III. Normative Metrics

What Are the Normative Metrics?

Performance (VMT) and place (use mix) are combined to create place types that help organize transit zones. However, each place type also has additional characteristics (or metrics) that can be used to evaluate performance. For the purpose of this Guidebook a Normative Metric is defined as a measure that allows for the comparison of similar transit zones within each place type. These metrics are normative, in the sense that they represent the average value, of the universe of values, within each place type. They can be used to compare any given transit zone to the average or norm of the universe of similar transit zones.

The Normative Metrics in this Guidebook can be used as performance measures. Paired with the Performance-Based TOD Typology, they gauge the performance of transit zones. The data for each station area comes from a variety of sources and are compiled from CTOD's National TOD database. Table 3 shows the different metrics analyzed and the national average for each metric (if applicable.)

Comparing the national average of these metrics to the Normative Metric for each place type can show if transit zones of different place types

Table 3: Normative Metrics

Metric	National Average
Total Intensity (residents + workers)	N.A.
Residents	N.A.
Workers	N.A.
Workers/Residents	N.A.
Households	N.A.
Household Size	2.59
Gross Density (units/acre)	N.A.
Residential Density (units/acre)	N.A.
Average Block Size (acres)	N.A.
Monthly T Cost	N.A.
Yearly T Cost	N.A.
Average Median Income (1999)	$40,696
Travel Time to Work (minutes)	24.3
Employment Gravity (jobs nearby)	N.A.
Transit Access Index	N.A.
Autos/Household	1.9
Home Journey to Work Transit	5.7%
Home Journey to Work Walk/ Bike/Transit	8.2%
Workplace Journey to Work Transit	5.7%
Workplace Journey to Work Walk/Bike/Transit	8.2%

Figure 10: Normative Metric Relationships

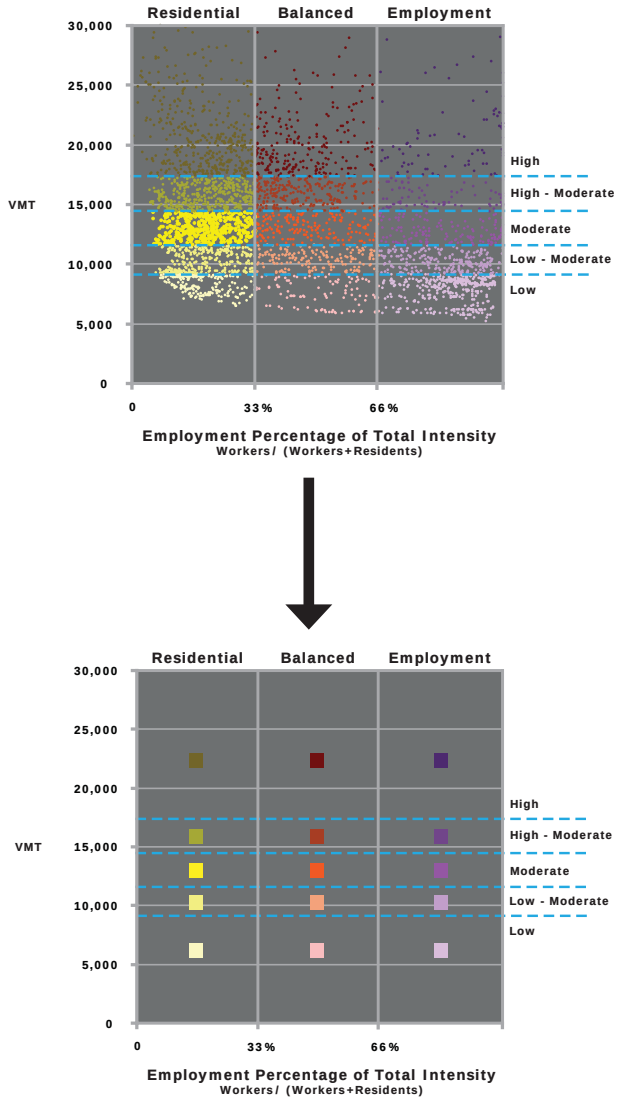


Table 4. Normative Metrics

Place Types	Residential Places					Balanced Places					Employment Places				
	Low VMT	Low-Mod VMT	Mod VMT	High-Mod VMT	High VMT	Low VMT	Low-Mod VMT	Mod VMT	High-Mod VMT	High VMT	Low VMT	Low-Mod VMT	Mod VMT	High-Mod VMT	High VMT
Total Intensity (residents + workers)	54,216	24,718	12,580	7,708	3,429	64,155	21,763	11,600	6,867	3,242	109,306	34,914	13,009	5,969	2,325
Residents	44,293	20,106	10,229	6,292	2,716	29,875	10,732	5,884	3,695	1,764	12,581	5,103	2,065	1,154	321
Workers	9,923	4,612	2,351	1,416	713	34,280	11,031	5,716	3,172	1,478	96,725	29,811	10,944	4,815	2,004
Workers/Residents	18.3%	19.5%	19.6%	20.3%	19.6%	51.6%	49.7%	48.2%	46.0%	46.2%	86.5%	83.9%	84.2%	83.0%	87.1%
Households	16,214	7,684	3,906	2,253	974	15,466	4,646	2,429	1,467	670	6,828	2,524	861	467	120
Household Size	2.71	2.61	2.62	2.71	2.68	1.95	2.21	2.41	2.43	2.60	1.58	1.67	2.22	2.28	2.64
Gross Density (units/acre)	50.0	21.6	10.3	5.7	2.2	48.7	16.4	7.6	4.0	1.9	28.5	10.3	4.6	2.2	0.9
Residential Density (units/acre)	53.2	23.6	12.1	6.7	3.4	55.6	20.9	10.5	5.8	3.5	51.4	20.6	10.8	6.0	2.9
Block Size (acres)	4.2	4.1	5.7	7.7	18.8	3.7	5.8	8.5	9.9	23.7	3.7	6.4	14.2	69.9	86.7
Monthly T Cost	$422	$563	$688	$781	$906	$394	$597	$721	$794	$900	$463	$613	$713	$793	$920
Yearly T Cost	$5,064	$6,756	$8,256	$9,372	$10,872	$4,728	$7,164	$8,652	$9,528	$10,800	$5,556	$7,356	$8,556	$9,516	$11,040
Average Median Income (1999)	$31,713	$35,643	$41,344	$53,492	$62,06t9	$43,997	$37,364	$43,395	$51,138	$65,544	$41,875	$34,183	$43,935	$40,985	$57,562
Travel Time to Work (minutes)	35.6	31.4	27.4	25.5	24.7	23.5	22.1	21.4	21.6	22.9	18.0	17.1	18.7	19.0	21.5
Employment Proximity	233,890	127,448	65,640	42,260	20,788	451,725	152,310	73,393	41,335	27,131	396,277	159,118	99,648	58,747	32,167
Transit Access Index	31	19	13	10	3	56	28	11	9	4	85	45	19	10	4
Autos/Household	0.45	0.82	1.18	1.47	1.71	0.52	0.87	1.22	1.41	1.68	0.48	0.74	1.11	1.18	1.61
Home Journey to Work Transit	58%	39%	23%	15%	8%	43%	25%	14%	10%	8%	25%	16%	13%	9%	5%
Home Journey to Work Walk/Bike/ Transit	68%	47%	27%	18%	10%	64%	40%	23%	15%	11%	58%	37%	24%	18%	9%
Workplace Journey to Work Transit	33%	20%	11%	7%	2%	38%	17%	8%	5%	3%	38%	16%	9%	5%	3%
Workplace Journey to Work Walk/Bike/ Transit	47%	30%	18%	12%	6%	48%	23%	12%	8%	5%	43%	19%	11%	7%	5%

are performing better or worse than the national average. (The national average is the average of all people or households in the US, not just those living in transit zones.)

Table 4 on page 15 shows the Normative Metrics for each place type in the typology. These metrics are meant to give an overall sense of the characteristics of each place type. The metrics were calculated by averaging all of the transit zones within each place type. For example, the normative intensity for a low VMT, residential transit zone is derived by averaging all of the transit zones in that place type, and computes to 54,215 persons (workers and residents.) The TOD Database provides these metrics for every operational transit zone in the US.

In Figure 10, each point in the graphic at the top is a transit zone in the TOD database. The boxes in the graphic to the bottom show figuratively how the Normative Metrics represent the average of all the stations within one place type. (A more detailed explanation of how CTOD calculated each metric is in the appendix.)

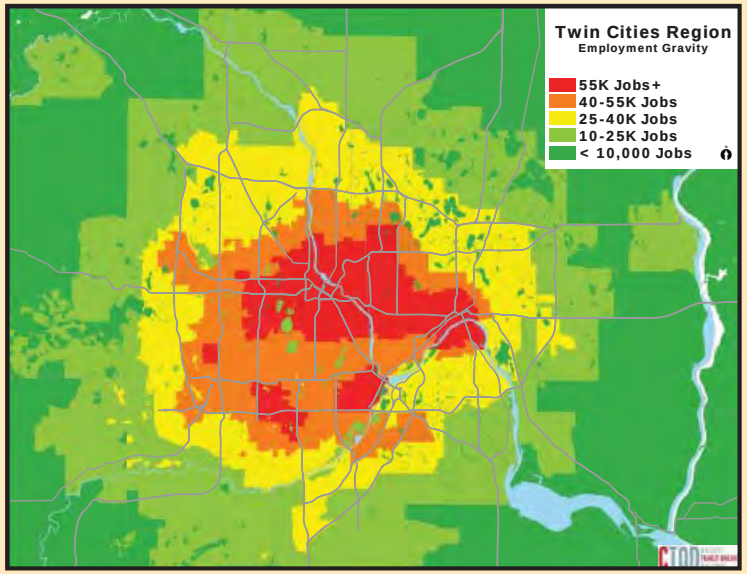
Overall, the Normative Metrics of lower VMT places show higher performing TOD than higher VMT places (higher transit ridership, lower auto ownership, etc.) A discussion of key findings from the Normative Metrics follows.

Focus on Employment Proximity

Employment proximity, or employment gravity, measures the access that residents within a transit zone have to jobs across the region by using a gravity based model.[7]

Previous research by CNT and CTOD has found that households that are near many jobs, or have higher employment proximity, have lower VMT than those with lower access to employment.[8] There are at least two factors that may reduce the need for driving in the presence of greater employment: 1) Because there are a more jobs near the transit zone, residents are more likely to have shorter commutes than people who live in places with low employment access. 2) Places with high employment access may also have many local services and shopping opportunities that residents can access without driving long distances. The map shows employment gravity in the Twin Cities, with the areas in red with the highest employment gravity, or proximity.

Figure 11. Employment Gravity in the Twin Cities



7 The total employment access is defined as the sum of all of the jobs in a region, weighted by the inverse square of their distance from a given station area. For example, a block group with 100 jobs that is 2 miles from a station area would contribute $100/2^2 = 100/4 = 25$ jobs to the employment access for that station area, whereas a block group with 100 jobs that is 10 miles away would only contribute $100/10^2 = 100/100 = 1$ job.

8 Center for Transit Oriented Development and Center for Neighborhood Technology. "Transit Oriented Development and the Potential for VMT-Related Greenhouse Gas Emissions Reduction," March 2010.

Key Findings from Normative Metrics

Overall, most transit stations perform better than or at the national average, outperforming the typical non-transit-oriented place. Within each metrics or set of metrics there are some interesting variations on this general theme.

Auto Ownership & Transportation Costs

Transit zones in low VMT places types tend to have low transportation costs and low rates of automobile ownership. This finding could influence local land use policies, such as parking requirements for new development, providing a rationale for allowing lower parking ratios in lower VMT places. Higher VMT transit zones that want to improve their performance on this metric might consider what elements would make it easier for households to get rid of one or more cars, including grocery stores within walking distance of households or sidewalks and other pedestrian amenities.

Figure 12 shows how the Performance-Based TOD Place Types differ on vehicle ownership. The difference between the highest and lowest VMT places is significant, but scaling down from one level to another happens incrementally. This graphic also shows that auto ownership does not vary significantly with changes in use mix, though it does with VMT.

While the Normative Metrics compare the performance of transit zones around the country to one another, it is also important to consider how these areas are performing when compared to the national average. On this particular metric, the national average for vehicle ownership (1.9 cars per household) is slightly higher than the average for the highest VMT place type. However, households in low VMT transit zones own one fourth as many cars on average.

Figure 13 shows that the average household living in a low VMT transit zone spends half as much on transportation costs than households living in high VMT places ($4,000-5,000 compared to $10,000-11,000). Transportation costs quantify the yearly expenditures the average household will make on auto ownership (car payments, maintenance, etc.), auto use (gas purchases), and transit use. The average household in the US spends about 19 percent of their income on transportation costs, and 47 percent of their income on the costs of housing and

Figure 12: Normative Metrics for Household Automobile Ownership

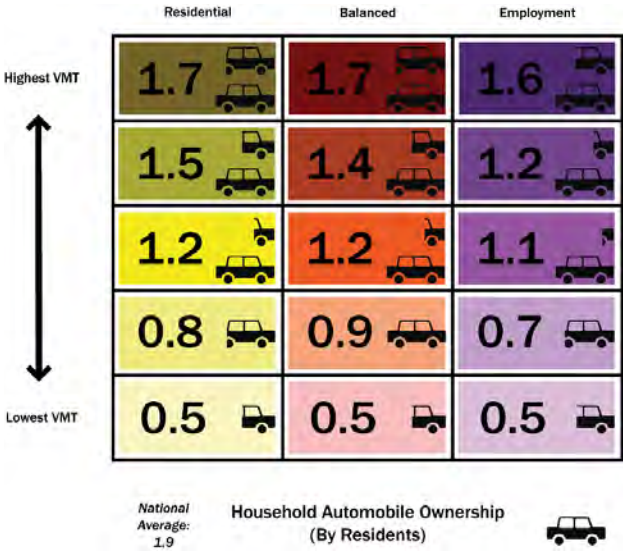
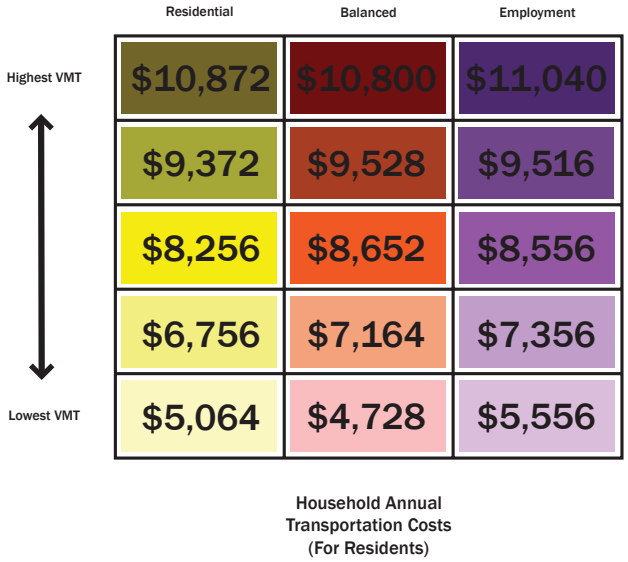


Figure 13: Normative Metrics for Transportation Costs



transportation combined.[9] More and more, policy makers and stakeholders are looking at both housing and transportation costs as a measure of the neighborhood affordability.

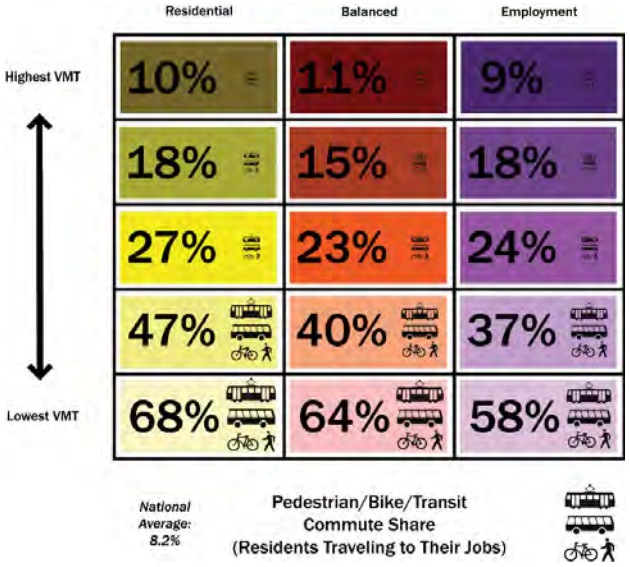
Because of the potential savings on transportation costs that are available in low VMT place types, these transit zones are important places to ensure that a range of housing options exist to serve residents with a wide range of incomes.

Commute Travel Behavior

Low VMT place types exhibit more transit ridership and higher rates of walking and biking to work than high VMT transit zones. This finding is equally true of commutes by residents living in transit zones and commutes by workers who work in transit zones.

Figure 14 shows that 58 percent of commuters in low VMT, residential places use transit to get to work, more than 10 times the national average. However, transit ridership rates in high VMT transit zones are much lower (closer to the national average.) In general, workers living in more residential transit zones use transit to commute more than residents in balanced or

Figure 14: Normative Metrics for Non-Auto Journey to Work



employment place types, independent of VMT. However, these differences are less pronounced when comparing the percent of people who use transit, walk, and bike to work. Residents of transit zones that have a lot of employment activity may find it easier to walk or bike to jobs within the transit zone.

The Normative Metrics also underscore a similar pattern for people who work in transit zones. In low VMT transit zones, workers take transit at 8 times the rate as the national average. In contrast, workers traveling to high VMT transit zones take transit even less than the national average. This finding suggests that concentrating employment in low VMT transit zones will have a strong positive impact on transit use in general.

Urban Form

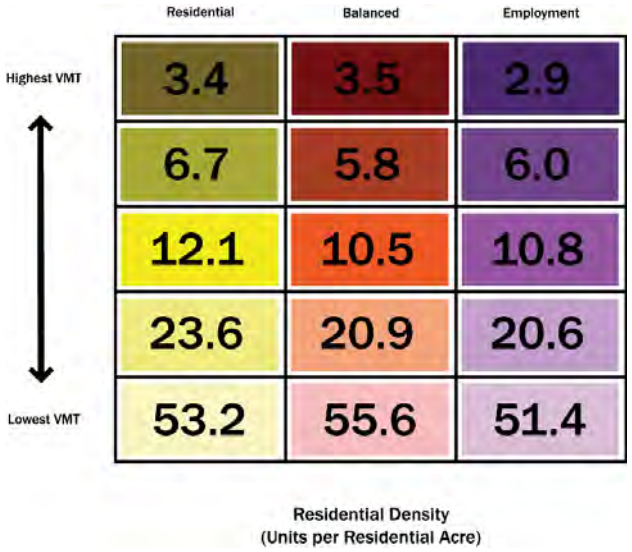
Low VMT transit zones tend to have more intensity (residents + workers) and higher residential densities than high VMT transit zones. Residential densities in low VMT transit zones are over 15 times as high compared to high VMT transit zones (shown in Figure 15.) Blocks in low VMT transit zones average between 3.7 acres (for employment and balanced use places) and 4.2 acres (for residential places). In high VMT places, the range is between 18.8 acres (for residential places) and 86.7 acres (for employment places).

This finding suggests that low VMT transit zones are also characterized by urban form that is generally more pedestrian-friendly than high VMT transit zones. Block sizes and pedestrian connectivity are difficult to change, a challenge for high VMT transit zones that want to transition into lower VMT places.

However, there are examples of places where older, suburban-style malls or manufacturing districts have recreated grid street networks to support more walking. In Oak Park, a pedestrian mall was reintroduced to the street

9 Center for Transit-Oriented Development and CNT. "The Affordability Index: A New Tool for Measuring the True Affordability of a Housing Choice," January 2006.

Figure 15: Normative Metrics for Residential Density



network and loaded with pedestrian amenities. It provided some parking for local businesses and opened up traffic flow to reduce congestion. In Gresham, OR, the city reintroduced the grid when redeveloping a large tract of land into a commercial center. Research has shown that urban form characteristics known as "the four Ds" (density, design, distance, destinations) are critical for lowering overall VMT. While this study has focused on household VMT data as a performance standard, future research should look to investigate the 4D research with this performance-based approach.

Other Uses for Normative Metrics

The case studies show how the Normative Metrics can also be used to analyze the performance of a particular transit zone. The Normative Metrics offer individual transit zones a starting point to analyze how they compare to stations that are similar to them in terms of VMT and use mix. The individual transit zone may differ considerably from a normative metric for its place type. Places in transition may use the Normative Metrics to see where they might end up on the spectrum.

Policy makers and stakeholders that want to outline strategies to improve the performance of their station area can use the Normative Metrics to set quantitative goals. To lower VMT, they may look to the Normative Metrics to see what the norm for that place type is in terms of vehicle ownership, transit use, density and more to determine the types of changes to be made.

Many policy changes will happen locally, but federal and state actors could also use the Normative Metrics to set up funding mechanisms and initiatives that will help local jurisdictions achieve their goals. Allocations of federal grants for affordable housing or redevelopment funds could be targeted to areas that plan for more changes. Additionally, with an existing baseline for each station area, it is possible to track progress over time, making adjustments to funding easier and giving each jurisdiction a fair playing field no matter what type of place they are.

The Normative Metrics may also be useful in scenario planning at the regional scale, discussed more in Section IV below. Residential density, employment proximity, transit access, and block size are all important inputs to the average VMT in a transit zone. Some metrics may be more important than others for a particular transit zone, and the potential for a transit zone to change some of those metrics will differ depending on the specific place. A full complement of illustrations of the metrics can be found in the Appendix.