

TFLEx Guide for Transit Newbies

Module 3

Key Performance Indicators

Introduction

The Transit Finance Learning Exchange (TFLEx) – created and run by your transit finance colleagues – exists as a strategic alliance of transit agencies. TFLEx has developed a body of reference material (“TFLEx Guide for Transit Newbies”) to educate finance staff in the field of transit without extensive costs. This coursework can be accessed at www.TFLEx.org.

Welcome

Welcome to the Key Performance Indicators module!

This module will provide you with a basic understanding of the key performance indicators, or KPIs, that help the transit industry tick.

After completing this module, you will be able to:

- Define Key Performance Indicators
- Describe the difference between a measure and a metric
- Identify the different categories of transit agency performance measures and their characteristics
- Define the leading and lagging measures
- Determine the persons served by the KPIs and potential pitfalls of measures and metrics

Please see the Table of Contents, below, for the location of the KPI module glossary.

Additional Information

Field of Study: Finance

Prerequisites: None

Advanced Preparation: None

Program Level: Basic

Delivery Method: QAS Self-study

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CPE Credits

TFLEEx members will earn 1.0 CPE credit upon successfully completing a knowledge test (qualified assessment) for this module (KPIs). Upon gaining an understanding of the material in this work and completing the review questions, contact Joe Costello, TFLEEx Executive Director, at CostelloConsultingCorporation@gmail.com. He will provide you with a final knowledge test. You will have 30 days to send your answers to Mr. Costello. Upon answering at least 70% of these questions correctly, you will receive a certificate of completion for the 1.0 CPE credit, as well as evaluative feedback.

Not a member of TFLEEx? Please reach out to Joe Costello, TFLEEx Executive Director, at CostelloConsultingCorporation@gmail.com to find out how your agency can join. We encourage you to do so. We know you would get great value in being part of this organization!

About TFLEEx

The Transit Finance Learning Exchange was founded in 1999 by a number of transit agencies and continues to be run by your transit agency colleagues.

TFLEEx offers semi-annual workshops, Forum and Special Interest Group Calls, training and professional development, comparative metrics, and, of course, invaluable networking. Of note, TFLEEx members meet twice annually to explore topics of mutual interest, share relevant experiences, and develop best practices. These are facilitated workshops where all attendees participate in the discussions. As TFLEEx is run by your transit finance colleagues, the workshops offer an opportunity for further follow up at the next workshop and Forum and SIG (special interest group) calls – Zoom calls on topics of interest held between workshops. The workshops and calls provide continuing education credits.

Visit www.tflex.org for more information and dates of upcoming calls and workshops.

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In this next section of the module, you will learn how to:

- Define Key Performance Indicators
- Describe the difference between a measure and a metric

What are Key performance Indicators?

What are Key Performance Indicators (KPIs)? KPIs are a subset of Performance Measures so let's take a look at the broader group before narrowing it down to KPIs.

A performance measure is a quantification that accurately documents the activities or results of an Agency, a group or an organization. Performance measures can and should be used at all levels of the organization to help understand how well the organization, or unit within a larger organization, is performing in a particular area.

In a way, the term performance measure can be a bit of a misnomer because it can either be a measure or a metric.

A 'measure' is the raw data. It is a count or summation of something. It can be almost anything. They are often bound by a time period or may represent a snapshot in time. Number of calls received by customer service during May. Number of purchase orders issued this week. Number of accidents this year. Value of inventory as of fiscal year end. These are all measures.

A 'metric' is the combination of multiple measures that provides more context regarding performance. Number of purchase orders issued/full-time employee/week. Accidents per 1000,000 miles. Subsidy per passenger.

Metrics often allow for comparison over time periods that might otherwise not be comparable. For example, let's look at the measure of accidents by month vs. the metric of Accidents per 100,000 miles. A count of accidents by month might be sufficient if you have a static service but if you ever have a service change, or if you have seasonal service, a simple count of accidents does not allow an accurate comparison to prior periods. By using the metric Accidents per 100,000 miles, that does allow comparisons to prior periods regardless of service level.

So, what makes a measure or a metric a Key Performance Indicator? The focus is on the word "Key." KPIs are the highest-level measures and metrics that are most important to the Agency or measure how well the organization is accomplishing its Mission and Goals. Because each organization has different goals and objectives, something that is a KPI for one Agency may not be a KPI for another. Some examples of measures and

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metrics that transit agencies are likely to use would be Ridership, Subsidy per Passenger, Farebox Recovery Ratio and Mean Distance Between Failures.

There will also be measures and metrics that are KPIs for a specific department, division or section, but not for the Agency as a whole. Percentage of invoices paid within 30 days. Percentage of Marketing projects competed on time. Uptime for maintenance equipment.

Selecting KPIs

In order to successfully choose good KPIs, those who are choosing them must have a clear understanding of what is most important to the agency or organizational unit for which the KPIs are being selected. Different departments within the agency will have different ideas as to what makes a KPI useful – for example, the KPIs useful to finance will be quite different from the KPIs used by operations. KPIs are often developed and/or selected as part of a strategic planning process.

KPIs need to be defined in a way that is understandable, meaningful, and most importantly, measurable. The data needed to report KPIs should be easy to measure, collect and/or calculate. It should be reliably accurate.

The KPIs should be controllable to some degree. KPIs that are hard to measure or non-controllable by the Agency or the divisions/individuals responsible for developing and reporting them, may result in a lack of buy-in leading to the KPIs being ignored.

It is also important to explain to employees what the KPIs are, why they are important to the Agency, how they tie to Agency performance, Mission, Vision and Values. They should be reported regularly and easily available for employees to find and see how the Agency is performing. In fact, it should be difficult for them NOT to see the regular reporting of KPIs. This reinforces their importance and increases employee buy-in.

A very common method for choosing KPIs is to apply a management framework such as the Balanced Scoreboard. Google search or use this link for a definition of Balanced Score Card: www.balancescorecard.org

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Learning objectives

You've made great progress so far! By now you should be able to define Key Performance Indicators and describe the difference between a measure and a metric. Let's test that knowledge.

Review Questions

1. Which of the following statements does NOT describe a measure?
 - A. A measure is the raw data.
 - B. A measure can be almost anything.
 - C. A measure is a combination of metrics.
 - D. A measure can be bound by a time period or represent a snapshot in time.
2. Which of the following is correct?
 - A. KPIs are only for the Agency as a whole, not for a specific department, division or section.
 - B. KPIs are the lowest-level measures and metrics.
 - C. The same KPIs should be used for all departments within the agency.
 - D. It is important for even the lowest level employee to see the Agency's KPIs regularly.

Answers

1. C does not describe a measure. It is exactly the opposite. A metric is a combination of measures.
2. D is correct. Understanding KPIs and their link to the Agency's Mission, Vision and Values helps promote employee buy-in. The other statements are the opposite of what is correct.

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In the following section of the module, we will learn to:

- Identify the different categories of transit agency performance measures and their characteristics

Categorizing KPIs

So how do we measure performance? There are four categories that need to be measured. These identify various categories of transit agency performance measures and their characteristics.

KPIs can be grouped into categories, such as the following.

- **Traditional Financial Reporting:** This data is the traditional focus of financial personnel in the transit agency.
- **Effectiveness:** This is the traditional focus of operations management for the transit agency. This tells you how much service is provided, how well the Agency, department or unit is accomplishing or making progress toward its goals. Or, in other words, it measures if the Agency is “doing the right things.”
- **Efficiency:** Traditionally more emphasized by external parties and stakeholders, these measures tell how well resources such as labor, vehicles, and fuel are used to accomplish the Agency’s goals. Or, is the Agency utilizing resources in an efficient manner.
- **Quality:** This focuses on the reliability of the service functions and minimizing errors or negative events such as accidents or service interruptions. Quality metrics show whether the Agency “Doing things right.”

Traditional Financial Reporting

Traditional Financial Data includes reports such as the Statement of Net Position (Balance Sheet), Statements of Revenues, Expenses and Changes in Net Position (Income Statement), Statements of Cash Flows, Budget vs. Actuals report, etc. These reports may not fit inside the standard definition of a KPI, but in addition to measuring the financial performance of the Agency, financial data contained within those financial reports become a part of many other KPIs.

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Traditional financial reporting (including the notes to the financial statements) is intended to inform interested parties with details of the financial results and financial status of the Agency including revenues earned, expenses incurred, cash flows in and out for a particular period of time and a snapshot of the Agency's financial position at a specific moment in time. It shows the future financial obligations of the Agency and the assets available to meet those obligations.

Traditional financial reporting is used by internal management, the Agency's Board of Directors, external stakeholders, bondholders and other creditors, State and Federal governments and other grantors, and financial institutions who currently, or might in the future, do business with the Agency.

In addition to the legal requirements to produce financial statements, traditional financial reporting is required to secure debt financing and to obtain grant funding and report on the progress of those grants. It also translates agency operations into language common to the business community.

Because the financial statements are prepared according to GAAP and subject to independent audit, financial data are also considered highly reliable and accurate.

One drawback of traditional financial reporting is that, because it is based on historical facts, it is considered a lagging indicator (leading and lagging indicators are discussed later in this module). It is sometimes described as "driving by looking in the rear-view mirror." Traditional financial data doesn't help identify ways to drive change or improvement. It also doesn't help the agency focus on the end-user of the system.

Effectiveness Key Performance Indicators

Effectiveness KPIs measure how effectively an organization is performing related to its goals. This category can be split up into Service KPIs and Cost-Effectiveness KPIs

Service KPIs

Service KPIs measure how much service is provided or how much service is consumed. Several examples of service KPIs are discussed below.

Ridership – Providing rides is kind of the whole point of public transit, isn't it? Ridership is the basic building block for measuring service effectiveness. Ridership is the number of passenger boardings. The data may be collected through several channels: farebox/turnstile data, on-board personnel or automatic passenger counters. It is validated or supplemented through on-board ride check samplings.

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Ridership is used to gauge and monitor the number of people reached by the transit agency and then identify trends in the amount of service desired and used. It is generally reported as unlinked passenger trips.

Unlinked Passenger Trips – This measure counts a rider every time a passenger boards a vehicle. If a passenger, in order to travel from their point of origin to their destination has to make two transfers (meaning they would have to board three different vehicles to accomplish the full length of their trip), this would be counted as three unlinked passenger trips.

Linked Passenger Trips – The Linked Passenger Trips measure treats the entire trip of an individual from origin to destination as one trip, regardless of how many transfers the passenger makes or how many vehicles they board. Using the example above, as you might have surmised, this would represent one Linked Passenger Trip.

Which measure is better? Both measures have value and communicate different things.

Because Unlinked Passenger Trips counts every boarding, it is important for calculations of capacity of service that is required to meet demand.

Linked Passenger Trips tells us how many actual people were served during the day (or other time period) and is much more useful for understanding travel patterns. As a consequence, it impacts system design and where and how routes are deployed.

The relationship between the two measures is important, too. The ratio of unlinked trip to linked trips is an indication of the efficiency of system design. A high ratio may indicate an inefficient system. These measures need to be looked at in the context of existing fixed guideway. A system that is bus only may have an easier time making route changes to lower that ratio. For a customer who uses only transit to complete their travel in a fixed guideway system (not someone who drives to a rail station) might, by necessity, be forced into three or more trips to reach their final destination, such as:

1. a trip on a feeder/distributor route to get to the train station,
2. the train trip, and
3. then another feeder/distributor that takes them from the train station to their final destination.

The goal of system design should be to minimize transfers. The more transfers a customer has to make, the longer the trip is likely to take, the more likely that one or more of the connections will not be made smoothly or timely. Extended ride times and missed connections are the kinds of things that can drive ridership down by causing a choice rider (a rider who is not transit-dependent) to decide not to use the system.

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If both measures are important, why aren't both always reported? There are several reasons.

1. Annual reporting to the Federal Transit Administration (FTA) through the National Transit Database (NTD) requires the reporting of unlinked trips, but not linked trips.
2. The difficulty of data collection. Collection of unlinked trip data is relatively easy and fairly reliable, especially with the increasing use of Automated Passenger Counters (APC). Unlinked trips can be physically counted. Collection of linked trip data, not as easy nor as reliably accurate. A combination of surveys, random sampling and mathematical models are used to estimate linked passenger trips. The increasing use of tap cards and other technologies is helping make data collection and estimation of linked trips more reliable.
3. Linked trips are also not generally reported publicly because that indicator is a substantially lower number than unlinked trips.

Note: A link to the National Transit Database website can be found under "Other Resources" on this TFLEEx website (www.tflex.org).

Transit agencies generally endeavor to increase ridership whenever possible and within financial constraints.

Passenger Miles – The passenger miles indicator captures the total number of miles traveled by passengers on transit vehicles and is another measure of service consumed. When looking at costs related to service consumed, Passenger Miles is a better measure than just a count of ridership. After all, it costs more money to transport a passenger 20 miles than it does to transport them one mile. Passenger miles are calculated as follows:

$$\text{Ridership} \times \text{Average Trip Length}$$

Average Trip Length is usually measured through statistical sampling. It is reported annually to the National Transit Database.

Load Factor Measurements – The purpose of Load Factor calculations is to measure service effectiveness on any route, group of routes or system as a whole. They highlight how well service supplied is matched to service demand. These measures are: Passengers per Mile (or per Hour), Passenger Miles per Vehicle Seat Mile and Peak Load Factor.

Passengers per Mile (or per Hour) – Passengers per Mile is calculated as follows:

$$\frac{\text{Unlinked Passenger Trips}}{\text{Total Revenue Miles}}$$

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The higher this ratio, the fewer empty seats. Passengers per mile may not present the best comparability between agencies because service characteristics such as speed of travel, population density or average length of route can vary widely from route to route and location to location or agency to agency.

Passenger Miles per Vehicle Seat Mile – This metric compares service consumed in the form of Passenger Miles to service provided in the form of seat miles. Seat miles for each vehicle are calculated by

$$\# \text{ of seats on the vehicle(s)} \times \text{revenue service miles}$$

System Seat Miles is the summation of the set miles of all vehicles. A ratio of 1.0 would mean that on average, every seat is filled for the specific measurement parameters (e.g. trip, route, etc.).

Peak Load Factor – This metric measures the maximum load during the Peak Period related to the capacity provided. It is calculated as follows:

$$\frac{\text{Maximum Peak Period Load}}{\text{Vehicle Capacity}}$$

Sometimes, particularly on rail modes, this ratio may exceed 1.0. A ratio of 1.5 would indicate that there is one standing passenger for every two seated passengers.

Cost-Effectiveness KPIs

Cost-Effectiveness KPIs combines service and financial data in the same metric.

Net Subsidy – Net Subsidy is a measure of the cost of service that must be subsidized through revenue sources beyond the revenue generated by operations. That subsidy may be in the form of dedicated tax revenues, federal or state grants, member city contributions, etc., or most likely, a combination of those and other sources. Net Subsidy is calculated as follows:

$$\text{Operating Expenses} - \text{Operating Revenues}$$

Net Subsidy is budgeted and should be reported regularly to management, the Board and Stakeholders. Those stakeholders that are funding partners are particularly interested as it may affect how much money they need to disburse to the Agency!

As a summary metric, Net Subsidy is easy to understand, which is particularly valuable to Boards and stakeholders. However, the fact that it is a summary metric limits its

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usefulness by management. It tells how much, but not why. It doesn't contain sufficient detail to provide any help in directing the agency or making any specific management decisions. It won't inform management as to where inefficiencies are or where operations might be improved.

Subsidy per passenger – As you might suspect by the use of the word “subsidy”, this measure is closely related to Net Subsidy above. Subsidy per passenger is calculated as follows:

$$\frac{\text{Net Subsidy}}{\text{Ridership}}$$

It is a valuable metric because it incorporates cost and the total ridership in a single metric.

While an agency-wide value may also be reported as a summary metric, subsidy per passenger is usually broken out and reported by mode, by route and perhaps by jurisdiction, too.

Subsidy per Passenger Mile – Some agencies may take this to the next step, and calculate subsidy per passenger mile as follows:

$$\frac{\text{Net Subsidy}}{\text{Passenger Miles}}$$

This may help make the subsidy values a little more comparable over different modes or other splits that have significantly different service characteristics.

For example, say Agency X breaks up its bus service subsidy calculations by member jurisdiction. The central business district (CBD) jurisdiction has a lot of riders taking short trips. Suburban area A has very little local service, but a large amount of express bus service. As a result, the subsidy per passenger between the two jurisdictions will be wildly different. However, by taking into account that the CBD area has a large number of passengers taking short trips and the suburban area has fewer passengers, each of whom travel a longer distance, Subsidy per passenger mile may provide a truer, more comparable picture of cost-effectiveness than subsidy per passenger.

Tracking subsidy per passenger or passenger mile over time can be a good indicator as to how cost-effectiveness is trending. But a better indicator of the trending is...

Cost per Revenue Hour (or Revenue Mile) – This metric removes the revenue component from the calculation. Because it is only looking at cost, the calculation is not affected by such items as fare changes or changes to other operating revenues (e.g. new advertising contracts, increases in vending revenues, etc.). As such, Cost per Revenue Hour/Mile

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provides the truest trending of the cost of service. It is one of the metrics used to benchmark transit agencies across the industry.

The Cost per Revenue Service Hour/Mile is usually reported by mode and calculated as follows:

$$\frac{\text{Total Operating Cost}}{\text{Total Revenue Service Hours (or Miles)}}$$

This metric can be subdivided into multiple components for more insight into costs such as:

- Operating Cost per Revenue Hour – This includes all direct and indirect transportation costs that are associated with providing an hour's worth of service. Some components would be operator wages and benefits, cost for any other on-board personnel (e.g. fare collectors, police or other employees engaged in the security function, etc.), rail station or transit center personnel, front-line supervisors, and any other costs that are driven by the number of hours of service operated by the transit agency. It does not include maintenance or administrative costs.
- This can be further stripped of indirect costs so that it just includes the variable components. This can be helpful for planning purposes to determine the cost impact of minor service changes. For major service changes, the full operating cost per hour should be used.
- Maintenance Cost per Revenue Mile (or hour) – This metric is similar to the cost per hour discussed above but is the total direct and indirect costs associated with maintenance of vehicles, maintenance of way, stations and other transit facilities as well as other mileage-driven costs such as fuel. These costs include mechanics' wages and benefits, first line maintenance supervisors' wages and benefits, the cost of parts, etc. It does not include administrative costs.
- And, as above, only the direct variable components should be included in the calculation when estimating the cost of minor service changes and the full cost should be used for major service changes.
- While maintenance cost CAN be shown as a cost per hour, it is usually shown as Cost per Mile because the maintenance costs are more correlated to the number of miles operated, not the number of hours.
- Administrative Cost Per Hour/Mile – Because these costs don't directly involve the provision of transit services and do not vary based on the number of hours

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and miles of service, this metric is really only used as the reconciling item so that the three components can be added together to get the total.

$$\begin{aligned} &\text{Operating Cost per Hour/Mile} \\ &+ \text{Maintenance Cost per Hour/Mile} \\ &+ \text{Administrative Cost per Hour/Mile} \\ &\underline{\underline{= \text{Total Cost per Hour/Mile}}} \end{aligned}$$

This is the one instance where you might see Maintenance shown as a cost per hour rather than a cost per mile.

One of the limitations of Operating Cost per Hour and Maintenance Cost per Mile is that not every agency agrees on what cost elements are included in these calculations. One of those areas of variation among agencies is regarding how far up the management chain should you go before the costs are considered administrative. Is the Vice President of Maintenance part of the maintenance cost or part of admin? What about the Assistant Vice Presidents? Directors? Managers? Those types of decisions are for each Agency to decide what makes sense for them.

Farebox Recovery – Farebox recovery shows the percentage of operating expenses that are covered by farebox revenue and/or system user fees. User fees might be something like tolls paid by vehicles in a case where the agency operated a toll road. It is calculated as follows:

$$\frac{\text{Farebox Revenues} + \text{User Fees}}{\text{Operating Expenses}}$$

Some agencies have regulations or policies regarding what percentage of costs must be covered by fares. Management and the Board may use this ratio to determine the timing and magnitude of systemwide fare increases.

This metric is best used as a general agency-wide measure. It does not provide management with information needed to make decisions like which routes to keep or expand and which ones to cut back, especially because there are other factors to consider, like whether a route is serving a part of the community that has no alternative means of transportation, or is the only route in a ‘service desert.’ These factors are not reflected in fare recovery. Note: Proper calculation of farebox revenue does NOT include some revenue that is received from cities to compensate for low-fare or no-fare zones in some urban areas. Those revenues are, in fact, a subsidy.

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Efficiency Key Performance Indicators

Traditionally emphasized more by external parties and stakeholders, these KPI measures tell how efficiently labor, vehicles, and fuel are used to produce service.

Overall Efficiency – Overall efficiency compares output (service) to the resources used to create that output (operating expenses). It is calculated as follows

$$\frac{\text{Revenue Miles}}{\text{Operating Expenses}}$$

It is the inverse calculation of Cost per Revenue Mile. It is usually calculated at a mode of service level.

An Agency may substitute revenue hours in place of revenue miles if it feels like revenue hours are a more appropriate measure.

Labor Efficiency/Pay-to-Platform ratio – Labor efficiency, also known as the Pay-to-platform ratio is a calculation of the efficiency of your transportation operations in terms of operator pay. This can be calculated both on the basis of hours or dollars.

Labor is the single largest category of expense, and most of labor is operator labor. This measure yields an idea of the amount of labor cost driven by non-productive time. This has become a familiar measure in the industry.

The calculation is Total Pay Hours divided by Total Platform Hours or Total Pay Dollars divided by Total Platform Pay Dollars.

These two calculations will be different because not all pay hours are created equal. Overtime pay, shift premium, instructor bonus and other operator pay rules will result in differences between the two calculations.

Low ratios indicate efficient scheduling and/or efficient labor management. Tweaking the run cut or better management of the extraboard (see the glossary at the end of this module for definition) can make for a more efficient system.

Deadhead Ratio – The deadhead ratio is a measure of scheduling efficiency. A transit vehicle's movement without passengers onboard, typically for traveling to or from the garage or between different routes during the operator's shift, is referred to as "deadhead." The deadhead ratio is calculated by dividing (Total Miles – Revenue Miles) divided by Revenue Miles. Some systems may use deadhead hours instead of miles where that makes more sense.

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A high deadhead ratio may help to explain poor labor efficiency by highlighting where schedules are inefficient. But not all deadhead is controllable. Depending on the system, some, most or all deadhead is mostly a factor of the number and location of bus and/or rail facilities and travel patterns within to the service area.

One limitation is that outside of transit agency service planning, deadhead ratio is not something that is familiar or widely used.

Quality Key Performance Indicators

The last type of KPI measures we will discuss today are the Quality Measures. These measures consist of vehicle reliability, safety, on-time performance, and customer service. They measure whether a transit agency is 'doing things right'.

Mean Distance Between Failures (MDBF) – Mean Distance Between Failures is a quality measure of vehicle reliability. It is calculated dividing Total miles operated by Total Number of mechanical failures.

The National Transit Database requires reporting of mechanical failures, and it stratifies them into two different categories – Major Mechanical System Failures and Other Mechanical System Failures. The definitions and descriptions that follow are taken directly from the NTD Reporting Manual:

“Major mechanical system failures are failures of some mechanical element of the revenue vehicle not caused by a collision, natural disaster, or vandalism, which prevent a vehicle from completing or starting a scheduled revenue trip because actual movement is limited or because of safety concerns. Examples of major bus failures include breakdowns of:

- Brakes
- Doors
- Engine cooling systems
- Steering, axles, suspension

Agencies must classify a failure as major if it results in a safety hazard or if the vehicle is disabled. This means that a major mechanical system failure does not have to be expensive or difficult to repair in order to meet the definition; it could be inexpensive or easy to repair, such as a flat tire.

A number of factors can affect the number of major mechanical system failures that an agency incurs, such as local operating conditions, vehicle type, and effectiveness of the

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maintenance program. However, transit agencies must uniformly report data on major mechanical failures to ensure consistency in the NTD database.”

“Other Mechanical System Failures are failures of some other mechanical element of the revenue vehicle not caused by a collision, natural disaster, or vandalism, but, because of local agency policy, prevents the revenue vehicle from completing a scheduled revenue trip or from starting the next scheduled revenue trip even though the vehicle is physically able to continue in revenue service.

Common examples include breakdowns of:

- Fareboxes
- Wheelchair lifts
- Heating, ventilation, and air conditioning (HVAC) systems”

This KPI is helpful in assessing how well a maintenance program works. If buses are permanently assigned to a particular garage, it can also be used to compare maintenance performance between garages. Over time, it can also be used to gauge the quality levels among different fleets and vehicle manufacturers.

One limitation to this KPI is that it doesn’t communicate anything about the cost required to achieve the measured level of quality. An agency can always spend more money to improve this metric but that may not be the best use of those funds because after a certain level of expenditures, a point of diminishing returns is reached. It also doesn’t include the contextual information about the age of the fleet. Older fleets will almost certainly have a lower MDBF than a newer fleet. Or, if the goal is to maintain the same MDBF, it will simply be much costlier to do so for an old fleet.

Mean Distance Between Failures can also be predicted, in part, by the maintenance performance metric of Scheduled Maintenance Compliance. Scheduled Maintenance Compliance is the total number of completed Preventive Maintenance Inspections (PMs) divided by the total number of scheduled PMs.

Vehicle Accidents per 100,000 Miles - This is a safety quality measure and is calculated as follows:

$$(\text{Vehicle Accidents/Actual Fixed-Route Miles}) * 100,000.$$

This KPI is a high-visibility, customer-focused measure used to monitor the combined effectiveness of factors affecting safety. It is an important public facing KPI. It is objective and is easily counted/measured. An accident either occurred or it didn’t.

It can be further refined into Preventable Vehicle Accidents per 100,000 miles. After all, is it fair to count an accident for a vehicle that is standing still at a traffic light and gets hit

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from behind? While using preventable accidents does add some subjectivity to the measure, it is a more important measure for management as it represents the controllable portion of the KPI. Analysis of the number, type and details of accidents can be used in the development or refinement of operator procedures and training programs and perhaps, even operator screening and hiring processes.

On-time Performance (OTP) – On-time Performance is a service quality KPI measuring the frequency of vehicles picking up passengers within a designated allowable time window (such as the period from one-minute early to three minutes late). It may be the single most important KPI affecting ridership retention and growth by riders of choice. Having a service that can reliably pick up passengers and drop them off at the specified time they need is critical. All it takes is a missed meeting or two, or a missed transfer or two that result in a delay of 30 minutes or waiting for an hour for the next connecting bus and choice riders may decide not to use transit again. As such, On-time Performance is a good leading indicator of customer satisfaction.

While it is an extremely important metric, OTP does have some issues associated with it.

Comparability is limited because of two things:

1. On-time Performance is not reported to the National Transit Database.
2. There are inconsistencies in terms of definitions and measurement among agencies. Different modes, even within the same Agency may have different allowable time windows such as:
 - No more than one minute early to no more than three minutes late
 - No more than two minutes early to no more than five minutes late
 - No more than on time to no more than seven minutes late

Also, different agencies may measure OTP at different levels of depth. On-time performance can be measured at the highest level (trip level), where only departure from start of the line and arrival at the end of the line are measured against the designated time window, the lowest level (stop level) where departure from every single stop along the route is measured), or in-between where measurements are taken at several points (called time points) along each trip that represent significant stops or transfer points along the route.

Trip and time-point methods were more prevalent in the past, but the increasing use of GPS technology has made stop-level data easier to obtain and use. One issue with stop level data is that it will significantly lower the reported rate of on-time performance. Consider the following scenario:

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You are a bus operator. You leave your designated starting point on time. In the course of your route, you passed through your first six stops within your on-time window but have lost a little time and are now running four minutes late and driving through a typical dense urban environment. Your agency's designated on-time window is 'no more than one minute early to no more than five minutes late'. You approach a stop and there are 12 passengers waiting to board. You leave that stop running six minutes late. The next two traffic signals are red so you are late for your next two stops as well. You then catch a couple of green lights and arrive at the downtown transit center 3 minutes late (within your on-time window). Trip-level on-time performance is 100%. Stop-level OTP is 70%.

On-time Performance is calculated as follows:

$$\frac{\text{Total Number of Late Measurements}}{\text{Total Number of Time Measurements}}$$

The calculation is the same regardless of whether those measurements are trips, time points or stops.

Reminder: The cardinal sin of transit service is not running late; it is running early. Nothing destroys customer trust more than arriving at a stop in time to catch your bus (based on the schedule) and seeing that bus off in the distance having already left their stop.

Customer Satisfaction – The primary quality KPI for Customer Service is Complaints per 100,000 trips. This is calculated as follows:

$$(\text{Complaints Received} / \text{Total Ridership}) * 100,000$$

This KPI is primarily used to determine how well the service is perceived by the riding public. While a single measurement may not provide substantial useful management information, watching the trend over time will provide very useful information.

However, when analyzing trend data, it is important to be mindful of major events that might drive changes in the complaint rates such as:

- Fare increases
- New service (e.g. opening of a new rail line)
- Significant service changes
- Transition to new purchased transportation contractor(s)

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Related analysis might indicate that higher complaints reflected some passengers not happy about paying higher fares. Changing service contractors usually involves some transition issues which might affect riders, thereby increasing customer complaints. A change in Agency hiring practices would likely be invisible to customers and, if it had any effect, an improvement in MDBF would reduce, not increase the number of customer complaints.

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KNOWLEDGE CHECK

Learning objectives

You're getting near the end! By now you should be able to identify the different categories of transit agency performance measures and their characteristics. Let's test that knowledge.

REVIEW QUESTIONS:

1. Which of the following is NOT correct about farebox recovery?
 - A. It does not include tolls paid by vehicles even if the agency operates a toll road.
 - B. It is a cost-effectiveness KPI.
 - C. Farebox recovery calculates the percentage of operating cost paid for with passenger fares.
 - D. The agency may use this KPI to determine the timing and magnitude of fare increases.
2. Which of the following is NOT an efficiency metric?
 - A. Labor Efficiency/Pay-to-Platform ratio.
 - B. Statement of Cash Flows.
 - C. Deadhead Ratio.
 - D. Mean Distance Between Failures (MDBF).
3. Which answer is correct regarding the Pay-to-Platform metric?
 - A. It is a cost-effectiveness metric.
 - B. It measures wage rate competitiveness.
 - C. It is calculated only on the basis of dollars.
 - D. It provides an idea of the amount of labor cost driven by non-productive time.
4. Which answer is NOT correct about Mean Distance Between Failures?
 - A. For NTD reporting purposes, Mechanical failures can be stratified into three categories: Major, Minor and Other.
 - B. It is calculated dividing Total miles operated by Total Number of mechanical failures.
 - C. MDBF is a quality measure of vehicle reliability.
 - D. Agencies must classify a failure as major if it results in a safety hazard or if the vehicle is disabled.
5. Which of the following is correct regarding Vehicle Accidents per 100,000 Miles?
 - A. It is a safety quality measure.

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- B. It is calculated as follows: Preventable Vehicle Accidents / (Actual Fixed-Route Miles * 100,000).
- C. This KPI is somewhat obscure.
- D. It is highly subjective.

Answers

1. Answer “A” is not correct. This KPI includes farebox revenue and system user fees. User fees should include tolls if the agency operates a toll road.
2. The Statement of Cash Flows is part of Traditional financial reporting, not an efficiency metric.
3. Answer “D” is correct. Pay-to-Platform is a labor efficiency metric that can be calculated using hours or dollars. It does not measure wage competitiveness.
4. Answer “A” is not correct. The NTD only breaks mechanical failures into two categories, Major and Other. The other answer represent correct statements about MDBF.
5. Answer “A” is correct. Vehicle Accidents per 100,000 Miles is the gross measure of total Accidents per 100,000 miles. It can be further broken down to Preventable Accidents per 100,00 miles. This KPI is a high-visibility, customer-focused measure used to monitor the combined effectiveness of factors affecting safety. It is objective and is easily counted/measured. An accident either occurred or it didn't.

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Key Performance Indicators

In this last section, we will learn to:

- Define the leading and lagging measures
- Determine the persons served by the KPIs and potential pitfalls of measures and metrics

Leading vs. Lagging Indicators

Measures and metrics are often categorized as leading or lagging indicators.

Leading indicators – These are data points or metrics that might signal future events or trends. These indicators can help transit agencies anticipate problems, take proactive measures, and guide decision-making before issues become significant.

Lagging indicators – On the other hand, lagging indicators measure outcomes that have already occurred. These indicators reflect the results of past performance, providing insights into the overall effectiveness and efficiency of a transit system. While lagging indicators do not offer predictive insights, they are essential for assessing past success, identifying areas for improvement, and setting long-term strategic goals.

Leading indicators are used more for proactive decision-making while lagging indicators are used more for performance evaluation.

It may also be useful to your agency to think in terms of who is most likely to see/use each of the various KPIs you use, and whether those KPIs are leading or lagging indicators. Below is a table comparing the characteristics of various measures and metrics. It shows the primary user(s) of the measure or metric (other than management who should be using all of them), what type it is, and whether it is a leading or lagging indicator.

Metric	Primary User(s) (other than Management)	Type	Leading/Lagging
Ridership	Board of Directors, Stakeholders	Service Effectiveness	Lagging

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Revenue Miles	Service Planning		Leading
Pass/Mile (Hour)		Service Effectiveness	Lagging
Peak Load Factor	Service Planning	Service Effectiveness	Lagging
Pass/vehicle seat mile	Service Planning	Service Effectiveness	Lagging
Net Subsidy	Stakeholders	Cost Effectiveness	Lagging
Subsidy per Passenger	Stakeholders	Cost Effectiveness	Lagging
Subsidy per Passenger Mile	Stakeholders	Cost Effectiveness	Lagging
Cost per Revenue Hour/Mile		Cost Effectiveness	Lagging
Farebox Recovery	Board of Directors, Stakeholders	Cost Effectiveness	Leading
Overall Efficiency	Stakeholders	Efficiency	Leading
Labor Efficiency (Pay-to-Platform)	Service Planning	Efficiency	Leading
Deadhead Ratio	Service Planning	Efficiency	Leading
Mean Distance Between Failures		Quality	Leading
Accidents/100,000 miles		Quality	Leading
On-time Performance	Service Planning	Quality	Leading
Complaints/100,000 Passengers	Stakeholders	Quality	Lagging

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Key Performance Indicators

Pitfalls of Measures and Metrics

Tread carefully. KPIs, as well as other measures and metrics are critical to understanding and properly managing a transit agency, but an agency can't just manage by these ratios. There are any number of examples of decisions that could be made that would improve one ratio or another but would not be smart decisions for the overall health or effectiveness of the Agency.

- Ridership can always be increased by adding service, but management must be mindful of the cost.
- Forcing additional transfers will increase ridership as represented by unlinked passenger trips but this would certainly have negative impacts on the system's users.
- Farebox recovery and subsidy per passenger might be able to be improved by slashing expensive, unproductive routes. But it is important to keep many additional aspects in mind such as not creating a 'service desert' (area devoid of any transit services), not deleting a key route in the system that would result in ridership reductions in other areas of the system, constituent equity issues, etc.
- Labor efficiency might be improved by reducing certain pay categories or altering certain operator pay rules. But any adjustment to pay or pay rules is likely to cause a significant disturbance in the workforce and is likely to also be subject to union contracts or collective bargaining arrangements. Also, adjustments might have unintended negative consequences. For example, a reduction in report time might reduce the amount of time the operator spends in the pre-trip inspection, jeopardizing safety. Or perhaps if starting pay is reduced, that might reduce an Agency's ability to recruit a workforce sufficient to deliver the service.

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KNOWLEDGE CHECK

Learning objectives

You're made it to the end! In this last section, you learned how define leading and lagging measures, and determine the persons served by the KPIs and potential pitfalls of measures and metrics. Let's check that knowledge.

REVIEW QUESTIONS:

1. Which of the following is correct regarding lagging indicators?
 - A. They are data points that signal future trends.
 - B. They can help transit agencies anticipate problems.
 - C. They can guide decision-making before issues become significant.
 - D. They are primarily used for performance evaluation.
2. Which of the following is a leading indicator?
 - A. Subsidy per passenger mile.
 - B. Revenue miles.
 - C. Peak load factor.
 - D. Ridership.

Answers

1. Only answer "D" is correct. Lagging indicators are not predictive in nature, they just report past results. The other statements describe leading indicators.
2. Revenue miles (answer "B") is a leading indicator. The amount of service the Agency provides and changes to that are predictive of future ridership. The other metrics are lagging indicators.

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Key Performance Indicators

CONCLUSION

Congratulations! You have completed the **Key Performance Indicators** module. You should now know how to:

- Define Key Performance Indicators
- Describe the difference between a measure and a metric
- Identify the different categories of transit agency performance measures and their characteristics
- Define the leading and lagging measures
- Determine the persons served by the KPIs and potential pitfalls of measures and metrics

Final Knowledge Test

TFLEEx members will earn 1.0 CPE credit upon successfully completing a knowledge test (qualified assessment) for this module (KPIs). Upon gaining an understanding of the material in this work and completing the review questions, contact Joe Costello, TFLEEx Executive Director, at CostelloConsultingCorporation@gmail.com. He will provide you with a **final knowledge test**. You will have 30 days to send your answers to Mr. Costello. Upon answering at least 70% of these questions correctly, you will receive a certificate of completion for the 1.0 CPE credit, as well as evaluative feedback.

Not a member of TFLEEx? Please reach out to Joe Costello, TFLEEx Executive Director, at CostelloConsultingCorporation@gmail.com to find out how your agency can join. We encourage you to do so. We know you would get great value in being part of this organization!

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KPI GLOSSARY

Balanced Scorecard: A strategic planning and management system that is used extensively in business and industry, government, and nonprofit organizations worldwide to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals.

Cost per Revenue Service Hour: Total operating costs divided by total revenue service hours.

Deadhead: A transit vehicle's movement without passengers onboard, typically for traveling to or from the garage or between different routes during the operator's shift.

Deadhead Ratio: Schedule miles less revenue miles, divided by revenue miles.

Extraboard: A roster of bus operators assigned to cover vacant runs and other work on a daily or weekly basis. Operators on the extraboard may choose assignments during a sign-up period or be assigned as needed if no regular runs are available.

Farebox Recovery: Farebox revenue divided by operating expenses.

Lagging Indicator: Reports incidents after they have happened.

Labor Efficiency: Also called Pay-to-platform ratio. Pay hours divided by platform hours.

Leading Indicator: The KPIs that help the user predict the agency's performance.

Net Subsidy: Cost incurred to produce the amount of service consumed. Calculated by taking operating revenues minus operating expenses.

Key Performance Indicators: Ways to periodically assess the performance of an organization and its departments and employees.

On-time Performance: Number of scheduled trips less the number of times late, divided by the number of scheduled trips.

Overall Efficiency: Miles of service divided by operating expense.

Passengers per Mile: Passenger boardings divided by revenue miles.

Ridership: Number of passenger boardings. Usually reported as Unlinked Passenger Trips.

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Subsidy per Passenger: Net subsidy divided by ridership.

Traditional Reporting: Reporting that provides information about what the agency has spent and received from what sources, and what is still owed.

Vehicle Reliability: Vehicle reliability is measured by Mean Distance Between Failures. Total mile operated divided by the number of mechanical failures.

Additional glossary terms

A general transit glossary and list of acronyms can be found under “Other Resources” on this TFLEEx website (www.tflex.org).