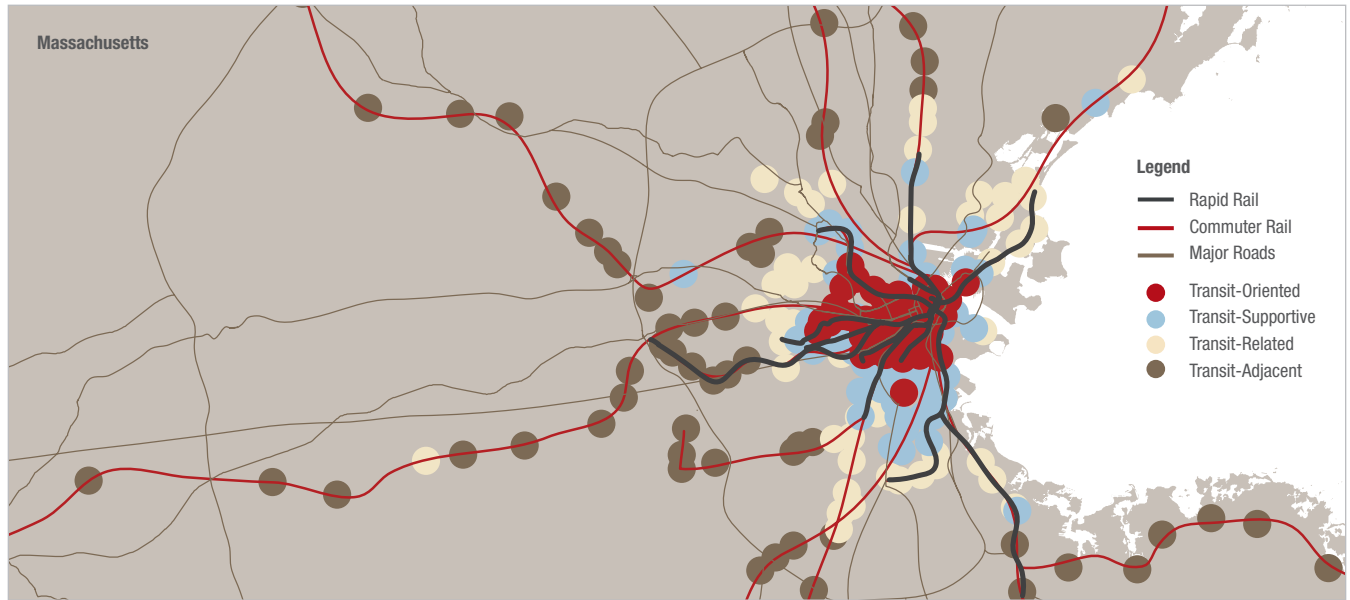


**FIGURE 3**  
**MBTA Station Area eTOD Score Types**



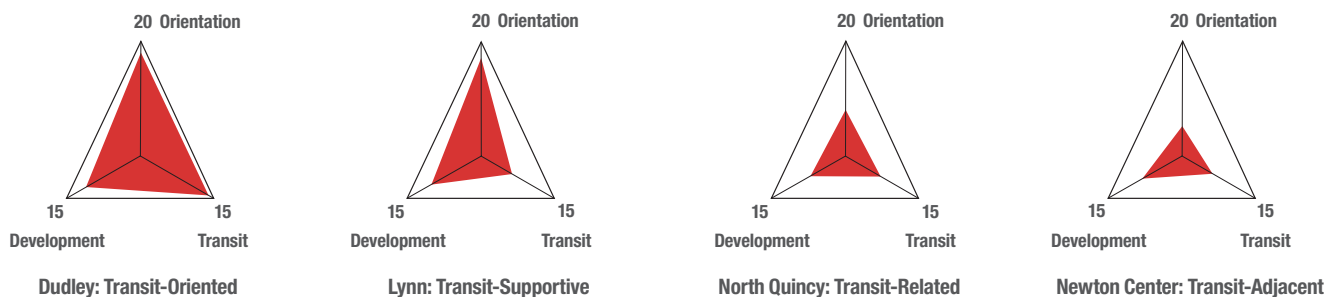
The highest-rated “transit-oriented” station areas share a combination of built, social and transit attributes that reduce driving, increase transit ridership, and promote equity. Given the rating system’s strong correlation with average daily household VMT within station areas, the combined *eTOD Score* provides a holistic measure of those conditions that contribute to less driving and more transit ridership, both now and almost certainly into the future.

While the combined scores provide important information about the suitability of the station area for high performing equitable TOD, the three separate sub-scales on **Transit**, **Orientation** and **Development** can be used to better understand the strengths and weaknesses of different station areas. The radar graphs in **Figure 4** can help planners assess

the types of measures that can improve an area’s *eTOD Score* and thereby improve the performance and equity of TOD within that station area.

While this rating system focuses on transit station areas rather than individual TOD projects or proposals, it can be used to assess the extent to which a TOD project provides what is “missing” in a station area. For example, the Lynn station area shown below is well-oriented toward core transit riders but scores poorly on transit (as it is commuter rail rather than more frequent bus or rapid transit service) and has a mixed record with respect to development attributes. Individual projects that build on the identified strengths and/or address the weaknesses in a station area should “rate” highly as equitable transit-oriented development.

**FIGURE 4**  
**Examples of the Four Station Area Types**



The *eTOD Score* Rating System was developed by staff from the Dukakis Center and CTOD, with input from an advisory committee.

This report was authored by Stephanie Pollack, Anna Gartsman, and Jeff Wood.

For more information read the full report which can be downloaded at: <http://www.northeastern.edu/dukakiscenter/transportation/>

## eTOD STATION AREA RATING SYSTEM



### INTRODUCTION: PURPOSE AND NEED FOR A TOD RATING SYSTEM

Planners and policymakers have long been working to understand what factors best predict the performance of transit-oriented development (TOD) in order to encourage high performing TOD that can effectively reduce driving and increase transit ridership. The task is even more difficult for those who want to ensure that TOD simultaneously improves social equity. The Dukakis Center for Urban & Regional Policy at Northeastern University and the Center for Transit-Oriented Development (Center for Neighborhood Technology, Reconnecting America, and Strategic Economics) have worked in collaboration to create a “rating system” to measure the capacity for equitable TOD within a transit station area.

Unlike rating systems for individual TOD projects, this proposed *eTOD Score* rating system seeks to measure the capacity for equitable TOD within a given public transit station area. It identifies easily quantifiable and comparable built, social, and transit attributes that reduce driving, encourage higher transit ridership, and promote transit equity and accessibility.

This research uses daily household Vehicle-Miles Traveled (VMT) as the key performance metric for transit-oriented development and regards areas with already low VMT as optimal locations for TOD. *eTOD Score* was piloted in Massachusetts, where household VMT data was available to analyze which attributes to include in the rating system and to validate the resulting scoring system. The resulting rating system – as well as each of its three sub-scores – has a very

strong and inverse relationship with VMT, so regions without available VMT data can adopt this rating system with the confidence that it accurately predicts which station areas are likely to achieve the best TOD performance.

### CONSTRUCTING THE eTOD SCORE RATING SYSTEM

The *eTOD Score* rating system is based on the concept that successful and equitable transit-oriented development should focus on all three concepts in the acronym TOD:

- The availability, quality and use of public **transit** (as well as other non-automobile means of transportation)
- **Orientation** toward “transit-oriented neighbors” who make up the core of transit ridership
- The characteristics of **development** in the neighborhoods surrounding the transit station

The rating system was constructed by evaluating different metrics to characterize each of these areas. The goal was to generate a rating system that would allow for the comparison of station areas across the region, while also identifying the strengths and opportunities presented within individual station areas.

**Transit** metrics capture the frequency of service, quality, and use of the available public transportation network - factors that have been shown to influence the success of TOD. Transit service, for example, needs to be sufficiently frequent, fast, and connected to essential destinations. When transit quality is higher, more residents are interested in making use of the service, which then results in decreased driving.

The middle and least-understood concept in the phrase TOD, **orientation**, raises the question, “To what or to whom is TOD oriented?” The Dukakis Center’s research supports the conclusion that TOD should be oriented toward people most likely to use transit, a group the Center calls “core riders.” This conclusion builds on prior research identifying a set of demographic and socioeconomic groups who are over-represented among transit riders compared to their proportion of the population. Such core riders are

## eTOD STATION AREA RATING SYSTEM

important to TOD performance because they have been demonstrated both to drive less and use transit more. At the same time, a number of the socioeconomic and demographic groups who constitute a disproportionate share of transit users are also important from an equity perspective. If both Transit and Development are oriented toward core riders, the resulting TOD should be both high performing and equitable.

As for **development** and the built environment, proximity to a station in and of itself does not necessarily encourage less driving or more transit use, which is why some development is transit-adjacent rather than transit-oriented. Elements of the built environment, such as walkability and density, influence the travel choices of both residents and visitors of the station area. This rating system incorporates measures of the types of development which encourage less driving.

### MEASURES

*eTOD Score* was piloted in Massachusetts. The Massachusetts Bay Transportation Authority (MBTA) transit system consists primarily of three different modes: commuter rail, rapid transit, and bus, which allows for the development of a rating system applicable to different types of transit station areas.

All MBTA rapid transit stations as well as select bus stops on high-frequency "Key Routes" were included in the construction of *eTOD Score*. In total, we analyzed 345 station areas, including 276 rapid transit station areas and 69 bus stop areas. Neighborhoods outside of station areas are not eligible for rating under this system.

Following extensive analysis of a variety of potential scoring

attributes, ten station area attributes (see **Figure 1**) were selected for inclusion in the rating system based on their relationship to VMT, and were then divided among three different sub-scales. In order to create an easily understandable rating system, each attribute received a score of up to 5 points (for a total possible "rating" of 50 points across the ten measures). Points are assigned based on the quintile distribution of that attribute across all of the transit station areas in the MBTA system. Those in the lowest quintile received one point, with one point added per quintile, for a maximum of five points.

### Transit Sub-Scale

The three selected measures that constitute the transit sub-scale are:

- **Transit Accessibility:** The Transit Access Shed index (TAS), developed by the Center for Neighborhood Technology (CNT), is a 100 point scale which calculates the size of the area that passengers who board at a given station can easily access using transit in 30 minutes, scaled by the frequency of transit service at that station;
- **Transit Connectivity:** The Transit Connectivity Index (TCI), also developed by CNT, is a 100 point scale which measures access to and the frequency of transit service at a bus or rail stop location and within the surrounding neighborhood;
- **Transit Use:** Transit use is considered as the non-automobile commute share, measured as the percentage of workers who use transit, bike, or walk to work in the station area as reported by the American Community Survey (ACS).

Transit ratings for MBTA station areas vary from a low score of 3 (in the bottom quintile of station areas for all

**FIGURE 1**

**Final eTOD Score Attributes**

Category	Metric	Measure
Transit	Transit Accessibility	Transit Access Shed Index (TAS)
	Transit Connectivity	Transit Connectivity Index (TCI)
	Transit Use	Percentage workers who use transit, bike, or walk to work
Orientation	Transit Dependency	Percentage of 0-car households
	Lower Income	Percentage of households with income <\$25,000
	Rental Housing	Percentage renters
	Affordability	Percent of income spent on transportation
Development	Walkability	WalkScore®
	Residential Density	Households per acre
	Employment Gravity	Employment gravity measure

three measures) to a high score of 15 (top quintile for all three measures). 36 station areas received the maximum possible transit score, mostly rail and bus station areas located in the downtown core. 48 station areas received the minimum possible transit score; all of them are commuter rail stations. By selecting only the key bus routes, our methodology overemphasizes “well-performing” bus areas. Nonetheless, it is notable that the best-performing bus stop areas are indistinguishable from the best-performing rail station areas on these three measures.

## Orientation Sub-Scale

The four selected measures which constitute the orientation sub-scale are:

- **Transit Dependency:** The percentage of zero-vehicle households in the station area, because persons living in households without a car are far more likely to use transit than those in households with cars and because serving transit-dependent populations is an important component of equity;
- **Lower Income:** The percentage of households with incomes under \$25,000 in the station area, because lower income households are more likely to use transit and because serving lower income residents is an important component of equity;
- **Rental Housing:** The percentage of renters in the station area, because renters are more frequent users of public transportation than homeowners;
- **Affordability:** Affordability is derived from the H+T<sup>®</sup> Index developed by CNT. The component used here estimates the percent of income spent on transportation in the station area.

Orientation ratings for MBTA station areas vary from a low score of 4 (mostly commuter rail stations but also several suburban stations on the Green “D” Line) to a high score of 20 (found at many bus stops, as well as surface Green “B” and “E” Line station areas). On average, bus stop areas have more residents in zero-vehicle households, more low-income residents, and more renters than rail station areas.

## Development Sub-Scale

The three selected measures that constitute the development sub-scale are:

- **Walkability:** The independently developed WalkScore<sup>®</sup> of the station’s location (using latitude and longitude), because it measures important destinations within walking distance of the station as well as urban form, and because it is well-correlated with lower household driving;
- **Residential Density:** The number of households per acre

in the station area, because it measures population density in the station area;

- **Employment Gravity:** The Employment Gravity measure, developed by CNT, assesses the quantity of and the distance to all employment destinations relative to any location within the region.

The development rating varies between MBTA station areas from a low score of 3 to a high score of 15. Most of the lowest-scoring areas are commuter rail station areas and the highest-scoring are primarily subway station and bus stop areas in the downtown core and surrounding neighborhoods.

## THE RATING SYSTEM AND RESULTS

The three subscales can also be summed into a final combined score, thereby establishing a comparable *eTOD Score* for each station area. The overall score ranges from a minimum of 10 points to a maximum of 50 points. The score is then divided into four groups, which correspond to changes in average daily miles driven by households in the station area (see **Figure 2**). Residents of the best performing station areas drive less than half as much as those in the worst performing station areas.

Using these measures, it is possible to compare a given station area’s performance relative to other station areas. The final combined score of each station area reflects its quality of transit, orientation toward transit users, and the development of the station area. **Figure 3** presents a map of the Boston region that shows how the transit station and bus stop areas break out by their *eTOD Score*, and **Figure 4** provides examples of each type of station area.

**FIGURE 2**

*eTOD Score Ranges for Station Areas*

