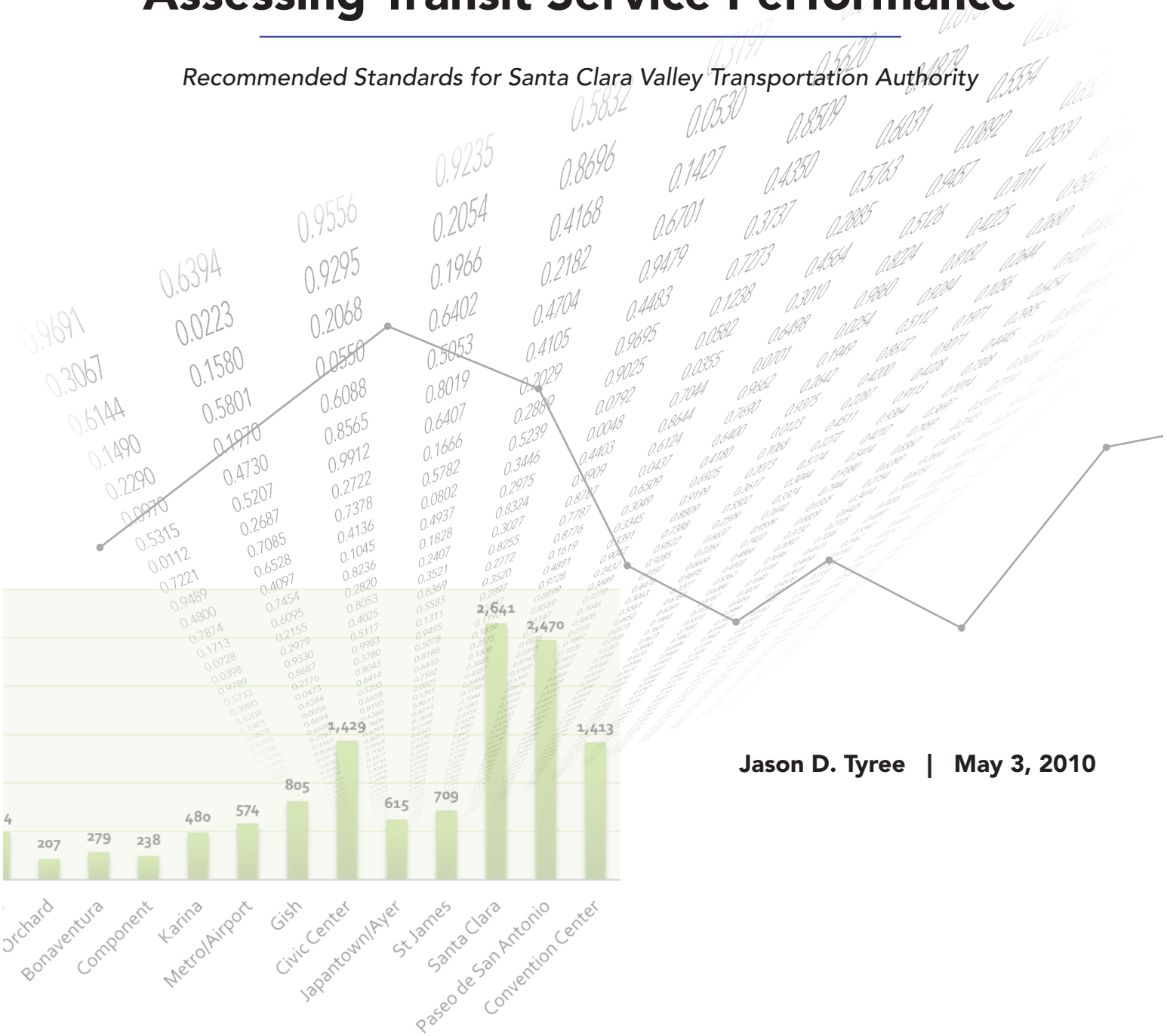
Assessing Transit Service Performance

Recommended Standards for Santa Clara Valley Transportation Authority



Jason D. Tyree | May 3, 2010

Assessing Transit Service Performance: Recommended Performance Standards for the Santa Clara Valley Transportation Authority

A Planning Report

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Jason D. Tyree

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This work is dedicated to the residents of Santa Clara County, California.

1. Poor Transit Performance: Not Your Neighbor's Problem

This research examines the practice of performance measurement in public transit service. The topic may seem trivial, but the implications are certainly not. An agency that has a good performance measurement system in place can offer transit service most efficiently and potentially save millions of taxpayer dollars. This section explains how the performance of transit service is related to the well-being of the community as a whole.

PUBLIC TRANSIT: FOR ALL, FROM ALL

Public transportation is probably not the first thing that comes to mind when asked to think of a government service, yet it is indeed an important service that local governments provide. Public transportation helps to move people around efficiently, reducing congestion on our local roads, expressways, and freeways. Public transportation is an important component of creating livable communities. Public transportation services come at a considerable cost, however, and just as the benefits are enjoyed by the entire community, the costs are also borne collectively. Since everyone is invested in the provision of public transit through taxes, it is important to make sure that it is being delivered efficienctly and effectively. The subject of this research is to examine how transit agencies can improve efficiency and effectiveness through the use of performance measurement.

The American people can be a tax-averse population. While we collectively pay about $4 trillion in federal, state, and local taxes annually, we are quick to ask how our tax burden can be reduced and how our money can be spent more wisely.[1] The modern politician seems to instinctively gravitate towards a position of lower taxes whenever faced with an election, which is perhaps a reflection of public sentiment. Along with this mantra of cutting taxes, there exists another strong public desire to curb perceived waste in government spending. So not only do we want our government to spend less, but also to spend more wisely. The first directive is debatable by some. The second directive is sensible to all. In order to spend our public money more wisely, we need to examine the expenditure of public funds, which we usually are fairly good at doing. We look at how the Department of Motor Vehicles spends money on office supplies; we scrutinize Department of Defense contracts; we pay attention to how well our cities pay their firefighters.

Likewise, Public transportation agencies should be afforded the same critical evaluation if we are truly interested in improving government efficiency. A typical metropolitan transportation agency

[1] The Economist, "Public-Sector Finances: The State's Take," *The Economist*, November 21, 2009: 79.

can spend well over $100 million a year of taxpayer funds[2] — which is a significant amount of the community's money. Considering such large amounts of public funds are at stake, everyone in the community should care how it is being spent.

In order to critically examine the efficient expenditure of public funds, this report looks at the practice of performance measurement throughout the public transit industry in the United States and specifically at a large public transportation agency in San José, California. The Santa Clara Valley Transportation Authority (VTA) is the public transportation provider for Santa Clara County, which is well-known as "Silicon Valley," a center of high-technology and innovation. VTA provides multi-modal transit services such as bus, light rail, commuter rail (through its partnership with the Joint Powers Board in operating Caltrain), paratransit (through partnership with Outreach, Inc.), and express buses. It has adopted a program of transit performance measurement, but its results are less than effective. This paper will synthesize conclusions from research in the field and suggest improvements that VTA can make in its performance measurement program for VTA to consider. The focus of this research is on experiences from transit agencies within the United States, though there are occasional lessons to be learned from abroad.

Funding Public Transit Agencies

Public transit agencies in the United States receive a considerable portion of their operating income from taxpayer dollars. Many people do not realize the extent of the public subsidy that is involved in the provision of transit service. Perhaps because transit agencies charge a fee (fares) for their service, people think of transit agencies more as private businesses and less as government agencies.

However, virtually no transit agency could exist without heavy public subsidies. Indeed, usually more than half of an agency's operating budget comes from general taxes.[3] Figure 1 shows 2008 data from the Federal Transit Administration's National Transit Profile, illustrating the typical U.S. transit agency's sources of operating funds.[4] Notice that 63% of a typical agency's operating funds come from some level of public tax money — either local, state, or federal. Fares typically make up only 31% of an agency's operating funds, which is called an agency's farebox recovery ratio.[5] The typically low farebox recovery ratio comes as a surprise to many. Even more surprising is the wide variability of farebox recovery ratios amongst transit agencies. Some agencies can receive upwards of

[2] Federal Transit Administration, "Performace Measurement," *Planning & Environment*, 2008, http://ww.fta.dot.gov/printer_friendly/planning_environment_4001.html (accessed August 2, 2009).

[3] Snehamay Khasnabis, Emadeddin Alsaidi, Libo Liu and Richard Darin Ellis, "Comparative Study of Two Techniques of Transit Performance Assessment: AHP and GAT," *Transportation Engineering* 128, no. 6 (Nov/Dec 2002): 499.

[4] The Federal Transit Administration is a Federal government agency which oversees public transit nationwide. It is part of the Department of Transportation.

[5] Farebox recovery ratio is a common measurement that transit agencies use to gauge service performance. The ratio is the percentage of transit operating expenses that are recouped by fare revenues.

70% of their operating revenues from fares, while others recover even less than 10% from fares. Khasnabis et al. determined that the typical range for most agencies is from 15% to 35%.[6] For VTA, fares constitute an unusually low 14.2% of operating funds.[7] This means that VTA is even more reliant on public funds than most transit agencies are in order to provide service. Considering that so much of a transit agency's money must come from taxes, taxpayers should care about how well this money is being spent.

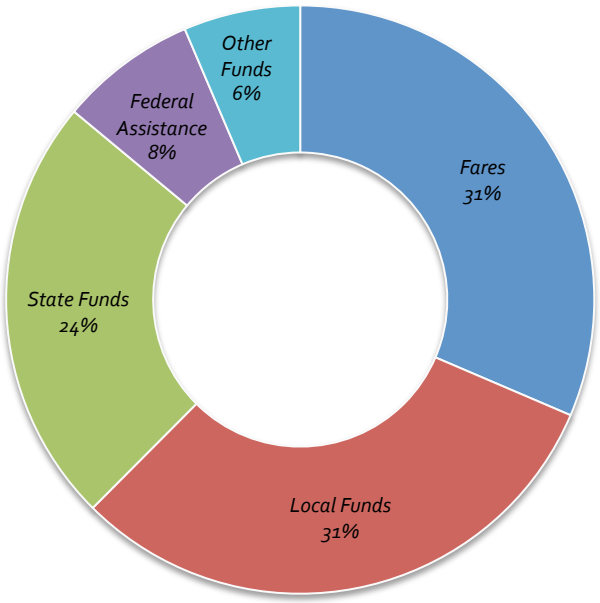

Figure 1. Typical Operating Sources of Funds
Source: Transit Administration National Transit Database 2008

An interesting feature of transit financing is that those who pay the largest share of public taxes are least likely to actually use transit service from day to day. Due to our national (and often statewide) progressive tax structure, higher-income individuals pay a disproportionate share of total taxes collected. For example, the Internal Revenue Service collected 61.3% of its total income tax revenue from the top 10% (by income) of taxpayers.[8] This means that it is the rich that pay most of the taxes collected, which is important for transit agencies because there is a disconnect between the primary users of the service and those who pay for it. Thompson and Matoff point out that large regional transit agencies owe much of their existence to the tax payments of the wealthy suburbs – precisely those people who are unlikely to use public transit.[9] This odd situation where the users of a service are not bearing the brunt of its costs may explain why transit performance fails to garner the attention it deserves. The riders are less likely to care when they notice that the route they take everyday to work seems to carry just a handful of riders because someone else is largely paying for it. The wealthy non-riding taxpayers see transit as a way to reduce congestion on the freeways and roads; riders see transit as a public service to help them get around. From any perspective, improving transit performance is in everyone's best interest because performance improvements translate into more public benefit for the entire community.

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[6] Khasnabis et al., "Comparative Study," 499.

[7] Santa Clara Valley Transportation Authority, "Short Range Transit Plan FY 2010-2019," (San José, 2009): 11.

[8] Julie-Anne Cronin, *Working Paper #85: U.S. Treasury Distributional Methodology*, Office of Tax Analysis (Washington, D.C.: Department of the Treasury, 1999).

[9] Gregory L. Thompson and Thomas G. Mattof, "Keeping Up with the Joneses," *Journal of the American Planning Association* 69, no. 3 (2003): 301.

Why We Spend Public Money on Transit

One might ask why the general public is willing to subsidize transit to such a high degree, given the dominance of car travel over transit. The answer is similar to the reason why government provides any other service — government services benefit the community as a whole and private markets undersupply them.[10] To economists, this concept is called welfare maximization, but to the public and to urban planners it means making our communities better. We provide police service for our communities because it has the benefit of maintaining order and safety in our lives. We provide a court system because it has the benefit of reducing crime and fostering a business environment that follows the rules. We provide basic education because it has the benefit of increasing economic strength and prosperity. The benefits of all of these public services are spread throughout the community so that the cumulative effect is to increase the well-being of our society.

The provision of public transit provides similar benefits that are shared by the entire community. Public transit provides the primary public benefit of congestion reduction and increased mobility, but there are other public benefits as well. Research by Bhatta and Drennan found considerable evidence that public transit yields benefits to the community in the form of increased output, increased productivity, lower production costs, higher incomes, higher property values, higher employment, and reduced noncommercial travel time.[11] A 1999 report by Cambridge Systematics found that every $1 invested in public transportation projects generates approximately $6 in local economic activity.[12] These are benefits that the entire community enjoys, which is why the community subsidizes transit. It is therefore in the community's interest to improve transit performance, so that the public benefits can be maximized. Huge decisions are being made every day at transit agencies nationwide, often involving millions of dollars of public money. The extent to which we improve these decisions will determine how successful transit can be in creating more livable communities.

Performance Matters

Transit agencies want people to ride transit. As more people ride transit, the public benefits get larger and the community is made better off. The agency benefits from additional fare revenue and is also able to spread its fixed costs over a larger number of riders, reducing its average cost per rider. This means that attracting riders is in the front of transit managers' minds. As Miller et al. put it in their review of transit performance, "passengers are the *raison d'etre* of transit travel and

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[10] Bruno De Borger, Kristiaan Kerstens and Alvaro Costa, "Public Transit Performance: What Does One Learn from Frontier Studies?," *Transport Reviews* 22, no. 1 (January 2002): 1.

[11] Saurav Dev Bhatta and Mathhew P. Drennan, "The Economic Benefits of Public Investment in Transportation," *Journal of Planning Education and Research* 22, no. 3 (2003): 288-296.

[12] Cambridge Systematics, Inc., *Public Transportation and the Nation's Economy: A Quantitative Analysis of Public Transportation's Economic Impact*, (Washington, D.C.: Cambridge Systematics, Inc., 1999).

their perceptions and needs are central."[13] Since passengers are the prime reason for transit and agency managers want passengers to ride, managers are keenly aware of the concerns of riders who may or may not ride transit. As agencies better understand transit service from the passenger perspective, they can provide better service and get more people to ride.

Transit Agency Goals

Transit agencies are like private companies in that they exist in order to achieve certain goals. For private companies, the overarching goal is almost always profit generation; for charitable organizations it may be protecting rainforests or feeding children. For transit agencies, the goals are usually more complex but center around the idea of improving the livability of the community. Grava offers some typical goals of transit agencies:

- Improve the commute of a maximum number of workers
- Increase mobility for everyone
- Provide a high level of safety, security, amenities, etc.
- Improve the environment
- Conserve resources (especially fossil fuels)[14]

Notice that each of these goals is directly related to the number of people riding transit. As more people ride, each goal is advanced. In this way, ridership[15] is a sort of indicator that shows how well an agency is doing what it should. DeBorger et al. declare that since passengers are the main reason for transit's existence, any performance measurement system must include ridership at its core.[16] As will be shown in Chapter 2, many performance measures do include ridership as an element because these measures offer an objective and quantified assessment of service performance, which helps managers increase ridership.

Researchers generally agree that transit performance standards should be tied closely to their goals. If performance measures are tied to goals, the performance of routes and the performance of the agency will be closely related. In this respect, the creation of effective agency goals and the subsequent creation of related performance standards is extremely critical. Poorly conceived performance standards, or a lack of having them altogether, may have a detrimental effect on agency goals or give erroneous conclusions regarding service.

The transit industry is moving in the right direction, using better performance measures and using them more extensively. Indeed, a Transit Cooperative Research Program (TCRP) survey by Benn

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[13] Mark A. Miller, Michael Smart and Brian D. Taylor, "Transit Stops and Stations: Transit Managers' Perspectives on Evaluating Performance," *Journal of Public Transportation* 12, no. 1 (2009): 59.

[14] Sigurd Grava, *Transit Performance Measures*, (Institute for Civil Infrastructure Systems, 1998): 3, parenthesis added.

[15] "Ridership" is a general term which indicates the number of people who ride a transit service. It can be represented as boardings, alightings, or linked passenger trips (not including transfers), depending on the situation.

[16] De Borger, Kerstens, and Costa, "Public Transit Performance," 19.

found that performance measurement usage is growing steadily over time.[17] These standards are usually quantifiable metrics that help managers determine service performance. Theoretically, these standards allow transit managers to objectively assess the performance of their services and make better decisions regarding allocation of resources (money). In reality, considerable disagreement exists concerning the use of performance measures.[18] In effect, most researchers agree on the need to quantify performance, but they do not agree on how to do so.

VTA has attempted to implement service performance measures like many similar agencies. In February 2007, VTA adopted its Transit Sustainability Policy (TSP), which includes a comprehensive program of service performance measures. VTA acknowledges its "fiduciary and professional responsibility to use its revenues and funding effectively and efficiently,"[19] which led to the creation and adoption of the policy. As a government agency tasked with the responsibility of spending over $300 million in taxpayer dollars annually, VTA recognizes the need to improve transit service performance and allocate its resources to their highest and best use.[20] The program of performance measurement seeks to support the following goals for the agency:

1. Improve System Ridership, Productivity, and Efficiency
2. Improve Farebox Recovery
3. Improve Transit's Role as a Viable Alternative Mode
4. Use Transit Investments and Resources More Effectively[21]

The set of performance measures outlined in the TSP works to achieve these goals and improve the effectiveness and efficiency of VTA. The TSP outlines performance measures such as boardings per station, boardings per revenue mile, and minimum peak load factor, all of which attempt to evaluate service performance by route and offer managers insight into how to improve performance.

With the TSP and its associated performance measures, the foundation for improving performance has been built. However, more work needs to be done to refine the TSP and improve the usefulness of the performance measures. Since the adoption of the TSP, VTA has seen mixed results regarding its effectiveness. For example, staff analysts prepare a quarterly report of service performance, which evaluates routes based on the TSP performance standards. Many VTA managers use the report to compare performance between routes. However, the TSP standards fall short on some crucial components, such as determining the benchmark value that a service must meet in order to be considered effective. Senior VTA planners have repeatedly expressed a desire for a more robust and effective TSP so that public money can be spent more wisely. This research

[17] Howard P. Benn, *Bus Route Evaluation Standards: A Synthesis of Transit Practice*, (Washington, D.C.: Transportation Research Board, 1995): 25.

[18] Khasnabis, et al., "Comparative Study," 499.

[19] Santa Clara Valley Transportation Authority, *VTA Transit Sustainability Policy & Service Design Guidelines*, (San José, CA: Santa Clara Valley Transportation Authority, 2007): 1.

[20] Santa Clara Valley Transportation Authority, "Short Range Transit Plan FY 2010-2019," 14-37.

[21] Santa Clara Valley Transportation Authority, *VTA Transit Sustainability Policy,* 2.

aims to provide VTA managers with exactly the tool they need to guide public funds more effectively.

This research also examines the topic of performance measurement throughout the industry, focusing on transit in the United States in order to minimize the variability of differing regulatory environments, social norms, and funding mechanisms. It applies the lessons learned to the practice of performance measurement at VTA and suggests improvements in order to make VTA's use of performance measures more effective. The goal is to make VTA a more effective and efficient transit provider, which will benefit the entire community it serves.

Organization of the Report

Lessons learned from relevant literature on the subject are incorporated throughout the report. Chapter 2 reviews a range of typical transit performance measures and discusses the logic behind each one. Chapter 3 describes VTA's use of transit performance measures. Chapter 4 is a peer review and attempts to identify best practices in the industry in order to formulate effective recommendations for VTA. Finally, Chapter 5 provides six recommendations to improve VTA's performance measures and the TSP.

2. Common Performance Measures

Virtually all transit agencies agree on the need to measure performance, however few agree on how best to do so. The same disagreement exists throughout the literature on transit performance — even the experts disagree on how performance should be measured.[1] The disagreement is especially striking when the goal is to measure qualitative characteristics of transit such as comfort, safety, and accessibility.[2] This research focuses on the quantitative measures of transit service performance, if for no other reason than the qualitative measures are simply too difficult to standardize in any meaningful and consistent way, in addition to the reality that they are difficult to make effective. This chapter introduces the types of performance measures and gives an overview of some commonly used measures.

Qualitative Versus Quantitative Measures

Performance measures are numerous. A study by Phillips catalogued a menu of no less than 222 different performance measures in use throughout the industry![3] Other studies found fewer measures, though they do confirm that there are plenty. Benn found the use of 44 different measures in use amongst the 111 agencies he surveyed.[4] Distilling the multitude of performance measures helps to understand them. Performance measures can be grouped into two broad categories based on whether they measure qualitative or quantitative characteristics.

Some measures are qualitative in nature and attempt to measure characteristics such as safety, security, comfort, convenience, or accessibility. These are the tough ones to use, because they require quantifying a qualitative feature. Imagine a transit manager tasked with improving safety throughout a system of several dozen bus routes. First, he would need to assess the safety of each route, which would require somehow defining and quantifying the term "safety." Immediately this becomes a subjective exercise, because safety can be quantified in many ways. Should the manager use the number of traffic collisions the transit buses were involved in? Or perhaps tackle safety from the passenger perspective and survey how safe the riders feel at the route's stops? Like other qualitative measures, it is very difficult to produce an objective assessment of the characteristic measured. This is not to say that these measures are not important. Indeed, Smart et al. believe

[1] Khasnabis et al., "Comparative Study," 499.

[2] Ibid.

[3] Jason Keith Phillips, "An Application of the Balanced Scorecard to Public Transit System Performance Assessment," *Transportation Journal* 43, no. 1 (January 2004): 26-55.

[4] Benn, *Bus Route Evaluation Standards*, 25.

safety, for example, is the prime concern for transit managers. However they do acknowledge that it is difficult to get a grasp on the issue of safety since it lies "often partially and sometimes completely outside the control of transit agencies."[5] Khasnabis et al. similarly conclude that there is no consensus on how to quantify qualitative measures.[6] Quantitative measures, on the other hand, are by their nature easier to use and can be much more useful.

Quantitative performance measures attempt to measure characteristics such as on-time performance, cost efficiency, revenue generation, labor efficiency, and service utilization. These characteristics are numerical by nature and beg to be compared! Imagine a transit manager tasked with assessing and improving on-time performance. He only needs some basic policy direction regarding what is to be considered "on time" (such as a bus arriving between one minute before and five minutes after a scheduled time) and the task primarily becomes one of collecting and organizing the relevant data. Once the basic policy direction is agreed upon, the quantitative measures are quite objective by nature.

Quantitative performance measures are also more useful because they can be more closely linked to revenues and expenses. Usually the first thing an outsider such as a policy maker, taxpayer, or news reporter thinks of when they consider government efficiency is money. How much money is coming in and how much is going out? Quantitative measures are easy to understand in this sense, because they can directly involve either expenses or revenues. Sure, the case can be made that objective measures such as safety can be related to revenues (riders who feel safer will ride more and generate more fare revenue), but the relationship is less clear and less direct.

Efficiency Versus Effectiveness

Quantitative performance measures can be further classified by whether they attempt to measure effectiveness or efficiency. Efficiency indicators measure how well an agency can maximize outputs and minimize inputs. For example, an efficiency indicator would measure VTA's proficiency at transporting a large number of passengers with a small amount of labor. A non-transit example would be measuring the efficiency of a gasoline engine based on its input (gasoline) and its output (miles), which leads to a mile-per-gallon efficiency indicator. As such, efficiency indicators are usually ratios of inputs and outputs.[7]

Effectiveness indicators are harder to understand and harder still to establish agreement. In general, effectiveness indicators are intended to measure how successful transit service is at achieving its goals. Gleason and Barnum offer a comprehensive and convincing argument on the topic of effectiveness indicators. They argue that performance measures dealing with effectiveness are

[5] Miller, Smart, and Taylor, "Transit Stops and Stations," 75.

[6] Khasnabis et al., "Comparative Study," 499.

[7] John M. Gleason and Darold T. Barnum, "Toward Valid Measures of Public Sector Productivity: Performance Measures in Urban Transit," *Management Science* 28, no. 4 (1981): 382.

commonly misunderstood, which has led to their inappropriate use and the misallocation of funds based on these faulty conclusions. Effectiveness indicators, they argue, should not be ratios and generally not include cost elements. These indicators should be absolute-level indicators that indicate how well agency goals are being met and, as such, should be tied directly to the goals of the agency. They point out that "in every case known to the authors, the goal is to maximize ridership," so the most appropriate example of an effectiveness indicator is one that measures absolute ridership. Of course Gleason and Barnum admit that their perspective on effectiveness indicators is not widely held (or used in practice).[8]

While there may be disagreement on the details of effectiveness and efficiency indicators, there is still general agreement on the principles behind each. Efficiency indicators measure how well something is done, as in minimizing waste during a process. In the transit industry, this usually translates into comparing an input (a resource such as service hours or route miles) to an output (such as ridership). Effectiveness indicators attempt to measure how well agency goals are being met. These indicators are usually not financial in nature. The next section discusses some common performance measures, grouped into either effectiveness or efficiency types.

Performance Measures for Effectiveness

Passengers. It is sometimes useful to measure the number of passengers riding a route or a system. This may be helpful when looking at a route's performance over time, for example. However, an absolute value measure of this sort only provides value when all other variables are held constant. For example, comparing the number of riders between two routes does not account for the possibility of vastly different resources devoted to a route (a route may have twice the riders as another, but have three times the service hours and therefore three times the cost).

Passengers per Station/Stop. This measures the number of riders that board at a particular stop. This indicator places emphasis on the stop instead of the transit route itself. This measure is most often used for light rail, commuter rail, or Bus Rapid Transit (BRT)[9] stops where considerable capital investment in the station has been made. An example of this measure is shown in Figure 2. This chart shows a selected group of VTA's light rail system stations and displays the average weekday boardings (passengers) per station in fiscal year 2009. The chart makes it quite clear that this sort of indicator can be very useful in gauging the effectiveness of each light rail station.

[8] Gleason and Barnum, "Toward Valid Measures of Public Sector Productivity," 383.

[9] Bus Rapid Transit (BRT) is a relatively new premium transit mode that incorporates features of both light rail and bus service. As such, it is a unique and distinct transit mode.

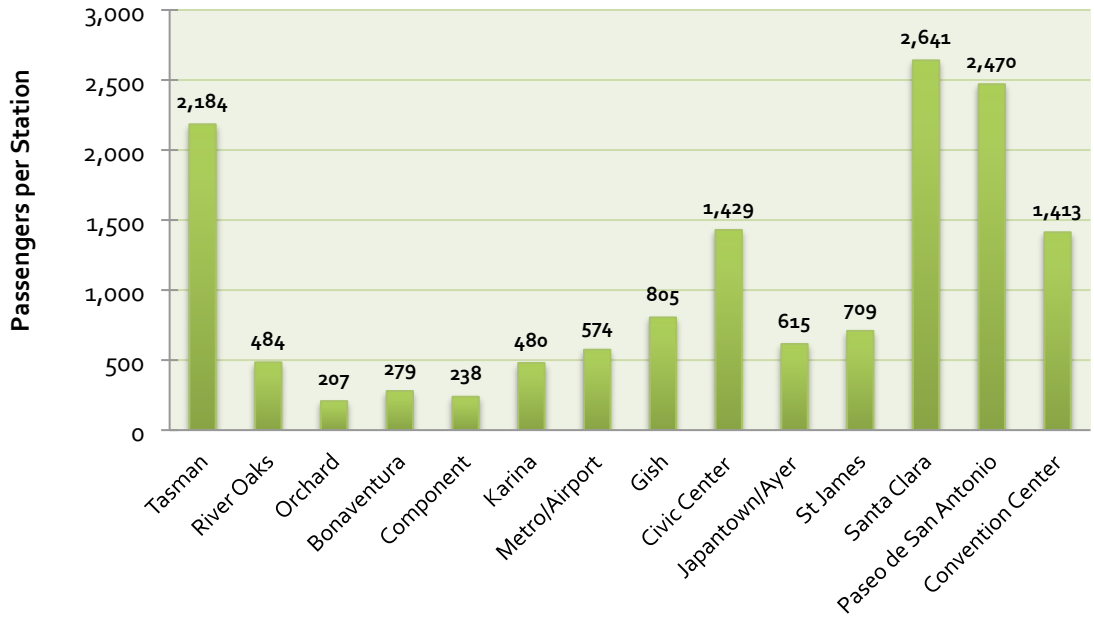


Figure 2. Passengers per Station Example Chart
Source: Santa Clara Valley Transportation Authority Service and Operations Planning, FY 2009

Propensity to Use Public Transportation. This is an agency-wide indicator that shows the number of transit trips per capita of a service area's population on an annual basis. This indicator is useful for comparing the propensity of transit use between regions/agencies or to compare an individual agency's performance over time.

Performance Measures for Efficiency

Passengers per Revenue Hour. If there were one singular performance indicator that warrants special consideration, passengers per revenue hour would be it. A survey by Benn found that this indicator is the single most common service performance indicator in the industry and is used by 78% of the agencies surveyed.[10] Other studies concur that this indicator is the most widely used, including Urbitran Associates, Khasnabis et al., and Mistretta et al. The indicator is a measure of productivity and works by comparing the number of passengers on a route, an output, to the number of revenue hours, an input.

Benn offers some insight into why this indicator may be so popular. It would be hard to find another indicator that does as good of a job at relating the most important output, number of riders, to one of the most important inputs, service hours. The number of riders is the most important output because agencies want to maximize the public good they provide. The number of service hours deployed on a route is often the most important input because 80% of a typical

[10] Benn, *Bus Route Evaluation Standards,* 17.

agency's costs are from wages, which are measured by the wage rate per hour and is directly related to the number of service hours. In other words, an agency's largest component of total operating costs is staff wages, which are paid by the number of service hours delivered. So in this way, this performance measurement captures an output that the agency wants to maximize and an input that it wants to minimize.[11]

Figure 3 shows an example of this indicator in use. The data plotted on this graph are for VTA's 52 non-express routes where each dot represents a route. Each route's revenue hours are shown on the y-axis and the number of daily boardings on the x-axis. Charts like this show the efficiency of each route, and outliers can immediately pop up (notice the dashed trend line, which indicates the two variables are roughly proportionally related; notice also that a few routes seem to deviate from this trend a bit, which may lead a manager to further examination of their performance).

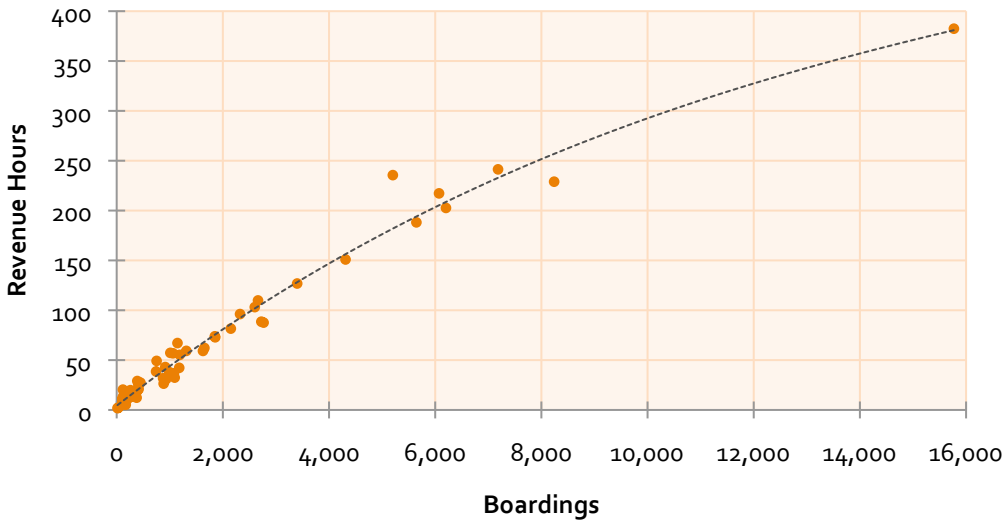


Figure 3. Boardings per Revenue Hour Chart Example
Source: Santa Clara Valley Transportation Authority Service and Operations Planning, FY 2009

Passengers per Revenue Mile. This productivity measurement is similar to passengers per revenue hour but considers the route length as the input instead of service hours. This reflects the desire to capture another important input in some transit routes since many mode types have considerable capital investments that are closely related to route length. Light rail, for example, is a transit mode where the amount of capital investment is closely related to the route length. The principal advantage of this measure is that it attempts to capture (roughly) the capital investment that went into each route, line, track, etc. The principal disadvantage is that it does a poor job of capturing the main cost driver for an agency — revenue hours.

[11] Benn, *Bus Route Evaluation Standards,* 17.

Peak Load Factor. This indicator is commonly used for express bus service, where seat turnover is low and people spend longer periods of time on the bus. These routes have fewer pick-up stops and travel non-stop to their final destination. Because of their unique travel nature, it is more useful to measure express performance based on how full the buses on the route usually are. Peak load factor takes the average load (number of riders) on the bus at the peak segment (usually between the last pick-up stop and the final destination). Peak load factors are usually expressed in percentages. For example, a peak load factor of 40% indicates that a bus on a particular route will usually be 40% full.

Operating Cost per Hour. This measurement is a measure of efficiency and shows how much it costs an agency to deploy an hour of service. This is another indicator that incorporates the high cost of labor. This indicator is especially useful to compare an agency's performance over time.

Operating Cost per Mile. This measurement is similar to operating cost per hour but measures the cost per mile in an attempt to account for capital investments that track with route length.

Average Fare per Passenger. This is a common measurement used to measure the average fare paid per passenger. This indicator can help assess the impacts of fare policy changes or implementation of new fare technology (such as smart cards or passes). It can also show the long-term trend of the agency's fiscal performance.

Cost per Passenger. This measure is similar to the average fare per passenger but looks at the ratio from the cost perspective. This indicator is useful for assessing the impacts of changing cost elements (such as wage costs, fuel costs, etc.) over time.

Farebox Recovery Ratio. This is another common measurement which shows the ratio of operating expenses that are recovered from fares. Farebox recovery ratios vary greatly from agency to agency and from mode to mode. A healthy farebox recovery ratio generally indicates service that is well-used and a relatively efficient service delivery. A hypothetical scenario helps to understand how farebox recovery works. Imagine two buses, both of which cost $20,000 per day to operate. Now imagine bus A carries 1,000 riders per day and bus B carries 5,000 riders per day. Assuming both have a similar average fare per passenger (let's say $1), bus A has a farebox recovery ratio of 25% and bus B is 5% (total fare revenue received divided by total operating cost). A healthy farebox recovery ratio indicates service that is both well used and well delivered.

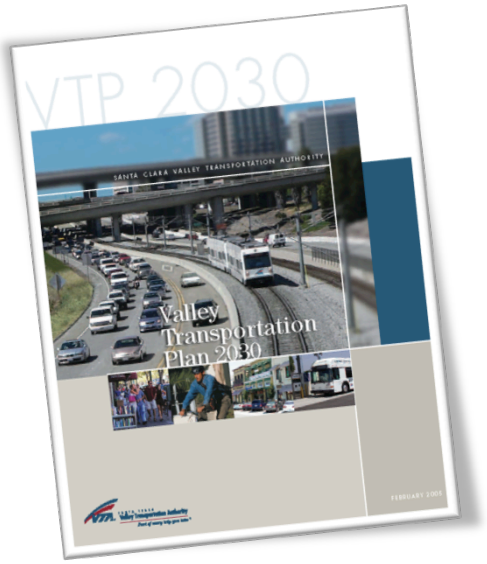
Given the number of standards, it is no surprise that performance measurement remains elusive and confusing to many transit managers. With agency goals in mind, an agency can put a few relevant ones to work and make considerable improvements in efficiency and effectiveness. Fortunately, VTA is moving the right direction and has adopted a system of performance improvements, flawed as they may be.

3. Not Effective: Performance Measurement at VTA

VTA's efforts to use performance measurement to improve transit service have been marginally effective. The agency has produced and adopted a system of performance standards, however the system lacks detail regarding the process for using them. The standards themselves could be improved as well. This chapter takes a critical look at Transit Sustainability Policy and flags potential areas for improvement.

History of the Transit Sustainability Policy

Prior to February 2007, VTA lacked a standardized process for evaluating both existing and proposed transit services. Existing service was assessed based on a multitude of performance measures, with no clear direction regarding which ones were important. Even after assessments were completed, they could be (and were often) ignored by senior managers and policy makers. Proposed projects were evaluated by planning staff who would do their best to present an objective assessment of the project based on their professional judgment. However, when the ultimate decision would be made by the VTA Board (appointed by a rotating set of cities throughout the County), it would often be based on politics. After all, the VTA Board operates in the political arena, and without an effective system of objective assessment, how else would the Board make its decisions? Some argued that projects to extend the light rail system moved forward as if they were on autopilot, with nary a concern regarding whether they actually made sense or not. Political power often ensured the continuation of poorly performing routes. It became clear to many senior managers at VTA that the financial health of the agency was in long-term danger. The lack of planning that went into many projects was particularly frustrating to planning staff, and it became clear that the process needed to be de-politicized.[1]



Valley Transportation Plan 2030 (Image: VTA)

[1] Chris Augenstein, interview by Jason Tyree, (January 18, 2010).

In an effort to introduce good planning into the decision-making process, VTA planning staff set out to create a process and policy by which VTA would make decisions based on solid planning analysis. The first step was to acknowledge the intention to create such a policy, which was shown in Valley Transportation Plan 2030 (VTP 2030), VTA's long-term plan for transportation throughout the County (akin to a city's General Plan) adopted in February 2005. The text read:

> To help ensure that VTA's investments in current and future transit services are supported by local land use and policy decisions, VTA will develop a Transit Expansion Policy (TEP). Capital project funding and service expansion will be linked with the TEP, and apply to both bus and rail projects and services. The TEP will provide a policy framework for transit expansion, and establish thresholds for minimum commitments from local governments.[2]

Around the time staff was developing the new expansion policy, VTA had just completed a light rail extension project into southeastern San José and Campbell that many staff planners felt was an unjustified waste of money, and the agency seemed to be setting its sights on more light rail extensions — some wondered if there were no end in sight for new expansion projects. The effort to create an expansion policy could not have come at a more relevant time.[3]

The ensuing effort to create the expansion policy was a multi-year effort and had its own set of challenges. Staff looked to other transit agencies to gauge the best practices in transit expansion policies, but quickly found out that not many agencies had such a policy.[4] The ones that did have a policy provided some direction, but only minimally. Bay Area Rapid Transit (BART), for example, had an expansion policy with more than a dozen performance criteria without a weighting system to prescribe which ones were the most important.[5] Additionally, planning staff were facing significant resistance from staff in other departments who believed that such a policy could not be effective and would in fact harm VTA's ability to deliver projects. Planning staff continued with the effort, re-framing the expansion policy into a more comprehensive set of guidelines to ensure the financial sustainability of the entire agency. As the expansion policy began to include all aspects of financial sustainability, staff renamed the forthcoming document the Transit Sustainability Policy (TSP).

A separate effort proved to be a timely help in creating the TSP. In response to public concern regarding VTA's effectiveness and structure, in 2006 VTA hired an independent consulting firm called the Hay Group to perform a top-down review of the agency. As the TSP was being developed, the Hay Group's results were beginning to take shape in preparation for its ultimate report, which would commonly become referred to as the Hay Group Report. The Hay Group was discovering fatal flaws in VTA's organization and barriers to the agency's effectiveness, and included in these

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[2] Santa Clara Valley Transportation Authority, *Valley Transportation Plan 2030*, (San José: Santa Clara Valley Transportation Authority, 2005): 174.

[3] Kevin Connolly, interview by Jason Tyree, (December 2, 2009).

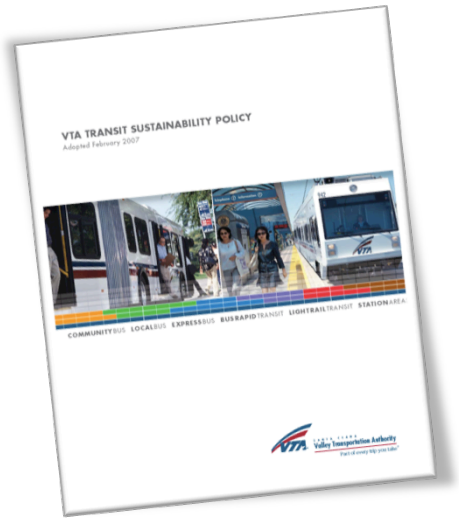
[4] Chris Augenstein, interview by Jason Tyree, (January 18, 2010).

[5] Kevin Connolly, interview by Jason Tyree, (December 2, 2009).

identified problems were the agency's use of performance measurement. The report concluded that VTA's existing performance measures were "not tightly linked to VTA's overall goals and objectives" which limited their usefulness. In addition, performance measures were "not tracked, reported or actively used to improve divisional or VTA performance," resulting in poor performing services not being held accountable.[6] The report highlighted and reiterated the need for VTA to continue developing the Transit Sustainability Policy. The release of the Hay Group Report in 2007 increased public awareness and provided a significant external boost to the TSP creation effort (internally, VTA staff remained skeptical of the report, fearing it would lead to a drastic reorganization that could alter or eliminate their jobs).[7]

The TSP effort continued and broadened its scope. As staff were developing the TSP, they realized that it could not only provide an objective assessment of existing and proposed transit service, but that it could also serve as a vehicle to engage local cities in transit supportive land use policies. Planning staff at VTA were quite aware that a critical reason why VTA transit service was so underutilized was due to the low density, sprawling land use patterns throughout Santa Clara County. The light rail system, for example, served areas of insufficient residential or employment density. If VTA could use the TSP as a tool to engage the cities in improving their land use policies, VTA could improve its transit performance in the long run. For example, if Sunnyvale wanted a light rail extension, the TSP could show that the extension's projected performance failed the standard. However, if Sunnyvale were to amend its General Plan to implement higher density development around the proposed light rail stations, the project might meet the projected TSP ridership standards and Sunnyvale could get the extension.

By the time the TSP was finished and up for adoption in February 2007, the policy had won over most of its critics and the Board adopted the policy without major disagreement. VTA finally had a comprehensive guideline for evaluating transit performance for existing and proposed service.



VTA Transit Sustainability Policy (Image: VTA)

About the Transit Sustainability Policy

The Transit Sustainability Policy is a 258-page document that is meant to provide an overview of VTA's different transit services and prescribe design and performance guidelines for transit service. The TSP itself is quite short (11 pages) and is a policy outline of

[6] Hay Group, *Santa Clara Valley Transportation Authority Organizational and Financial Assessment*, (San José: Hay Group, 2007): 16.

[7] Chris Augenstein, interview by Jason Tyree, (January 18, 2010).

transit, transit performance, and the performance measurement process. The bulk of the TSP is actually contained in its Appendix, called the Service Design Guidelines (SDG). The SDG is divided into seven sections that give service design guidelines and performance criteria for each of the transit modes VTA offers. VTA staff, and this report, use the terms TSP and SDG interchangeably when referring to the document as a whole, since the TSP and SDG come together as a package. The TSP sections are:

- Transit Sustainability Policy
- Modal Summary
- Community Bus
- Local Bus
- Express Bus
- Bus Rapid Transit
- Light Rail
- Station Areas

The Modal Summary section orients the reader to the different transit modes and offers a description of each mode, example vehicles, and the philosophy behind each mode. This section serves as a good reference for a reader who may be unfamiliar with the transit modes at VTA. The bulk of the document is spread throughout the five sections which detail each transit mode. Each section provides a fairly comprehensive set of guidelines for the mode. The guidelines include a modal overview, a set of performance standards, guidelines for designing routes, guidelines for stops and stations, vehicle characteristics, and specialized branding and marketing guidance. The Station Areas section provides guidance on integrating transit stations with surrounding land uses.

The information in each section is meant to be useful for the public and local government planners, but it is particularly geared toward VTA staff. Short-range planners (service planners) use the document as a reference when they propose route alignments and place transit stops/stations. Long-range planners use the document to evaluate performance, redesign transit networks, and consider new transit service. Marketing professionals use the document to gain direction regarding where to focus marketing efforts and how to market the services. Engineers use the document as they draft engineering plans for transit stations, exclusive transit ways, and other transit facilities. But perhaps most importantly, members of VTA's Board of Directors use the TSP to make informed and objective decisions regarding expenditures of public funds. Board members make their decisions in a political arena and they rely on the document to help them make decisions that are based on data and not popularity. For these reasons, it is important for the TSP to be effective, objective, and comprehensive. This chapter critiques the TSP using these criteria.

Common Elements Throughout the TSP

There are several concepts that are common throughout the TSP and apply to each of the modes. The writers of the TSP placed many of these elements in the Modal Summary section to enforce their applicability to all of the agency's transit services.

Over-arching Goal: Farebox Recovery Ratio Improvement. VTA correctly recognizes farebox recovery ratio as a good gauge to measure both the usage of transit service but also the efficiency with which it is delivered. To this end, VTA has adopted a goal of achieving a 20 to 25 percent farebox recovery ratio.[8] This means that for every dollar VTA spends on transit service, it hopes to recover 20 to 25 cents from fares. Everything in the TSP was crafted with this goal in mind and in the hopes of moving the agency toward this goal from the current recovery ratio of 14.2%.[9]

Primary Standards. VTA has adopted Average Weekday Boardings per Revenue Hour as the primary performance measurement to use for most transit service. This standard is the most widely-used performance measure in the industry today.[10] Express Bus service is treated differently due to the unique nature of the service (low seat turnover, few stops, freeway travel, and long distance routes) and is measured by Average Peak Load Factor as its primary performance measurement. These measurements, along with some secondary measurements for light rail service, form the backbone of the performance measurement process. As such, the tables throughout the SDG that outline the benchmark values by which service must meet are very important and are scrutinized in detail.

Probationary Period. The first common element is a "probationary period" for new transit service. The TSP recognizes that new transit service needs time to mature and should not be held to normal standards immediately. The TSP prescribes a gradual ramping up of performance expectations during the first two years of service. For example, a BRT service that has been in operation for 12 months is only expected to meet 80% of its performance target; a normal BRT standard is 200 average boardings per mile, so the new service is only expected to achieve 80% of this level, which is 160 average boardings per mile. Unfortunately, the TSP contradicts itself when prescribing performance expectations for each mode.

The Local Bus, Express Bus, and BRT mode sections each include a table which indicates the performance expectations for new transit service over their first 24 months of service. The Community Bus and Light Rail sections do not include such a table, which leaves the reader to wonder why. Are there no probationary periods for these modes? Did the authors simply forget to include the tables? At first glance it may appear that the answer may be found in the introduction, because it includes a table which is intended to give a summary of the probationary standards for all the modes. However, the standards presented here contradict the standards in the Local Bus and Express Bus sections.

Table 1 shows the probationary period standards as presented across the various tables in the TSP. The Local Bus, Express Bus, and BRT rows indicate the standards from each mode's section. The

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[8] Santa Clara Valley Transportation Authority, "Short Range Transit Plan FY 2010-2019," 4.

[9] Ibid., 11.

[10] Urbitran Associates, Inc., *Guidebook for Evaluating, Selecting, and Implementing Suburban Transit Services*, (Washington, D.C.: Transit Cooperative Research Program, 2006): 11.

All Service (Introduction) row indicates the standards from the Introduction section. Notice the inconsistency between the All Service row and the Local Bus and Express Bus rows (the inconsistent numbers are highlighted in bold text). Is a 6-month old Local Bus service expected to achieve 60% or 70% of its normal service standard? The inconsistency should be fixed to improve the credibility and usefulness of the standards.

Table 1. Probationary Period Standards

New Transit Service Performance Expectations				
Time from Implementation (Months)	6	12	18	24
	% Compliance with Service Standard			
Local Bus	**60**	**75**	**missing**	100
Express Bus	**60**	**75**	**missing**	100
BRT	70	80	90	100
All Service (Introduction)	**70**	**80**	90	100

Source: VTA Service Design Guidelines & Transit Sustainability Policy

Periodic Service Standards Review. The Introduction of the TSP includes guidance on how to update the TSP standards periodically so that the TSP retains its usefulness. The authors of the TSP wisely understood that conditions change over time and the standards need to be re-evaluated and adjusted accordingly in order to account for changes in the transit market, changes in revenues and costs, and other external factors. Unfortunately, the guidance is minimal and lacks sufficient detail in order to be of any use.

The Introduction includes two brief mentions of the process to review the TSP standards. In a sub-section titled Service Review, one sentence reads: "It shall be the policy of VTA to review all services for possible refinements at least annually."[11] This single sentence is meant to establish the policy of updating the TSP standards, but does not offer any guidance concerning the process by which the standards are updated. It does not answer some significant questions, such as:

- Who updates the standards?
- How are the new standards determined?
- Is a peer review involved each time?
- Is current performance in comparison to current standards considered?
- Does the VTA Board adopt the revisions each time?

These unanswered questions threaten the credibility and usability of the document. For example, the TSP was adopted in February 2007 and has not yet been formally updated or revised (as of January 2010). Since the policy is to update the standards "at least annually," the document is apparently outdated and a performance measurement based on its standards could be questioned.

[11] Santa Clara Valley Transportation Authority, *VTA Transit Sustainability Policy,* 5.

The Introduction includes another mention of the updating process, though it doesn't provide any clearer guidance; rather, it adds confusion to the issue. When discussing the primary standards for transit service, the text prescribes: "This standard is recalculated quarterly as part of the Service Management Plan (SMP), and may move up or down."[12] On the very same page that the TSP prescribed an annual update, now the TSP is prescribing a quarterly update. In addition, the reference to the SMP is outdated; the SMP is a transit service evaluation process that has since been discontinued and replaced by the Annual Transit Service Plan.[13] Clearly, this outdated and inadequate section of the TSP is in dire need of revision.

Evaluation and Recommendation Process. This section of the TSP is a well-written and useful section which outlines the process by which the TSP is used to make a recommendation regarding new transit service. This section prescribes a 4-step process by which projects are brought from concept to implementation. The steps are outlined below:

> **Step 1 – Project Proposal or Study Area Definition.** In this step, projects are conceptualized from a number of sources, including VTA Board direction, a ballot measure, or a planning study. The projects are defined to a level sufficient for a ridership analysis to be performed in the next step.
>
> **Step 2 – Ridership Analysis/Application of Service Design Guidelines.** This step involves projecting the project's ridership as defined in Step 1. Once ridership is projected, the performance of the new service can be determined and compared to the performance standards in the TSP.
>
> **Step 3 – Recommendations.** Based on the results of Step 2, staff then makes a recommendation either to move the project forward as defined, to modify the project for Step 2 again, or to drop the project. This step also includes securing the necessary agency and VTA Board approvals.
>
> **Step 4 – Implement and Monitor Service.** Following the approvals to proceed, the project is implemented. Following implementation, the performance of the project is monitored to assess its performance against the standards in the TSP.[14]

The process as outlined in this section is mostly sound, though Step 2 is missing important details regarding how to perform ridership analysis. The text does not prescribe what timeframe to use for ridership projections, which is an important detail that can lead to drastically different results, depending on the timeframe chosen. This is the final global element of the TSP that needs revision. Next, each mode section is evaluated separately.

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[12] Santa Clara Valley Transportation Authority, *VTA Transit Sustainability Policy,* 5.

[13] The Annual Transit Service Plan is an annual process by which VTA staff reviews and makes route modifications to improve system performance.

[14] Ibid., 8.

Local Bus

The Local Bus mode includes all buses that are not considered Community, Express, or Limited buses. This mode category includes the greatest number of routes, 34 as reported in VTA's 2010 Short Range Transit Plan (SRTP).[15] Similar to other agencies, local buses are the backbone of VTA's bus network and meet a variety of transportation needs. They offer a relatively high degree of flexibility when compared to other modes, offering the benefit of being able to adapt to changing travel market demands.

VTA Local Bus (Image: VTA)

There is an opportunity to improve categorization within the Local Bus mode. VTA categorizes local buses into smaller sub-categories, though it does not do so consistently across different documents. The TSP prescribes three sub-categories (in decreasing order of importance): Primary Grid, Secondary Grid, and Feeder. The agency's 2009 Short Range Transit Plan, however, groups and evaluates Local Buses using a different set of route types: Core, Local, and Feeder.[16] Imagine an unfamiliar reader's confusion upon learning that a sub-category of the Local Bus mode is also called Local. The 2010 Short Range Transit Plan makes matters worse by dropping the Feeder group altogether and combining the previous Feeder routes into the Local category.[17] The inconsistency between VTA documents illustrates the disjointed and uncoordinated process by which service planning is carried out. The sub-categories should be made consistent across all documents.

Table 2. Local Bus Performance Standards

Local Bus Performance Standards			
	Avg. Boardings Per Revenue Hour		
	Weekday	Saturday	Sunday
Primary Grid	30	30	30
Secondary Grid	30	30	30
Feeder	25	25	25

Source: VTA Service Design Guidelines & Transit Sustainability Policy

[15] A Short Range Transit Plan is a Federally-mandated planning document that details an agency's plan for transit service over a ten-year horizon. It includes a review of service performance, the agency's operating forecast, and the agency's capital program.

[16] Santa Clara Valley Transportation Authority, "Short Range Transit Plan FY 2009-2018," (San Jose, 2008): 5-7.

[17] Santa Clara Valley Transportation Authority, "Short Range Transit Plan FY 2010-2019," 5.

The TSP outlines performance standards for Local Bus as shown in Table 2. The text indicates that these performance standards were developed based on existing performance in Fall 2006. Here is where the issue of service standards review comes up for Local Bus. The footnote in the text indicates that "standards will be periodically updated to reflect annual average ridership performance."[18] Staff has interpreted this language to mean that the benchmark values should be updated annually and their values based on the average annual performance of each route category. Two annual documents serve as the vehicle by which VTA performs this update: the annual Short Range Transit Plan (SRTP; a public report mandated by the FTA) and the annual Transit Operations Performance Report (an internal report). Figure 4 is an example performance evaluation (for the Local Bus sub-category) as shown in VTA's 2010 SRTP. Eight of the sixteen routes meet the benchmark standard, as indicated by the dotted line; the other eight do not.

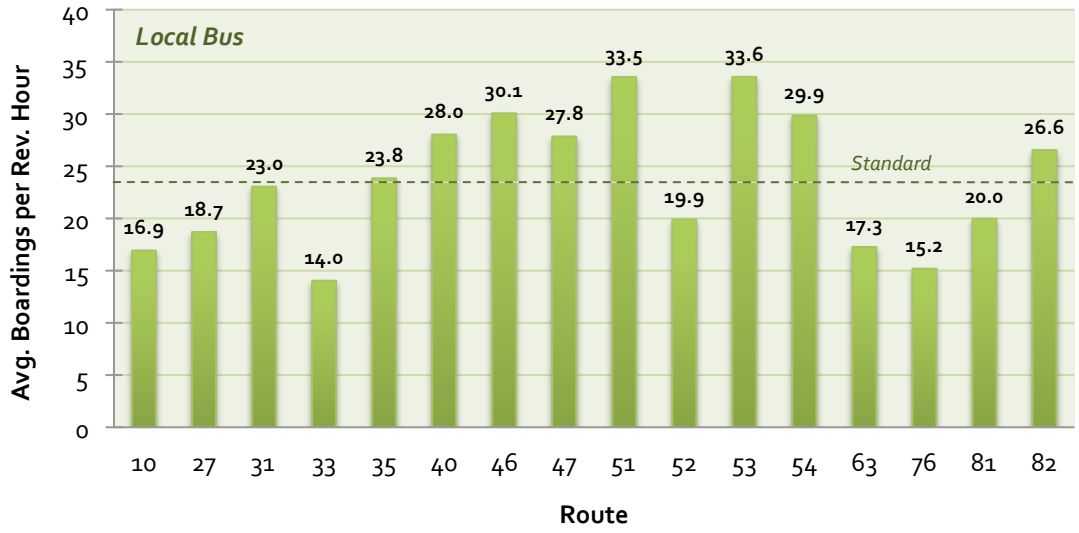

Figure 4. FY 2009 Performance for Local Bus

Source: VTA Short Range Transit Plan 2010-2019

As per the TSP, the benchmark standard is simply the average performance of all the routes in the category. This methodology yields some interesting results:

- Roughly half of the routes in each category fail the standard (a result of using the average performance for the standard)
- As performance for the system as a whole changes over time, the standard moves accordingly, which perpetuates the above result
- Individual lines that perform exceptionally well or particularly poorly will distort the standard
- Route categories that have routes that do not cluster together may have a standard that does not make practical sense (such as the light rail category explained later)

[18] Santa Clara Valley Transportation Authority, *VTA Transit Sustainability Policy,* LB3.

Many managers at VTA have questioned the usefulness of a standard that inherently causes about half of all routes to fail. It is hard to suggest discontinuing a route, for example, because it fails the standard, when there are quite a few routes that similarly fail the standard. The methodology for setting the benchmark should be evaluated to suggest improvements.

COMMUNITY BUS

VTA Community Bus (Image: VTA)

The Community Buses are 23 routes, including four shuttles, that typically operate small (30 foot) buses and serve as community feeders to the rest of the transit system. These routes are "typically deployed in lower-density residential developments, central business districts, and provide connections between residential areas and schools, shopping malls, employment centers, and recreational areas."[19] Community Buses have a lower fare than regular bus routes and this route category also includes VTA's free shuttles such as the downtown DASH and Great America shuttles.

Table 3 shows the performance standards for community bus. Again, average Boardings per Revenue Hour is the standard applied to this service, and the values in the table were set based on an evaluation of community bus performance at the time. Like local bus, the footnote for the table prescribes an annual update of the values in the table based on the average ridership performance.

Table 3. Community Bus Performance Standards

Community Bus Performance Standards			
	Avg. Boardings Per Revenue Hour		
	Weekday	Saturday	Sunday
Community Bus	20	20	20

Source: VTA Service Design Guidelines & Transit Sustainability Policy

Figure 5 shows the performance of the Community Bus routes as reported in the 2010 SRTP. Notice that even more than half of the routes (14 of the 23) fail the standard. This reiterates the need to revisit the benchmark setting process. Also notice that the Community Bus category as a whole generally performs worse than the Local Bus category.

[19] Santa Clara Valley Transportation Authority, *VTA Transit Sustainability Policy,* CB1.

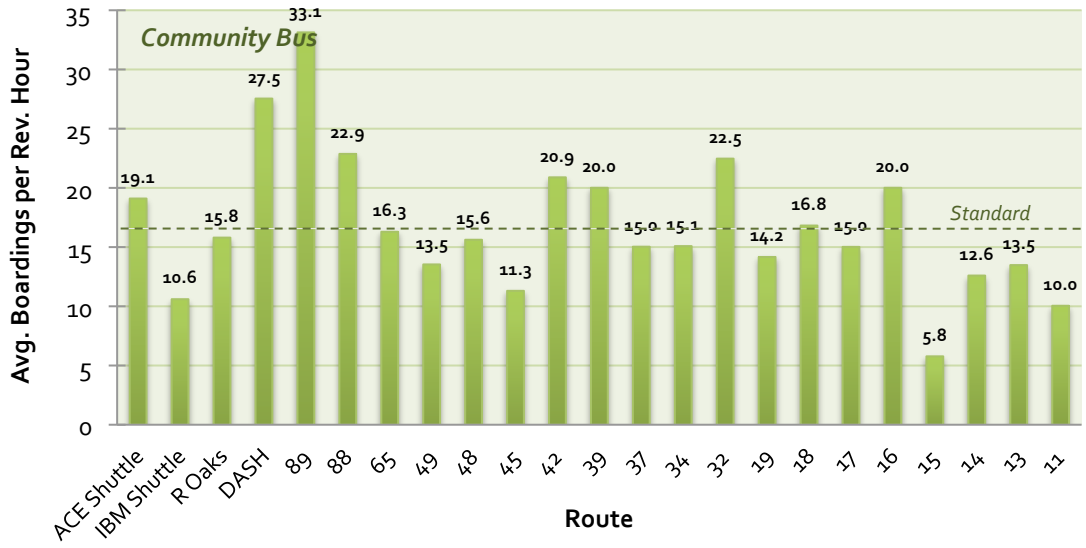

Figure 5. FY 2009 Performance for Community Bus

Source: VTA Short Range Transit Plan 2010-2019

EXPRESS BUS

Express Bus is a specialized service that caters to commuters traveling to and from work. The service is designed to traverse longer distances and offer commuters service that is time-competitive with driving. These routes typically make just a few stops in outlying suburban areas before traveling non-stop (often on freeways, expressways, or on HOV lanes) to their final destination employment center. Express service requires a higher fare than Local Bus service due to the longer distances traveled. VTA uses standard 40-foot vehicles for the service, though many agencies use larger and more comfortable coaches for their express service. VTA's Express Buses compete directly with privately-operated service, provided by major employers such as Google, Yahoo!, and Apple. These private services offer express style service as an employee benefit and almost always provide a higher class of service than VTA, using stylized coaches, more amenities (Wi-Fi, power outlets, and even coffee/donut service), and travel directly to the work site.[20] Given the unique character of this service, its poor performance, and the fact that the private sector provides competing service, VTA is currently engaged in an 18-month study of the service in order to formulate a long-term strategy for its Express Bus service.

VTA breaks down Express Bus service into sub-categories. The main sub-category for this service is Peak Express, which includes the eleven routes that operate during weekday peak commute periods. Another sub-category is for Full-Day Express, which includes just one route which operates during the off-peak hours as well. The Regional Express sub-category is for the two regional services operated by partner agencies, the Dumbarton Express and the Highway 17 Express. VTA

[20] Findings are from an as-yet unreleased VTA online survey of Express Bus passengers in 2009.

contributes operating funds for these services. Finally, the Limited Stop sub-category includes four routes that are a hybrid service providing routes that have a mix of Local and Express features. This can be a bit confusing to an unfamiliar reader, since the Limited Routes are actually a type of Express route but yet charge a Local Bus fare and are evaluated like Local Bus.

Each of the sub-categories is given separate treatment for evaluation. Table 4 shows the prescribed performance standards in the TSP for the different sub-categories of Express Bus service. Limited Stop routes are treated like other bus routes, with a minimum average boardings per revenue hour. Because of their low seat turnover and longer trip lengths, the Express routes are evaluated using a Minimum Peak Load Factor. This measure serves as a good measure of resource utilization and basically indicates how "full" the bus is at its peak point. For weekday service, all of the Express routes are expected to achieve a minimum 60% Peak Load Factor.

Table 4. Express Bus Performance Standards

Express Bus Performance Standards			
	Weekday	Saturday	Sunday
	Avg. Boardings Per Revenue Hour		
Limited Stop	20	20	20
	Minimum Peak Load Factor		
Peak Express	60%	-	-
Full-Day Express	60%	50%	50%
Regional Express	60%	50%	50%

Source: VTA Service Design Guidelines & Transit Sustainability Policy

Figure 6 shows the performance for Express Bus as reported in the 2010 SRTP. This chart does not show the Limited and Regional Express sub-categories. Notice the wide range in performance for these routes — from a very low 26% to a passing 62% Peak Load Factor. This route category is the only category where the benchmark is not set by assessing the average of the component routes. Rather, the benchmark is fixed at 60% because this is roughly what performance is required to achieve a 20% farebox recovery ratio for Express Bus service.[21] Unfortunately, only one of VTA's Express routes meet the standard. This is likely due to many factors, including competition from the private sector, a lack of special amenities, unimpressive vehicles, and inconvenient schedules.[22] VTA hopes the Express Bus service study will be able to improve this service for the long term.

[21] Santa Clara Valley Transportation Authority, *VTA Transit Sustainability Policy,* EX6.

[22] Lilia Scott, interview by Jason Tyree, (December 4, 2009).

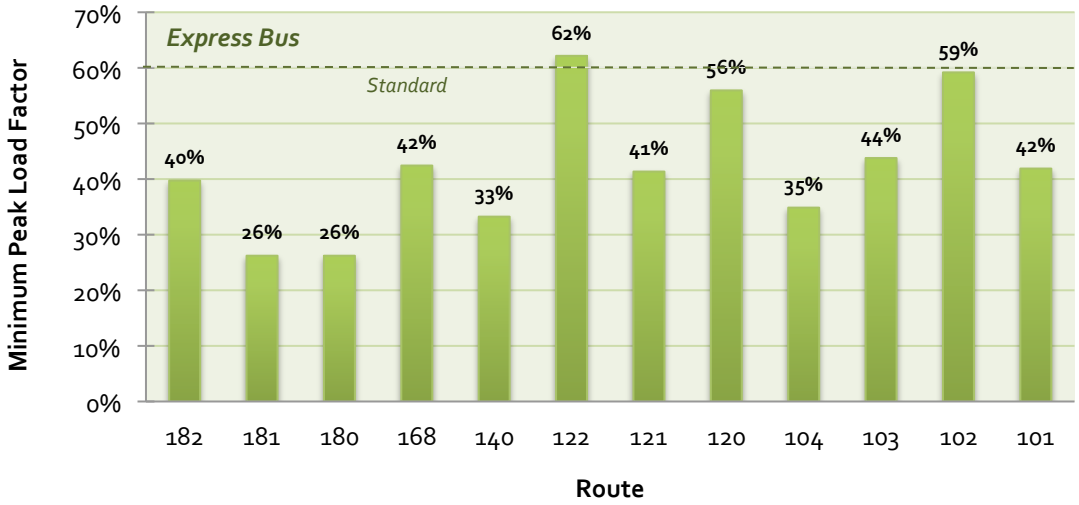

Figure 6. FY 2009 Performance for Express Bus

Source: VTA Short Range Transit Plan 2010-2019

LIGHT RAIL

Light rail is a high-capacity and high-quality transit service that links major travel origins and destinations along fixed rail guide ways. VTA has made significant investments in light rail, with 42 miles of track serving 62 stations. The system operates two lines of service and one spur line.[23] Because of the significant capital investment required for light rail service, its performance is evaluated differently than bus service. Whereas labor is the major cost associated with providing bus service, light rail service relies more heavily on capital costs (stations, track, right-of-way, etc.). As a result, performance measurement for light rail focuses on capital elements of service, such as route miles and stations.

Table 5 outlines the performance standards for light rail service. For existing service, the sole performance measurement used is Boardings per Station. For new service, Boardings per Revenue Hour and Boardings per Revenue Mile are also used.

Table 5. Light Rail Performance Standards

LRT Performance Standards			
Performance Standard	**Study Area**	**Existing LRT Service**	**New LRT Service**
Average Boardings per Revenue Hour	Line	-	55
Minimum Boardings per Station	Station	310	600
Average Boardings per Route Mile	Segment/Line	-	1,250

Source: VTA Service Design Guidelines & Transit Sustainability Policy

[23] Santa Clara Valley Transportation Authority, "Short Range Transit Plan FY 2010-2019," 8.

The standards for new light rail service may seem straightforward, but when a proposed project is up for consideration, significant questions arise regarding their use. This scenario occurred in 2009 when VTA planning staff were asked to perform a TSP analysis of two proposed light rail extension projects. The Eastridge extension is a 2.6-mile, 3-station extension from the existing Alum Rock station to a new station at the Eastridge Transit center. The Vasona extension is a 1.6-mile 2-station extension from the existing Winchester station to a new station at Route 85.[24] Figure 7 shows the project map.

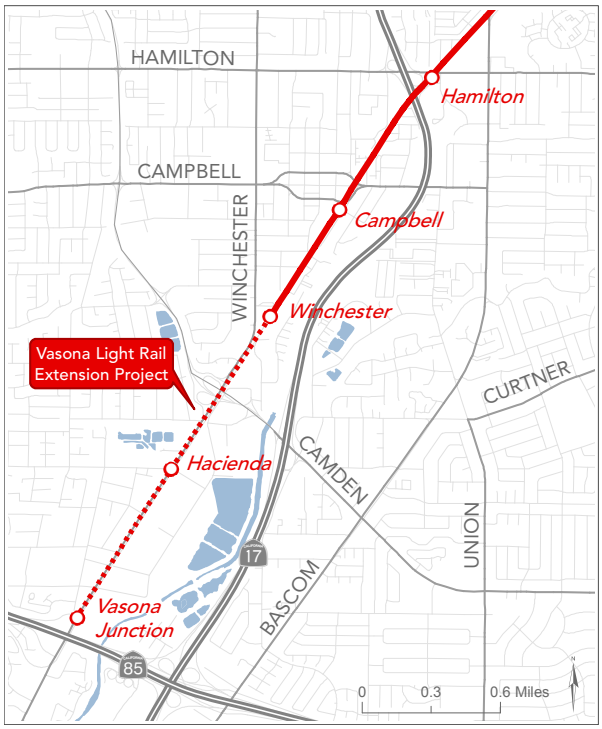

Figure 7. Vasona Light Rail Extension Map

Source: Jason Tyree for VTA

Immediately upon starting the analysis for these extensions, staff realized that the process would not be as objective as they had hoped. Since all of the performance measures use boardings as one component, the critical question immediately became "boardings in what year?" One option was to estimate boardings as if the extensions were operating today. Another alternative was to project boardings out to the VTA Travel Demand Model's standard horizon year, 2035. This method incorporated all of the demographic, land use, population, and transit network changes that were part of the Association of Bay Area Governments' (ABAG)[25] long-term projections. Another option was to use the projects' service delivery year (the year the extensions would theoretically open for service), which was estimated to be 2020. This method again would use a projection of ABAG's long-term changes. In short, the TSP text does not give any clear direction regarding method to use. In addition, if one of the two future year methods were used, it made sense that the benchmark standards would have to be projected as well, but it was unclear how that should happen. Staff felt it to be illogical to compare 2035 boardings with 2008 performance standards. As a result of these significant questions, staff had to use their best judgment and decide on one methodology. Each methodology yielded differing results, which illustrates the important of this process. Depending on the method used, the projects could have looked either very good or very poor. A truly objective assessment should not offer this much discretion in methodology and variability in results.

[24] Kermit Cuff, interview by Jason Tyree, (January 20, 2010).

[25] The Association of Bay Area Governments (ABAG) is the regional planning agency for the nine-county San Francisco Bay Area. Transportation planning is performed by a separate agency called the Metropolitan Transportation Commission (MTC).

In addition to the ambiguity regarding how to evaluate proposed service, the evaluation of existing service is also not effective. Figure 8 shows the light rail system performance by station for FY 2009 as reported in the 2010 SRTP. There are 62 stations in the system, and the average weekday boardings per revenue hour is 559, which becomes the benchmark standard.[26] The light rail system is a perfect example to demonstrate the flaws of using the average as the standard. Notice that most of the stations have less than 500 boardings but a few stations have boardings above 1,000. These outliers with very high boardings skew the average so that the standard now causes 42 out of 62 stations to fail. This result calls into question the standard itself, since so many of the stations fail. While it may be very true that these stations have low ridership in comparison to peer systems, it makes little practical sense to highlight two-thirds of a system's stations as failures. In a light rail system, there is likely always going to be a wide disparity in boardings because of the nature of station types. End-of-line stations, downtown stations, and transfer stations will naturally have higher boardings which, when compared to the system as a whole, will distort the average. Of the ten stations that have boardings above 1,000, eight of them are either downtown, at the end-of-line, or are transfer stations. Because of the unique distribution of any light rail system's boardings, using a system average boarding value as the standard will usually be ineffective at highlighting a manageable number of under-performing stations.

The TSP has not helped VTA staff improve performance on the light rail system because each year the results are similar. The results declare an overwhelming majority of the system's stations to be sub-standard, which is hardly helpful for managers who want to improve system performance and have limited time to spend on the task.

VTA Light Rail Vehicle (Image: VTA)

[26] Santa Clara Valley Transportation Authority, "Short Range Transit Plan FY 2010-2019," 9.

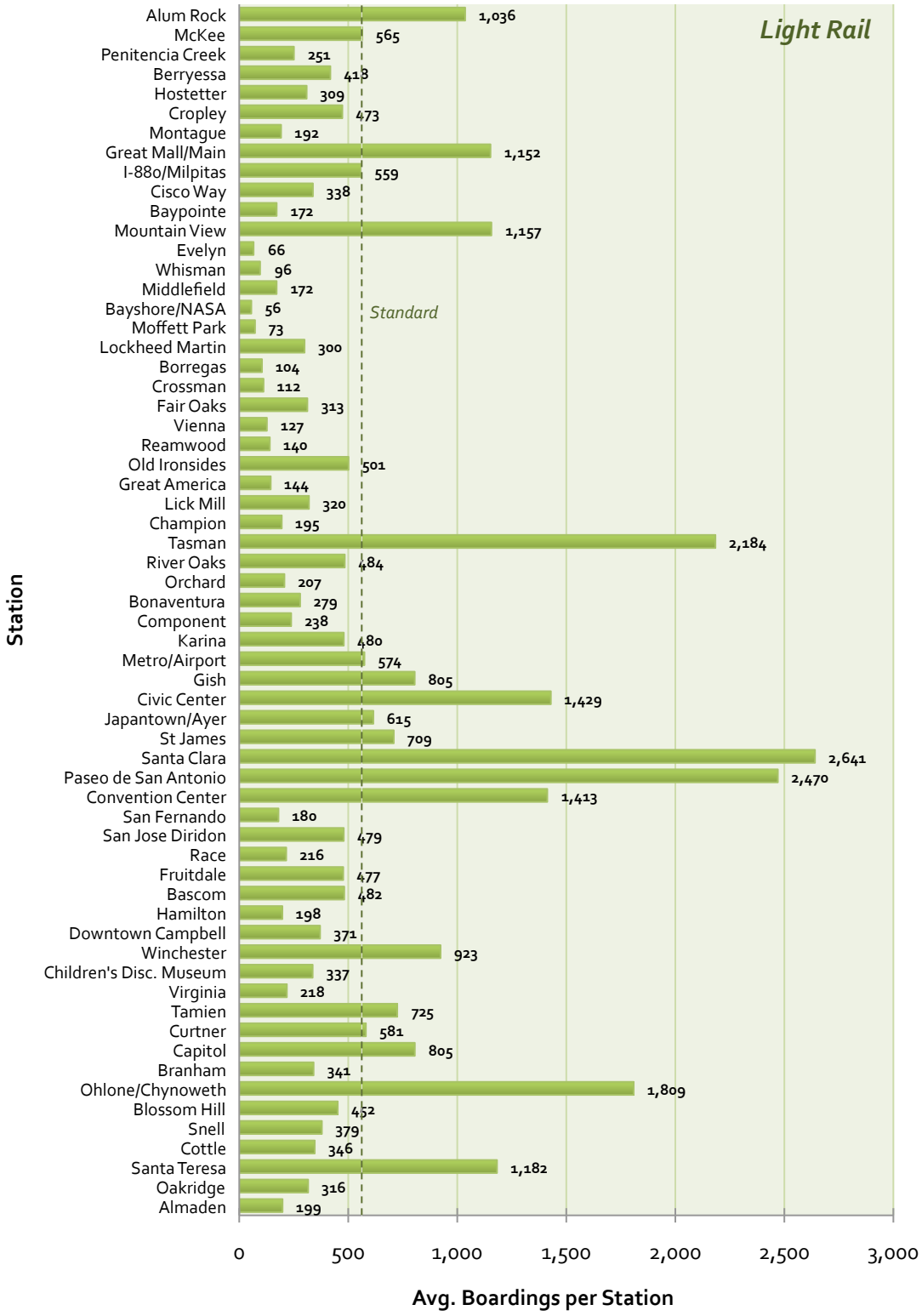

Figure 8. FY 2009 Light Rail Performance

Source: VTA Short Range Transit Plan 2010-2019

Bus Rapid Transit

Bus Rapid Transit (BRT) is a relatively new transit mode that aims to provide the same level of service as traditional rail but with lower cost and greater flexibility.[27] This is achieved by using simple routing, limited stop service, and a mix of capital investments such as dedicated running ways, transit signal priority, specialized vehicles, and off-board fare collection. The service is meant to mimic rail transit from the passenger perspective, so the vehicles are stylized and specially branded, service is frequent and fast, and the routing is simple. VTA classifies BRT service into two categories, BRT1 and BRT2, based on the level of investment and the amenities offered, with BRT2 being the full build-out of BRT features. VTA operates the Rapid 522, which has some features of BRT service such as limited stops, simple routing, and signal priority, but none of the capital investments of BRT2 service. VTA plans to upgrade this route to full BRT2 and is currently engaged in design work to do so. The writers of the TSP recognized that BRT will likely play a significant role in VTA's mix of future service, so the TSP gives this mode significant attention and detail.

Table 6 details the performance standards for BRT service. Notice that BRT uses the average boardings per revenue hour standard like the regular bus routes, but also uses Boardings per Station and Boardings per Revenue Mile like the light rail mode. The use of both light rail-style capital intensive measures and bus-style labor intensive measures reflects the hybrid nature of BRT. The two levels of BRT have differing standards, with BRT2 expected to achieve higher performance due to its higher capital investment.

VTA's Rapid 522 - BRT1 (Image: VTA)

[27] Santa Clara Valley Transportation Authority, *VTA Transit Sustainability Policy,* BRT1.

Table 6. Bus Rapid Transit Performance Standards

BRT Performance Standards				
Ridership Standard	**Study Area**	**Existing and/or New BRT Route**	**BRT 1**	**BRT 2**
Average Boardings per Revenue Hour	Corridor/Segment	Existing/New	45	55
Boardings per Station	Station	Existing/New	150	350
Average Boardings per Route Mile	Corridor/Segment	Existing/New	200	350 to 475

Source: VTA Service Design Guidelines & Transit Sustainability Policy

4. Peer Review: How VTA Can Learn from Other Agencies

VTA can learn from its peers in two important ways – it can compare the performance of peer systems with its own transit services and it can also learn from their best practices of using performance standards. This research offers some insight for both.

Peer Performance Comparison

This researcher performed a peer performance comparison using Light Rail systems rather than bus systems. Bus routes are quite heterogeneous within an agency and also between agencies. Imagine how tricky and complicated it would be to try and compare VTA's 74 routes with a number of other agencies' numerous routes, all of which are very different. Light Rail systems are a bit less complex since each agency's system can be analyzed as a whole and differences in service areas can be minimized by selecting appropriate agencies for comparison.

VTA's Light Rail system can be compared amongst its peers relatively easily using the National Transit Database (NTD), the Federal Transit Administration's national database for transit agency statistics. Public transit agencies submit statistics to the Database on a regular basis, so it provides a comprehensive and useful set of data for analysis.

TriMet Bus in Portland, Oregon (Image: TriMet)

To meaningfully compare VTA's Light Rail system with its peers, a targeted peer review was performed. The NTD identified a total of 29 public agencies operating light rail service in the United States.[1] Many of these agencies are quite unlike VTA and were not included in the peer review. Therefore, the following were removed from the peer review:

- agencies with service areas of population greater than 4 million (VTA's service area has a population of approximately 1.5 million)
- small agencies that operate less than 100 vehicles in maximum service (VTA operates between 500 and 999 vehicles in maximum service)
- agencies whose light rail system is not directly operated by the agency

[1] Federal Transit Administration, *National Transit Database* (Washington, D.C., 2008).

As a result of these criteria, eight agencies were removed from the analysis, which left 21 agencies, including VTA, to compare in the peer review. For comparison, the peer review looked at three variables, shown graphically in Figure 9:

- **Total Miles of Track.** This statistic is a good representation of the level of capital money that each agency has invested in its light rail system.
- **Annual Revenue Hours of Service.** This statistic is a good representation of the amount of light rail service the agency provides.
- **Annual Ridership.** This statistic is the primary gauge for the effectiveness of the light rail system and shows how many people are riding the system.

The x-axis represents the level of capital investment. It is apparent that the bulk of the systems appearing in the right-hand side of the chart are Midwestern or Western cities. This is an interesting result, which seems to indicate that cities in the Midwest and West have invested more heavily in their light rail systems. A possible explanation is because older established cities in the East have invested more heavily in subway and commuter rail systems and less in light rail systems. VTA has a relatively high level of capital investment, only surpassed by four other transit agencies.

The y-axis represents the amount of service provided by each system. Because of the relatively small sample size, it is hard to make any conclusions regarding the relationship between the level of capital investment and the amount of service provided. It does appear that some of the systems with high levels of capital investment also provide a high amount of service, though the relationship does not seem to hold true with the rest of the agencies.

The size of the circles represents the ridership of each system, which is a good gauge for the systems' effectiveness. This is where some important patterns begin to emerge. There seems to be a generally linear relationship between both the amount of service offered and the track miles when compared to ridership. In other words, more service or more investment both generally result in higher ridership. VTA's ridership is not impressive.

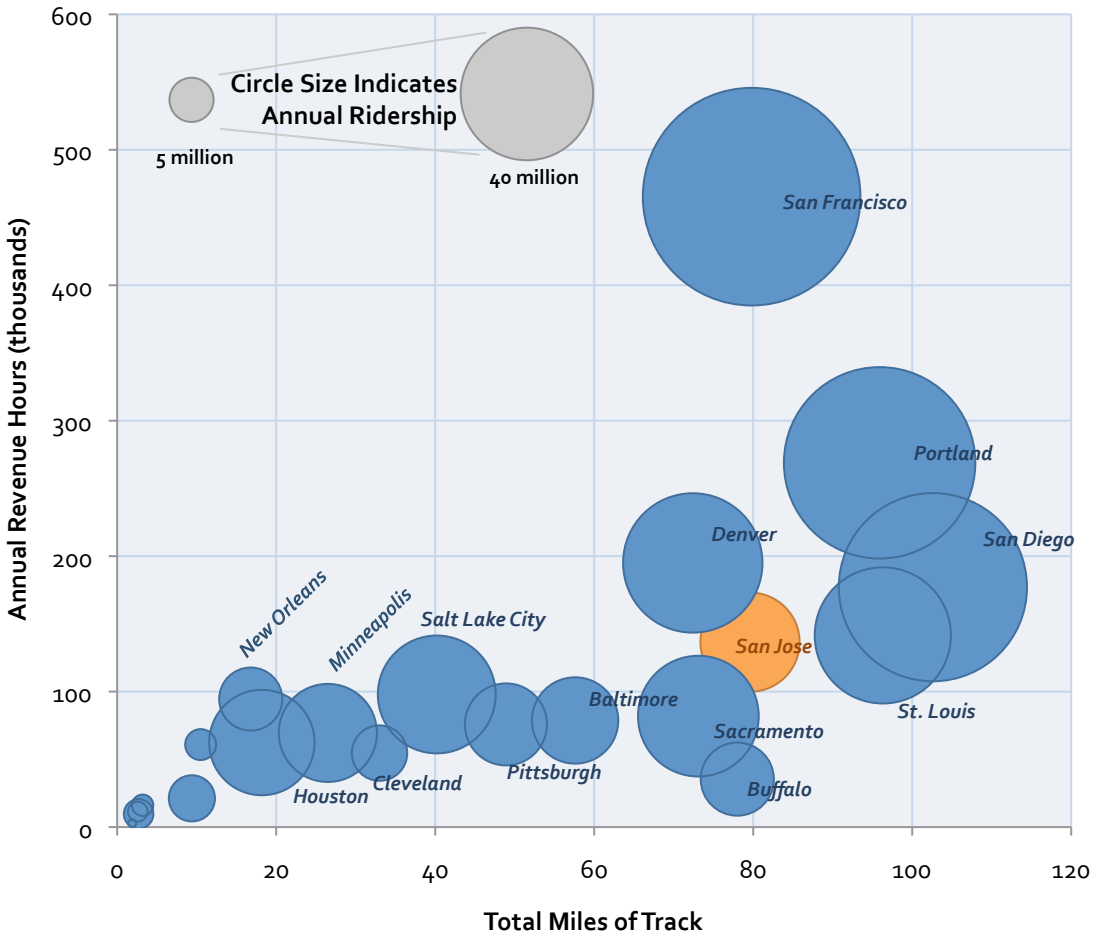

Figure 9. Light Rail System Basics Peer Comparison

Seattle, Memphis, Charlotte, Tampa, and Kenosha shown in lower-left corner (included in review but too small to label)

Source: Jason Tyree using data from the National Transit Database - Revenue Year 2008

To get an even better sense of VTA's performance relative to its peers, a more selective peer review was performed with a smaller set of peers. Using the previous agencies as a starting point, five agencies were selected that most closely compare with VTA. These five agencies are all Midwestern or Western cities and serve similarly-sized metropolitan areas.

The goal of this detailed review was to determine how these agencies compare to VTA using the main performance standard for VTA's light rail system, Average Weekday Boardings per Station. The peer review gives VTA another assessment of how its performance standard compares to others. To achieve this standard for each of the peer systems, the NTD was used to gather each system's number of stations and each system's average weekday ridership. The ridership could then be divided by the number of stations to determine the Average Weekday Boardings per Station. The results are shown in Table 7, sorted in ascending order of performance.

Table 7. Light Rail Peer Review – Boardings per Station

Detailed Peer Review – Boardings per Station			
Agency	Number of Stations	Average Weekday Ridership	Boardings per Station
San José VTA	65	34,400	**529**
Sacramento RT	48	60,500	**1,260**
Salt Lake City UTA	25	44,800	**1,369**
St. Louis Metro	37	59,000	**1,595**
Portland TriMet	63	107,600	**1,708**
Denver RT	36	68,800	**1,911**

Source: National Transit Database – Revenue Year 2007

Suddenly, VTA's light rail system looks like a very poor performer. It has the lowest average weekday ridership and the lowest number of boardings per station. The poor performance of VTA's light rail system is illustrated in another study as well. VTA's Light Rail System Analysis project (scheduled for completion in April 2010) performed a peer review in 2009 and came up with interesting results comparing each system's Boardings per Route Mile. Table 8 shows the results sorted in ascending order of performance. Again, VTA performs most poorly. The results here confirm that despite VTA's significant investment in Light Rail, it is not effective in carrying riders when compared to peer systems.

Table 8. Light Rail Peer Review – Boardings per Route Mile

Detailed Peer Review – Boardings per Route Mile		
Agency	Route Miles	Boardings per Route Mile
San José VTA	81	**460**
Sacramento RT	73.8	**800**
Denver RT	70	**1,010**
Portland TriMet	95.9	**1,160**
Salt Lake City UTA	39.4	**1,420**
San Francisco MUNI	83.1	**2,080**

Source: American Public Transportation Association 2008

PEER BEST PRACTICES COMPARISON

To learn from other agencies' best practices in their use of performance standards, several agencies were evaluated. To perform this peer review, the focus was placed on bus service rather than light rail service in order to get a differing perspective from the previous peer review. As part of the VTA Express Bus Study (scheduled for completion by early 2011), VTA completed a peer review of performance measures usage among agencies that operate Express Bus service. For their review, eight agencies were evaluated. This study also contacted five additional agencies to determine their usage of performance standards. Overall, it was discovered that many transit agencies do not have a comprehensive system of performance evaluation.[2] However there are lessons to be learned from peer practices; a few examples are highlighted below.

Bay Area Rapid Transit (BART). Bay Area Rapid Transit uses a set of 36 performance measures to evaluate service on a quarterly basis. Since BART is a heavy commuter rail system with fixed investments, it focuses on measures that are not directly related to transit service delivery, such as equipment reliability and frequency of bicycle thefts, rather than measures that evaluate station or route ridership.[3] Planning staff, policy makers, and the public often wish there were fewer performance measures or that they were prioritized so that they could be more useful.[4]

- **Lesson learned**: Need to prioritize performance measures.

For expansion projects, BART takes a much closer look at service performance. In its System Expansion Policy, BART prescribes a number of criteria that expansion projects must meet, including ridership thresholds, cost per new rider, and community support.[5] Appropriately, BART recognizes that new capital projects deserve extra scrutiny to demonstrate the need for public money, because building expansion projects almost always comes with a long-term commitment of operating and maintenance funds.

- **Lesson learned**: New service and investments deserve extra scrutiny.

Portland TriMet. Portland's TriMet is widely recognized as a leader in effective transit service.[6] TriMet applies a singular standard to its bus routes. Like most transit agencies, TriMet uses boardings per revenue hour as their standard. Unlike other agencies, they set the benchmark value for performance based on the performance of all of their routes aggregated together as and not in categories. Routes with less than one-half the agency-wide average weekday boardings per revenue

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[2] Jacobs in association with ARUP, *Synthesis of Peer Review and Market Analysis*, (San José: Santa Clara Valley Transportation Authority, 2010): 4.

[3] Bay Area Rapid Transit, *Quarterly Service Performance Review*, (Oakland: Bay Area Rapid Transit, July - September 2009).

[4] Kevin Connolly, interview by Jason Tyree, (December 2, 2009).

[5] Bay Area Rapid Transit, *System Expansion Policy*, (Oakland: Bay Area Rapid Transit, 2008): 11.

[6] Chris Augenstein, interview by Jason Tyree, (January 18, 2010).

hour are considered "low-performing."[7] Planning staff then use this list of low-performing routes (19 routes out of a system of 92 in fiscal year 2009) to target for improvement, modification, or deletion. Planning staff has found this to be an effective way to improve overall system performance.[8] Interestingly, for TriMet's 2009 fiscal year, the resulting minimum performance standard worked out to be 15 average weekday boardings per revenue hour, which is exactly the value that this research recommends for VTA's Minimum Standard for bus service in Chapter 5.

- **Lesson learned**: Effective standards should result in a manageable number of routes that fail so that managers can give under-performing routes enough attention.
- **Lesson learned**: Set standards by using a comparison to the performance of routes within the agency, rather than using the performance of other agencies' routes.

[7] Tri-County Metropolitan Transportation District of Oregon, *Transit Investment Plan*, (Portland: Tri-County Metropolitan Transportation District of Oregon, 2009): 11.

[8] Erik Hess, interview by Jason Tyree, (February 20, 2010).

5. Better Standards for VTA

This chapter brings the results of this research together and suggests improvements to VTA's transit performance standards. There are six specific recommendations to improve the TSP.

Recommendation 1: Resolve Bus Category Discrepancies

The bus system has inconsistent categorization that can easily be fixed. The Local Bus category has inconsistent sub-categories and the Express Bus category also includes the Limited Bus sub-category which adds unnecessary confusion. To resolve this issue, the following changes are recommended:

1. **Rename the Local Bus category Non-Express Bus**. This nomenclature better describes the component routes. It also parallels nicely with the other bus category, Express Bus. Finally, renaming the category resolves the issue of having a category and a sub-category both named Local.
2. **Move Limited Bus sub-category from the Express Bus category to the Non-Express Bus category**. The Limited routes have features similar to both the Express and Non-Express routes, but the Limited routes are evaluated based on the same metric as the Non-Express routes. Moving the Limited routes into the Non-Express category has the benefit of making the evaluation metric consistent across the two categories — Express routes all use Peak Load Factor; Non-Express routes all use boardings per revenue hour.
3. **Non-Express sub-categories should be Core, Local, Community, Limited.** This would end the inconsistency across documents. The old Feeder category is combined into Local because the term feeder is also an adjective that describes the service philosophy behind many bus routes outside of the old Feeder sub-category.
4. **Combine Peak Express with Full-Day Express and rename County Express.** The Full-Day Express has only one route, and the benefits of creating a separate sub-category for it are minimal and it just adds confusion. The new County Express sub-category incorporates all of the routes that provide express service within Santa Clara County (as opposed to Regional Express, which provides service regionally).

The new categorization structure for all of VTA's directly-operated transit service is shown in Figure 10. Note that the Non-Express category includes BRT for a future time when VTA operates full BRT service.

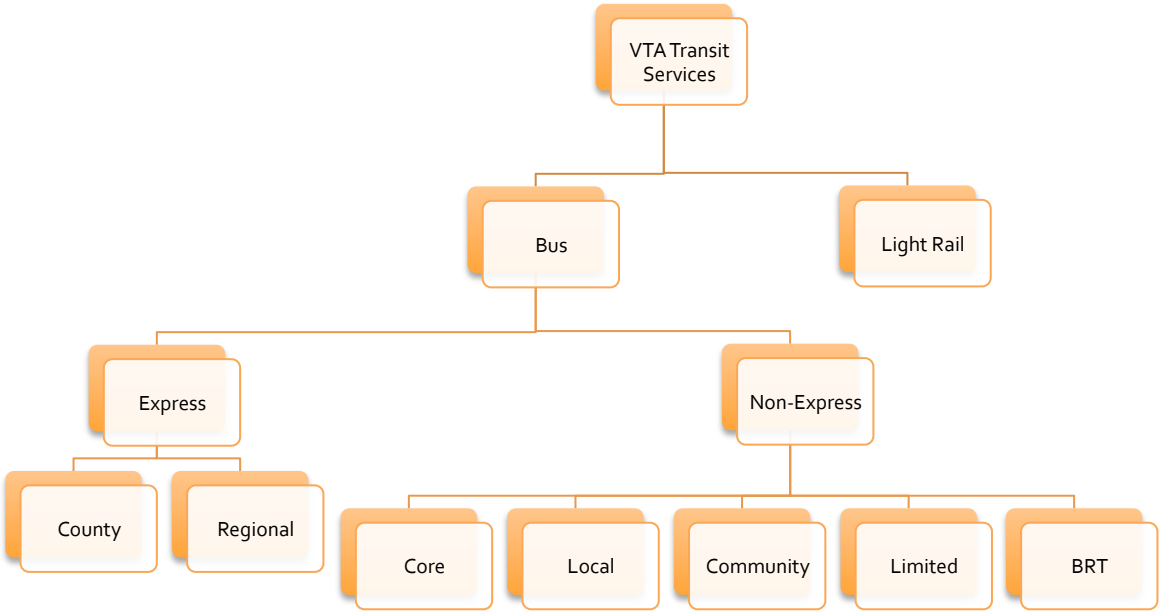

Figure 10. Recommended Transit Categorization Structure
Source: Jason Tyree

RECOMMENDATION 2: CREATION OF MINIMUM AND TARGET SERVICE STANDARDS

The inadequacy of the benchmark standards is a big reason that the TSP standards simply do not work, and is a principle concern to managers. The standards are virtually meaningless because so many routes are declared failures. Further, there is agreement at VTA that even those services that do meet the standard should perform much better, especially when compared to peers. This brings up the basic question: "what is the purpose of the benchmarks?" There are two main reasons for setting standards which are not reflected in VTA's current standards. First, benchmarks are needed to set a minimum standard by which transit service must perform. Services that do not meet the standard are not worthy of taxpayer subsidy. The second reason for benchmarks is to have a performance target that services should strive to meet. Without such a target, the implication is that once service meets the minimum standard, they are doing just fine and no improvement should be sought. This research suggests a new approach to setting benchmark standards which satisfies both needs of performance standards. Because there are two goals for the performance standards, service needs to be assessed using two separate standards and not just one.

Minimum Standard. First, service should be assessed against a minimum performance standard in order to determine whether or not the route satisfies the lowest performance the agency is willing to accept. In order to make this assessment meaningful and useful, this standard should declare only a manageable number of routes as substandard. Fortunately, the VTA Board has already adopted a standard that will actually work quite well for the minimum standard. The TSP declares that the "categorical minimum standard for any bus transit service is 15 boardings per revenue

hour."[1] This mimics the experience of several other transit agencies who use a similar "minimum" standard, and many are close to 15. If the new Minimum Standard were set at 15 boardings per revenue hour, only 10 bus routes of the 62 total would fail the standard, which is a huge improvement in the usefulness of the standard. It would be much easier for VTA managers to target these 10 under-performing routes than it would be to target the 32 routes that fail under the current class-based standards. For example, VTA could conceivably eliminate these 10 under-performing routes, but it would be hard to imagine VTA eliminating 32 routes (more than half of all the routes).

The Express Bus services would also get a minimum standard. The recommended standard is a Minimum 40% Peak Load Factor. Under this system, four of the twelve routes fail the standard and would be candidates for elimination or serious modification. Again, four routes is much more manageable than the current system where eleven of the twelve routes fail the standard. Table 9 shows the difference between the current system, which fails a total of 43 out of 74 routes, and the proposal which fails a much more manageable 14 out of 74. The BRT route category would also be subject to the same minimum, though it is not listed in the table because VTA does not currently assess the 522 as a BRT route (it is assessed in the Core category).

Table 9. Recommended Minimum Standards for Bus

Recommended Minimum Standards for Bus					
Route Category	**Core**	**Local**	**Community**	**Limited**	**Express**
Number of Routes	19	16	23	4	12
# Failed – Current	9	8	14	1	11
# Failed – Proposed	0	1	8	1	4

Source: VTA Short Range Transit Plan 2010-2019

Because of the nature of Light Rail, it should not be assessed against a minimum standard. Light Rail is unique because of the significant capital investments that have been put into the infrastructure. Because of these investments and the inflexible nature of light rail infrastructure, it is usually counterproductive to make short-term significant changes. For example, closing an under-performing station will result in the negligible benefit of a small reduction in thru-travel time (perhaps twenty seconds, considering VTA's short dwell time at each station). The capital money that was spent on building the station will not be recovered, and the agency will have to continue maintaining the station (for liability reasons), plus there will be some passengers that are inconvenienced with the closure. The minimal benefit is simply not worth the drawbacks. A more effective way to improve light rail performance is to focus on not building poorly-performing lines in the first place.

[1] Santa Clara Valley Transportation Authority, *VTA Transit Sustainability Policy,* 5.

The lack of a minimum standard for Light Rail stations does not preclude station closure due to poor performance, however. Sometimes it may make sense to close a station, but the consideration of station closure is a complex issue that should be dealt with on a case-by-case basis in the political realm. There are outside factors involved that a document such as the TSP cannot and should not attempt to account for. VTA managers should (and do already) pay attention to the lowest performing stations and look for opportunities to improve their performance. For example, the eleven stations on the Light Rail system from Reamwood to Evelyn have consistently been the lowest-performing group of stations in the system since they opened.[2] VTA is engaged in a comprehensive study of the Light Rail system and hopes to improve the performance of these stations by offering more attractive service (shorter headways, express service, etc.). This unique and perpetual problem with a group of stations could not have been foreseen or accounted for by the TSP.

Target Standard. Once service is deemed to meet the Minimum Standard, it should be assessed against a Target Standard. The fact that a route meets a minimum standard simply means the route is acceptable — next we need to find out if the route is doing well. To set this standard, routes should be assessed against the performance of the route category as a whole, which is similar to the way the standard is set today (by using the category average). The recommended method is to set the Target Standard at the 80th percentile of the route category. In other words, the standard will highlight the top 20% of the routes in a category. The 80% that are below the Target Standard would be considered successful (assuming they passed the Minimum Standard), but identified as routes that should get better.

Setting the Target Standard by a comparison to the category performance has the advantage of automatically updating itself as time passes and as performance changes. Over time, a route category may progressively achieve better performance, which will pull the Target Standard higher and incentivize improving the performance of the routes even more. The Target Standard gives managers the information they need regarding which routes to target for performance improvements (by modifying routing, adjusting service, marketing, etc.).

As an example of what these standards look like when implemented, Figure 11 shows the Local Bus category with the recommended standards. The Minimum Standard declares one route as failing and twelve as candidates for improvement.

[2] Santa Clara Valley Transportation Authority, "Short Range Transit Plan FY 2010-2019," 8.

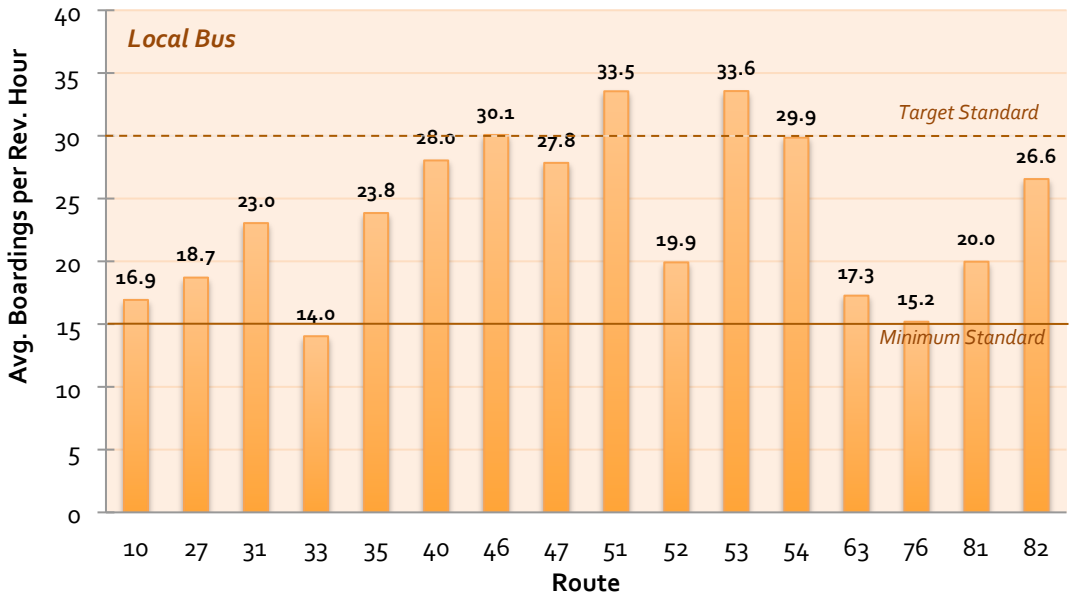

Figure 11. Target and Minimum Standards Applied to Local Bus

Source: VTA Short Range Transit Plan 2010-2019

For Express Bus service, the existing standard of 60% Peak Load Factor becomes the new Target Peak Load Factor. This works out nicely because the 60% target is related to the system-wide target of a 20% farebox recovery ratio. So if a route meets the target, it should also be meeting the goal of 20% farebox recovery ratio. Table 10 summarizes the results of applying both the minimum and target standards to the various bus service categories.

Table 10. Summary Results of Target and Minimum Standards

Recommended Minimum Standards for Bus					
Route Category	Core	Local	Community	Limited	Express
Number of Routes	19	16	23	4	12
Fail	0	1	8	1	4
Pass, Could Improve	15	12	10	2	7
Meet Target	4	3	5	1	1

Source: VTA Short Range Transit Plan 2010-2019

Light Rail should be assessed against a Target Standard as well, though it does require special treatment. The Target Standard for Light Rail is also set at the 80th percentile of the system's Boardings per Station, excluding the stations at the end-of-line and that serve as transfer stations between Light Rail lines. These high-boarding stations should not be part of the equation because they would unfairly affect the result. A proposed Light Rail project today, for example, would need to meet a minimum 568 Boardings per Station to be considered effective.

Recommendation 3: Light Rail Minimum Standard for Proposed Projects

Light Rail is unique because of the level of capital investment required and the permanence of the infrastructure. As discussed previously, it is not useful to apply minimum service standards to light rail stations that have already been built. However, it is important to have a standard to apply to stations when new projects are proposed, since the important factor with light rail is to build high-performing routes in the first place. For this reason, the TSP needs to provide an effective standard to use when evaluating proposed projects. The recommended standard is a Minimum Boardings per Station equal to the 20th percentile value of the system's Boardings per Station.

This standard is similar to the current Light Rail standard of the average value of the system's Boardings per Station, however the average is less appropriate because of the nature of Light Rail station boarding patterns. As discussed earlier, a typical Light Rail system will usually have a small number of stations with very high boardings which will skew the average. Using the percentile value accounts for this pattern and results in a more meaningful standard. In effect, the standard is declaring that any new station should not be in the bottom 20% of the system's stations, measured by Boardings per Station.

Recommendation 4: Resolve Probationary Period Discrepancy

The probationary period for new transit standard is not consistent throughout the TSP, as illustrated in Table 1. This is a relatively easy issue to fix, and simply requires deciding on a consistent set of probationary period standards. The standards in the Local Bus and Express Bus sections should be modified to comply with the standards as listed in the introduction section. This will make the entire document consistent, as shown in Table 11. The text should also be clarified so that the reader knows the standards refer to the new Minimum service standards, as discussed in Recommendation 2.

Table 11. Suggested Probationary Standards for New Transit Service

Recommended New Transit Service Performance Expectations				
Time from Implementation (Months)	6	12	18	24
	% Compliance with Minimum Service Standard			
Local Bus	70	80	90	100
Express Bus	70	80	90	100
BRT	70	80	90	100
All Service (Introduction)	70	80	90	100

Source: VTA Service Design Guidelines & Transit Sustainability Policy

Recommendation 5: Add Detail to New Service Ridership Analysis

When evaluating new service for performance, the ridership analysis step lacks the necessary details to make the process objective. This is critical, because the methodology used for modeling can have a huge impact on the projected ridership of the project, which of course will determine the outcome of the analysis. To provide an objective analytical process, the following detail should be added. In Step 2 of the Evaluation and Recommendation Process (described on page 29), there are three choices for the methodology and staff should follow one method:

1. **Model current year ridership of the new project and compare to current year performance.** This method supposes that the proposed project is in service at the time of the analysis and thus is comparable to the current year performance standards. For example, a light rail extension up for analysis in 2010 would be modeled in the 2010 transit network/land use scenario. The results would be compared to 2010 actual performance standards.
2. **Model project delivery year ridership of the new project and compare to same year performance standards.** In this method, the project ridership is modeled using the assumed project opening year. The difficult part of this method comes in projecting what the performance standards in this delivery year would be. In the light rail extension example, the ridership output from the model would likely include the ridership for all the light rail stations, so a system average could be determined as used as the minimum Boardings per Station.
3. **Model the horizon year ridership of the new project and compare to the horizon year performance standards.** The VTA travel demand model typically has two modeling years that provide the most accurate results, the base year (usually close to the current year) and a horizon year in the long-term (currently 2035). Modeling ridership for interim years (such as method 2 above) is less accurate because of interpolation and a lack of interim land use assumptions. As a result, it is often preferred to model in the horizon year, regardless of the project delivery year. Again, this method also requires projecting out what the standards would be in the horizon year.

Recommendation 6: Streamline the TSP Update Process

Today's TSP requires active staff effort on a regular basis to keep the document and its standards current, which is ineffective. As discussed previously, the TSP alludes to a need to regularly update the standards, but does not prescribe how to perform the update. Probably due to this lack of clear direction, VTA has failed to update the document since it was adopted more than three years ago.

Rather than prescribe a detailed process by which VTA should assess the standards and suggest revisions on a regular basis, this research recommends making the process more automatic. Standards that update themselves automatically should be used in order to automate the updating process and conserve staff effort. The standards as recommended in Recommendations 2 and 3 incorporate automatic updating. For example, as performance of the Community Bus routes

change over time, the 80th percentile Target Standard will also change. This resolves the issue of staff having to evaluate where the standard should be on a regular basis.

The Minimum Standard does not automatically update (it is fixed at 15 boardings per revenue hour) and will require an active effort to update. However, this standard has a long shelf life and should not have to be updated often. This research recommends looking at this standard once every five years to evaluate whether the standard should be changed. However, it is important to insert language in the TSP that reiterates that the standard as written remains valid indefinitely. This would resolve the current issue where the TSP can be questioned because it prescribes an update that hasn't happened.

6. Next Steps

VTA has an opportunity to greatly improve the efficiency and effectiveness of its transit service. The TSP is a solid foundation in performance measurement and a great start, but a set of six reasonable improvements will have a tremendous impact on how useful the TSP can be for transit managers.

Process for Adopting Recommendations

This report will be presented to the Planning department at VTA for review. Staff will review the research, and assuming staff agrees with the recommendations, they should make the appropriate changes to the TSP and seek Board approval of the updated document. Bringing the new TSP to the Board will also allow the current membership to reiterate their support of the performance review process (most of the Board members were not members when the TSP was adopted).

More Research Needed

The transit industry is still learning how to assess performance effectively. Many agencies simply do not use performance standards at all; the ones that do use standards are learning how to make them effective. New trends throughout the industry deserve attention and further study. For example, there is a recent trend towards contracting out transit service to private companies. This trend certainly has implications for performance measurement and needs to be studied.

The End Result: A Better Community for All?

The recommendations in this report would go a long way towards helping managers at VTA improve the efficiency and effectiveness of VTA's transit service. The agency would offer more utilized service using fewer resources. Getting more people out of their cars and onto transit benefits everyone by making our roads less congested, our neighborhood shopping districts thrive, and our air cleaner. Here we have a rare and excellent opportunity to do exactly what planners love to do: make our communities more livable.

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