Regional Transportation District
Transit Asset Management Plan 2024

REGIONAL TRANSPORTATION DISTRICT
1660 BLAKE STREET, DENVER, CO 80202

This page intentionally left blank

Table of Contents

Executive Summary

In 2016, the Federal Transit Administration (FTA) mandated that every federally funded transit agency in the United States must have a Transit Asset Management (TAM) Plan in place by October 2018. RTD last completed a TAM Plan in 2022, and this iteration of the TAM Plan reflects changes to RTD's asset management system since 2022 and provides information on the Asset Management Plan (AMP) horizon, conforming to section 625.29 of Title 49.

TAM requirement nine mandates agencies to continually improve asset management capabilities and to detail efforts to improve in the TAM Plan (Table 2).

For this iteration of the TAM Plan, the most notable improvements concern the light rail infrastructure asset management practice. Consistent with the intent described in the prior TAM Plan, RTD has made significant improvements to the maturity of both information and process for light rail track assets. RTD's track inventory now matches the level at which assets are renewed and the level at which they are maintained rather than the granularity commensurate with the level of the capital program. This improvement in inventory granularity is also accompanied by meaningful improvements to the condition inspection procedure and utilization of condition inspection information. RTD's new asset management strategy for track assets has been dubbed the "Age-Minus" approach. This method was developed in response to a suite of business needs including:

- to have a strong financial plan for renewals
- to better utilize condition assessment information in renewal planning and ensuring safety
- to identify areas where wear or deterioration will likely result in a premature failure at a point less than the expected useful life (EUL) of the asset

To maximize performance and reduce uncertainty in light rail track EUL, full-depth replacements will be performed when track assets are renewed. A full-depth replacement means that no components will be reused, and the track will be entirely renewed restoring the EUL to the same as new construction. Because partial replacement of track components does not deliver a known operational life extension, full-depth replacements are preferred. A full-depth replacement provides the highest likelihood that a renewal will last the full design life of the assets. In the management of track assets going forward, safe service at the designed speed will be the highest priority. Secondly, the reduction of risk, specifically defined as the effect of uncertainty on objectives, will be reduced.

Having been shown to deliver desirable results, the method for delivering the improvements to light rail track will be expanded to other asset classes and groups. This method involves a robust requirements gathering process in which cross-departmental and multi-disciplinary teams are engaged to assess the quality, completeness and utility of information as well as specific "pain-points" encountered by different functions. This information is used to develop a single unified list of business requirements that serve as the plan for improvements. Once

the business requirements are established, the requirements are further broken down into actionable components and project managed to completion.

Having successfully employed this method for light rail track, it is the agency's intention to utilize this method to deliver improvements in other asset classes including light rail systems, bridges, public facilities and more.

A TAM plan is the cornerstone of asset stewardship. It is the public case for investment in the assets to justify the use of tax dollars to meet community requirements. It aims to demonstrate the best use of funding to deliver services now and into the future. While the agency has identified the need to take a different approach on developing a TAM-compliant asset management system (AMS), the agency is still committed to honoring the letter and spirit of the TAM regulation and the laws from which the regulation is derived. This document communicates this commitment for the agency, its planning partners, regulators including the FTA, and the communities that RTD serves. Accordingly, this document summarizes:

- The principles RTD uses to make asset decisions aligned to the Strategic Plan and Strategic Initiatives
- The assets RTD uses in the provision of public transportation
- The current state of those assets for which RTD has capital responsibility
- How RTD makes asset investment decisions
- The proposed capital investment plan for the period 2024-2030
- Actions to further improve asset management decision-making
- How this plan will be evaluated for continuous improvement

RTD's mission is to make lives better through connections, and its vision is to be the trusted leader in mobility, delivering excellence and value to customers and community (RTD, 2021). The communities RTD serves should know how the agency invests taxpayer dollars and how decisions are made regarding the best use of limited resources. This is accomplished in part through transparency in decision-making processes to sustain the condition and performance of the assets.

The following table summarizes the agency's response to each aspect of the TAM regulation.

1. INVENTORY		
Revenue vehicles	671 – Transit Buses 116 – Articulated Buses 168 – Intercity Buses	352 – Cutaway Buses 201 – Light Rail Vehicles 66 – Commuter Rail Vehicles
Equipment	45 – Automobiles 5 – Steel Wheeled	380 – Truck & Other Rubber Tire Vehicles 349 – Non-vehicle Equipment
Facilities	9 – Maintenance Facilities 5 – Administration Facilities	118 – Public Facilities 114 – Conveyances

Infrastructure	58 – Grade Crossings 118 – Catenary Wire Segments 261 – Switches 136 –Track Miles 232 – Relay Cases 64 – Substations 86 – Rail Vehicle Bridges 3 – Commuter Rail Alignments
2. CONDITION ASSESSMENT	
Revenue vehicles	Age-Based Analysis
Equipment	Age-Based Analysis
Facilities	Age-Based Analysis and Physical Condition Assessment
Infrastructure	Combination of Age-Based Analysis and Physical Condition Assessment in addition to Guideway Under Performance Restriction
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 prepares and updates a Five-Year Financial Forecast (FYFF) that includes projected capital construction and improvements, service levels and operating costs, and revenues to fund the capital and operating programs. The Asset Management Plan (AMP) is the input of asset renewal and replacement needs into the Five-Year Financial Forecast (FYFF). In RTD's financial plans, the AMP is fully funded. In addition, contributions to reserves are made in anticipation of funding needs within the planning horizon that may exceed ability to fund annually from revenues in a particular year. This results in an average contribution of approximately $120 Million annually to fund the AMP.
4. PRIORITIZED LIST OF INVESTMENTS	
What is the result or output of those decision support tools and processes?	The result of the decision support tools and processes described is the Asset Management Plan (AMP). The prioritized AMP is the result of the prioritization process. The funded/unfunded AMP is the intersection of the prioritized list of needs and the funding allocated to replacements and renewals. The funded items are included in the FYFF and budgets, while the unfunded items are retained in the AMP and considered in future process iterations.
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 it in August 2022. The intent of the policy is to improve how RTD manages assets henceforth; it is forward looking in nature and represents the agency's vision and shared commitment for good asset management. The AMS applies to the entire organization and directs the short, medium, and long-term plans for assets to achieve the agency mission of making lives better through connections.

6. IMPLEMENTATION STRATEGY	
How is RTD going to execute the TAM Plan?	RTD has identified a framework that is intended to move the agency from a system reliant on judgement, perception and intuition to one that will be data driven. A focus on improvements to asset information and incremental improvements to the AMP to achieve that desired state. Processes around the AMP are well defined and are completed annually. Appropriate maintenance protocols will be implemented. Projects and activities to acquire, dispose, repair and renew assets will be planned and executed.
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 performed as part of 'business as usual,' and those activities specific to improving the AMS. TAM activities are the subset of these activities targeting specific TAM elements.
8. IDENTIFICATION OF RESOURCES	
What resources are needed to execute TAM plan activities?	Personnel from across the agency are involved in asset management activities, including GM/CEO, the Leadership Team, the Asset Management Division (AMD), and Operations, Capital Programs, Finance, Administration, Communications, Planning, and General Counsel departments. The AMD's in-house expertise enables the agency to employ robust asset management practices. A shift in emphasis from ISO 55000 certification to more fundamental AMS improvements has somewhat changed the structure of the AMD.
9. EVALUATION PLAN	
What is the Agency doing to ensure that the TAM plan delivers the intended results?	The current TAM plan provides the baseline for evaluating the agency's future plans. RTD intends to regularly review its asset management maturity, setting maturity targets in its Strategic Asset Management Plan (SAMP). RTD intends to evaluate the degree to which it is meeting the requirements of TAM and the agency's strategic needs through the following measures: • Measures identified in the Strategic Plan • Assessments of adherence to the AMP process • Regular AIM assessments and associated AIM improvement plans

Table 1: Summary of TAM Required Elements

1 Introduction

1.1 Background

On June 29, 2012, Congress passed the MAP-21 act. In accordance with section 20019 of this law, the FTA established mandatory standards for all transit providers. The final implemented regulation was published in the Federal Register on July 26, 2016, with an effective date of October 1, 2016 (Transit Asset Management; National Transit Database, 2016). As illustrated in Table 2, RTD is a Tier I Agency, meaning all TAM requirements apply to the agency.

The FTA requirements for a TAM Plan are as follows:

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, which 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 FTA, the Denver Regional Council of Governments (DRCOG), and the Colorado Department of Transportation (CDOT).

This document also serves as staff's commitment to continue to improve. The annual update cycle of this document will serve to apprise functional teams across the agency regarding the state of its 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 the transit system built to serve them.

1.3 Document Purpose

RTD's TAM Plan is a report that meets the FTA TAM requirements under MAP-21. The TAM Plan:

- Is targeted to meet RTD's strategic objectives and highlights the principles by which RTD will manage its assets in accordance with its mission of making lives better through connections
- Describes RTD's asset management practices and sets out a clear plan for enhancing these practices over the plan horizon
- Represents the agency's current state of asset management practice and outlines intention for future development

1.4 Document Structure

This TAM Plan has been structured to comply with the FTA TAM requirements outlined in Table 2.

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 2024-2030 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.

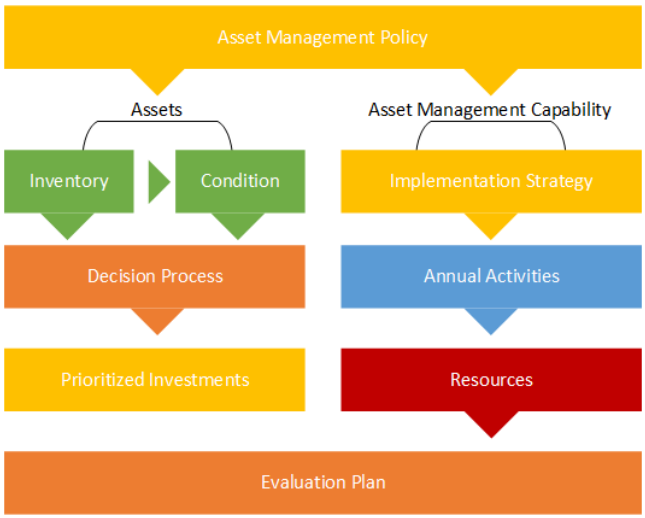


Figure 1: RTD TAM Plan Structure

Key definitions are included in the glossary in Appendix A.

1.5 Scope

This TAM Plan covers the period 2024-2030 and will be updated as needed. The assets in scope for this version are detailed below. The agency AMP covers 2024-2030 to coincide with the agency Five-Year Financial Forecast (FYFF) that is used for budgetary and other fiscal purposes.

Revenue Vehicles	Equipment	Facilities	Commuter and Light Rail Infrastructure
•Bus fleet •Light rail vehicles •Commuter rail vehicles •Paratransit fleet	•Automobiles •Truck and other rubber tire vehicles •Steel wheeled vehicles •Non-vehicle equipment	•Administrative •Maintenance •Public •Conveyances	•Track •Bridges •Grade crossings •Switches •Overhead catenary wire •Signaling •Substations

Figure 2: Assets in Scope for this TAM Plan

1.6 Alignment

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

This TAM Plan aligns with:

- **FTA TAM requirements** – the content of the TAM Plan complies with the nine FTA TAM required elements

- **2021-2026 RTD Strategic Plan and 2024-2025 Strategic Initiatives**– the content of the TAM Plan reflects the agency's mission, vision, values, and strategic priorities. The Strategic Plan also contains specific tactics regarding asset management, including the development and maintenance of a healthy, and continuously improving, AMS and the development of and adherence to the AMP (Regional Transportation District, 2024)
- **RTD Five-Year Financial Forecast (FYFF)** – the list of prioritized projects is the Asset Management Plan (AMP) provided in this TAM Plan which is an input into the development of the FYFF, as part of RTD's investment planning process (Regional Transportation District, 2022)
- **RTD Asset Management Plan (AMP)** – the AMP is both a process and a product that results in a prioritized set of needs used to meet agency strategic and financial planning objectives. Needs are derived from data in systems of records which are vetted and prioritized by asset stewards across the agency
- **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, Five-Year Financial Forecast[2], and departmental records utilized for the integration of information

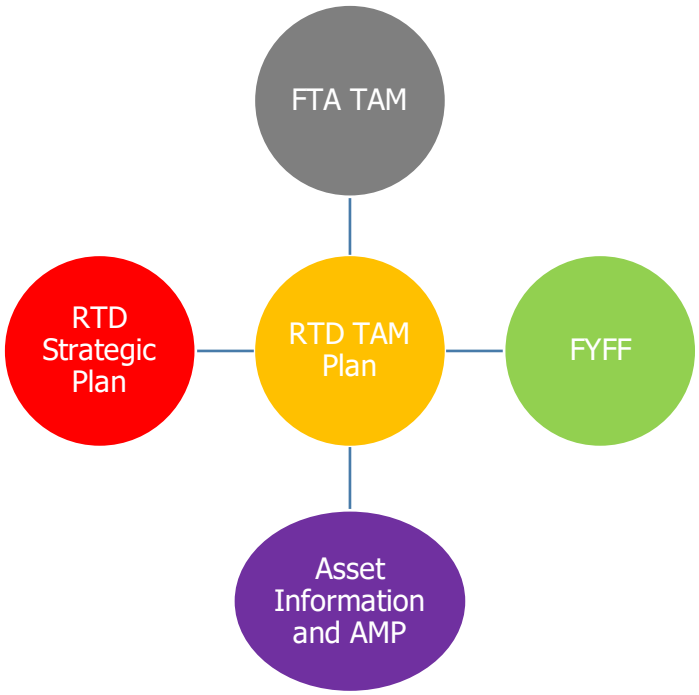


Figure 3: RTD TAM Plan Alignment

[1] Asset data retrieved from Trapeze EAM and Enterprise Data Warehouse November, 2024.
[2] Last approved by Finance, Administration, and Audit Committee in 2023.

1.7 Asset Management Policy

An Asset Management (AM) 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 August 11, 2022. The policy describes a forward-looking commitment to good asset management practice, intended to pursue investment optimization across the entire asset portfolio to maximize its value. Asset management performed according to this policy will result in assets that are in a state of good repair.

The latest version of the Asset Management Policy is included on pages 16 and 17 of this document. This document is included as evidence of compliance with TAM requirement five (5), and is the documented executive-level expectations for asset management in the agency.

Asset Management Policy

We make lives better through connections.

Policy Name:	**Asset Management Policy**				
Policy #:	**RTD-AMD-PLY-0001**	**Date Issued:**	**2022/08/11**	**Current Version:**	**D**
General Manager and CEO Approval:					
Chief Financial Officer Approval:					
Responsible Department:	**Finance**				

1. POLICY STATEMENT

To improve how RTD manages assets and represents a vision and shared commitment for good Asset Management.

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 the vision "to be the trusted leader in mobility delivering excellence and value to our customers and community".

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

3. POLICY

Mature Asset Management helps RTD fulfil its service level agreement with the region's transit assets to provide public transportation services that:

- provide value to customers as well as to the broader Denver metro region while sustaining planet Earth
- deliver high-quality, customer service
- encourage employee ownership
- contribute to financial success

The Leadership Team is committed :

- understanding what's critical to meet strategic priorities and achieving success with outcomes
- optimizing of limited resources to meet strategic priorities
- being transparent about the tradeoffs between risk, cost and performance inherent in all decisions
- using clearly defined agency strategies, objectives, operational plans, and processes

The Leadership Team implements these principles by:

- having a "big picture" perspective on priorities across the organization
- considering the whole life cycle costs and value of assets
- determining the root causes of the problems to be faced
- utilizing a uniform method of evaluating risk
- including appropriate staff 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

REVISION BLOCK

Draft prepared by:			
Name	Signature	Position	Date
Charles Austin		Manager, Business Analysis	08/11/2022
Description of Revision(s): Revised to incorporate the RTD Strategic Plan 2021-2026			
Reviewed by: L. Cripps			
Information Governance and Management Division Acceptance:			
Version: D		Date issued:	

2 RTD and its Assets

The Regional Transportation District provides transportation services to over 3 million people located within its 2,345 square mile service area, such services include bus, rail, paratransit services, demand-responsive micro-transit services, and special event services. Though operating a reduced schedule, RTD used these assets to provide over 48 million revenue miles across all modes in 2023.

2.1 The RTD Story

BUS

The Colorado General Assembly created RTD in 1969. Efforts in early years focused on regional transportation planning. In 1973, voters approved a 0.6% 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 several counties throughout the metro area. By 1976, ridership had grown to 35 million boardings annually.

RAIL

RTD celebrated its first light rail opening in October 1994. With a fleet of only 11 light rail vehicles, the 5.3-mile line attracted hundreds of thousands of customers when it began operations. Now, eight light rail lines service 57 stations along seven individually constructed corridors.

In November 2004, voters approved the FasTracks ballot measure for the region-wide expansion of transit service. The 0.4% sales and use tax continues to fund the FasTracks program, which has grown to include 122 miles of new commuter rail and light rail, 18 miles of bus rapid transit corridor, and numerous rail and bus stations. The program consists of six new rapid transit corridors and three existing corridor extensions.

2.2 Service Area

The agency's service area is composed of eight counties including all of Boulder, Broomfield, Denver and Jefferson counties, large areas of Adams, Arapahoe and Douglas counties, and a small portion of Weld County.

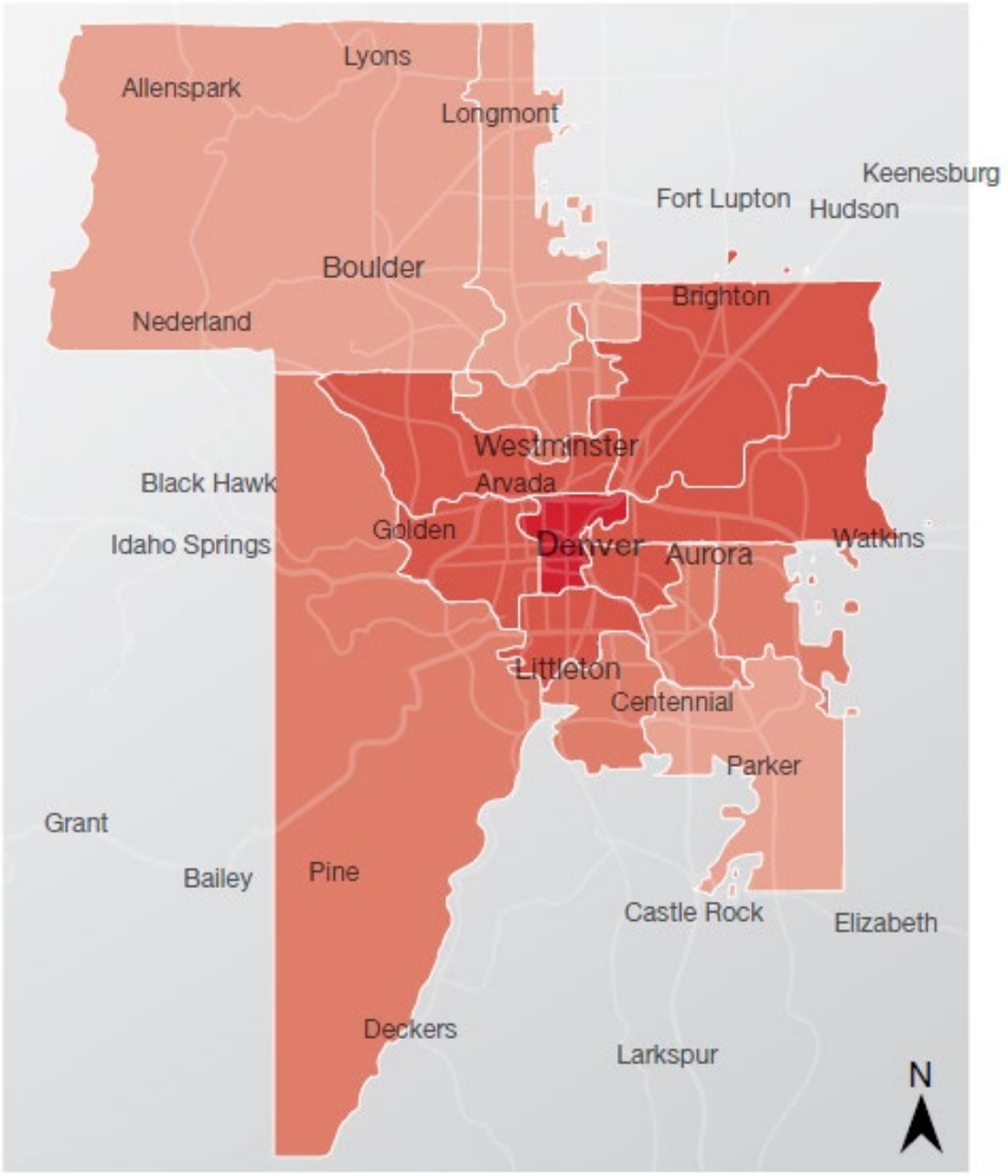


Figure 4: RTD District Map

In 2000, RTD provided approximately 77 million passenger trips. (U.S. Department of Transportation, 2000) By 2019, passenger trips grew to 105 million, a 30% increase in boardings. Over the same period, per the Colorado State Demographer's Office, the Denver/Boulder region increased from approximately 2.4 million residents to approximately 3.2 million residents, a 31% increase (2019). Unsurprisingly, due in large part to the COVID-19 pandemic the agency experienced a severe decline in ridership in 2020, resulting in

approximately 52 million boardings for the year. (U.S. DOT, 2021) In 2023, the agency reported approximately 65 million passenger boardings in a National Transit Database (NTD) submission. While ridership is recovering, it is unclear when utilization of RTD's assets by customers will return to pre-pandemic levels.

2.3 RTD Assets

RTD is an asset-intensive organization. RTD's Statement of Net Position notes that capital assets total nearly $9.4 billion, excluding accumulated depreciation, of which most is within the scope of TAM as detailed in this section. (Regional Transportation District, 2023)

As assets are operated, their condition degrades over time, and their risk of failure increases. Failures, including those having an impact on safety, can manifest in a variety of ways. Asset condition is therefore a leading indicator for safety risks, and 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 understand their assets' deterioration rates can also make more informed decisions on renewal frequencies and their approach to preventive maintenance. RTD's commitment to improve AIM to support decision-making is expected to include data on the frequency and severity of potential failures of assets and the components of systems that comprise them in accordance with the Operational Risk Framework (ORF). Utilizing the ORF aligns the Asset Management System and Safety Management Systems.

For the purposes of this TAM Plan, RTD has categorized its assets in accordance with FTA guidelines: revenue vehicles, equipment, facilities, and infrastructure, using the flowchart depicted in Figure 5 below, adherence to which ensures repeatable results and an improvement in inventory data quality.

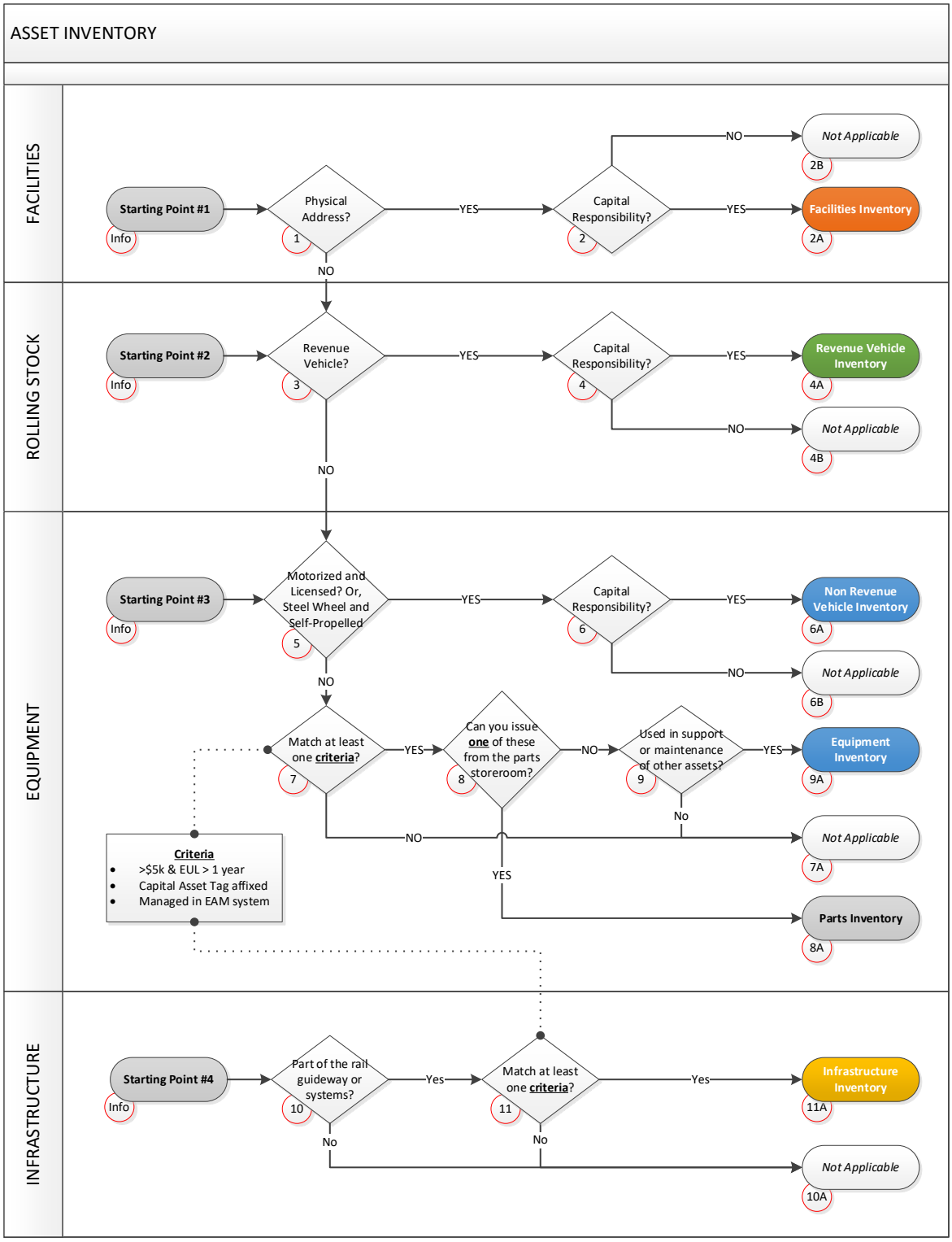


Figure 5: Inventory Classification Process

2.3.1 Revenue Vehicles

RTD's revenue vehicle fleet is composed of 1,307 buses, 201 light rail vehicles and 66 commuter rail vehicles. The operation and maintenance of bus vehicles is shared between the agency and third-party contractors. The light rail vehicle fleet is exclusively operated and maintained by the agency. The operation of 66 commuter rail vehicles is shared between RTD and a third-party, Denver Transit Operators (DTO), and all maintenance activities on the commuter rail vehicles are performed by DTO.

Transit vehicles in the agency's rubber tire fleet include:

- Standard 40' fixed-route transit buses with a seated capacity of approximately 40 passengers, including battery electric bus (BEB) assets
- Fixed-route articulated buses with 33% greater capacity than standard buses
- Regional intercity coaches, such as those used for Flatiron Flyer service, built for longer trips at highway speed, which are typically 45 feet long and have a seated capacity of 55 passengers
- Cutaways which are made by second stage manufacturers, using the chassis of full-size vans, used to provide on-demand service for eligible customers with disabilities (Access-a-Ride) and in areas where ridership does not support fixed route service (FlexRide)

In service RTD buses have been 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[3] to an external partner company, TransDev. All intercity coaches are operated and maintained by RTD. All cutaway buses are operated and maintained by third parties (Via Transportation, MV Transportation and Evergreen Senior Center).

Figure 6: Transit Bus (Gillig)

Figure 7: Articulated Bus (New Flyer)

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

Figure 8: Intercity Coach (MCI)

Figure 9: Cutaway Bus (StarTrans)

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

Figure 10: Light Rail Vehicle (Siemens SD-160)

The Hyundai Rotem commuter rail vehicles are operated by both RTD on the N Line and a contractor on the A, B, and G lines, while their ongoing maintenance is outsourced to DTO. RTD will assume responsibility at the end of the contracted period of performance of 30 years. Condition assessments will not be performed on these assets until such time as RTD assumes additional maintenance responsibility for the 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 and repair maintenance program, and then replaced. This approach is adopted for revenue vehicles maintained by third parties, including buses and commuter rail vehicles.

Table 3 below presents the total number of revenue vehicles for which RTD has capital responsibility, 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 expected 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 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. (U.S. Department of Transportation, 2016). The percentage of vehicles in backlog within each type is also presented. Table 3 also presents the total initial capital cost[4] of the vehicles in each sub-fleet. In the AMP, and certain budgeting and financial tools, costs other than the total initial capital cost are used, such as the expected replacement value in the plan year.

RTD's bus fleet has been a focus of renewals, there are no active fixed route buses in backlog. RTD does maintain a contingency fleet that is in backlog but is not typically used in revenue service—these are primarily used for training. Few cutaway vehicles are presently operated in backlog but are expected to be replaced in 2025. In the future, based on a combination of timing, funding availability and subject matter expert judgements, some transit buses may be operated in backlog.

Regarding the ULB for LRVs, RTD performed an evaluation of the useful life of the vehicles. Previously RTD had planned on using the LRVs to a 40-year life, but upon further analysis the agency will revert to a 31-year ULB, consistent with FTA guidance. Performance of the LRVs

[4] In the future, RTD intends to determine the WLC (e.g., capital expense and operating expense) of its assets and this will be considered for inclusion in a subsequent generation of the TAMP.

has declined while parts obsolescence has affected parts costs and availability. RTD plans on retiring the oldest eleven 1993 model year SD-100 LRVs in the coming year, which will not affect the agency's ability to deliver service.

Revenue Vehicle Type	Count	ULB	Average Age Score	% in Backlog	Original Cost
Transit Buses	671	14	3.8	0.0%	$313.2m
Articulated Buses	116	14	3.3	0.0%	$76.6m
Intercity Buses	168	14	3.5	0.0%	$96.3
Cutaway Buses	352	10	3.4	5.4%	$23.2m
Commuter Rail Vehicles	66	39	4.4	0.0%	$300.8m
Light Rail Vehicles	201	31	3.6	5.5%	$556.4m

Table 3: Revenue Vehicle Inventory, Condition and Backlog

2.3.2 Equipment

Significant improvements in equipment asset information have been made since the last iteration of the TAM plan. The TAM Systems guidance was helpful in improving the agency's understanding of current and future expectations of equipment information in the TAM framework. (U.S.DOT, 2020) While the present TAM requirements indicate equipment inventories must contain assets that cost $50,000 or more, RTD's Accounting division defines an asset as an asset of $5,000 or more with at least a one-year useful life. Capital asset tags are assigned to equipment assets noted as being an asset in the Fixed Financial Assets (FFA) register managed by Accounting. Additionally, assets in the equipment class have importance significant enough to be managed in Trapeze Enterprise Asset Management (EAM) system. Assets managed in this way are deemed to have special importance to continued service delivery. At least one of the three criteria above must be met in order for equipment to be considered an asset in the AMP. Presented in this plan are those assets included in the AMP and which need to be described in sections three and four of the TAM requirements. Were the agency to only report on the decision tools and the prioritized list of investments with the $50,000 threshold, the explanation of what has and will occur would be incomplete. Given a desire to ensure alignment of agency activities, and to provide transparency in agency processes, the equipment inventory information presented in this TAM Plan is guided by the requirements for the AMP, which staff believes to exceed the requirements outlined in the TAM regulations.

Equipment information will continue to include non-revenue vehicles in a manner conforming to the three NTD categories, which are automobiles, truck and other rubber tire vehicles, and steel wheel vehicles. Asset information for non-revenue vehicles has been more mature than for other equipment assets, so no change in how the non-revenue vehicle assets has occurred for this iteration of TAM reporting. These assets have long been included in the AMP process.

The inventory of non-revenue vehicle equipment is found in Table 4. This provides detail on the 45 automobiles, five steel wheel non-revenue vehicles, and 380 rubber tire non-revenue

vehicles in this equipment group. Additional information includes the initial capital cost of the assets along with the useful life benchmark (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 new. An asset that has reached the end of its ULB 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 ULB is scored at 2.5, and from that point onwards is considered in backlog (U.S. Department of Transportation, 2016).

Figure 12: RTD Automobile

Figure 13: RTD Bucket Truck

Figure 14: RTD Truck

Figure 15: RTD Utility Truck

RTD has historically managed its non-revenue vehicle 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 repair, and then replaced.[5] As such, condition scores for non-revenue vehicle equipment are age-based. However, the agency has departed from planning for age-based renewals of assets in this category while an examination of the utilization and utility of these assets is underway. Until such time as a new means for evaluating the utilization and performance of assets in this class, and particularly vehicles used primarily for administrative purposes, it is the expectation that few renewals will take place within this class of equipment and vehicles will be knowingly operated in backlog.

[5] Some non-revenue vehicles adopt an ad-hoc approach in which they are replaced after a combination of factors.

Equipment Type: Non-revenue Vehicles	Count	ULB	Average Age Score	% in Backlog	Original Cost
Automobile	45	8	1.7	88.9%	$ 0.8m
Steel Wheel	5	25	4.2	0.0%	$ 2.6m
Truck and Other Rubber Tire	380	14	3.2	24.2%	$ 20.2m

Table 4: Non-revenue Vehicles Equipment Inventory, Condition and Backlog

Non-vehicle equipment is purchased from a variety of manufacturers and is owned, operated and maintained by RTD. Non-vehicle equipment consists of various types of machinery used indirectly in the provision of public transportation services. There is a broad range of assets reflected in Table 5, from in-plant equipment, to parts management equipment, to landscaping equipment. A more detailed equipment asset inventory can also be found in Appendix G. Non-vehicle equipment information gathering exercises are expected to continue uncovering assets for inclusion into the AMP and TAM Plan within the four-year horizon of this plan.

In order to improve the AMP, the AMD worked closely with asset stewards across the agency to conduct physical inventories of equipment assets. This is viewed as a step forward in improving information maturity for assets in this class, expanding both the number of items included and the quality of the information therein. It is expected that this effort will facilitate improved management of equipment assets in the future. In addition, RTD will be able to share more information on equipment assets with its planning partners in the TAM Plan.

Non-vehicle equipment represents a wide variety of assets and are not yet managed in a uniform way. While the efforts to improve inventory have yielded results, additional information on non-vehicle equipment assets will need to be matured to develop an effective management strategy by equipment type. Additional information on ULBs and/or EULs will also need to be developed to ensure the accuracy of equipment lifespan estimates collected from third-party resources to ensure that RTD is using the equipment in a manner similar to those used in establishing the ULB. Strategies other than age-based approaches will require additional maturity, such as collecting and utilizing data on engine hours in replacement planning. Within the period of this plan, it is expected that the inventory will further increase and that an age-based approach to management will be the most common method employed for asset replacement.

Equipment Type: Non-vehicle	Count	EUL	Average Age Score[6]	% in Backlog[7]	Estimated Value[8]
Various Equipment	3	10	3.1	33.33%	$30,542
Various Equipment	16	12	2.1	68.75%	$312,947
Various Equipment	270	15	2.9	46.30%	$7,568,785
Various Equipment	7	20	1.6	71.43%	$87,228
Various Equipment	14	25	2.7	28.57%	$723,435
Various Equipment	13	30	2.5	53.85%	$386,737
Various Equipment	10	35	2.5	0.00%	$583,309
Various Equipment	14	40	2.8	0.00%	$241,552
Various Equipment	1	45	2.6	0.00%	$12,543
Various Equipment	1	75	2.7	0.00%	$6,682

Table 5: Non-vehicle Equipment Inventory, Condition and Backlog

2.3.3 Facilities

For the purposes of this TAM Plan, RTD owns:

- Five administration facilities where RTD administration functions occur
- Nine maintenance facilities where maintenance work occur
- 118 public facilities, which includes stations, buildings and other structures where customers can board or alight from an RTD transit vehicle
- 114 conveyances such as elevators and escalators, installed within facilities (these are treated here separately based on NTD reporting requirements)

Administration, maintenance, and public facilities for which RTD has capital responsibility are operated and maintained by RTD, although some services, such as cleaning and snow removal, may be contracted to third parties. Conveyance manufacturers include Kone and ThyssenKrupp, and conveyance maintenance is outsourced to third parties.

Figure 16: Bus Maintenance Facility

[6] Estimated value based on a combination of estimated replacement cost and original cost. Further refinement is expected.

[7] Lack of some in-service dates results in inaccuracy in average age estimate.

[8] Lack of in-service date results in inaccuracy in estimated backlog percentage

RTD has historically managed components of its facilities and their related equipment on an ad-hoc basis where maintenance or renewal activities take place based on maintenance staff evaluations that equipment is nearing the end of its useful life or when failures have occurred. The more critical facility elements, such as underground storage tanks, can have redundancy built in to minimize service interruptions when they fail to perform as designed.

Since 2015, RTD has performed in-house assessments to determine the condition score of individual elements of each facility for which RTD has capital responsibility. As such, facility condition scores are assessment-based. This is based on the Transit Economic Requirements Model (TERM) scale and is utilized for both TAM and NTD reporting.

Figure 17: Light Rail Maintenance Facility

Figure 18: 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 existing 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.

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

Table 6: Facility Elements Assigned Individual Condition Score

The public facilities condition score represents the average of the attributes in Table 6, such that existing elements have an equal contribution to the average condition score. (Regional Transportation District, 2017).

Figure 19: Conveyance (elevator)

Conveyance inspections are outsourced to third parties in accordance with applicable legislation and regulations but are not used to determine condition. These assets are managed consistent with regulatory standards, parts obsolescence, and resolving operational issues. Both preventive and reactive maintenance activities are performed by third parties, and the activities delivered under these contractual agreements are monitored by RTD staff to ensure contract adherence and acceptable performance of the assets.

Table 6 presents the total number of facility assets for which RTD has capital responsibility, along with their EUL 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).

Table 6 also presents the total initial capital cost for each asset type.

Facility Type	Count	EUL	Average Physical Condition Score	% in Backlog	Original Cost
Administration Facility	5				
Blake	-	50	3.8	-	$11.7m
Navajo	-	50	3.5	-	$0.5m
Security Command Center	-	50	3.8	-	$0.8m
Treasury	-	50	3.2	-	$1.9m
711	-	50	4.8	-	$9.0m
Maintenance Facility	9				
Boulder	-	50	3.7	-	$19.6m
District Shops	-	50	3.3	-	$39.4m
East Metro	-	50	3.5	-	$6.1m
Elati	-	50	3.5	-	$59.0m
Mariposa	-	50	2.9	-	$14.9m
Peoria Rail Maintenance	-	50	4.6	-	$0.9m
Platte	-	50	3.3	-	$26.7m
Rio Court	-	50	3.5	-	$4.8m
Commuter Rail Maintenance Facility	-	50	4.2	-	$60.6m
Public Facility	118	-	3.8	6.0%	$1033.4m

Table 6: Facility Inventory, Condition and Backlog

Table 7 presents the total number of conveyances for which RTD has capital responsibility.

Conveyance	Count
Conveyance – Directly Operated	99

Table 7: Conveyance Inventory, Condition and Backlog

Table 8 presents an inventory of third-party conveyance and facility assets.

Third-Party Asset Inventory	
Asset Type	Count
Conveyance	14
Public Facility (included in Public Facility total above)	14
Maintenance Facility (included in Maintenance Facility total above)	1

Table 8: Third-Party Conveyance and Public Facilities Inventory

2.3.4 Infrastructure

RTD's rail infrastructure can most easily be addressed in three parts: directly operated light rail, third party operated commuter rail, and directly operated commuter rail.

RTD owned rail infrastructure includes grade crossings, catenary wire segments, track, relay cases, switches, and substations; as well as light rail and commuter rail vehicle bridges, and commuter rail alignments operated and maintained by a third party.

Figure 20: Light Rail Vehicle Bridge

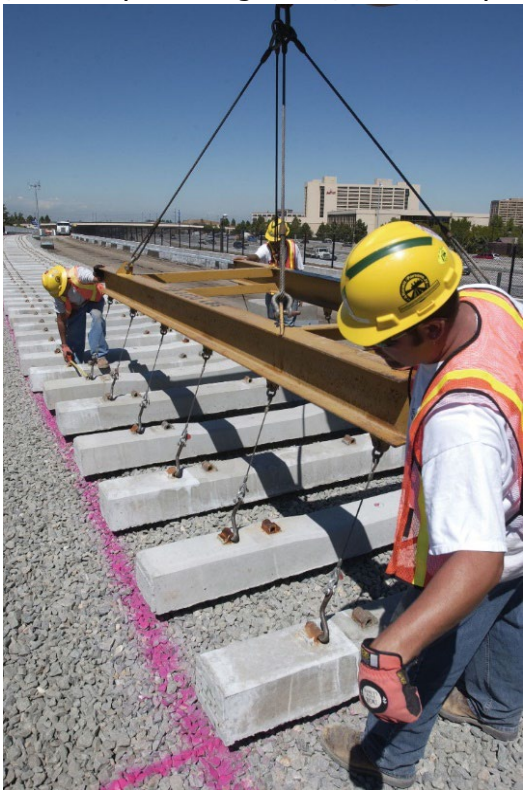


Figure 21: Track Infrastructure

Light rail infrastructure is purchased from and constructed by a variety of manufacturers and is owned, operated, and maintained by RTD. As described in the executive summary of this document, RTD encountered issues with how the light rail infrastructure had historically been managed and as a result has created a new strategy for managing these assets. The new "Age-Minus" method takes into account asset age and condition in concert to inform maintenance and renewal decisions concerning track assets. While age and condition are strongly related, the combination has already been shown to improve insight into asset condition. Both track asset age and assessed condition are reflected in Table 11. In a similar fashion, RTD has near-term plans for improving other light rail infrastructure information, again using the method described in the executive summary.

Seventy-seven light rail vehicle bridges are owned and maintained by RTD. Seven roadway bridges above the light rail are inspected by RTD and owned and maintained by the Colorado Department of Transportation. Light rail vehicle bridges are inspected once every two years by an independent third-party contractor per state law. Defects noted in inspections are then addressed through a combination of in-house and contracted resources, as determined by RTD staff. Though inspection data is obtained from the third-party the inspection methodology does not conform to the TERM scale. Condition assessments for bridges owned

and maintained by third parties are not recorded in the TAM Plan. As a result, the agency relies on age-based scores to communicate the condition of assets to planning partners.

All commuter rail infrastructure was delivered under the FasTracks program. The operation of the A, B, and G lines, as well as all commuter rail electrical power substations is outsourced to DTO. RTD will assume ownership for these commuter rail infrastructure assets at the end of the contracted period of performance (30 years from inception). Condition assessments will not be performed on these assets until such time as RTD assumes capital responsibility. In 2020, RTD opened a directly operated commuter rail line, the N Line. This directly operated commuter rail infrastructure added to the diversity of RTD's rail assets and is noted separately from light rail assets and in more detail than the third-party controlled assets in the inventory.

Table 10 presents the total number of light rail infrastructure assets for which RTD has capital responsibility, along with their EUL and age-based condition, and backlog scores.

Table 11 displays Light Rail Track Miles by type. It is a significant change from previous TAM Plan iterations reflecting the improvements to this asset class's management strategy and condition inspection methodology. While historically only age-based condition estimates were provided, inspected condition is now also available. The table shows improved inventory granularity. The interaction of significant track types reflects differences in cost and useful life that result from differences in track design. The data are presented in groups reflecting the track design aspects utilized in NTD reporting. Though age and inspected condition are highly related, the improved depth of information significantly augments decision-making capabilities.

Table 12 presents the total number of light rail and directly operated commuter rail vehicle bridges for which RTD has capital responsibility, along with their EUL and age-based condition scores.

Table 13A represents the number, EUL, and age-based score for key directly operated commuter rail assets.

Table 13B represents the original directly operated commuter rail assets as reflected in the Fixed Financial Assets records.

Table 14 represents the directly operated commuter rail track by type, noting the differences in EUL between the types and relevant age-based scores.

Tables 15 and 16 represent the FTA performance measure for infrastructure which is the percentage of guideway directional route miles (DRM) with performance restrictions by light rail and commuter rail by class, respectively.

Changes to the light rail track mileage under performance restriction are reflected in Table 15. Significant portions of light rail track were under performance restriction in 2024. The increase in performance restrictions reflect the closure of an approximately 4.4 mile section

of track for renewal activities; restrictions for routine maintenance activities including inspections; and, most notably, large portions of alignments that have been performance restricted as a result of condition inspections.

Tables 11 and 13 also present the total initial capital cost for each light rail asset type. Table 12 notes the estimated replacement cost of the track assets, as estimated by the Engineering division of the Capital Programs Department.

As previously stated, RTD's first directly operated commuter rail line, the N Line, opened in 2020. The asset information for this line does not reside in a single system of record. Work has been performed to improve the inventory quality, but there are incongruences between different information resources. The costs are commensurate with the level of the capital program, which are not easily broken down to the level of the asset counts by type. To present the best currently available estimates, directly operated commuter rail assets are presented separately in tables 14A and 14B. While the information presented in this plan is believed to be accurate, further refinements are expected to support improvements to the AMP for these assets.

Light Rail Infrastructure Type	Count	EUL	Average Age Score	% in Backlog	Original Cost
Grade Crossings	45	15	2.9	20.0%	$3.9m
Relay Cases	223	50[9]	4.2	0.0%	$65.2m[10]
Switches	247	25	3.1	16.2%	$3.9m
Signal	316	25	3.4	10.4%	$285.4m
Substations	64	25	3.4	10.9%	$34.3m
Catenary Wire Segments	77	25[11]	3.2	15.6%	$35.1m

Table 10: Light Rail Infrastructure Assets Inventory, Condition, and Backlog

Light Rail Track Miles by Type	# Track Miles	EUL	Average Age Score	Average Condition Score	% in Backlog	2024 Replacement Cost
Tangent Track: At Grade/In-Street/Embedded	5.9	25	3.6	3.9	47.1%	$130.5m
Tangent Track: At Grade/Ballasted	46.4	30	3.8	3.5	0.0%	$513.8m
Tangent Track: Below-grade/Cut-and-Covert Tunnel	0.1	30	4.0	4.0	0.0%	$1.2m

[9] In June 2020, the EUL for relay cases was adjusted from 25 years to 50 years after consultation with light rail maintenance of way.
[10] 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.
[11] In June 2020, the EUL for catenary wire was adjusted from 20 years to 25 years after consultation with light rail maintenance of way.

Tangent Track: Below-Grade/Retained Cut	5.4	30	4.0	3.7	0.0%	$59.2m
Tangent Track: Elevated/Concrete	4.0	30	3.8	3.6	0.0%	$44.8m
Tangent Track: Elevated/Retained Fill	9.9	30	3.9	3.7	0.0%	$109.1m
Tangent Track: Elevated/Steel Viaduct or Bridge	0.4	30	3.5	3.6	0.0%	$4.2m
Tangent Track: At-Grade/In-Street/Embedded: Street Crossing	1.4	15	3.5	4.0	3.0%	$39.2m
Curved Track: At-Grade/Ballasted	25.1	25	3.5	3.4	5.9%	$276.4m
Curved Track: At-Grade/In-Street/Embedded	1.2	25	3.3	3.9	39.5%	$27.2m
Curved Track: Below-Grade/Cut-and-Covert Tunnel	0.6	25	3.1	4.0	0.0%	$6.7m
Curved Track: Below-Grade/Retained Cut	5.4	25	3.3	3.8	0.0%	$59.2m
Curved Track: Elevated/Concrete	3.8	25	3.4	3.7	5.3%	$43.1m
Curved Track: Elevated/Retained Fill	7.5	25	3.4	3.6	5.3%	$82.6m
Curved Track: Elevated/Steel Viaduct or Bridge	0.4	25	3.7	4.0	0.0%	$3.9m
Curved Track: At-Grade/In-Street/Embedded: Street Crossing	0.6	15	3.1	3.6	12.0%	$14.3m

Table 11: LRT Track Miles Inventory, Condition and Backlog

Rail Bridges	Count	EUL	Average Physical Condition Score	% in Backlog	Original Cost
Light Rail Vehicle Bridges	76	80	3.8	1.4%	$190.3m
Directly Operated Commuter Rail Bridges	10	50	4.6	0.0%	-

Table 12: Rail Vehicle Inventory, Condition and Backlog

Directly Operated Commuter Rail Infrastructure Type	Count	EUL	Average Age Score	% in Backlog
Grade Crossings	13	15	4.3	0.0%
Relay Cases	9	50	4.8	0.0%

Switches	14	20	4.5	0.0%
Communications House	6	20	4.5	0.0%
Catenary Wire Segments	41	20	4.5	0.0%

Table 13A: Rail Infrastructure Assets Inventory, Condition, and Backlog

Commuter Rail Infrastructure Type Cost	Original Cost
Bridges and Guideway	$215.2m
Signal	$89.5m
Track	$52.8m
Catenary Wire Segments	$49.3m
Grade Crossings	$1.0m
Relay Cases	$0.03m
Switches	$0.02m

Table 13B: Rail Infrastructure Assets Original Cost

Directly Operated Commuter Rail Track Miles by Type	# Track Miles	EUL	Average Age Score	% in Backlog
Tangent Track	11.1	30	4.7	0.0%
Curved Track	6.3	25	4.6	0.0%

Table 14: LRT Track Miles Inventory, Condition and Backlog

Light Rail Guideway Under Performance Restriction	2021[12] by Track Miles	2022 by Track Miles	2023 by Track Miles	2024 by Track Miles	2024 % of Guideway Track Miles
January	6.4	1.0	0.0	3.5	3.0%
February	0.4	0.0	0.0	8.9	7.6%
March	1.7	2.7	0.0	8.7	7.3%
April	0.0	12.6	1.6	8.7	7.4%
May	12.5	0.0	2.0	8.5	7.2%
June	1.9	0.0	1.6	17.9	15.1%
July	11.8	2.7	8.5	18.8	16.0%
August	0.4	5.1	2.4	27.7	23.4%
September	11.0	0.0	5.9	23.5	19.9%
October	1.0	0.0	1.6	19.5	16.5%
November	10.5	0.2	4.9	Not available	-
December	1.1	0.2	2.8	Not available	-

Table 15: Light Rail Guideway Performance Restriction by Track Mile

[12] In August 2020, all light rail track was remeasured and the DRM for each track segment as well as the total DRM was updated accordingly (Regional Transportation District, 2020). The performance restrictions for years prior to 2020 are presented using the metrics that were in place during those periods.

Commuter Rail Guideway Under Performance Restriction	2021 by Track Mile	2022 by Track Mile	2023 by Track Mile	2024 by Track Mile	2024 % of Guideway Track Miles
January	2.4	1.0	1.0	0.9	1.1%
February	2.6	0.9	1.0	0.9	1.1%
March	2.7	1.0	1.0	0.9	1.1%
April	2.6	1.0	1.0	0.9	1.1%
May	0.4	1.0	1.0	0.9	1.1%
June	0.6	1.0	0.1	1.0	1.1%
July	0.6	1.0	0.1	1.0	1.1%
August	0.7	1.0	0.1	1.0	1.1%
September	1.0	1.0	1.2	1.2	1.4%
October	1.2	1.0	1.8	Not available	-
November	1.2	1.0	0.8	Not available	-
December	1.1	1.0	0.8	Not available	-

Table 16: Commuter Rail Guideway Performance Restriction by Track Mile

Table 17 presents an inventory of third-party infrastructure assets.

Third-Party Asset Inventory	
Infrastructure Type	Count
Commuter Rail Alignments	3
Light Rail Vehicle Bridges	7

Table 17: Third-Party Infrastructure Assets Inventory

3 Current Capital Investment Decision Process

On an annual basis, RTD will prepare and update a Five-Year Financial Forecast (FYFF) including projected capital construction and improvements, service levels and operating costs, and revenues to fund the capital and operating programs.

The FYFF also provides the basis for the agency'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 FYFF projects are included in the TIP.

The current renewal and replacement capital investment decision process begins with the agency AMP. The AMP is a process, as well as a product (Fig. 22) The AMP begins with information from systems of record, primarily Trapeze EAM and the Fixed Financial Assets list, but also includes ad-hoc resources such as manual inventories in spreadsheets. This collection of information is used to create an "Initial AMP" which is prepared for asset stewards. The asset stewards then assess the age-based information and apply their

judgement to determine whether to accept or modify the results of the initial AMP, this is known as the validated AMP. This stage is also where asset stewards augment information on "fact sheets" that are prepared by the AMD using the information from the system(s) of record with additional information which will assist other stewards in appropriately prioritizing the funding requests among other requests. The prioritized AMP has been the result of the annual evaluation of information from the validated AMP requests by a panel of asset stewards. The Asset Management Working Group (AMWG) has been convened where asset stewards use the information available to them in the validated AMP stage to prioritize requests. To better match the timing of the new FYFF which replaces the Mid-Term Financial Plan (MTFP) prioritization of capital investments will now be completed each spring. This change in timing is reflected in Figure 23.

The prioritization process has resulted in in the prioritized list of investments shown in Tables 20A through 20G. The prioritized AMP is then compared to available funding for asset renewals and replacements. Funded requests become part of the budget in the FYFF and the remainder of the renewal and replacement requests remain in the AMP process for consideration in future iterations of that process. The AMP process is illustrated in Figure 22 and the relationship of each AMP cycle to the FYFF is shown in Figure 23.

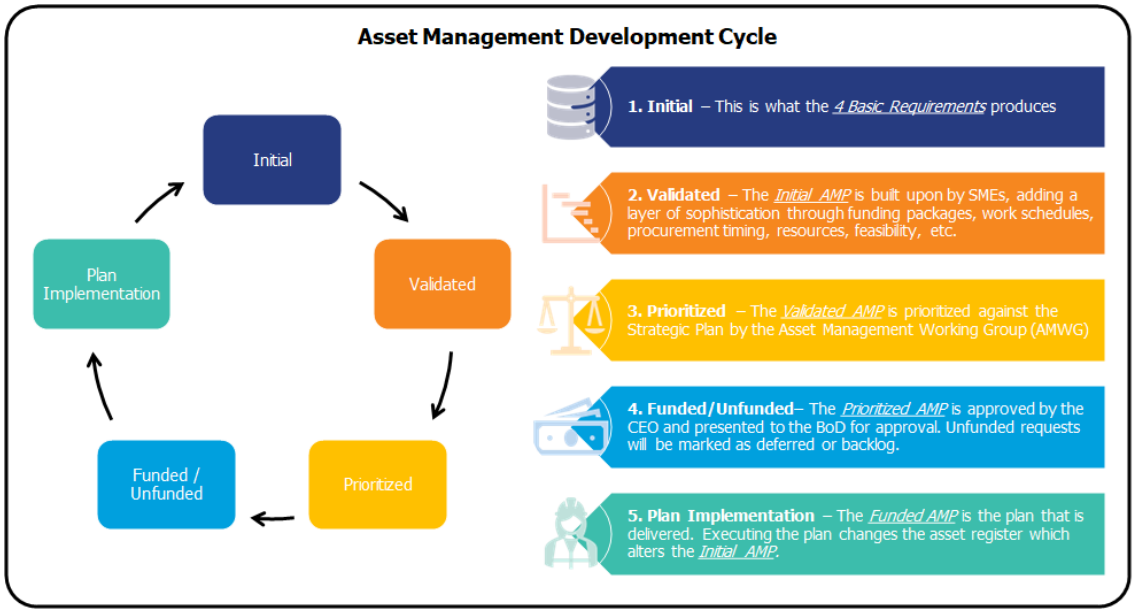


Figure 22: AMP Development Process

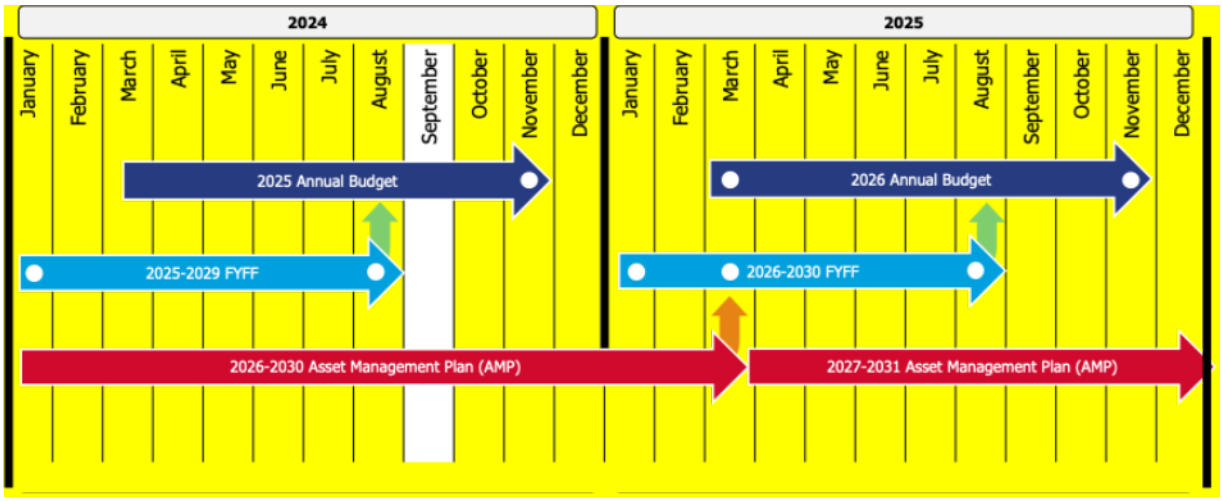


Figure 23: Connection between FYFF and AMP with milestones

Another aspect to the capital investment decision process is the AMP Bypass. The AMP Bypass is used to request and secure funds when the timing of the need does not allow for the prioritization of the request against others. There are two bypass types, each described below:

Type One

Type One requests are those that are the results of an unforeseen, uncontrollable, and unplanned circumstance. These requests are the heart of the bypass exception process, allowing RTD to move swiftly to repair, renew, or replace assets that have been affected by an outside event. Type One projects will complete steps one through four of the bypass exception process to allow for expedited action.

Examples of Type One events: Theft, weather event (flood, fire, tornado, etc.), collision/accident.

Type Two

Type Two projects are those repair, renewal, or replacement needs that have been identified as an immediate concern but cannot pass the test of being related to an unforeseen, uncontrollable, or unplanned event. These needs are often immediate only because advance planning was not completed due to a breakdown in an internal process or procedure. Projects that fall into this category will be required to complete steps one through five of the bypass exception process and will be subject to high levels of examination.

Example of Type Two events: asset failure due to increased age or deterioration from normal activities.

To be exhaustive in the description of the capital investment process, it must be noted that the Accountable Executive, RTD's General Manager and Chief Executive Officer, has the

authority to fund investments in addition to the AMP and AMP Bypass processes. An example of this is funding the renewal of track assets in Downtown Denver, some of the agency's oldest track assets, when the need became apparent in 2024. This $150 Million effort represents RTD's largest light rail track renewal effort which is slated to begin in 2025. While it is not anticipated that similar interventions will be needed for light rail track assets in the future, as a result of asset management system improvements for this class of assets, the pragmatic application of the Accountable Executive's authority was necessary in this instance. The asset management system includes the ability of the Accountable Executive to override other processes to ensure the success of the agency.

4 List of Prioritized Investments

The output of the current capital investment decision process is a list of prioritized capital projects. For 2024-2030, the requested renewal and replacement needs are shown in Tables 18A-18G. For ease of presentation, each year of prioritized investments is presented separately.

Reflecting the annual budget cycle, only items in the approved budget are truly funded, though funds are planned for asset renewals and replacements in the scope of this TAM Plan. As the agency's AMP is focused on the renewal and replacement of existing assets, only the prioritized renewal and replacement needs are reflected in the TAM Plan. Other investments such as those required to comply with laws, regulations, and legal judgements are considered obligatory and are addressed outside of the AMP prioritization process.

4.1 Prioritized AMP Investments by Year – 2024 through 2030

Prioritized investments in descending order of importance are shown by year.

Table 18A – 2024 Prioritized List of Investments

Investment Priority	Requesting Department	Title	Location	Project Costs
1	Intelligent Transport Systems	Digital Video Recorder Replacement	District-wide	$ 2,896,000
2	Light Rail Infrastructure	Grade Crossing Replacement - 13th & Osage	Central Rail Line	$ 1,400,000
3	Light Rail Vehicles	Wheel Lathe Replacement	Elati Light Rail Division	$ 1,835,700
4	Light Rail Infrastructure	Rail Replacements - Central Corridor - 14th & California	Central Rail Line	$ 600,000
5	Security	Server Replacements	District-wide	$ 285,000
6	Facilities	Roll Up Door Replacement	Elati Light Rail Division	$ 720,000

7	Facilities	Hoist Replacement	District Shops – Operations Center	$ 4,000,000
8	Light Rail Infrastructure	Diamond/Switch Replacement	Central Platte Valley (CPV) Rail Line	$ 1,200,000
9	Support Fleet	Support Service Vehicle Replacements	District-wide	$ 751,000
10	Public Facilities	Parking Structure Repair - Table Mesa	Park-n-Ride	$ 450,000
11	Light Rail Infrastructure	Grade Crossing Replacement - Walnut St	Central Platte Valley (CPV) Rail Line	$ 400,000
12	Light Rail Infrastructure	Grade Crossing Replacement - Kalamath St	Central Rail Line	$ 1,200,000
13	Treasury	Ticket Vending Machine	District-wide	$ 2,600,000
14	SCADA	SCADA Equipment	District-wide	$ 207,000
15	Support Fleet	Pool/Admin Vehicle Replacements	District-wide	$ 326,500
16	Public Facilities	Bridge Repair - PED Bridge - I25 & Arapahoe	Southeast Rail Line	$ 100,000
17	Public Facilities	Bridge Repair - PED Bridge - I25 & Dry Creek	Southeast Rail Line	$ 600,000
18	Support Fleet	Transit Police Vehicle Replacements	District-wide	$ 221,800
19	Treasury	Currency Counter Replacement	Platte Division	$ 50,000
20	Public Facilities	Parking Structure PM Program	District-wide	$ 1,997,500
21	Public Facilities	Bridge Repair - LRT Bridge - Broadway	Southeast Rail Line	$ 300,000
22	Bus	Transit Buses - 40 ft	District-wide	$ 6,943,300
23	Sign Shop	Equipment Replacement	District Shops – Operations Center	$ 54,400
24	Light Rail Infrastructure	Skid Steer Loader Replacement	Rio Court	$ 85,000
25	Public Facilities	Bridge Repair - LRT Bridge - Arapahoe	Southeast Rail Line	$ 320,000
26	Bus	Transit Buses - 30 ft	District-wide	$ 6,246,000
27	Public Facilities	Tactile Replacement	District-wide	$ 50,000
28	Bus	Access-a-Ride and FlexRide Cutaways	District-wide	$ 263,700
29	Facilities	Vehicle Wash Replacement	District Shops – Operations Center	$ 222,900
30	Public Facilities	High Block Replacement	District-wide	$ 650,000
31	Bus	Intercity MCI Buses	District-wide	$ 4,461,000

Table 18B – 2025 Prioritized List of Investments

Investment Priority	Requesting Department	Title	Location	Project Costs
1	Light Rail Infrastructure	Full-Depth Track Replacement	Downtown Loop Rail Line	$ 150,000,000
2	Support Fleet	Support Service	District-wide	$ 2,902,800
3	IT	Server	District-wide	$ 1,017,500
4	ITS	Printers	District-wide	$ 1,083,000
5	Public Facilities	Ped Bridge - McCaslin	Park-n-Ride	$ 100,000
6	Equipment	Accu-Press	District Shops	$ 145,000
7	Support Fleet	Transit Police	District-wide	$ 200,000
8	ITS	CAD/AVL	District-wide	$ 2,430,000
9	Public Facilities	Table Mesa	Park-n-Ride	$ 450,000
10	Bus	Intercity	District-wide	$ 5,947,920
11	IT	Network	District-wide	$ 208,000
10	Public Facilities	Fire System - Lincoln Station	Park-n-Ride	$ 350,000
11	ITS	Radio - APX6000	District-wide	$ 1,095,554
12	Facilities	HVAC	Boulder Division - Maintenance	$ 3,842,000
13	Public Facilities	High Block	District-wide	$ 650,000
14	ITS	Radio - XTS2500	District-wide	$ 2,697,813
15	Equipment	Compressors	District Shops	$ 75,000
16	Public Facilities	LRT Bridge - Tufts	Southwest Rail Line	$ 360,000
17	Support Fleet	Pool/Admin	District-wide	$ 604,989
18	SCADA	Equipment	District-wide	$ 378,147
19	Public Facilities	Street Improvements	District-wide	$ 1,048,213
20	Public Facilities	Ped Bridge - I25/Dry Creek	Southeast Rail Line	$ 600,000
21	Public Facilities	Curb and Tactile	District-wide	$ 50,000

Table 18C – 2026 Prioritized List of Investments

Investment Priority	Requesting Department	Title	Location	Project Costs
1	IT	Server	District-wide	$ 296,135
2	Bus	Cutaway	District-wide	$ 37,785,000

3	Public Facilities	High Block	District-wide	$ 650,000
4	ITS	CAD/AVL	District-wide	$ 2,430,000
5	Support Fleet	Support Service	District-wide	$ 949,457
6	IT	Network	District-wide	$ 414,265
7	Facilities	HVAC	Platte	$ 1,795,000
8	Support Fleet	Transit Police	District-wide	$ 459,150
9	SCADA	Equipment	District-wide	$ 5,694
10	IT	Telecom	District-wide	$ 101,900
11	ITS	Radio - XTS2500	District-wide	$ 2,697,813
13	Support Fleet	Pool/Admin	District-wide	$ 49,245
14	Treasury	Change Machine	District-wide	$ 62,000
15	Public Facilities	Curb and Tactile	District-wide	$ 50,000
16	Sign Shop	Laser Machine	District Shops	$ 52,800

Table 18D – 2027 Prioritized List of Investments

Investment Priority	Requesting Department	Title	Location	Project Costs
1	Facilities	HVAC	Boulder Station District Shops - Operations Center Building L	$ 736,200
2	Bus	40ft	District-wide	$ 90,326,632
3	IT	Network	District-wide	$ 333,100
4	ITS	CAD/AVL	District-wide	$ 4,511,700
5	Treasury	Farebox	District-wide	$ 8,310,000
6	Bus	60ft	District-wide	$ 67,399,200
7	Support Fleet	Support Service	District-wide	$ 1,687,284
8	SCADA	Equipment	District-wide	$ 18,145
9	ITS	Radio - APX6000	District-wide	$ 1,054,315
10	Light Rail Infrastructure	Traction Power Replacement	Central Platte Valley (CPV) Rail Line	$ 1,300,000
11	Support Fleet	Transit Police	District-wide	$ 98,340
12	Bus	Intercity	District-wide	$ 10,408,860
13	Public Facilities	Curb and Tactile	District-wide	$ 50,000
14	ITS	Radio - APX6500	District-wide	$ 245,800
15	Support Fleet	Pool/Admin	District-wide	$ 297,065
16	Public Facilities	High Block	District-wide	$ 650,000
17	ITS	Radio - XTS2500	District-wide	$ 4,238,564

18	IT	Server	District-wide	$ 20,000
19	IT	Telecom	District-wide	$ 66,200

Table 18E – 2028 Prioritized List of Investments

Investment Priority	Requesting Department	Title	Location	Project Costs
1	Light Rail Vehicle	Wheel Lathe	Mariposa	$ 500,000
2	Facilities	Hoist	Mariposa	$ 399,400
3	ITS	CAD/AVL	District-wide	$ 542,700
4	Bus	Intercity	District-wide	$ 31,226,580
5	IT	Network	District-wide	$ 810,800
6	Support Fleet	Support Service	District-wide	$ 751,151
7	SCADA	Equipment	District-wide	$ 26,600
8	ITS	Radio - APX6500	District-wide	$ 713,422
9	Public Facilities	Curb and Tactile	District-wide	$ 50,000
10	Bus	60ft	District-wide	$ 4,493,280
11	Support Fleet	Transit Police	District-wide	$ 160,370
12	ITS	Radio - XTS2500	District-wide	$ 1,187,038
13	ITS	DVR	District-wide	$ 332,000
14	IT	Telecom	District-wide	$ 46,300
15	Support Fleet	Pool/Admin	District-wide	$ 673,633
16	Sign Shop	Braille Machine	District Shops	$ 30,000
17	Facilities	Vehicle Wash	Platte	$ 1,490,900
18	Light Rail Vehicle	Tire Press	Mariposa	$ 267,900

Table 18F – 2029 Prioritized List of Investments

Investment Priority	Requesting Department	Title	Location	Project Costs
1	Light Rail Vehicle	Wheel Lathe (Hegenscheidt)	Mariposa	$ 1,335,700
2	Bus	40ft	District-wide	$ 29,748,273
3	IT	Network	District-wide	$ 118,800
4	SCADA	Equipment	District-wide	$ 878,388
5	ITS	Radio - XTS2500	District-wide	$ 875,290
6	Support Fleet	Support Service	District-wide	$ 1,750,938
7	ITS	DVR	District-wide	$ 280,000

8	Bus	Cutaway	District-wide	$ 9,240,000
9	IT	Telecom	District-wide	$ 30,700
10	Support Fleet	Pool/Admin	District-wide	$ 27,985
11	Sign Shop	Envision & Gerber	District Shops	$ 114,100

Table 18G – 2030 Prioritized List of Investments

Investment Priority	Requesting Department	Title	Location	Project Costs
1	Bus	40ft	District-wide	$ 32,452,662
2	Support Fleet	Support Service	District-wide	$ 761,706
3	ITS	Radio - APX6000	District-wide	$ 770,251
4	Bus	Mall	District-wide	$ 40,818,452
5	IT	Network	District-wide	$ 54,000
6	Sign Shop	Envision & Gerber	District Shops	$ 228,200
7	Bus	60ft	District-wide	$ 8,986,560
8	IT	Telecom	District-wide	$ 10,000
9	Bus	Cutaway	District-wide	$ 7,920,000

5 Improving Asset Management Capabilities at RTD

In order to be successful, an agency's asset management system must be aligned to its strategic objectives. The 2021-2026 Strategic Plan addresses the agency's strategic priorities which include asset management objectives. To further underscore the importance of asset management to the health of an asset intensive organization the 2024-2025 strategic initiatives include the "Back to Basics" initiative that elucidates the agency's commitment to asset management in the following way, "Redouble agency efforts to maintain assets in a state of good repair leveraging sound asset management principles." (Regional Transportation District, 2024)

As an agency with a 55-year history, RTD is beginning to see the effects of infrastructure decay. RTD had some unrecognized deficiencies in infrastructure condition of light rail track that has been used for transit service delivery since 1994, some of which led to an anticipated $150 Million track renewal effort in 2025. A notable area of track requiring a performance restriction resulted in the Colorado Public Utilities Commission (PUC) issuing a corrective action plan (CAP) that required making changes to resolve. To ensure the agency utilized an approach for understanding asset management system maturity, a method rooted in the International Standards Organization (ISO) 55001 standard was developed. This method assessed the maturity of asset management information and processes and paired that information with requirements in the PUC CAP as well as the aspirations and pain points of an internal group of stakeholders to develop a robust set of requirements that serve as the

roadmap to improvement. An ongoing project management effort was used to turn plans into action and improve the state of asset management for light rail track assets. Having achieved notable success using this method of requirements gathering and project management, this method has begun to be propagated to other asset types to facilitate similar improvements. Results of utilizing this method will be monitored to continually improve the method in a plan-do-check-act method of continual improvement.

Historically, RTD has had the necessary funding in place to maintain its assets in a state of good repair. However, RTD's backlog of existing assets is growing and will experience swells of assets achieving their respective EULs, such as those from pre-FasTracks expansion activities including the original light rail alignment known as the Metro Area Circulator (MAC) or Central Corridor, the Southwest light rail alignment, the Southeast rail alignment that was a component of the T-REX project, and the Central Platte Valley (CPV) extension. The asset renewal and replacement needs are expected to be $1.3 Billion for the 2024-2031 planning period (Figure 25). Presently the AMP records reflect a funding need of over $187 million for 2024, which largely accounts for the backlog for assets in the scope of the TAM. (Figure 26) The actual funding needs are likely higher due to assets out of scope of the TAM, assets that have yet to be recognized in the AMS, and uncertainty around the infrastructure and facilities needs that result from a lack of controlled and available asset information on which to formulate data-driven plans. The known unfunded needs by asset type are summarized in Figure 27. It is anticipated that the asset information maturity effort noted in the executive summary of this document will shed light on the true needs of facilities investment within the planning horizon of this iteration of the TAM Plan. By gathering requirements in a structured, rigorous way, and project managing the efforts to deliver on those requirements the ability to make data-driven decisions concerning facilities assets will be improved.

RTD's asset management maturity improvement initiative was not initially driven by a growing set of decaying assets, but rather 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 16 years RTD has invested over $6.4 billion on new rail and bus rapid transit service.

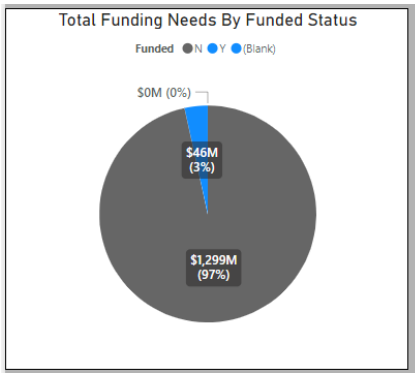
The funding for the most recent expansion projects did not make sufficient provision for the long-term maintenance and capital renewal of the new assets. Without a solid, long-term renewal plan in place with funding earmarked, the risk of a growing backlog of renewal projects without adequate funding is too great to be unaddressed. In RTD's financial plans the AMP is fully funded. In addition, contributions to reserves are made in anticipation of funding needs within the planning horizon that may exceed the ability to fund annually from revenues in a particular year. This results in an average contribution of approximately $120 Million annually to fund the AMP.

A growing backlog for any transit agency increases risks to safety, service, and future sustainability; it feeds a pattern of expensive reactionary repair and remediation tasks. The AMP process and available funding are tools to ensure the future viability of the assets and

position the agency for providing value to the customers and community the agency serves. RTD's processes are focused on addressing backlog and ensuring safe, reliable service that generates value for customers and the community.

On a routine basis RTD prepares an 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 the investments that are needed over the coming budget planning cycle as was recently done with the light rail track assets. Improvements in AIM will facilitate the agency's ability to forecast costs, estimate performance consequences, and understand risk to achieving strategic objectives.

The AMP will determine which assets are included for renewal or replacement in the investment prioritization process. The projected funding needs over the period 2024-2031 are illustrated in the graphs that follow.



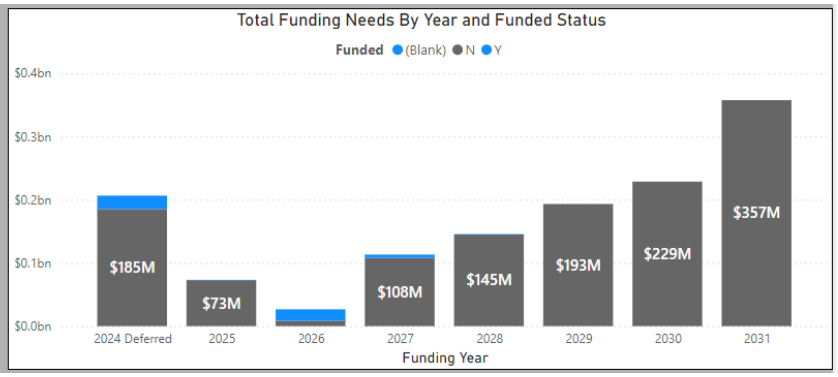


Figure 25: Total Funding Need by Status *Figure 26: Total Funding Needs by Year and Funded Status 2024-2031*

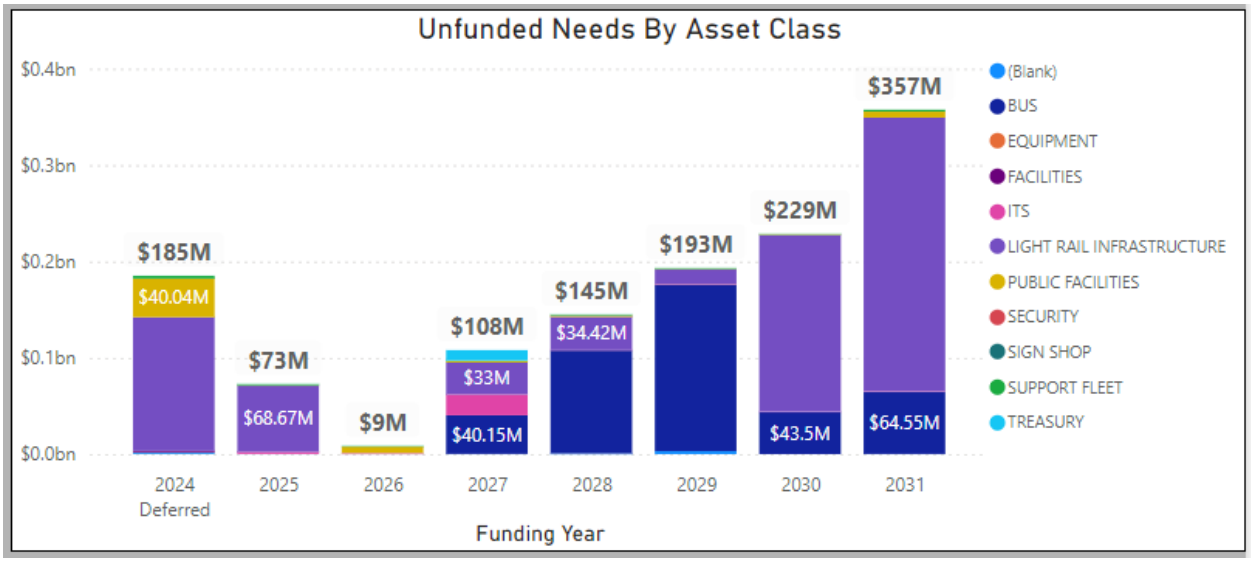


Figure 27: Unfunded needs by asset class, 2024-2031

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 (SAMP) 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 AMS. This approach to utilizing an existing asset management framework is a best practice and is still a focal point for the SAMP.

Typically, organizations begin with a focus on asset information, particularly the inventory of all their assets and assessing asset condition. This information supports clearer planning, because this allows the organization to fully assess its assets and their condition. The intended result 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 successfully employed an asset information maturity improvement methodology within light rail track assets and expects to expand this effort to other asset classes to ensure that information is available to support decision-making and planning for RTD and its partners.

The current strategy is to focus on continued improvement of the agency asset management capabilities through AIM improvement initiatives, utilizing principles of good asset management and tools derived from ISO 55000 standards, though the agency will not seek certification within the four-year scope of this TAM Plan. The SAMP is due to be revisited, and it is expected that the adjustments from being focused on ISO 55000 certification to an approach more centered on fundamental activities that improve the asset management system by enhancing AIM.

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 furthering the development and improvement of the AMP. TAM activities are the subset of these, targeting the specific TAM elements, and are shown in a third section below.

5.2.1 "Business as Usual" Asset Management Activities

As an asset-intensive organization, RTD already performs several asset management activities on a routine basis, and these will continue to improve through the TAM Plan horizon.

This section summarizes those "business as usual" activities, using the Institute of Asset Management's Conceptual Model for Asset Management (2015) to categorize into six main blocks. This should not be interpreted to imply these ongoing activities are all necessarily well aligned or integrated at present.

Figure 31: The Institute of Asset Management (IAM) Conceptual Model for Asset Management

Strategy and Planning

The Planning department periodically conducts demand analysis for RTD's transit service and uses this to support long-term strategic planning for system optimization, expansion and enhancement. At present, strategic planning for capital renewals and maintenance volumes is not formally performed, though RTD anticipates the need to enhance its capabilities in this area through the development of asset class strategies and the AMP (see next section for details).

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 the FYFF. Operations and maintenance decision-making is performed within each asset owner group.

Lifecycle Delivery

Ongoing activities include capital project processes for asset acquisition, which is split between the Capital Programs Department for commuter rail and facility assets and the Operations Department for rail, bus and rail infrastructure assets. Maintenance delivery occurs for each major asset class and includes preventive and corrective maintenance, along with condition assessments where warranted. Some asset classes have a larger focus on preventative maintenance, while others have more emphasis on corrective maintenance and maintain assets when they fail or are near failure. Most maintenance delivery is performed by staff, with some being outsourced. Asset operations are a significant part of RTD's ongoing activities, and includes bus, rail, equipment and infrastructure operations, some of which are also outsourced. Improved asset information and a focus on aligning to strategic objectives will facilitate more effective resourcing strategies that ensure the resources to meet strategic objectives are allocated. RTD also performs shutdown and outage management of its assets to enable maintenance access. As assets develop operating faults, the agency 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. Other systems including Railroad Software have been added to address the specific requirements of light rail maintenance of way and directly operated commuter rail maintenance of way (commonly referred to as North Metro). However, these systems have not been fully integrated into organization processes.

There are several basic data and information management processes in effect, including regular reporting to the NTD, and regular data quality assessment and cleansing processes for Trapeze EAM information. The Asset Management Division employs a data science and analytics team to support designated asset stewards with collection, management, and analysis of non-physical data. This group also performs data assurance tasks on corporate data and performs all FTA TAM report preparation activities.

The RTD data science and analytics team also administers the asset information maturity (AIM) process, having designed the framework, administered assessments, and provided significant consultative guidance in the development of AIM improvement plans and professional support in the execution of many analytics tasks within the plans.

Organization and People

RTD applies procurement and supply chain management principles for its outsourced asset management functions. These include procuring design and construction services, along with some ongoing operations and maintenance of assets. The operation and maintenance of approximately half of RTD's bus services is outsourced, and the maintenance of certain facility assets, such as elevators, is also outsourced.

Risk and Review

RTD's Finance department uses standard accounting practices to perform asset costing and valuation, including their valuation and depreciation of assets over time. Integration of the ORF into AIM improvement plans, in the renewal/replacement requests and more broadly into other operational plans is expected within the period of this TAM Plan.

5.2.2 Asset Management System Activities

As previously stated, it is essential that an agency's asset management system is aligned to its strategic objectives. The activities to enhance the asset management system capabilities are summarized in the aforementioned "Back to Basics" initiative that communicates the agency's commitment to asset management in the following way, "RTD strives [to] redouble agency efforts to maintain assets in a state of good repair leveraging sound asset management principles." (Regional Transportation District, 2024) The ability for the asset management system to deliver the right funding, in the right year, for the right reasons requires effective processes and valid information. Much of the activities of the Asset Management Division, working with groups throughout the agency, are aimed at improving information and processes to deliver positive agency outcomes.

5.2.2.1 Design an Asset Management Organization

This includes the implementation of an AMS that meets the agency's strategic needs: the framework to define and manage the key elements, including a 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 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 improved information to aid in accurate and precise financial planning to meet the agency's strategic needs, not limited to those items with a particular asset management focus in the strategic plan.

5.2.2.4 Assurance and Performance

In order to deliver on the Asset Management Accountability Team (AMAT) goal of achieving an Optimized AMP, an improved performance management framework aligned to measure those things most critical to delivery of the agency's strategic plan will be required. It is not anticipated that a unified organization-wide asset performance framework will be delivered within the scope of this four-year TAM Plan. However, improved asset performance measures may be a component of AIM initiatives in the coming years.

5.2.2.5 Enhance Asset Information

This is centered on the development and implementation of an AIM framework, including definition of RTD's information requirements and the strategies employed for meeting them, along with clear governance for asset information. Without changes in organizational structure, it is not anticipated that a unified, organization-wide asset register will be delivered within the scope of this four-year TAM Plan.

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 the development of an appropriate asset management culture.

5.2.2.7 Enabling Activities

This is to support the delivery of the asset management objectives in the Strategic Plan. They include:

- Funding asset renewals and replacements through the AMP process
- Requiring funding requests to include sufficient information for making data-driven decisions aligned to objectives
- Monitoring and reviewing progress, with adjustments made as necessary

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 assessment which may include predictive models
Decision processes for investment prioritization	Continue to develop the AMP process and products to deliver on agency strategic priorities. Develop a culture of appreciation for data and its utility in decision-making. Continue to develop asset information to facilitate resourcing strategies and financial planning to ensure alignment to objectives and sustainability
Prioritized list of investments	Annual update each year based on improved agency-wide decision process, as noted above
Asset Management Policy	Ensure effectiveness in delivering agency objectives and purpose through the management of physical assets through periodic review. The policy will be improved as needed
Implementation strategy	Implement improvements as detailed in the asset management roadmap as well as continuing with the 'business as usual' actions (see Appendix D)
Evaluation	Annually review progress and compliance and incorporate changes based on lessons learned

Table 21: TAM Activities

5.3 Resourcing Strategy

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

Staff resources from across the agency are involved in RTD's asset management activities, including the GM/CEO, the Leadership Team, the Asset Management Division, and the Operations, Capital Programs, Finance, Communications and Engagement, Planning, and General Counsel departments.

5.3.1 Business as Usual Asset Management Activities

The resourcing strategy for the "business as usual" annual asset management activities will continue with the current strategy, i.e. resourcing the activities through the agency departments that currently perform or are involved in them.

5.3.2 Asset Management System Activities

The 2021-2026 Strategic Plan 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 32: ISO 55000 Contributing Resource Groups

In late 2011, RTD assigned two employees the task of building an Asset Management Division (AMD). The Division would eventually be responsible for improving the management of assets and building an agency-wide AMS.

To ensure the most accurate, non-biased information possible, the Leadership Team determined the AMD should be independent of the asset delivery functions.

According to Chris Lloyd, asset management leadership and culture expert: "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 and Lloyd, 2012).

The AMD was placed in the Finance Department in 2022 to facilitate greater alignment to supporting the agency's financial planning needs through delivery of the AMP processes and products. More details are in Appendix F.

The AMD staff possess a wealth of asset management expertise, as a number of its employees transferred from other areas of the agency, bringing with them significant knowledge of agency operations, experience in maintenance of many asset classes, physical asset business analysis, and/or data science. External hires provided additional subject matter expertise, knowledge, skills, and abilities.

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 AMD. Supporting resources from other agency departments will be utilized and consulted or informed on an as-needed basis. Details of both the accountable executive and the AMD are in Appendix E.

6 Evaluation Plan

6.1 TAM Plan Evaluation

The TAM Plan will be evaluated on degree of compliance when RTD receives each triennial audit.

However, the plan 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 SAMP. 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 periodically evaluate its performance against the previous cycle's TAM Plan improvement goals and agency objectives with documentation and explanation of progress (Regional Transportation District, 2021).

7 Signature

The TAM Plan was developed during fiscal year 2024. The document describes activities required to sustain an FTA compliant asset management program that includes participation through all levels of the organization. I endorse and adopt this document.

APPROVED BY FTA DESIGNATED ACCOUNTABLE EXECUTIVE:

Signature Date

Debra A. Johnson

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.
- **Asset Information Maturity (AIM)** – This consists of a framework, an assessment, AIM plans, and updates to the Asset Management Accountability Team on progress towards stated objectives in plans. The framework that includes a six-stage model indicating relative maturity that are mutually exclusive based on the availability of information, the quality of data in its utility for decision-making/planning, the presence or absence of a documented plan/procedure for the development and utilization of data suitable for decision-making/planning, whether or not documented plans/procedures are followed and monitored for adherence, and whether a 'plan-do-check-act' cycle of continuous improvement is applied to tune information and plan quality to achieve organization objectives. The inventory consists of 24 items based on ISO 55000 clauses 7.5 and 7.6 regarding information and its control. The plans are signed documents available on the RTD intranet.
- **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 for assets using age-based replacement or renewal strategies including rolling stock, equipment, and infrastructure. For facilities, condition inspections resulting in a score of 3 or less on the TERM scale shall be considered to be in backlog.
- **Base System** – Base System refers to RTD's assets not included in the FasTracks system. The Base System is supported in part by a 0.6% sales and use tax. Base System funding and FasTracks funding are tracked separately.
- **Capital Responsibility** – Transit agencies are required to report condition assessments for assets that they own or jointly own with another entity, that they are responsible for replacing, overhauling, refurbishing, or conducting major repairs on that asset, or for which the cost of those activities is itemized as a capital line item in the agency's budget.
- **CDOT** – Colorado Department of Transportation.
- **Consist** – A set of railroad vehicles forming a complete train.
- **Contracted Service** – A contract for services is a formal, legally binding agreement between RTD and a private company to provide service delivery.
- **Data Driven Decisions -** The process of making organizational decisions based on actual and verifiable data rather than intuition or observation alone. The approach includes problem solving where a well-defined set of actions are driven by decisions which are further driven by insights (extracted from data) using sound methods.
- **Denver Regional Council of Governments (DRCOG)** – Denver's metropolitan planning organization (MPO). 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 Service.
- **Estimated Useful Life (EUL)** – The Estimated Useful Life indicates the expected duration in years that the asset will remain in service under normal operating conditions and maintenance. This metric is agency-defined as opposed to FTA established Useful Life Benchmarks. At the end of useful life of the asset, major renewal or replacement is expected.
- **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 system.
- **Five-Year Financial Forecast or FYFF** – 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.
- **ISO 55000** – The international standard covering management of assets of any kind. Prior to the establishment of this standard, 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 and is composed 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
- **Leadership Team (LT)** – Agency leaders who hold the title of Chiefs and/or Assistant General Managers that lead departments and/or operating modalities
- **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.
- **National Transit Database** – A federal reporting program for transit agencies receiving Federal Transit Administration (FTA) funding, which 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.
- **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 (ULB)** – The Useful Life Benchmark indicates the expected duration in years that the asset will remain in service under normal operating conditions and maintenance. This metric is established by the FTA as opposed to the agency-defined Estimated Useful Life metric. At the end of useful life of the asset, major renewal or replacement is expected.

Appendix B: Asset Management (AM) Roadmap

The 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 AM Policy and Strategic Asset Management Plan (SAMP), including asset management objectives aligned to agency objectives
- The definition and implementation of an AMS 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
- Development of a resourcing strategy
- Utilization of the agency operational risk framework (ORF) in asset-related decisions
- Establishment, development and use of additional information to meet strategic objectives, such as the inclusion of equity measures to improve equitable outcomes and creating value for customers and the broader community

Asset Management Planning

This roadmap activity group develops specific strategies and plans in support of meeting asset management objectives and includes:

- Performing asset information maturity (AIM) assessments that identify information that may be needed to make asset management decisions
- Managing the Asset Management Plan (AMP) processes and products to ensure that asset renewal and replacement needs are prioritized as an input into the Mid-Term Financial Plan (FYFF) and resulting budgets
- Prioritizing asset renewals and replacements as the foundation of the AMS, with the ability to assess enhancement and expansion requests as a reflection of system maturity and long-term planning capabilities
- Development of clear decision-making criteria aligned with asset management objectives to support investment prioritization including asset information maturity improvements

Improve Rigor and Control

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

- Through the AIM process, identify data and information that if improved will enhance the decision-making capability of the agency
- Develop AIM improvement plans for each asset type to facilitate improvement activities and accountability for progress towards stated goals

- Implement a project management procedure 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
- Implement change management processes

Assurance and Performance

This roadmap activity group implements processes to assure the performance of the assets and the AMS and includes:

- The design and implementation of a performance management framework
- Ongoing management review of the outcomes from the performance management framework and audits, with continual improvement adjustments made accordingly
- An improved approach to assessing the root cause of asset failures

Enhance Asset Information

This roadmap activity group implements improvements to asset information, and includes:

- The further development and implementation of an AIM assessment and improvement system to improve decision-making capability regarding agency assets
- A clear governance approach for the information used to support AMS, including structured and unstructured information and the documents comprising the AMS itself
- The development of standards and specification for information, aligned with RTD's information requirements
- Ongoing information quality audits and associated updates
- The incorporation of additional information into the AMS to meet agency strategic objectives, such as the inclusion of information regarding equity, which is likely to be accomplished within the four-year scope of this TAM Plan
- Deploy a structured approach of requirements gathering to identify the specific decisions or problems the AMS aims to address, ensuring that information requirements and data quality standards are directly tied to these decision-making needs. This alignment will clarify what data is essential and guide prioritization of data improvement efforts
- Expand the scope of asset information to include insights into asset design life, utilization and performance, enabling a shift from age-based to performance-based management approaches for key asset classes. This transition supports data-driven decisions and aligns with RTD's objectives to enhance reliability and optimize lifecycle investments

Learning and Communication

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

- The definition of competence requirements for the AMS
- The performance of a training needs analysis for the AMS, and implementation of appropriate asset management training
- Activities to raise awareness of asset management throughout the organization
- The development of an asset management culture, including appropriate leadership and commitment
- The definition and implementation of a communications plan

Enabling Activities

This roadmap activity group supports the delivery of an AMS that meets the agency's strategic objectives

- Establishing and empowering an implementation team
- Setting up governance and controls of the roadmap
- Monitoring and reviewing progress, with adjustments made as necessary

Appendix C: 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
  - Ten to fifteen FTEs from the Asset Management Division, who will split their time between tasks associated with the AMP process and AIM initiative
  - 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 asset management 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, Access, Excel, 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 D: Asset Management Roles and Responsibilities

1. **Accountable Executive** – a single position with ultimate accountability for Asset Management and the Asset Management System within RTD. This is the General Manager and Chief Executive Officer.
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 the Chief Financial Officer, Chief Operations Officer, and Assistant General Manager for Capital Programs. Due to changes in organization structure, personnel changes, the AMAT has been temporarily suspended.
3. **Chief Financial Officer** (CFO) – reporting directly the Accountable Executive, the CFO chairs AMAT. This position is critical to developing an asset management culture. In this role the CFO ensures the alignment of asset management initiatives to strategic objectives. By having a robust understanding of agency needs, this individual can guide the agency in the development, implementation and maintenance of an AMS that enhances agency capabilities. This individual also ensures adequate resourcing for the AMS overall, and the AMD.
4. **Asset Management Division** – the AMD is responsible for the design, delivery, embedding, review and continual improvement of the Asset Management System's (AMS) products, processes and information. The AMD manages the AMP and AIM initiatives. The Asset Management Senior Manager reports to the Chief Financial Officer.
5. **Other RTD resources** – as needed, other RTD resources will be utilized, consulted or informed regarding the AMS. This could include operations, maintenance, finance, safety, human resources, communications, IT, capital programs, legal, and procurement staff. The AMAT will allocate these resources directly when within their reporting line or via a request to other members of the Leadership Team when they are not.
6. **External resources** – RTD will also utilize external expertise to develop the internal asset management competencies of both the AMD and other RTD resources involved with the AMS. The alternative to this is to be continually reliant on an external entity to supply expertise indefinitely. By having actions guided by both an established asset management framework and interactions with consultants, RTD intends to cultivate an AMD 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 AMS, specifically the operations and maintenance of approximately half of the bus fleet and a large portion of the commuter rail system.

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

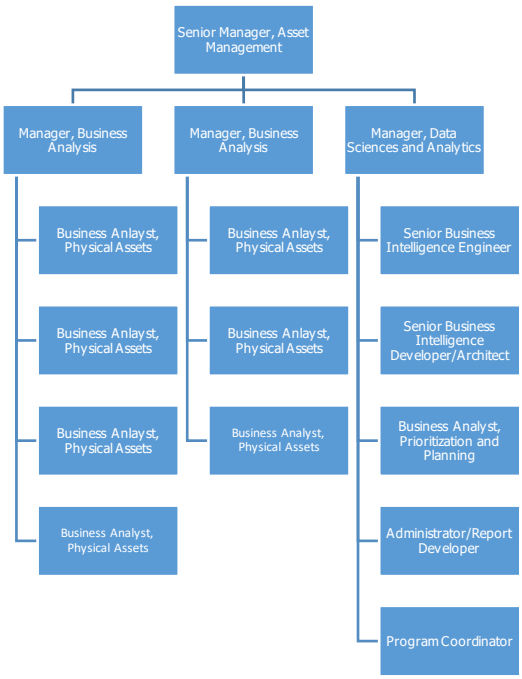


Figure 33: AMD Organization Chart 11/2024

Appendix E: 2021 – 2026 Strategic Plan Elements

RTD's mission is to make lives better through connections and its vision is to be the trusted leader in mobility, delivering excellence and value to our customers and community. (Regional Transportation District, 2021).

RTD's six shared values are ideals and beliefs that the agency collectively holds to be true and will aid in developing an intentional culture:

Values:

- *Passion*: We will be purposeful in delivering our work
- *Respect*: We will demonstrate respect and integrity in our interactions with both our colleagues and community members
- *Diversity*: We will honor diversity in thought, people, and experience, being receptive to unique ideas and viewpoints to achieve optimal results in problem-solving
- *Trustworthiness*: We will be forthright in our actions; we will do what we say, when we say we will do it
- *Collaboration*: We will approach our work in a collaborative manner, seeking and acknowledging valued input from our colleagues and the community
- *Ownership*: We will commit ourselves to continuous learning and do what it takes to deliver our shared vision

Strategic Priorities:

The agency's strategic priorities are the goals departments, teams, and individuals will strive to achieve over the 2021 – 2026 planning window.

- *Community Value*: RTD strives to be a strong community partner, providing value to our customers as well as to the broader Denver Metro region while sustaining planet Earth
- *Customer Excellence*: RTD strives to consistently deliver high-quality customer service
- *Employee Ownership*: RTD seeks to attract and retain a highly skilled and engaged workforce
- *Financial Success*: RTD takes very seriously the management of all financial resources

Appendix F: Non-vehicle Equipment

Description	Equipment ID	Year	Replacement Cost	EUL
AERATOR - PUSH	AR04	2001	$4,759.99	15
AERATOR - PUSH	AR05	2001	$4,759.99	15
AERATOR - PUSH	AR06	2003	$3,749.99	15
AERATOR - TOWABLE	AR02	1999	$2,349.99	15
AERATOR - TOWABLE	AR03	2001	$2,349.99	15
ALL TERRAIN VEHICLE	ATV1	2006	$15,303.67	15
ALL TERRAIN VEHICLE	ATV2	2015	$25,694.48	15
ALL TERRAIN VEHICLE	ATV3	2015	$25,694.48	15
ALL TERRAIN VEHICLE	ATV4	2017	$14,289.06	15
ASPHALT CRACK FILLER - TOWABLE	AM1	1997	$63,240.41	15
ASPHALT CRACK FILLER - TOWABLE	AM2	2015	$60,799.77	15
BOOTH RADIATOR FLUSH W/VENT SYSTEM	TL-DSHUS0401	1999	$11,500.00	30
BORING BAR	TL-DSHUS0364	1989	$26,000.00	35
BRAKE - BOX PAN FINGER 10 TON 3/16" CAPACITY MILD STEEL ELECTRIC GEAR DRIVE	TL-DSHBS0873	1989	$71,415.00	35
BRAKE - STRAIGHT 96" 14 GAUGE MILD STEEL	TL-DSHBS0638	1987	$10,512.78	30
BRAKE PRESS - 6FT, 14 GAUGE HYD CAM ACTION, W/MANUAL BACK GAUGE, W/DIES	TL-DSHBS0869	1992	$13,688.52	25
BRAKE PRESS- 10FT, 100 TON HYD RAM, W/CNC BACK GAUGE W/DIES	TL-DSHBS0870	1996	$52,676.00	25
BROOM POWER	PB04	2015	$4,163.50	15
BROOM POWER	PB06	2015	$4,163.50	15
BROOM POWER	PB07	2015	$4,163.50	15
BROOM POWER	PB10	2019	$4,163.50	15
BROOM POWER	PB11	2019	$4,163.50	15
BROOM POWER	PB12	2019	$4,163.50	15
CAP CUTTING/SURFACING MACHINE	TL-DSHUS0402	1989	$12,300.00	30
CART - ELECTRIC	CT20	2002	$10,854.80	15
CART - ELECTRIC	CT21	2005	$12,097.40	15
CART - ELECTRIC	CT24	2018	$15,796.75	15
CART - ELECTRIC	CT25	2018	$15,796.75	15

CART - ELECTRIC	CT26	2018	$15,796.75	15
CART - ELECTRIC	CT27	2018	$22,562.52	15
CART - UTILITY	CT23	2011	$13,949.05	15
CHIPPER-SHREDDER	CH1	2002	$11,180.44	15
CLEANER PARTS 90 GALLON ULTRASONIC	TL-DSHUS0383	2018	$17,949.00	15
CLEANER PULSE	TL-DSHUS0385	2006	$18,997.99	25
DRILL PRESS RADIAL ARM 4` ARM X 11" COLUMN	TL-DSHUS0369	1989	$52,645.00	40
DYNAMOMETER ABSORBER - ENGINE	TL-DSHUS0353	1999	$68,808.28	25
DYNAMOMETER CONTROL- ENGINE	TL-DSHUS0351	1999	$45,163.42	25
DYNAMOMETER CONTROL ROOM- ENGINE	TL-DSHUS0350	1989	$316,268.52	35
DYNAMOMETER INTERFACE - ENGINE	TL-DSHUS0352	1999	$20,603.75	25
DYNOMETER ALTERNATOR TESTER HD GEN	TL-DSHUS0394	2001	$59,235.00	25
FORKLIFT	F21	1989	$58,866.79	15
FORKLIFT	F22	1989	$58,866.79	15
FORKLIFT	F30	1993	$84,230.87	15
FORKLIFT	F33	1999	$62,049.76	15
FORKLIFT	F34	1999	$51,266.69	15
FORKLIFT	F35	1999	$48,798.10	15
FORKLIFT	F36	1999	$48,798.10	15
FORKLIFT	F37	1999	$48,798.10	15
FORKLIFT	F38	1999	$48,576.16	15
FORKLIFT	F42	2002	$64,516.98	15
FORKLIFT	F43	2002	$64,516.98	15
FORKLIFT	F44	2005	$96,328.52	15
FORKLIFT	F45	2007	$68,430.66	15
FORKLIFT	F46	2007	$44,083.05	15
FORKLIFT	F48	2008	$65,038.49	15
FORKLIFT	F49	2008	$65,038.49	15
FORKLIFT	F50	2008	$65,327.34	15
FORKLIFT	F51	2008	$65,263.15	15
FORKLIFT	F52	2010	$51,332.75	15
FORKLIFT	F54	2012	$45,886.52	15
FORKLIFT	F55	2012	$47,725.80	15
FORKLIFT	F56	2012	$47,725.80	15
FORKLIFT	F66	2020	$41,958.64	15

FORKLIFT - HIGH REACH	F47	2007	$36,083.43	15
FORKLIFT - ORDER PICKER	F53	2011	$176,220.00	15
FORKLIFT - ORDER PICKER	F62	2018	$39,084.99	$15
FORKLIFT - ORDER PICKER	F63	2018	$39,084.99	15
FORKLIFT 6K LPG	F58	2017	$32,375.89	15
FORKLIFT 6K LPG	F59	2017	$32,375.89	15
FORKLIFT ELECT	F57	2015	$54,401.29	15
HIGH LIFT	HL6	1989	$42,954.18	15
HIGH LIFT	HL10	1996	$25,958.51	15
HIGH LIFT	HL11	1996	$25,958.51	15
HIGH LIFT	HL13	1997	$28,759.17	15
HIGH LIFT	HL14	2001	$19,499.17	15
HIGH LIFT	HL15	2001	$21,512.24	15
HIGH LIFT	HL16	2002	$80,424.47	15
HIGH LIFT	HL17	2005	$221,316.25	15
HIGH LIFT	HL18	2005	$17,983.81	15
HIGH LIFT	HL19	2005	$17,983.81	15
HIGH LIFT	HL20	2006	$67,108.61	15
HIGH LIFT	HL21	2008	$22,658.36	15
HIGH LIFT	HL22	2008	$22,658.36	15
HIGH LIFT	HL23	2008	$23,780.05	15
HIGH LIFT	HL24	2008	$23,780.05	15
HIGH LIFT	HL25	2012	$22,456.35	15
HIGH LIFT	HL26	2012	$24,127.39	15
HIGH LIFT	HL27	2012	$27,981.33	15
HIGH LIFT	HL28	2014	$58,574.10	15
HIGH LIFT	HL30	2014	$23,046.54	15
HIGH LIFT	HL29	2016	$14,181.83	15
HONING MACHINE CYLINDER	TL-DSHUS0366	1989	$52,640.00	35
HONING MACHINE PISTON ROD AND PIN	TL-DSHUS0365	1989	$10,940.60	35
KEY SEATER (KEYWAY CUTTER)	TL-DSHUS0373	1989	$13,726.00	40
LATHE - COLLET	TL-DSHUS0375	1989	$11,154.20	35
LATHE - ENGINE	TL-DSHUS0372	2021	$36,000.00	25
LATHE - ENGINE	TL-DSHUS0368	1989	$30,752.00	40
LATHE - ENGINE	TL-DSHUS0370	1989	$30,144.00	40
LATHE - ENGINE	TL-DSHUS0371	1954	$6,682.00	75

LINE MARKER	LM07	2004	$7,402.98	15
LINE MARKER	LM08	2004	$7,402.98	15
MAGNETIC PARTICAL HORIZONTAL INSPECTION BENCH	TL-DSHUS0360	1980	$12,543.40	45
MILLING MACHINE VERTICAL CNC END MILL	TL-DSHUS0248	2016	$50,000.00	25
MILLING MACHINE W/DIGITAL READOUT	TL-DSHUS0367	1989	$40,486.65	40
MOBILE COLUMN LIFT - BATTERY POWER	WL101	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL102	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL103	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL104	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL105	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL106	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL107	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL108	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL109	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL110	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL111	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL112	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL113	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL114	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL115	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL116	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL117	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL118	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL119	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL120	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL121	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL122	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL123	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL124	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL125	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL126	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL127	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL128	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL129	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL130	2023	$11,630.00	15

MOBILE COLUMN LIFT - BATTERY POWER	WL131	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL132	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL133	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL134	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL135	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL136	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL137	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL138	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL139	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL140	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL141	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL142	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL143	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL144	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL145	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL146	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL147	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL148	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL149	2023	$11,630.00	15
MOBILE COLUMN LIFT - BATTERY POWER	WL150	2023	$11,630.00	15
MOWER - RIDING	RM16	-	$34,549.17	15
MOWER - RIDING	RM05	1999	$20,004.00	15
MOWER - RIDING	RM06	2000	$20,004.00	15
MOWER - RIDING	RM09	2001	$19,990.00	15
MOWER - RIDING	RM10	2003	$20,004.00	15
MOWER - RIDING	RM11	2003	$20,004.00	15
MOWER - RIDING	RM12	2006	$17,999.00	15
MOWER - RIDING	RM13	2014	$52,426.21	15
MOWER - RIDING	RM14	2014	$52,426.21	15
MOWER - RIDING	RM15	2023	$34,549.17	15
MOWER - ROTARY 80IN PTO	TK1M	1999	$1,570.00	15
MOWER - WALK BEHIND	WM26	-	$6,788.00	15
MOWER - WALK BEHIND	WM20	2004	$7,233.00	15
MOWER - WALK BEHIND	WM37	2004	$7,233.00	15
MOWER - WALK BEHIND	WM38	2004	$7,233.00	15
MOWER - WALK BEHIND	WM17	2006	$1,379.00	15

MOWER - WALK BEHIND	WM48	2012	$399.00	15
MOWER - WALK BEHIND	WM49	2012	$399.00	15
MOWER - WALK BEHIND	WM50	2012	$399.00	15
MOWER - WALK BEHIND	WM51	2015	$6,788.00	15
MOWER - WALK BEHIND	WM52	2015	$6,788.00	15
MOWER - WALK BEHIND	WM53	2015	$7,233.00	15
MOWER - WALK BEHIND	WM54	2015	$7,233.00	15
MOWER - WALK BEHIND	WM55	2019	$6,788.00	15
MOWER - WALK BEHIND	WM56	2019	$6,788.00	15
MOWER - WALK BEHIND	WM57	2019	$6,788.00	15
MOWER - WALK BEHIND	WM58	2019	$6,788.00	15
MOWER - WALK BEHIND	WM59	2019	$6,788.00	15
MOWER - WALK BEHIND	WM60	2019	$7,233.00	15
MOWER - WALK BEHIND	WM61	2019	$4,650.00	15
MOWER - WALK BEHIND	WM62	2019	$4,650.00	15
MOWER - WALK BEHIND	WM63	2019	$7,233.00	15
NOTCHER - CORNER 6" X 6"X 14 GAUGE	TL-DSHBS0619	1990	$10,995.00	30
NOTCHER - CORNER 6" X 6"X 14 GAUGE	TL-DSHBS0616	1993	$5,086.30	30
OVEN HEAT TREAT	TL-DSHUS0374	1989	$14,836.00	40
OVEN PARTS CLEANING	TL-DSHUS0243	1989	$6,214.00	40
PAINT GUN CLEANING STATION	TL-DSHBS0627	2011	$8,695.00	10
PARTS WASHER	TL-DSHUS0384	1989	$57,013.12	35
PLASMA ARC- 5` X 10` CNC CUTTING TABLE- W/HYPERTHERM CONTROLLER AND POWERMAX TORCH	TL-DSHBS0211	2007	$49,510.00	15
POST POWER FLOOR PULL SYSTEM 15 TON	TL-DSHBS0628	2010	$5,362.67	12
POST POWER FLOOR PULL SYSTEM 15 TON	TL-DSHBS0629	2010	$5,362.67	12
POST POWER FLOOR PULL SYSTEM 15 TON W/HIGH PULL EXTENSION	TL-DSHBS0630	1977	$2,426.61	20
POST POWER FLOOR PULL SYSTEM 15 TON W/HIGH PULL EXTENSION	TL-DSHBS0631	1991	$10,401.72	20
POST POWER FLOOR PULL SYSTEM 50 TON	TL-DSHBS0749	1991	$17,805.00	20
POST POWER FLOOR PULL SYSTEM 50 TON	TL-DSHBS0750	1991	$17,805.00	20
POST POWER FLOOR PULL SYSTEM 50 TON W/HIGH PULL EXTENSION	TL-DSHBS0751	1991	$17,805.00	20
POWER BROOM	PB13	2013	$1,877.65	15
POWER BROOM	PB14	2013	$1,877.65	15
POWER BROOM	PB15	2013	$1,877.65	15

POWER BROOM-MOWER	PB17	2023	$20,008.89	15
POWER BROOM-MOWER	PB18	2023	$20,008.89	15
POWER RAKE-SEEDER	PR-1	2008	$2,125.99	15
PRESS - 100TON H FRAME W 48", D 22". 18" STROKE	TL-DSHBS0726	1989	$12,349.98	30
PRESS - 100TON H FRAME W 48", D 22". 18" STROKE	TL-DSHUS0247	1989	$12,349.98	40
PRESS ARBOR 25 TON	TL-DSHUS0227	1989	$6,233.32	40
PRESS ARBOR 25 TON	TL-DSHUS0245	1989	$6,833.07	40
PRESS ARBOR 25 TON	TL-DSHUS0254	1989	$6,833.07	40
PRESS ARBOR 25 TON	TL-DSHUS0255	1989	$6,833.07	40
PRESS ARBOR 25 TON	TL-DSHUS0256	1989	$6,833.07	40
PRESS ARBOR 25 TON	TL-DSHUS0260	1989	$6,833.07	40
PRESSURE WASHER	PW01	2005	$5,650.00	15
PRESSURE WASHER HOT WATER HIGH PRESS	TL-DSHUS0392	2013	$16,880.00	12
PRESSURE WASHER HOT WATER HIGH PRESS	TL-DSHUS0393	2013	$16,880.00	12
PRESSURE WASHER HOT WATER HIGH PRESS	TL-DSHUS0389	2023	$9,618.67	12
RIVITER BRAKE LINING	TL-DSHUS0388	1999	$37,136.67	30
ROTOTILLER	ROT02	2001	$1,019.99	15
SAW BAND - VERTICAL CONTOUR 36" THROAT W/BLADE WELDER	TL-DSHBS0728	1976	$27,000.00	30
SAW BAND- HORIZONTAL 9" X 16"	TL-DSHBS0734	1989	$11,295.00	15
SCARIFIER - STRIPER	LM09	2015	$14,744.90	15
SCRUBBER - RIDING 32"	SC41	2015	$23,367.18	15
SCRUBBER - RIDING 48"	SC34	2008	$62,644.94	15
SCRUBBER - RIDING 72" TRACTOR MOUNT	SC17	1992	$140,690.59	15
SCRUBBER - RIDING 72" TRACTOR MOUNT	SC27	1999	$135,782.93	15
SCRUBBER - SWEEPER - RIDING 60"	SC19	1995	$140,690.59	15
SCRUBBER - WALK BEHIND	SC25	1997	$140,690.59	15
SCRUBBER - WALK BEHIND 26"	SC18	1993	$140,690.59	12
SCRUBBER - WALK BEHIND 26"	SC29	2003	$9,806.60	12
SCRUBBER - WALK BEHIND 26"	SC30	2003	$9,806.60	12
SCRUBBER - WALK BEHIND 26"	SC31	2003	$9,806.60	12
SCRUBBER - WALK BEHIND 26"	SC32	2003	$9,806.60	12
SCRUBBER - WALK BEHIND 27"	SC36	2008	$10,104.73	12

SCRUBBER - WALK BEHIND 30"	SC35	2008	$10,286.64	12
SCRUBBER - WALK BEHIND 33"	SC42	2019	$14,485.45	12
SCRUBBER - WALK BEHIND 33"	SC43	2019	$14,485.45	12
SCRUBBER - WALK BEHIND 34"	SC33	2006	$14,587.70	12
SCRUBBER - WALK BEHIND 34"	SC37	2011	$14,975.76	12
SHEAR - 10FT, 11 GAUGE MAX MILD STEEL HYD RAM, W/CNC BACK GAUGE AND 8` SQUARING ARM	TL-DSHBS0872	1989	$30,599.00	25
SHEAR- 6FT- HYD LEVER ACTION- .375 MILD STEEL MAX W/36 INCH CNC BACK GAUGE	TL-DSHBS0871	1989	$28,876.50	25
SKIDSTEER	TK13	1994	$56,035.68	15
SKIDSTEER	TK26	2003	$77,269.42	15
SKIDSTEER	TK31	2003	$64,755.18	15
SKIDSTEER	TK40	2007	$29,375.93	15
SKIDSTEER	TK46	2019	$55,804.06	15
SNOWBLOWER	SB26	-	$899.00	15
SNOWBLOWER	SB27	-	$899.00	15
SNOWBLOWER	SB3	-	$899.00	15
SNOWBLOWER	SB32	-	$899.00	15
SNOWBLOWER	SB38	-	$899.00	15
SNOWBLOWER	SB34	1997	$899.00	15
SNOWBLOWER	SB36	2001	$899.00	15
SNOWBLOWER	SB37	2001	$899.00	15
SNOWBLOWER	SB39	2001	$899.00	15
SNOWBLOWER	SB44	2003	$899.00	15
SNOWBLOWER	SB46	2003	$899.00	15
SNOWBLOWER	SB47	2003	$899.00	15
SNOWBLOWER	SB48	2003	$899.00	15
SNOWBLOWER	SB49	2004	$3,299.00	15
SNOWBLOWER	SB50	2004	$899.00	15
SNOWBLOWER	SB51	2019	$899.00	15
SNOWBLOWER	SB52	2019	$899.00	15
SNOWBLOWER	SB53	2019	$899.00	15
SOLVENT SAVER RECYCLER	TL-DSHBS0632	2003	$7,826.00	15
STEELABRATOR MAGNUM	TL-DSHUS0387	1998	$16,550.00	30

SURFACER PRECISION GRINDER (HEAD/BLOCK SURFACING)	TL-DSHUS0363	1989	$22,748.00	35
SWEEPER - FULL SIZE STREET	SW14	2002	$180,454.47	15
SWEEPER - FULL SIZE STREET	SW15	2002	$293,053.06	15
SWEEPER - FULL SIZE STREET	SW17	2010	$131,316.37	15
SWEEPER - PARKING LOT	SW07	1990	$67,368.65	15
SWEEPER - PARKING LOT W/CAB	SW16	2002	$71,885.27	15
SWEEPER - WALK BEHIND	SW13	2001	$9,956.81	15
TANK RADIATOR HOT	TL-DSHUS0399	2007	$12,500.00	20
TANK RADIATOR TESTING W/282 HEAVY DUTY FLEX LIFT	TL-DSHUS0398	2012	$8,485.00	20
TANK SPRAYER	TS1	1986	$4,800.00	15
TANK SPRAYER	TS2	2001	$3,899.99	15
TANK SPRAYER	TS3	2005	$2,243.77	15
TANK SPRAYER	TS4	2005	$2,243.77	15
TANK SPRAYER	TS5	2005	$2,243.77	15
TANK SPRAYER	TS6	2005	$2,243.77	15
TANK SPRAYER	TS7	2005	$2,243.77	15
TANK SPRAYER	TS8	2005	$2,243.77	15
TANK SPRAYER	TS9	2005	$2,243.77	15
TESTER FUEL NOZZLE - CUSTOM MADE FOR RTD	TL-DSHUS0382	1995	$8,560.00	35
TESTER STARTER	TL-DSHUS0391	1989	$6,569.15	35
TOOLCAT WORK MACHINE	TK41	2007	$88,152.59	15
TOOLCAT WORK MACHINE	TK47	2019	$82,343.78	15
TOOLCAT WORK MACHINE	TK48	2019	$82,343.78	15
TRACK MAINT - BALLAST CAR	TM02	2015	$178,234.38	30
TRACK MAINT - TRAILER GONDOLA	TM04	2017	$67,980.08	15
TRACTOR - LANDSCAPE	TK32	1984	$16,147.00	15
TRACTOR - LANDSCAPE	TK9	1990	$119,993.24	15
TRACTOR - LANDSCAPE	TK30	2001	$99,645.09	15
TRACTOR - LANDSCAPE	TK44	2018	$38,610.03	15
TRACTOR - LANDSCAPE	TK45	2018	$38,610.03	15
TRACTOR MOWER - WALK BEHIND	TK11	-	$13,937.56	15
TRACTOR MOWER - WALK BEHIND	TK19	1996	$13,137.12	15
TRAILER	TR6	1978	$11,978.00	15
TRAILER	TR25	2002	$21,611.69	15

TRAILER	TR28	2005	$25,811.08	15
TRAILER	TR30	2007	$3,578.00	15
TRAILER	TR33	2007	$25,926.77	15
TRAILER	TR34	2008	$5,599.99	15
TRAILER	TR35	2008	$9,106.56	15
TRAILER	TR47	2014	$7,811.84	15
TRAILER COMMAND CENTER	TR51	2018	$44,400.03	15
TRAILER DUMP	TR55	2018	$8,659.97	15
TRAILER FLOODLIGHT WITH GENERATOR	TR40	2008	$15,937.88	15
TRAILER FLOODLIGHT WITH GENERATORI	TR39	2008	$15,937.88	15
TRAILER LANDSCAPE	TR56	2019	$14,399.09	15
TRAILER LANDSCAPE	TR57	2019	$14,399.09	15
TRAILER LANDSCAPE	TR58	2019	$14,399.09	15
TRAILER LR DEMO	TR10	1988	$5,599.99	15
TRAILER SEWER JETTER	SJ01	2000	$8,495.07	15
TRAILER TILTBED 20`	TR52	2018	$8,144.08	15
TRAILER TILTBED 20`	TR53	2018	$8,144.08	15
TRAILER TILTBED 20`	TR54	2018	$8,144.08	15
TRAILER TILTBED 20`	TR59	2019	$11,839.35	15
TRAILER TILTBED 20`	TR60	2019	$11,839.35	15
TRAILER UTILITY	TR41	2011	$24,659.21	15
TRAILER UTILITY	TR42	2011	$24,659.21	15
TRAILER UTILITY	TR43	2011	$24,659.21	15
TRAILER UTILITY	TR44	2012	$31,273.50	15
TRAILER W/AIR COMPRESSOR	CM5	1994	$28,751.37	15
TRAILER W/AIR COMPRESSOR	CM6	2000	$26,468.78	15
TRAILER W/LIGHT PLANT	TR26	2002	$14,707.98	15
TRANSMISSION DYNANOMETER ECOLIFE INTERFACE	TL-DSHUS0362	2019	$6,487.20	10
TRANSMISSION DYNO CONSOLE ALLISON (545 SERIES)	TL-DSHUS0361	2000	$14,817.20	25
TRANSMISSION DYNO CONSOLE ALLISON (B500)	TL-DSHUS0395	2019	$15,360.00	10
TRANSMISSION DYNO CONTROLLER INTERFACE SYSTEM	TL-DSHUS0229	2013	$18,835.50	15
TRANSMISSION DYNO ZF CONSOLE (EARLY ZF`S)	TL-DSHUS0396	1999	$14,445.30	25
TRANSMISSION DYNOMETER	TL-DSHUS0397	2003	$269,524.00	25

TUG	TU100	1979	$44,974.57	15
TUG	TU6	1989	$64,100.64	15
TUG	TU7	2000	$90,014.42	15
TUG	TU8	2000	$90,014.42	15
TUG	TU9	2000	$90,014.42	15
VALVE GRINDER	TL-DSHUS0376	1989	$5,000.00	15
VALVE GRINDER	TL-DSHUS0377	2012	$7,535.00	15
VALVE SEAT MACHINE	TL-DSHUS0378	1989	$13,806.90	30
VALVE SEAT MACHINE	TL-DSHUS0379	1997	$37,411.00	30
VENT SYSTEM RADIATOR HOT TANK VENTILATION	TL-DSHUS0400	1999	$13,853.74	30
WATER JET - 1530 MAXIEM BY OMAX SYSTEM, W/PUMP, COMPUTER, TERRAIN FOLLOWING & SOLIDS RECOVERY	TL-DSHBS0875	2019	$160,000.00	15
WELDER TIG - 400 AMP SYNCROWAVE	TL-DSHBS0876	2007	$9,954.00	15
WELDER TIG - 400 AMP SYNCROWAVE	TL-DSHBS0166	2007	$5,650.00	15
WELDER TIG - 400 AMP SYNCROWAVE W/RADIATOR-1 COOLING SYSTEM	TL-DSHBS0157	1989	$3,272.00	15
WELDER TIG - 400 AMP SYNCROWAVE W/RADIATOR-1 COOLING SYSTEM	TL-DSHBS0163	1989	$3,272.00	15

Appendix G: References

AMCL. (2017). *ISO 55001 Gap Assessment Report and Roadmap.* New York: AMCL.

BSI. (2014, March 31). *BSI ISO 55000 Series.* London: The British Standards Institution.

Colorado State Demography Office. (2019). *Population Totals for Colorado and Sub-State Regions*. Retrieved September 13, 2019, from Colorado State Demography Office: https://demography.dola.colorado.gov/population/population-totals-colorado-substate/#population-totals-for-colorado-and-sub-state-regions

Genova, D. A. (2017, July 11). Proposed Core and Task Goals for 2018. Denver, CO: Regional Transportation District.

Johnson, C., Lloyd, C., & Johnson and Lloyd. (2012). Organisational Culture And Leadership: Lessons for Asset Management. *IET and IAM Asset Management Conference 2012.* IET.

Regional Transportation District. (2016). *Board of Directors Report.* Denver, CO: Regional Transportation District. Retrieved from http://www.rtd-denver.com/documents/financialreports/strategic-budget-plan-2017-2022.pdf

Regional Transportation District. (2016). *Building Inspection Procedures.* Denver, CO: Regional Transportation District.

Regional Transportation District. (2016). *Conveyance Scoring Procedure.* Denver, CO: Regional Transportation District.

Regional Transportation District. (2016). *SGR Bridges and Tunnels Inspection Procedure.* Denver, CO: Regional Transportation District.

Regional Transportation District. (2017). *2018 Recommended Budget.* Denver, CO: Regional Transportation District. Retrieved from http://www.rtd-denver.com/documents/financialreports/rtd-approved-budget-2018.pdf

Regional Transportation District. (2017). *Asset Management Annual Report.* Denver, CO: Regional Transportation District.

Regional Transportation District. (2017). *Public Facilities Inspection Procedure.* Denver, CO: Regional Transportation District.

Regional Transportation District. (2017). *Rail Infrastructure Inspection Procedure.* Denver, CO: Regional Transportation District.

Regional Transportation District. (2020). *2021 Requested Budget Update.* Denver, CO: Regional Transportation District.

Regional Transportation District. (2021). *5-Year Strategic Plan.* Denver: Regional Transportation District.

Regional Transportation District. (2021, April 29). *Strategic Asset Management Plan.* Denver, cO: Regional Transportation District. Retrieved from thehub.rtd-denver.com: https://thehub.rtd-denver.com/sites/SSF/AM/Asset%20Management%20System%20Documentation/Strategic%20Asset%20Management%20Plan%20(SAMP).pdf

Regional Transportation District. (2022). *Adoption of the 2022-2027 Mid-Term Financial Plan.* Denver, CO: Regional Transportation District. Retrieved from http://www.rtd-denver.com/documents/financialreports/RTD-2018-proposed-amended-budget.pdf

Regional Transportation District. (2023). *Comprehensive Annual Financial Report.* Denver, CO: Regional Transportation District.

The Institute of Asset Management. (2015). *Asset Management: An Anatomy.* Bristol, United Kingdom: The Institute of Asset Management.

U.S. Department of Transportation. (2000). *2000 Table 28: Transit Operating Statistics: Service Supplied and Consumed: Details by Transit Agency*. Retrieved 9 13, 2019, from Federal Transit Administration: https://www.transit.dot.gov/ntd/data-product/2000-table-28-transit-operating-statistics-service-supplied-and-consumed-details

U.S. Department of Transportation. (2013, October 3). *49 CFR Chapter VI.* Washington, D.C.: U.S. Department of Transportation.

U.S. Department of Transportation. (2016). *49 CFR Parts 625 and 630.* Washington, D.C.: U.S. Department of Transportation.

U.S. Department of Transportation. (2016). *Default Useful Life Benchmark (ULB) Cheat Sheet.* Washington, D.C.: U.S. Department of Transportation.

U.S. Department of Transportation. (2017). *TAM Infrastructure Performance Measure Reporting Guidebook: Performance Restriction (Slow Zone) Caclculation.* Washington, D.C.: U.S. Department of Transportation.

U.S. Department of Transportation. (2018). *TAM Facility Performance Measure Reporting Guidebook: Condition Assessment Calculation.* Washington, D.C.: U.S. Department of Transportation.