to these destinations from the surrounding area can make the trip without having to transfer.

A natural, geometric consequence of radial patterns is that as bus routes approach the center, they are either routed onto the same streets or they run on very nearby parallel streets. In Suffolk, transit routes tend to do both. An example of this is in the Brentwood/North Bay Shore area, as shown in Figure 54.

A few SCT routes running north from Bay Shore converge at Brentwood LIRR station. A bit further away, the routes run on parallel north-south streets, and as they approach Brentwood station they converge onto Pine Aire Drive.

This part of the County presents a relatively strong market and need for transit—with a higher population density as well as a high density of people with low incomes combined with a street pattern with moderate walk network connectivity. It is reasonable then for SCT to offer so much service there, and this also translates to the higher ridership that is observed in this area.

Transit service being divided among more streets inevitably leads to lower frequencies on each street, and therefore longer waits. This is used as a coverage tool to get buses as close to people as possible. However, if someone misses their bus, the wait is quite long.

If some of these parallel routes can be consolidated onto a few main streets, frequency can be made better and waits can be shorter, however, longer walks would be required. This is why walking distance and waiting time are inexorably linked in any transit network, and trade-off against one another.

These routes could, in the future, be designed and scheduled to have combined frequencies: if two routes on the same street come every 60 minutes, then they can be designed to arrive exactly 30 minutes apart, and someone traveling a short distance could wait at a single stop for either bus. This is one approach to increasing frequency on some corridors without sacrificing coverage.

Yet, this approach cannot be combined with the use of pulsing at key transfer points. For a pulse to work, all routes must be scheduled to arrive at the same time. So two 60-minute routes running on the same street, approaching a pulse point would have buses running down the street, serving the same stops around the same time each hour.

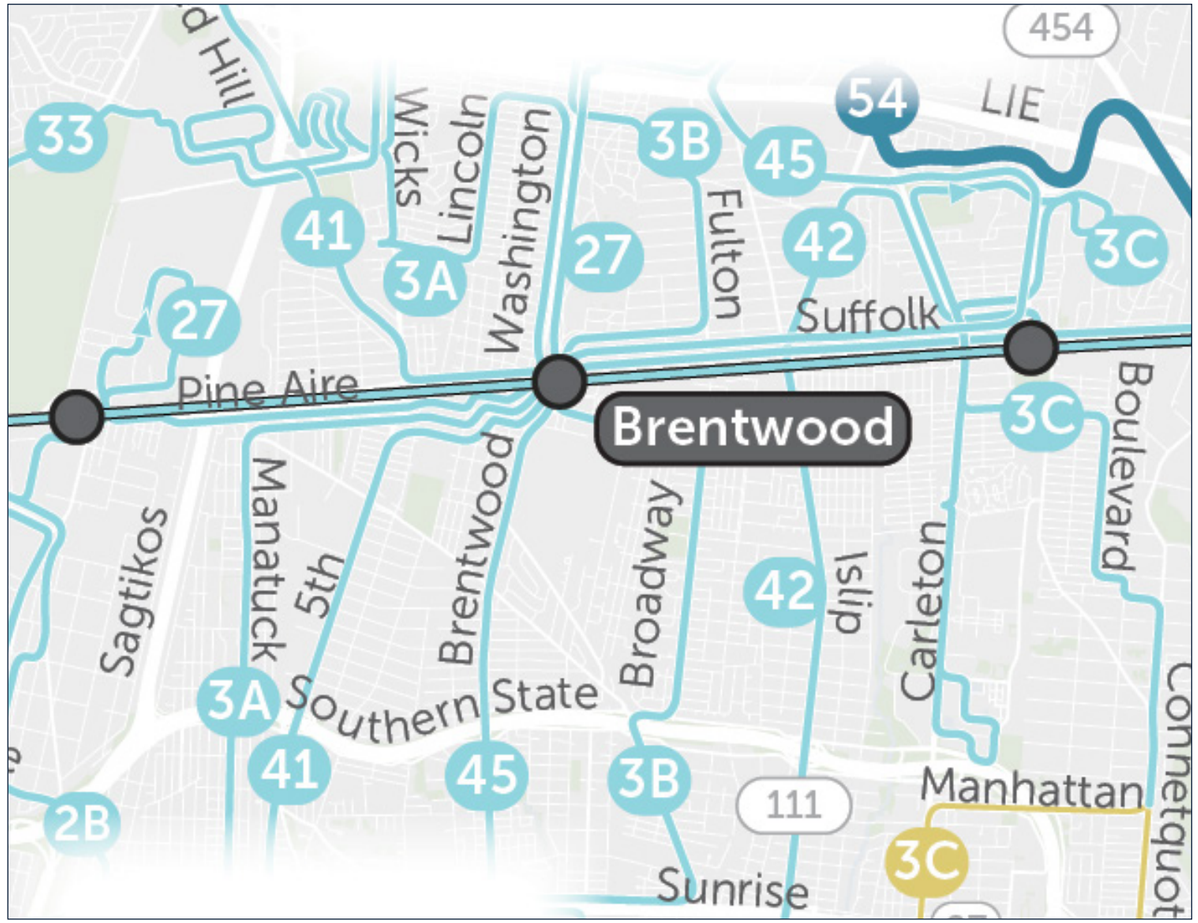


Figure 54: Some SCT routes are within walking distance of each other. The routes south of Brentwood station are all within 0.5 to 1 mile away.

On-Time Performance

On-time performance is a measure of how reliably buses depart when customers expect them to depart. Reliability is particularly important when a transit network is built of infrequent routes. If another bus is not coming soon, the timeliness of each bus is extremely important.

On an infrequent route, an early departure can be much worse than a late one. If a route that comes every 60-minutes is 5 minutes late, someone might be 5 minutes late to work, and that is bad. But if it is 5 minutes early, they probably weren't at the bus stop in time to catch it, and they have to catch the next bus—which means they are now 60 minutes late to work.

SCT considers a bus "on-time" if it arrives at a timepoint at most 2 minutes before or 5 minutes after the scheduled time and departs at most 5 minutes after the scheduled time.

The chart in Figure 55 shows the percentage of times each route was observed to be on time on Weekdays, Saturdays, and Sundays in 2019. All the routes have an on-time performance of less than 65%. The shorter routes S20 and S25 have relatively better performance compared to much longer routes like S62 or S92.

In general, a shorter route can stay on-time more easily. For each one-way run there is usually a few minutes of layover and recovery time at the end of the route, and for shorter routes this layover and recovery time is often a larger percentage of the overall time that a route is running, providing a greater buffer against disruption.

Thus, agencies will sometimes split longer routes as a way to improve on-time performance. Yet splitting longer routes creates other challenges, particularly for riders, as they may now have to transfer to continue a trip that was once a one-seat ride.

If SCT chooses to continue offering a network of mostly low-frequency routes, reliability will be very important, and the low levels of on-time performance that SCT is currently achieving will continue to be a significant barrier to usefulness.

If the SCT network were designed for routes to pulse at transit hubs so that passengers could transfer between them quickly, reliability would be even more important. If an arriving bus is late and misses the pulse by just a few minutes, that can cause passengers to miss their connection and be 30–60 minutes late to their destinations.

If a bus is delayed on a trip, those delays can also transfer onto the next trip that the vehicle is supposed to make if there is not enough "buffer" recovery time scheduled at the end of the trip. Hence very low on-time performance is an indicator of not enough recovery time in the schedules. This means that in order to provide a certain frequency reliably, a route needs more vehicles than are currently planned.

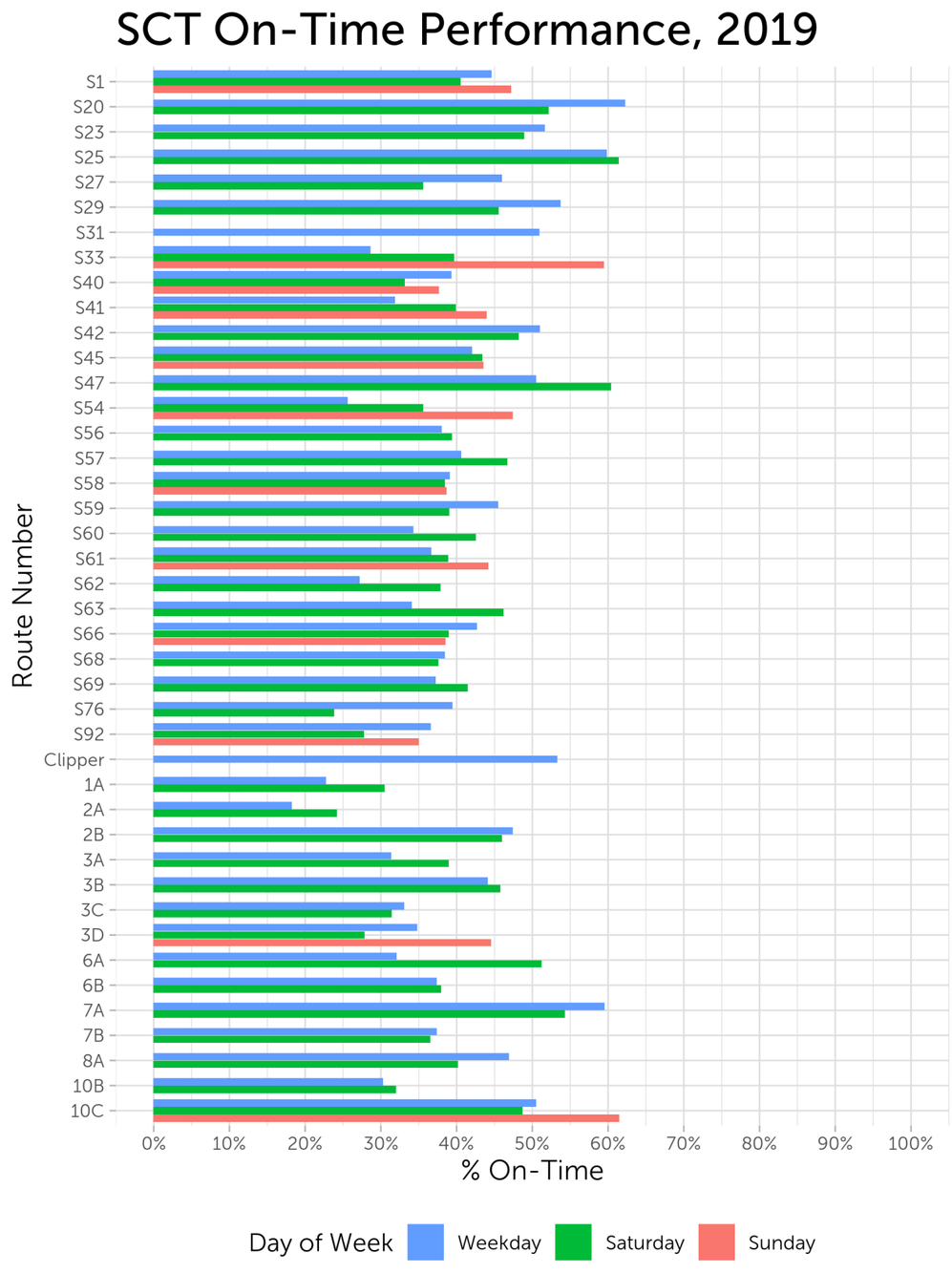


Figure 55: On-Time Performance of SCT Routes by Day of Week

5 Key Questions

Suffolk County has a unique opportunity to rethink the purpose of the transit network, and how transit relates to other ways of getting around such as walking, cycling and driving. The Reimagine Transit is an opportunity for everyone to carefully consider how Suffolk County is spending its transit budget, and the goals and priorities for transit.

The focus of Reimagine Transit is on what can be done in the next few years, so we can't assume that any new resources are available. This means some hard choices have to be made. This does not mean that the County thinks that the resources available to provide transit service today are adequate. Nor does it mean that transit couldn't be expanded in the future.

We would like the community to help us decide on the best use of the funds currently dedicated by Suffolk County to transit. Beyond this, the County sees great value in identifying new funding sources for transit and increasing the number and scope of partnerships to expand and improve transit in the County.

Ridership or Coverage?

The Reimagine Transit is a unique opportunity for Suffolk County to consider and clearly define the right balance between desirable but competing goals for transit.

The current transit network is a legacy of past generations, and has accrued years of good intentions, good ideas, stop-gap measures, and special requests. Much of the existing network may be worth keeping as is, perhaps because it suits the County and its values, or perhaps because it is known and familiar to riders, which is a value in and of itself.

It is also possible that since this transit network was last re-designed, the County has changed enough to justify a fresh start. Transit networks are intricate, interwoven, living things, and adapting them incrementally over time is very difficult.

The most difficult choice for the public, elected officials, and stakeholders will be between providing high frequency, long-span services in order to attract high ridership and providing wide coverage.

Recall that high ridership serves several popular goals for transit, including:

- Competing more effectively with cars, so that the County can grow without increasing traffic congestion.
- Collecting more fare revenue, increasing the share of the transit budget paid for by fares.
- Making more efficient use of tax dollars by reducing the cost to provide each ride.
- Improving air quality by replacing single-occupancy vehicle trips with transit trips, reducing greenhouse gas emissions.
- Supporting dense and walkable development and redevelopment.
- Extending the most useful and frequent services to more people.

On the other hand, many popular transit goals do not require high ridership in order to be achieved, and instead are achieved by providing transit coverage of many places. These include:

- Ensuring that everyone in the service area has access to some transit service, no matter where they live.
- Providing basic transit access for people who cannot use personal vehicles.
- Serving newly developing places, even if they don't yet have the size or density to constitute a large transit market.

This choice is not binary. A transit agency can pursue high ridership and extensive coverage at the same time, but the more it pursues one, the less it can provide of the other. Every dollar that is spent providing very high frequency along a dense mixed use corridor is a dollar that cannot be spent bringing transit closer to each person's home or reaching residential areas in the less dense parts of the County, and vice versa.

Making the Decision

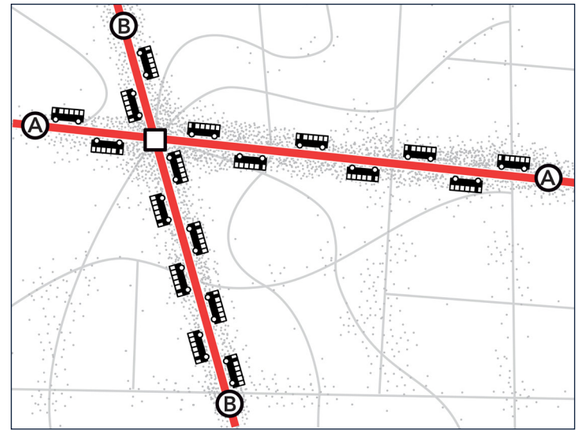
In a network designed solely for high ridership, a lot of service is concentrated in the places which have the strongest market for transit: more density, walkability, linearity, and proximity. Transit runs frequently and longer during the day to provide useful service. A few routes can be extended to other dense areas in the County or places with high ridership potential, but most low-density places have very little, or no, transit service.

In the network designed solely to maximize coverage, many routes serve a large proportion of the developed area of the County, but are not very frequent. Most people have some transit service very near to them, but they have to wait longer for the bus to arrive.

No public transit agency focuses solely on either of these goals. Most transit agencies have some direct, frequent, long-span routes on which ridership and productivity are high, and others which run at lower frequencies and more limited times, for specific coverage purposes. We suggest that people think about this choice not as binary, "yes-or-no" decision, but as a point on a sliding scale that the community can help to set:

How much of the County's transit budget should be spent on the most useful service in pursuit of high ridership? How much should be spent on providing coverage?

Ridership Network



Coverage Network

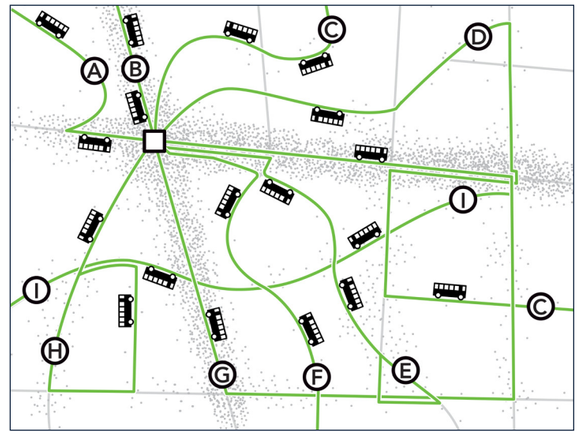


Figure 56: A network designed solely to maximize ridership looks very different from a network designed solely to maximize coverage.

Walking or Waiting?

Another way to think about the question of ridership and coverage is to think specifically about how far a person should have to walk to reach a bus stop, and how long they should have to wait, on average, before the next bus comes.

Walking and waiting are important to consider on their own, because both of these activities add time and inconvenience to any transit trip, and different people have a wide variety of preferences regarding each.

For example, a young person without disabilities who is in a hurry might have no problem walking over a half-mile to a bus stop if the bus is always coming soon. An older person or person with a disability might prefer to have a bus stop much closer to their front door, even if it means they need to memorize the bus schedule or risk waiting a long time.

Connections or Complexity?

Most transit networks start out as networks with relatively few transfers between routes (we often call these Direct Service networks). Yet, as a community grows bigger, Direct Service networks become massively complex. At some point, cities make a transition from a Direct Service network to a Connective one, a transition that often requires severing direct links that people are used to in order to create a structure of very frequent service that is more broadly useful and legible.

The current SCT system is very complex, with many long infrequent routes designed to minimize transfers across the large service area. The network also includes many shorter routes designed to provide service within a few villages or hamlets. There is a lot of overlap and inconsistent spacing between routes in some areas.

In the **Direct Service Option**, on the left, there are nine routes in the network and everyone has a one-seat ride, but everyone must wait, on average, 30 minutes for a bus and therefore fewer people find service useful.

In the **Connective Option**, on the right, there are only three routes and only one-third of trips have a one-seat ride, but the average wait for a bus is now only 10 minutes, and even if you must transfer, your total waiting time is only 20 minutes, 33% less than in the Direct Service Option. So more people find the service useful.

Figure 57: Example of the Connections versus Complexity Trade-off for a simple town.

Connective networks reduce total trip time over a broad area, provide better frequency, and are simpler because they have fewer routes. We do not want to imply, however, that connective networks, which require more transfers, have no downsides.

The largest disadvantage is simply the effort required. Partway through your trip, you must gather your things, exit the bus, possibly walk to another stop, and wait for another bus. The walk will be very short, and the high frequencies mean that the wait will be short as well. Excellent shelter and information will also be provided. But it will still be an inconvenience. The level of effort may also be greater for people with limited mobility.

The second disadvantage is that transferring can compound risks associated with reliability. There is always the fear of missing a connecting bus and being stuck at the transfer hub. In a connective network, this will only occur in cases of major disruption. In routine operations, there should be so many buses along each route that waits would be short. This advantage is not available to lower-frequency networks which depend on pulsing for transferring.

Because they involve consolidation of service to increase frequency, Connective networks also mean that more walking is required to access higher frequency service. As such, the connections-or-complexity question is related to the waiting-or-walking question as well as the broader ridership-or-coverage question.

Increase Transit Resources?

Wrestling with the first choice—how to balance ridership and coverage—and altering the transit network to meet new, clearer goals and match community values may improve people's sense that the transit network is delivering on their goals and is therefore worth further investment.

While there are things a transit agency can do to get higher ridership within a fixed budget, the relationship between investment and relevance in Figure 58 and Figure 59 demonstrate the principle of "you get what you pay for". Glancing at the two charts shows that, in general, the communities that invest in more transit service get more transit trips per capita. Thus, more service generally leads to more ridership. People can't ride bus routes that don't exist.

Suffolk County could increase transit frequency and ridership without investing in more service. However, this would require cutting and reallocating low-ridership services. There is no way around this basic geometric fact.

As part of this Reimagine Transit study, the County will exploring some hybrid paths to shift resources away from coverage service and toward ridership service while minimizing disruption. For example, some very low productivity services may be replaced by on-demand services that still provide coverage, but at a lower cost per riders. These changes may free some resources by changing how coverage-oriented transit services are delivered.

These kinds of changes can help reduce the investment in low productivity routes while maintaining basic coverage of the area, but the range of places that these services can operate effectively and efficiently is limited. And on-demand microtransit services have a very low ceiling for their maximum potential productivity. Thus, these kinds of efficiency maximization initiatives will generally only help at the margins.

When thinking more broadly about the entire County and the entire transit network, there are realistically two paths forward if Suffolk County wants to significantly increase transit frequency, transit usefulness, and transit ridership within a fixed budget:

- Cut low-ridership coverage services, or
- Supply more transit service.

When there is new revenue available for transit, ridership can be increased without cutting coverage. The growing resource pot protects the community from having to make painful trade-offs between competing, but closely-held, values.

The questions of how to balance frequency with coverage, and how much service to pay for, both relate to people's feelings that the transit network is valuable and relevant to their lives. If people do not understand what goals SCT and Suffolk County are trying to achieve, then there will be some natural reluctance to increase investment in the transit system

A key reason for the relatively low level of investment in transit in Suffolk County is that the level of funding Suffolk receives from the State of New York is relatively low per capita compared to nearby peers. This state funding formula is unlikely to change very soon, and at least in the short term, SCT has to plan services with the level of funding it currently receives. That does not preclude, however, having a larger conversation with state and regional partners about changes to the funding formula. In addition, the County can consider whether it wants to further supplement the state funding with more local resources to expand transit service in the County.

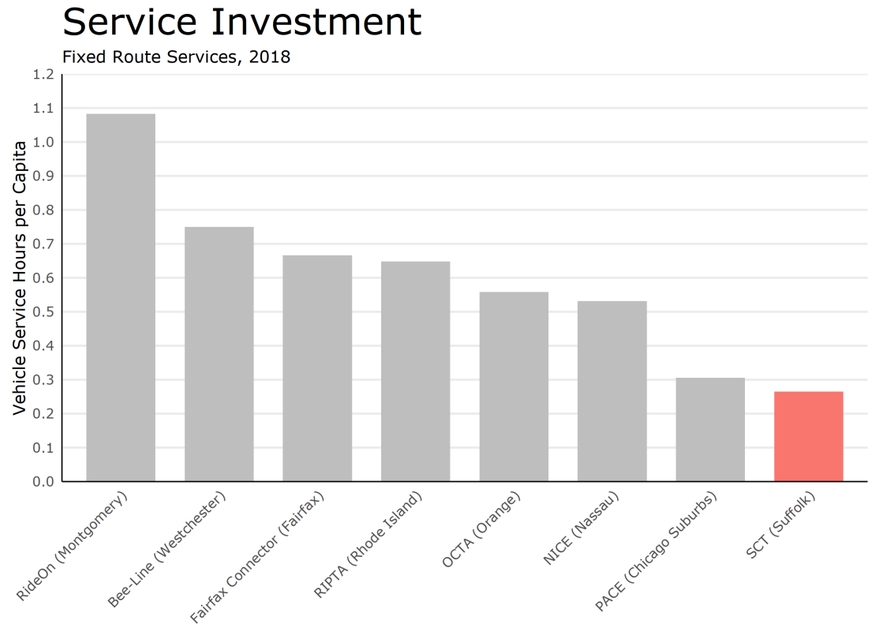


Figure 58: SCT's level of service investment relative to its population is much lower than that of similar agencies operating in suburbs of large American cities.

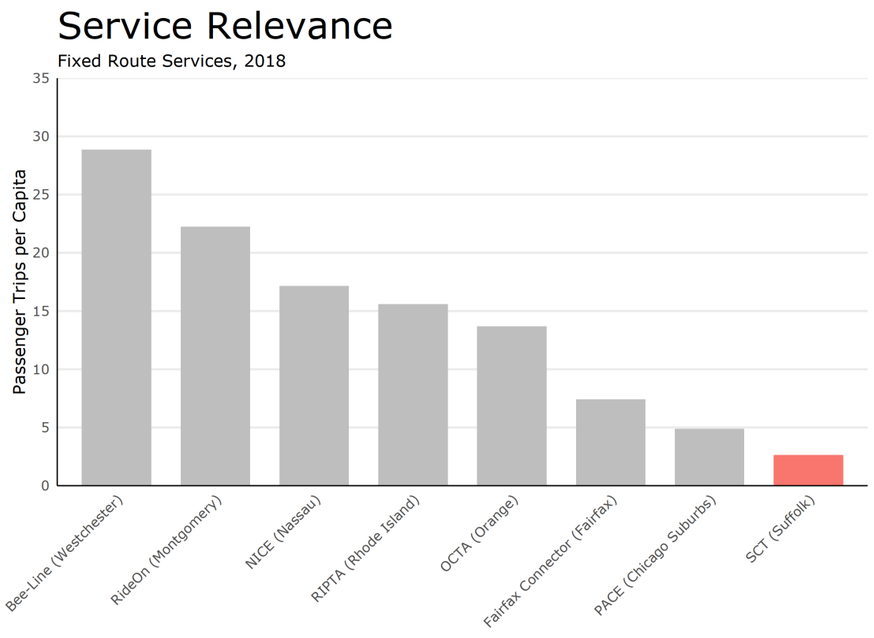


Figure 59: Consequently, the level of ridership the system gets relative to its population is also low. More service investment is linked to more relevant service.

6 Transit Concepts

Introduction to the Network Concepts

This chapter presents two network design Concepts for Suffolk and compares them to the existing network. Both Concepts have the same amount of service—that is to say, the amount of total annual service hours is the same in both Concepts[1]. However, they show different ways to allocate these same resources.

The Concepts differ in the degree to which they emphasize Ridership and Coverage goals, described on page 16. The existing system devotes about 50% of its resources toward Ridership goals and about 50% to Coverage goals and duplication. The Coverage Concept in this report puts 40% of its resources toward Ridership goals and 60% toward Coverage goals. The Ridership Concept puts about 70% of its resources toward Ridership goals and 30% toward Coverage goals.

The Concepts shown in this chapter represent a spectrum of possibilities, and are not intended to be an either/or proposition. By showing the public, stakeholders, and decision-makers the range of possibilities, the County is asking: "Now that you see the outcomes of emphasizing one goal over another, how should we balance the Ridership and Coverage goals? In other words, if you want better service, what is your definition of better?" When comparing these Concepts and their outcomes, the choice is not "Pick one of these two"; rather, it is "Where on the spectrum of possibilities (illustrated in Figure 60) should the SCT network be?

[1] One service hour is one bus operating on the street, picking up and dropping off passengers, for one hour.

Concepts, Not Proposals

At this stage, the study team is not proposing any specific changes to the network. The public conversation about the Concepts will help guide the development of an actual network Proposal.

Some features are common to all conceptual networks, as outlined under the Key Assumptions section, but even these are not proposals yet. In designing the Concepts, we are highlighting the Ridership-Coverage trade-off, and to do this, we made a single choice about matters that were unrelated to that trade-off, and kept that choice constant across both concepts. Different choices could have been made, and we welcome public comment about these features of the plan.

None of the staff from SCT, Suffolk County, nor the Consultant staff have a preference among the Concepts shown in this report.

The most important word to remember is **"if"**. The Ridership Concept shows what might happen **if** the County chose to shift toward Ridership goals as the primary goal. No decision has been made yet. The Coverage Concept shows what might happen **if** the County chose to maintain the same level of overall network coverage, but with consistent service design guidelines and variable transit service areas.

It is more useful to compare the Concepts to each other, than to the existing network. The schedule of the existing network is not in line with the real operating conditions in Suffolk County, as evidenced in the on-time performance of SCT routes. The Concepts try to take these conditions into account. This is explained further in the "Concept Assumptions" sections on the next page.

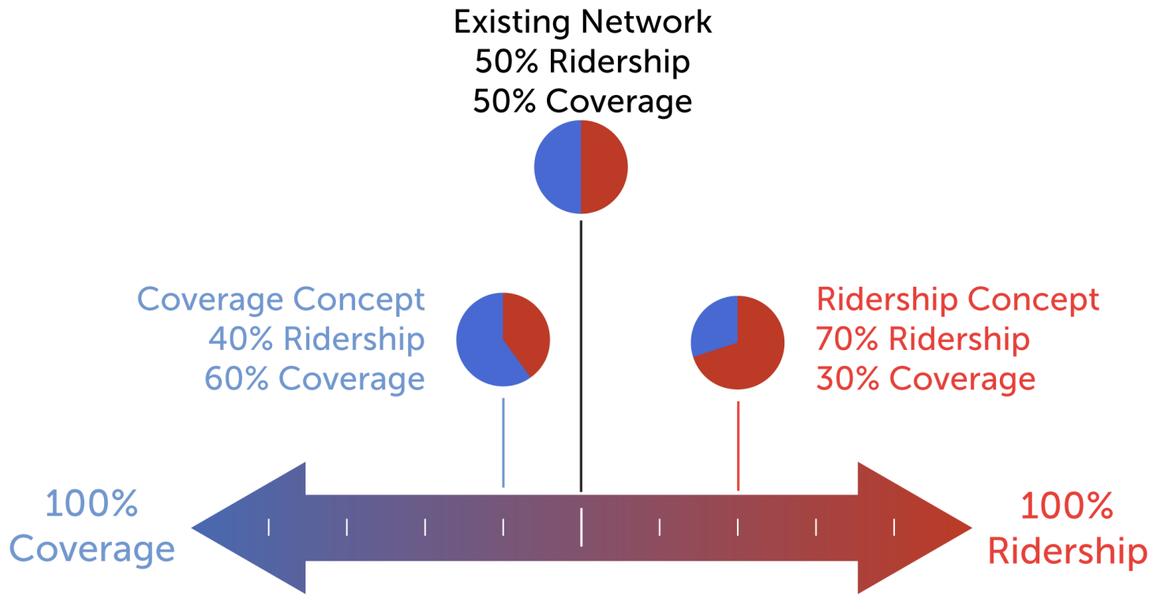


Figure 60: Spectrum of Transit Choices for the SCT Network. The pie charts represent how resources are divided between Ridership goals and Coverage goals/duplication in each scenario.

The Big Picture Matters More Than the Details

These Concepts have not been refined to the point that they would be ready to implement, because their purpose is to illustrate choices at a high altitude. Based on public feedback to the Concepts, a final plan will be developed, and details will be clarified in the next phase of this planning process.

In general, these Concepts are intended to be complete descriptions of the predominant midday pattern of services, seven days a week. The Concepts also show frequencies changing throughout the day and week, but this is not meant to detail:

- Morning and evening peak services
- Specialized commute services consisting of only a few trips
- Local routing details such as turnarounds
- Scheduling—the concepts identify frequencies for each period of the day, but an actual schedule will include a transition from one frequency to another.
- Minor deviations affecting small numbers of trips

Some of these details will be added later in a final plan, but doing so now, at this conceptual stage, would be premature.

Concept Assumptions

Making Up for Slow Speeds

Over the last several years the speed of service on SCT routes has declined. When the speed of service goes down, one of two things must happen: either the schedule must be updated to reflect the slower speed or the service provided becomes perpetually behind schedule. SCT's schedules have not been updated, so most routes today have poor on-time performance, as described on page 58.

When buses run slower than scheduled, they cannot consistently reach stops at their scheduled times. These delays can add up. There may be cases when a bus reaches the end of the route and begins its next trip, and there is not enough buffer time. Then, delays from a previous trip can spill over into the next one, further degrading on-time performance.

An agency can respond to this problem in two ways. One option would be to rewrite the schedule to reflect the slower speed but make no change in the number of buses and operators on the route and in doing so also reduce the frequency of service. A second option is to rewrite the schedule and add a bus and operator to provide the same frequency as previously provided, but this obviously costs more. If SCT wished to provide the actual frequency of service promised in its current schedules, it would need to provide about 15% more service hours, compared to the service hours it spends today.

Both the Concepts have roughly 15% more service hours compared to the existing schedules to account for the slower actual speed, so their resource budgets are in line with actual operations. If the County wished to solve the problem of slower speeds without spending additional resources, both of these concepts would have to show 15% less service.

Connections Over Complexity

The project team prioritized fewer routes with better connections over more numerous, complex routes at lower frequency. Both Concepts have been drafted in such a way as to take most advantage of timed connections or "pulses" at some key locations throughout the County. Connected networks make it possible to provide fewer, more frequent routes, instead of spreading service thin. The higher frequencies and short connection times have a very positive impact on how far one can reach in a given time in both Concepts. In the network maps of the Concepts, locations where timed connections may be made are shown with this symbol: ⏲

Note that not all routes will be able to make timed connections at every pulse point in the network.

Demand Response Zones

The Coverage Concept includes numerous new Demand Response zones to efficiently provide coverage across large areas of low density suburban and rural areas. Within these zones, a customer will need to request a pickup, either by calling a customer service center or by using a smartphone app. Customers may have to wait 30 to 45 minutes for a pickup. Customers would likely be served by smaller 10-15 passenger vans or vehicles similar to those used for paratransit service. Once picked up, a customer would be taken to their destination, and may share the ride with others going in a similar direction.

These zones have timed arrivals and departures at nearby transit hubs, where people can connect to and from the fixed routes. Both Concepts assume that the Southampton Microtransit pilot program will continue to operate.

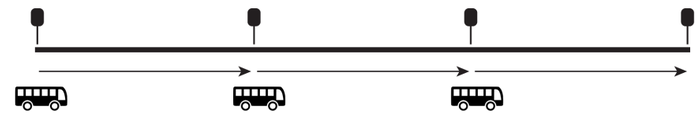
Route Numbering

In both Concepts, the numbers of the routes have been changed in order to simplify the numbering system to some extent:

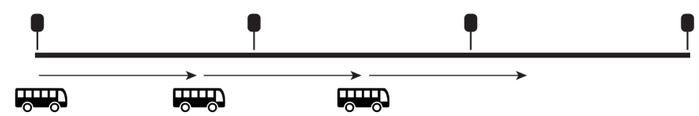
- The tens digits of the route numbers increase from west to east.
- Odd-numbered routes tend to run north-to-south while even-numbered routes tend to run east-to-west.
- In the Coverage Concept, Relatively frequent routes (with midday frequency of 30 minutes) all have single-digit numbers.

Figure 61: The relationship between speed, on-time performance, and the cost of service.

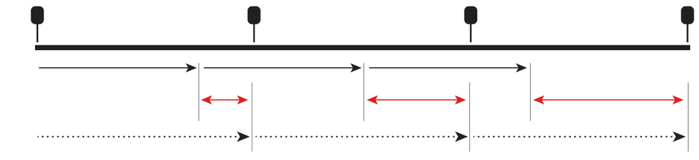
Each arrow represents the distance a bus can travel in 30 minutes. With three buses running, each stop has a bus arriving every 30 minutes.



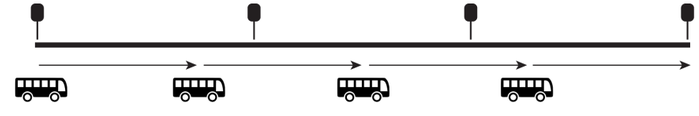
Over time, the actual driving speed goes down. Each bus can cover lesser distance in 30 minutes.



As a result, buses arrive later than the schedule at each stop. This delay is represented by the red arrows.



The agency must add a bus to provide a reliable 30-minute frequency service, and match the schedule to actual speeds.



Coverage Concept

In the Coverage Concept, most areas that are served today by SCT fixed route services would still have some transit service, but this means that service is spread more thinly. The Concept is designed to provide the same level of coverage as the existing network, but some duplication and complexity has been removed. Riverhead, Central Islip, Patchogue, and Smith Haven Mall are places where timed connections are possible between many routes.

Many low density suburban and rural areas where existing service is very infrequent, are served by Demand Response (labeled in the maps as On-Demand Transit) zones. Within the zones, passengers will have to request a pickup with a wait time of 30 to 45 minutes. They have timed arrivals and departures at nearby transit hubs, where people can connect to and from the fixed routes.

The maps below and on the next two pages are meant to provide a high-level overview of the service available in the County and the western part of the County, respectively, during the middle of the day in the Coverage Concept. It is not meant to provide minor routing details.

To explore this Concept and its relevance to your life you can:

1. Find a place you care about on the map using the labeled streets.
2. Note which routes are nearby, by number and by color.
3. Look at the legend to learn the weekday frequencies of these routes.
4. See where else the routes go and which routes they connect to.

Other information in this Concept that you may want to review:

- The table on page 69 shows each route's frequencies, how they change throughout the day, during what hours each route operates, and how long routes run on the weekend.
- The charts on page 74 show the number of residents and jobs served by frequent service and by any service in this concept.
- Maps illustrating how the area people could reach within 60 minutes would change from various locations around the County compared to the Existing network, start on page 75.
- Maps showing how the number of jobs someone could reach within 60 minutes from locations all across the County are shown on page 78 and page 79.

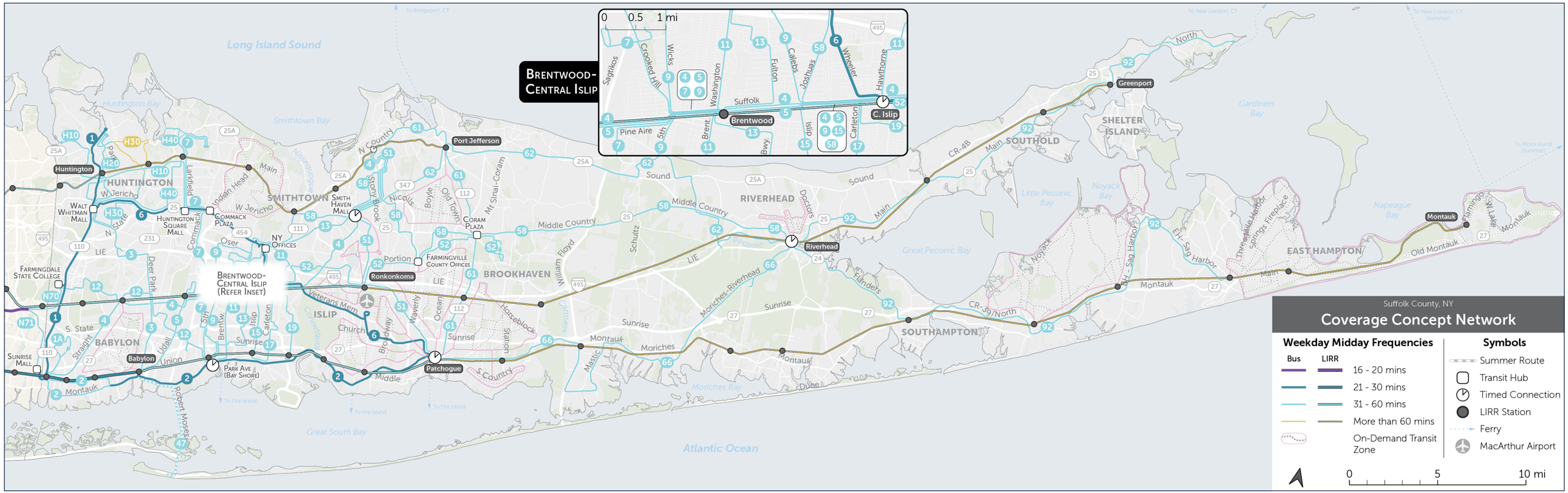


Figure 62: Map of the Coverage Concept Network in Suffolk County

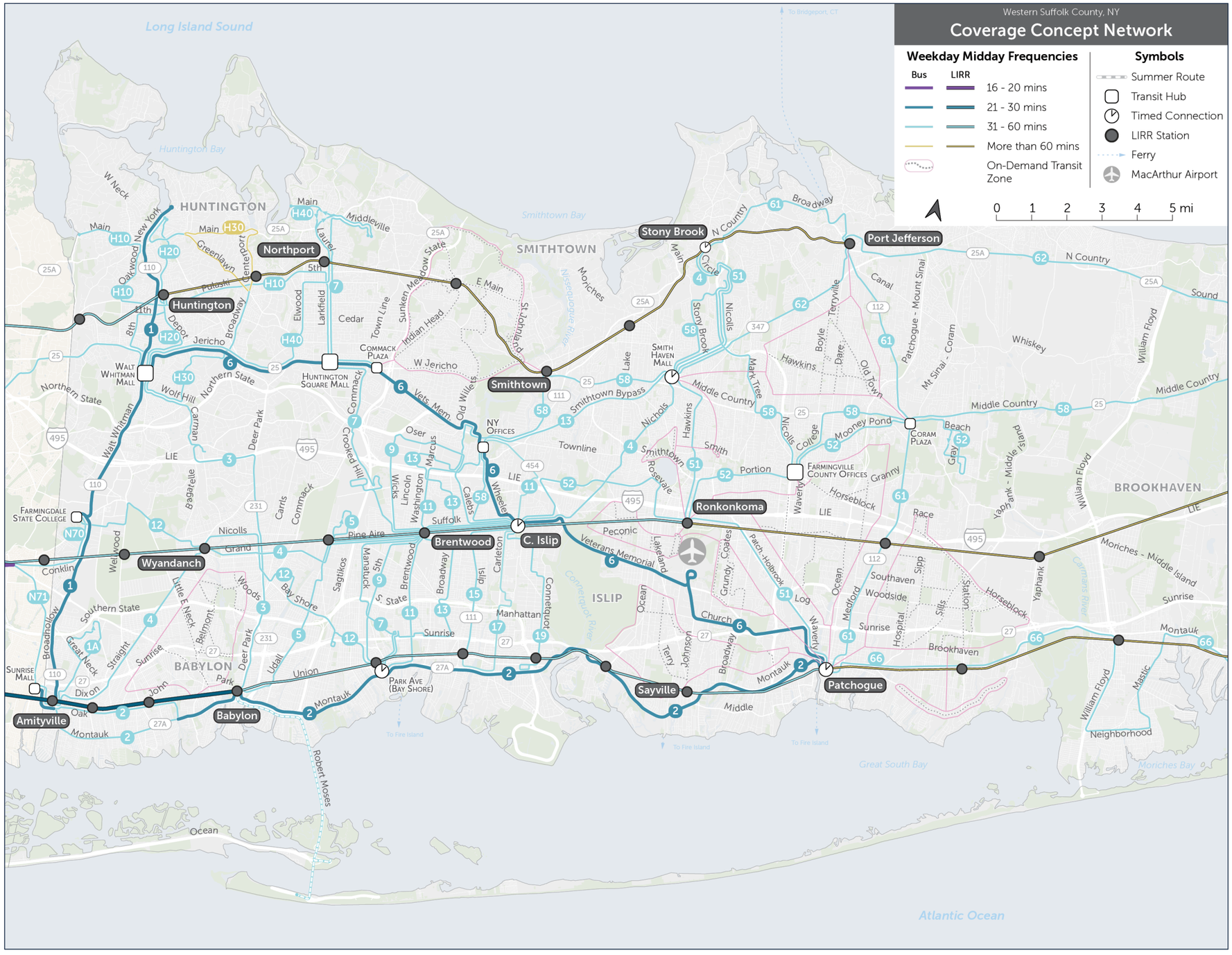


Figure 63: Map of the Coverage Concept Network in the Western Part of Suffolk County

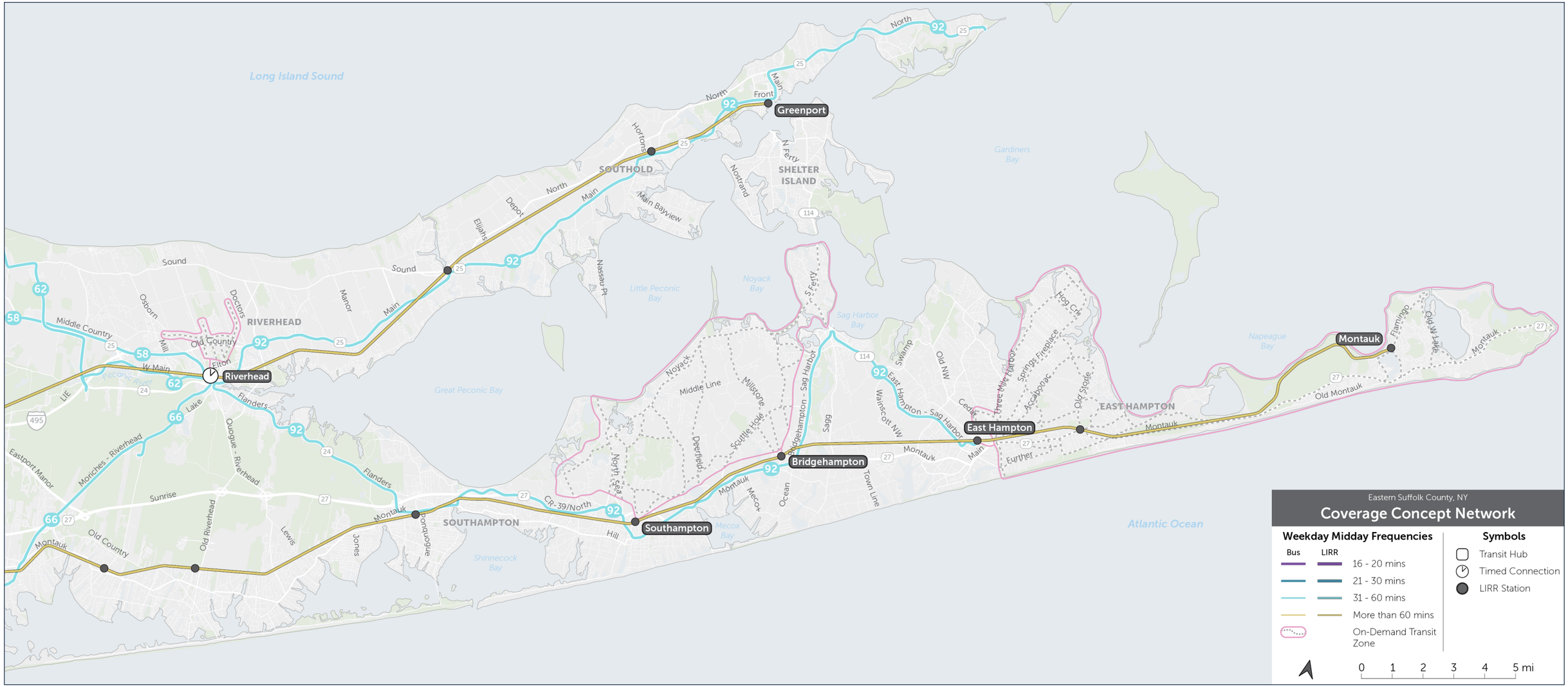


Figure 64: Map of the Coverage Concept Network in the Eastern Part of Suffolk County

When is Service Available?

Figure 65 shows the frequency by time of day for routes in the Coverage Concept. Most fixed routes run from 6 am to 6 pm every day of the week, and at 60-minute frequency all day. The frequent midday Routes 1, 2, and 6 run from 5 am to 10 pm on weekdays and 6 am to 8 pm on weekends. Routes 2A and 2B refer to the two branches of the frequent Route 2 between Amityville and Babylon.

There are also nine Demand Response Zones, including the Southampton Microtransit Pilot. Similar to the 60-minute fixed routes, the Demand Response Zones operate from 6 am to 6 pm every day of the week. Within the zones, passengers will have to request a pickup with a wait time of 30 to 45 minutes.

In both Concepts, the spans of service as well as frequency over the day are consistent across weekdays and weekends. Route 1 is the only route with additional morning and evening peak period service, when it offers a frequency of 20 minutes.

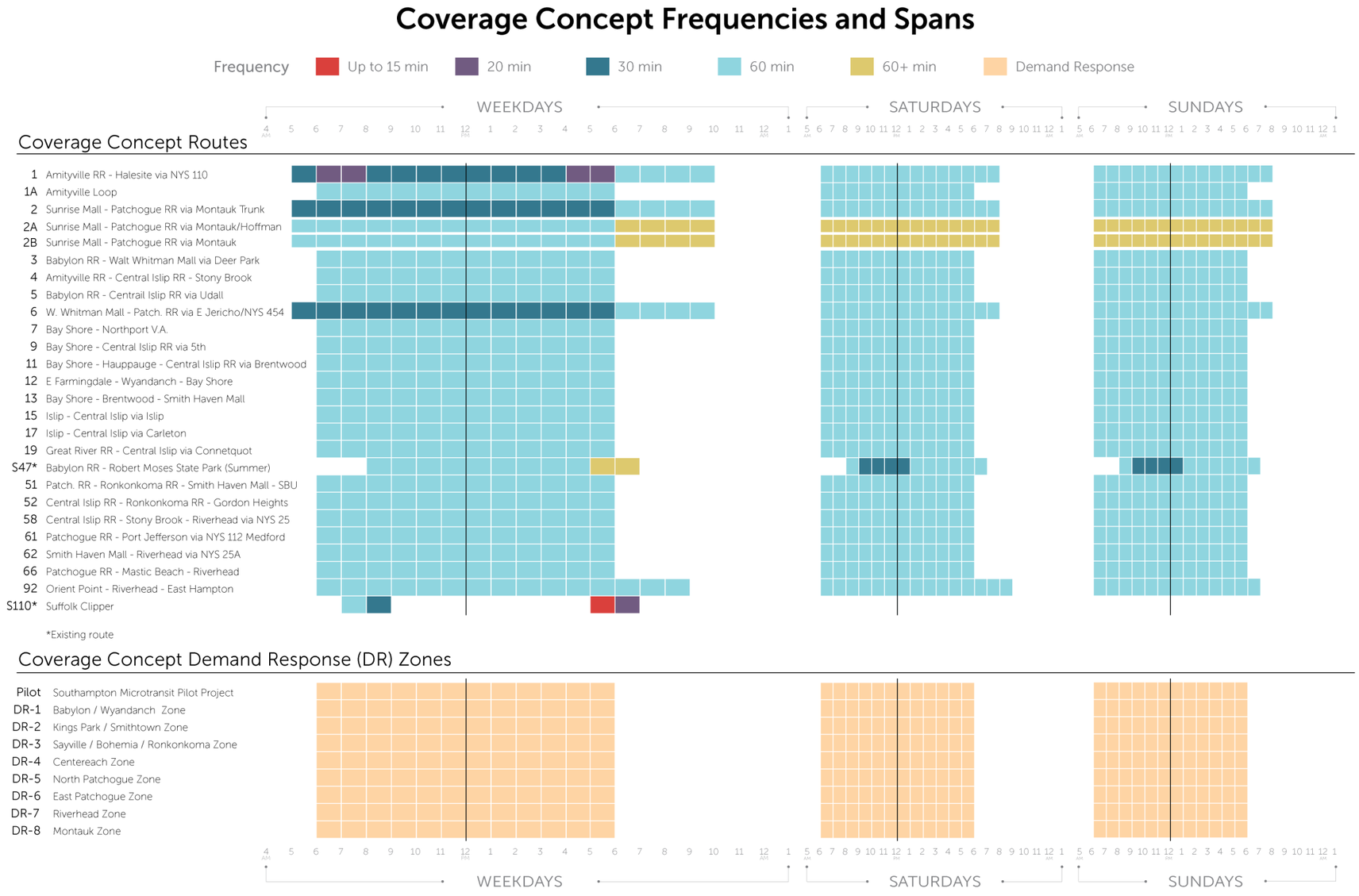


Figure 65: Spans and Frequencies for All Proposed Coverage Concept Routes and Demand Response Services

Ridership Concept

The Ridership Concept concentrates more frequent service where there are more people, jobs and opportunities. This dramatically increases how many useful destinations an average resident can reach in a given amount of time, which is the key to increasing ridership. Concentrating service into fewer but more frequent routes means that some lower-demand areas would be a longer walk from transit service, or not have service at all, in this Concept.

The maps below and on the next page show the midday network in the Ridership Concept. They are not meant to be specific about the details Instead, they are meant to provide a high level view of frequent and infrequent service available across Suffolk County and the overall design of this concept.

The Ridership Concept keeps service in corridors with higher density and where the existing services have relatively higher productivity. In the southwestern areas of Brentwood, Central Islip, and Bay Shore, service is consolidated into three routes which provide 30-minute frequency. In addition to Central Islip, timed connections between buses are also possible at Brentwood.

The project team is certain that, were the Ridership Concept to be implemented, it would get higher ridership than the Coverage Concept. Why are we so certain? Repeated, wide-scale research has shown that higher frequencies and longer spans of service are correlated with increases in ridership. In other words, people choose transit if it is workable given their destination and their time constraints, so making more destinations accessible within less time for a large number of people will attract more riders.

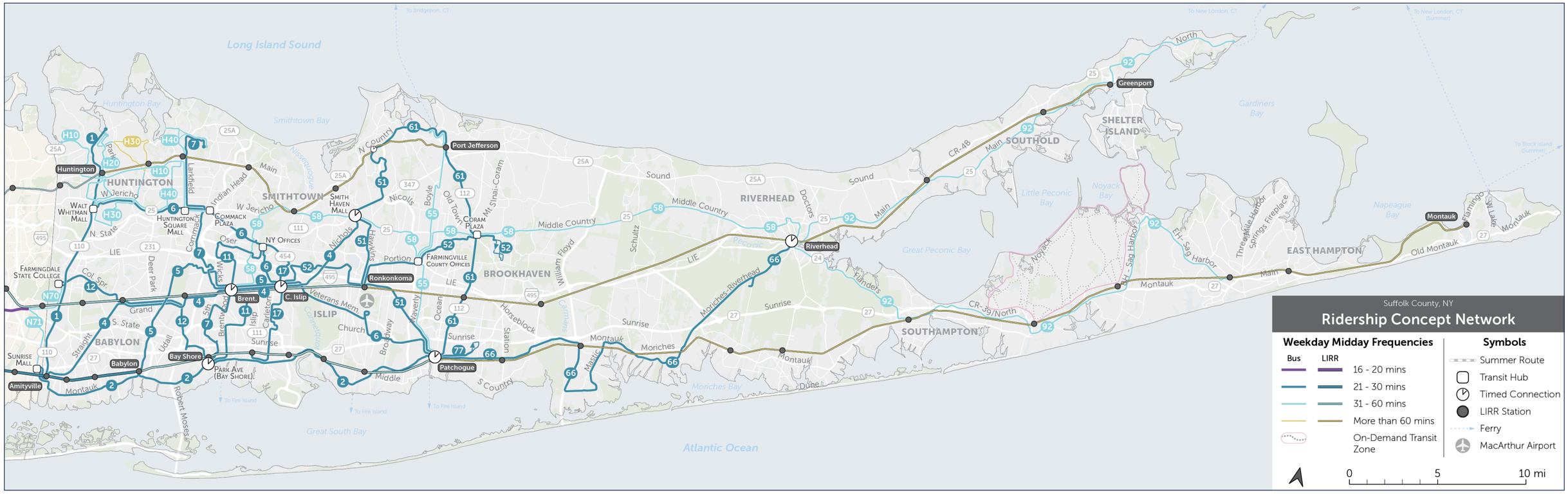


Figure 66: Map of the Ridership Concept Network in Suffolk County

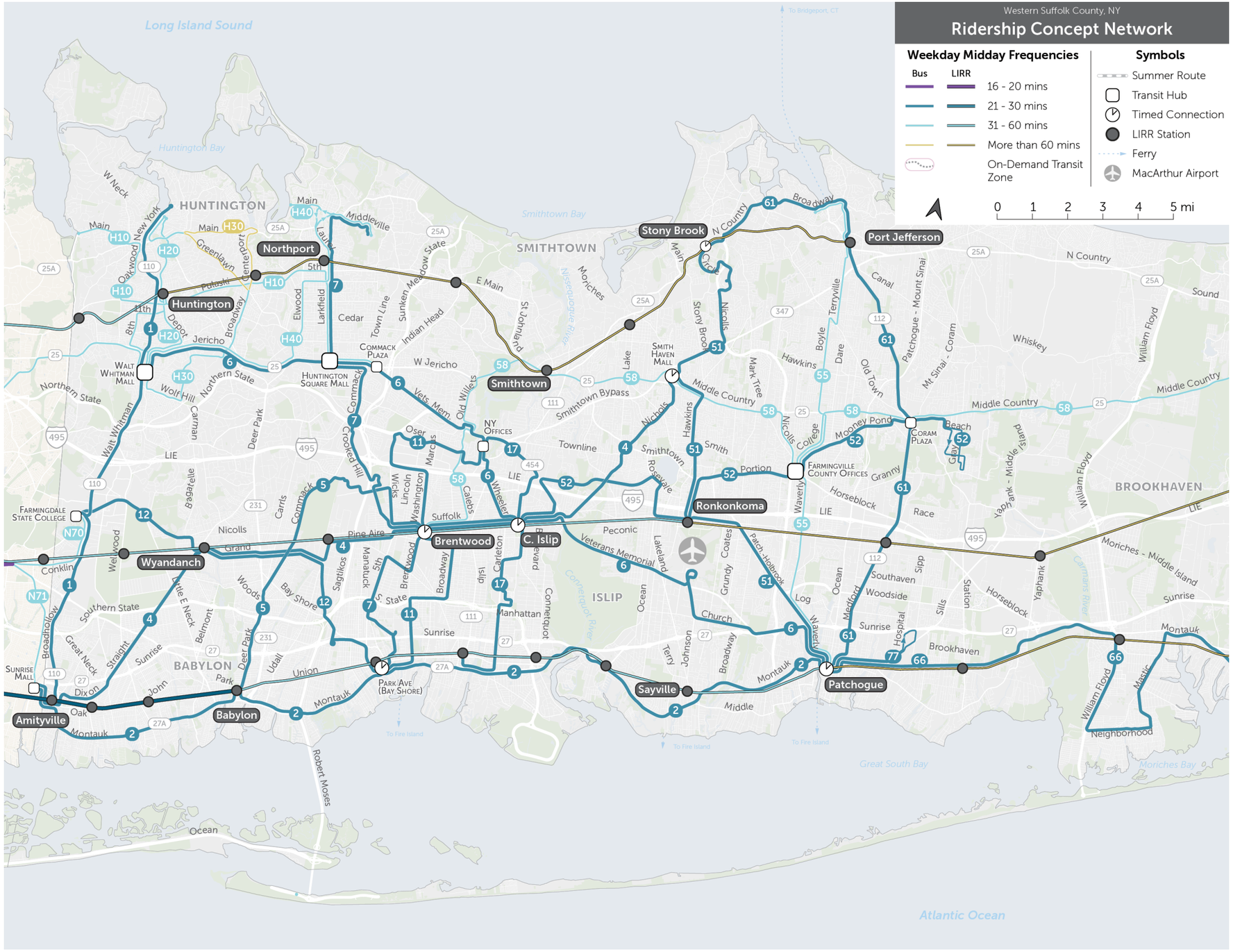


Figure 67: Map of the Ridership Concept Network in the Western Part of Suffolk County

When is Service Available?

Figure 68 shows the frequency of the routes in the Ridership Concept by time of day for weekdays and weekends. Similar to the Coverage Concept, spans of the routes are consistent over the day. Most routes are frequent routes which run from 5 am to 10 pm, and provide 30-minute service between 5 am and 6 pm. They run 60-minute service on weekends between 6 am and 8 pm.

Compared to the Coverage Concept, the routes run more frequently on weekdays and also longer on weekdays and weekends. This means that more useful service is available in areas and corridors with high ridership potential for a longer duration.

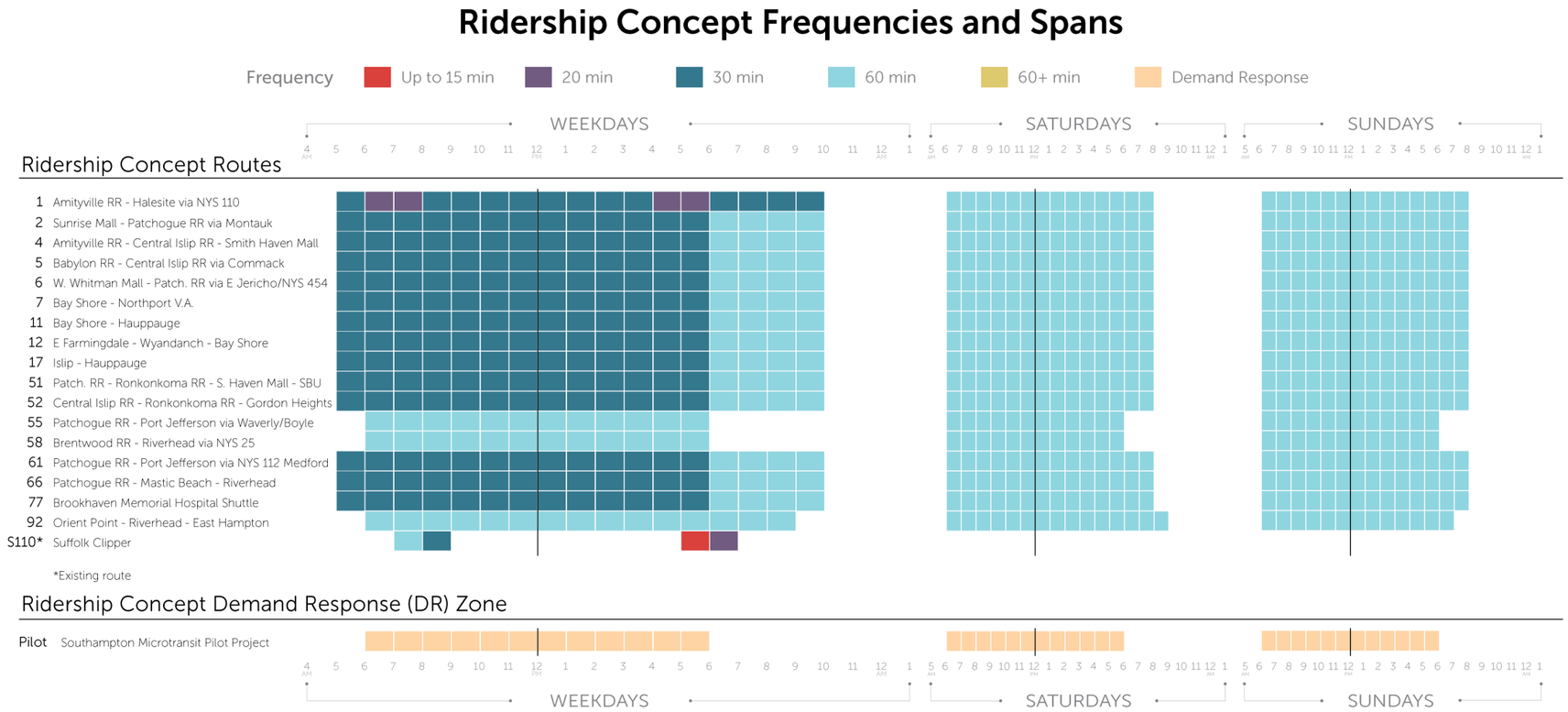


Figure 68: Spans and Frequencies for all proposed High Ridership Concept Routes

Comparing Outcomes

The design of the networks and when and where service operates are important to thinking about how service changes might affect individuals and their trips, but they tell us only so much about the overall effects of these networks.

In this section, we look at three different ways of measuring the potential outcomes of the concepts. These measurements are not forecasts. They do not make assumptions about how culture, technology, prices or other factors will change in the next few years.

These are simple arithmetic measures that combine existing distance, time and population information to show the potential of each Concept and how they each differ from the Existing network.

Proximity

The first measure reported, on the next page, is very simple: *How many residents and jobs are near transit?*

Proximity does not tell us how useful people will find transit service, only that it is nearby to them. We also report on proximity to transit by the frequency of service, to provide a little more information about how many people are near service that they are more likely to use.

Wall Around Your Life

To understand the benefits of a network change, consider this simple question: *Where could I get to, in a given amount of time, from where I am?*

This question refers to the physical dimension of liberty and opportunity. If you can get to more places in a given amount of time, you will be more free and have more opportunities outside your immediate neighborhood.

Isochrones provide a visual explanation of how a transit network changes peoples' freedom to travel, on foot and by transit, to or from a place of interest. A few examples are included in this report beginning on page 75. Further examples are available in the Appendix.

Access

Isochrones display the change in access that a person would experience to or from a particular place. By summing up the isochrones for every single part around the County, we can describe how access to jobs would change for all residents of the service area.

This is a good proxy for a ridership forecast, because it describes the part of ridership forecasting that is basic math and highly predictable:

Could more people access more jobs (and other opportunities) by transit, in less time? If the answer is "Yes," that implies higher ridership potential.

Summary of Outcomes

Proximity

The Coverage Concept slightly improves the number of residents and jobs near any all-day service, and near more frequent service (every 30 minutes).

Almost three times as many residents and jobs are near 30-minute service in the Ridership Concept. However, fewer people and jobs overall are near any service.

Wall Around Your Life

The Coverage Concept moderately changes how much area is accessible from various locations in the County within 60 minutes. In some locations, a network offering more timed connections provides more opportunities and freedom, while in other locations, fewer direct connections compared to Existing Network shrinks the area reachable in a 60 minute travel time.

The change in the size of isochrones is much bigger in the Ridership Concept. The areas which have increased frequency and timed connections can access much larger areas compared to Existing Network, and those places tend to have many people and jobs. Other parts of the County, where there are fewer people and jobs, have no service and therefore the isochrone maps show a decline in the area reachable in 60 minutes.

Access

Overall, the Coverage Concept slightly increases access to jobs for an average person in the County. This is in part because of timed connections at various locations.

The Ridership Concept dramatically increases access to jobs for an average person in the County. It puts a lot more frequent and useful service in the Western parts of the County where the density of residents and jobs is much higher. The usefulness is also increased due to timed connections.

Proximity to Transit

The number of people and jobs within a certain distance from transit is the simplest measure of transit outcomes. In this report we call this measure "proximity to transit", and define it as how many people and jobs are located within half a mile of a bus stop with service at a particular frequency.

The charts in Figure 69 and Figure 70 illustrate what proportion of the County's residents and jobs would be located within ½ mile of transit in each of the Concepts. Overall, the Coverage Concept has 73% of residents and 80% of jobs near some transit service.

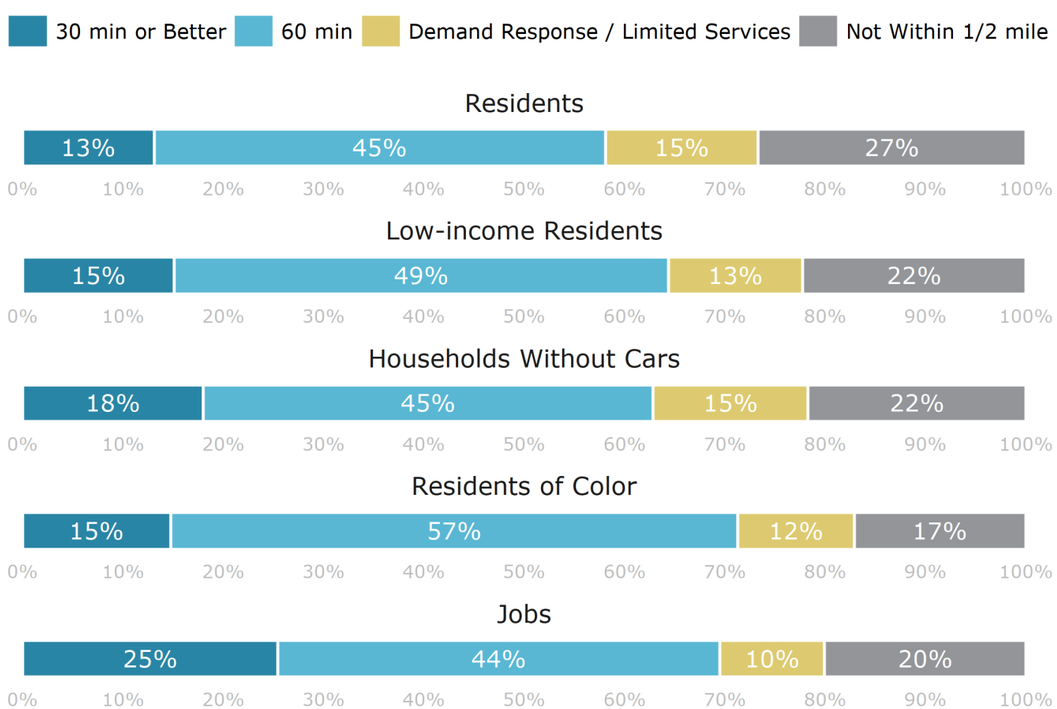
The Ridership Concept has 54% of the County's residents and 64% of its jobs near any transit service overall. However, the proportion of people near more *frequent* transit is much higher in the Ridership concept: 44% of all residents and 55% of all jobs would be within ½ mile of 30-minute transit service during most of the day. This difference reflects the basic geometric trade-off: the Ridership Concept focuses the highest frequency and most useful transit service to the best markets for transit with the goal of reaching the most jobs and places most likely to generate high ridership relative to cost.

The Ridership Concept also significantly increases the proportion of the County's residents of color and residents with limited incomes near every 30-minute transit service—nearly four times as many.

Proximity does not tell us how useful the service is to people—only that it is nearby. In pursuit of a maximum Coverage goal, an agency will spread service thinly, to cover as many people as possible. Spreading transit thinly means routes have low frequencies, short spans, and circuitous routing that might now be useful but help an agency meet a coverage goal.

Proximity to frequent service is a key measure of ridership potential. Frequent service is more expensive relative to the area it covers, but it is more useful by offering travel times more competitive with driving and therefore tends to attract higher ridership. Thus, the more people and jobs near frequent service, the more a network is achieving a ridership goal. Or, another way to think about the Ridership Concept, is that its network provides highly useful service to most people, at the expense of providing service to fewer people and places.

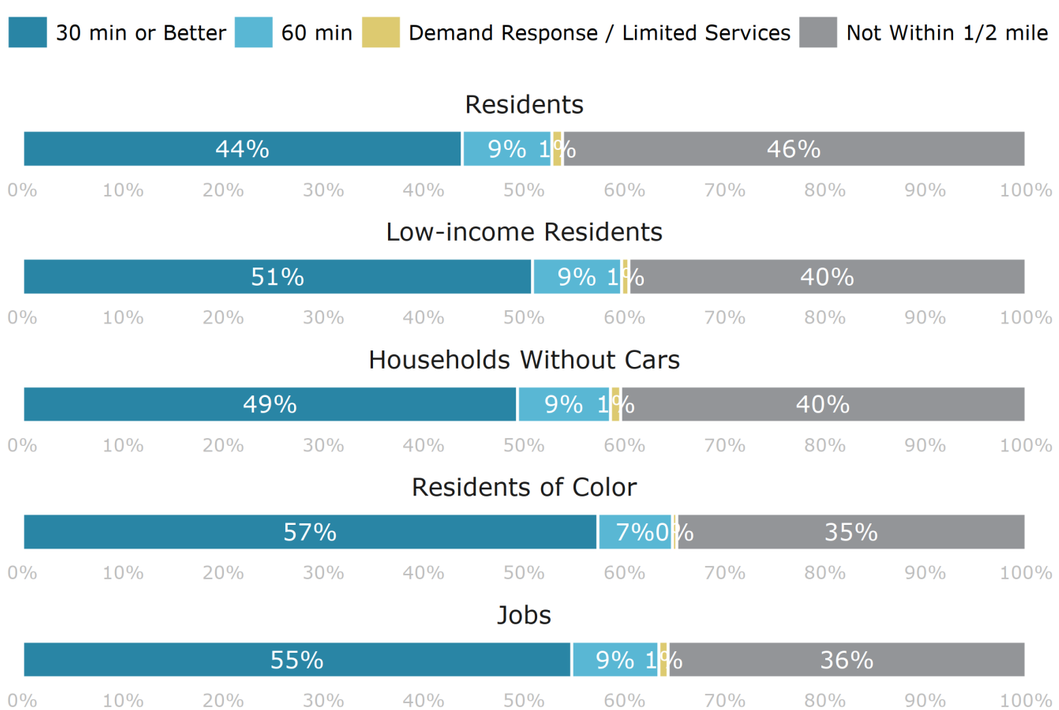
Coverage Concept



Note: Proximity is measured as being located within 1/2 mile of a bus or rail stop.

Figure 69: Proximity of Residents, Jobs, and Communities of Concern in the Coverage Concept

Ridership Concept



Note: Proximity is measured as being located within 1/2 mile of a bus or rail stop.

Figure 70: Proximity of Residents, Jobs, and Communities of Concern in the Ridership Concept

Freedom, Access, Usefulness

People ride transit if they find it useful. High transit ridership results when transit is useful to large numbers of people. A helpful way to illustrate the usefulness of a network is to visualize where a person could go by transit and walking, from a given location, in a given amount of time.

The maps in Figure 71 show someone's access to and from Bay Shore in 60 minutes, at midday on a weekday in the Coverage and Ridership Concepts. Each Concept is compared to the Existing Network. The technical term for this illustration is "Isochrone". A more useful transit network is one in which these isochrones are larger, so that each person is likely to find the network useful for more trips.

The dark blue represents areas that are reachable today and remain reachable in the corresponding Concept. Areas that are newly reachable are shown in light blue, and areas that are longer reachable are shown in gray. More examples of isochrones are on the next page and in the Appendix.

Not Just the Area – Also What is Inside the Area

The real measure of usefulness is not just how much geographic area we can reach, but how many useful destinations are in that area. Ridership arises from service being useful, for more people, to get to more busy places. That's why predictive models of ridership do this very same analysis behind-the-scenes.

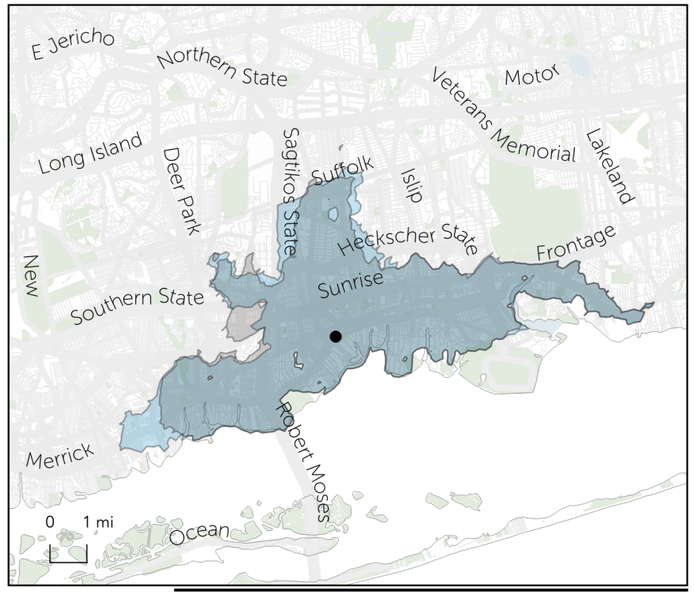
When reviewing these maps remember that waiting time counts, and in most cases, a longer walk to a high-frequency route can get people farther and faster, than a shorter walk to an infrequent route. Also remember that some of the access shown in these maps isn't reached on a single route, but requires a transfer.

How far can I travel in **60 minutes** from

Bay Shore Mechanicsville Rd at Park Ave

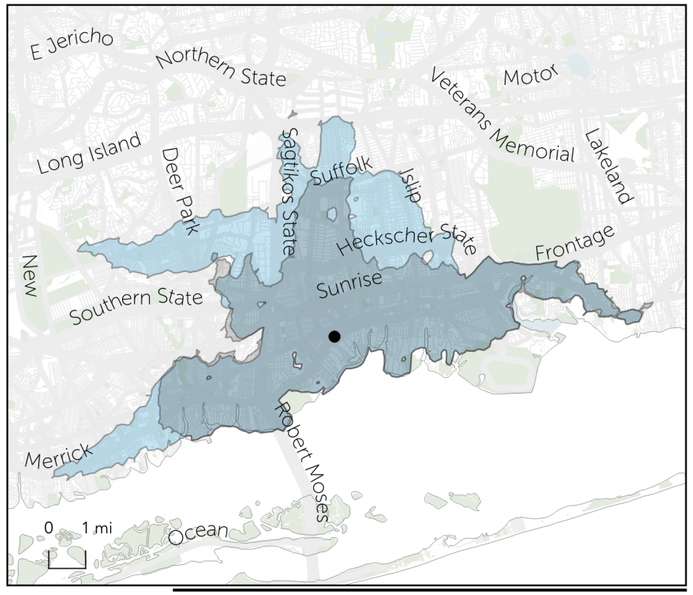
on weekdays at noon using:

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	-100	+0
45 minutes	-1,200	-200
60 minutes	+13,600	+3,900

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+3,200	+700
45 minutes	+44,800	+8,700
60 minutes	+91,200	+30,800

Figure 71: An isochrone shows how far someone can go, in a given amount of time, by walking and transit. These isochrone maps from The Bay Shore Mechanicsville hub show change in access to jobs and residents in 60 minutes in the Coverage and Ridership Concepts.

How far can I travel in **60 minutes** from

Central Islip LIRR

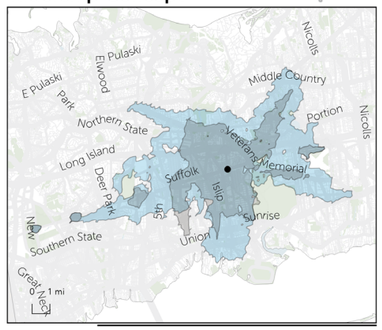
on weekdays at noon using:

New Access / Retained Access / Lost Access

Coverage Concept

What is reachable in...?	Pop Change	Job Change
30 minutes	+1,200	+2,600
45 minutes	+9,900	+18,700
60 minutes	+43,500	+42,200

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+4,100	+5,900
45 minutes	+57,200	+29,900
60 minutes	+119,600	+74,200

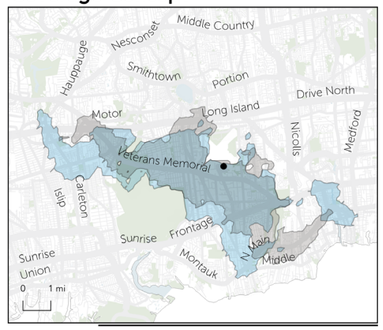
How far can I travel in **60 minutes** from

Long Island MacArthur Airport

on weekdays at noon using:

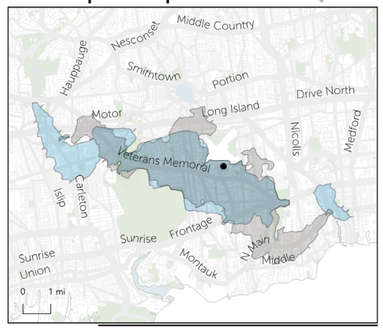
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	-400
45 minutes	+2,500	+5,400
60 minutes	+17,700	+10,800

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+1,200	+3,500
60 minutes	+2,600	+5,000

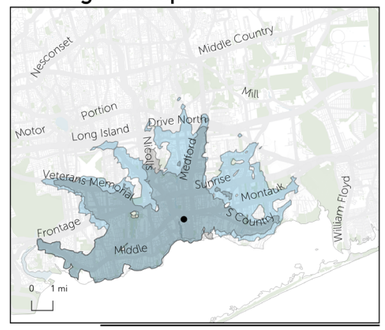
How far can I travel in **60 minutes** from

Patchogue LIRR

on weekdays at noon using:

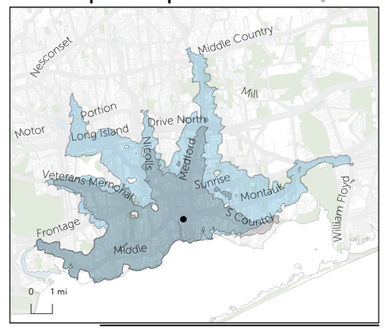
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+700	+300
45 minutes	+4,100	+5,100
60 minutes	+36,900	+14,400

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+2,000	+1,100
45 minutes	+28,000	+13,500
60 minutes	+63,700	+21,600

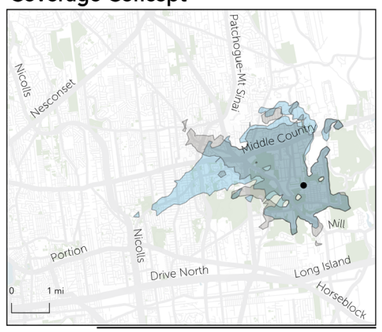
How far can I travel in **60 minutes** from

Gordon Heights

on weekdays at noon using:

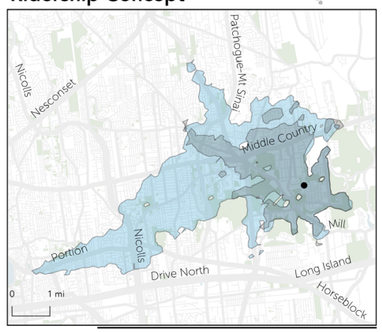
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+200	+0
60 minutes	+4,600	+1,000

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+500	+100
45 minutes	+11,200	+2,400
60 minutes	+34,000	+7,400

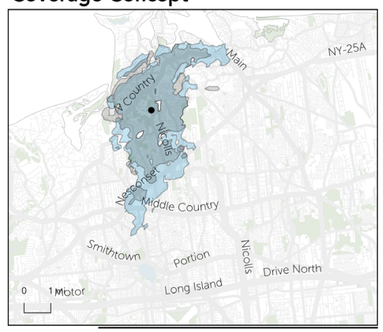
How far can I travel in **60 minutes** from

Stony Brook University

on weekdays at noon using:

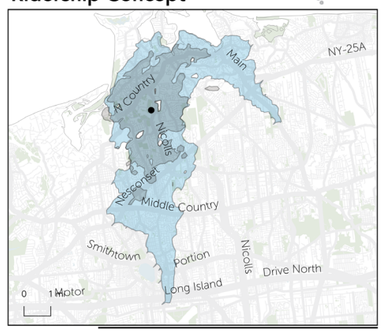
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+100
45 minutes	+1,700	+1,700
60 minutes	+10,200	+6,000

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+700	+300
45 minutes	+14,200	+9,200
60 minutes	+43,100	+20,400

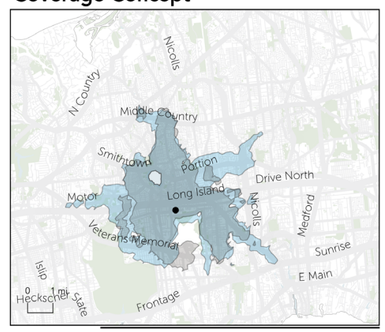
How far can I travel in **60 minutes** from

Ronkonkoma LIRR

on weekdays at noon using:

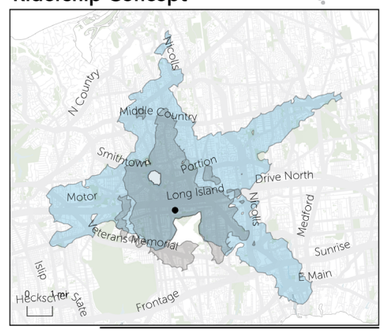
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+600	+0
60 minutes	+18,900	+5,700

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+1,200	+400
45 minutes	+38,200	+9,900
60 minutes	+87,200	+31,900

Figure 72: Isochrones Comparison Showing How Far People Can Go in 30, 45, and 60 Minutes Using Transit From Various Locations in the County (See Appendix for more locations)

Change in Access

The previous maps show how the Concepts change where people could go in a given time, from certain places in the County (access to other opportunities, like education and shopping would likely change in a similar way).

We can run the same analysis on a grid of locations throughout the County to estimate how each concept changes access to jobs and opportunities across the entire County.

The maps on the next three pages illustrate this. In these maps, every hexagon represents the number of jobs that can be reached in 60 minutes as compared to the Existing network. Blue hexes represent more jobs accessible and pink hexes represent fewer jobs available. Hexes are also sized by the number of people who live in each hexagon. Where no hexes are shown, there is very little change (less than 1,000) in the number of jobs accessible within 60 minutes from that location in that Concept.

Coverage Concept

The Coverage Concept shows slight-to-modest increase in the number of jobs accessible within 60 minutes from many locations, especially in the Western five towns. Locations with reduction in jobs access are mostly areas where complex routings in the Existing network have been simplified. This includes North Amityville, areas west of Bay Shore, parts of Central Islip, Bayport, and Sayville.

There are fewer and more direct routes in Hauppauge, which leads to a slight loss of job access there. On the other hand, because of the timed connection at Central Islip station and the number of routes that converge there, the job access from areas near the station increases significantly. The number of jobs accessible from parts of the County east of Brookhaven barely changes. The magnitude of change in job access (shown as deeper hues in the maps) in this Concept is generally low.

Ridership Concept

With more frequent routes across most of the Western part of the County, the Ridership Concept substantially increases access to jobs and opportunity. Traveling within the denser part of the County would be much faster, because waiting times would be much shorter, both for the initial wait for a bus and for a connection. This means that within a given time, people can access much more area. The Ridership Concept requires people to walk longer distances, but it gets most people farther and faster to their destinations, primarily due to shorter waits.

The Ridership Concept concentrates more useful service (and hence increases job access) where there are the most people. This is seen in the Western five towns as big, dark blue hexes. The biggest gains are in the Central Islip-Brentwood area, along Straight Path, Montauk Highway, and near Stony Brook University.

Since some areas are too far from transit compared to the Existing Network, their access to jobs is lower. These areas are presently covered by parts of Routes 1A, S25, S27, 2A, S57, S59, 6A, 6B, and S62. In these areas in the Ridership Concept, duplication and complexity of service is reduced, or no service is provided due to much lower density than other parts of the County.

Overall Change in the Concepts

The maps on the next three pages show how the two Concepts change access to jobs for different parts of Suffolk County. By adding up all the increases and decreases across the County, we can estimate how each concept changes the access to jobs for the average person in Suffolk.

Figure 73 shows the change in how many jobs people could reach by walking and transit in 60 minutes on average across the County. With the Existing Network, the average person can reach about 18,000 jobs in 60 minutes by transit. In the Coverage Concept this increases slightly to 20,200, about a 13% increase. In the Ridership Concept, the improved frequency of service substantially increases the number of jobs the average person could reach to 26,700, a 49% increase.

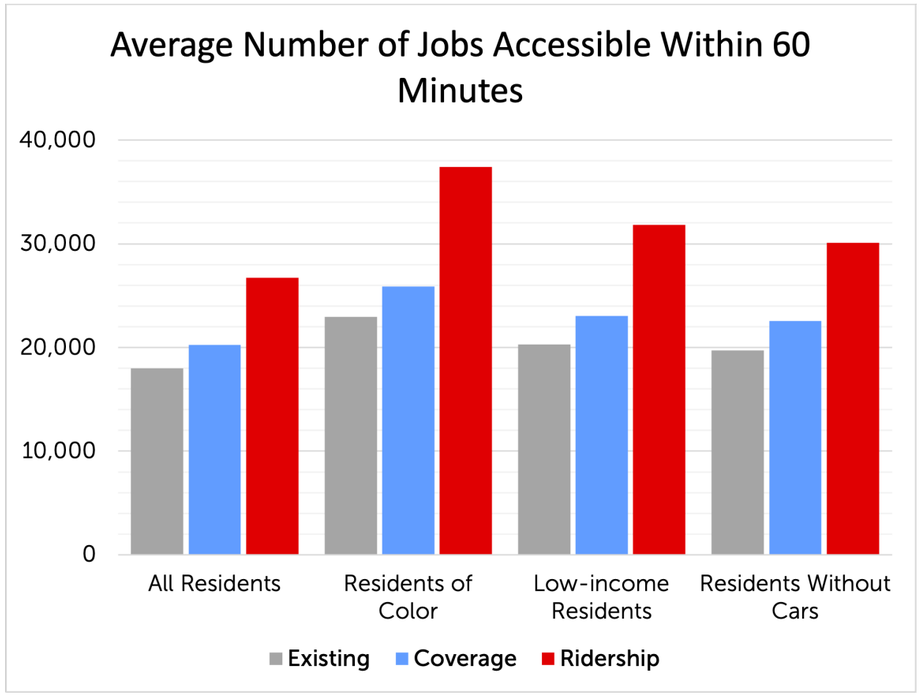


Figure 73: Average 60-Minute Job Access for Residents, Minority Residents, Low-Income Residents, and Residents Without Cars for the Existing Network, the Coverage Concept, and the Ridership Concept.

It is also worth considering how these job access factors change for people identifying as racial or ethnic minorities or people in disadvantaged situations. The Coverage Concept increases access to jobs for people of color by about 13%. The Ridership Concept increases this even further—to about 37,400, a 63% increase—because it improves service in areas where these residents live more so than other residents. For people with limited incomes and those without cars, the Coverage Concept increases job access by about 14%. The Ridership Concept substantially increases the access to jobs for both disadvantaged population groups- 57% more for low-income residents and 53% more for those without cars. The Ridership concept increases average job access to people in disadvantaged groups by more than it does on average for people in the County as a whole. So by this measure, the Ridership Concept is achieving a more equitable outcome.

Figure 74: Change in Jobs Reachable in 60 minutes for the Coverage Concept Compared to Existing Network in Suffolk County

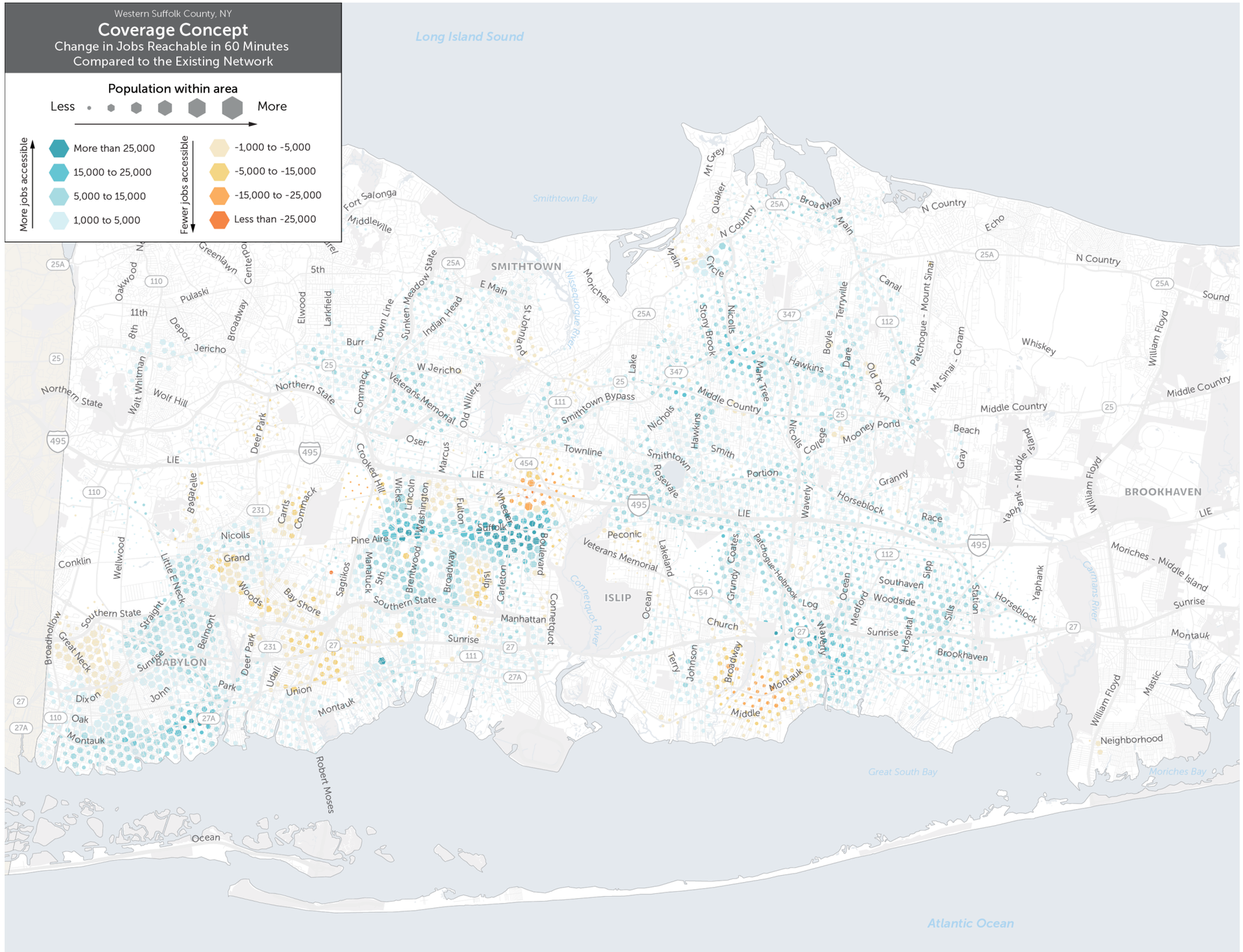


Figure 75: Change in Jobs Reachable in 60 minutes for the Coverage Concept Compared to Existing Network in the Western Part of Suffolk County

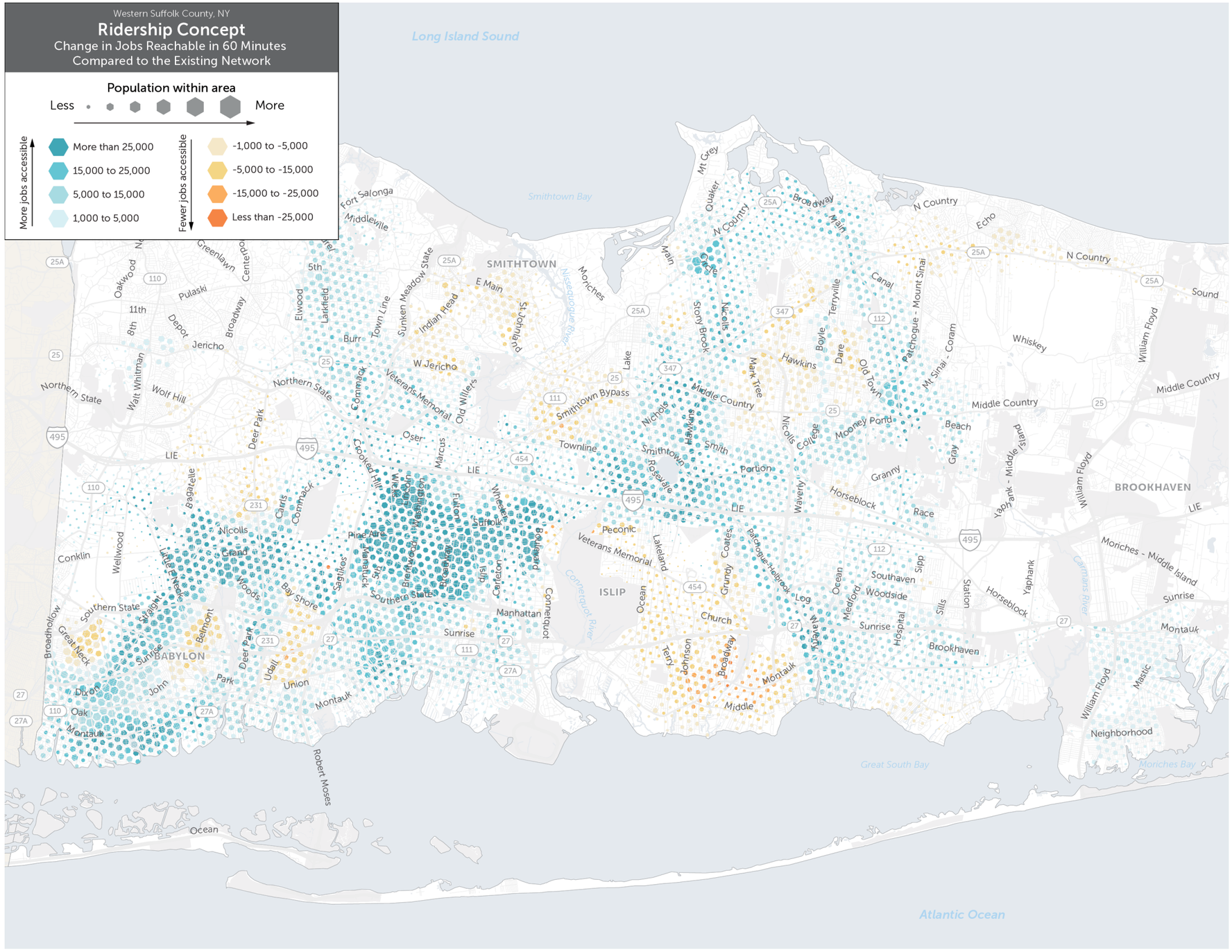


Figure 76: Change in Jobs Reachable in 60 minutes for the Ridership Concept Compared to Existing Network in the Western Part of Suffolk County

Next Steps

If you're interested enough to read this far, we'd love to have you more involved in this project!

This report is the first step in working with the public for Reimagine Transit: Suffolk County Mobility. It kicks off a round of public engagement in the County's decision of whether to continue providing high coverage, or to spend more of its budget attracting high ridership.

In April and May 2021, members of the project team, Suffolk County staff, and others will be engaging the public through media outreach, social media engagement, surveying at key transit centers, and other places. The project team will also engage with a select group of local representatives called the Reimagine Transit Advisors. Through this process, we need you to tell us what you think about these concepts and what priorities Suffolk County should emphasize as it thinks about a new network.

Building on the input we get from you, our study team will develop a draft Network Plan beginning in Summer 2021. The Draft Network Plan will include maps of the new routes, and measures like job access change and proximity to service will be summarized in a report for the public and stakeholder to review in Fall 2021. If Suffolk County decides to move ahead with any of the recommendations of the Draft Network Plan, then there will be additional community notification before any actual service changes are made.

For more information and to stay involved in the project, go to https://www.connectli.org/ReimagineTransit.html to

- take the survey;
- email the team to ask questions;
- find out more about meetings and events where you can learn more about the entire Reimagine Transit process; and
- generally stay up to date on the latest happenings with the network redesign process!

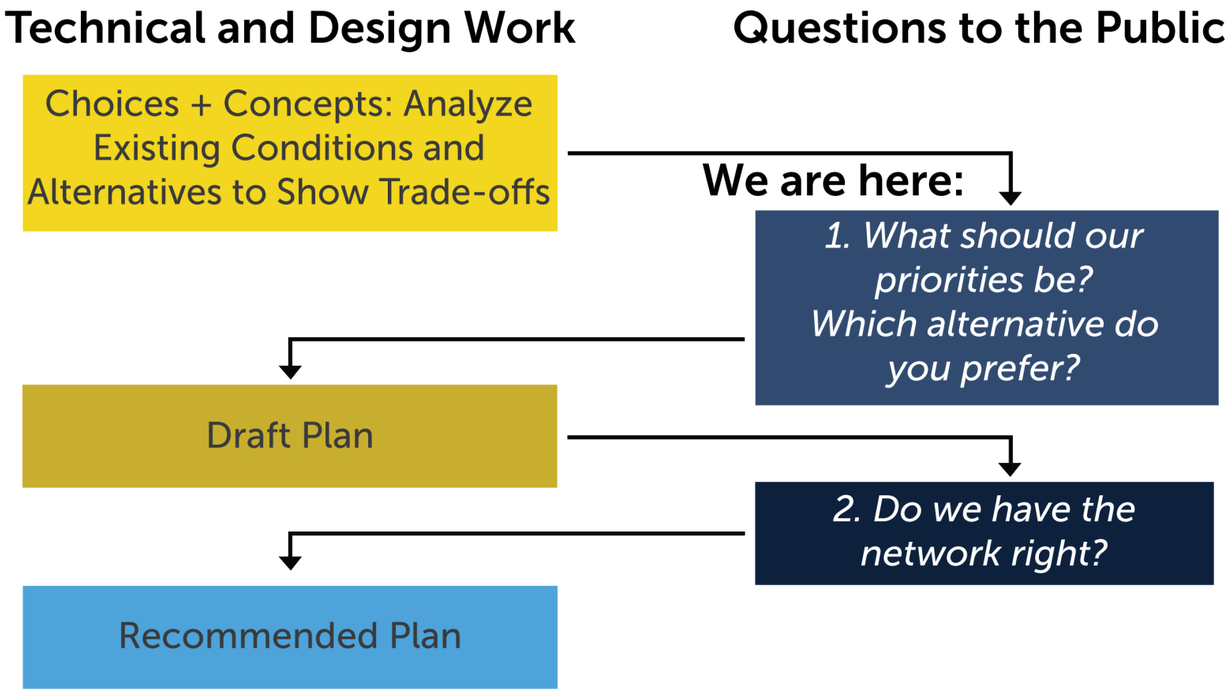


Figure 77: The process of technical work and public engagement that will inform the Reimagine Transit process for SCT.

Appendix

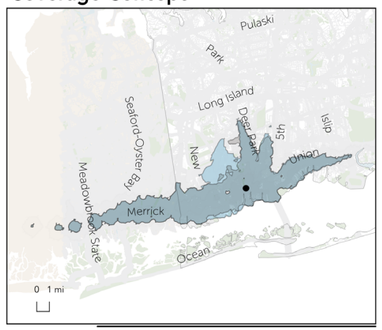
Change in Areas Reachable in 60 Minutes in the Concepts

How far can I travel in **60 minutes** from

Babylon LIRR

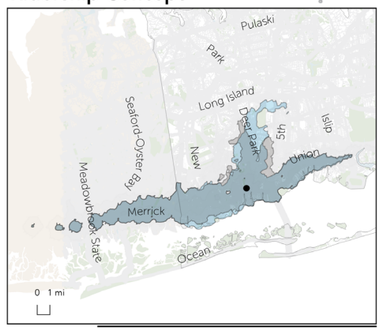
on weekdays at noon using:

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+1,000	+1,000
45 minutes	+7,800	+2,200
60 minutes	+35,300	+6,700

Ridership Concept



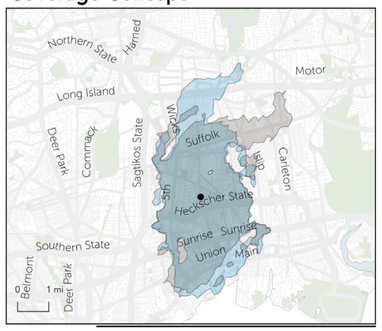
What is reachable in...?	Pop Change	Job Change
30 minutes	+2,900	+1,600
45 minutes	+36,800	+10,700
60 minutes	+12,700	+10,800

How far can I travel in **60 minutes** from

Brentwood Rd @ Connecticut Ave

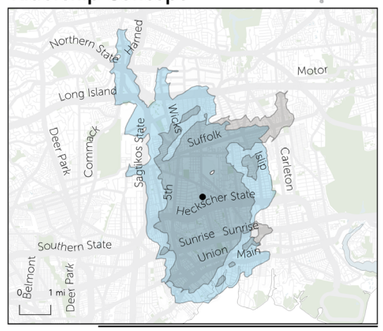
on weekdays at noon using:

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	-100	+0
45 minutes	-200	+800
60 minutes	+600	+9,000

Ridership Concept



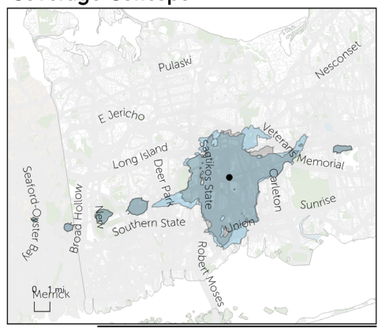
What is reachable in...?	Pop Change	Job Change
30 minutes	-100	+0
45 minutes	+28,400	+12,800
60 minutes	+37,800	+18,800

How far can I travel in **60 minutes** from

Brentwood LIRR

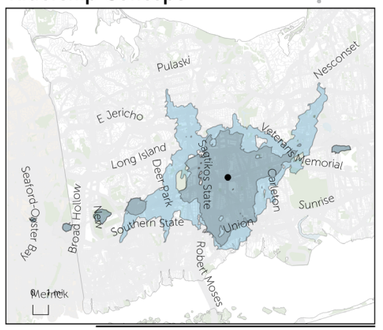
on weekdays at noon using:

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	-100	+0
45 minutes	+1,500	+1,800
60 minutes	+13,200	+17,900

Ridership Concept



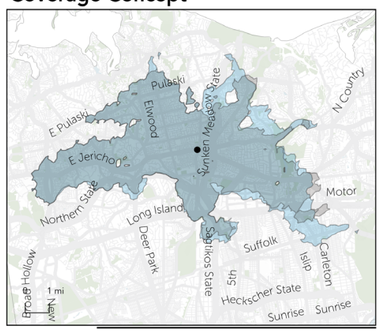
What is reachable in...?	Pop Change	Job Change
30 minutes	+10,400	+3,200
45 minutes	+67,900	+47,100
60 minutes	+99,700	+57,600

How far can I travel in **60 minutes** from

Commak Plaza

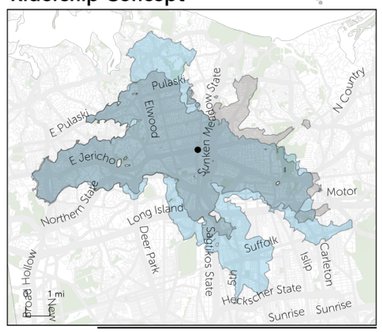
on weekdays at noon using:

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+1,200	+400
45 minutes	+3,000	+3,100
60 minutes	+16,400	+7,800

Ridership Concept



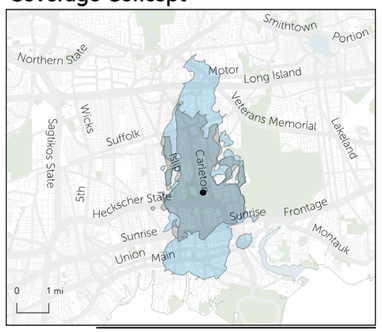
What is reachable in...?	Pop Change	Job Change
30 minutes	+3,200	+1,400
45 minutes	+19,100	+9,400
60 minutes	+47,100	+20,500

How far can I travel in **60 minutes** from

County Courts

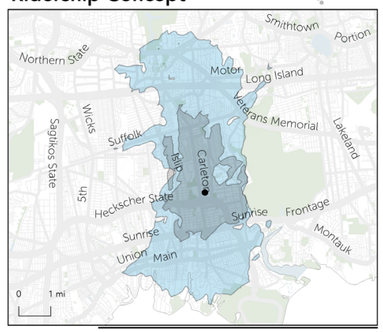
on weekdays at noon using:

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	-100	+0
45 minutes	+1,300	+500
60 minutes	+19,900	+9,900

Ridership Concept



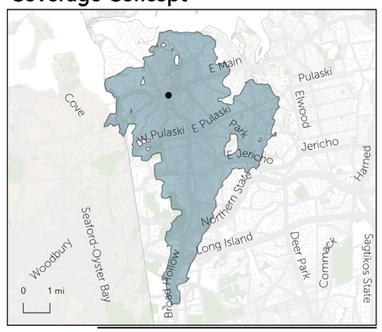
What is reachable in...?	Pop Change	Job Change
30 minutes	+1,600	+700
45 minutes	+31,700	+11,000
60 minutes	+56,400	+33,100

How far can I travel in **60 minutes** from

Downtown Huntington Main St at New York Ave

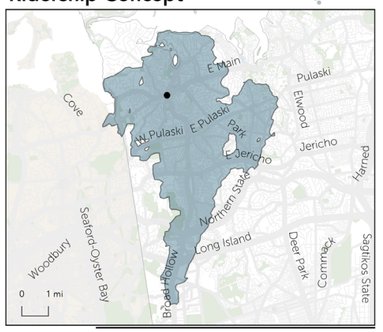
on weekdays at noon using:

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+0	+0
60 minutes	+0	-100

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+0	+0
60 minutes	+0	-100

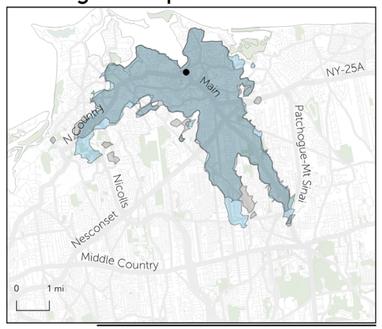
How far can I travel in **60 minutes** from

Downtown Port Jefferson

on weekdays at noon using:

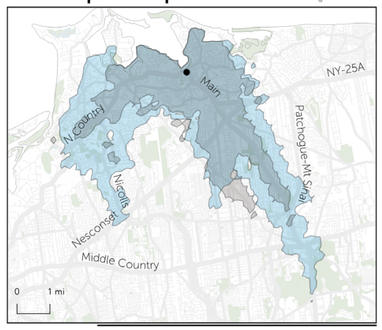
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+200	+100
60 minutes	+4,400	+3,600

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+300	+100
45 minutes	+15,300	+10,200
60 minutes	+31,500	+19,300

How far can I travel in **60 minutes** from

Farmingdale State College

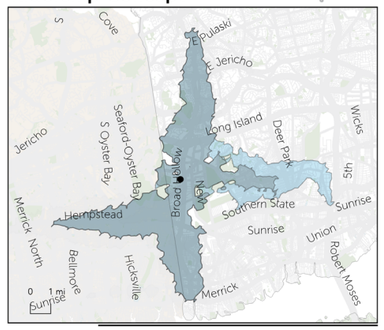
on weekdays at noon using:

New Access / Retained Access / Lost Access

Coverage Concept

What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+0	+300
60 minutes	-3,600	+1,400

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+300	+1,200
45 minutes	+10,700	+4,000
60 minutes	+30,300	+16,700

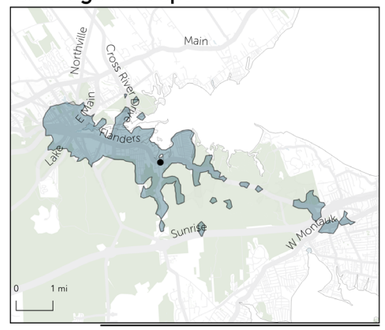
How far can I travel in **60 minutes** from

Flanders

on weekdays at noon using:

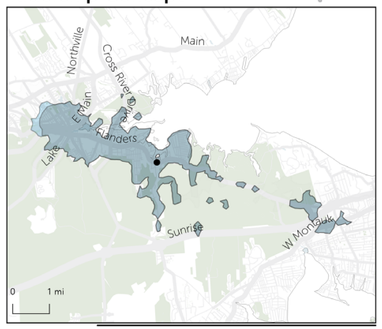
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+0	+0
60 minutes	+0	+0

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+0	+0
60 minutes	+400	+500

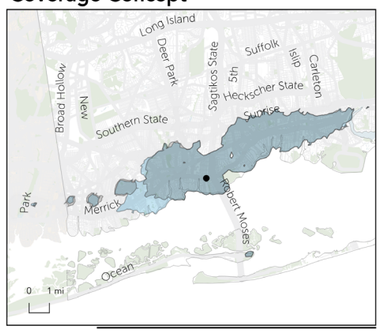
How far can I travel in **60 minutes** from

Good Samaritan Hospital - West Islip

on weekdays at noon using:

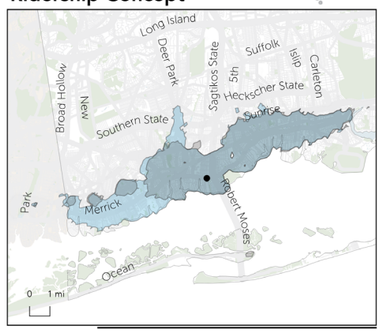
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	-100
45 minutes	+5,400	+2,700
60 minutes	+8,600	+1,500

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	-200	-100
45 minutes	+9,000	+3,300
60 minutes	+40,900	+8,900

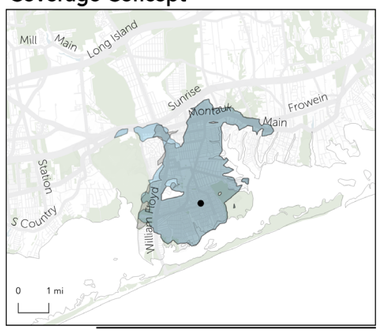
How far can I travel in **60 minutes** from

Mastic Beach

on weekdays at noon using:

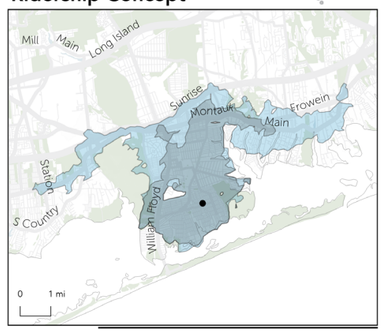
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	-100	+0
60 minutes	+1,600	+400

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+700	+0
45 minutes	+16,200	+1,900
60 minutes	+17,500	+4,400

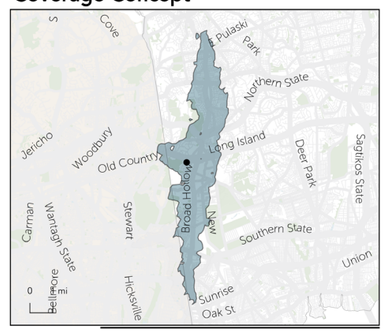
How far can I travel in **60 minutes** from

Melville Office Park

on weekdays at noon using:

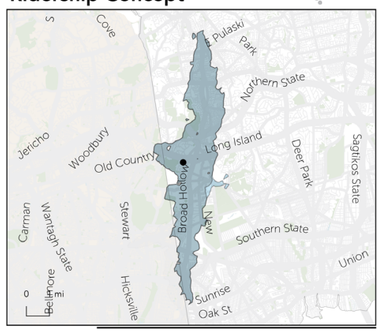
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+0	+0
60 minutes	+0	+0

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+0	+0
60 minutes	+200	+1,000

How far can I travel in **60 minutes** from

New York Institute of Tech

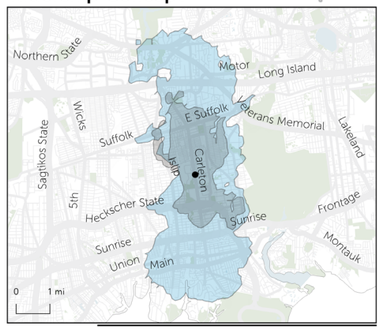
on weekdays at noon using:

New Access · Retained Access · Lost Access

Coverage Concept

What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+1,200	+500
60 minutes	+12,200	+6,300

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	-100	+0
45 minutes	+19,200	+6,500
60 minutes	+45,100	+24,800

How far can I travel in **60 minutes** from

Northport VA Medical Center

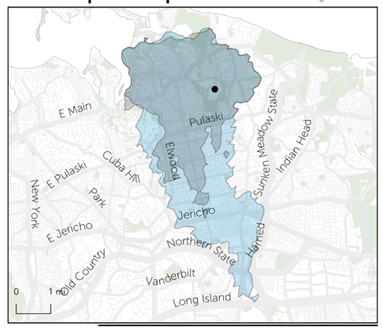
on weekdays at noon using:

New Access · Retained Access · Lost Access

Coverage Concept

What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+0	+0
60 minutes	+1,000	+300

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+1,100	+600
45 minutes	+14,400	+4,100
60 minutes	+21,000	+10,600

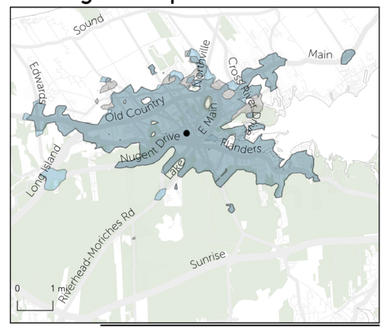
How far can I travel in **60 minutes** from

Riverhead LIRR

on weekdays at noon using:

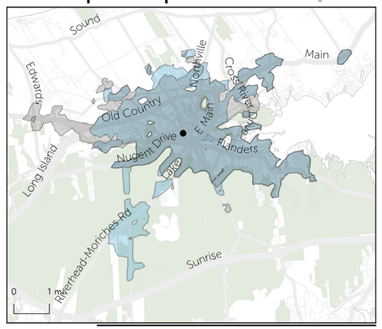
New Access · Retained Access · Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	-100	-100
45 minutes	-100	+0
60 minutes	-200	-100

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+100	+0
60 minutes	-300	-500

How far can I travel in **60 minutes** from

Smith Haven Mall

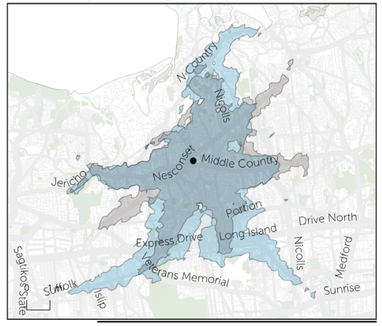
on weekdays at noon using:

New Access · Retained Access · Lost Access

Coverage Concept

What is reachable in...?	Pop Change	Job Change
30 minutes	-100	-100
45 minutes	+1,200	+600
60 minutes	+12,300	+900

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+3,200	+1,100
45 minutes	+32,900	+18,400
60 minutes	+34,300	+13,400

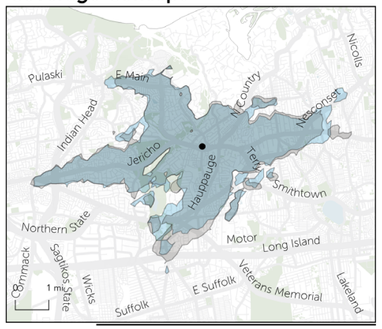
How far can I travel in **60 minutes** from

Smithtown LIRR

on weekdays at noon using:

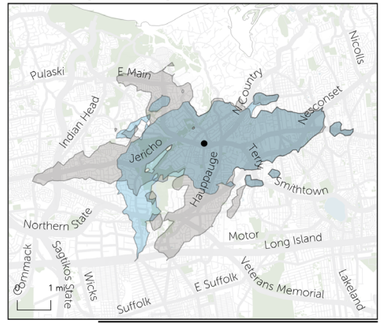
New Access · Retained Access · Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	-200	-400
60 minutes	-300	-1,100

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	-1,000	-400
60 minutes	-16,600	-4,600

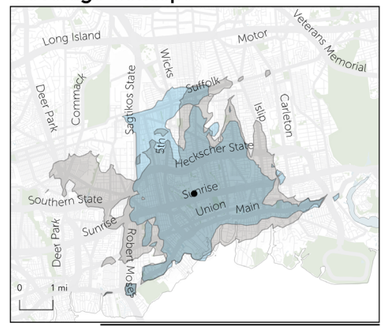
How far can I travel in **60 minutes** from

South Shore Mall

on weekdays at noon using:

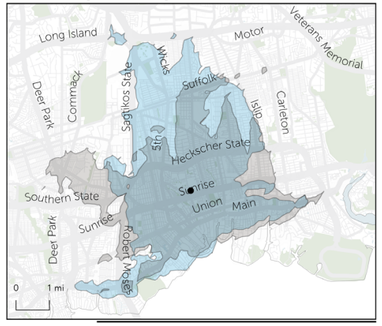
New Access · Retained Access · Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	-100	-100
45 minutes	+1,100	+100
60 minutes	-19,800	-4,500

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+2,000	+1,300
45 minutes	+28,000	+6,000
60 minutes	+26,600	+6,900

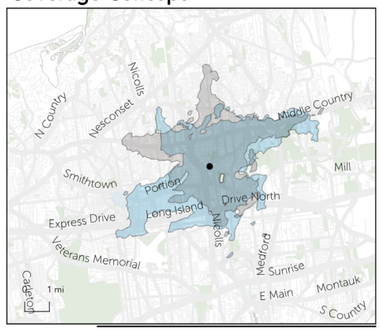
How far can I travel in **60 minutes** from

Suffolk County Community College

on weekdays at noon using:

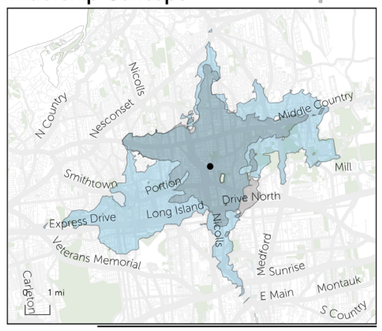
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+2,300	+400
60 minutes	+8,000	+4,100

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+2,600	+400
45 minutes	+29,500	+6,800
60 minutes	+62,300	+16,000

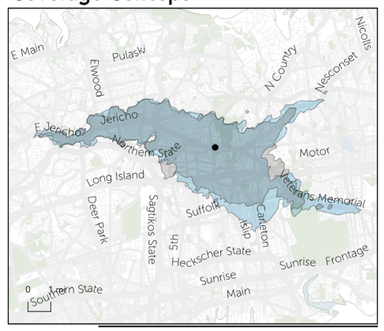
How far can I travel in **60 minutes** from

Suffolk County Offices at Hauppauge

on weekdays at noon using:

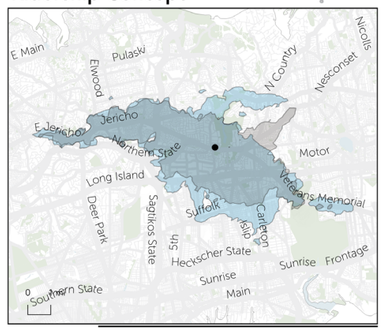
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+100	+0
45 minutes	+6,400	-1,100
60 minutes	+21,400	+6,100

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+200	+0
45 minutes	+8,900	+3,300
60 minutes	+30,900	+13,700

How far can I travel in **60 minutes** from

Tanger Outlets Deer Park

on weekdays at noon using:

New Access / Retained Access / Lost Access

Coverage Concept

What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	-1,900	-100
60 minutes	+5,300	-400

Ridership Concept

What is reachable in...?	Pop Change	Job Change
30 minutes	+4,200	+1,200
45 minutes	+71,100	+18,000
60 minutes	+159,400	+68,300

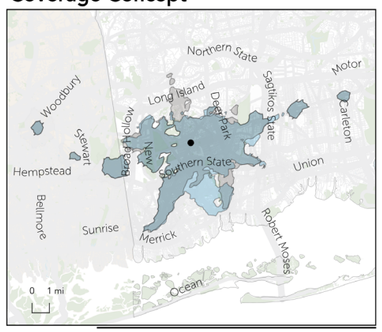
How far can I travel in **60 minutes** from

Wyandanch LIRR

on weekdays at noon using:

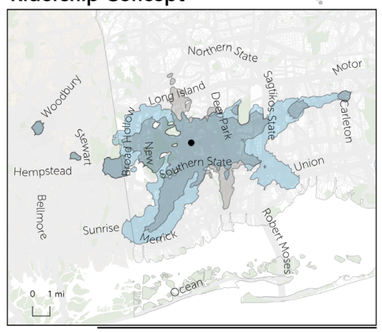
New Access / Retained Access / Lost Access

Coverage Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+0	+0
45 minutes	+500	-300
60 minutes	+15,500	+3,100

Ridership Concept



What is reachable in...?	Pop Change	Job Change
30 minutes	+4,800	+1,100
45 minutes	+43,800	+37,600
60 minutes	+85,000	+55,000