Wake County Transit Alternatives

A Wake County Transit Investment Strategy Report

Wake TRANSIT

JARRETT WALKER + ASSOCIATES | Let's think about transit

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It is time for the people of Wake County to think about what kind of transit system they want.

Every day, another 62 people move to Wake County. As one of the fastest-growing urban counties in the nation, Wake County will need to plan for a future of much heavier transportation demand, in the context of roads that are already congested and difficult to expand. It also needs to plan for an aging population with greater transportation needs, and for the new demand for urban styles of housing for people who want to rely more heavily on walking, cycling, and transit.

All of these factors are at play in similar cities around the US, and they are leading to an increase in demand for expanded public transit services. The typical mechanism for these expansions, at least in the early stages, is a voter-approved funding source such as a small sales tax increment. Such measures have passed in many similar communities, including most recently in Durham and Orange counties of North Carolina.

The Wake County Transit Investment Strategy, of which this report is a part, is designed to help county voters think through their transit options, and to assemble a plan that might be worthy of voter support. The final decision about whether to expand transit at all will lie with the voters when the proposed measure is submitted to them. For this reason, the focus in this report is not on building an argument for expanded transit, but rather on encouraging citizens to think about what kind of transit system they would like, if the decision were made to expand it.

This report lays out a wealth of information designed to help people think about their options. The first five chapters were first issued in January 2015 as a report called "Transit Choices." The key new material in this expanded report is a set of four different alternatives for what a transit network might look like roughly 10 years from now. These alternatives present contrasting images that illustrate different possible sets of priorities that could govern the plan. The release of this report begins a public outreach process in which we encourage public comment on the four alternatives. That feedback will help forge a final plan to be presented to the voters.

The Existing Situation

Chapter 3 explores in detail the current demographics and development patterns of Wake County, and the current transit services serving them. One key point of interest is that Wake County has a remarkably low level of overall transit service compared to the most similar communities nationwide. For example, the total quantity of transit service per capita is about one third what it is in Austin, Texas or Madison, Wisconsin (Chapter 3 page 59). These two regions are also state capitals with major universities and tech sectors.

The most important idea in this chapter is that the relationship between transit service and ridership is fairly well understood, and can be validated in existing ridership patterns both in Wake County and nationwide.

Ridership tends to arise from high-frequency service connecting locations that have a high degree of density and walkability. Density determines the number of people, jobs and activities in the fixed area around each stop, so it determines the size of the market for which transit will compete. Walkability determines whether it is possible for people to walk between transit

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stops in the destinations in the area. This is why even where density is equal, ridership is much higher in areas where the street grid is well-connected, major streets are easy to cross, and pedestrians are generally welcome in the urban environment.

Another important factor for high ridership is linearity, the degree to which major destinations lie in straight paths that a transit line can serve efficiently. This is why ridership potential is always higher in places where major destinations are right along the street, as opposed to those where they are set far back from the street or require driving in circuitous paths.

As for the service provided, ridership tends to respond very heavily to frequency, because frequency determines the usefulness of service in three independent ways:

- Frequency reduces waiting time[1].
- Frequency makes it easy to connect from one service to another, dramatically increasing the range of destinations that can be reached.
- Frequency as a backstop for problems of reliability, since a delayed or missing vehicle is less likely to be a problem if another vehicle is coming along soon.

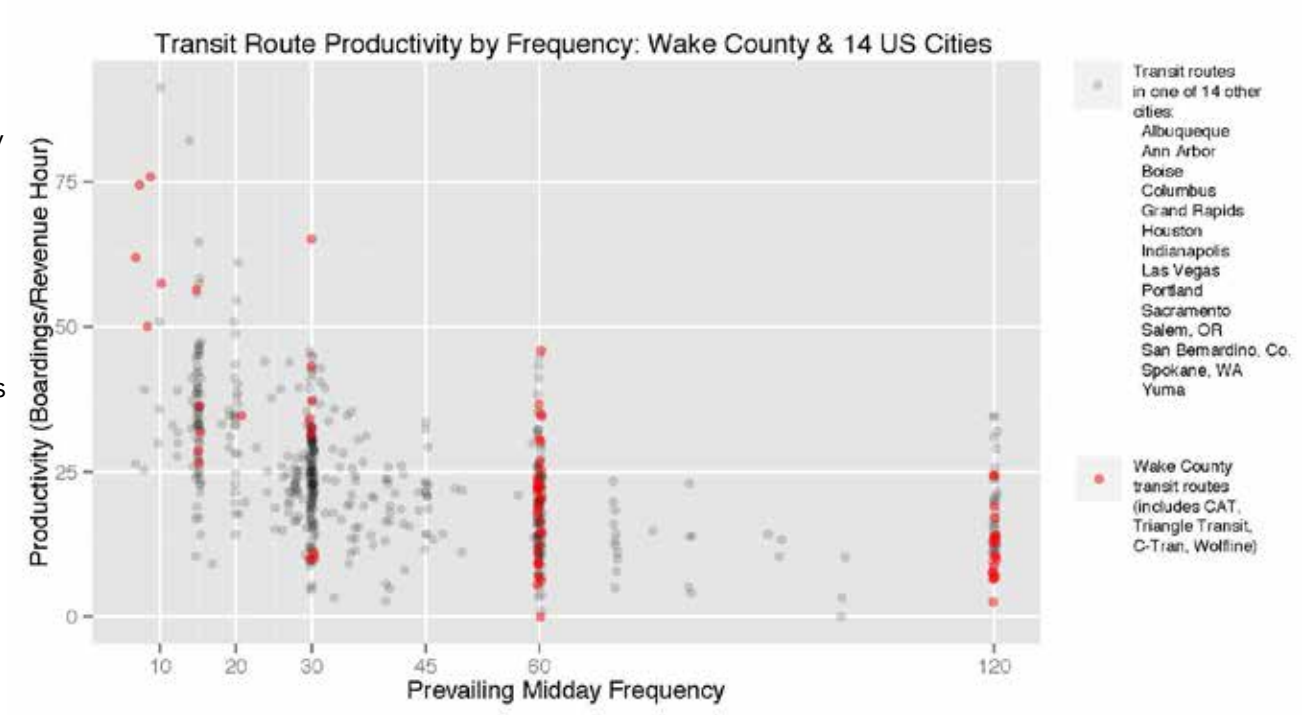

Figure 1: Transit Route Frequency and Productivity

For this reason, we tend to see nationwide a strong correlation between frequency and productivity, where productivity means ridership divided by the cost of service. Doubling frequency doubles the cost of service, but where the physical conditions are right (density, walkability, etc. …) this investment pays off.

Hard Choice: Ridership or Coverage?

Transit plans are not just technical analyses but also expressions of community values. These values come into play in thinking about difficult trade-offs that needed to be made inside a plan, which arise from conflicts between widely shared values, so there is no technical answer. Chapter 5 explores these trade-offs in detail. The

1. Waiting time is not just time spent at a bus stop. It's time spent where you do not want to be. If you report to work at 8:00 but your hourly bus gets there at 7:02 or 8:02, you will spend 58 minutes waiting at your destination.

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four alternative networks are also designed to illustrate the trade-offs to help people determine their own view on them.

One of the most difficult is the trade-off between ridership goals and coverage goals. We often see transit evaluated as though it's only purpose were ridership, but in fact there is a strong expectation that transit agencies provide service to a broad area, including places where high ridership (by countywide standards) is not a realistic objective. As we noted above, very high ridership networks are those that concentrate narrowly on the markets where transit can perform best, rewarding them with high frequency and service quality. The resulting small service area is often deemed unacceptable to a countywide population or constituency.

For that reason, it is necessary to strike a balance between the goal of ridership and a competing goal that we call coverage.

The goal of ridership is met by carrying as many people as possible for the given service budget. Transit purposes served by this goal include increasing transit's overall relevance, minimizing subsidy, and supporting urban styles of development that tend to work well with high ridership transit. The ridership goal produces a transit network whose benefits touch the greatest possible number of lives.

By contrast, the goal of coverage is met by transit service being available, regardless of how heavily it is used. Transit purposes served by this goal include lifeline access for people with mobility needs, and the desire to serve all communities and groups in the county regardless of their ridership potential.

Transit plans must therefore strike an explicit balance between the resources spent on ridership goals and the resources spent on coverage goals. For example, a policy can take the form of a percentage of resources devoted to the ridership goal, with the remainder devoted to the coverage goal.

Hard Choice: infrastructure or service? Rail transit or all-bus networks?

Chapter 5 also explores the trade-off between infrastructure and service. To some degree, infrastructure supports service, of course. Good transit infrastructure makes service more attractive or less expensive to provide. Infrastructure can also attract federal funding which makes it somewhat easier to build.

However some of the money spent on infrastructure comes at the expense of money that could be spent on service. For example, a network that includes a large rail transit project will have less money to spend on local bus service, yielding a smaller network countywide. At the opposite extreme, a network focused entirely on local bus service would have very abundant service, but the service would all be prone to traffic congestion and other delay which would limit its usefulness.

As with the ridership coverage trade-off, there is a spectrum of possibilities. A rail project, for example, can be scaled down to free more resources for local bus service. Some of the objectives of rail can also be met by bus rapid transit facilities, which typically cost less, and offer somewhat less in speed and reliability benefits, but may represent a desired balance point between infrastructure investment and service investment.

Framing the Alternatives

These hard choices do not have technically right or wrong answers. Each community must find its own balance between these

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competing goals, depending on its values, its objectives for transit, and what kind of community and economy it wants to be.

The "Alternative Space"

To help the citizens of Wake County think through these options, the plan has developed four conceptual alternatives for what the network might look like roughly 10 years after a successful measure was approved by the voters.

These alternatives illustrate dramatically different priorities that the Wake County Transit Investment Plan could eventually pursue through its eventual infrastructure components and network design objectives.

The four alternatives are based on two points on the ridership-coverage spectrum, combined with two points on the infrastructure-service spectrum. On the latter, one pair of alternatives has a rail rapid transit (RRT) backbone, while the other is an all-bus network featuring a core network of Bus Rapid Transit (BRT) facilities.

By arranging the alternatives in this way, we invite the public to think about both tradeoffs at once, and form clear views about where they would like to be on each spectrum. The alternatives are not the only possible points on each spectrum, but they help people figure out where their own opinion lies.

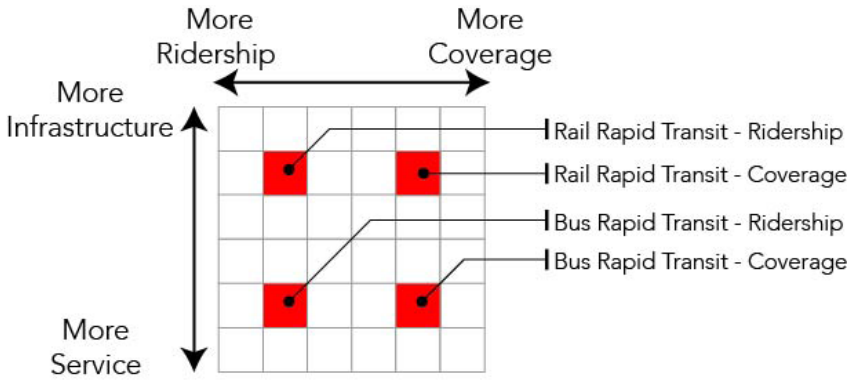

Figure 2: The Alternative Space

Key Assumptions and Cautions

Comparison, not Prediction

We cannot emphasize too strongly that the purpose of these alternatives is comparison, not prediction. A wide range of assumptions have had to be made in order to construct these alternatives, and it is easy to argue that they should have been made differently. What matters, however, is not whether the alternatives are exactly realistic for a future year. What matters is their contrast with one another, and the public response to the value tradeoffs that these contrasts illustrate.

A One-Decade Snapshot

In the final plan, the transit service will improve over many years. For this alternatives exercise, however, the goal is to compare four different possibilities, so we must choose a future year for which to draw them. For this purpose we chose a year 10 years in the future. This tends to be a timeframe that is still of interest to many voters, but that is far enough in the future for substantial infrastructure to potentially have been developed.

In the actual plan, many improvements, particularly to bus services, will occur much sooner than 10 years. In fact, services that

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do not require new fleet can begin within a year after funding begins to flow. What is more, substantially more transit, including potentially greater infrastructure, is possible further in the future in each alternative. **For that reason, it is essential to be clear that these are not alternatives for the whole plan, but merely for what it might look like at a particular point in time.**

Uncertainty

If Wake County were in complete control of the process by which infrastructure is built, the infrastructure elements shown in the final plan could be presented as promises. In fact, major transit infrastructure in the United States typically develops through a combination of local, state, and federal sources. The federal role tends to be particularly large, up to 50% of the total project cost.

As a result, a Wake County transit plan will only be able to say that if a particular infrastructure option is selected, that option will be pursued in competition for federal funding. In this plan, conservative assumptions have been made about the likelihood of gaining federal funding. In general only those segments that appear most likely to satisfy federal requirements have federal funding assumed, while other segments are assumed to be built mostly with local funds.

A federal competition will also require a later project called an Alternatives Analysis (AA), which will again consider multiple options in addition to the one preferred in Wake County's transit plan. The AA process, in which the public will also participate, effectively proves to the Federal Transit Administration that the proposed alternative is the best one for serving the market. Sometimes, a different alternative for alignment emerges at that point and turns out to be preferred, usually in the context of further local discussion. For that reason, the Wake County transit plan that goes to the voters can only devote the level of resources necessary to develop the proposed infrastructure if federal funding is secured, and endorse a particular infrastructure solution for the purposes of moving forward.

For these reasons, the infrastructure elements of these alternatives cannot be considered promises. They will, however, be statements of strong voter intention which are typically needed to begin the process that ultimately leads to a successful project.

Degrees of Specificity

Long-range planning, however, inevitably involves accepting a range of uncertainty about the future. What is more, some aspects of a transit network need to be planned further in advance than others do.

In general, services requiring major infrastructure, or services that run at high frequency, benefit from being planned further in advance, because people benefit from long-term certainty about them. This certainty can help people, businesses, planners and developers to make location choices that maximize the value of transit to them, which tends to improve transit's usefulness and thus its ridership. For that reason, the alignments shown for major infrastructure and frequent bus service are specific; that is, they mean service on exactly the streets shown.

Less frequent services, such as those running every 30 or 60 minutes, have less impact on location choice, so they tend not to be planned so far in advance. Thus, infrequent services shown on these maps should be viewed as general indications of the quantity and range of service that would be provided under each alternative. They are not necessarily specific proposals for exact routings.

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Infrastructure Options

At an earlier stage, the plan considered a wide range of options for transit infrastructure. These included light rail, commuter rail, and several different types of bus facilities. Through a review process that included the Advisory Committee, this list was narrowed to two major types of investment: the high infrastructure alternatives, based on rail rapid transit (RRT) and the lower infrastructure alternatives, based on Bus Rapid Transit (BRT).

Rail Rapid Transit (RRT) Alternatives

In the higher infrastructure alternatives, the core investment is a rail rapid transit line operated using diesel multiple unit (DMU) vehicles. In these scenarios, additional tracks would be built along current rail lines to allow for the planned frequency of service in addition to the existing and planned operations of freight, Amtrak, and other services. The alignment is similar to that of a previously proposed light-rail line, but the technology provides greater flexibility at lower cost. The key differences between DMU and light-rail are that DMU:

- … complies with federal requirements for vehicles that share tracks with freight, and that operate immediately adjacent to active freight tracks. This means that they need less separation from the freight line than light-rail does, which in turn means lower costs.
- … does not require an overhead electric power system it is therefore easier to operate at a wide range of frequencies. The electric power system of light-rail is so expensive per mile that it is only justified where very high levels of service are planned. This makes it difficult to phase in service by increasing frequencies as demand warrants. DMU, by contrast, can run either at high frequency or at lower frequencies, and can even have occasional peak trips just as standard commuter rail does. This flexibility is especially helpful in the relatively low density markets of Wake County, where rail demand is likely to build gradually.

Bus Rapid Transit (BRT) Alternatives

In the lower infrastructure alternatives, no rail network is proposed. However, a range of bus rapid transit facilities thatwould have high-frequency bus services, and that could also be used by multiple bus routes are provided which bring to bus service some of the speed and reliability benefits of rail, and also some of the amenities in terms of more attractive stations etc.

BRT can mean many things. In these alternatives it means a range of physical improvements sufficient to achieve a moderate and reliable speed. (BRT is assumed to average 20 mph including stops, compared to 45 mph for rail and 13.3 mph for local buses.) This can be achieved by a mixture of segments of exclusive lane, signal priority treatments, and a range of other measures. Only one segment of fully separated busway is proposed in the BRT alternatives parallel to Capital Boulevard, extending along West Street between Peace Street and Atlantic Avenue.

All BRT facilities would have frequent service, but could also be used by multiple bus routes whose service could continue beyond the end of the infrastructure. This is an important difference between BRT and rail, since rail services must obviously end where their infrastructure ends.

Network Elements

In addition to the major infrastructure described above, all scenarios contain a mixture of standard bus service elements. These elements are classified according to

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frequency and span of service according to the following table in Figure 3, which is discussed in more detail in Chapter 8.

A particularly important tool is high frequency, defined as service running every 15 minutes or better all day seven days a week. This service level signifies that a bus or train is always coming soon more or less whenever you need it. It is therefore the foundation for spontaneity and tends to be useful to a broad range of customers. Because it is strongly associated with high ridership, those scenarios where ridership is the major goal tend to feature large amounts of the service, concentrated in areas of high demand.

The lowest frequencies tend to be used when extending service across the largest distances, such as to the outer towns, or when covering large areas of relatively low density. These services generally have coverage as a goal, so there are far more in the alternatives where the coverage goal prevails.

The Four Alternatives

The four maps at the end of this chapter (pages 13-16) show the four alternatives.

A general sense of the outcomes of these alternatives can be seen from observing how many people and jobs are within a half-mile of different kinds of service.

As would be expected from such a major investment, all alternatives improve the number of people and jobs with access

		Weekday Frequency (min)			Span (duration of each period) (hours/day)				Weekend Frequency (min)		Saturday Span (hours/day)			Sunday Span (hours/day)		
Service Type	Map Symbol	Peak	Base	Eve	Peak	Base	Eve	Total	Base	Eve	Base	Eve	Total	Base	Eve	Total
Rail Rapid Transit		15	15	15	6	9	3	18	15	15	15	3	18	15	3	18
Rail Rapid Transit		30	30	30	6	9	3	18	30	30	15	3	18	15	3	18
Bus Rapid Transit		10	15	15	6	9	5	20	15	15	15	5	20	13	4	17
Frequent Route		15	15	30	6	9	5	20	15	30	15	5	20	13	4	17
30-minute Route		30	30	60	6	9	5	20	30	60	15	5	20	13	4	17
60-minute Route		60	60	60	6	8	2	16	60	60	16		16	16		16
Peak-only Route		varies	n/a	varies	6	not in service		6	not in service							

Figure 3: Service Types Table

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to transit. However, the outcome is very different depending on whether the prevailing goal is ridership or coverage.

When planning for the ridership goal, relatively little is invested in low ridership services that tend to provide the most coverage to low-density populations and jobs. As a result the percentage of population and jobs served by some transit in the ridership alternatives is lower than in coverage alternatives, but the usefulness of the transit is much higher. Ridership outcomes will arise not from how many people have access to some minimal service, but by how many have access to useful service, such as the frequent network.

The total coverage numbers in these tables may seem to be disappointing, but this expresses an unavoidable fact about the settlement patterns of the county. Wake County has a fairly large rural population, and substantial areas of very low density that even a coverage alternative cannot bring within a half-mile at a reasonable cost. Transit's benefit to people who are not directly covered includes not just the indirect benefits to the economy, but also opportunities for other forms of access such as park-and-ride. In addition, all scenarios include a substantial expansion of rural lifeline services to keep pace with an expanding rural population.

	Entire Network				Frequent Network				
	Population		Jobs		Population		Jobs		
Alternative	% of total covered	change from existing (% pts)	% of total covered	change from existing (% pts)	% of total covered	change from existing (% pts)	% of total covered	change from existing (% pts)	Vehicle Revenue Miles (millions)
Existing	37%		61%		4%		18%		4.3
BRT Ridership	42%	5%	73%	11%	15%	11%	41%	23%	9.6
BRT Coverage	59%	21%	82%	21%	10%	6%	30%	12%	10.1
RRT Ridership	37%	0%	67%	6%	14%	9%	39%	21%	6.7
RRT Coverage	52%	14%	78%	16%	8%	3%	25%	7%	6.0

Figure 4: Percent of Population and Jobs within 1/2 Mile of Transit (Triangle Regional Model 2010)

	Entire Network				Frequent Network				
	Population		Jobs		Population		Jobs		
Alternative	Total Covered	change from existing	Total Covered	change from existing	Total Covered	change from existing	Total Covered	change from existing	Vehicle Revenue Miles (millions)
Existing	328,430		281,259		37,017		84,560		4.3
BRT Ridership	370,699	42,269	333,007	51,748	133,984	96,967	188,363	103,803	9.6
BRT Coverage	515,805	187,375	376,789	95,530	89,868	52,851	139,446	54,886	10.1
RRT Ridership	327,315	-1115	307,444	26185	119,327	82310	180,391	95831	6.7
RRT Coverage	453,613	125,183	355,163	73,904	67,322	30,305	114,632	30,072	6.0

Figure 5: Total Population and Jobs within 1/2 Mile of Transit (Triangle Regional Model 2010)

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Next Steps

Chapter 10 outlines the next steps for the project. Briefly, the public will be asked to not just which of the four alternatives they prefer, but how they would adjust their preferred alternative to make it even more to their liking. Tabulated results from these questions will help us pinpoint very precisely where respondents think the final plan should be on both the ridership-coverage spectrum and the infrastructure-service spectrum. Based on this input, the project team will develop a final recommended plan, which will go through further public comment before being presented for adoption as the final plan to be used in the referendum.

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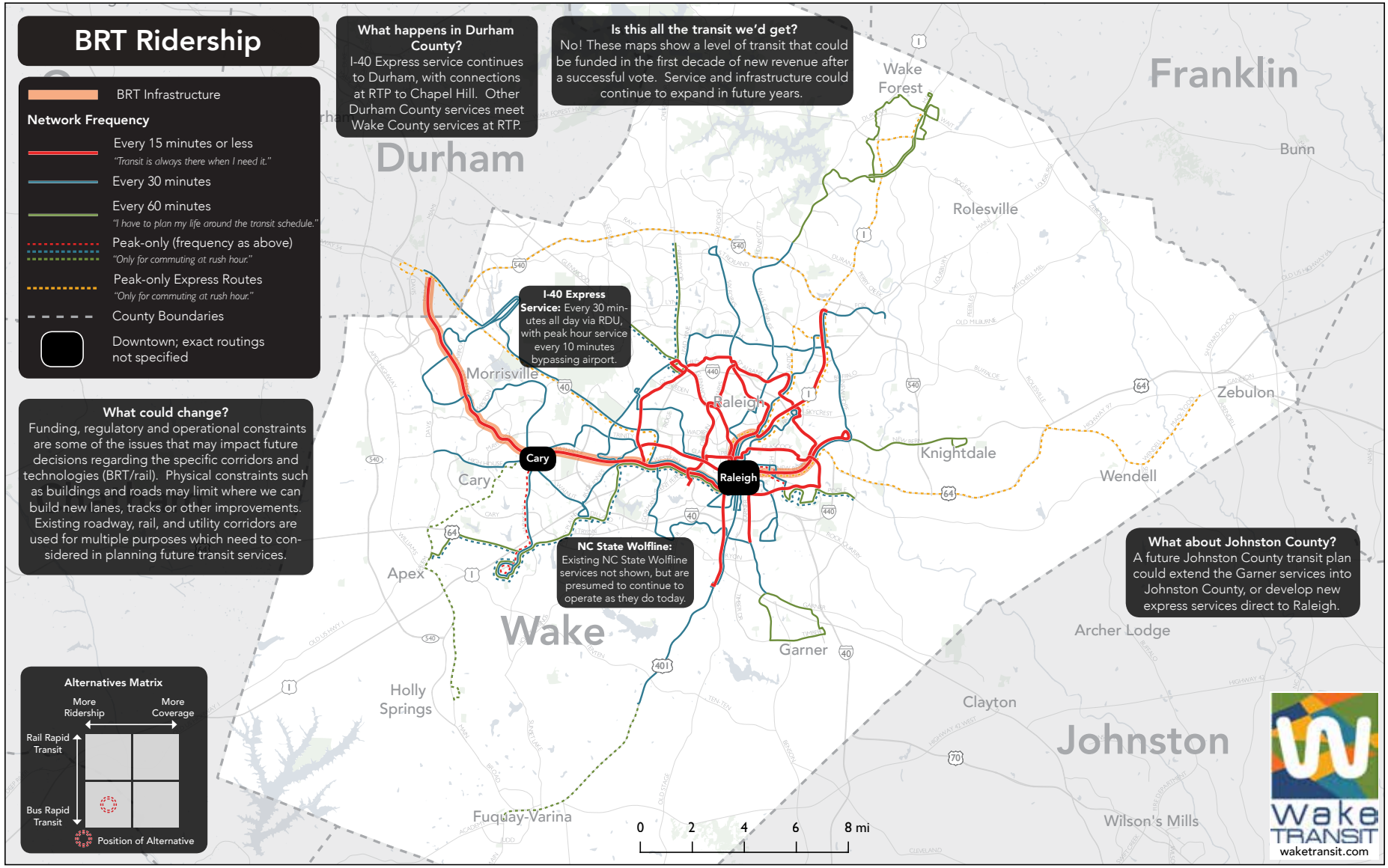

Figure 6: BRT Ridership Alternative Map

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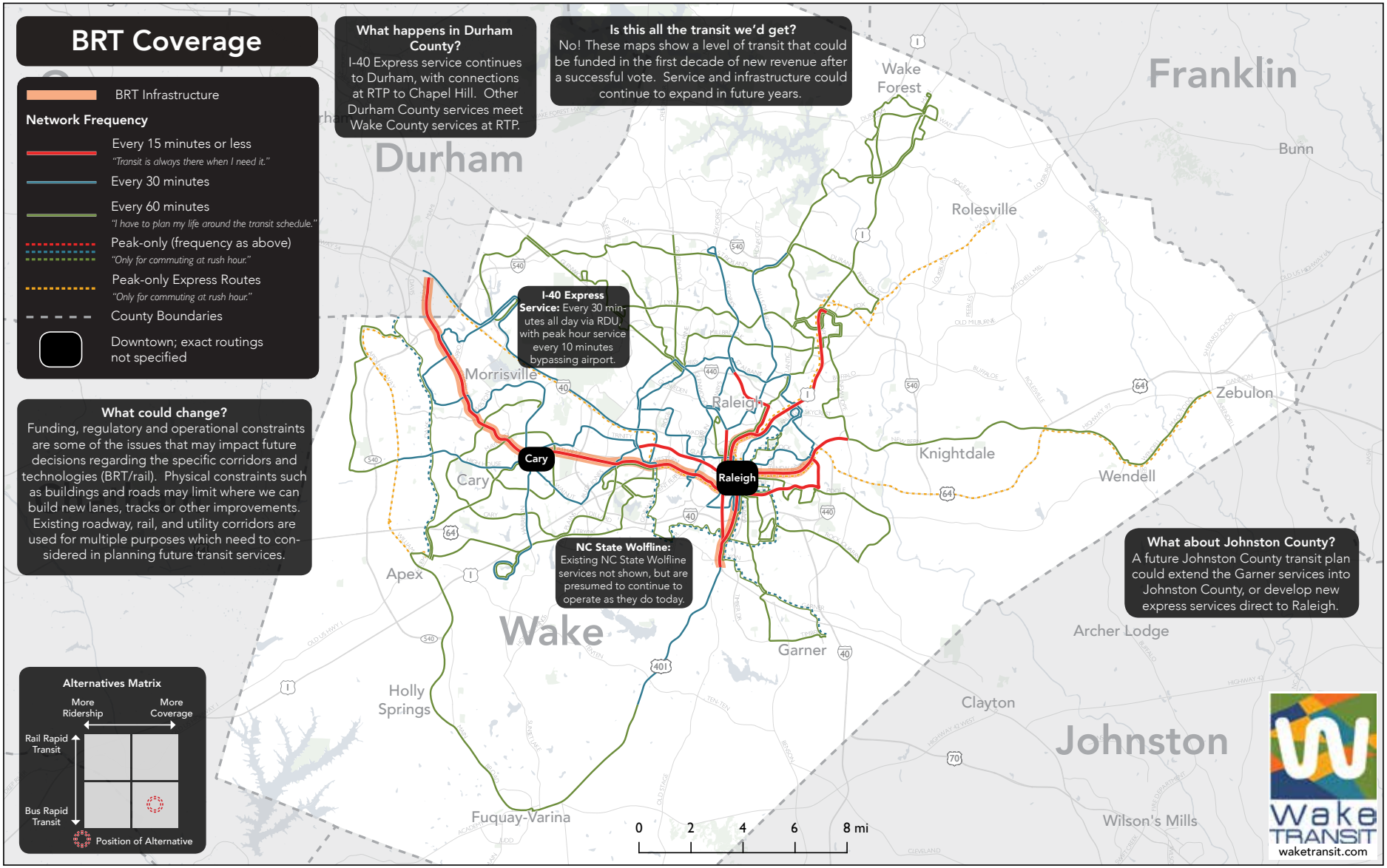

Figure 7: BRT Coverage Alternative Map

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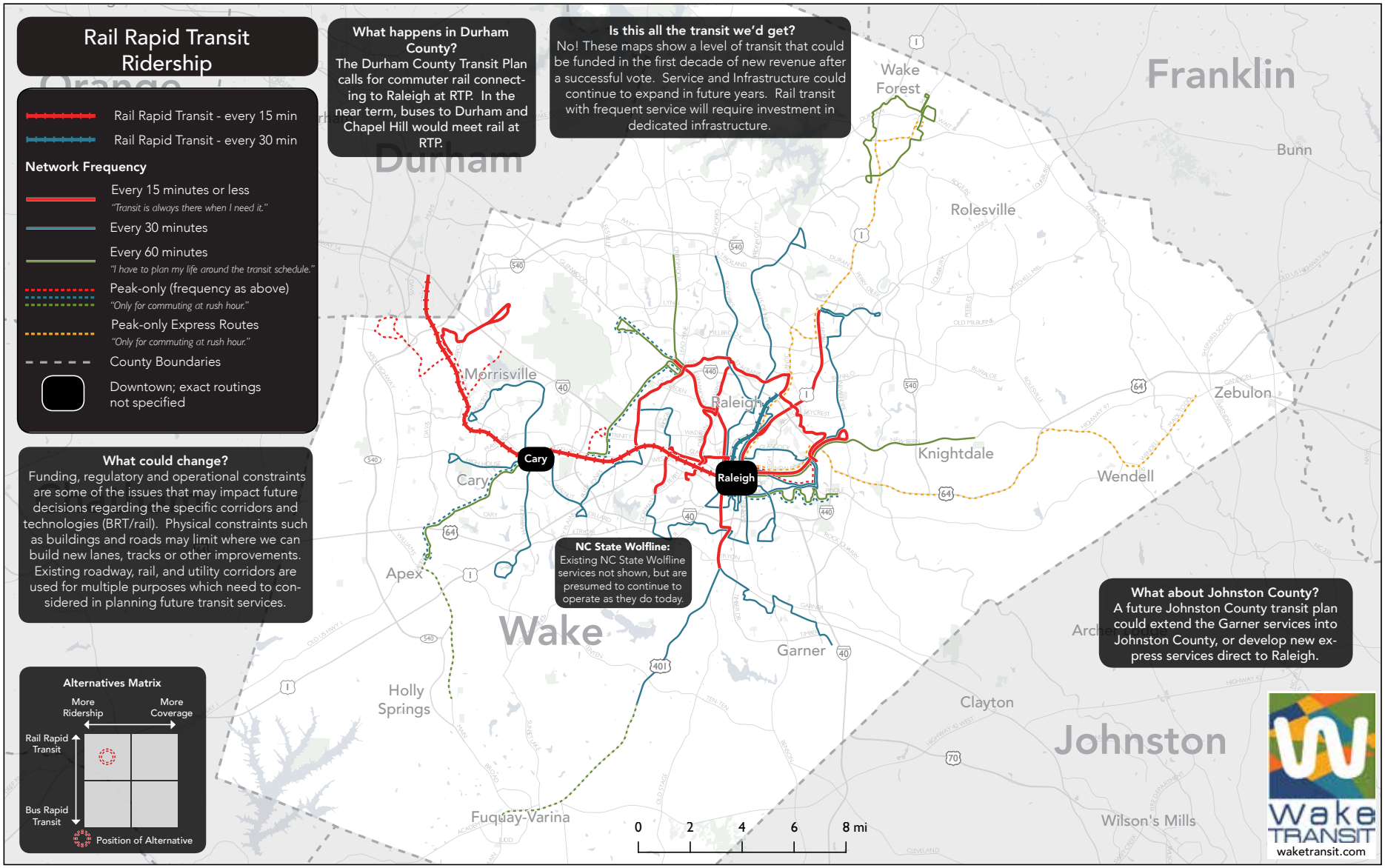

Figure 8: Rail Rapid Transit Alternative Map

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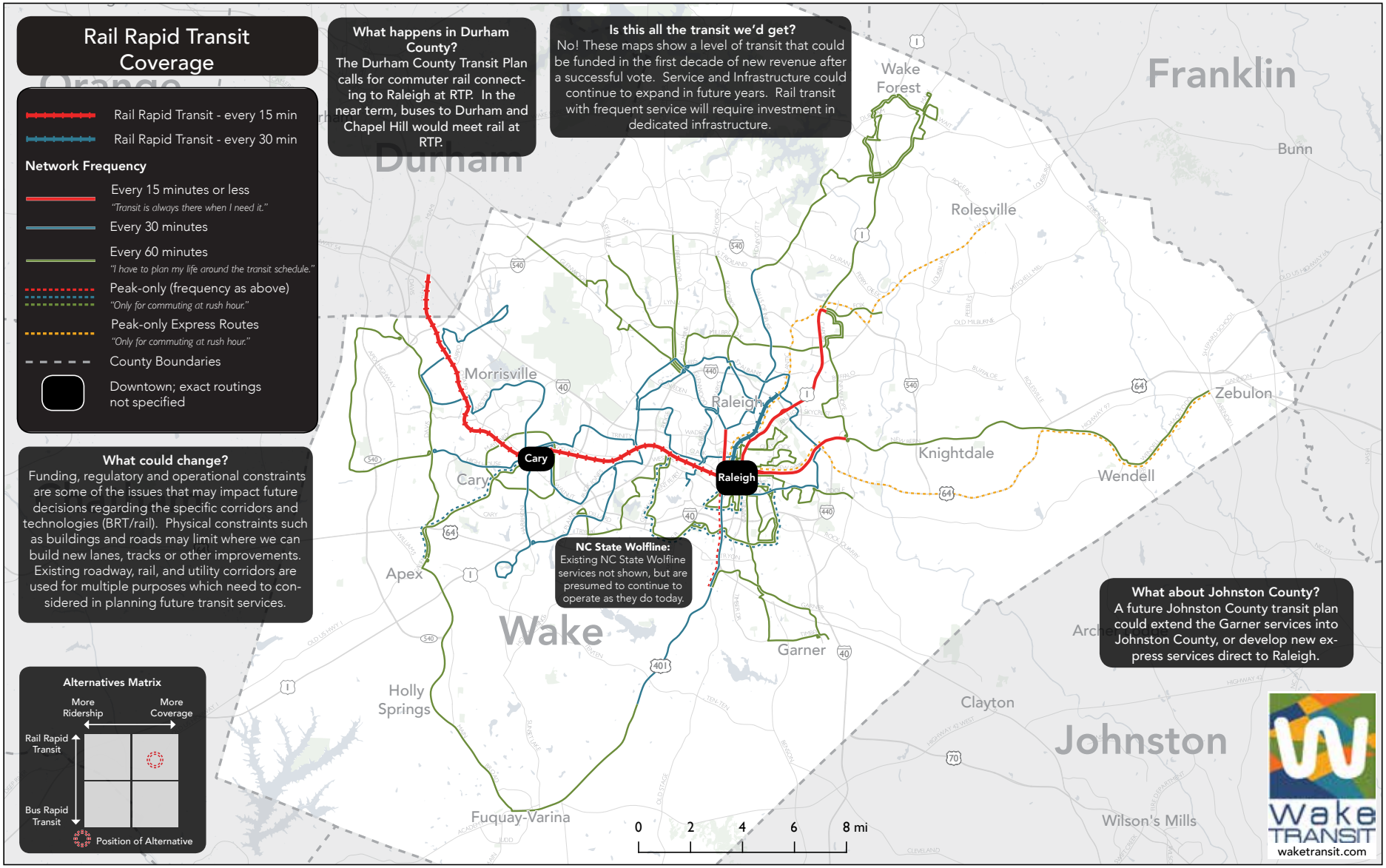

Figure 9: Rail Rapid Transit Coverage