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Communicating Competitive Conditions in Transit Markets: The Transit Competitive Index (TCI)

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Communicating Competitive Conditions in Transit Markets: The Transit Competitive Index (TCI)

The Puget Sound region's ambitious growth management and transportation goals depend heavily on providing more and better public transportation service. Continuing improvement in transit services is required in order to move today's region from being largely auto-dependent to a region with many alternative travel options. Major steps in that direction were taken with the initial investment in the regional transit system. The Puget Sound Regional Council (PSRC) is in the process of refining the *Destination 2030* Update which provides a framework for coordinating public transportation services at the regional level. Part of this effort is to develop corridor level plans for transit service improvements to meet transit demand for the region. Cambridge Systematics is assisting PSRC in developing two tools to provide better transit planning capabilities: a transit Service Planning Tool (SPT) and Transit Competitive Index (TCI). This paper will present the methodology of TCI, an index that can be used to communicate competitive conditions of various travel markets of travel service areas.

At the heart of this approach is an innovative transit market research. For many years, transportation professionals analyzed problems and framed solutions in terms of traveler attributes (i.e., demographic characteristics). Categorizing travelers into these types of groups is certainly valuable for understanding the transit market, providing a portrait of who is or is not using a particular service. However, these characteristics are not too helpful in understanding the key attitudes and perceptions that lead to travelers' mode choice. To better understand the reasons that different travelers have for choosing their mode for everyday travel, PSRC adopts an approach that breaks away from these stereotypes and instead determines the attitudes that drive each market segment's mode choice. This technique will query households about their attitudes and sensitivities toward their local travel experiences. For example, how much do people value their privacy when they travel or how important is transit reliability. By understanding the importance of such attitudes, we can group all travelers into distinct market segments with shared attitudes, then develop mode choice model to quantify how each segment's specific attitudes drive their choice of mode and their preferences for transit services. Using this comprehensive understanding of each travel market, we can match the optimal transit services to the specific travel market conditions through a competitive positioning process.

CS has pioneered the application of this sophisticated market research to transit planning and operations. In 1999 CS applied this technique (which is typically used for its private sector clients) to a long range strategy for transit services throughout the San Diego County. Since then, many more transit agencies have embarked on similar efforts that encompass strategic planning, comprehensive operations analysis, and corridor planning using this market research approach, including San Diego Association of Governments (SANDAG), Bay Area Water Transit Authority (WTA), Bay Area Rapid Transit (BART), San Mateo County Transit District (SamTrans), Santa Clara Valley Transit Authority (VTA), San Francisco Muni San Francisco Municipal Railway (MUNI), Utah Transit Authority (UTA), PACE bus service in Chicago, and Capital Metropolitan Transportation Authority in Texas. Methodological advances in the field of travel demand modeling, combined with the availability of cheap computing power, have allowed many planning organizations to develop increasingly complex models at a fine-grain of geographic detail. Current mode choice models often have complex nesting structures and

are evaluated for multiple market segments (i.e. characteristics about the traveler and trip purposes). Tradeoffs are often made between increasing realism with more complex methodology and extreme detail, and ability to easily extract and use that information for planning purposes. In the context of planning an efficient transit network, we developed the Transit Competitive Index (TCI) as a simple means to convey the most competitive and cost-effective transit service. This technique inherits the benefits of the methodological realism of the region's mode choice models, but avoids the common pitfalls of information overload and long-times associated regional model runs. We also developed an ArcGIS application named the Service Planning Tool (SPT) to enable further exploration of the transit competitiveness by market segment and varying geographies. In addition, the SPT allows transit planners to test alternatives service concepts by applying segment-specific mode choice models to estimate the relative potential ridership impacts from a wide range of transit improvement strategies and across a wide range of travel markets. It allows users to answer important planning questions under various "what if" scenarios such as: What attitudes and preferences drive each market segment's choice for local travel options? What strategies would be most effective for each market segment? Where are the easy-to-reach and hard-to-reach markets? And what strategies are most likely to be effective for improving transit ridership between different origins and destinations?

Transit must provide the right type of service in each travel market where it can compete effectively. In order to provide a cost-effective system-level transit service plan, we must recognize that some travel markets will never be amenable to high transit mode shares and some are. The competitiveness of transit in a certain travel market (origin-destination pair) is a function not only of the transportation networks, but of conditions that exist regardless of what kind of transportation is available. These non-level-of-service conditions can be characterized by variables such as availability and cost of parking, density of compatible land use, pedestrian environment, etc. These conditions exist regardless of what kind of transit service is currently deployed or could be deployed, but they have critical consequences for how much ridership even the most effective transit service could capture. The assessment of each travel market's conditions informs us as to how tough a market might be and what conditions will pose the toughest challenges. In some markets, for example, the abundant supply of free parking will undermine any attempt to attract more riders with improved transit service. In other markets, high density of land use would provide lucrative opportunities. The potential transit competitiveness for an origin-destination market is characterized by the combination of these conditions coupled with the market segments of travelers (see Proussagalou et al.[1], Outwater et al.[2], Zhou et al.[3], and Wornum[4] for a discussion about the development and application of Factor Analysis, Cluster Analysis, and

[1] Proussaloglou, K.E., K. Haskell, R.L. Vaidya, and M. Ben-Akiva. An Attitudinal Market Segmentation Approach to Commuter Mode Choice and Transit Service Design. (CD-ROM) Proceedings of the 80th Transportation Research Board. Washington DC, January 2001.

[2] Outwater, M.L., S. Castleberry, Y. Shiftan, M. Ben-Akiva, Y. Zhou, and A.R. Kuppam. Use of Structural Equation Modeling for an Attitudinal Market Segmentation Approach to Mode Choice and Ridership Forecasting. (CD-ROM) Proceedings of the 82nd Transportation Research Board. Washington DC, January 2003.

[3] Zhou, Y., Viswanathan, K., Popuri, Y., and Proussaloglou K.E. Transit District Customers in San Mateo County, California: Who, Why, Where, and How. Proceedings of the 83rd Transportation Research Board. Washington DC, 2004.

[4] Wornum, C. Private Sector Market Research Techniques: Advancing Customer-Responsive Transit Service Design. Proceedings of New Frontiers. Amsterdam Holland, December 2007.

Structural Equations modeling to develop traveler market segments) and is irrespective of the current transit service level.

We have developed techniques for assessing these critical conditions in each travel market that will determine the most competitive and cost-effective transit service. These techniques involve calculating a TCI, which is a composite metric that provides a single score of the transit market conditions and opportunities for each origin, destination and O-D pair in a transit agency's service area. The TCI measures the conditions within a given origin, destination, or O-D pair (i.e. Traffic Analysis Zone or TAZ) that determine the ability of transit to compete with automobiles for customers. This index combines the concentration of the market segments together with various market conditions within a specific travel market (i.e., O-D pair or corridor). These market conditions may include travel volume, traffic congestion, land use density, mix of land uses, socioeconomic composition, parking supply and cost, pedestrian environment, and other market conditions.

The TCI considers the market conditions and weights them in proportion to their relative effect on mode choice. This is done using the coefficients in the mode choice models, which is estimated for each market segment. TCI analysis gives three indices to describe the overall transit competitiveness of a place. Each traffic analysis zone (TAZ) is assigned two indices that describe the relative market ability of transit to compete with automobiles for customers. One index quantifies the ability of transit to compete for trip productions (i.e., origins). The second index quantifies the ability of transit to compete for trip destinations (i.e., attractions). A third index is developed based on origin-destination pairs. Recognizing that TAZs are often too disaggregated to glean useful information from in either tabular or graphic form, they may be combined to form larger areas with a corresponding weighted TCI for the area. Viewing the TCIs at this district level is especially important when analyzing origins and destinations together, with what would otherwise be thousands of pairs.

As opposed to being a number of seemingly meaningless magnitudes, the meaning of the TCIs is further enhanced by calibrating them to an easy to understand scale. The scale used to calibrate each TCI is set so that a marginally competitive zone has a TCI of 100. A zone with a TCI of 50 is half as competitive, and a TCI of 200 would be twice as competitive. While the primary usefulness of TCI is its relative simplicity, we recognize that for some locations planners will want to know what contributed to the transit competitiveness. Each TCI may be broken out into the contributing market conditions: 50 percent of a destination TAZ with TCI of 200, for example, may be a result of high parking prices, 30 percent caused by high density office space, 10 percent because of congestion, etc. Each of these reasons and their relative share of the TCI provide a quantitative understanding of what challenges and opportunities exist in these markets, what drives the transit competitiveness of a place, and an assessment of how customers may respond should any of these conditions change. For example, if a large portion of a destination's transit competitiveness is driven by the scarcity of parking, it would be important to know that a large parking deck would cause a significant drop in transit ridership as opposed to a destination where parking availability was a smaller factor in its TCI.

Because most things are most easily characterized with graphics, we have developed a dynamic GIS tool that allows users to group TAZs into larger areas. A user may then view the composite TCIs and examine the breakout of a TCI into its component market conditions, where the contribution of each condition is displayed as bar charts. The ArcGIS based tool also displays tables providing a breakdown of each single or aggregate zone's total trip

volume by trip purpose, socioeconomic characteristics, concentration of market segments, current transit ridership, and other statistics. These maps can reveal sobering explanations for low ridership, or demonstrate how well aligned current transit service or planned extensions of existing service are with favorable competitive conditions.

These results have recently been used in San Diego County and in Silicon Valley by the Santa Clara Valley Transportation Authority (VTA) to launch potentially significant realignments of service. The Salt Lake City region, San Francisco, suburban Chicago, and Austin (Texas) are all in the process of evaluating their service and the competitive conditions they are facing. These evaluations may lead to perhaps the most compelling application of these results. Most transit agencies in the United States are required by political fiat or because of an internal mindset for supply-side planning to provide transit where it is not competitive given current market conditions. This information provides both the transit agencies and the communities in which they are trying to serve with some clear choices: Either the communities must do more to make transit competitive or the agency should cut back or abandon service in these areas. The TCI analysis shows both parties what is needed and where. Cities may need to increase the price of parking, provide exclusive right-of-way for transit, better pedestrian environments, higher density housing or employment centers, etc. Although the half-dozen applications of this market research to long-term transit planning are in their very early stages, a few agencies may be using the information to set thresholds for continuing or extending service. Since the TCI analysis can quantify the potential impact these will have on ridership, transit agencies can negotiate with jurisdictions over what is needed to generate acceptable levels of ridership. The TCI methodology provides an easy to understand tool that generates actionable analysis useful to planners and decision-makers at PSRC and other regional transit planners.