Regional Transportation District
Transit Asset Management Plan 2019

REGIONAL TRANSPORTATION DISTRICT
1660 BLAKE STREET, DENVER, CO 80202

RTD-AMD-PLN-0001 V. B 10/2019

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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 (2012).

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

A Transit Asset Management Plan (TAMP) 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 RTD makes asset investment decisions
- The proposed capital investment plan for the period 2020-2025
- 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. 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 for asset 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 the American Public Transportation Association (APTA) and Transportation Research Board (TRB). RTD examples were used by the FTA in its *TAM Facility Performance Measure Reporting Guidebook* (U.S. Department of Transportation, 2018). 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 the implementation of an investment planning process for planning and budgeting, as well as the target to achieve ISO 55000 certification by the end of 2020.

The Asset Management System (AMS) in RTD is being developed in close coordination with the safety management system, and both informed by a developing corporate risk framework to understand and manage 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	768 – Transit Buses 116 – Articulated Buses 160 – Intercity Buses	404 – Cutaway Buses 185 – Light Rail Vehicles	✓
Infrastructure	40 – Grade Crossings 75 – Catenary Wire Segments 76 – Track Segments 300 – Signal Segments	224 – Relay Cases 249 – Switches 64 – Substations 70 – Light Rail Vehicle Bridges	✓
Facilities	11 – Maintenance Facilities 3 – Administrative Facilities	112 – Public Facilities 96 – Conveyances	✓
Equipment	175 – Automobiles 4 – Steel Wheeled	202 – Truck & Other Rubber Tire Vehicles	✓
2. CONDITION ASSESSMENT			
Revenue vehicles	Age-Based Analysis		✓
Infrastructure	Age-Based Analysis, Physical Condition Assessment, and Guideway Under Performance Restriction		✓
Facilities	Age-Based Analysis and Physical Condition Assessment		✓
Equipment	Age-Based Analysis		✓
3. DECISION SUPPORT TOOLS			
What tools and processes does RTD use to prioritize funding around those assets described in its 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 the 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 list is subdivided into three funding categories: Compliance, Renewal, and Enhancement.		✓
5. TAM AND SGR POLICY			
What are the guiding principles for asset management efforts at RTD?	RTD adopted an Asset Management Policy in June 2014 and most recently updated July 2019. The intent of the policy is to improve how RTD manages assets from now on - it is therefore forward-looking in nature and represents the Agency's 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 the Agency purpose of moving people.		✓

6. IMPLEMENTATION STRATEGY		
How is RTD going to execute the TAM plan?	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 does RTD perform to maintain its 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 ISO activities targeting specific TAM elements.	✓
8. IDENTIFICATION OF RESOURCES		
What resources are needed to execute RTD TAM plan activities?	Personnel 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 has expertise that enables the Agency to mature asset management practices. From 2012 through 2016, the AMD added additional staff in two key areas: physical asset business analysis and data science.	✓
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	✓

Table 1: Summary of RTD TAM Required Elements

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 (Transit Asset Management; National Transit Database, 2016). RTD is a Tier I Agency, so all the requirements apply.

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

Tier	Element	Brief Description
Tier I & 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 2: TAM Elements Required by Tier

1.2 Intended Audience

This document captures RTD's commitment to its planning partners: the Federal Transit Administration, Denver Regional Council of Governments (DRCOG), and Colorado Department of Transportation (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 the Agency's 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 2 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 2020-2025 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, and 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.

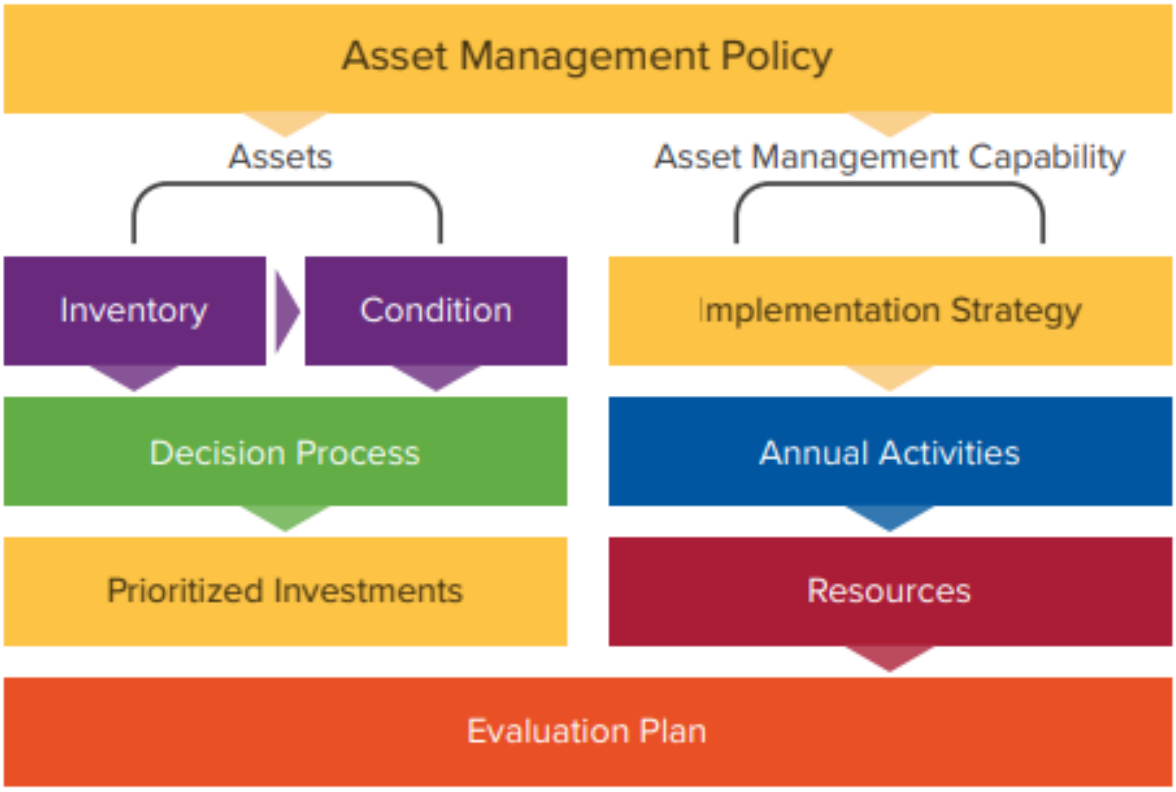

Figure 1: RTD TAM Plan Structure

Key definitions are included in the glossary in Appendix A.

1.5 Scope

This TAM Plan covers the time period 2019-2026 and will be updated annually. The assets in scope for this version are detailed below.

Figure 2: Assets in Scope for this TAM Plan

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 2020-2025, as part of RTD's investment planning process (Regional Transportation District, 2019)
- **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 appropriate systems of record, including Trapeze EAM, Enterprise Data Warehouse[1], Fixed Financial Assets list[2], Mid Term Financial Plan[3], RTD Board of Directors 2020 Requested Budget[4], and departmental records utilized for the integration of information.

[1] Asset data retrieved from Trapeze EAM and Enterprise Data Warehouse September 4, 2019.
[2] Fixed Financial Asset list dated February 4, 2019.
[3] Approved by RTD Financial Administration and Audit Committee on September 17, 2019.
[4] 2020 Requested Budget Update dated September 11, 2019 (Regional Transportation District, 2019).

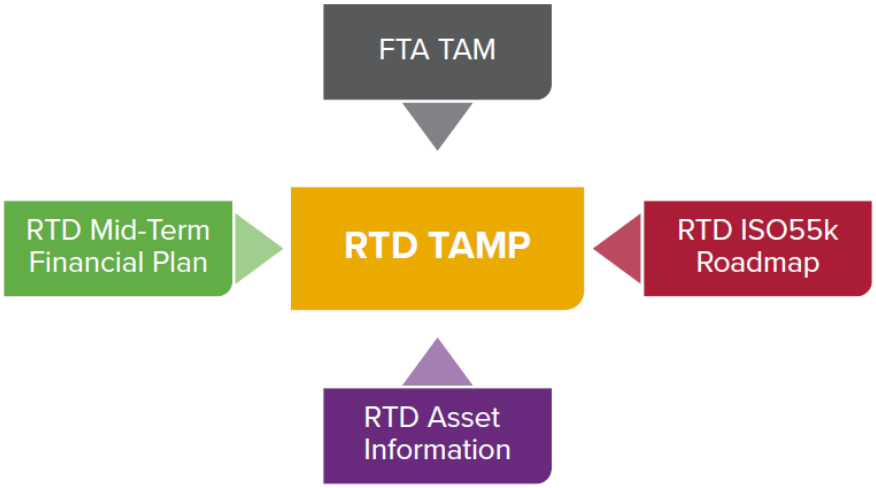

Figure 3: RTD TAM Plan Alignment

Future generations of this TAM Plan will directly align with RTD's Asset Management Policy and the Strategic Asset Management Plan (Regional Transportation District, 2019).

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" (Transit Asset Management; National Transit Database, 2016).

RTD's Asset Management Policy was updated on July 31, 2019. 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**	**Date Issued:**	2019-07-31	**Current Version:**	**B**
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, 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 a good value for tax payers
- Satisfy customers
- Are reliable
- Are ethical and in compliance with all regulations

We are committed 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

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- 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 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 provides transportation services to 3.08 million people located within its 2,400 square mile service area, including bus, rail, shuttles, ADA paratransit services, demand responsive services like FlexRide, and special event services. Using these assets, RTD delivers 43 million service miles, across 141 routes, including 86 local bus, 8 light rail and 3 commuter rail routes.

2.1 The RTD Story

BUS

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 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.

RAIL

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. Now, eight light rail lines service 57 stations along 7 individually constructed 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.

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.

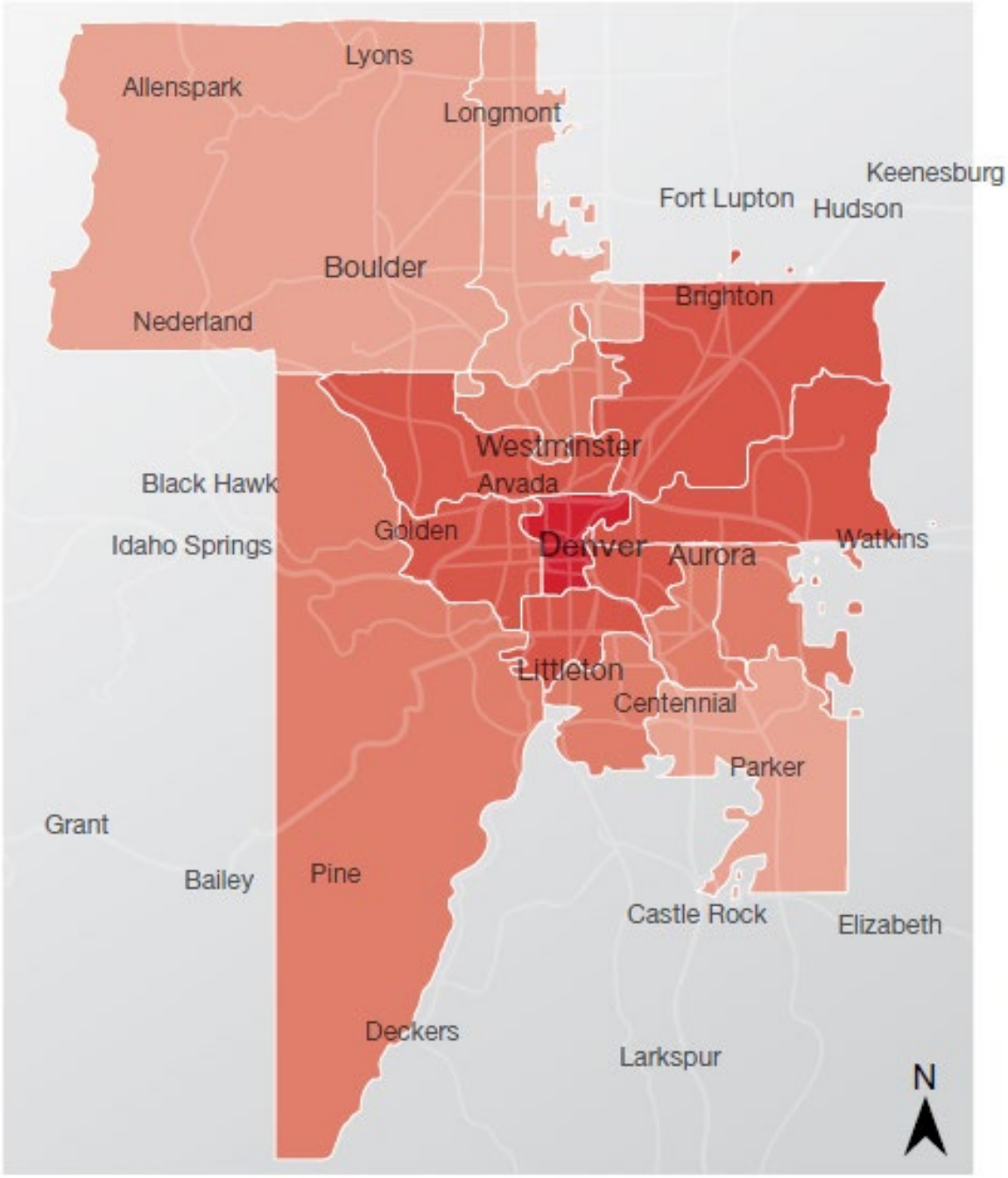


Figure 4: RTD District Map

At the turn of the millennium RTD had approximately 77 million passenger trips (U.S. Department of Transportation, 2000), and is on course to have nearly 100 million passenger trips in 2019, over a 20% increase in boardings. Over the same period, per the Colorado State Demography's Office, the Denver Boulder region has increased from approximately 2.4 million residents to approximately 3.2 million residents, a 31% increase (2019).

2.3 RTD Assets

RTD is an asset-intensive organization. RTD's Statement of Net Position notes that total capital assets sum to nearly $8.9 billion (Regional Transportation District, 2019). Much of this total expenditure resulted in assets in the scope of Transit Asset Management. This section provides further details on RTD's asset inventory and condition for assets in-scope of TAM.

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 5 below, which ensured repeatable results and an improvement in inventory data quality.

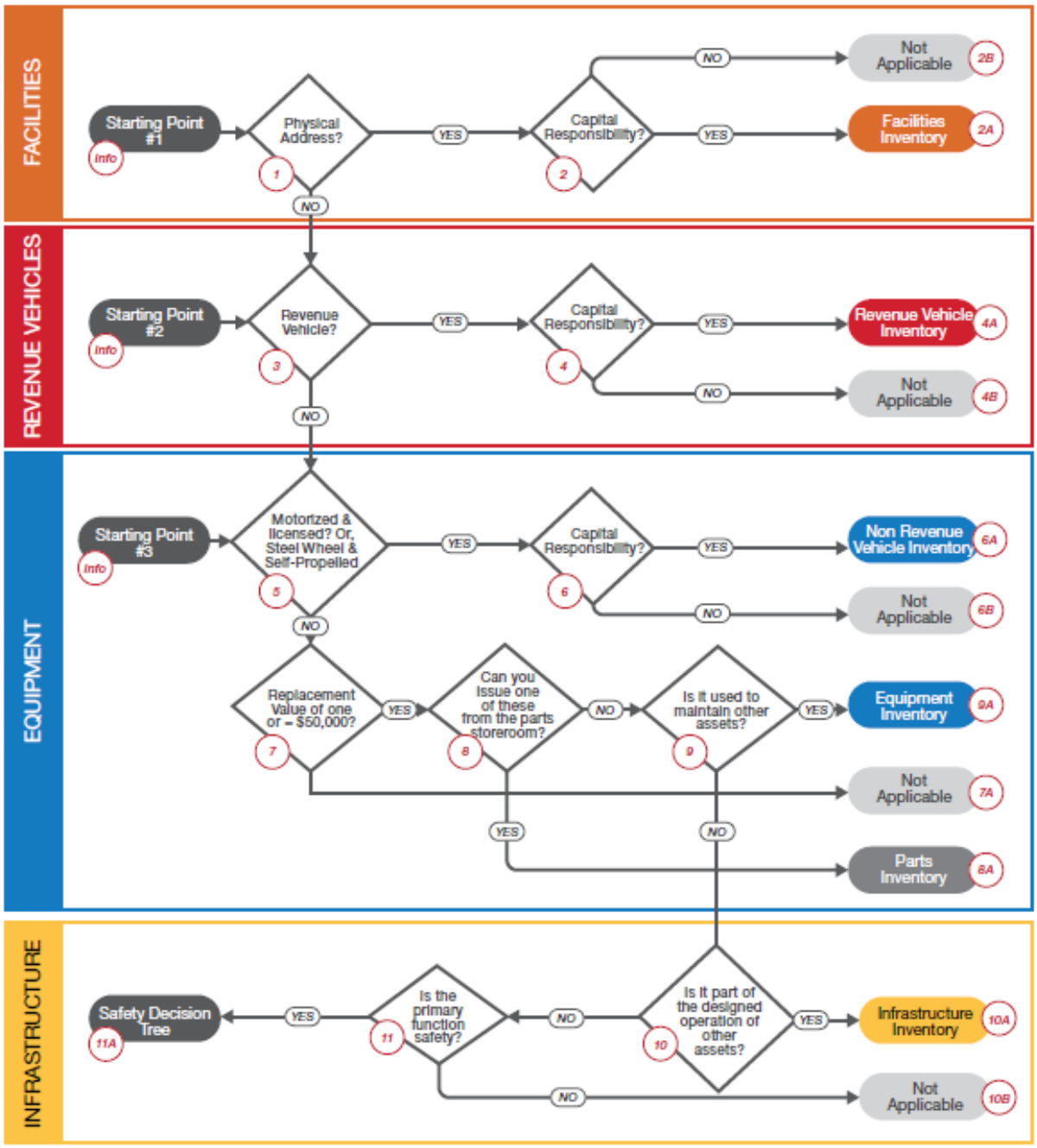


Figure 5: Inventory Classification Process

2.3.1 Revenue Vehicles

RTD's revenue vehicles comprise 1,448 buses and 185 light 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 (FlexRide).

RTD buses are procured from a variety of manufacturers including: 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[5] to two 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 6: Standard Bus (Gillig)

Figure 7: Articulated Bus (New Flyer)

Figure 8: Intercity Coach (MCI)

Figure 9: Cutaway Bus

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

Light rail vehicles (LRV) are electrically-powered 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. LRVs 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 10: Light Rail Vehicle (Siemens SD-160)

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 (DTO). RTD owns the commuter rail vehicles and will assume ownership at the end of the contracted period of performance (30 years). Commuter rail vehicles are considered out-of-scope until such time as RTD assumes capital responsibility for the operation and maintenance of these vehicles.

Figure 11: Commuter Rail Vehicle (Hyundai Rotem)

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.

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 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 (U.S. Department of Transportation, 2016).

RTD's bus fleet has been a focus of renewals, however some transit buses are now considered to be in backlog. Based on a combination of vehicle performance, condition, and cost of maintaining rather than replacing vehicles, some transit buses will be operated in backlog and will be replaced at 18 years.

Table 3 also presents the total initial capital cost[6] of the vehicles in each sub-fleet.

Revenue Vehicle Type	Count	ULB	Average Age Score	% in Backlog	Original Cost
Transit Buses	768	14	4.0	10.4%	$282m
Articulated Buses	116	14	4.2	0.0%	$76m
Intercity Buses	160	14	4.2	0.0%	$90m
Cutaway Buses	404	10	4.0	0.0%	$24m
Light Rail Vehicles	185	40	4.2	0.0%	$483m

Table 3: Revenue Vehicle Inventory, Condition and Backlog

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 175 automobiles, 4 steel wheel non-revenue vehicles and 202 rubber tire non-revenue vehicles. Non-vehicle equipment includes non-self-propelled rail tampers, equipment hoists, wheel lathes and exhaust fans, 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.

[6] 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.

Figure 12: RTD Automobile

Figure 13: RTD Bucket Truck

Figure 14: RTD Truck

Figure 15: RTD Utility Truck

Figure 16: 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.[7] As such, condition scores for equipment are age-based.

The table below presents the total number of non-revenue vehicle assets, along with their ULB, and a score representing the condition of the equipment based on its age. 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. 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. A non-revenue 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 (U.S. Department of Transportation, 2016).

Inventory, condition and backlog information for non-vehicle equipment is not provided for this generation of the TAMP.

Table 4 also presents the total initial capital cost for each vehicle type.

Equipment Type	Count	ULB	Average Age Score	% in Backlog	Original Cost
Automobile	175	8	4.0	21.3%	$ 4.3m
Steel Wheel	4	25	4.7	0.0%	$ 1.8m
Truck & Other Rubber Tire	202	14	3.8	10.0%	$ 11.3m

Table 4: Equipment Inventory, Condition and Backlog

2.3.3 Facilities

For the purposes of this TAMP, RTD has: 3 administrative facilities where RTD administrative functions take place; 11 maintenance facilities where maintenance work takes place; 112 public facilities which includes stations, buildings and other structures where riders can board or disembark from an RTD transit vehicle; and 96 conveyances (elevators and escalators), installed within other facilities but are treated here separately based on National Transit Database (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 and snow removal at certain facilities, are contracted to third-parties. Conveyance manufacturers include Kone and Thyssenkrupp and their maintenance is outsourced to third-parties.

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

Figure 17: Bus Maintenance Facility

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 (Regional Transportation District, 2016).

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.

Figure 18: Light Rail Maintenance Facility

Figure 19: Public Facility

The condition score of each of the elements that exist at an Administration or Maintenance facility is averaged to provide the condition score of the facility. Currently, each extant facility element is weighted equally. The following table presents the elements of each facility that are assigned an individual condition score. Not all facilities have all listed elements.

Administrative Facilities	Maintenance Facilities	Public Facilities
1. Roof 2. Building Shell 3. Parking Lots 4. Grounds 5. Parking Garage	1. Roof 2. Building Shell 3. Parking Lots 4. Grounds 5. Vehicle Wash/ Fuel Islands 6. Parking Garage 7. Administrative Areas 8. Maintenance Shop 9. Storeroom/ Parts Storage 10. Stairs / Stairways	1. Driver Relief Stations 2. Grounds 3. Parking Lots 4. Platform 5. Pedestrian Plaza 6. Storage Space 7. Parking Structure

Table 5: Facility Elements Assigned Individual Condition Score

The Public Facilities condition score represents the average of the attributes in Table 5, such that extant elements have an equal contribution to the average condition score. (Regional Transportation District, 2017).

Figure 20: Conveyance (elevator)

Conveyance inspections are outsourced to third-parties in accordance with applicable legislation and regulations but are not used to determine condition. 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 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 (U.S. Department of Transportation, 2018).

Facility Type	Count	ULB	Average Physical Condition Score	% in Backlog	Original Cost
Administrative Facility	3				
Blake	-	60	3.6	0.0%	$11.7m
711	-	60	5.0	0.0%	$4.7m
Security Command Center	-	60	-	0.0%	$0.8m
Maintenance Facility	11				
District Shops	-	60	3.9	0.0%	$39.4m
Platte	-	60	3.0	0.0%	$26.7m
East Metro	-	60	3.4	0.0%	$6.1m
Boulder	-	60	3.9	0.0%	$16.9m
Mariposa	-	60	3.4	0.0%	$14.9m
Rio Court	-	60	4.0	0.0%	$4.8m
Navajo	-	60	3.4	0.0%	$0.5m
Peoria Rail Maintenance	-	60	5.0	0.0%	$0.9m
Elati	-	60	4.0	0.0%	$59.0m
Treasury	-	60	3.2	0.0%	$1.9m
Longmont	-	60	3.3	0.0%	$2.6m
Public Facility	112	-	3.6	8.2%	$905.0m

Table 6: Facility Inventory, Condition and Backlog

Conveyance	Count	ULB	Average Age Score	% in Backlog	Original Cost[8]
Conveyance	96	25	3.9	9.4%	$17.0m

Table 7: Conveyance Inventory, Condition and Backlog

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) and light rail vehicle bridges.

[8] Some conveyance costs may be included in original cost of a facility and not recorded individually.

Figure 21: Light Rail Vehicle Bridge

Figure 22: Signals

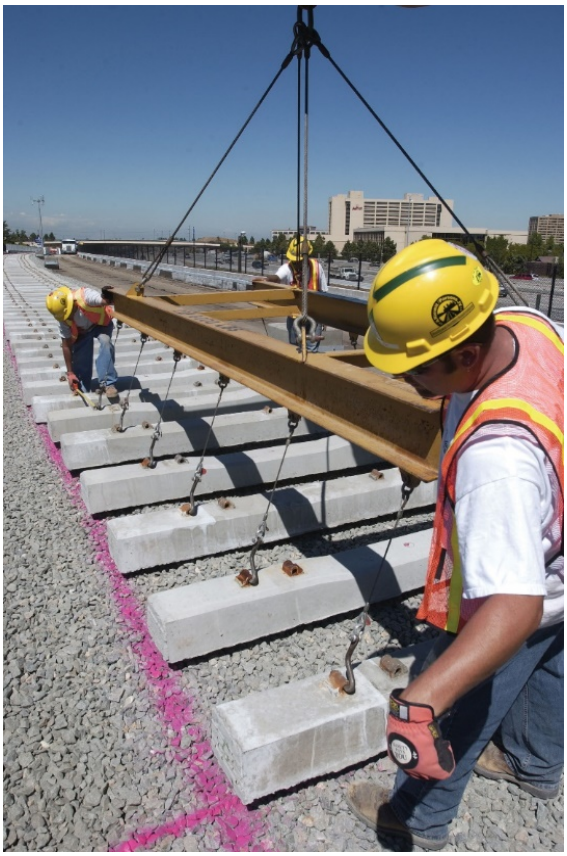


Figure 23: Track Infrastructure

Figure 24: Grade Crossing

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, Denver Transit Operators. RTD owns the commuter rail infrastructure and will assume ownership at the end of the contracted period of performance (30 years). Commuter rail infrastructure is considered out-of-scope until such time as RTD assumes capital responsibility for the operation and maintenance of the commuter rail infrastructure.

Seventy light rail vehicle bridges are owned and 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 (Regional Transportation District, 2017).

Light rail vehicle 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 8 below presents the total number of infrastructure assets, along with their ULB and age-based condition score.

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 (U.S. Department of Transportation, 2017).

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 Age Score	% in Backlog	Original Cost
Grade Crossing	40	15	3.9	5.0%	$3.9m
Relay Cases	224	25	3.9	0.4%	$64.2m[9]
Signal Segments	300	25	3.8	0.3%	$285.4m
Switches	249	25	3.6	0.4%	$3.8m
Track Segments	76	30	3.9	1.3%	$646.9m
Substations	64	25	3.9	1.6%	$34.3m
Catenary Wire Segments	75	20	3.2	4.0%	$20.4m
Total					$1,058.9m

Table 8: Infrastructure Assets and Condition

Light Rail Vehicle Bridges	Count	ULB	Average Physical Condition Score	% in Backlog	Original Cost
Light Rail Vehicle Bridges	70	80	3.9	1.4%	$92.1m

Table 9: Light Rail Vehicle Bridge Condition Score

Guideway Under Performance Restriction by Track Mile	2017	2018	2019
January	0.0	2.1	0.0
February	1.7	1.2	0.2
March	0.0	2.3	1.1
April	0.0	0.0	2.6
May	0.0	0.0	1.5
June	0.0	0.0	1.1
July	1.6	0.19	Not available
August	1.0	0.0	Not available
September	3.6	1.89	Not available
October	3.4	3.55	Not available
November	2.3	0.1	Not available
December	0.0	0.0	Not available

Table 10: Guideway Performance Restriction by Track Mile

[9] Relay case replacement cost is used as the original cost of these infrastructure elements were not recorded individually. They were recorded at a level commensurate with the level of the capital program.

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 2020-2025 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 2020-2025 are presented separately in the FasTracks financial plan (Regional Transportation District, 2016).

The process used to prioritize investments for the 2020-2025 Mid Term Financial Plan is built upon a legacy project prioritization process. The process is shown in Figure 25 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 an investment planning process. The intent of this process is to align all investment with the Asset Management Policy, Agency Objectives, and Strategic Asset Management Plan.

An important additional element of an investment planning 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. An investment planning process will serve as one of RTD's decision support tools.

Capital Investment Decision Making Process

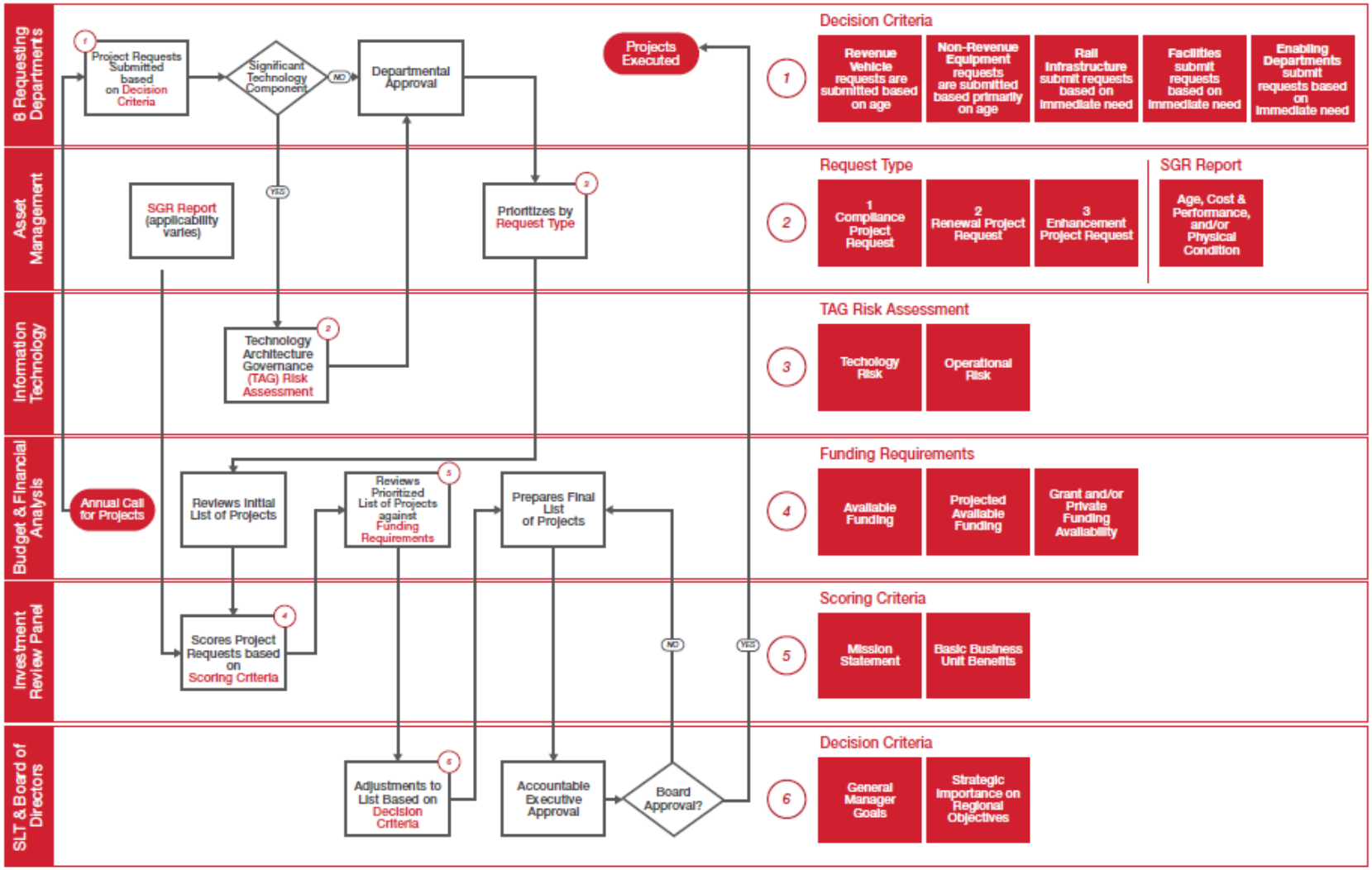


Figure 25: Capital Investment Decision Making Process

4 List of Prioritized Investments

The output of the current capital investment decision process is a list of prioritized capital projects. For 2020-2025, the list is separated into two project types and each project type is broken down into three funding categories.

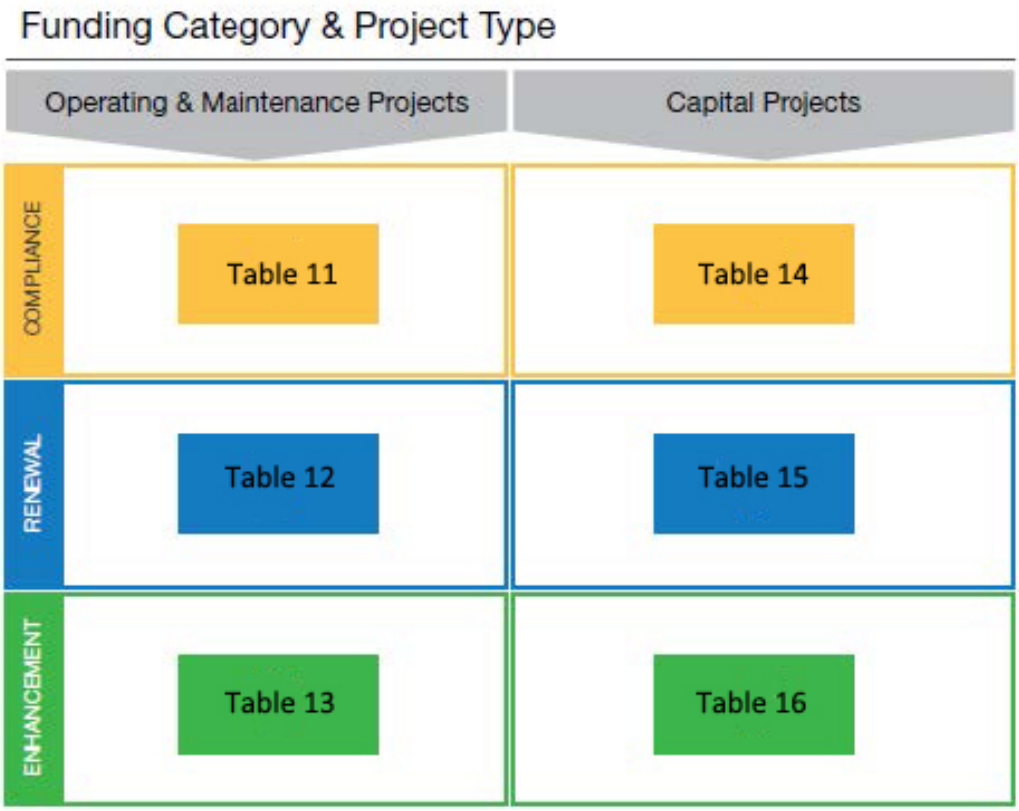


Figure 26: Project Funding Category and Type

4.1 Funded Operating and Maintenance Project List

Tables 11, 12 and 13 are the list of approved Capital Operating & Maintenance projects over the period 2020-2025.

Table 11

Compliance Project Title	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Project O&M Costs - 2024	Project O&M Costs - 2025	Total O&M Costs
1 FTE: Safety Manager - Rail	$60,000	$60,000	$60,000	$0	$0	$0	$180,000
Cost Increases for Access-a-Ride Service	$1,250,000	$800,000	$800,000	$1,250,000	$800,000	$800,000	$5,700,000
Asset Subtotal	**$1,310,000**	**$860,000**	**$860,000**	**$1,250,000**	**$800,000**	**$800,000**	**$5,880,000**
Non-Asset Subtotal	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total	**$1,310,000**	**$860,000**	**$860,000**	**$1,250,000**	**$800,000**	**$800,000**	**$5,880,000**

Table 12

Renewal Project Title	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Project O&M Costs - 2024	Project O&M Costs - 2025	Total O&M Costs
Exhaust Fans (13) Replacement Maintenance End @ Platte	$0	$0	$9,000	$90,000	$0	$0	$99,000
Overhead Sectional Doors (34) Replacement @ District Shops	$0	$0	$500,000	$0	$0	$0	$500,000
Fuel Pumps Upgrade @ District Shops	$0	$0	$0	$60,000	$0	$0	$60,000
Canvas Wash Bay Doors (4) Replacement in Car Wash @ District Shops	$0	$0	$121,000	$0	$0	$0	$121,000
Roll-Up Doors (3) Replacement in Landscape Building @ District Shops	$0	$0	$100,000	$0	$0	$0	$100,000
CDL Training Course @ Weston Property	$0	$975,000	$0	$0	$0	$0	$975,000
Supervisors Office Remodel @ Boulder	$0	$0	$360,000	$0	$0	$0	$360,000
Building Automation Upgrade @ Boulder	$0	$565,400	$0	$0	$0	$0	$565,400
Third Floor Remodel @ District Shops	$250,000	$0	$0	$0	$0	$0	$250,000
Concrete and ADA Tactile Replacement @ Southeast Corridor	$0	$0	$1,026,200	$1,026,200	$0	$0	$2,052,400
Concrete and ADA Tactile Replacement @ Southwest Corridor	$0	$0	$513,100	$513,100	$0	$0	$1,026,200

Renewal Project Title (continued)	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Project O&M Costs - 2024	Project O&M Costs - 2025	Total O&M Costs
Train Hoist Rams (16) in Service Pits @ Mariposa	$0	$0	$265,000	$0	$0	$0	$265,000
FlexPass Program	$250,000	$250,000	$250,000	$255,000	$0	$0	$1,005,000
Capital Maintenance Costs	$0	$0	$0	$0	$0	$14,267,000	$14,267,000
Oracle ERP Upgrade and/or Alternative System	$1,500,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$6,500,000
Enterprise Customer Relationship Management System (CRM)	$700,000	$700,000	$700,000	$700,000	$700,000	$700,000	$4,200,000
Oracle Hardware Engineered Systems End of Life Replacement	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$1,500,000
Fixed Route Schedule & Run-Cutting Software Hosting & Warranty	$0	$208,960	$42,000	$33,000	$24,000	$0	$307,960
Board District Redistricting	$0	$0	$75,000	$0	$0	$0	$75,000
Asset Subtotal	**$2,700,000**	**$3,490,400**	**$4,844,300**	**$3,639,300**	**$1,950,000**	**$16,217,000**	**$32,841,000**
Non-Asset Subtotal	**$250,000**	**$458,960**	**$367,000**	**$288,000**	**$24,000**	**$0**	**$1,387,960**
Total	**$2,950,000**	**$3,949,360**	**$5,211,300**	**$3,927,300**	**$1,974,000**	**$16,217,000**	**$34,228,960**

Table 13

Enhancement Project Title	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Project O&M Costs - 2024	Project O&M Costs - 2025	Total O&M Costs
15L Route Improvements	$125,000	$250,000	$250,000	$250,000	$250,000	$250,000	$1,375,000
Subregional TIP Projects	$200,000	$250,000	$275,000	$200,000	$200,000	$200,000	$1,325,000
University of Denver AV Shuttle	$9,000	$8,000	$8,000	$0	$0	$0	$25,000
Transit Plaza Upgrades @ Thornton PnR	$0	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Bus Transfer Station @ Clear Creek Crossing	$0	$100,000	$100,000	$100,000	$100,000	$100,000	$500,000
Driver's Relief Station @ Arapahoe Crossing	$0	$20,000	$20,000	$20,000	$20,000	$20,000	$100,000
Mezzanine Addition (2nd Floor) for Operator Training @ Elati	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$90,000
Rider Alert System	$225,000	$225,000	$225,000	$225,000	$225,000	$225,000	$1,350,000
Enterprise Content Management	$200,000	$200,000	$1,534,500	$684,500	$716,000	$716,000	$4,051,000

Enhancement Project Title (continued)	Project O&M Costs - 2020	Project O&M Costs - 2021	Project O&M Costs - 2022	Project O&M Costs - 2023	Project O&M Costs - 2024	Project O&M Costs - 2025	Total O&M Costs
1 FTE: Traveler Information Systems (Real-Time) Development Support	$0	$0	$175,000	$175,000	$175,000	$175,000	$700,000
Account-Based Fare Collection System	$1,150,000	$400,000	$450,000	$500,000	$550,000	$600,000	$3,650,000
Risk Management Information System Upgrade	$150,000	$155,000	$160,000	$166,000	$173,000	$180,000	$984,000
Safety Management System Software Solution	$0	$100,000	$100,000	$100,000	$100,000	$100,000	$500,000
Conversion of Digital Customer Relations Liaison (Rider Alerts) to Lead Supervisor (incremental)	$19,663	$19,663	$19,663	$19,663	$19,663	$19,663	$117,978
1 FTE: Marketing / Events Coordinator	$40,574	$81,148	$81,148	$81,148	$81,148	$81,148	$446,314
Employee Appreciation Event - incremental	$0	$15,000	$0	$25,000	$0	$0	$40,000
Cost Increases to Fixed Route Contracts	$1,992,038	$3,358,509	$4,251,109	$5,280,433	$6,846,302	$8,368,156	$30,096,546
Cost Increases to Flex Ride Contracts + Special Services	$176,976	$230,540	$292,593	$359,318	$428,990	$484,800	$1,973,217
Cost Increases to Paratransit Contracts	$1,223,151	$2,620,849	$4,133,538	$5,768,747	$7,551,722	$9,474,361	$30,772,368
DRCOG Wayfinding Grant	$241,575	$0	$0	$0	$0	$0	$241,575
Equity Training	$175,000	$20,000	$20,000	$20,000	$20,000	$20,000	$275,000
4 FTE: VM Mechanics Maintenance Operations	$284,556	$284,556	$284,556	$284,556	$284,556	$284,556	$1,707,336
1 FTE: Digital Media/Video Media	$97,200	$97,200	$97,200	$97,200	$97,200	$97,200	$583,200
1 FTE: Cybersecurity Engineer	$180,000	$180,000	$180,000	$180,000	$180,000	$180,000	$1,080,000
1 FTE: Planning Project Manager	$0	$110,000	$110,000	$110,000	$110,000	$110,000	$550,000
3 FTE: LRV Maintenance Supervisors	$324,729	$324,729	$324,729	$324,729	$324,729	$324,729	$1,948,374
1 FTE: Crime Data Analyst	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$720,000
Armed Security @ DUS	$0	$0	$283,920	$283,920	$283,920	$283,920	$1,135,680
Security Command Center - University Project	$0	$0	$0	$0	$0	$120,000	$120,000
Security Increase on LR Vehicles	$501,037	$501,037	$1,002,074	$1,002,074	$1,002,074	$1,002,074	$5,010,370
Asset Subtotal	**$1,874,000**	**$1,483,000**	**$2,872,500**	**$2,070,500**	**$2,159,000**	**$2,336,000**	**$12,795,000**
Non-Asset Subtotal	**$5,576,499**	**$8,213,231**	**$11,650,530**	**$14,331,788**	**$17,725,304**	**$21,225,607**	**$78,722,958**
Total	**$7,450,499**	**$9,696,231**	**$14,523,030**	**$16,402,288**	**$19,884,304**	**$23,561,607**	**$91,517,958**

4.2 Funded Capital Project List

Tables 14, 15 and 16 are the approved capital projects over the period 2020-2025.

Table 14

Compliance Project Title	Project Capital Costs - 2020	Project Capital Costs - 2021	Project Capital Costs - 2022	Project Capital Costs - 2023	Project Capital Costs - 2024	Project Capital Costs - 2025	Total Capital Costs
Fire Control System Replacement @ District Shops	$0	$0	$1,100,000	$0	$0	$0	$1,100,000
TVM Replacement (ST80) for PCI Non-Compliance	$1,400,000	$0	$1,400,000	$0	$0	$0	$2,800,000
Asset Subtotal	**$1,400,000**	**$0**	**$2,500,000**	**$0**	**$0**	**$0**	**$3,900,000**
Non-Asset Subtotal	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total	**$1,400,000**	**$0**	**$2,500,000**	**$0**	**$0**	**$0**	**$3,900,000**

Table 15

Renewal Project Title	Project Capital Costs - 2020	Project Capital Costs - 2021	Project Capital Costs - 2022	Project Capital Costs - 2023	Project Capital Costs - 2024	Project Capital Costs - 2025	Total Capital Costs
Transit Buses - 40 Foot	$16,650,480	$17,140,200	$40,157,040	$11,263,560	$6,366,360	$0	$91,577,640
Transit Buses - 30 Foot	$0	$0	$10,355,000	$5,384,600	$4,970,400	$0	$20,710,000
Intercity Buses	$0	$0	$0	$0	$0	$3,810,000	$3,810,000
Hop Vehicle Replacement	$0	$0	$400,000	$200,000	$200,000	$0	$800,000
Access-a-Ride Cutaway Buses	$2,549,300	$0	$4,547,400	$0	$16,604,900	$964,600	$24,666,200
FlexRide Cutaway Buses	$792,880	$0	$288,320	$0	$0	$2,811,120	$3,892,320
Support & Service Vehicles	$96,000	$90,000	$2,515,000	$1,607,000	$1,979,000	$2,168,000	$8,455,000
Administrative & Pool Vehicles	$159,000	$144,000	$630,000	$487,000	$360,000	$752,000	$2,532,000
In-Plant Vehicles & Equipment	$32,000	$50,000	$1,143,500	$1,527,700	$447,000	$588,500	$3,788,700
Frame Pulling Machine	$195,000	$0	$0	$0	$0	$0	$195,000
Gerber Machines Replacement for Bus Signage	$103,000	$0	$0	$0	$0	$0	$103,000
Oracle ERP Upgrade and/or Alternative System	$2,750,000	$750,000	$0	$0	$0	$0	$3,500,000

Renewal Project Title (continued)	Project Capital Costs - 2020	Project Capital Costs - 2021	Project Capital Costs - 2022	Project Capital Costs - 2023	Project Capital Costs - 2024	Project Capital Costs - 2025	Total Capital Costs
Enterprise Customer Relationship Management System (CRM)	$250,000	$0	$0	$0	$0	$0	$250,000
Highblock Replacement @ Southwest Corridor	$0	$0	$650,000	$650,000	$650,000	$0	$1,950,000
Highblock Replacement @ Central Corridor - 20th & Welton to 30th & Downing	$0	$0	$650,000	$650,000	$650,000	$0	$1,950,000
In-Ground Hoists Replacement in Bays T-1 & T-2 @ District Shops	$0	$0	$380,000	$0	$0	$0	$380,000
Steel Inspection Pits Replacement @ East Metro	$0	$0	$205,600	$2,570,000	$0	$0	$2,775,600
Roof Replacement @ Platte	$4,718,335	$0	$0	$0	$0	$0	$4,718,335
In-Ground Lifts (6) Replacement @ District Shops	$0	$0	$320,000	$0	$0	$0	$320,000
Roof Replacement @ East Metro	$0	$0	$0	$35,000	$6,392,144	$0	$6,427,144
Makeup Air Units (MAUs) (4) Replacement @ Platte	$0	$0	$1,028,000	$0	$0	$0	$1,028,000
HVEC Unit Replacements @ Platte	$0	$0	$30,000	$3,000,000	$0	$0	$3,030,000
Bus Wash Replacement @ East Metro	$0	$0	$0	$0	$0	$1,644,800	$1,644,800
Brake Hoist Replacement @ East Metro	$0	$0	$308,400	$0	$0	$0	$308,400
High Speed Roll Up Door Replacements @ East Metro	$0	$82,240	$0	$0	$0	$0	$82,240
AC Systems (3) Replacement @ Blake	$0	$0	$120,000	$0	$0	$0	$120,000
Facilities and Equipment Replacement	$0	$0	$0	$0	$0	$8,332,932	$8,332,932
Downtown Track & Switches Replacement	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$1,500,000	$1,000,000	$10,500,000
Rail Replacement @ Central Corridor	$1,250,000	$1,250,000	$1,250,000	$0	$0	$0	$3,750,000
Materials & Supplies - Light Rail	$0	$0	$300,000	$300,000	$300,000	$0	$900,000
OCS Wire Replacement	$1,600,000	$400,000	$800,000	$800,000	$600,000	$500,000	$4,700,000
Asset Subtotal	**$33,145,995**	**$21,906,440**	**$68,078,260**	**$30,474,860**	**$41,019,804**	**$22,571,952**	**$217,197,311**
Non-Asset Subtotal	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total	**$33,145,995**	**$21,906,440**	**$68,078,260**	**$30,474,860**	**$41,019,804**	**$22,571,952**	**$217,197,311**

Table 16

Enhancement Project Title	Project Capital Costs - 2020	Project Capital Costs - 2021	Project Capital Costs - 2022	Project Capital Costs - 2023	Project Capital Costs - 2024	Project Capital Costs - 2025	Total Capital Costs
Electric Buses	$0	$15,045,000	$0	$0	$0	$0	$15,045,000
Bus Transfer Station @ Clear Creek Crossing	$1,000,000	$0	$0	$0	$0	$0	$1,000,000
Driver's Relief Station @ Arapahoe Crossing	$1,000,000	$0	$0	$0	$0	$0	$1,000,000
Oracle Hardware Engineered Systems End of Life Replacement	$0	$0	$400,000	$0	$0	$0	$400,000
Traveler Information Systems (Real-Time) Development Support	$0	$0	$150,000	$300,000	$0	$0	$450,000
PIDs Program Infrastructure Support	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$1,500,000
Information Security Technology-Supervisory Controls Environment	$150,000	$0	$0	$0	$0	$0	$150,000
Risk Management Information System Upgrade	$115,000	$0	$0	$0	$0	$0	$115,000
Standard Security Architecture for Supervisory Controls (SC SSA)	$175,000	$0	$0	$0	$0	$0	$175,000
Cab Signaling on LRVs	$2,000,000	$1,000,000	$1,500,000	$1,500,000	$1,000,000	$0	$7,000,000
Heavy Equipment for LR Maintenance	$250,000	$250,000	$1,500,000	$0	$0	$0	$2,000,000
Security Command Center - University Project	$0	$0	$0	$0	$5,743,100	$0	$5,743,100
Overhead Product Reels @ East Metro	$0	$0	$311,544	$0	$0	$0	$311,544
New Maintenance Facility	$0	$0	$0	$0	$0	$50,000,000	$50,000,000
Charging Infrastructure for Electric Buses	$1,200,000	$235,000	$0	$0	$0	$0	$1,435,000
Longmont to Boulder @ SH 119	$0	$0	$0	$30,000,000	$0	$0	$30,000,000
Account-Based Fare Collection System	$3,626,168	$0	$0	$0	$0	$0	$3,626,168
General Manager's Discretionary Account	$0	$0	$0	$0	$0	$0	$0
Asset Subtotal	**$9,766,168**	**$16,780,000**	**$4,111,544**	**$32,050,000**	**$6,993,100**	**$50,250,000**	**$119,950,812**
Non-Asset Subtotal	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total	**$9,766,168**	**$16,780,000**	**$4,111,544**	**$32,050,000**	**$6,993,100**	**$50,250,000**	**$119,950,812**

(Regional Transportation District, 2019)

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 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.

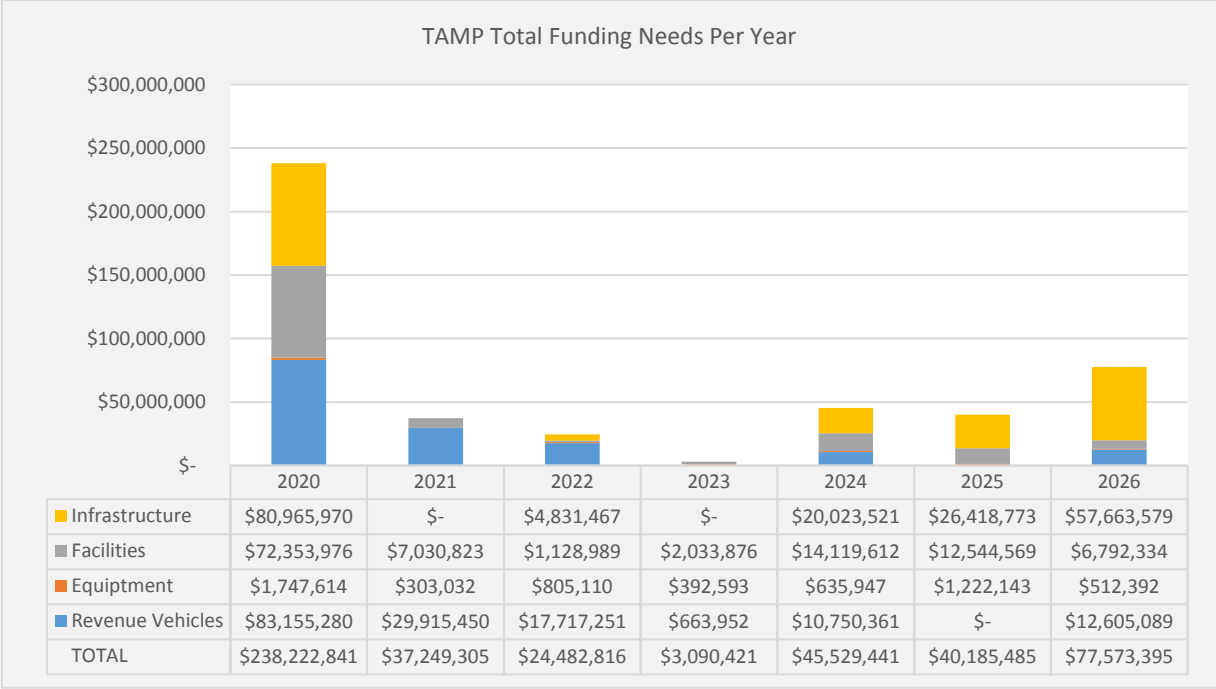
RTD's asset management maturity improvement initiative is not driven by a growing set of decaying assets, but by the expansion of the asset base in recent years. Beginning with the T-REX project and continuing with the current FasTracks project, over the past 15 years RTD has spent over $5.1 billion 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.

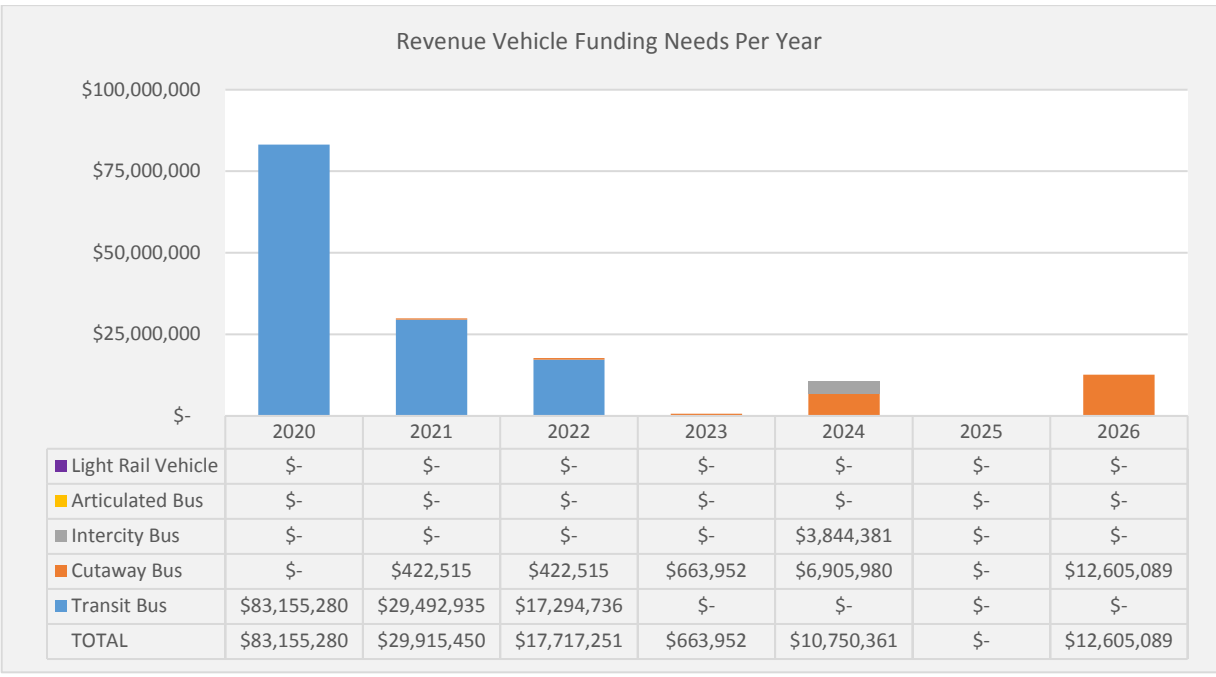
RTD is preparing an Asset Management Plan (AMP) that addresses future funding needs for existing assets, prioritizing renewals over enhancements. The original cost of assets is less useful to the Agency than projected future costs, therefore RTD's efforts emphasize creating accurate and increasingly precise estimates of what investments are needed over the coming budget planning cycle.

The AMP is the combined output of individual Asset Class Strategies that focus on what will need to be renewed, when it will need to be renewed, and the expected costs of renewals. The AMP will populate the renewal bucket of the investment prioritization process. The projected funding needs over the period 2020-2026 are illustrated in the graphs that follow.



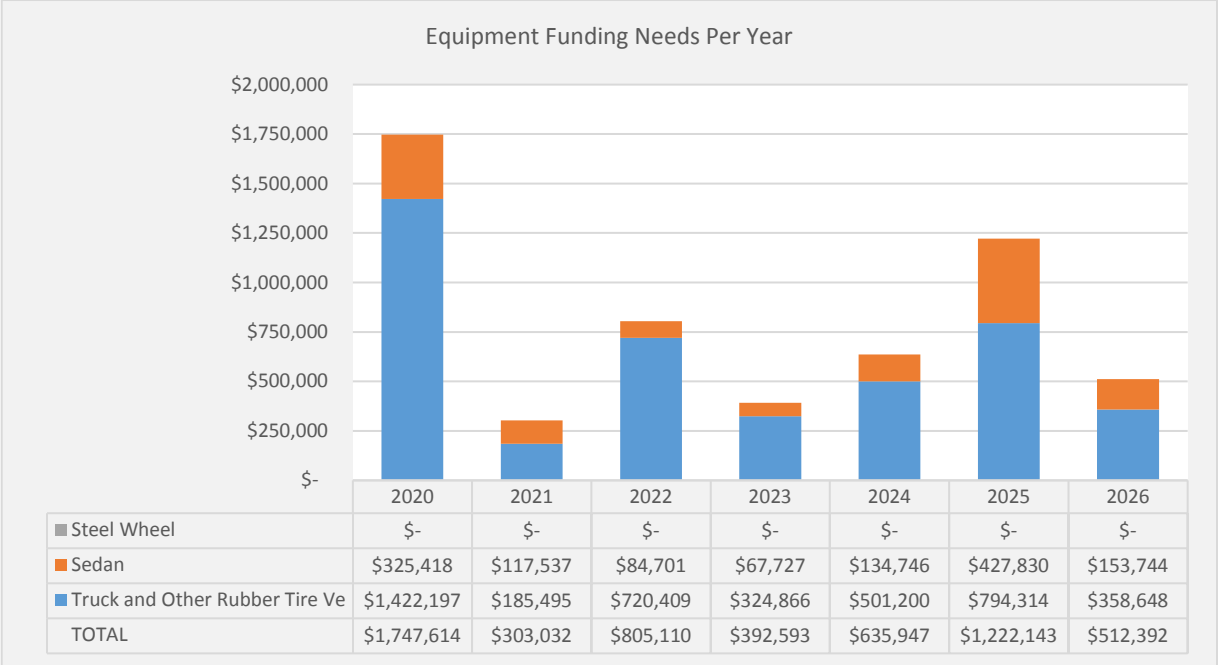
	2020	2021	2022	2023	2024	2025	2026
Infrastructure	$80,965,970	$-	$4,831,467	$-	$20,023,521	$26,418,773	$57,663,579
Facilities	$72,353,976	$7,030,823	$1,128,989	$2,033,876	$14,119,612	$12,544,569	$6,792,334
Equiptment	$1,747,614	$303,032	$805,110	$392,593	$635,947	$1,222,143	$512,392
Revenue Vehicles	$83,155,280	$29,915,450	$17,717,251	$663,952	$10,750,361	$-	$12,605,089
TOTAL	$238,222,841	$37,249,305	$24,482,816	$3,090,421	$45,529,441	$40,185,485	$77,573,395

Figure 27: Total Funding Needs Per Year, 2020-2026



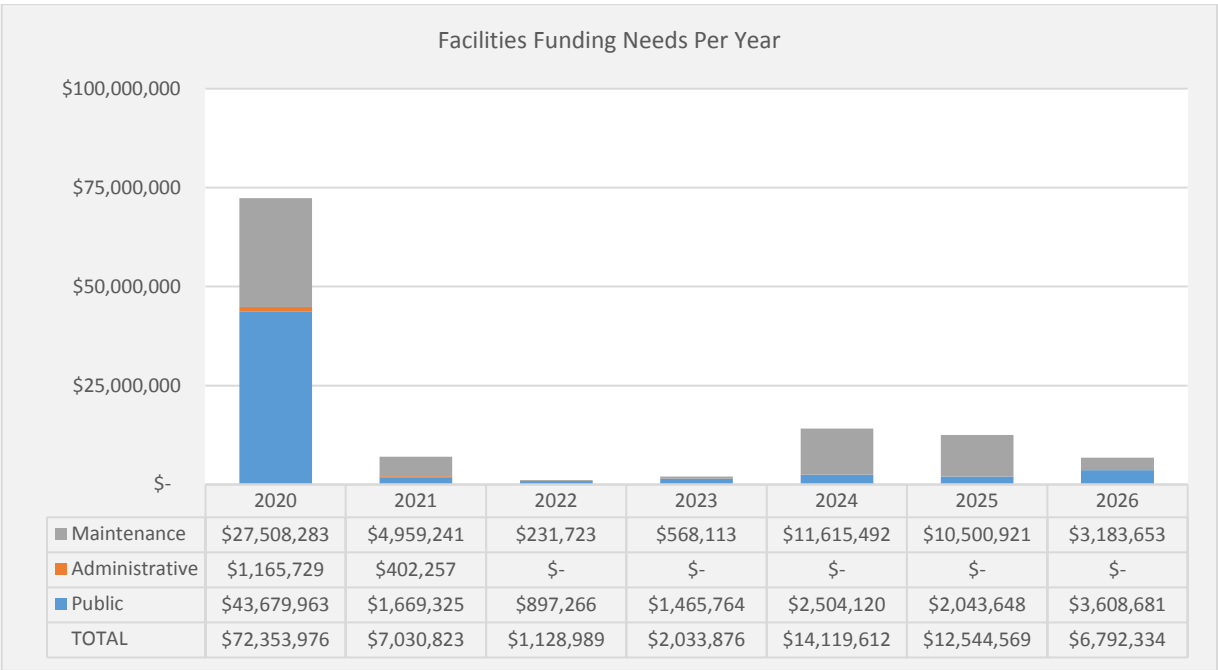
	2020	2021	2022	2023	2024	2025	2026
Light Rail Vehicle	$-	$-	$-	$-	$-	$-	$-
Articulated Bus	$-	$-	$-	$-	$-	$-	$-
Intercity Bus	$-	$-	$-	$-	$3,844,381	$-	$-
Cutaway Bus	$-	$422,515	$422,515	$663,952	$6,905,980	$-	$12,605,089
Transit Bus	$83,155,280	$29,492,935	$17,294,736	$-	$-	$-	$-
TOTAL	$83,155,280	$29,915,450	$17,717,251	$663,952	$10,750,361	$-	$12,605,089

Figure 28: Revenue Vehicle Funding Needs Per Year, 2020-2026



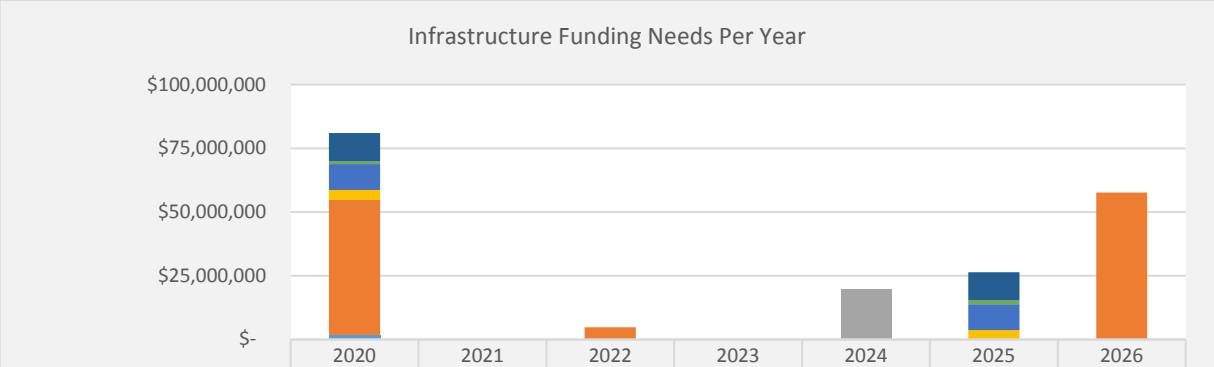
	2020	2021	2022	2023	2024	2025	2026
Steel Wheel	$-	$-	$-	$-	$-	$-	$-
Sedan	$325,418	$117,537	$84,701	$67,727	$134,746	$427,830	$153,744
Truck and Other Rubber Tire Ve	$1,422,197	$185,495	$720,409	$324,866	$501,200	$794,314	$358,648
TOTAL	$1,747,614	$303,032	$805,110	$392,593	$635,947	$1,222,143	$512,392

Figure 29: Equipment Funding Needs Per Year, 2020-2026



	2020	2021	2022	2023	2024	2025	2026
Maintenance	$27,508,283	$4,959,241	$231,723	$568,113	$11,615,492	$10,500,921	$3,183,653
Administrative	$1,165,729	$402,257	$-	$-	$-	$-	$-
Public	$43,679,963	$1,669,325	$897,266	$1,465,764	$2,504,120	$2,043,648	$3,608,681
TOTAL	$72,353,976	$7,030,823	$1,128,989	$2,033,876	$14,119,612	$12,544,569	$6,792,334

Figure 30: Facilities Funding Needs Per Year, 2020-2026



	2020	2021	2022	2023	2024	2025	2026
Substations	$11,086,810	$-	$-	$-	$-	$11,086,810	$-
Switches	$1,016,591	$-	$-	$-	$-	$1,452,273	$-
Relay Cases	$10,191,807	$-	$-	$-	$-	$10,191,807	$-
Signal Segments	$3,925,810	$-	$-	$-	$-	$3,687,882	$-
Track Segments	$-	$-	$-	$-	$20,023,521	$-	$-
Catenary Wire Segments	$52,898,025	$-	$4,831,467	$-	$-	$-	$57,663,579
Grade Crossings	$1,846,926	$-	$-	$-	$-	$-	$-
TOTAL	$80,965,970	$-	$4,831,467	$-	$20,023,521	$26,418,773	$57,663,579

Figure 31: Infrastructure Funding Needs Per Year, 2020-2026

5.1 Strategic Asset Management Plan

RTD aims to comply fully with MAP-21 requirements for transit asset management and beyond. It has developed 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 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 (AMCL, 2017). The Roadmap is included in Appendix D.

Figure 32: 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.

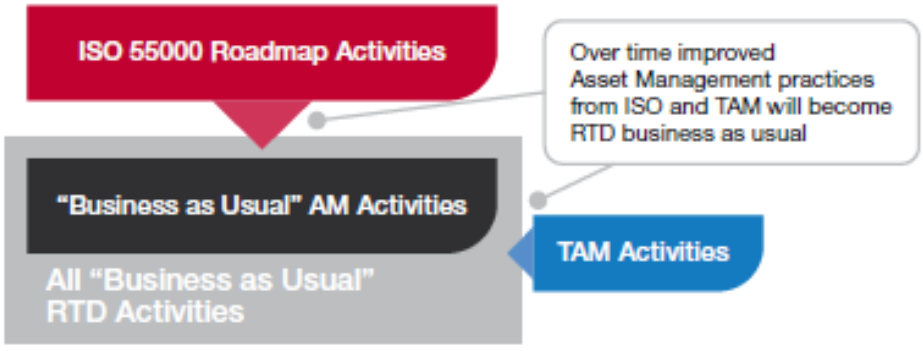


Figure 33: Asset Management Activities

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 Institute of Asset Management's Conceptual Model for Asset Management to categorize into six main blocks (2015). This should not be interpreted to imply these ongoing activities are all necessarily well aligned or integrated at the moment.

Figure 34: The Institute of Asset Management (IAM) Conceptual Model for Asset Management

Strategy and 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, 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 (FasTracks) 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 and People

RTD applies some procurement and supply chain management principles for its outsourced asset management functions. These include the capital delivery of its FasTracks 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 two service providers, and the maintenance of certain facility assets, such as elevators is also outsourced.

Risk and 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 an Asset Management Policy, Strategy and Risk Management 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 (AMP) as key elements of an 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 Framework, 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 an investment planning process for both capital projects and maintenance. 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
Asset Management 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 D)
Evaluation	As part of an annual update, progress on and compliance to this TAM Plan will be reviewed and lessons learned incorporated into the update.

Table 17: 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 (AM) 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 35: 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" (Johnson & Lloyd, 2012).

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 analysis and data science. 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.

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

The 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 (Regional Transportation District, 2019). 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 a future annual update.

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:

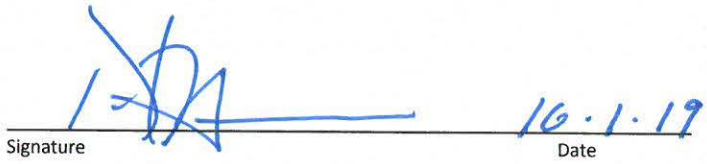
1. **ISO spot checks** – regular detailed reviews of specific elements of the emerging Asset Management System to identify risks to certification, and implement corrective measures

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 2019. 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 adopt the 2019 RTD TAM Plan.

APPROVED BY - FTA DESIGNATED ACCOUNTABLE EXECUTIVE:



Signature Date

10.1.19

David A. Genova

General Manager and CEO

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.
- **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 3 of this document.
- **National Transit Database** – 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.

- **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" (Transit Asset Management; National Transit Database, 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 Documents 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.

Appendix C: RTD Process for Mid Term 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 on the immediate need.
    d. Facilities submits projects requests based on 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 Steering Committee (TASC) for a Risk Assessment.
    a. The TASC 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 General Counsel.
    b. Renewal – The primary intent of a Renewal project request is to address existing assets and systems. Backlog is also addressed 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:

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 Asset Management Risk Framework

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 Asset Management Risk Framework, and used as input into the asset management planning process
- Development of Asset Class Strategies
- Definition and implementation of an 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

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

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

Enhance Asset Information

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

- Development and implementation of an Asset Information Framework, 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

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

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 for 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. RTD's aim is to use the tools it already owns, rather than invest in new ones at this time.
  - Hardware and Software necessary to support:
    - Multiple source software systems – e.g. Trapeze EAM, Oracle EBS
    - Data Warehouse – provides aggregation and integration of data
    - Analysis and reporting tools – Power BI, Tableau, Access, Excel, R-STATS, SPSS and others
- Financial resources
  - Financial resources necessary to support asset management 'business as usual' activities, TAM and ISO implementation. Beyond these, RTD has 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 Team (AMAT)** – 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.

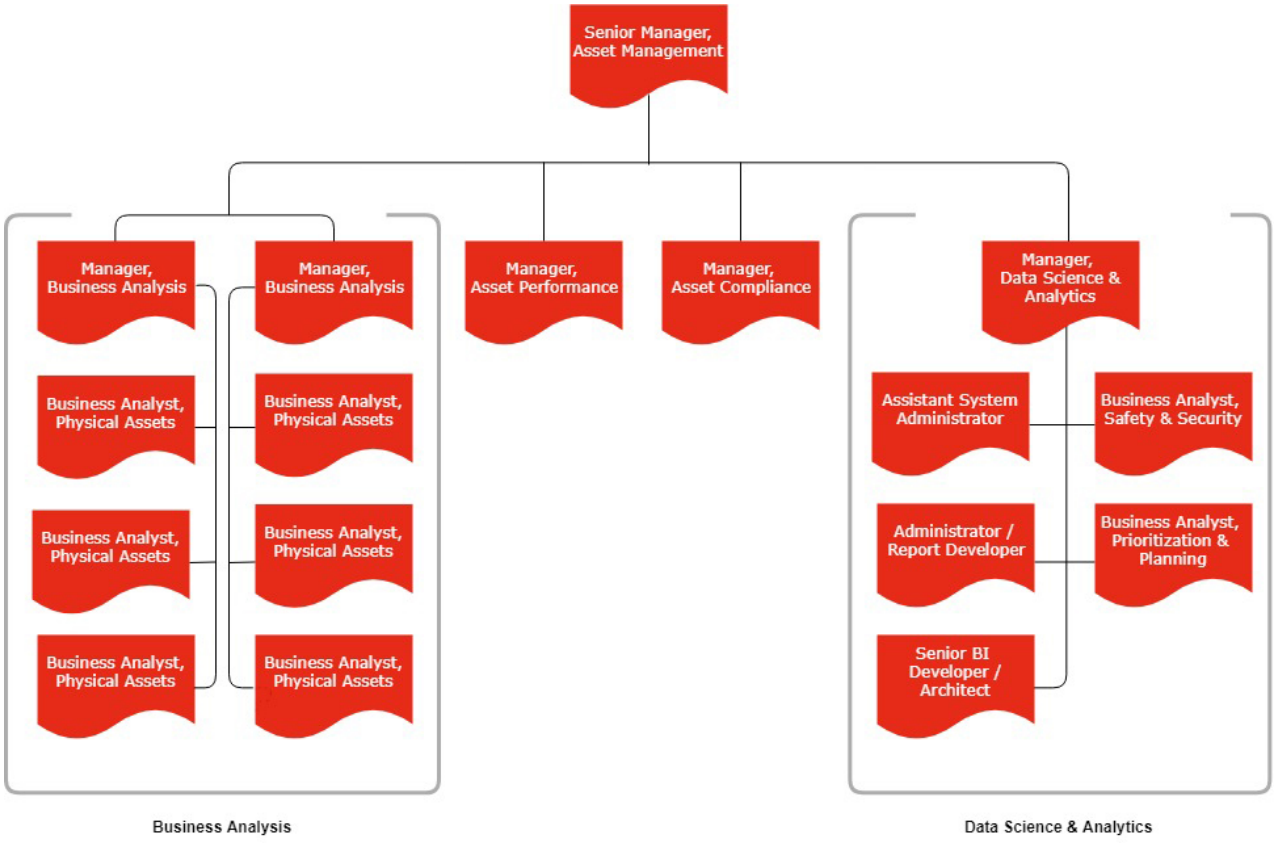


Figure 36: AMD Organization Chart 9/13/2019.

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 Team 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 cultivate 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 activities 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 figure below is a representation of RTD's purpose and objectives, adopted June 2019. RTD's purpose is to **move people** (Regional Transportation District, 2019). This purpose provides direction for the Agency that activities can be aligned towards. The phrase that "a three-quarter full bus is better than a one-quarter full bus, all else held equal" captures RTD's intention of increasing the effective and efficient utilization of assets in carrying out activities. This is a shift in how the Agency is conceptualized, wherein previous efforts were focused on completion of the FasTracks expansion effort and an emphasis on increasing available service hours and geographic coverage, rather than utilization.

RTD's efforts to improve the movement of people are attained through improving its ability to attract and retain customers by enhancing Leading Indicators, and the optimization of service within Constraints. RTD has adopted both performance and maturity targets for each of these concepts and is in the process of managing to these targets.

Figure 37: RTD's Purpose and Objectives

Appendix H: References

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