C.9. Intelligent Transportation Systems Technical Plan

C.9.1. Introduction

The Intelligent Transportation System (ITS) Branch is part of Colorado Department of Transportation's (CDOT) Division of Maintenance and Operations. The CDOT ITS Branch plans, designs, constructs, deploys, operates, and maintains ITS systems and assets that provide operating improvements to Colorado's statewide multimodal transportation system. ITS applications provide travel information to the public by a variety of methods, an overview of which can be found in the ITS Program Fact Sheet within the most recent Budget Allocation Plan.

There are nearly 3,000 ITS devices installed on the roadway, as well as 1,200 ITS network devices installed in the CDOT Node Buildings and other facilities included in the ITS asset management program. ITS also operates and manages 1,600 miles of fiber optic cable statewide. These assets are used to assist in operation and traveler decision-making and maintain the flow of traffic on Colorado's highways.

The ITS Program operates statewide, and CDOT Regions are responsible for communicating needs for maintaining or acquiring new ITS assets on an annual basis. Lists of regional needs are compared against asset conditions of devices requested for replacement—including age, software/hardware considerations, down time, past maintenance costs, regulatory requirements, etc. ITS projects are often grouped by geographic area. The ITS inventory goes through CDOT's Asset Investment Management System (AIMS) which predicts the long-term performance of each asset given various budget scenarios.

The main sources of funding for the ITS Asset Management Program are the State Highway Fund and federal reimbursement for eligible expenditures. Asset Management funds support the operation of ITS such as salaries, fiber location, power source costs, and communications costs. In recent years, ITS has seen an increase in budget allocations from $14.4 million in 2015-16, to $17.6 million in 2016-17, and $25.6 million in 2017-18.

C.9.2. Regulatory Considerations

C.9.2.1. Regulations/Resolutions

The following list provides an overview of relevant federal and state regulations and requirements governing planning, policy, data, performance, funding, and project selection of surface treatment projects.

- Colorado Revised Statutes (CRS) 43-1-106 (8) (h), and 43-10-109
- CDOT Connected and Autonomous Technology (CAT) Program Mission Statement

C.9.3. Asset Inventory & Condition

C.9.3.1. Asset Inventory

There are currently 2,938 ITS devices installed on the roadways, as well as 1,237 ITS network devices installed in the CDOT Node Buildings and other facilities included in the ITS asset management program. ITS also operates and manages 1,600 miles of fiber optic cable statewide. All of this equipment is used to assist in decision-making and maintaining the flow of traffic on Colorado's highways.

Regularly updated ITS inventory summaries are provided by the Performance and Asset Management Branch and may be viewed here. For example, an inventory of CDOT's ITS devices can be found in CDOT's Risk-Based Asset Management. Custom queries and reporting requests can be made through the Performance and Asset Management Branch.

C.9.4. Asset Conditions

CDOT uses "useful life" to communicate the condition of ITS assets. Useful life, which is specific to each device type, is defined as the length of time that a device is expected to provide CDOT with adequate data and information needed to keep up with CDOT's goals for the traveling public. A value of 100 percent indicates that a piece of equipment has reached its useful life. Values greater than 100 percent indicate that equipment has exceeded its useful life. Useful life is explained further in CDOT's Risk-Based Asset Management.

Other important ITS data items are also considered which provide greater granularity regarding prioritization of asset management decisions and device condition. These include device functionality and device availability. Device functionality is defined by the ITS Branch as the primary purpose of the device and includes five functionality categories—regulatory, safety, mobility, data support, and system support.

C.9.5. Performance

C.9.5.1. Metrics

The objective of the ITS Program is to develop statewide policies, procedures, and guidelines on design, maintenance, life-cycle asset management, integration, and operation of traffic signal and ramp meters; manage various statewide funding programs and pools; and facilitate informed decision making on project prioritization. The Program is focused on implementing new and innovative technology, including Connected Vehicle/Autonomous Vehicle applications, deploying and integrating statewide ITS systems, incorporating automated performance measures, and extending technical resources to CDOT Regions in the areas of traffic signal and ramp metering.

C.9.5.2. Targets

ITS has identified the target for device capital replacement as 90 percent of device useful life, which is calculated by dividing the device age by the device life cycle. ITS has been discussing possibly using this condition but has not defined what that represents at this time and believes

that additional device maintenance historical information is also needed as a basis to develop a data-driven condition reporting system.

C.9.6. Funding

C.9.6.1. Funding Mechanisms

The main sources of funding for the ITS Asset Management Program are the State Highway Fund and federal reimbursement for eligible expenditures. Asset Management funds support the operation of ITS such as salaries, fiber location, power source costs, and communications costs. Recent ITS budgets and estimates are summarized in Table 4.

Table 4. ITS Asset Management Program Allocations (millions)

Actual FY 2016-17	Actual FY 2017-18	Budget FY 2018-19	Proposed FY 2019-20
$17.6	$25.6	$25.6	$23.5

C.9.6.2. Region Pool Distributions (4-Year Forecast)

The ITS Program is a statewide program and therefore is not a regional delegation. ITS projects are often grouped by geographic area.

C.9.7. Investment Strategies

The application of ITS investment strategies is ensured through the use AIMS which predicts the long-term performance of each asset given various budget scenarios.

C.9.8. Lifecycle Management & Project Selection

C.9.8.1. Lifecyle Management

CDOT assesses device functionality along with age, life cycle, and availability to prioritize maintenance and capital replacement activities. Device availability is defined as the time the device was inoperable or the difference between the time when the device stopped operating and the time the device was repaired. This allows CDOT to determine percent of availability at a device level, device category level, corridor, and other geographic area and statewide system level.

ITS tracks its device life cycle through the inventorying of unique device acquisition/ instillation date, manufacturer's expected life cycle, maintenance costs, and instances of device failure. However, although life cycle is an extremely important indicator as it pertains to ITS asset management, developing an adequate life cycle analysis can be challenging. CDOT also considers the Federal Highway Administration's (FHWA) lists of device life cycles. FHWA conducts state surveys and compiles the results to develop their own device life cycle lists.

Technology gradually becomes obsolete due to changes in CDOT technology requirements. Unlike other firm assets, which are expected to be viable throughout their entire life cycle, ITS technology can quickly lack necessary coverage or interoperability needed. In this case, much of

the deterioration of ITS infrastructure is evaluated on both its physical side as well as its continued viability.

C.9.9. Treatment Lists

The ITS Program is a statewide program and there is not a regional delegation. Each year requests are sought from CDOT Regions regarding their needs for maintaining devices or acquiring new devices. This list received is compared against condition of a device requested for replacement, including age, software/hardware considerations, down time, past maintenance costs, regulatory requirements, etc. For new device requests, traffic issues and potential results are considered by implementing the device requested. Finally, selecting equipment or a regional request is considered with regard to project cost, available funds, need, and likely benefits.

Other considerations used in selecting ITS projects or strategies include federal guidelines such as MAP 21; and CDOT policies and changing objectives.

CDOT is not always the initial installing party for an ITS device. Through devolution, CDOT has come into possession of the many ITS devices, such as fiber optic cabling, that were laid by local or regional agencies or even third-party organizations. Often, needed information, such as the installation date, is missing from the device record. CDOT has overcome this challenge by using the first device inventory as the installation date for life cycle purposes.

C.9.9.1. Regions

C.9.10. Region and Local Partner Roles

Local partners are responsible for off-system assets and may be contracted by CDOT for maintenance. Local partners may install new ITS infrastructure that will become CDOT assets through devolution. With Headquarters assistance, Regions develop ITS architecture plans which blend statewide standards and goals with regional and local needs and knowledge.

C.9.11. Headquarters Roles

The ITS Program is responsible for all aspects of the system from planning, engineering, construction, and maintenance for CDOT-owned assets. The Program also takes over asset management responsibilities when ITS infrastructure is devolved from local jurisdiction to CDOT.

C.9.12. Reporting, Management, & Documentation

C.9.12.1. Reporting to Internal and External Stakeholders

Reporting of needs and long-range direction is achieved through statewide and regional ITS architecture plans. The documents describe regional ITS elements, their relationship to each other, the roles and responsibilities of stakeholders, and a systematic approach for implementation of intelligent transportation systems in the region over a 20-year timeframe.

Inventory and condition reporting are provided by the Performance and Asset Management Branch and may be viewed here. Inquires and reporting requests can be made through the Branch.

C.9.12.2. Management / Advisory Committees

The ITS Program works collaboratively with CDOT Regions, FHWA, metropolitan planning organizations, local agencies, and other stakeholders to develop and implement policies, standards, and operational procedures for traffic signals and ramp meters.