SECTION 2 – OPERATIONS PLAN

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2.1.0 GENERAL

RTD's objective is to operate all LRT and bus routes safely, reliably and efficiently and to integrate LRT operations with bus service for the greatest convenience to the public. The LRT system is a means by which the integration of transportation services will assist the region in meeting clean air standards, alleviating traffic congestion and improving the overall quality of life in the area.

The LRT system has been designed to address transportation needs of the public in the Denver metropolitan area. The most recent addition to the LRT system is the Central Platte Valley Light Rail Spur (CPV LRT Spur), a 1.8 mile long light rail segment that provides an alternative route into downtown Denver and also provides direct light rail access through the rapidly growing Central Platte Valley and to downtown Denver. This segment opened in April 2002 and is a welcome addition to the Central Corridor and Southwest Corridor that opened in 1994 and 2000, respectively. Due to the complexities of a growing system, RTD introduced a letter and color designation for easier customer recognition. Currently the C Line (Orange) operates between Mineral Station and Denver Union Station. The D Line (Green) operates between Mineral Station and 30th/Downing Station with alternate weekday peak hour trips turning in downtown Denver on 19th St. Both lines operate on common track between Mineral Station and the Junction near Colfax Avenue. The C Line swings to the West and serves the Auraria Administration Building, Invesco Field at Mile High football stadium, Pepsi Center/Six Flags Elitch Gardens with the terminus at Denver Union Terminal in Lower Downtown Denver serving many thousands of sports and entertainment spectators attending events at Invesco Field, Pepsi Center, and Coors Field. The D Line turns easterly at the Junction and northeasterly into central Downtown, and serves the Auraria Campus at the Colfax at Auraria Station, the Performing Arts Center and new Colorado Convention Center before bisecting downtown by running along California Street northbound, and Stout St. southbound conveniently serving the large employment population in Central Downtown and the Welton St. community.

The Southeast Corridor (T-REX) is a 19 mile long extension of light rail originating at I-25/ Broadway Station and extending south along I-25 to Lincoln Avenue in northern Douglas County, with a spur on I-225 connecting from the light rail on I-25 to Parker Road. T-REX also includes highway and access improvements. This corridor has been in Final Design and under construction since 2001. In December 2006, T-REX will realize its final major milestone when Southeast Corridor Light Rail opens to the public. The new line will expand RTD's existing light rail system and extend light rail service along the southeast corridor of I-25 and I-225. An extensive bus feeder system will make it easy for people to get to and from the 13 new light rail stations. Bridges and underpasses will provide pedestrian access to several of the stations.

2.2.0 MAINLINE

The LRT is a conventional light rail transit system extending from 30th Avenue and Downing Street and Denver Union Station from the north to Littleton/Mineral Station on the south. Operations through downtown Denver are contra-flow relative to normal traffic, with trains heading northeasterly on California Street and southwesterly on Stout Street. The LRT provides direct connections between the light rail stations and Arapahoe Community College, Downtown Littleton, Englewood Civic Center, Broadway Marketplace, Auraria Campus, Colorado Convention Center, the 16th Street Mall, (Market Street Station and Civic Center Station), Five Points, the Auraria Administration Building, the Invesco Field at Mile High football stadium, Pepsi Center/Six Flags Elitch Gardens with the terminus at Denver Union Terminal in Lower Downtown Denver serving many thousands of sports and entertainment spectators attending events at Invesco Field, Pepsi Center, Coors Field, and many major hotels and businesses in between. The addition of T-REX in 2006 introduces rail service to University of Denver students and faculty, thousands of employees at the Denver Tech Center, Greenwood Plaza Office Park, Inverness, and Meridian Office Parks, the Ritchie Center at DU, the Coors Events Center (formerly Fiddler's Green), Park Meadows Mall and the Colorado Center.

The Design Engineer shall coordinate with RTD specific requirements for future corridors which include pocket track, tail track, end of line geometries, maximum speed, consists, minimum headway and cross over locations.

2.3.0 LRT STATIONS

As part of the initial LRT Central Corridor project, 14 passenger stations were constructed along the 5.3 mile corridor. A new station was added at 27th and Welton in late 1995. With the construction of the Southwest Corridor, an 8.7 mile extension to the Central Corridor, 5 new stations were added to the alignment in July 2000. The 1.8 mile Central Platte Valley extension, which opened in 2002, added 4 stations. All station platforms are unattended and utilize automated fare machines for ticket sales and ticket validation. This self-service proof of payment system is monitored by Fare Inspectors. Platform security is provided by Light Rail Transportation Supervisors and local jurisdictional Police Departments, as part of their normal duties. A private contract security service also rides the trains and patrols all stations and park and rides. When T-REX opens in 2006, 19 miles of LRT will be added and 13 more stations will be added at Louisiana, University, Colorado, Yale, Southmoor, Belleview, Orchard, Arapahoe, Dry Creek, County Line, Lincoln, Dayton and Nine-Mile and all, but Louisiana Station, will have new or expanded park-n-rides providing 6,000 parking spaces along the corridor.

2.4.0 LRV FLEET

Presently, RTD has a fleet of light rail vehicles (LRV) to service the Central, Southwest, and Central Platte Valley Corridors. Additional vehicles will be delivered by March 2006 for use on the Southeast Corridor. The LRV has 6-axles, is single-articulated, double-ended, and bi-directional. They are approximately 80 feet in length, 8 feet 9 inches in width, 13 feet high and weigh approximately forty (40) tons. These vehicles operate on a standard railroad track gauge of 4 feet 8 1/2 inches. They are powered from an overhead wire by

750VDC (nominal) direct current and capable of speeds up to 55 mph. Each vehicle can seat 64 passengers and will accommodate up to an additional 61 standing passengers at normal loads. Additional standees may be accommodated at a crush load capacity.

2.4.1 Operations

LRVs on the RTD alignment are operated manually. Automatic block wayside signals, traffic signals, radio communication, operational procedures and train orders govern operators regarding all movements of the vehicles. Appropriate street traffic signals, speed limit signage and wayside signals assist the operator in selecting proper movement sequence and speeds. Powered switches are operated by operators via carborne equipment. All city street operations are by line of sight. City street crossings coordinate adjacent street intersection traffic signals. High speed crossings are protected using gate crossings with flashers and warning bells. Medians have also been installed at crossings to prevent traffic from driving around active gates. Gated crossings shall be monitored and recorded by video equipment. Multiple crossings are jointly used and maintained by the Union Pacific Railroad and RTD.

2.4.2 Transit Integration

The system is operated by (RTD) as part of a fully integrated mass transit system which includes local bus routes, express bus routes, regional routes, shuttle bus routes and demand-response service for passengers with disabilities. RTD provides transit services to one of the largest geographical districts in the United States. RTD has a service area of approximately 2,400 square miles and serves the City and County of Denver and Broomfield, and all or portions of Adams, Arapahoe, Boulder, Jefferson and Douglas counties. RTD serves 38 municipalities within those 7 counties and operates 176 total fixed bus routes and 11 call-n-Rides. The service area population is 2.5 million. In 2003 the RTD fleet logged over 3 million hours of service with total annual boardings (including the Sixteenth Street Mall Shuttle, Light Rail and Access-a-Ride) of over 78.9 million. The size of the service area, population density, the nature of the roadway system and the development of suburban activity centers, has led to the creation of a system with a wide range of service types intended to most effectively serve this large and diverse region.

2.5.0 HOURS OF SERVICE

The LRT system operates in revenue service from approximately 3:30 a.m. to 2:15 a.m. on weekdays. On weekends, a late trip leaves from Union Station at 2:15 a.m. Departure of the first train of the day from the yard is prior to the 3:30 a.m. service start because of the travel time required between the yard and the first passenger station stop. This train will loop the system at reduced speed and will act as a sweep train, ensuring that the alignment is free of obstruction or other problems. The arrival of the last train into the yard

will occur later than the scheduled revenue hours per day due to travel time from the last in-service station to the Light Rail Operations Facility.

2.6.0 SERVICE AND VEHICLE LOAD STANDARDS

Service standards include vehicle loading standards and service frequency, and establish criteria to determine the maximum level of crowding and service frequencies that a passenger would experience on the LRT system. The load standards established for RTD's light rail service are described below:

- Peak periods – 125 passengers per vehicle
- Off-peak periods – 64 passengers per vehicle (seated load)
- Special Events -- 180 passengers per vehicle (crush load)

2.7.0 STATION DWELL TIMES

Train dwell times at each passenger station are estimated to be 20 seconds on average, which allows sufficient time for normal boarding and exiting of passengers. At certain mixed traffic stations in the Denver CBD, additional dwell time is required for both large passenger loading and unloading as well as the need to adhere to the City Traffic Signal System. Adequate layovers at terminals for operators to use the restroom and switch vehicle ends are an essential part of the operating schedules.

2.7.1 City and County of Denver (CCD) Traffic Signals

The desired LRT headways lend themselves to light cycles of 75 seconds and CCD has made the changes to adopt a 75-second light cycle throughout the day and re-timed the lights in general to support the automobile traffic flows and LRT contra-flows on California and Stout Streets.

2.7.2 Other Jurisdiction Signals

The Design Engineer shall coordinate with RTD and other jurisdictions as necessary.

2.8.0 FACILITIES AND EQUIPMENT

These criteria will provide an overview of the facilities and equipment required to operate and maintain RTD's LRT system.

2.9.0 COMMUNICATIONS EQUIPMENT

The key element of the communications system is the Supervisory and Control and Data Acquisition (SCADA) system and the radio. Each LRV operating cab and mobile units will have fixed mobile radios installed. In addition, all Train Operators, Light Rail Supervisors, Shop Supervisors and Maintenance of Way (MOW) employees working in the field will carry portable radios while on duty. Mobile and portable radios will provide two-way voice communications over channels designated for light rail use. The Operations channel will

provide direct two-way communications between Central Control and all train operations personnel. A separate Maintenance channel may be utilized for communications between Maintenance personnel in the course of their activities and for exclusive use by operators/supervisors/maintenance personnel in moving vehicles during abnormal operations (dead car tow, foul weather, etc.) or other situations which may present a safety hazard.

In addition to the radio channel for Light Rail operations, a Bus Operations channel and Supervisors' channel may be utilized by Light Rail Operations for security or coordination with Bus Operations Dispatch whenever required.

Additional communication equipment includes:

- Emergency and public pay telephones are provided on some platforms for passenger use. Telephones will also be used in Central Control for emergency contact of Fire/Police and emergency medical services. Public pay telephones shall not be included on new platforms, but may be located near them. See Section 14 for emergency telephone requirements at new stations.
- Public Address (PA) equipment will be used for announcements on the LRVs, in the yard and the Maintenance shop.
- Automatic Vehicle Locator (AVL) will be utilized on LRVs and other mobile units as required.
- Public Address (PA) systems and variable message signs (VMS) will be utilized on selected platforms.
- Fax Machine: Central Control (located at the Mariposa facility) will utilize fax for receiving and sending information.

2.9.1 SCADA

The SCADA system provides for overall control and monitoring of traction power facilities, signals, station platform CCTV, ticket vending machines intrusion and fault alarms, passenger information systems and security systems. Information and signals for the SCADA system are transmitted through fiber optic cables with communications houses located at various points along the ROW.

2.10.0 TRAIN TO WAYSIDE COMMUNICATIONS SYSTEM

The train-to-wayside communication system will be used for providing routing wherever there are powered switches. The signals and switches on the operator's console provide the operator information regarding the status of the route and the ability to make changes in the switch positions. This is accomplished via street imbedded loops, interrogator equipment and carborne transponders. This enables the operator to make changes in the route quickly and safely thus enabling service schedule adherence in the event of abnormal operations. This same equipment may also be utilized in the build out of a rapid transit system to preempt traffic signals.