Regional Transportation District

Transit Asset Management Plan 2018

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Executive Summary

In 2016, the Federal Transit Administration (FTA) mandated 'Transit Asset Management Plans' for all federally-funded transit agencies in the United States by October 2018. The FTA is concerned about the sustainability of transit assets when the backlog of renewals is estimated at $90 billion nationwide. The Federal Government's *Moving Ahead for Progress in the 21st Century* (MAP-21) said the time had come to change focus from construction to longer term stewardship (U.S. Department of Transportation, 2013).

This Regional Transportation District (RTD) Transit Asset Management Plan is a formal report that meets the FTA TAM requirements under MAP-21.

A Transit Asset Management Plan is the cornerstone of asset stewardship. It is the public case for investment in the assets, to justify the use of tax dollars and fares to meet community requirements. It aims to demonstrate the best use of funding to deliver services now and into the future.

Accordingly, this document summarizes:

- The principles RTD uses to make asset decisions aligned to Agency priorities

- What assets RTD owns

- The current state of those assets

- How we make asset investment decisions

- The proposed capital investment plan for the period 2018-23

- Actions to further improve asset management decision making

- How this plan will be evaluated for continuous improvement

RTD, like all transit agencies, is highly asset-intensive: nearly 90% of its value lies in the physical assets it owns. In the past fifteen years, RTD has spent $5.1 billion on expansion, including new rail and bus rapid transit lines.

When MAP-21 was passed in 2012, RTD appointed dedicated staff to focus on asset management and began to review both its asset inventory data (the details of what assets RTD owns and manages) and the condition of these assets, using the principle of State of Good Repair (SGR). Both of these are now requirements from the FTA.

RTD then made the decision to move beyond FTA minimum requirements and commit to implementing established international good practice in the form of ISO 55000 certification. This is focused on better decision-making across the asset portfolio towards optimization. By 2017, RTD had put in place the first steps towards an integrated process to prioritize all capital investment by agency objectives. This has further been refined to categorize all investment proposals by Compliance, Renewal or Expansion, and generally fund them in that order to ensure good stewardship. This ensures investment to maintain existing assets is sustained before funding new asset or non-asset projects.

This process forms the basis for this TAM Plan, along with RTD's commitment to continue to develop its asset management practices.

RTD is actively involved in transit asset management thought-leadership, through APTA and TRB. RTD examples were used by the FTA in its Facility Condition Assessment (U.S. Department of Transportation, 2017). RTD believes that a shift in culture is needed towards improved stewardship of assets using better information and decision tools.

RTD's long term strategy is to make consistently good decisions across RTD's asset portfolio and asset systems to deliver customer needs in a financially sustainable and safe way, using the ISO 55000 framework. This effort has led to a proposed new end-to-end process for planning and budgeting that will be reflected in the 2019 TAM PLAN update, as well as the target to achieve ISO 55000 certification by the end of 2020.

The asset management system in RTD is being developed in close co-ordination with the safety management system, and both informed by a developing corporate risk framework to understand and management risks to agency objectives. The aim is to move towards international good practice risk-based prioritization.

RTD exists to move people effectively and efficiently, and the focus here is to ensure effective stewardship of the assets that deliver this purpose. The cities RTD serves should know what investments are made and how they are prioritized to make the best use of limited resources. This is done through transparency in decision processes to sustain the condition and performance of the assets.

1. INVENTORY

Revenue vehicles	770 – Transit Buses	349 – Cutaway Bus	
	116 – Articulated Bus	172 – Light Rail Vehicles	✔
	170 – Intercity Bus	66 – Commuter Rail Vehicles	
Infrastructure	39 – Grade Crossings	214 – Relay Cases	
	141 – Catenary Wire Segments	240 – Switches	✔
	73 – Track Segments	61 – Substations	
	298 – Signal Segments	64 – Light Rail Vehicle Bridges	
Facilities	7 – Maintenance Facilities	384 – Public Facilities assets	✔
	3 – Administrative Facilities	85 – Conveyances	
Equipment	82 – Sedans	281 – Truck & Other Rubber Tire Vehicles	✔
	4 – Steel Wheeled		

2. CONDITION ASSESSMENT

Revenue vehicles	Age-Based Analysis	✔
Infrastructure	Guideway Under Performance Restriction	✔
Facilities	Physical Condition Assessment	✔
Equipment	Age-Based Analysis	✔

3. DECISION SUPPORT TOOLS

What tools and processes do we use to prioritize funding around those assets described in our inventory?	On an annual basis, RTD executes a process which prepares and updates a six-year Mid Term Financial Plan including projected capital construction and improvements, service levels and operating costs, and revenues to fund the capital and operating programs. Part of process includes prioritizing the projects into three funding categories: Compliance, Renewal, and Enhancement.	✔

4. PRIORITIZED LIST OF INVESTMENTS

What is the result or output of those decision support tools and processes?	The output of the annual Mid Term Financial Plan process is two primary lists of projects; Capital Projects & Capital Maintenance Projects. Each of lists is subdivided into three funding categories: Compliance, Renewal, and Enhancement.	✔

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5. TAM AND SGR POLICY

What are the guiding principles for asset management efforts at our agency?	RTD originally adopted an Asset Management Policy in June 2014 and most recently updated November 2017. The intent of the policy is to improve how RTD manages assets from now on - it is therefore forward-looking in nature, and represents our vision and shared commitment for good Asset Management at RTD. The Asset Management system applies to the entire organization and directs the short, medium, and long-term plans for assets to achieve our agency purpose of moving people.

6. IMPLEMENTATION STRATEGY

How are we going to execute the TAM plan at our agency?	RTD has chosen ISO 55000 as the framework to build its Asset Management system. As part of that choice, RTD underwent a gap assessment to determine the necessary tasks needed to achieve ISO 55000 certification.

7. LIST OF KEY ANNUAL ACTIVITIES

What activities do we perform to maintain our TAM system?	RTD identifies two types of asset management activities: those ongoing asset management activities that RTD performs as part of 'business as usual', and those activities specific to achieving ISO 55000 certification. TAM activities are the subset of these targeting the specific TAM elements.

8. IDENTIFICATION OF RESOURCES

What resources do we need to execute TAM plan activities at our agency?	Resources from across the agency are involved in RTD's Asset Management activities, including the CEO/GM, the Senior Leadership Team, the Asset Management Division (AMD), Bus Operations, Rail operations, Capital Programs, Finance and Administration, Communications, Planning, and General Counsel. The AMD acts as the experts that serve as an enabling function to the agency. From the passage of MAP-21 in 2012 through 2016 when the final rule came out, the AMD added additional staff in two key areas: physical asset and business analysts, and data sciences.

9. EVALUATION PLAN

What is the agency doing to ensure that the TAM plan delivers the intended results?	There are two primary areas of the Evaluation Plan; the TAM Plan itself and ISO 55000. The current TAM Plan provides the baseline for evaluating future TAM Plans produced by the Agency. RTD intends to regularly review its asset management maturity, setting maturity targets in its Strategic Asset Management Plan. RTD intends to evaluate the degree to which it is meeting the requirements for ISO 55000, and therefore its readiness for an ISO 55001 certification audit, through the following measures: ISO spot checks ISO health check ISO mock audit ISO audit ISO surveillance audits

1 Introduction

1.1 Background

On June 29, 2012, Congress passed MAP-21. In accordance with section 20019 of this law, the Federal Transit Administration established standards that transit providers shall follow. The final rule was published on July 26, 2016 in the Federal Register with an effective date of October 1, 2016 (U.S. Department of Transportation, 2016). RTD is a Tier 1 Agency, so all the requirements apply.

The FTA requirements for a Transit Asset Management Plan are as follow:

Tier	Element	Brief Description
Tier I and II	1. An inventory of assets	A register of capital assets and information about those assets.
	2. A condition assessment of inventoried assets	A rating of the assets' physical state; to be completed for assets an agency has direct capital responsibility for; should be at a level of detail sufficient to monitor and predict performance of inventoried assets
	3. Description of a decision support tool	An analytic process or tool that (1) assists in capital asset investment prioritization and/or (2) estimates capital needs over time (does not necessarily mean software)
	4. A prioritized list of investments	A prioritized list of projects or programs to manage or improve the SGR of capital assets
Tier I only	5. TAM and SGR policy	A TAM policy is the executive-level direction regarding expectations for transit asset management; a TAM strategy consists of the actions that support the implementation of the TAM policy
	6. Implementation strategy	The operational actions that a transit provider decides to conduct, in order to achieve its TAM goals and policies
	7. List of key annual activities	The actions needed to implement a TAM plan for each year of the plan's horizon
	8. Identification of resources	A summary or list of the resources, including personnel, that a provider needs to develop and carry out the TAM plan
	9. Evaluation plan	An outline of how a provider will monitor, update, and evaluate, as needed, its TAM plan and related business practices, to ensure the continuous improvement

Table 1: TAM Elements required by Tier

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1.2 Intended Audience

This document captures RTD's commitment to its planning partners: the Federal Transit Administration, DRCOG, and CDOT.

It is also a commitment to staff at RTD to continue to improve. The annual update cycle of this document will serve to keep functional teams across the Agency informed about the state of RTD's assets and its integrated plan, as well as its ongoing strategy towards good asset management.

Members of the public can also reference this document to understand how RTD is using its funding to maintain and optimize the transit system built to serve them.

1.3 Document Purpose

The RTD Transit Asset Management Plan is a report that meets the FTA TAM requirements under MAP-21. It is targeted to meet RTD's strategic objectives, and highlights the principles in which RTD will manage its assets to deliver its purpose of moving people.

It describes RTD's asset management practices, and sets out a clear plan for enhancing these practices over the plan horizon.

It represents our commitment to follow best asset management practices.

1.4 Document Structure

This TAM Plan has been structured to comply with the FTA TAM requirements outlined in Table 1 above.

Section 1 introduces the document and RTD's Asset Management Policy. The latter is an overarching policy on RTD's approach to managing all assets, and to improving its asset management capabilities. [FTA TAM requirement 5]

Section 2 summarizes RTD's asset base, its condition and backlog [FTA TAM requirements 1 and 2]

Section 3 describes RTD's current capital investment decision-making process and criteria. [FTA TAM requirement 3]

Section 4 provides the current approved capital projects for 2018-2023 that arise from that decision process. [FTA TAM requirement 4]

Section 5 describes RTD's approach to improving its asset management capabilities, including its overall strategy, the annual asset management activities and the resources needed to support those activities. [FTA TAM requirements 6, 7, 8]

Section 6 describes RTD's approach to evaluating its TAM Plan and approach to Asset Management [FTA TAM requirement 9]

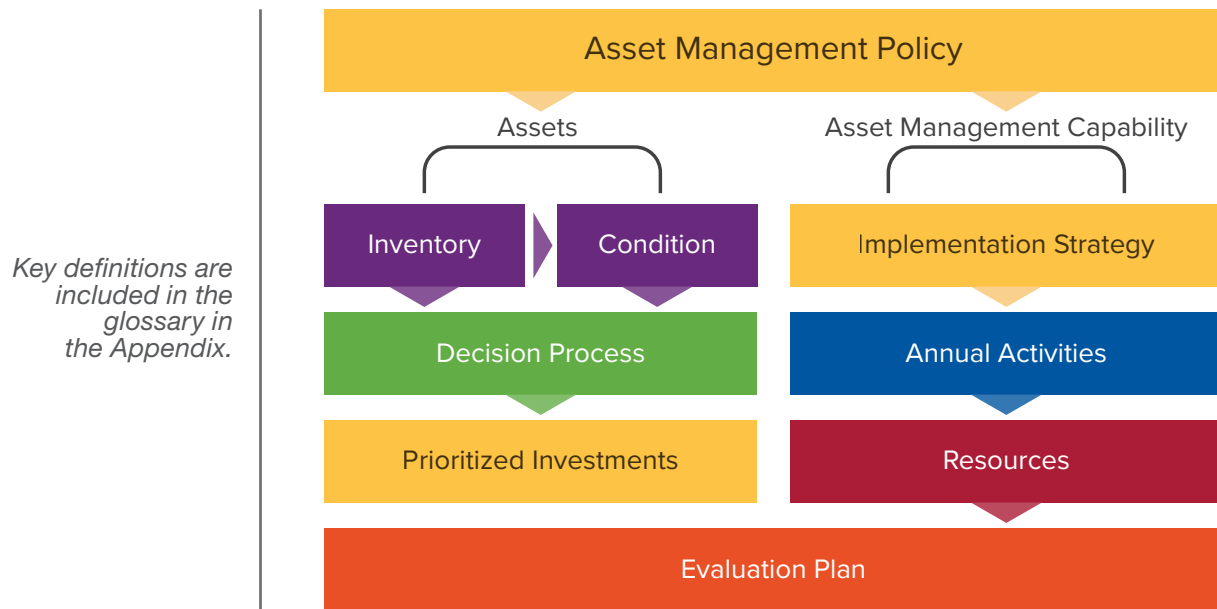Figure 1 below summarizes the document structure .

Figure 1: RTD TAM Plan structure

1.5 Scope

This TAM Plan covers the time period 2018-23, and will be updated annually. The assets in scope for this version are detailed below.

Figure 2: Assets in scope for this TAM PLAN

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1.6 Alignment

Organizational alignment is a core principle of good practice asset management.

This TAM Plan aligns with:

- **FTA TAM requirements** – the content of the TAM Plan complies with the nine FTA TAM required elements
- **RTD Mid Term Financial Plan** – the list of prioritized projects come from the approved Mid Term Financial Plan for the period 2018-23, as part of RTD's Strategic Business Planning (SBP) process (Regional Transportation District, 2018)
- **RTD ISO 55000 roadmap** – the annual activities described in this TAM Plan are contained in RTD's ISO 55000 roadmap (AMCL, 2017)
- **RTD Asset Information** – the inventory and condition information held in this TAM Plan are drawn from the RTD Asset Management Annual Report 2017 (Regional Transportation District, 2017).
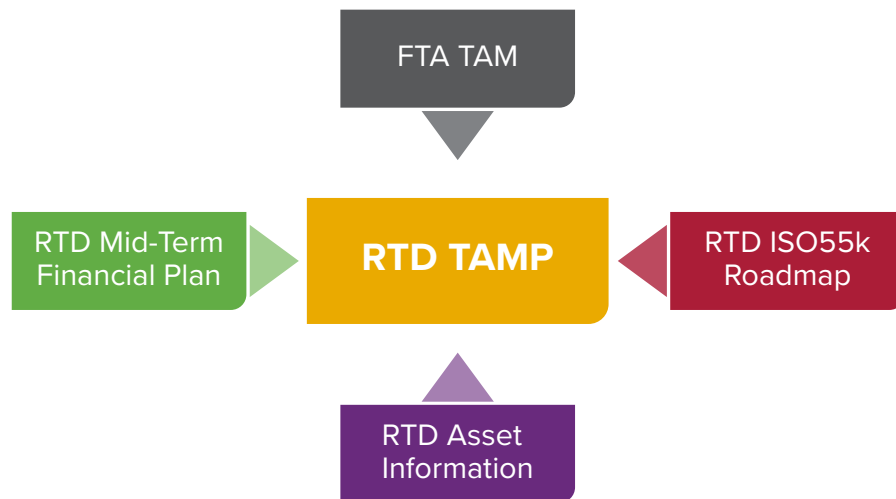

Figure 3: RTD TAM Plan Alignment

Future generations of this TAM Plan will directly align with RTD's Asset Management Policy, and the Strategic Asset Management Plan being developed through RTD's ISO 55000 certification initiative.

1.7   Asset Management Policy

A TAM policy is a documented commitment to achieving and maintaining a state of good repair for all capital assets. The FTA has defined state of good repair as "The condition in which a capital asset is able to operate at a full level of performance." (U.S. Department of Transportation, 2016).

RTD's Asset Management Policy was adopted on November 21st, 2017. The policy describes a forward-looking commitment to good asset management practice, intended to optimize investment across the entire asset portfolio to maximize its value. Value means delivering on the Agency objectives, two of which are safety and reliability. Asset management performed according to this policy will result in assets that are in a state of good repair.

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Policy Name:	Asset Management Policy				
Policy #:	RTD-AMD-PLY-0001	Adopted:	2017-11-21	Current Version	A
Revised:		Last review Date			
General Manager Approval:					
Assistant General Manager Approval					
Responsible Department:	Safety, Security and Asset Management – Asset Management				

1. POLICY STATEMENT

The intent of this commitment is to improve how RTD manages assets from now on - it is therefore forward-looking in nature, and represents our vision and shared commitment for good Asset Management at RTD.

2. RESPONSIBILITIES

All RTD Employees: An integrated Asset Management system applies to the entire organization and directs the short, medium and long-term plans for assets to achieve our agency purpose of moving people.

Any exceptions to this commitment must be documented as out of compliance and signed by the General Manager.

3.   POLICY

Good Asset Management helps RTD fulfil its service level agreement with the region's transit assets to provide transit services that:
- Are safe
- Are fiscally sustainable
- Are efficient
- Are clean
- Are reliable
- Are in compliance with all regulations

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	1 of 3	RTD-AMD-PLY-0001	A

We commit to:
- Understanding what's critical to delivering our objective and saying no to what's not important
- Making best use of our limited resources to meet our objective
- Being transparent about the tradeoffs between risk, cost and performance inherent in all decisions
- Using clearly defined agency strategies, objectives, operational plans, and processes

We will implement these principles by:
- Having a "big picture" perspective on our objective across the organization
- Considering the whole life costs and value of our assets
- Determining the root causes of the problems we face
- Utilizing a uniform method of evaluating risk
- Including everyone at the table to make unbiased decisions
- Proactively using evidence-based, repeatable processes
- Actively reviewing if projects deliver what was intended
- Sharing data across departments and using it ethically and competently

2 RTD and its Assets

The Regional Transportation District (RTD provides transportation services to 2.8 million people located within its 2,400 square mile service area, including bus, rail, shuttles, ADA paratransit services, demand responsive services like Call-n-Ride, and special event services. Using these assets, RTD delivers 43 million service miles, across 142 routes, including 88 local bus, 8 light rail and 2 commuter rail routes.

2.1 The RTD Story

RTD was created in 1969 by the 47th session of the Colorado General Assembly. Efforts in these early years focused on regional transportation planning. In 1973 voters approved a 0.5% sales tax initiative to finance a $1.56 billion multi-modal transit system. At this time, RTD acquired privately owned bus companies, improved service frequencies, and expanded routes in numerous counties throughout the metro area. By 1976, ridership grew to 35 million rides annually.

RTD celebrated its first light rail opening in October 1994. The 5.3-mile D Line attracted hundreds of thousands of riders when it began operations with just eleven light rail vehicles. April 2016 marked another milestone in Denver transit history with the opening of the metro area's first high-speed commuter rail line - the University of Colorado A Line. Now, ten rail lines service 53 stations along the Denver's North, East, Southeast, Southwest, and West rail corridors.

In November 2004, region voters approved the FasTracks transit tax for region-wide expansion of transit service. The 0.04% sales tax provides funds to build RTD's FasTracks program, 122 miles of new commuter rail and light rail, 18 miles of bus rapid transit, and bus stations. The program consists of six new rapid transit corridors and three existing corridor extensions, and expands and enhances service for easy, convenient bus/rail connections across the eight-county district. Additional commuter rail services west of the downtown Denver area will be provided in the future with 11.2 miles of rail line from Union Station to Arvada and Wheat Ridge on the G Line.

2.2 RTD Service Area

The RTD service area comprises eight counties including all of Boulder, Broomfield, Denver and Jefferson counties, parts of Adams, Arapahoe and Douglas Counties, and a small portion of Weld County.
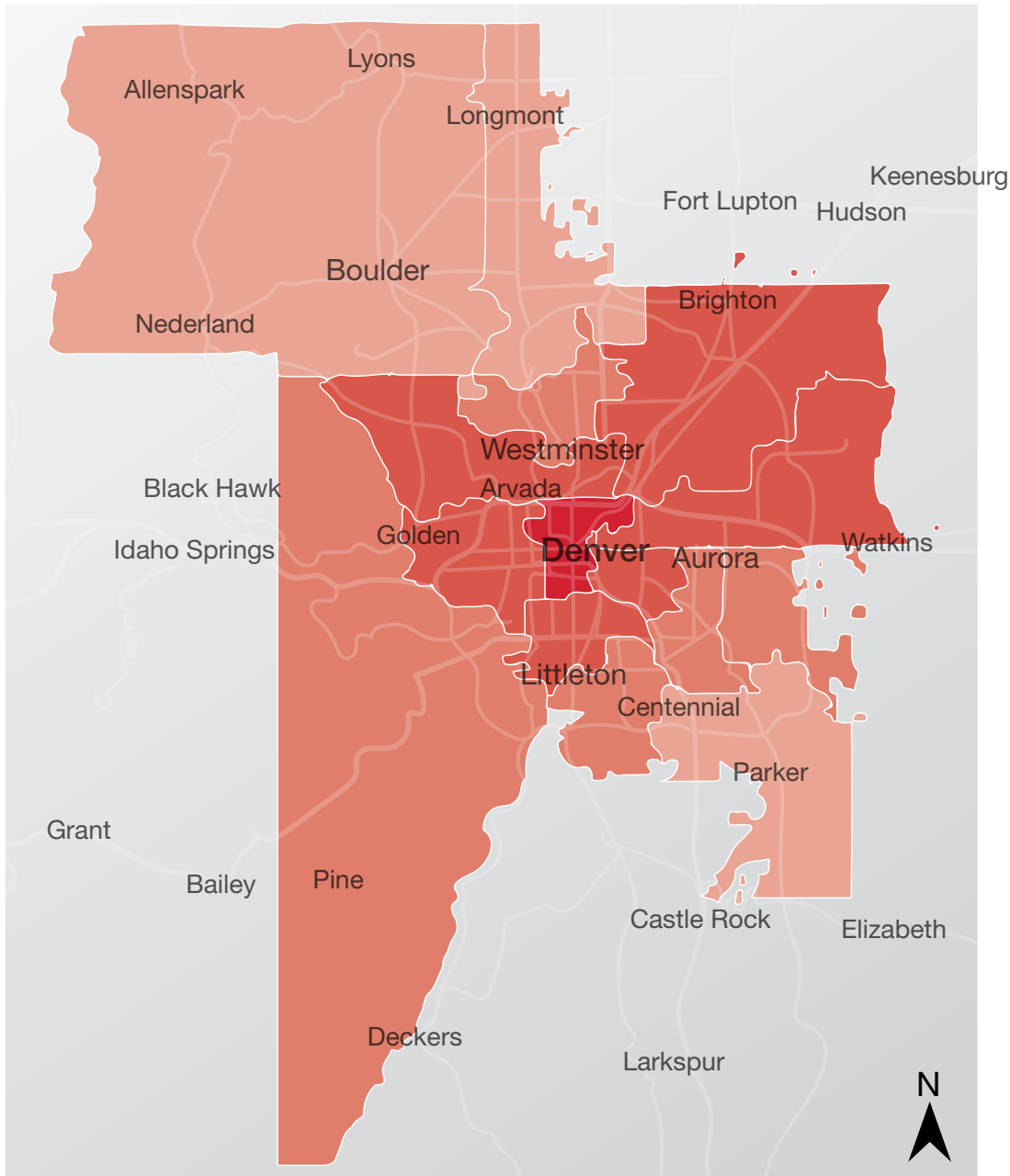
Figure 4: RTD District Map

At the turn of the Millennium RTD had approximately 77 Million passenger trips *(NTD Unlinked Passenger Trips, 2000)*, and RTD is on course to have approximately 100 Million passenger trips in 2018, a 29% increase in boardings. Over the same period, per the Colorado State Demographer's Office, the Denver Boulder region has increased from approximately 2.4 Million residents to approximately 3.2 Million residents, a 31% increase.

RTD Unlinked Passenger Trips and Denver-Boulder Region Population
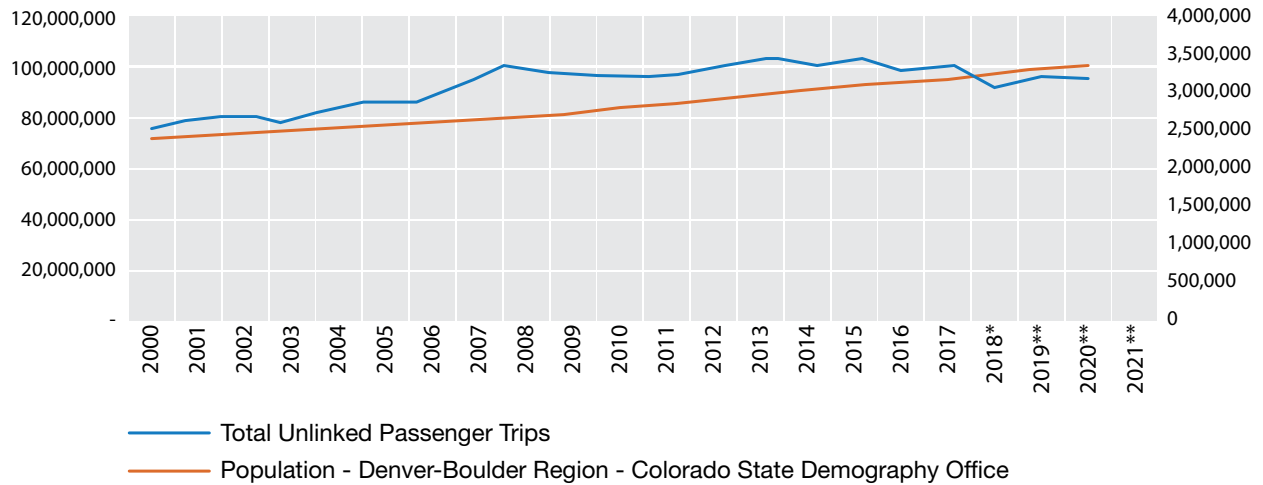
Figure 5: Ridership vs. population growth

* Estimate derived from 2018 Fare Revenue Projection for 2018 from RTD Adopted Budget

** Estimate derived from 2019-2021 Fare Revenue Modeling performed in August 2018

2.3 RTD Assets

RTD is an asset-intensive organization: roughly eighty-eight % of its value is in physical assets. In the past fourteen years, RTD has spent over $4.7 billion on expansion, including new rail and bus rapid transit lines. This section provides further details on RTD's asset inventory and condition.

As assets are operated, their condition degrades over time and their risk of failure increases. Failures can manifest themselves in a variety of ways, including those having an impact on safety. Asset condition is therefore a leading indicator for safety risks, and so understanding asset condition today, and how quickly it might degrade in the future, is an important aspect of good asset, safety and risk management. Organizations that know their assets' deterioration rates can also make more informed decisions on renewal frequencies and their approach to preventive maintenance.

For the purposes of this TAMP, RTD has categorized its assets in accordance with FTA guidelines: revenue vehicles, equipment, facilities and infrastructure, using the logic depicted in Figure 6 below, which ensured repeatable results and an improvement in inventory data quality
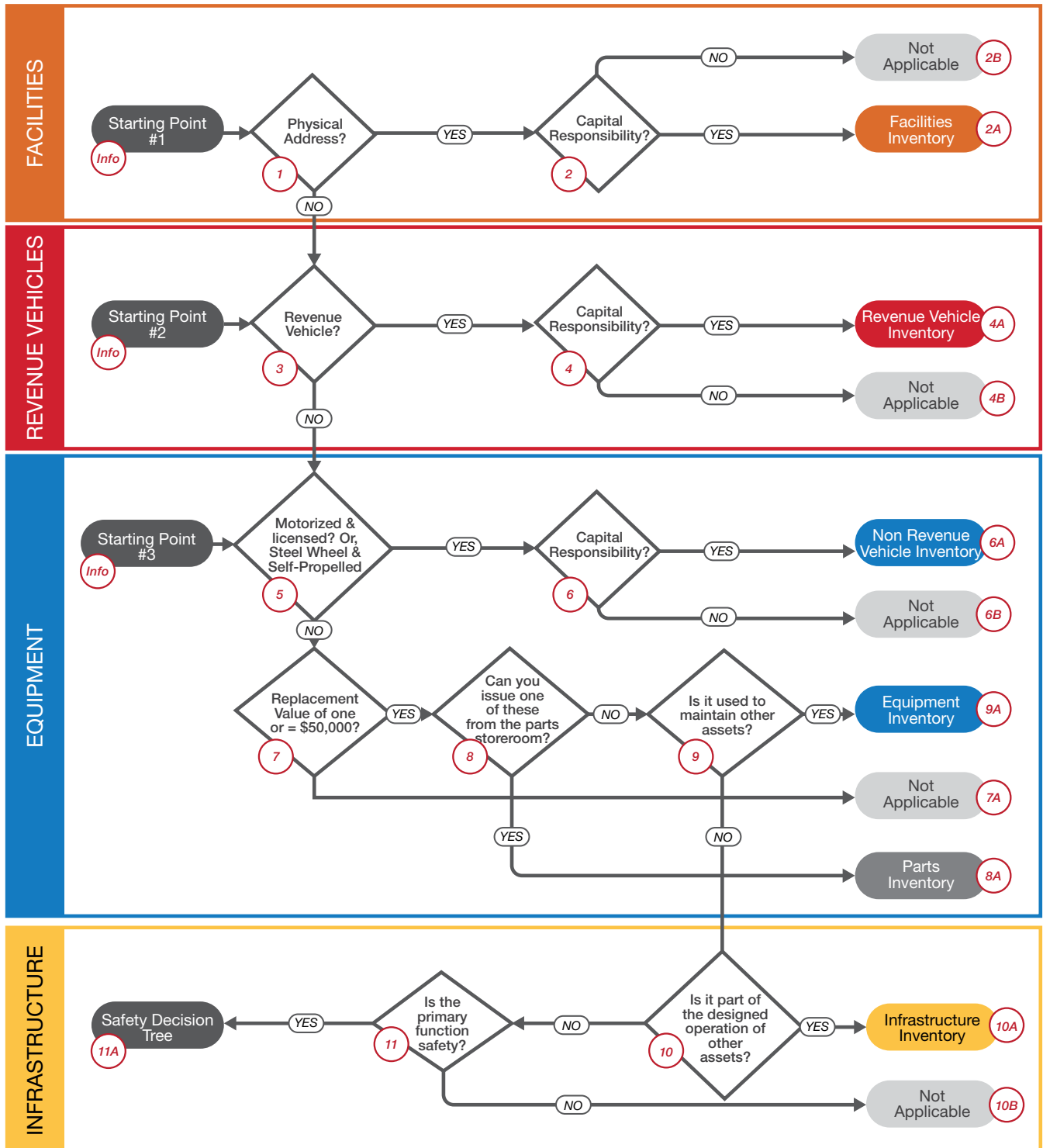
Figure 6: Inventory Classification Process

2.3.1 Revenue Vehicles

RTD's revenue vehicles comprise 1,405 buses, 172 light rail vehicles and 66 commuter rail vehicles.

Buses include fixed route standard transit buses which are 40 feet long and carry 40 passengers, fixed route articulated buses with 33% greater capacity than standard buses, regional Intercity coaches, such as the Flatiron Flyer, built for longer trips at highway speed which are typically 45 feet long and have a seated capacity of 55 passengers, and cutaways which are made by second stage manufacturers using the chassis of full size vans, and used to provide on-demand service for some ADA passengers (access-a-ride) and in areas where ridership does not support fixed route service (call-n-ride).

RTD buses are provided from a variety of manufacturers, including Orion, Gillig, BYD, New Flyer, MCI, Goshen, Eldorado, and Startrans. Approximately 50% of standard and articulated (fixed route) buses are operated and maintained by RTD, with the operations and maintenance for the remainder outsourced[1] to three external partner companies (First Transit and TransDev). All intercity coaches are operated and maintained by RTD, and all cutaway buses are operated and maintained by third-parties (Via Transportation, MV Transportation and Evergreen Senior Center).

Figure 7: Standard Bus (Gillig)

Figure 8: Articulated Bus (New Flyer)

Figure 9: Intercity Coach MCI

Figure 10: Cutaway Bus

[1] Buses operated by third-parties are sometimes referred to as "contracted services".

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Light Rail Vehicles (LRV) are electrically-powered light rail vehicles using a 750-volt DC overhead catenary system. Individual vehicles can be coupled together to form up to four cars per consist, with a seated capacity of 64. LRV can carry up to 236 passengers per car utilizing the standing room. All light rail vehicles are manufactured by Siemens and are acquired, owned, operated and maintained exclusively by RTD.

Figure 11: Light Rail Vehicle (Siemens SD-160)

Figure 12: Commuter Rail Vehicle (Hyundai Rotem)

Commuter Rail Cars are larger, non-articulating, and have much higher operating voltage than light rail vehicles. They are built to specifications regulated by the Federal Railroad Administration (FRA). They are also overhead catenary electrically-powered vehicles, running on 25kV AC power, operated as 'married pairs': two vehicles are the minimum consist and can be coupled only in groups of two. A married pair has a seated capacity of 182 passengers and total capacity of 340. All commuter rail vehicles are delivered under the FasTracks program, and their ongoing operation and maintenance is outsourced to a third-party (Denver Transit Operators) under the FasTracks program. RTD owns the commuter rail vehicles and will assume ownership at the end of the FasTracks period of performance (30 years).

RTD has historically managed its revenue vehicle inventory based on age: the vehicles are procured, maintained in a state of good repair for a specified number of years through a preventative maintenance program, and then replaced. This approach is adopted for revenue vehicles maintained by third-parties, including bus and commuter rail.

RTD has long been at the forefront of U.S. transit agency development of quantitative condition assessments of individual assets and asset subsystems using detailed assessment rubrics. Through this work, RTD concluded that its revenue vehicle sub-fleets are essentially homogenous within their type and year of manufacture with respect to condition and resultant performance because the individual vehicles in each sub-fleet are utilized uniformly throughout their useful life.

This uniform utilization allows RTD to confidently conduct assessments of a few samples of vehicles within sub-fleets and make accurate and precise determinations about the condition of the sub-fleets as a whole. While gaining this knowledge was costly, the resulting confidence in the reliability of current condition data is valuable. In the case of revenue vehicles, it was found that condition assessments were not superior to age-based ULB assessments in their ability to weigh risk, performance, and cost of the assets. As such, condition scores for RTD revenue vehicles are age-based.

The table below presents the total number of revenue vehicles, along with their Useful Life Benchmark (ULB), which is the expected duration in years that an asset will remain in service according to RTD's standards and the average condition based on its age. The condition range is from 1 to 5, where 1 indicates the vehicle is significantly beyond its useful life benchmark and 5 is considered brand new. A vehicle that has reached the end of its useful life benchmark is scored at 2.5 and from that point onwards is considered in backlog.

Revenue vehicles can be kept operating reliably and safely beyond their useful life benchmark, but costs start to increase significantly at that point. The table provides backlog for each vehicle type. RTD uses the FTA definition for revenue vehicle backlog, which is the percentage of revenue vehicles that have met or exceeded their useful life benchmark.

RTD is at the tail-end of a multi-year campaign to replace buses resulting in no direct-operated buses in backlog. The table also presents the total initial capital cost of the vehicles in each sub-fleet and the average cost per vehicle, derived by dividing the total cost by the fleet size.

Revenue Vehicle Type	Count	ULB	Score	Total Capital	Average Cost per Vehicle	Backlog
Transit Bus	770	14	3.68	$269m	$0.3m	0% - RTD-operated 2% - third-party-operated
Articulated Bus	116	14	4.34	$76m	$0.6m	0% - RTD-operated 2% - third-party-operated
Intercity Bus	170	14	4.23	$93m	$0.5m	0%
Cutaway Bus	349	10	4.34	$20m	$0.05m	2%
Light Rail Vehicles	172	31	3.98	$433m	$2.5m	0%
Commuter Rail Vehicles	66	39	4.81	$249	$3.7m	Unknown[2]

Table 1: Revenue Vehicle inventory, condition and backlog

[2] In the future, RTD intends to determine the whole-life cost (e.g., capex and opex) of its assets and this will be considered for inclusion in a subsequent generation of the TAMP.

2.3.2 Equipment

For the purposes of this TAMP, RTD's equipment assets comprise non-revenue vehicles and non-vehicle equipment costing over $50,000. RTD has 82 sedans, 4 steel wheel non-revenue trains and 281 rubber tire non-revenue vehicles. Non-vehicle equipment includes non-self-propelled rail tampers, equipment hoists, wheel lathes and exhaust fans within Union Station, but inventory numbers for these assets is not provided for this generation of the TAMP.

Equipment is purchased from a variety of manufacturers, and is exclusively owned, operated and maintained by RTD.

Figure 13: RTD Sedan

Figure 14: RTD Pool Car

Figure 15: RTD Tow Truck

Figure 16: RTD Bucket Truck

Figure 17: RTD Shuttle Wagon

RTD has historically managed its equipment inventory based on age: the equipment is procured, maintained in a state of good repair for a specified number of years through preventative maintenance and then replaced [4]. As such, Condition scores for equipment are age-based.

The table below presents the total number of non-revenue vehicle assets, along with their Useful Life Benchmark (ULB), a score representing the condition of the equipment based on its age [5] and the backlog for each vehicle type, for which RTD uses the FTA definition for non-revenue vehicle backlog, which is the percentage of vehicles that have met or exceeded their useful life benchmark.

Inventory, condition and backlog information for non-vehicle equipment is not provided for this generation of the TAMP. The table also presents the total initial capital cost of the vehicles and the average cost per vehicle, derived by dividing the total cost by the fleet size.

Asset Class	Count	ULB	Average Age Score	% in backlog	Cost
Sedan	82	8.00	2.98	7%	$ 1,598,369
Steel Wheel	4	25.00	4.70	0%	$ 1,023,164
Truck & Other Rubber Tire	281	14.00	3.68	12%	$ 13,878,872

Table 2: Equipment inventory, condition and backlog

[4] *Some vehicles adopt a hybrid approach in which they are replaced after a certain number of years and miles*

[5] *The score range is from 1 to 5, where 1 indicates the asset is significantly beyond its useful life benchmark and 5 is considered brand new. An asset that has reached the end of its useful life benchmark is scored at 2.5 and from that point onwards is considered in backlog.*

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2.3.3 Facilities

For the purposes of this TAMP, RTD has 3 administrative facilities where RTD administrative functions take place, 8 maintenance facilities where maintenance work takes place, 384 public facilities which includes stations, buildings and other structures where riders can board or disembark from an RTD transit vehicle and 85 conveyances (elevators and escalators), installed within other facilities but are treated here separately based on NTD reporting requirements.

All administrative, maintenance and public facilities that are not used in the provision of contracted services are owned, operated and maintained by RTD, although some services such as cleaning at certain facilities and snow removal are contracted to third-parties. Some facilities have been delivered by RTD and some have been delivered by the FasTracks program (or its precursor T-Rex). Conveyance manufacturers include Kone and Thyssenkrupp and their maintenance is outsourced to third-parties.

Figure 18: Administrative Facility

Figure 19: Light Rail Maintenance Facility

Figure 20: Public Facility

Figure 21: Conveyance (elevator)

RTD has historically managed its facilities (and their related equipment) on a reactive basis, i.e., maintain or replace the assets when they fail. The more critical facility elements, such as underground storage tanks and boilers, have redundancy built in to minimize service interruptions when they fail to perform as designed. RTD fully complies with all regulations relating to safety inspections for certain facility assets.

From 2015 onwards, RTD has performed in-house assessments to determine the condition score of individual elements of each facility. As such, facility condition scores are assessment-based.

The condition score of each of the elements of a facility is averaged to provide the condition score of the facility. Currently, each facility element is weighted equally. The following table presents the elements of each facility which is assigned an individual condition score.

Administrative facilities	Maintenance facilities	Public facilities
1. Roof	1. Roof	1. Driver Relief Stations
2. Building Shell	2. Building Shell	2. Grounds
3. Parking Lots	3. Parking Lots	3. Parking Lots
4. Grounds	4. Grounds	4. Platform
5. Parking Garage	5. Vehicle Wash/ Fuel Islands	5. Pedestrian Plaza
	6. Parking Garage	6. Storage Space
	7. Administrative Areas	7. Parking Structure

Table 3: Facility elements assigned individual condition score

Not all facilities have all listed elements. The elements that do exist at each facility receive a condition score that is combined with all other elements to determine the overall facility condition score. (Regional Transportation District, 2017).

Conveyance inspections are outsourced to third-parties in accordance with applicable legislation and regulations but are not used to determine condition, and conveyance condition scores are age-based, based on a ULB of 25 years. (Regional Transportation District, 2016). Conveyance SGR condition scores are linearly mapped to age, with brand-new conveyances assigned a score of 5.0, conveyances between 25-30 years old assigned a score of 2.5, and conveyances older than 37 years assigned a score of 1.0.

The table below presents the total number of facility assets, along with their Useful Life Benchmark (ULB) and a score representing the condition of the asset. The table provides backlog for each asset, for which RTD uses the FTA definition for facilities backlog, the percentage of facilities with a condition rating below 3.0 on the FTA Transit Economic Requirements Model (TERM) scale.

Capital costs for facility assets are not provided in this generation of the TAMP.

Facility Type	Count	ULB	Average Physical Condition Score	% in Backlog	Cost[6]
Administrative Facility	3				
Blake	-	60	3.6	0%	Unavailable
District Operations	-	60	3.9	0%	Unavailable
Security Command Center	-	60	-	-	Unavailable
Conveyance	85	25	4.2	0%	Unavailable
Maintenance Facility	7				
District Shops	-	60	3.9	0%	Unavailable
Platte	-	60	3.0	0%	Unavailable
East Metro	-	60	3.4	0%	Unavailable
Boulder	-	60	3.9	0%	Unavailable
Elati	-	60	4.0	0%	Unavailable
Mariposa	-	60	3.4	0%	Unavailable
Rio Court	-	60	4.0	0%	Unavailable
Conveyance	85	25	4.2	0%	Unavailable
Public Facility	384	-	3.5	0%	Unavailable

Table 4: Facility inventory, condition and backlog

[6] *While RTD has necessary information for the management of its infrastructure assets, costs are attributed to large capital programs and cannot readily be disambiguated from these projects. RTD has yet to engage in a targeted replacement of specific infrastructure asset classes to develop more specific costs. This level of detail is commensurate with the current level of detail of RTD's capital projects to date.*

2.3.4 Infrastructure

For the purposes of this TAMP, RTD has light rail infrastructure (including grade crossings, catenary wire segments, track segments, signal segments, relay cases, switches, and substations), commuter rail infrastructure and bridges.
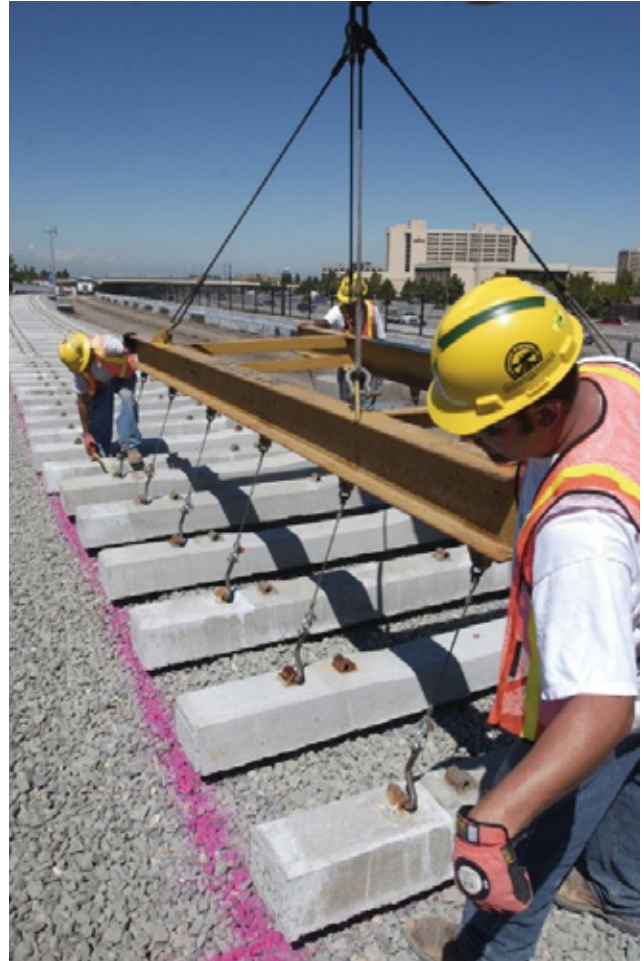

Figure 22: Signals

Figure 23: Bridge

Figure 24: Track Infrastructure

Figure 25: Grade Crossing

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Light rail infrastructure is purchased or constructed by a variety of manufacturers, and is exclusively owned, operated and maintained by RTD. All commuter rail infrastructure is delivered under the FasTracks program, and its ongoing operation and maintenance is outsourced to a third-party, DTO. RTD owns the commuter rail infrastructure and will assume ownership at the end of the FasTracks concessionaire agreement period of performance, at 30 years. 55 bridges are owned by RTD (with 9 owned by others) and are maintained by RTD.

RTD has historically managed light rail infrastructure assets based on age, but performed condition assessments of right-of-way light rail infrastructure for three years which better established the asset types and inventory, determined condition scores for each type of asset and refined the anticipated renewal frequencies for some assets. In doing so, RTD determined that age-based condition scores provided similar levels of accuracy as assessment-based condition scores, and so has stopped performing condition assessments.

As such, light rail infrastructure condition scores are age-based; however, assessment-based condition scores are also available. It is anticipated that future condition scores for light rail infrastructure will be based on the age of the assets.

Commuter rail infrastructure condition inspections are not currently performed because they are all less than five years old, and as such commuter rail infrastructure condition scores are not provided in this generation of the TAMP.

Bridges are inspected biannually by an independent third-party contractor per state law. The inspection reports received by the inspection agency describe the condition of seven bridge elements: abutments, caps, deck, girders/beams, head/wing walls, PPC (pillars, piers, columns) and railings. The inspection report condition data is turned into an SGR score from 1 to 5 for each element. All the element scores are averaged together to give an SGR score for the bridge (Regional Transportation District, 2016). As such, condition scores for bridges are assessment-based.

The table below presents the total number of infrastructure assets, along with their Useful Life Benchmark (ULB) and two condition scores, one based on the ULB the other based on inspection data.

The table also presents a backlog score for which RTD uses the FTA definition for infrastructure backlog, which is the percentage of guideway directional route miles (DRM) with performance restrictions by class. However, RTD anticipates that the guideway under performance restriction may not be an adequate measure of condition for rail infrastructure assets in the future.

There are many reasons why rail infrastructure assets would be under a temporary performance restriction: routine maintenance, inspection personnel in the right of way, police activity at or near crossings. These reasons give no indication of the condition of the assets. Additionally, track assets that are in very poor condition but exist in a high-density urban environment may not have a performance restriction because the design speed is so low to begin with. This case also fails to give any indication of the condition of the assets. The age of these assets along with physical inspections will likely be more useful for investment decisions.

Infrastructure Type	Count	ULB	Average Physical Condition Score	% in Backlog	Cost
Grade Crossings	39	15	3.8	0%	Unavailable
Catenary Wire Segments	141	25	3.9	0%	Unavailable
Track Segments	73	30	3.6	0%	Unavailable
Signal Segments	298	25	3.8	0%	Unavailable
Relay Cases	214	25	3.9	0%	Unavailable
Switches	240	25	3.7	0%	Unavailable
Substations	61	25	3.9	0%	Unavailable

Table 5 Infrastructure Assets and condition

Guideway Under Performance Restriction	2017	2018
January	0	2.1
February	1.7	1.2
March	0	2.3
April	0	0
May	0	0
June	0	0
July	1.6	0.2
August	1	0
September	3.6	1.9
October	3.4	Not Performed
November	2.3	Not Performed
December	0	Not Performed

Table 6 Guideway performance restriction

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Bridges	Count	ULB	Average Physical Condition Score	% in Backlog	Cost
Light Rail Infrastructure	64	80	4.0	0%	Unavailable

Table 7 Bridge condition score

3 Current Capital Investment Decision Process

The Capital Improvement Policy of RTD's Fiscal Policy Statement states that "On an annual basis, RTD will prepare and update a six-year Mid Term Financial Plan including projected capital construction and improvements, service levels and operating costs, and revenues to fund the capital and operating programs." (Regional Transportation District, 2016)

The Mid Term Financial Plan also provides the basis for the District's application for federal transit funding through the Transportation Improvement Program (TIP), prepared by the Denver Regional Council of Governments (DRCOG). The TIP is a list of all roadway and transit projects in the region that receive federal funding. RTD cannot receive federal funds for projects unless the qualifying Mid Term Financial Plan projects are included in the TIP.

The 2018-2023 Mid Term Financial Plan includes projects funded from the base system's 0.6% sales and use taxes. Projected FasTracks future expense and projects for the period 2018-2023 are presented separately in the FasTracks financial plan (Regional Transportation District, 2016)

The process used to prioritize investments for the 2018 - 2023 Mid Term Financial Plan is built upon a legacy project prioritization process. The process is shown in the flow diagram below, and detailed in Appendix C.

For some years, RTD has been improving the sophistication of its investment prioritization system. RTD has moved from a process that was primarily the product of professional judgement to a more standardized method of evaluating capital projects.

Significant effort has recently been placed into the development of the next generation investment prioritization process. The intent of this process is to align all investment with the Asset Management Policy, Agency Objectives, and Strategic Asset Management Plan. A description of this will be included in the next revision of RTD's TAM Plan.

An important additional element of the developing investment prioritization process is an evaluation step. This step will determine the degree to which projects came in at budget and on-time, as well as if they delivered stated outcomes. Stated outcomes will be part of a required business case that describes the intended effect of the capital project on the agency objectives. This will better allow RTD to continuously improve its investment prioritization process.

One key step implemented toward the next generation process is classifying and prioritizing capital projects based on three categories:

1. Compliance
2. Renewal
3. Expansion

Generally, capital projects will be funded in this order. The aim is asset-focused investments to prioritize sustainable management of existing assets over expansion of the transit system. The investment prioritization process will serve as one of RTD's decision support tools.
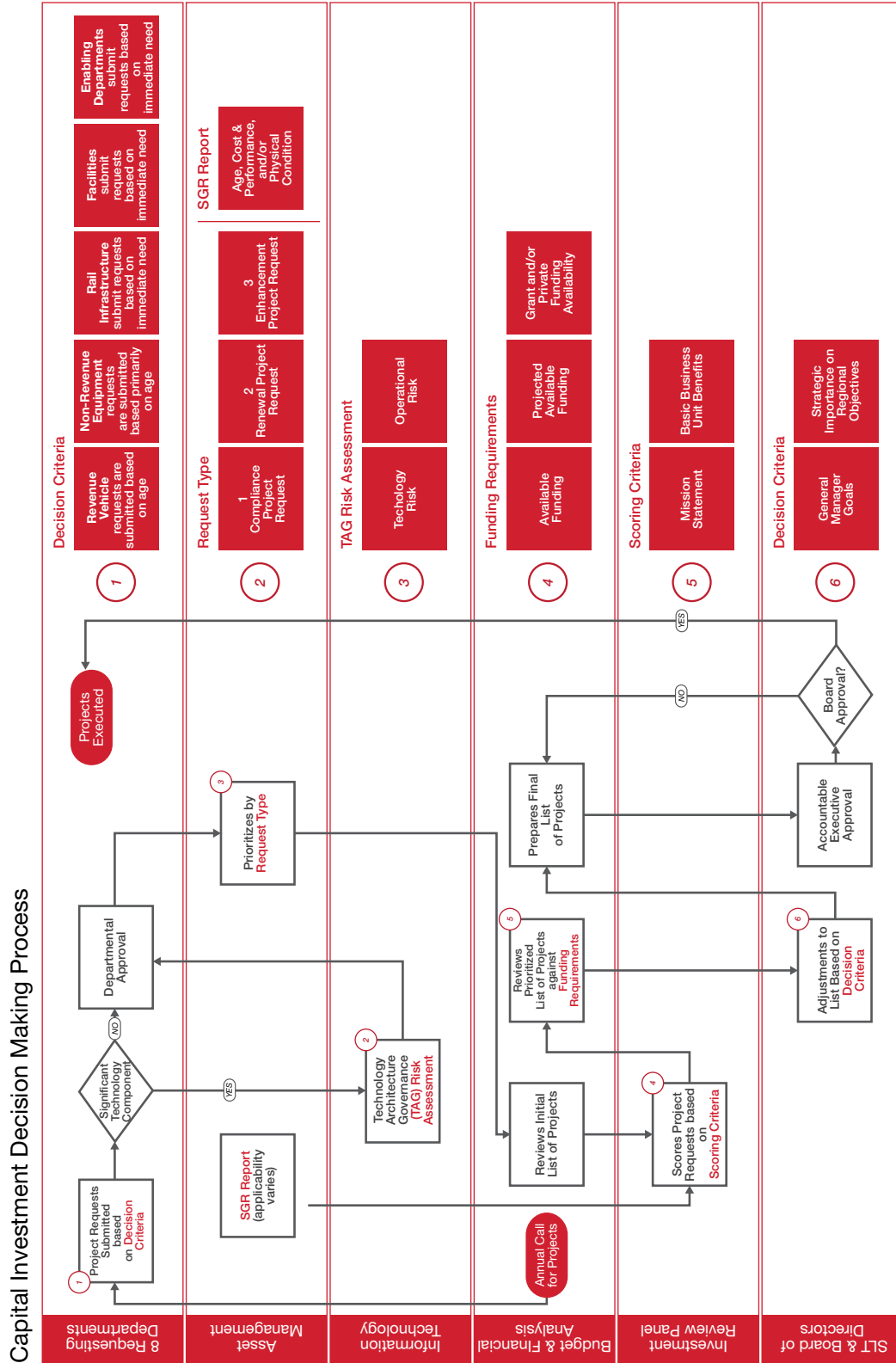
Figure 26: Investment prioritization process

4 List of Prioritized Investments

The output of the current capital investment decision process is a list of prioritized capital projects. For 2018-23, the list is separated into two project types and each project type is broken down into three funding categories.

Funding Category & Project Type

	Operating & Maintenance Projects	Capital Projects
COMPLIANCE	List 1	List 4
RENEWAL	List 2	List 5
ENHANCEMENT	List 3	List 6

Figure 27: Project Categories

4.1 Funded Operating and Maintenance Project List

Project List tables 1, 2 and 3 are the list of approved Capital Operating & Maintenance projects over the 2018-2023 time horizon.

Project List 1

Compliance Project Title	Request Score	Project O&M Costs - 2018	Project O&M Costs - 2019	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Total O&M Costs
1 FTE: Safety Manager - Rail	83.17	$ 118,800	$ 118,800	$ 118,800	$ 118,800	$ 118,800	$ 118,800	$ 712,800
Cost Increases for Access-a-Ride Service	76.28	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 9,000,000
1 FTE: Safety Compliance Officer - Bus	74.85	$ 106,000	$ 106,000	$ 106,000	$ 106,000	$ 106,000	$ 106,000	$ 636,000
Asset Subtotal		$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 9,000,000
Non Asset Subtotal		$ 224,800	$ 224,800	$ 224,800	$ 224,800	$ 224,800	$ 224,800	$ 1,348,800
Total	**78.10**	**$ 1,724,800**	**$ 1,724,800**	**$ 1,724,800**	**$ 1,724,800**	**$ 1,724,800**	**$ 1,724,800**	**$ 10,348,800**

Table 8

Project List 2

Renewal Project Title	Request Score	Project O&M Costs - 2018	Project O&M Costs - 2019	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Total O&M Costs
TVM Replacement - Open Bid	76.44	$2,245,000	$0	$0	$0	$0	$2,064,000	$4,309,000
In-Ground Hoists Replacement in Bays T-1 & T-2	63.91	$0	$0	$380,000	$0	$0	$0	$380,000
Steel Inspection Pits Replacement	61.26	$0	$0	$0	$205,600	$2,570,000	$0	$2,775,600
Oracle ERP Upgrade and/or Alternative System	59.14	$0	$0	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$4,000,000
Track Rail Grinding	58.31	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$900,000
Roof Replacement	58.14	$0	$20,000	$1,304,300	$2,612,352	$0	$0	$3,936,652
In-Ground Lifts (6) Replacement	55.75	$0	$0	$320,000	$0	$0	$0	$320,000
Enterprise Customer Relationship Management System (CRM)	55.54	$300,000	$500,000	$500,000	$500,000	$500,000	$500,000	$2,800,000
Roof Replacement	52.27	$0	$0	$35,000	$6,392,144	$0	$0	$6,427,144
Underground Tank Replacements	51.08	$822,400	$0	$0	$0	$0	$0	$822,400
RTU 03 Replacement	50.29	$300,000	$0	$0	$0	$0	$0	$300,000
Particulate Sensors Replacement with CO NO2 Sensors	49.30	$0	$200,000	$0	$0	$0	$0	$200,000
Exhaust Fans (13) Replacement Maintenance End	49.03	$0	$9,000	$90,000	$0	$0	$0	$99,000
Infrared Heater Replacements in Fueling Lanes	48.85	$24,672	$0	$0	$0	$0	$0	$24,672
Makeup Air Units (MAUs) (4) Replacement	48.24	$10,280	$1,028,000	$0	$0	$0	$0	$1,038,280
HVEC Unit Replacements	48.24	$0			$30,000	$3,000,000	$0	$3,030,000
Overhead LRT Doors (20) Replacement	47.88	$700,000	$0	$0	$0	$0	$0	$700,000
Bus Wash Replacement	46.96	$0	$0	$0	$0	$1,644,800	$0	$1,644,800
Boiler Replacement	45.16	$500,000	$0	$0	$0	$0	$0	$500,000
Bus Wash Two Lanes Replacement	43.68	$822,400	$0	$0	$0	$0	$0	$822,400

Renewal Project List

Renewal Project Title	Request Score	Project O&M Costs - 2018	Project O&M Costs - 2019	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Total O&M Costs
Air Handling Unit Replacement (4)	41.24	$495,000	$0	$0	$0	$0	$0	$495,000
Overhead Sectional Doors (34) Replacement	40.24	$0	$0	$500,000	$0	$0	$0	$500,000
Roof Top Furnaces for the Paint Booths	38.39	$0	$175,000	$0	$0	$0	$0	$175,000
Asset Subtotal		$6,069,752	$1,582,000	$2,779,300	$9,390,096	$7,364,800	$2,214,000	$29,399,948
Non Asset Subtotal		$300,000	$500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$6,800,000
Total	**51.71**	**$6,369,752**	**$2,082,000**	**$4,279,300**	**$10,890,096**	**$8,864,800**	**$3,714,000**	**$36,199,948**

Table 9

Project List 3

Enhancement Project Title	Request Score	Project O&M Costs - 2018	Project O&M Costs - 2019	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Total O&M Costs
15L Route Improvements	97.61	$0	$125,000	$250,000	$250,000	$250,000	$250,000	$1,125,000
3 FTEs: 1 Dispatcher & 2 Street Supervisors	83.32	$265,851	$265,851	$265,851	$265,851	$265,851	$265,851	$1,595,106
Security Officer Contract Award Increase	76.26	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$9,000,000
Ped Bridge & Tunnel Inspections - Biennial	72.48	$100,000	$0	$100,000	$0	$100,000	$0	$300,000
Staff Reallocation - Capital Programs	71.13	$1,265,827	$1,265,827	$1,265,827	$1,265,827	$1,265,827	$1,265,827	$7,594,962
Enterprise Content Management	62.04	$615,000	$801,500	$833,000	$633,000	$383,000	$383,000	$3,648,500
1 FTE: E3 Management Analyst II	58.01	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$510,000
Smart Media Technology - Administrative Portal Enhancements	57.78	$300,000	$300,000	$0	$0	$0	$0	$600,000
Law Practice Management Integrity Systems	54.90	$0	$50,000	$50,000	$50,000	$50,000	$50,000	$250,000
Rider Alert System	53.79	$0	$225,000	$225,000	$225,000	$225,000	$225,000	$1,125,000

Enhancement Project Title	Request Score	Project O&M Costs - 2018	Project O&M Costs - 2019	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Total O&M Costs
1 FTE: E3 Management Analyst III	53.27	$95,000	$95,000	$95,000	$95,000	$95,000	$95,000	$570,000
Smart Media Technology - Off-Site Hosting	45.00	$530,000	$380,000	$380,000	$380,000	$380,000	$380,000	$2,430,000
Contracted Services for IT Audit	43.08	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$600,000
International APTA Conference & Rodeo	39.00	$400,000	$0	$0	$0	$0	$0	$400,000
Asset Subtotal		$100,000	$125,000	$350,000	$250,000	$350,000	$250,000	$1,425,000
Non Asset Subtotal		$5,156,678	$5,068,178	$4,799,678	$4,599,678	$4,349,678	$4,349,678	$28,323,568
Total		**$5,256,678**	**$5,193,178**	**$5,149,678**	**$4,849,678**	**$4,699,678**	**$4,599,678**	**$29,748,568**

Table 10

4.2 Funded Capital Project List

Project List tables 4, 5 and 6 are the approved capital projects over the 2018-2023 time horizon.

Project List 4

Compliance Project Title	Request Score	Project Capital Costs - 2018	Project Capital Costs - 2019	Project Capital Costs - 2020	Project Capital Costs - 2021	Project Capital Costs - 2022	Project Capital Costs - 2023	Total Capital Costs
Blank Out Signs - Welton Street	68.75	$1,325,618	$0	$0	$0	$0	$0	$1,325,618
Asset Subtotal		$1,325,618	$0	$0	$0	$0	$0	$1,325,618
Non Asset Subtotal		$0	$0	$0	$0	$0	$0	$0
Total		**$1,325,618**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,325,618**

Table 11

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Project List 5

Renewal Project Title	Request Score	Project Capital Costs - 2018	Project Capital Costs - 2019	Project Capital Costs - 2020	Project Capital Costs - 2021	Project Capital Costs - 2022	Project Capital Costs - 2023	Total Capital Costs
Downtown Track & Switches Replacement	105.88	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$18,000,000
Rail Replacement @ Central Corridor	101.04	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$9,000,000
Access-a-Ride Cutaway Buses	85.16	$797,000	$797,000	$6,604,000	$0	$4,871,965	$4,936,070	$18,006,035
Transit Buses - 40 Foot	84.40	$26,204,000	$20,141,277	$15,731,788	$33,249,340	$9,617,585	$0	$104,943,990
Transit Buses - 30 Foot	84.40	$0	$10,355,000	$10,355,000	$0	$0	$0	$20,710,000
Qognify VMS Server Replacements	70.67	$300,000	$0	$0	$0	$0	$0	$300,000
Support & Service Vehicles	67.96	$1,212,000	$1,041,000	$696,000	$980,000	$154,000	$0	$4,083,000
SCADA Light Rail Communication Houses	66.67	$440,000	$0	$0	$0	$0	$0	$440,000
Call-n-Ride Cutaway Buses	66.42	$2,219,200	$486,200	$761,600	$0	$276,900	$0	$3,743,900
Oracle ERP Upgrade and/or Alternative System	59.14	$3,000,000	$3,500,000	$3,500,000	$0	$0	$0	$10,000,000
In-Plant Vehicles & Equipment	57.70	$217,000	$210,500	$0	$0	$0	$0	$427,500
Enterprise Customer Relationship Management System (CRM)	55.54	$600,000	$500,000	$0	$0	$0	$0	$1,100,000
Administrative & Pool Vehicles	48.55	$139,000	$161,000	$228,000	$25,000	$152,000	$0	$705,000
Asset Subtotal		$36,028,200	$37,691,977	$38,876,388	$38,754,340	$19,572,450	$9,436,070	$180,359,425
Non Asset Subtotal		$3,600,000	$4,000,000	$3,500,000	$0	$0	$0	$11,100,000
Total		**$39,628,200**	**$41,691,977**	**$42,376,388**	**$38,754,340**	**$19,572,450**	**$9,436,070**	**$191,459,425**

Table 12

Project List 6

Enhancement Project Title	Request Score	Project Capital Costs - 2018	Project Capital Costs - 2019	Project Capital Costs - 2020	Project Capital Costs - 2021	Project Capital Costs - 2022	Project Capital Costs - 2023	Total Capital Costs
15L Route Improvements***	97.61	$4,638,103	$1,625,000	$0	$0	$0	$0	$6,263,103
Materials & Supplies - Light Rail	89.38	$0	$0	$0	$0	$300,000	$300,000	$600,000
Heavy Equipment for LR Maintenance	89.09	$1,000,000	$0	$0	$0	$0	$0	$1,000,000
Burnham Yard Lead Land Purchase	83.13	$6,690,000	$0	$0	$0	$0	$0	$6,690,000
Cab Signaling on LRVs	74.96	$500,000	$1,500,000	$1,500,000	$1,500,000	$0	$0	$5,000,000
Bus Rapid Transit @ SH 119	73.71	$0	$0	$0	$0	$0	$60,000,000	$60,000,000
Engine & Transmission Dynamometers	66.63	$200,000	$0	$0	$0	$0	$0	$200,000
Transit Plaza Upgrades @ Thornton PnR	63.66	$110,000	$485,000	$0	$0	$0	$0	$595,000
CCTV Retrofit on LRV	63.57	$500,000	$500,000	$500,000	$500,000	$500,000	$0	$2,500,000
Water Jet Cutter @ District Shops	63.16	$200,000	$0	$0	$0	$0	$0	$200,000
Enterprise Content Management	62.04	$500,000	$0	$0	$0	$0	$0	$500,000
Law Practice Management Integrity Systems	54.90	$250,000	$0	$0	$0	$0	$0	$250,000
General Manager's Discretionary Account		$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$900,000
Asset Subtotal		$13,838,103	$4,110,000	$2,000,000	$2,000,000	$800,000	$60,300,000	$83,048,103
Non Asset Subtotal		$900,000	$150,000	$150,000	$150,000	$150,000	$150,000	$1,650,000
Total		**$14,738,103**	**$4,260,000**	**$2,150,000**	**$2,150,000**	**$950,000**	**$60,450,000**	**$84,698,103**

Table 13

5 Improving Asset Management Capabilities at RTD

As a relatively young agency, RTD has not experienced the decaying infrastructure or immediate funding shortages that many older and larger transit systems have. Historically, RTD has had the necessary funding in place and the professional expertise to maintain its transit assets in a state of good repair while keeping up with the growing demand for service.

RTD's asset management maturity improvement initiative is not driven by a growing set of decaying assets, but by the expansion of the asset base in recent years. Beginning with the T-REX project and continuing with the current FasTracks project, over the past 14 years RTD has spent over $4.7 billion on new rail and bus rapid transit lines, more than doubling its asset base.

The funding for the most recent expansion projects did not make provision for the long-term maintenance and capital renewal of the new assets. Without a solid, long-term renewal plan in place, with funding earmarked, the risk of a growing backlog of renewal projects without adequate funding is too great. A growing backlog increases risk to safety, service, and future sustainability. It feeds a pattern of expensive reactionary repair and remediation tasks.

RTD's bold increase in the scope of its transit system requires a more rigorous management process than in the past if it is to maximize value from the assets. To avoid the asset condition backlog that plagues some agencies, RTD intends to take the path toward good whole-life asset management while the assets are relatively new.

This section covers the TAM requirements for Implementation Strategy, Annual Activities, and Resources, within the overall context of RTD's developing Strategic Asset Management Plan.

5.1 Strategic Asset Management Plan

RTD aims to comply fully with MAP-21 requirements for transit asset management and beyond. It is developing an overall Strategic Asset Management Plan to summarize its strategy to improve asset management over the next period.

From 2004, with the publication of BSI PAS-55, and then ISO 55000 in 2014, organizations have been able to exploit a standardized good practice framework for implementing an aligned asset management system.

Typically organizations have started with a focus on asset information: particularly the inventory of all their assets, and assessing asset condition. This information supports clearer planning, because now the organization knows what assets it has and what state they are in. But the aim is not just a clear plan to cover all the assets, but a prioritized and optimized plan based on understanding the risks to its objectives, and using this to make the best use of limited resources.

RTD has invested heavily in both its asset inventory and asset condition measures over the past five years, and started on its journey to an integrated planning process that will optimize its asset base.

The current strategy is to achieve certification to ISO 55000, and use this as the foundation to align the management of its assets to the agency purpose and objectives.

In 2017, RTD commissioned an external gap assessment comparing current practices to the ISO 55000 standard. The results of the gap assessment were used to create an Asset Management Roadmap for the Agency to achieve certification to the ISO standard. The Roadmap is included in Appendix D.
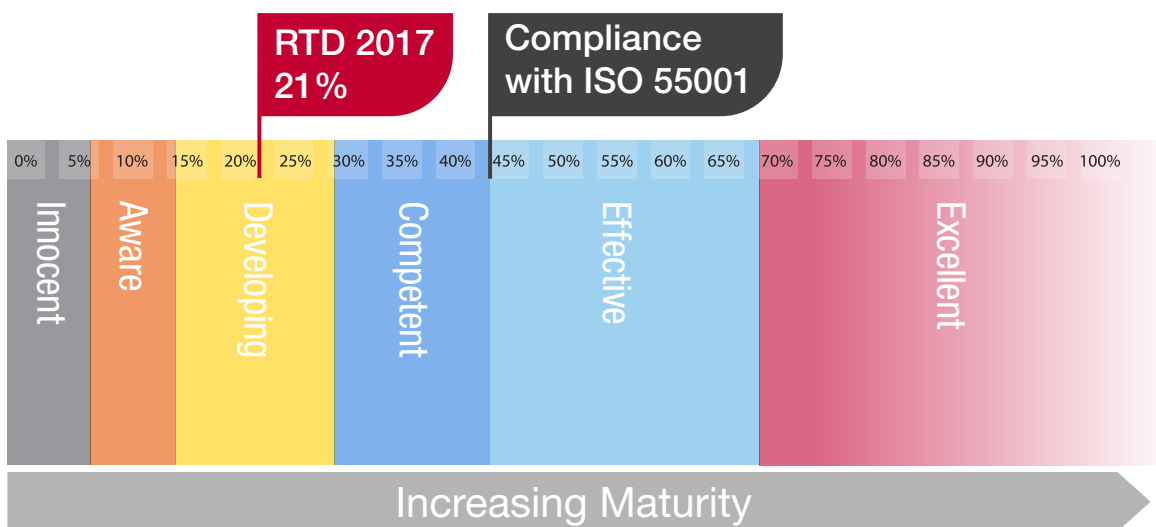
Figure 28: Gap Assessment results

5.2 Key Annual Activities

RTD identifies two types of asset management activity: those ongoing asset management activities that RTD performs as part of 'business as usual', and those activities specific to achieving ISO 55000 certification. TAM activities are the subset of these targeting the specific TAM elements, and these are pulled out into a third section here.
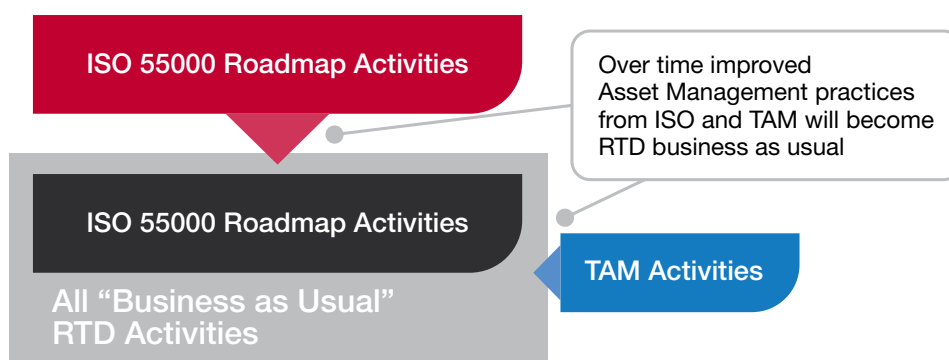

Figure 29: Asset management activities

5.2.1 Business As Usual Asset Management Activities

As an asset-intensive organization, RTD already performs a number of asset management activities on a routine basis, and these will continue and improve through the plan horizon of this document.

This section summarizes those 'business as usual' activities, using the IAM's Conceptual Model for Asset Management to categorize into six main blocks. This should not be interpreted to imply these ongoing activities are all necessarily well aligned or integrated at the moment.

Figure 30: Institute of Asset Management (IAM) Conceptual Model for Asset Management

Strategy & Planning

The RTD Planning Department periodically conducts **demand analysis** for its transit service and uses this to support long-term **strategic planning** for system optimization, expansion and enhancement. Strategic planning for capital renewals and maintenance volumes is not currently formally performed, however RTD anticipates enhancing its capabilities in this area through the development of Asset Class Strategies and an Asset Management Plan (see next section for details). Although not yet a business as usual activity, in undertaking the development of this TAM PLAN document, RTD has started on **Asset Management Planning.**

Asset Management Decision-Making

RTD's current approach to **capital investment decision-making** is described in section 3, and this activity is performed annually to develop RTD's Mid-term Financial Plan. **Operations and maintenance decision-making** is performed within each asset owner group but does not currently formally consider or align with agency objectives.

Lifecycle Delivery

Ongoing activities include capital project processes for **asset acquisition**, which is split between Capital Programs for Commuter Rail (FasTrack) and Facility assets, and Operations for Rail, Bus and Rail Infrastructure assets. Compliance with appropriate **Technical Standards and Legislation** is ensured within the capital projects and operations/maintenance functions, with some basic **configuration management** principles applied to in-house engineering designs. **Maintenance delivery** occurs for each major asset class and includes preventive and corrective maintenance, along with condition assessments. Some asset classes have a larger focus on preventative maintenance, while others have more emphasis on corrective maintenance and maintain assets when they fail. Most maintenance delivery is performed by RTD staff, with some being outsourced. **Asset operations** is a significant part of RTD's ongoing activities, and includes bus, rail, equipment and infrastructure operations, some of which is also outsourced. Basic **resource management** principles are applied to ensure enough operational resources are available as needed. RTD also performs **shutdown and outage management** of its assets to enable maintenance access. As assets develop operating faults, RTD implements its **fault and incident response plans** in accordance with agreed methods.

Asset Information

RTD uses several **asset information systems** to manage its Asset Information, including Trapeze EAM for asset inventory and maintenance management, and the Oracle Enterprise Business Suite for related financial information.

There are several basic **data and information management** processes in effect, including regular reporting to the National Transit Database (NTD), and regular data quality assessment and cleansing processes for Trapeze EAM information. RTD's Asset Management Division employs a Data Science & Analytics team to handle collection of non-physical data, perform data assurance tasks on corporate data and perform all FTA TAM Reporting.

Organization & People

RTD applies some **procurement and supply chain management** principles for its outsourced asset management functions. These include the capital delivery of its FasTrack program, along with some ongoing operations and maintenance of the assets the program delivers. The operation and maintenance of approximately half of RTD's bus services is outsourced among three service providers, and the maintenance of certain facility assets, such as elevators is also outsourced.

Risk & Review

RTD's Financial group uses standard accounting practices to perform **asset costing and valuation**, including their valuation and deprecation over time. Some informal **stakeholder management** principles are applied for engaging and managing key external stakeholders.

5.2.2 ISO 55000 Activities

In addition to the ongoing asset management activities described above, RTD also has activities defined as part of its plan towards ISO 55000, or its Asset Management Roadmap.

The central requirement for ISO 55000 is to design, implement, maintain and continually improve an asset management system based on Plan-Do-Check-Act principles. Once certification is achieved, ongoing ISO 55000 activities will continue to occur indefinitely to maintain and continually improve the AMS, while many of the ISO 55000 practices will transition to become business as usual.

The Roadmap and associated detailed activities are held in the ISO 55000 Gap Assessment and Roadmap report, but a summary is provided below:

5.2.2.1 Design an Asset Management Organization

This includes the implementation of an ISO 55000 compliant 'Asset Management System': the framework to define and manage the key elements, including AM Policy, Strategy and Agency-wide risk framework, with clearly defined roles and responsibilities.

5.2.2.2 Asset Management Planning

This includes the development of Asset Class Strategies and an Asset Management Plan as key elements of an improved end-to-end investment planning process.

5.2.2.3 Improve Rigor and Control

This implements improved control over core asset delivery and financial activities, and includes a Project Management Office for capital projects with a gated process for staged release of funding.

5.2.2.4 Assurance and Performance

Key here is a Performance Management Framework within RTD, as well as an improved approach to assessing the root cause of asset failures.

5.2.2.5 Enhance Asset Information

This is centered on the development and implementation of an Asset Information Strategy, including definition of RTD's information requirements and the strategies employed for meeting them, and clear governance for asset information.

5.2.2.6 Learning and Communication

This is to support the embedding of Asset Management awareness, culture and competencies, and includes a training needs analysis and a program of appropriate Asset Management training, as well as communication to raise awareness of Asset Management throughout the organization, and development of an appropriate Asset Management culture.

5.2.2.7 Enabling Activities

This is to support the delivery of the ISO 55000 roadmap. They include:

- Establishing and empowering an implementation team

- Adopting a project management office (PMO) approach to the roadmap

- Setting up governance and controls of the roadmap

- Monitoring and reviewing progress, with adjustments made as necessary

- Preparing for and undertaking the ISO certification audit

5.2.3 TAM Activities

For the period covered by the plan, the key activities are:

Asset Inventory	Maintain and improve
Condition assessment	Continue to develop RTD's approach to condition
Decision processes for investment prioritization	Continue to develop the end to end investment process for both capital projects and maintenance, and implement version 1 for next annual update. This includes the development of Asset Class Strategies and decision rules for lifecycle decisions for each class; the development of an integrated long term AMP; improved Business Case templates that more clearly align project proposals to Agency objectives.
Prioritized list of investments	Annual update each year based on improved Agency wide decision process, above
AM Policy	Periodic review to ensure continued effectiveness at delivering agency objectives and purpose through the management of physical assets. The policy will be improved as experience indicates the need.
Implementation strategy	As well as continuing with the business as usual actions, RTD intends to implement improvements as detailed in the Asset Management Roadmap (see Appendix E)
Evaluation	As part of its Annual Update, progress on and compliance to this TAM Plan will be reviewed and lessons learned incorporated into the Update.

Table 14: TAM activities

5.3 Resourcing Strategy

This section describes the resourcing strategy and plans to support the annual activities described above.

Resources from across the agency are involved in RTD's Asset Management activities, including the CEO/GM, the Senior Leadership Team, the Asset Management Division, Bus Operations, Rail operations, Capital Programs, Finance and Administration, Communications, Planning, and General Counsel.

5.3.1 Business As Usual Asset Management Activities

The resourcing strategy for the business as usual annual Asset Management activities is to continue with the current strategy, i.e. resourcing the activities through the agency departments that currently provide perform or are involved in them.

As ISO 55000 and TAM activities become business as usual over time, it is anticipated that changes to the current resources may arise.

5.3.2 ISO 55000 Strategy Activities

ISO 55000 requires the establishment of a functioning, effective, sufficiently-resourced management system for assets. The resourcing strategy is to establish clear accountability and responsibility for the Asset Management System, with the authority to direct and allocate resources being granted to the accountable group. The diagram below illustrates the accountability structure and other contributors.

Figure 31: ISO 55000 contributing resource groups

In late 2011, RTD assigned two people the task of building an asset management division (AMD). The division would be responsible for improving the management of assets and building an agency-wide asset management system.

It was important to the senior leadership team that to ensure the most accurate, non-biased information possible, the AMD should be independent of the asset delivery functions.

As Chris Lloyd, asset management leadership and culture expert says, "Strategic Asset Management calls for risk-based decision making, cross-functional working, and long-term thinking. It needs clarity on competence requirements and accountability and honesty about performance". (Chris Lloyd, 2016) .

The AMD was placed alongside the safety division, with both reporting to the Chief Safety Officer (CSO). The nexus between asset condition and safety and their management system frameworks made this a sensible structure.

To avoid creating an asset management silo, the AMD would be experts that would serve as an enabling function to the agency. From the passage of MAP-21 in 2012 through 2016 when the final rule came out, the AMD added additional staff in two key areas: physical asset business analysts and data sciences. These teams were recruited both internally and externally. Internal hires were proven problem solvers from across the organization, with experience in maintenance in each of the asset classes. This expertise and experience added credibility across the agency. External candidates were recruited where no internal candidate was available with the right blend of knowledge, skills, abilities, drive, fit and balance. More details are in Appendix F.

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The AMD will continue to attract and retain the best talent to deliver asset management expertise at RTD. The AMD recruiting process emphasizes a culture of excellence. The division continues to build AM competencies through training and practical application.

5.3.3 TAM Activities

The resourcing strategy for the TAM activities is not only to define an Accountable Executive for all TAM requirements but to assign TAM responsibilities to the Asset Management Division. Supporting resources from other RTD departments will be utilized and consulted or informed on an as-needed basis. Details of both the Accountable Executive and the Asset Management Division are in Appendix F.

6 Evaluation Plan

6.1 TAM Plan Evaluation

This inaugural TAM Plan will be evaluated on degree of compliance when RTD receives its next triennial audit.

However, it is intended to do more than meet compliance. It is a statement of intentions and commitment to deliver the culture, policy, and procedural changes necessary for the improved efficacy and efficiency of transit agencies that is implied in the regulations.

This TAM Plan provides a baseline for evaluating future TAM Plans produced by the Agency. RTD intends to regularly review its asset management maturity, setting maturity targets in its Strategic Asset Management Plan. This document will also serve as a basis of comparison to peer agencies, allowing RTD to learn from other TAM Plans to identify where improvements can be made.

RTD will annually evaluate its performance against the previous cycle's TAM Plan improvement goals and agency objectives with documentation and explanation of progress (RTD, 2018). The RTD agency objectives are in Appendix G.

6.2 ISO 55000 Performance Evaluation and Improvement

RTD has committed to achieving certification to the asset management standard ISO 55000. This requires the implementation of a management system for assets, based on plan-do-check-act principles with specific elements for performance evaluation and improvement. These are still in development in RTD, but will be implemented within the plan horizon and described in the next Annual Update.

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6.3 ISO 55000 Certification Evaluation

RTD intends to evaluate the degree to which it is meeting the requirements for ISO 55000, and therefore its readiness for an ISO 55001 certification audit, through the following measures:

1. **ISO spot checks** – regular detailed reviews of specific elements of the emerging asset management system to identify risks to certification, and implement corrective measures

2. **ISO health check** – mid-point review of the entire RTD asset management system against the requirements of ISO 55000

3. **ISO mock audit** - prior to the ISO audit, RTD intends to conduct a "mock audit" to evaluate its readiness for an actual ISO audit. Results from the mock audit will be used to determine the appropriate time for the actual audit, along with any gaps that still exist

4. **ISO audit** – formal assessment by an approved ISO auditor of RTD's asset management system against the requirements of ISO 55000

5. **ISO surveillance audits** - once certified, RTD is required to conduct periodic 'surveillance audits' to retain its certification status

7 Signature

The RTD TAM Plan was developed during fiscal year 2018. The document describes activities required to sustain an FTA compliant asset management program that includes participation from the highest levels of management down through all levels of the organization. I endorse and certify the 2018 RTD TAM Plan.

APPROVED BY - FTA DESIGNATED ACCOUNTABLE EXECUTIVE:

9.21.18

David A. Genova

General Manager and CEO

Appendices

Appendix A: Glossary

- **Accountable Executive** – a single, identifiable person who has ultimate responsibility for carrying out the safety management system of a public transportation agency; responsibility for carrying out transit asset management practices; and control or direction over the human and capital resources needed to develop and maintain both the agency's public transportation agency safety plan, in accordance with 49 U.S.C. 5329(d), and the agency's transit asset management plan in accordance with 49 U.S.C. 5326.

- **Backlog** – State of Good Repair backlog is representative of the reinvestment cost to replace any transit assets whose condition is below the midpoint on TERM's 1 (poor) to 5 (excellent) scale, or 2.5.

- **Base System** – Base System refers to RTD's Assets funded by a 0.6% sales tax prior to the passage of the FasTracks ballot initiative. RTD's base system funding and FasTracks funding are currently segregated.

- **CDOT** – Colorado Department of Transportation

- **Consist - a set of railroad vehicles forming a complete train.**

- **Contracted Services - A contract for services is a formal, legally binding agreement between RTD and a private company to provide service delivery.**

- **Denver Regional Council of Governments (DRCOG)** – Metropolitan Planning Organization (MPO) for Regional Transportation District, Denver. https://drcog.org/

- **Direct operated and purchased services** – Direct operated services are those services provided by RTD staff using RTD assets. Purchased Services are those operated under contract on behalf of RTD using outside staffing. See also Contracted Services.

- **FAST Act** – Fixing America's Surface Transportation (FAST) Act, reauthorizing the surface transportation programs through fiscal year 2020

- **FasTracks** – FasTracks is a ballot initiative that levied an additional 0.4% sales tax for expansion of the RTD system. FasTracks introduced commuter rail service as well as a Public Private Partnership (P3) to the RTD System. RTD's base system funding and FasTracks funding are currently segregated. http://www.rtd-denver.com/Fastracks.shtml Funding description: http://www.rtd-fastracks.com/main_33

- **ISO 55000** – the international standard covering management of assets of any kind. Before it, a Publicly Available Specification (BSI PAS-55) was published by the British Standards Institution in 2004 for physical assets. The ISO 55000 series of Asset Management standards was formalized in 2014. The standard is made up of three parts:

- **ISO 55000:2014 Asset management** – Overview, principles and terminology

- **ISO 55001:2014 Asset management** – Management Systems – Requirements
- **ISO 55002:2014 Guidelines for the application of ISO 55001**
- **MAP-21** – MAP-21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), was signed into law by President Obama on July 6, 2012
- **Mid Term Financial Plan** – A portion of RTD's total budget not already committed to specific capital projects and not apportioned to ongoing operations and maintenance that is evaluated and prioritized through a process described in section 5 of this document.
- **National Transit Database** – is a federal reporting program for transit agencies receiving Federal Transit Administration (FTA) funding. It serves as a primary repository for all transit-related data and statistics in the United States. The performance data from the NTD is used to allocate FTA funding and to report on public transit performance to Congress and researchers.
- **SBP** – RTD's Strategic Budget Plan, replaced in 2018 by the Mid-Term Financial Plan
- **Senior Leadership Team (SLT)** – the group of Assistant General Managers that report directly to the General Manager and CEO. This group is equivalent to the C-Suite in a private organization.
- **State of Good Repair** – "The condition in which a capital asset is able to operate at a full level of performance." (U.S. Department of Transportation, 2016).
- **TERM** – Transit Economic Requirements model is a tool used by the FTA along with a numeric code that represents the categorization of assets, as indicated in the TERM-Lite model.
- **Useful Life Benchmark** – The Useful Life Benchmark indicates the expected duration in years that the asset will remain in service under normal operating conditions and maintenance. At the end of useful life of the asset, major renewal or replacement is expected.

Appendix B: SGR Master Condition Rating Definitions for RTD

RTD follows the FTA guidance on condition ratings. This rating is based on how close an asset or component is to replacement or major overhaul. Scores will not have a greater granularity than a half point.

An asset is in a State of Good Repair if the score is greater than (2.5). Refer to individual asset group Inspection Standards Document for confidence in reliability and specific examples.

Confidence in Reliability = Remaining Useful Life
5.0) New or like new, 95% to 100% confidence in reliability; no visible defects, no damage, cosmetically looks new. An asset is only new once, after rebuild some old parts are not new and therefore the highest score after rebuild is (4.5).
4.5) The inspector is 90% to 95% confident in the reliability of the component / asset.
4.0) The inspector is 80% to 90% confident in the reliability of the component / asset. Shows minimal signs of wear, no major defects, and some minor defects with only minimal signs of deterioration. **Cosmetic defects/minor wear.**
3.5) The inspector is 70% to 80% confident in the reliability of the component / asset.
3.0) The inspector is 60% to 70% confident in the reliability of the component / asset. Some moderately defective or deteriorated components; expected maintenance needs. Cosmetically "fair" but all devices are functioning as designed. **Small repairs or minor refurbishment.**
2.5) The inspector is 50% to 60% confident in the reliability of the component / asset.
2.0) The inspector is 40% to 50% confident in the reliability of the component / asset. Asset near overhaul or retirement, but in serviceable condition. Asset has increasing number of defects or deteriorated component(s). **Significant or multiple repairs needed.**
1.5) The inspector is 30% to 40% confident in the reliability of the component / asset.
1.0) The inspector is less than 30% confident in the reliability of the component / asset. Asset is in need of major repair or refurbishment, multiple minor defects or major defects. Evidence of corrosion may be apparent; major or numerous minor areas of damage or structural issues. **Safety concern, critical damage, close to or time for overhaul or replacement.**
0) Not safe to use, multiple major repairs or Asset set for disposal/retirement.

Table 15

Appendix C: RTD Process for Mid Life Financial Plan

1. Annual call for projects.

2. Projects are submitted for consideration on an annual basis based on individual departmental Decision Criteria.

   a. Revenue Vehicle submits project requests based on ULB.

   b. Non-Revenue Equipment submits project requests based on primarily age.

   c. Rail Infrastructure submits projects requests based the immediate need.

   d. Facilities submits projects requests based the immediate need.

   e. Enabling Departments submit project requests based on the immediate need.

3. Projects that have a considerable technology component are redirected to Information Technology and their Technology Architecture Governance (TAG) Committee for a Risk Assessment.

   a. The TAG Risk Assessment is comprised of basic technology and operational risk components.

4. Projects are approved by each department head.

5. Asset Management Division prioritizes by Request Type:

   a. Compliance – The primary intent of a Compliance project request is to address specific legal requirements or to mitigate RTD liabilities, approved by Legal Counsel.

   b. Renewal – The primary intent of a Renewal project request is to address existing assets and systems. Backlog is also address in this request type.

   c. Enhancement - The primary intent of an Enhancement project request is to expand RTD's "footprint", enhance the value of the current service being provided, and or procure additional assets.

      i. The aforementioned steps in the MID TERM FINANCIAL PLAN process were underway when additional TAM requirements were released by the FTA. To provide a process that would more closely align to future requirements of the TAM, RTD added an additional step of classifying projects being evaluated for investment according to their status as either Renewal or Enhancement. This was done to provide information on future investment prioritization requirements to the RTD's Senior Leadership Team.

6. Initial list of projects are reviewed by the Budget & Financial Analysis division.

7. Project requests are scored on established Scoring Criteria which includes items in RTD's mission statement and basic business unit benefits.

   a. Mission Statement Criteria includes the following areas:

      i. Accessible Service: Improve accessibility to bus and rail services for our passengers by improving ADA on-time performance, improving ADA availability or improving ADA courtesy.

      ii. Clean Service: Improve the ability to provide clean bus and rail service and clean public facilities by improving promptness of graffiti removal, promptness of bus and rail interior and exterior cleaning and promptness of shelter cleaning.

      iii. Cost-Effective Service: Provide efficiencies in operations or support functions which enable RTD to increase levels of bus and rail service by increasing ridership, increasing farebox or EcoPass revenue, improving route efficiency and efficient hiring and training of personnel.

iv. Courteous Service: Improve the ability to provide courteous bus and rail service by reducing customer response time, reducing customer complaints or decreasing wait time for telephone information.

v. Meets Future Needs: Improves the District's ability to meet the needs of bus and rail service in the future.

vi. Reliable Service: Increase the reliability of bus and rail service by improving on-time performance, reducing road calls and reducing missed trips.

vii. Safe Service: Improve the physical safety of passengers and/or employees by reducing vehicle and/or passenger accidents, improving preventable maintenance.

b. Supplemental Information

i. To aid in informing project raters about the condition of an asset a State of Good Repair (SGR) Report including an assessment of an asset being considered for renewal or replacement was included at the initiator's request.

8. Budget & Financial Analysis reviews the prioritized list of projects against current Funding Requirements.

9. The prioritized list of projects are then evaluated by SLT who considers a number of additional factors, including but not limited to the annual goals set by the RTD Board of Directors, the projected available funding, grant and/or private funding availability for a project, and strategic importance to regional objectives.

10. A recommended list is then submitted to the RTD Board of Directors for evaluation and approval.

11. The RTD Board of Directors considers the prioritized list of projects as a component of the annual budget. The budget is either approved or modified before being ratified by vote of the 15 elected members of RTD's Board of Directors.

Appendix D: RTD Asset Management Roadmap

RTD Asset Management Roadmap includes the following activities:

D.1 Design an Asset Management Organization

This roadmap activity group embeds Asset Management principles, processes and structures into RTD and includes:

- The development of an Asset Management Policy and Strategic Asset Management Plan (SAMP), including Asset Management Objectives aligned to Agency objectives
- The definition and implementation of an ISO 55000 compliant Asset Management System based on Plan-Do-Check-Act principles
- Establishment of appropriate governance arrangements for the Asset Management System, including clear accountability for its implementation and continual improvement, and clarity for the roles and responsibilities across the AMS
- Stakeholder analysis, engagement and management
- Development of a resourcing strategy
- Design and implementation of an Enterprise Risk Framework

D.2 Asset Management Planning

This roadmap activity group develops specific strategies and plans in support of meeting RTD's Asset Management objectives, and includes:

- Performing risk assessments aligned with the overall Enterprise Risk Framework, and used as input into the asset management planning process
- Development of Asset Class Strategies
- Definition and implementation of an improved end-to-end investment planning process, Development of clear decision-making criteria aligned with Asset Management objectives to support investment prioritization
- Creation of Asset Management Plan(s) specifying the planned types and volumes of capital and maintenance work on the assets, with associated costs and resourcing requirements

D.3 Improve Rigor and Control

This roadmap activity group implements defined processes for improved control over core asset delivery and financial activities, and includes:

- Implement a Project Management Office for capital projects, and utilize a gated process, which includes staged release of funding
- Improve the handover of assets from capital to operating, including adequate asset information, spares and training materials
- Improve maintenance practices, potentially based on reliability-centered or risk-based maintenance
- Develop outage strategies and plans
- Implement change management processes

D.4 Assurance and Performance

This roadmap activity group implements processes to assure the performance of the assets and RTD's Asset Management System, and includes:

- Designing and implementing a Performance Management Framework for assets and the Asset Management System
- A defined approach to auditing the Asset Management System against the requirements of ISO 55001
- Ongoing management review of the outcomes from the Performance Management Framework and Audits, with continual improvement adjustments made accordingly
- Improved approach to assessing the root cause of asset failures

D.5 Enhance Asset Information

This roadmap activity group implements improvements to RTD's Asset Information, and includes:

- Development and implementation of an Asset Information Strategy, including definition of RTD's information requirements and the strategies employed for meeting them
- Clear governance approach for the information used to support the Asset Management System, including structured and unstructured information and the documents comprising the Asset Management System itself
- Development of standards and specification for information, aligned with RTD's information requirements
- Ongoing information quality audits and associated updates

D.6 Learning and Communication

This roadmap activity group supports the ongoing embedding of Asset Management awareness, culture and competencies, and includes:

- Definition of competence requirements for the Asset Management System
- Performing a Training needs analysis for the Asset Management System, and implementation of appropriate Asset Management training
- Activities to raise awareness of Asset Management throughout the organization
- Development of an Asset Management culture, including appropriate leadership and commitment
- Defining and implementing a communications plan

D.7 Enabling Activities

This roadmap activity group supports the delivery of the ISO 55000 roadmap. They include:

- Establishing and empowering an implementation team
- Adopting a project management office (PMO) approach to the roadmap
- Setting up governance and controls of the roadmap
- Monitoring and reviewing progress, with adjustments made as necessary
- Preparing for and undertaking the ISO certification audit

Appendix E: TAM Resources

It is anticipated the following specific resources will be required for TAM activities the duration of the plan horizon:

- **Staff resources:**
  - One accountable executive
  - Seventeen FTEs from the Asset Management Division, who will split their time between TAM and ISO 55000 implementation
  - FTE requirements for other RTD resources necessary for TAM activities are not defined in this generation of the TAM PLAN

- **Technology resources:**
  - The technologies are used to support AM across the agency. Our aim is to use the tools we already own, rather than invest in new ones at this time.
  - Hardware and Software necessary to support:
  - Multiple source software systems – IE. Trapeze EAM, Oracle EBS
  - Data Warehouse – provides aggregation and integration of data
  - Analysis and reporting tools; OBIEE, Tableau, Access, Excel, R-STATS, SPSS and others

- **Financial resources**:
  - Financial resources necessary to support asset management BAU activates, TAM and ISO implementation. Beyond these we have not defined any requirement for further resources for this generation of the TAM Plan.

Appendix F: Asset Management Roles & Responsibilities

1. **Accountable Executive** – a single position with ultimate accountability for Asset Management and the Asset Management System within RTD

2. **Asset Management Accountability Group** – this group has formal accountability delegated from the Accountable Executive for the delivery, embedding, review and continual improvement of the Asset Management System. The group is comprised of RTD's Chief Financial Officer, Chief Operations Officer, Assistant General Manager for Capital Programs and the Assistant General Manager for Asset Management, Security and Safety, and the Senior Manager for Asset Management Division.

3. **Asset Management Division** – the AMD is responsible for the design, delivery, embedding, review and continual improvement of the Asset Management System's products, processes and information, as well as preparing for and undertaking the ISO 55001 certification audit. It is anticipated that the Asset Management Division will have the following roles and responsibilities for ISO 55000 during the plan horizon:

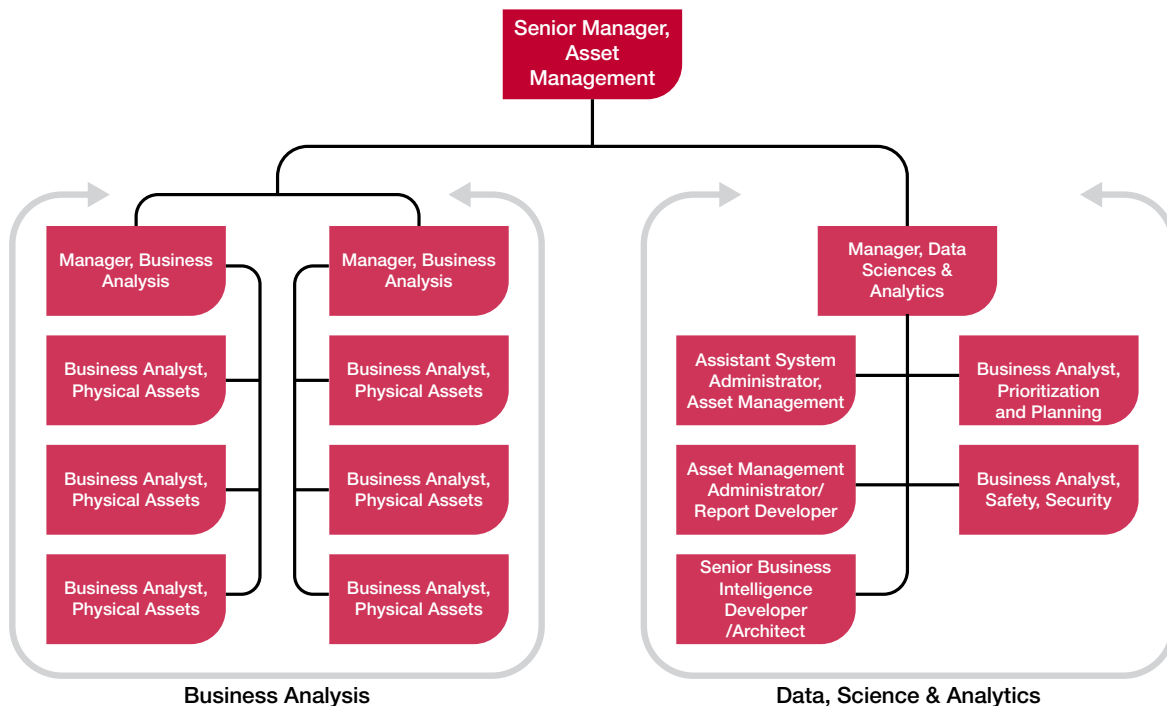The organization chart for the Asset Management Division is shown below.

Figure 32: AMD Organization Chart as of 8/31/18.

The Asset Management Senior Manager reports to the Chief Safety Officer, which is the Assistant General Manager of Safety, Security and Asset Management.

4. Other RTD resources – as needed, other RTD resources will be utilized, consulted or informed regarding the Asset Management System. This could include operations, maintenance, finance, human resources, communications, IT, legal and procurement staff. The Asset Management Accountability Group will allocate these resources directly when within their reporting line, or via a request to other members of the Senior Leadership Team when they are not.

5. External resources – RTD will also utilize external expertise to develop the internal asset management competencies of both the Asset Management Division and other RTD resources involved with the Asset Management System. The alternative to this is to be continually reliant on an external entity to supply expertise indefinitely. Selecting both an established asset management framework and interactions with consultants, RTD intends to culture an Asset Management Division capable of acting as an internal consulting service to the agency. The intention is to "own the process, not the product" as it relates to functions and competencies that will become annual activates for the AMD. Additional external resources will also be utilized to deliver aspects of the Asset Management System, specifically the operations and maintenance of approximately half of the bus fleet.

Appendix G: RTD Agency Objectives

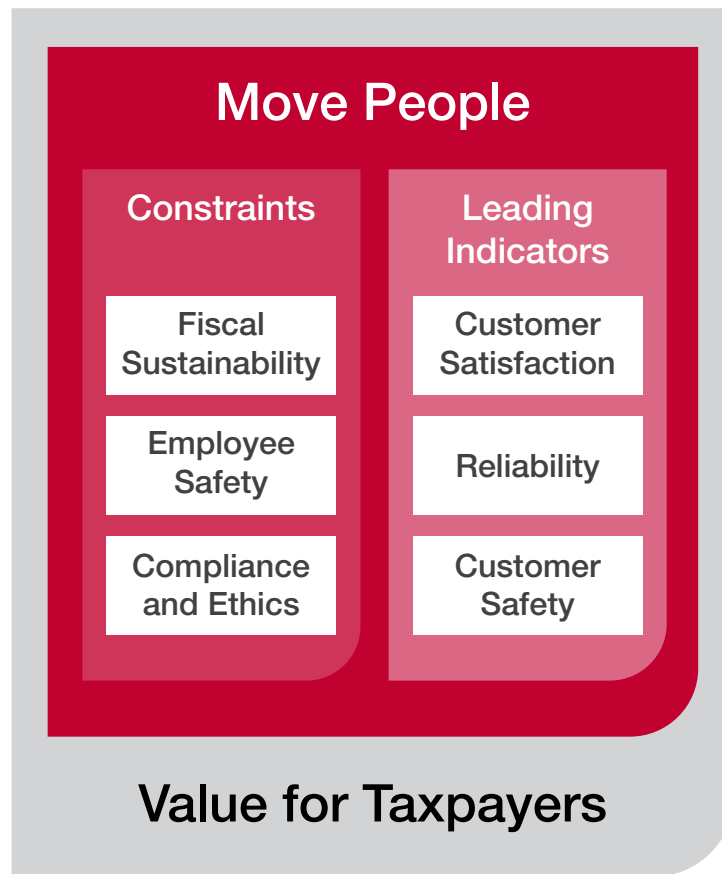The diagram below shows RTD's agency purpose and objectives, agreed April 2018.

Figure 33: RTD Agency Objectives

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