Basis of Design Report

D2 – Subway

Systems

Traction Electrification, Signals & Communications

Dallas, Texas
December 9, 2019

This Report was Prepared for DART

General Planning Consultant Six Managed by HDR

Document Revision Record

PE 10% Draft Basis of Design Report	**HDR Report Number:** Click here to enter text.
Project Manager: Tom Shelton	**PIC:** Tom Shelton

Revision Number: A	**Date:** 12/9/2019
Version 1	*Date: Click here to enter text.*
Version 2	*Date: Click here to enter text.*

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Verified/Approved By: Click here to enter text.	**Date:** Click here to enter text.

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1.1 Traction Electrification

1.1.1. TPSS Overview

The Traction Electrification portion of the D2 scope will include Traction Power Substations (TPSS) for the conversion of line voltage supplied by the utility to the proposed nominal operating voltage (845 VDC) of the catenary system. Substations will include all required high-voltage switching, protection apparatus, rectifier-transformers, rectifier assemblies, DC switchgear, positive and negative bus panels, interconnecting bus work, feeders, grounding and bonding systems, control batteries and chargers, local and/or remote controls, and supervision of equipment. Utility feeds will be brought into the TPSS and the AC bus will also distribute power along the alignment for redundancy. Also included are electrical supply supervisory control interfaces required for the supervision and control of power and electro-mechanical equipment vital to the continuous operation of the transit system. This includes both local control systems and remote monitoring and control systems.

1.1.2. Overhead Contact System (OCS) Overview

The OCS plans will be prepared based on the DART D2 Subway Scope of Work, the DART Design Criteria, the DART 20% Design Plans, the DART Standard Drawings and Specifications, and the Overhead Conductor Rail White Paper in order to produce a safe and functioning OCS system. The proposed new D2 double track light rail configuration will extend from the NW-1A alignment south of Victory Station to the SE-1 alignment where the existing Deep Ellum Station resides. The OCS comprises of the following major subsystems: foundations, poles, hardware assemblies and overhead conductors.

1.2 Signals

1.2.1. Signals Overview

The proposed D2 alignment is a connection between Victory Station and the location of the existing Deep Ellum Station. The new double-track system will operate from a new set of turnouts just south of Victory Station, to its Eastern connection to the Green Line located to the south of a newly configured Live Oak Station. The proposed D2 alignment is mostly below-grade with the exception of at-grade running from the connection south of Victory Station to just south of McKinney Avenue where the tracks will ramp downward through a Portal to tunnel construction. The tracks will ramp upward through a Portal to at-grade alignment in the area of Pacific Avenue and continue at-grade through the Deep Ellum Junction connection to the Green Line. See Figure 1 for a map of the proposed alignment.

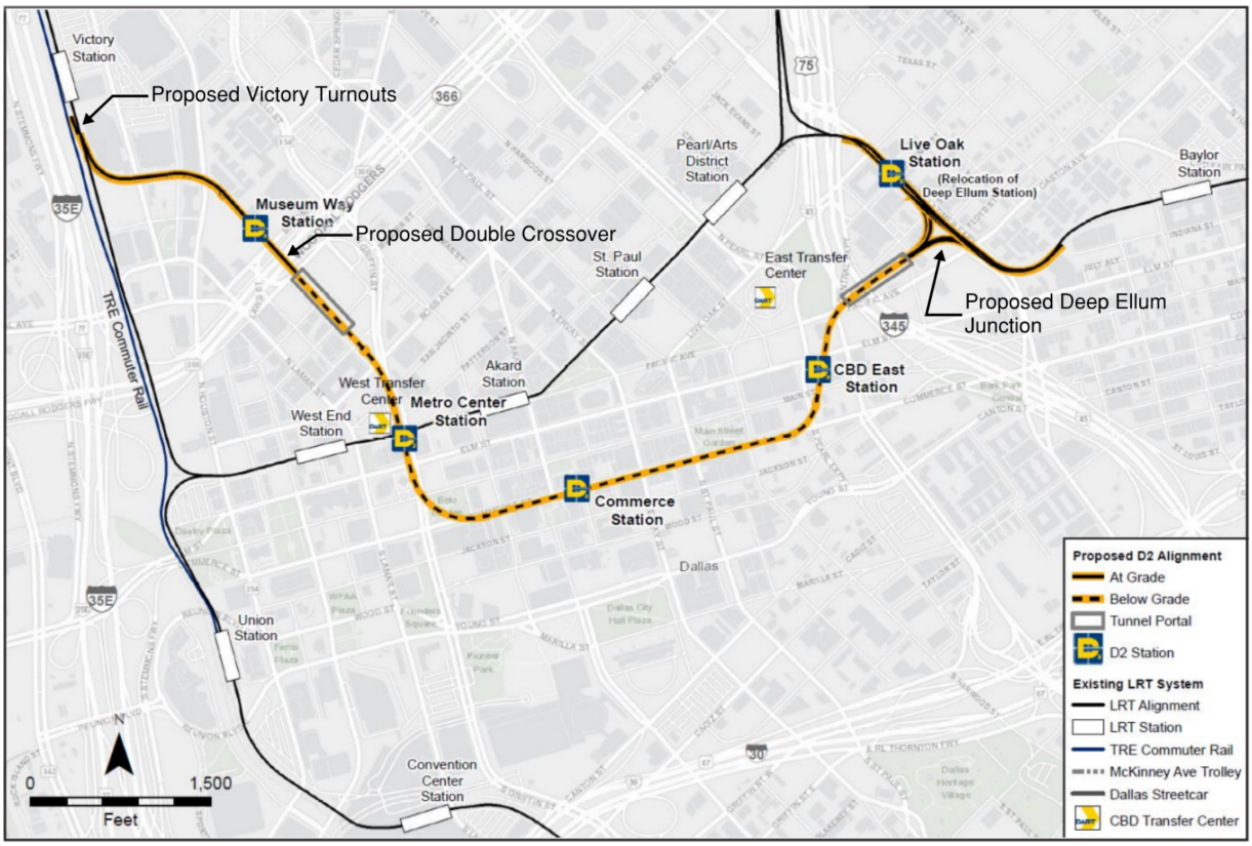

Figure 1: Proposed D2 Alignment

This new D2 line section will be fully signaled and shall have a cab signaling system compatible with the ATP system that is utilized on the existing Green Line. The signaling system shall provide the following functions:

- Interlocking control of switches and signals
- Safe routing of trains
- Safe separation of trains to prevent collisions protected by vital systems

Operationally, the signaling system will have three modes – Automatic, Local and Train Control Center (TCC).

The Automatic Train Control (ATC) system is to be comprised of two major subsystems: Automatic Train Protection (ATP) and Train to Wayside Communication System (TWC).

1.2.1.1 Automatic Train Protection (ATP)

An Automatic Train Protection system to enhance train safety and train operation whereby the interface between the wayside signal equipment and the vehicle's speed control equipment provides assurance for and maintains safe train operation. The Block Design and control lines will support the operational headway and will only allow one train within a ventilation zone as per NFPA 130.

1.2.1.2 Train to Wayside Communication System (TWC)

TWC is a function whereby trains can communicate information between the vehicle equipment and wayside interrogators at appropriate points along the route such as:

- Vehicle identification
- Routing information
- Establish routes
- Cancel routes
- Activate or deactivate Highway Crossing Warning System (HCWS)

1.2.2. Signals Design References, Calculations, and Studies

DART Design Criteria Volume 2: Systems Design

DART Design Criteria Volume 3: Drafting (CADD) Standards Manual

DART Systems Standard Specifications

DART Standard Supplements to Systems Standard Specifications

1.2.3. Signals Industry Standards

American Railway Engineering and Maintenance-of-Way Association (AREMA): “Communications & Signal Manual”, current revision

American Society for Quality (ASQ): ASQ Q9001 - Quality Management Systems - Requirements

Institute of Electrical and Electronics Engineers (IEEE), current edition

ASTM International (Formerly known as American Society for Testing and Materials) (ASTM), current edition

Insulated Cable Engineering Association (ICEA), current edition

National Electrical Manufacturers Association (NEMA), current edition

National Electrical Code (NEC), current edition

NFPA 70, National Electrical Code, current edition

NFPA 70E, Electrical Safety in the Workplace), current edition

NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems, current edition

Underwriters Laboratory (UL), current edition

Texas Manual on Uniform Traffic Control Devices (MUTCD), current edition

Texas Department of Transportation (TXDOT), current edition

American Society of Mechanical Engineers (ASME), current edition

1.2.4. Signals D2 Design Scope

Design, build and install a complete signaling system for the D2 Project starting south of Victory Station platform and ending in a new “WYE”, to be located just to the north of the intersection of N Good Latimer Expressway and Gaston Avenue in the area currently occupied by Deep Ellum Station.

1.2.4.3 Cab Signaling

The Contractor shall provide a cab signaling system that shall be 100% compatible with the Authority's existing ATP signal system. Train operations controlled by this cab signaling system is to include automatic safe train separation in all segments.

The Contractor shall be responsible for coordinating the wayside design of the D2 segment with the existing on board equipment that is currently utilized on DART property. This work shall include, but shall not be limited to, coordinating thorough testing of wayside and on-board vehicle cab signaling equipment.

1.2.4.4 Interlockings

The Contractor shall provide, as part of their design, redundant vital processors configured to operate in a warm stand-by mode for the interlocking control and speed command selection functionality.

The Contractor shall also provide and verify the Block Design for the D2 Project. This will include the sections of new D2 trackage and the entry and exit interfaces to the existing lines where the D2 ties in.

- The Contractor shall provide train starting lights, as specified in the Design Criteria, at the platform(s), where necessary. These indications will inform a train operator that the Train Ready-To-Depart signal was received by TWC and is being executed.
- The CIH's shall be equipped with fire suppression as specified in current editions of NFPA 70 and 130. The actual distance away from the nearest fire hydrants will have to be determined by field survey measurements to provide conformity to NFPA Standards.

1.2.5. Signals Proposals and Resolutions

1.2.5.1 Provision of new Central Instrument Houses (CIH) and Rooms

It is currently anticipated that new D2 CIHs shall be provided near the starting point south of Victory Station platform in the area of the new D2 turnouts which will control the Diamond (Double) crossover in the at-grade segment that passes below the existing Woodall Rogers Freeway, and also in the area of the new Deep Ellum Junction "WYE", to be located just to the north of the intersection of N Good Latimer Expressway and Gaston Avenue. Central Instrument Rooms will be provided within the underground stations as necessary for control and to house AF track circuit equipment. The quantities and locations of these new CIHs and rooms and their Limits of Control are to be determined.

1.2.5.2 Interfaces

Interface with the existing Swiss and Gaston Avenues Grade Crossings shall be modified for both northbound and southbound moves from the new D2 tracks. New Grade Crossing equipment will be included for Victory Avenue, Victory Park Lane, Houston Street and Hawkins Street. Interface with, and upgrades to the Central Office is part of the D2 signal scope. This interface requires early coordination between signals and communication.

Signal power is currently anticipated to be supplied from three new TPSSs. Two are anticipated to be located at-grade adjacent to either end of the new D2 trackage, with the third to be located near the central portion of the D2 tunnel, at a point to be determined, within the tunnel portion of the D2 Project.

1.3 Communications

1.3.1. Communications Overview

The DART communications system will support reliable and safe operations. It provides for voice, data, and video communications between the control center, stations, substations, communications facilities and other facilities located along the D2 alignment. The communications system includes:

- Communication Facilities and Cabinets
- Communications and Fiber Optic Cabling
- Communications Transmission Subsystem (CTS)
- Closed Circuit Television (CCTV) Subsystem
- Telephone Subsystem
- Public Address (PA) and Visual Message Board (VMB) Subsystems
- Supervisory Control and Data Acquisition (SCADA) Subsystem
- Fire Alarm Subsystem
- Intrusion and Access Control Subsystem
- Uninterruptible Power Supply (UPS)
- Power Supplies and Distribution Subsystem
- Communications Rooms and Facilities
- Fare Collection Local Area Network (LAN)
- Underground Radio Subsystem

The comunications design will provide for an integrated design of the above-listed subsystems and will provide for these subsystems to function as an extension of the existing DART Light Rail Communications System.

END OF REPORT