Durham Orange Counties Light Rail: An Assessment

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Abstract

This .

1 Introduction

2 Ridership

GoTriangle estimates that each year around 8 million people will ride the one train line that is currently being planned. This estimate is absurd. There is no light rail system in the United States that attracts this many riders in such a small city.

2.1 GoTriangle Ridership Estimates

GoTriangle's ridership figures have varied over time and across documents.

As of February 2019, the estimate on GoTriangle's website is 26,000 riders per day, which works out to 9.5 million riders per year (though my conjecture is that GoTriangle means 26,000 riders per work day). But I have seen figures as low as 6.1 million riders per year. It is not clear why the figures vary so much.

GoTriangle (2012) shows 12,000 daily riders. Why the number of daily riders more than doubled by 2019 is not clear.

2.2 FTA Ridership Statistics

For comparison, I use FTA ridership statistics for 2017. The FTA lists 35 U.S. cities with light rail systems. Of these, 12 are small enough that they do not need to report data to the FTA. The following is based on the 23 systems that do report ridership figures.

The key variables are ridership (annual unlinked trips) and city population. Throughout, I am using the urbanized area population as my measure of service area population. This makes a difference for a few cities where the service area population is much smaller than the urbanized area population. Notably, for Phoenix-Mesa, the service area population is only 10% of the urbanized population (which sounds strage to someone who knows the area well). For Charlotte, on the other hand, the service area population is quite a bit larger than the urbanized population.

2.3 Durham/Chapel Hill would be the smallest city with light rail

- The median population among cities that report ridership data is 2.4m. This is **7.3 times larger** than the population of Durham/Chapel Hill (population 330,000).
- The smallest city that reports light rail ridership is Buffalo, NY with a population of 940,000 and 4.7m riders. This is about 3 times larger than Durham/Chapel Hill, but still generates only 58% of the number of riders GoTriangle predicts for Durham/Chapel Hill.
- Charlotte, NC yields 14,000 daily riders (with falling tendency) (source?) out of a population of 1.8m. GoTriangle predicts that DOLRT will yield 50% more riders than Charlotte's light rail which is longer, has more stations, and services a population that is (currently) about 5 times larger.

2.4 Annual Riders Per Capita

- GoTriangle predicts 8m riders per year for a service area of 330,000 persons. This works out to **24** riders per person.
- The median ratio of annual ridership per person for the 23 systems that report ridership statistics is **5.6**; less than one quarter of GoTriangle's prediction.
- NO light rail system in the United States, no matter how dense, achieves 24 annual riders per person.
- Portland (OR-WA) is the system with the highest number of riders per person: 21.4. This is an outlier and likely results from the fact that Portland has deliberately restricted road traffic.

- The second highest number is attained by San Francisco /Oakland (15 riders per person). In other words, GoTriangle predicts a single track connecting Durham with Chapel Hill will produce more riders per persons than San Francisco /Oaklands entire light rail system.
- Charlotte, NC is an obvious comparison: it achieves 3.8 riders per person (4.8m riders out of a population of 1.8m). This is a plausible estimate for a single rail line. It implies annual ridership for Durham/Chapel Hill of 1.1m (about 1/7th of GoTriangle's projection).
- In 2015, the northern part of 15/501 carries about 15,000 riders a day. I refer to the section leading into downtown Durham past the split from 15/501 Business. GoTriangle's ridership numbers imply that more than all of these drivers will switch to light rail. Alternatively, it could be that most light rail riders will not actually travel to/from Durham (even though the density of rail stations will be highest there).

2.5 Point 3: Transit Demand

GoTriangle's ridership predictions are absurdly high relative to demand for public transit

- All of Durham's bus lines combined transport 6.3m riders per year. This is again based on FTA ridership statistics for 2017.
- GoTriangle predicts that *a single rail line* with transport 1.7m more riders than all bus lines combined.
- For comparison: The median ratio of light rail to bus annual ridership in the FTA database is 0.32.
- For Charlotte, NC, the ratio is 0.26 (rail transports about 1/4 of the passengers that travel by bus). This would seem like a reasonable expectation for DOLRT, which will feature only a single rail line.
- If the Charlotte ratio holds for DOLRT, we would expect 1.7m annual riders (less than 1/4 of GoTriangle's prediction).

2.6 Point 4: Train Capacity

- Each vehicle will carry at most 220 passengers, including standing passengers (GoTriangle presentation at Duke Climate Coalition, Feb 20, 2019).
- Each train has 2 vehicles.

- During rush hour (hours not specified), trains run every 10 minutes. So 6 x 440 = 2,640 passengers per hour, if every vehicle is packed to capacity.
- This capacity doubles because trains run both ways. So we have 5,280 passenger per hour.
- Assume that morning rush hour has passengers arriving at work between 7:30am and 8:30am. That would be 7 trains or 6,160 passengers.

These calculations assume that every vehicle is packed to capacity, which is obviously not possible.

It follows that at most 6,000 of GoTriangle's expected 13,000 riders a day can be peak hour commuters. **More than half of GoTriangle predicted riderhsip will be off peak.**

Why is this important? Because off-peak hour riders can be transported inexpensively with buses. They are irrelevant for most of DOLRT's goals: traffic congestion, CO2 emissions, access to jobs. More than half of GoTriangle's predicted ridership could be transported at much lower cost without building new infrastructure.

Another bottle neck for ridership is parking. 70% of DOLRT riders will travel to their train stations by car (source?). 6,000 peak hour commuters would then require 4,200 parking spots near train stations, again assuming that parking is fully utilized.

There will be parking at South Square, MLK, Leigh Village, Gateway, Friday Center. It is not known (to me) how many spots each station will have, but I doubt that the number adds up to 4,200 (the figure is 3,900 according to railway_technology.com). Note that all of the planned parking spots are "half way" between Durham and Chapel Hill. Evidently, GoTriangle expects that most commuters will drive to train stations that are located half way along the track so they can take rail at 18mph to cover the remaining 9 miles to work. This would easily double the time a typical commuter spends on commuting.

2.7 Conclusions

I draw two conclusions from this comparison:

1. The Durham/Chapel Hill area is too small to support a light rail system. No other U.S. city this small has light rail. For light rail to be economically viable, it would have to connect Raleigh to surrounding cities (Cary, Apex).
2. GoTriangle's ridership estimates are pure fantasy numbers that bear no plausible relationship to reality.

Overstated ridership estimates are, by the way, standard practice in the industry. On average, light rail ridership estimates were 70% higher than actual ridership outcomes.

What are the alternatives to light rail?

Clearly, transportation has to move away from cars carrying one or two persons each. Fortunately, alternatives are coming online as I am writing this. Several cities are experimenting with self-driving van services. In contrast to rail, these will solve the "last mile problem." Instead of discharging passengers at a handful of train stations, vans drop off passengers where they actually need to go.

By the time the planned DOLRT would come online (2028, if everything goes according to plan), it will be technologically obsolete.

2.8 Ridership fact summary

1. On average, light rail ridership estimates were 70% higher than actual ridership outcomes.

2. Charlotte, NC light rail: Service area population 1.8m; annual riders: 4.77m. Source: National Transit Database, Monthly Module, retrieved Nov-2018.

3. DOLRT: Service area population (for Durham/Chapel Hill transit area): 240,000 (source: NTD). Assuming 50% population growth by 2035, the service area population is 360,000 (1/5th of Charlotte's current service area). Projected ridership in 2035 (GoTriangle): at least 6m (figures vary across documents).

4. Population densities:

   (a) at the city level: Durham: 2,100 persons per sq mile; Charlotte: 2,800; Raleigh: 3,200.

   (b) at the county level: Durham: 1,000 (source: Wikipedia); Mecklenburg county (Charlotte): 2,013; Wake county (Raleigh): 1,254. The claim (made by GoTriangle during the Feb 2019 meeting orgainized by the Duke Climate Coalition) that Durham is suitable for light rail because of population density while Raleigh is not does not hold up.

3 Cost

4 Benefits: Traffic

5 Benefits: Environment

6 Sources of Information

GoTriangle's documents can be found in their Resource Library.

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References

GoTriangle (2012): "Alternatives Analysis Executive Summary," https://gotriangle.org/sites/default/files/do-aa-executive-summary-073112.pdf.