Core Systems RFP Technical Review
HHCTCP

September 1, 2010

Agenda

- Operations & Maintenance (O&M) Concepts and Plan
- Fare Collection Concepts and Plan
- Train Control
- Traction Power
- Passenger Vehicles
- Communications
- Project Interface Systems Integration Management
- Potential MSF Modification
- Verification Testing and Acceptance/Safety & Security

Operations & Maintenance Concepts and Plan

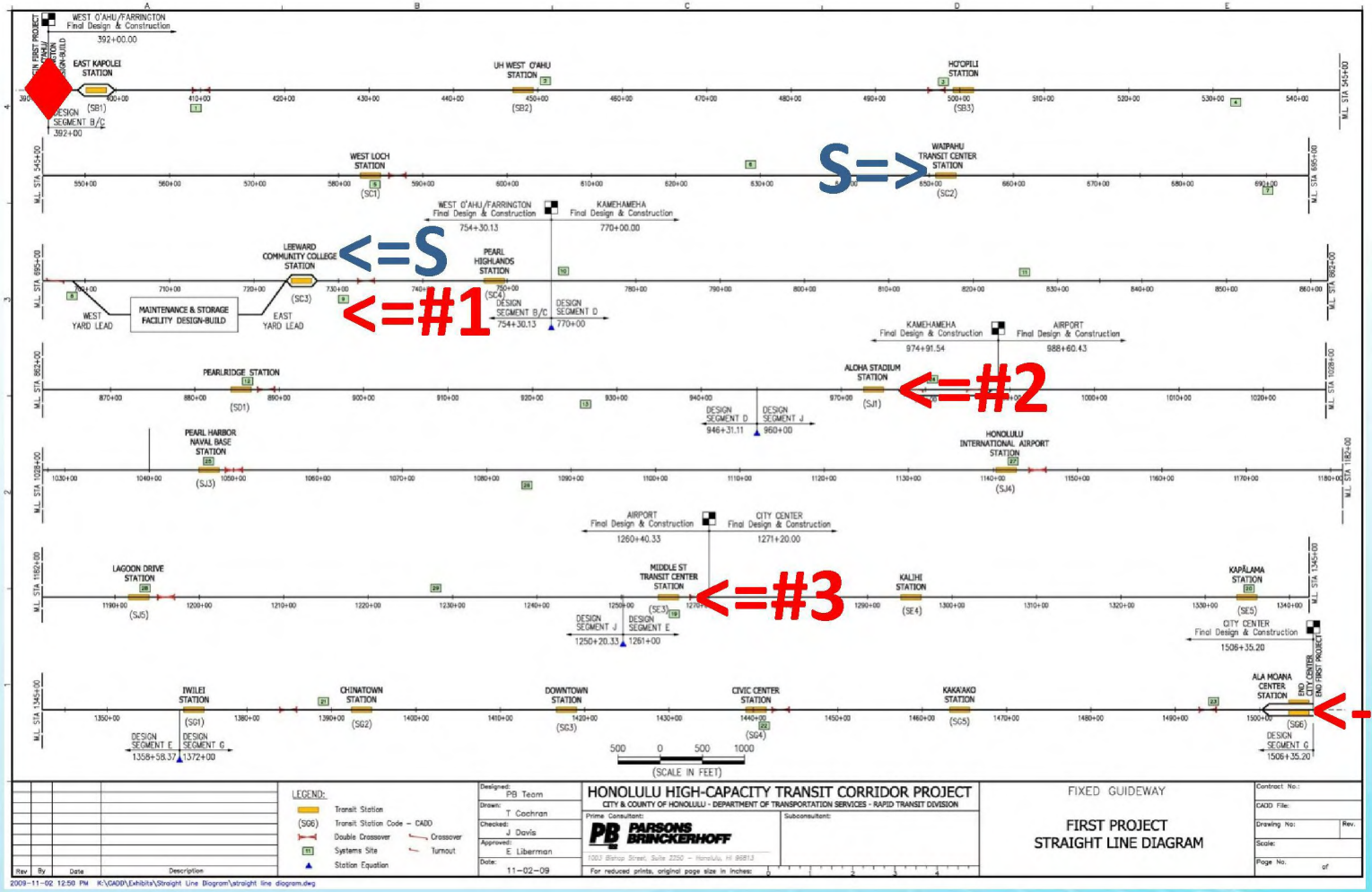
O&M Requirements in the RFP

- TP-3
  - Fleet Sizing Requirements
  - O&M and CARP Requirements
- SP-6.17 to 6.29
  - O&M Compensation, including for CARP
- MP-2
  - Reporting/Recording
  - Upgrades & Expansion Work
  - PR & Advertising, etc.

General System Info – Full Build

Alignment Distance	approx. 20 miles each direction
Approx. O/W Running Time (w/Dwell)	43 minutes
Stations	21 (2 center platform; 18 side platform; 1 side & center)
West End Terminal	East Kapolei, 2-track, crossovers before station, tail tracks behind
East End Terminal	Ala Moana, 3-track, crossovers before station, no tail tracks
Pockets/Siding	Aloha Stadium Siding, south of eastbound mainline track
Intermediate Crossovers	12 (10 diamond, 1 universal, and 1 single)
Park 'n' Ride Facilities	4 (East Kapolei, UH West O'ahu, Pearl Highlands, Aloha Stadium)
Maintenance & Storage Facility	Adjacent to LCC w/wash, MOW, wheel true, OSB, and OCC facilities
Substation locations	17 (14 TPSS and 3 GBS)
Line Capacity (pphpd)	6,429 (2019), 8,083 (2030), 12,150 (ultimate)

Overview of Operating Segments



Overview of Operating Plans

Shuttle Service and Intermediate O&M Periods

	SHUTTLE SERVICE O&M PERIOD			INTERMEDIATE O&M PERIOD #1			INTERMEDIATE O&M PERIOD #2			INTERMEDIATE O&M PERIOD #3		
Opening:	March-2013			September-2014			July-2015			May-2017		
Between:	Waipahu Transit Center and Leeward Community College			East Kapolei and Leeward Community College			East Kapolei and Aloha Stadium			East Kapolei and Middle Street Transit Center		
Stations:	2			6			9			13		
Operating mode:	Manual shuttle on one track			Fully-automated pinched loop			Fully-automated pinched loop			Fully-automated pinched loop		
	Hrs	Period	Max Hwy	Hrs	Period	Max Hwy	Hrs	Period	Max Hwy	Hrs	Period	Max Hwy
Weekday												
Base:	-	-	-	-	-	-	-	-	-	-	-	-
Peak (AM):	-	-	-	-	-	-	4	6a-10a	10	4	6a-10a	10
Base:	-	-	-	10	8a-6p	15	6	10a-4p	20	6	10a-4p	20
Peak (PM):	-	-	-	-	-	-	4	4p-8p	10	4	4p-8p	10
Base:	-	-	-	-	-	-	-	-	-	-	-	-
Late:	-	-	-	-	-	-	-	-	-	-	-	-
Total hours:	-			10			14			14		
Saturday												
Base:	4	10a-2p	none	-	-	-	10	8a-6p	20	10	8a-6p	20
Late:	-	-	-	-	-	-	-	-	-	-	-	-
Total hours:	4			-			10			10		
Sunday/Holiday												
Base:	4	10a-2p	20	-	-	-	10	8a-6p	20	10	8a-6p	20
Late:	-	-	-	-	-	-	-	-	-	-	-	-
Total hours:	4			-			10			10		

Overview of Operating Plans

Full and Optional O&M Periods

	FULL O&M PERIOD			OPTIONAL O&M PERIOD		
Opening:	March-2019 to March-2024			March-2024 to March-2029		
Between:	East Kapolei and Ala Moana Center			East Kapolei and Ala Moana Center		
Stations:	21			21		
Operating mode:	Fully-automated pinched loop			Fully-automated pinched loop		
	Hrs	**Period**	**Max Hwy**	**Hrs**	**Period**	**Max Hwy**
Weekday						
Base:	2	4a-6a	6	2	4a-6a	6
Peak (AM):	4	6a-10a	3	4	6a-10a	3
Base:	6	10a-4p	6	6	10a-4p	6
Peak (PM):	4	4p-8p	3	4	4p-8p	3
Base:	1	8p-9p	6	1	8p-9p	6
Late:	3	9p-12a	10	3	9p-12a	10
Total hours:	20			20		
Saturday						
Base:	12	6a-6p	6	12	6a-6p	6
Late:	6	6p-12a	10	6	6p-12a	10
Total hours:	18			18		
Sunday/Holiday						
Base:	12	6a-6p	6	12	6a-6p	6
Late:	6	6p-12a	10	6	6p-12a	10
Total hours:	18			18		

TP-3 Fleet Sizing Requirements

Maximum Capacity	12,150 (ultimate)
Minimum Train Length	2-car trains (approx. 120 feet)
Maximum Train Length	as per TP-4 (approx. 240 feet)
Minimum Peak Line Capacity	7,200 pphpd
Station Dwell Time	Calculated based on loading/unloading rate (1 pax/sec/25-inch clear space), comfort loading capacity, Offeror door size, and equipment performance time
Maximum Cruise Speed	65 mph
Maximum Peak Operating Headway	4 minutes (2019), 3 minutes (2030), and not less than 115% of design headway
Maximum Round Trip Time	87 minutes
Travel Time	As per RFP alignment drawings and Offerors' equipment characteristics
Vehicle Comfort Loading Capacity	Seating capacity of at least 20% of vehicle design load capacity; and standees at 3.2 passengers/m^2 (about 162 per vehicle)
Vehicle Spare Ratio	15% of Operating Fleet

Operations Management Plan

- Core Systems Contractor
  - O&M Administration and Management Services
  - Operations Services
  - Maintenance Services
  - CARP/Upgrades and Enhancements
- City
  - CSC O&M Oversight
  - Fare Enforcement
  - Revenue Collection
  - Public Safety
  - Cleaning/Maintenance/Supplies
  - Public Relations and Advertising
  - Bus Bridge/Backup Services

Operations Management Plan - CSC

- O&M Administration & Services
  - Supervision, including the following O&M key positions:
    - General Manager
    - Train Operations Manager
    - Vehicle Maintenance Manager
    - MOW Manager
    - System Safety and Security Manager
    - Training and Quality Manager
  - Clerical support
  - Inventory control (purchasing, disbursement, expediting, receiving, cataloguing, storage, and requisition control)
  - Preparing and updating records and reports
  - HR management and administration
  - IT administration
  - Finance, budget, and payroll
  - O&M scheduling
  - O&M personnel training
  - Occupational safety
  - Public relations and advertising (assisting City with site tours, community relations, and facilitating/maintaining advertising on system equipment
  - Security at the MSF

Operations Management Plan - CSC

- Operations Services
  - Supervision (OCC and line)
  - System Supervision and Control (OCC)
  - Train Attendants (50% of operating fleet; 15-minute requirement)
  - Station Attendants
  - Clerical Support
  - Preparing and updating reports and records
  - Train scheduling
  - Operations employees scheduling
  - Passenger services
    - Prompt response to passenger information queries and requests
    - Reports/record-keeping of passenger complaints
    - Prompt response to passenger distress events (direct and contacting public safety agencies)
    - Transport of passengers affected by OTS vertical circulation equipment
    - Distribution of schedules, maps, and other passenger information
  - Bus bridge/back-up services (notification and assistance only)

Operations Management Plan - CSC

- Maintenance Services
  - Supervision (MSF and field)
  - Maintenance
    - Vehicles and all on-board equipment
    - Traction electrification facilities and equipment
    - Command, control, and communications and equipment
    - Guideway equipment and trackwork
    - Stations facilities (non-public System areas) and station equipment
    - Facilities and equipment at the MSF site
    - O&M system support vehicles
    - Pavements and grounds (non-public System areas)
    - Fare vending equipment / administration and maintenance of FCCS
    - Cleaning and janitorial (non-public System areas)
  - Storeroom support
  - Clerical support
  - Preparing and updating records and reports
  - Maintenance planning and scheduling
  - Maintenance employees scheduling

Operations Management Plan - CSC

- **CARP**
  - **Commences at the start of the Full O&M Period, through the Optional O&M Period**
  - **Meet annually to review work and assess condition of assets**
    - **State of Good Repair**
    - **State of Good Repair (SGR):** As with the Rail Modernization Study, state of good repair was defined using TERM's numerically based system for evaluating transit asset conditions. TERM uses deterioration schedules to rate an asset's condition on a scale of 5 (excellent), 4 (good), 3 (adequate), 2 (marginal) through 1 (poor) based on the asset's type, age, rehabilitation history and other factors. Specifically, this study considers an asset to be in a state of good repair when the physical condition of that asset is at or above a specific condition rating value of 2.5 (the mid-point between adequate and marginal).3 Similarly, an entire transit system would be in a state of good repair if all of its assets have an estimated condition value of 2.5 or higher. The level of investment required to attain and maintain a state of good repair is therefore that amount required to rehabilitate and replace all assets with estimated condition ratings that are less than this minimum condition value.
  - **CARP work requires City authorization to proceed**

Operations Management Plan - CSC

- Upgrades and Enhancements
  - Required to be provided by CSC
  - Requires City authorization to proceed
  - CSC software enhancements to be provided at no cost
  - Other third-party software to be reimbursed by the City at CSC's cost, unless required to correct errors
  - Installation and implementation to be compensated under "Extra O&M Work" provision, unless required to correct errors

Operations Management Plan - City

- CSC O&M Oversight
  - During D/B Phase
    - By GEC
  - During O&M Phase
    - By GEC or City - TBD
- Fare Enforcement
- Revenue Collection
- System Safety Oversight Review Committee (SSORC) (TP-3.2.9.1)
- System Safety Program Plan (TP-3.2.9.2)
- System Security Plan (TP-3.2.9.5)
- Emergency Procedure Plan (TP-3.2.10)
- Cleaning/Maintenance/Supplies
- Public Relations and Advertising
- Bus Bridge/Backup Services (City to provide bus bridge)

Performance Measurement

- What Measures will be used to Track the System's Performance?
- What Measures will be used to Track the Core System Contractor's Performance?

Performance Measurement - CSC

- Core Systems Contractor Performance Measurement (tied to payment)
  - System Service Availability
  - Fare Vending Availability
  - Service Mode Downtime Event Limits
  - MSF Maintenance Standards and Frequencies
  - (Elevator/Escalator – NIC)

Performance Measurement - CSC

- **Monthly Payment Formula**

$$P = \left((PE_m + (P_{IS_c} \times \Delta_{miles}) + P_{OH_c}) \times F_{A_m}\right) + \Delta W - F_F + P_{CR} - (D_p \times PE_m) + PU_m + PI_m \quad -(FM_p \times PF_m)$$

  - Economically-adjusted O&M price for the month
  - Service level changes for vehicle miles and operating hours within ± twenty percent (20%) of the Baseline Service Levels
  - **System Service Availability payment factor [LD as per SP-6.20(h)]**
  - Cost of Extra O&M Work
  - **Total deduction for loss of fare vending availability [LD as per SP-6.20(h)]**
  - Economically-adjusted price for CARP Work completed in the month
  - Economically-adjusted price of increased operating hours
  - **Accumulated downtime penalty percentages [LD as per SP-6.20(h)]**
  - Utility price (using actual unit costs) for the month of the invoice
  - Insurance price for the month of the invoice
  - Additional Work pursuant to a City-approved Change Order
  - **MSF facilities maintenance payment factor [LD as per SP-6.20(h)]**

Performance Measurement - CSC

- Core Systems Contractor Performance Measurement (tied to payment)
  - System Service Availability
  - Fare Vending Availability
  - Service Mode Downtime Event Limits
  - MSF Maintenance Standards and Frequencies
  - (Elevator/Escalator – NIC)

Performance Measurement - CSC

- System Service Availability
  - Minimum for Full Payment: 99.5%
    - 99.90% - 100% = +2% in payment
    - 99.80% - 99.89% = +1% in payment
    - Gradual deducts below 99.50%
    - 95.00% - 97.39% = 75% of full payment
    - 90.00% - 94.99% = 50% of full payment
    - Below 90.00% = No payment
  - System Service Availability is Comprised of:
    - Service Mode Availability
    - Fleet Availability
    - Station Availability

Performance Measurement - CSC

- System Service Availability
  - Service Mode Availability
    - Ratio of actual mode hours to scheduled mode hours
    - Deducts for "Mode Downtime Event"
    - Considers "Exclusions", "K" factors, and grace period (less than one operational headway)
  - Fleet Availability
    - Ratio of actual vehicle hours to scheduled vehicle hours
    - Deducts for "Vehicle Downtime Event" when vehicles are defined as not "fully functional"
    - Considers "Exclusions" and grace period (less than one operational headway)
  - Station Availability
    - Ratio of actual station hours to scheduled station hours
    - Deducts for "Station Downtime Event"
    - Considers "Exclusions"

Performance Measurement - CSC

- Core Systems Contractor Performance Measurement (tied to payment)
  - System Service Availability
  - Fare Vending Availability
  - Service Mode Downtime Event Limits
  - MSF Maintenance Standards and Frequencies
  - (Elevator/Escalator – NIC)

Performance Measurement - CSC

- **Fare Vending Availability**
  - **Inoperable fare vending equipment**
    - **Deduct is equivalent to 120x the basic adult fare for each hour or fraction thereof that the equipment is unavailable**
  - **Inoperable fare vending arrays**
    - **If inoperability exceeds scheduled headway, then station is out of service and this is taken into account in System Service Availability calculation**
  - **Inoperable fare vending control system**
    - **Deduct is equivalent to 120x the highest adult fare for each hour or fraction thereof that the equipment is unavailable**
  - **Considers "non-chargeable" failures and grace period (of two hours)**

Performance Measurement - CSC

- Core Systems Contractor Performance Measurement (tied to payment)
  - System Service Availability
  - Fare Vending Availability
  - Service Mode Downtime Event Limits
  - MSF Maintenance Standards and Frequencies
  - (Elevator/Escalator – NIC)

Performance Measurement - CSC

- Core Systems Contractor Performance Measurement (tied to payment)
  - System Service Availability
  - Fare Vending Availability
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  - MSF Maintenance Standards and Frequencies
  - (Elevator/Escalator – NIC)

Performance Measurement - CSC

- **MSF Maintenance Standards and Frequencies**
  - **Deducts per category, not to exceed a total deduction of 2% of the monthly O&M payment**

TABLE 9: MSF FACILITIES MAINTENANCE PERFORMANCE DEDUCTIONS

CATEGORY OF FACILITIES MAINTENANCE		PERFORMANCE DEDUCTION (FM_p)
A.	Janitorial Services	0.20%
B.	Hardscapes and Softscapes	0.10%
C.	Heating, Ventilation and Air Conditioning	0.20%
D.	Lighting and Facilities Electrical	0.10%
E.	Plumbing	0.10%
F.	Signage and Boards	0.10%
G.	Glass and Glazing	0.10%
H.	Pest Control	0.10%
I.	Graffiti	0.10%
J.	Surface Parking	0.10%
K.	Cleaning Non-Light Metro Vehicle Bldg Areas	0.10%
L.	Elevator Maintenance	0.20%
M.	Control Centers and Administrative Offices	0.10%
N.	Traction Power Substations & System Eqpt Rooms	0.10%
O.	Guideways	0.10%
P.	Building Exteriors	0.10%
Q.	Building Interiors	0.10%
	Total	2.00%

Performance Measurement - CSC

- Core Systems Contractor Performance Measurement (tied to payment)
  - System Service Availability
  - Fare Vending Availability
  - Service Mode Downtime Event Limits
  - MSF Maintenance Standards and Frequencies
  - (Elevator/Escalator – NIC)
  - Dependability Monitoring and Epidemic Failures

Performance Measurement - CSC

- **Dependability Monitoring**
  - City right to examine and analyze failed items jointly with CSC
  - Failure cause categorized and corrective action implemented by CSC
  - Monitoring thereafter
- **Epidemic Failures**
  - Component failures that exceed 10% of the total of such components during warranty period in any 12-month period are considered “epidemic”
  - CSC to undertake system-wide modification program

Performance Measurement

- **What Measures will be used to Track the System's Performance?**

- **What Measures will be used to Track the Core System Contractor's Performance?**

Performance Measurement - System

- Mandatory
  - As reported to National Transit Database
  - Affords comparison of HHCTCP rail system with other systems
  - Examples
- Optional
  - Can be published or not
  - Tailored to local conditions
  - Examples

Performance Measurement - System

- Examples of "Mandatory" Measures
  - Service Efficiency
    - Operating Expense/Vehicle Revenue Mile
    - Operating Expense/Vehicle Revenue Hour
  - Cost Effectiveness
    - Operating Expense/Passenger Mile
    - Operating Expense/Unlinked Passenger Trip
  - Service Effectiveness
    - Unlinked Passenger Trips/Vehicle Revenue Mile
    - Unlinked Passenger Trips/Vehicle Revenue Hour
  - Safety/security incidents
  - Service supplied/consumed statistics
  - Etc.

Performance Measurement - System

- **Examples of Optional Measures**
  - "How are we doing" passenger surveys
  - Subsystem reliability measures
  - On-time performance
  - % of customer complaints not closed w/in 14 days
  - Fare recovery ratio
  - Fare evasion %
  - Employee availability (by union local)
  - Etc.

Reporting

- To the City
- To Others

Reporting

- To the City
  - Incident/accident reporting/notification - immediate
  - Management report – monthly, w/invoice
  - Operations reports – daily, monthly, annually
  - Maintenance reports – daily, monthly, annually
  - Training reports - prior to passenger service and upon program completion
  - System assurance monitoring reports - monthly
  - Sustained operating system performance report - annually
  - CARP report – annually upon start of Full O&M period
  - Readiness tests report - quarterly
  - Electromagnetic compatibility monitoring report – per inspection and non-compliant event
  - Employee check-in/check-out report – available daily
  - Financial reports from fare communication and control system – as required

Reporting

- **To Others (including the City, State, and other local and federal governmental agencies)**
  - **Reporting in compliance with:**
    - **(FTA, DOT) 49 CFR Part 630 – National transit database**
    - **(FTA, DOT) 49 CFR Part 655 – Prevention of alcohol misuse and prohibited drug use in transit operations**
    - **(FTA, DOT) 49 CFR Part 659 – Rail fixed guideway systems; State safety oversight**
    - **(NTSB) 49 CFR Part 840 – Rules pertaining to notification of railroad accidents**
    - **(OSHA, DOL) 29 CFR Part 1904 – Recording and reporting occupational injuries and illnesses**

Questions?

Agenda:

- Operations & Maintenance (O&M) Concepts and Plan
- **Fare Collection Concepts and Plan**
- Train Control
- Traction Power
- Passenger Vehicles
- Communications
- Project Interface Systems Integration Management
- Potential MSF Modification
- Verification Testing and Acceptance/Safety & Security

Fare Collection Concepts and Plan

Requirements

- Proof Of Payment System
- Interface With The Bus
  - Seamless
- Passenger Friendly
- Exact Fare
- Transfers
- Allows For Expansion Of Newer Fare Media

Fare Structure

- Variety of Passes Sold for TheBus
- Continue same on Rail
- Rules Of Use are the same
- All Local Passes and Ticket Types Remain the same

Proof of Payment

- Enforcement
- Inspection on Bus
- Inspection on Rail
- Adjudication System
- Ticket Identifiers

Equipment Requirements

- Ticket Vending Machines
- Issues
  - Timed Trip Tickets
  - Passes
  - Accept Bills and Coins
- Options
  - Debit/Credit Cards
  - Smart Cards
- ADA Requirements

Equipment Requirements (Cont'D)

- Communications Links
  - Maintenance
  - Revenue
  - Security

Maintenance

- Each Machine ID
- Date Time Stamp for each Event
- Event Description
- Elapsed Time
- Machine Access Reports
- Service Required

Security

- Intrusion Alarms
- Cashbox Removal
- Cashbox Replacement
- Any Access to TVM

Other System Requirements

- Money Carts
- Communications Links
- Debit/ Credit Card Network
- SCADA
- Documentation
- Training
- Submittals
- Revenue and Accounting

System Requirements (Cont'D)

- Design Reviews
- First Article Testing /Acceptance
- Production Runs, Testing /Acceptance
- Station By Station Install/Test Acceptance
- System Test Acceptance
- Warranty Period

Questions?

Agenda

- Operations & Maintenance (O&M) Concepts and Plan
- Fare Collection Concepts and Plan
- **Automated Train Control**
- Traction Power
- Passenger Vehicles
- Communications
- Project Interface Systems Integration Management
- Potential MSF Modification
- Verification Testing and Acceptance/Safety & Security

Automated Train Control (ATC)

System Operation

The system will have:

- **Automatic Train Protection (ATP)** - maintains safety of operation including separation of trains running on the same track and through interlockings.

- **Automatic Train Operation (ATO)** - performs those functions traditionally assigned to motormen in a driver controlled system, for example, station stopping, door opening/closing, turnback operation, and speed regulation.

- **Automatic Train Supervision (ATS)** - directs train operations to provide scheduled service under normal conditions, monitors performance against schedule, and permits corrective action to be taken by Operations Control Center (OCC) personnel. ATS performs management data acquisition and processes the resultant reports in a desired format for the OCC controllers.

ATC Inputs/Outputs

- Contact rail voltage
- Direction selection (forward/neutral/reverse)
- Vehicle speed/no motion information (from two independent sources)
- Control vehicle location
- Control vehicle ID
- ID of all other vehicles in the train
- Selected route (destination)
- Operating mode selection (auto/manual)
- Manual Master Controller position indications
- Passenger door control (open/close)
- Passenger doors open indication
- Passenger doors closed and locked indication
- Door status (Normal/fault/cut-out)
- Derailment detection
- Friction brake status (Normal/fault/cut-out)
- Propulsion status (Normal/fault/cut-out)
- Propulsion demand
- Propulsion cutout control
- Propulsion train wash control
- Brake demand
- Brake cutout control
- Brake status (Normal/fault/cut-out)
- Other vehicle systems status (Normal/fault)
- Other vehicle system bypass/cutout control status (Normal/bypass or cutout active)
- Communications control
- Lights control (internal/external)
- Couple/uncouple controls
- Radio / high-speed wireless LAN link
- ATC equipment power (uninterruptible)

Fail Safe Design

- The ATC system will be certified per Mil STD 882C.
- Frequency Site Survey shall be performed before and after system installation.

Objectives of Safety Program

A. Systematically eliminate hazards through the ATC design process

B. Isolate hazardous substances, components, and operations

C. Locate equipment to reduce hazards to personnel during operation and maintenance

D. Minimize risks caused by environmental conditions

E. Design to eliminate or minimize risk created by human error

F. Consider alternate approaches to eliminate hazards

G. Provide adequate protection for personnel from power source faults

H. Provide warnings and cautions when risks cannot be eliminated

Operations in the Event of Failure

- Redundant ATP in the event of primary ATP failure.
- Redundant ATP to operate separate from ATS.
- Backup OCC to mimic Primary OCC for a suspended period of time.
- Terminal and pocket tracks shall be capable of performing departure testing and trouble shooting.

Station Stopping Accuracy

- Automatic station stops shall be controlled by the ATO subsystem. Consists shall stop with the center of the train aligned within ±2 feet of the platform's center.
- The ATS subsystem shall be able to intervene to modify the stop point for two-car and three-car trains within the platform limits. Stops shall be made from any approach speed based on a nominal deceleration rate compensated for the grade approaching the station.
- The system shall be capable of adjusting the stop profile to account for the grade in the approach and the length of the consist.

Objectives of ATP

A. Prevent rear-end collisions resulting from one train over-taking another.
B. Prevent trains from being routed on conflicting routes that could result in head-on collisions, or one train running into the side of another.
C. Prevent derailment or collision hazards caused by track switches being moved just ahead of or under a train.
D. Prevent derailment or collisions resulting from trains traveling at excessive speeds for track conditions.
E. Prevent derailment or collisions resulting from trains traveling at excessive speeds at the end-of-line.
F. Prevent injury resulting from collisions with patrons who falls into the guideway adjacent to the platforms.
G. Prevent derailment and injury resulting caused by collisions between trains and high-rail maintenance vehicles.
H. Prevent injury to passengers aboard the vehicle as a result of natural or man-made disasters that could results in vehicle damage.
I. Prevent injury to passengers aboard the vehicle as a result of erratic vehicle door opening.

Functions of ATP

A. Train Detection
B. Train Separation
C. Motion and no-motion Detection
D. Overspeed Protection
E. Overtravel Protection
F. Signal Transmission and Detection
G. Rollback Protection
H. Door Control Protection
I. Direction Reversal Protection
J. Propulsion and braking interlocks
K. Platform Fall detection
L. Seismic Activity Detection
M. Broken Rail Detection
N. Excessive Wind Detection
O. Guideway Encroachment Detection
P. Guideway Interlockings
Q. Operating Speed Limits and Restrictions
R. Temporary Speed Protection and Restriction
S. Manual Operation

Modes of Operation

1. Normal ATO (automatic driverless operation) with ATP at speeds of up to 65 mph.
2. Degraded ATO with ATP and at a reduced speed not to exceed 30 mph (failed vehicle limp home)
3. Operation from a Manual Controller, without ATP and with line-of-sight, at a safe operating speed determined by location and track conditions.
4. Power outage with ATO and ATP at an optimum speed to move the vehicle to a station platform for safe unloading of passengers.
5. Yard move manual or ATO at a maximum speed of 10 mph.
6. Train wash manual or ATO at a maximum speed of 3 mph.
7. Manual or ATO Automatic couple/uncouple operation

Objectives of ATO

A. Following departure test, a train shall be made available from the MSF to the transfer track area by the yard operator; the automatic operating mode shall be enabled automatically by the operator when concealing the manual panel into its compartment. Once it is verified the operator has disembarked and communicated as such via radio, OCC responds to an indication whereupon the command shall be issued to move the train into automatic system under ATC control.

B. In the case of a malfunction for a train within the automatic system and the failure of OCC to perform corrective action remotely, maintenance personnel shall control the disabled train's movement using the vehicle's control panel with the protection of ATP for all trains in the area.

C. When a train is made available by OCC to the MSF, the ATC system shall control the train's travel to the transfer track area. Once a door is "keyed" open by the yard operator, the automatic operating mode shall be disabled. OCC shall then receive an alarm that the train is no longer under ATC control. The operator shall use the previously concealed manual panel for travel into the yard.

Functionality of ATS

A. Status and Performance Monitoring: The overall monitoring of system performance information at OCC shall be accomplished by displaying the different areas of ATC system operation, traction electrification system, audio communications and CCTV on separate monitors.

B. ATC System Operations Displays: These monitor display(s) shall provide visual representations of the real-time conditions throughout the system.

C. Traction Power Schematic Display (TPSD): The TPSD shall provide a visual indication of the traction electrification system for the system.

D. Performance control and override: Oversight and operation of the system shall be accomplished solely by the ATS system. OCC controllers shall be able to intervene manually to allow maximum flexibility of train operations for optimum restoration of performance of abnormal situations.

Yard Operations

- ATP in the yard
- Transfer tracks will launch vehicles into revenue service
- OCC will receive train position on all yard tracks
- Yard will have intrusion protection
- Yard ATO & ATS functionality will be defined per new yard layouts (to be provided).

Questions

Agenda

- Operations & Maintenance (O&M) Concepts and Plan
- Fare Collection Concepts and Plan
- Train Control
- **Traction Power**
- Passenger Vehicles
- Communications
- Project Interface Systems Integration Management
- Potential MSF Modification
- Verification Testing and Acceptance/Safety & Security

Traction Power

HONOLULU RAIL TRANSIT

HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT

AR00073605

Standards & Codes

- IEEE
- NFPA
- NEC
- ANSI
- Hawaii Public Utility Commission
- OSHA
- NESC
- ICEA

TRACTION POWER SUPPLY

- HECO Power Supply
- Traction Power Stations and Gap Breaker Stations
- Yard Traction Power Station
- Shop Stinger Supply and Stingers
- Emergency Trip Stations (Blue Light Stations).
- Traction Power Conductors

TRACTION POWER SYSTEM

- 13 Supply Stations, 3GBS, 1 MSF TPSS
- Pre-fab., Metal Enc. with A/C
- Approx. TPSS size 60'L x 20'W x 12'H
- HECO Utility Supply 12.47kV or 11.5 KV for TPSS
- ALL TPSS 3.0MW (NEMA RI-9 / Equiv.)
- Approx. GBS size 40'L x 20'W x12'H

TPSS/GPS ENCLOSURE

Pre-Fab Enclosures

- Double sided wall with Thermal & acoustic insulation
- Large equipments such as circuit breakers, transformers can be easily replaced and accessed
- Enclosure are fitted with Fire Alarm, emerg. Lights, double exits, eye wash, Emerg. Trip Stations, Fire Extinguishers, Intrusion System, First Aid Kits

TPSS SUPPLY STATIONS

- Min 4, Max 6 DC Feeder Bkrs.
- Main (Cathode) DC Breaker.
- Silicon Diode/Thyristor Control Rectifier 12 Pulse
- High or Low Res. Grounding
- Load Measure & Transfer Trip
- Negative Ground Device (NGD)

GAP BKR. STATIONS

- 3 Gap Breaker Stations
- Utility Supply 208V or 480V 3Ph.
- Prefabricated, Metal Enclosure
- Approx. size 40’L x 20’W x 12’H
- Min 4, Max 6 DC Feeder Breakers.

MSF TPSS STATION

- Pre-fab. Metal Enc. with A/C
- Approx. size 60'L x 60'W x 12'H
- Utility Supply 12.47/11.45kV
- 3.0 MW (NEMA RI-9 / Equiv.)
- Approx. 7 DC Feeder Breakers

Shop Supply Station for Shop Stingers

- Supplied by MSF Contractor
- Within Existing Room
- Utility Supply 12.47KV
- Approx: 500KW, 6 Pulse
- 14 DC Feeder Breakers or Contractors

Shop Stingers

- Supplied by MSF Contractor
- 7 Bays, 2 Stingers per Bay
- 750V DC Supply
- 100A for Control Power Only
- 200A for Traction Power (TBD)

Contact Rail

- Procured by MSF & Installed by Civil Contractor
- Rail 85Lbs/yd
- Electrical resistance 0.002ohm/1000ft @20°C
- Current carrying capacity 4000A
- Temperature rise 45°C above ambient
- Deflection not to exceed 1/64th of an inch
- Cross bonding typically at 2000 to 2500 feet
- DC cables 2.4KV insulated, unshielded

750V DC Switches for Contact Rail Supply & Sectionalizing

- Disconnect & By Pass Switches
- Manual/Motor operation
- Pad mounted with enclosure
- Lockable/interlocked in Open & Closed positions

Traction Power Supply & Return Conductors

- Stranded Cu Single Conductor
- 2.4KV Insulation, unshielded
- Multiples of 500 or 750Kcmil
- Bolted connections
- Extra Flexible Stranding for Contact Rail Connections

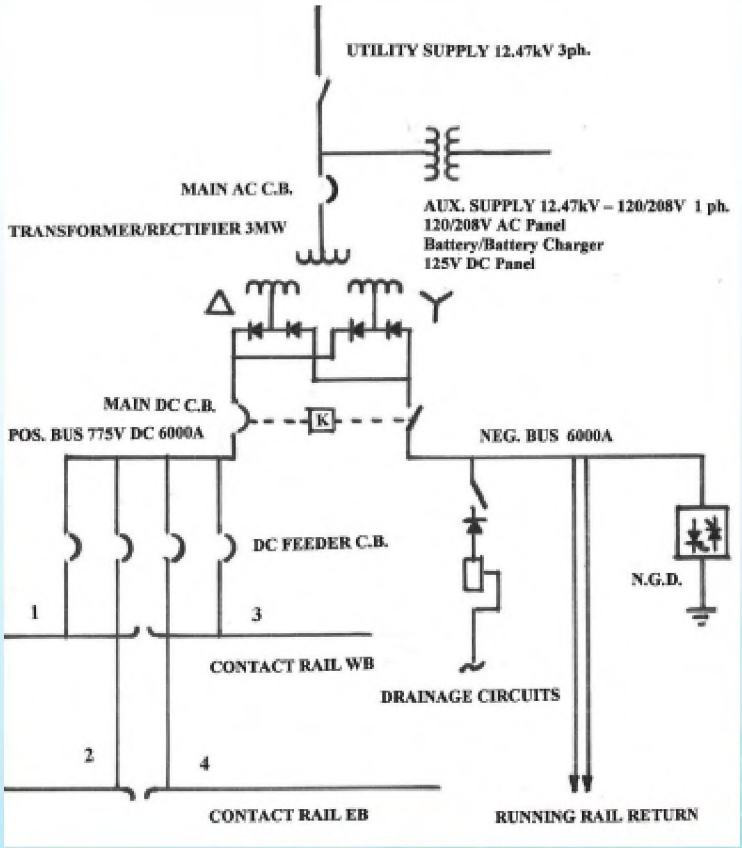
Possible Options

- Power Saving by reusing vehicle braking energy
- Emergency Power supply for vehicles during system wide loss of power
- Emergency power supply is provided through storage batteries or other means either installed onboard vehicles or wayside at TPSS

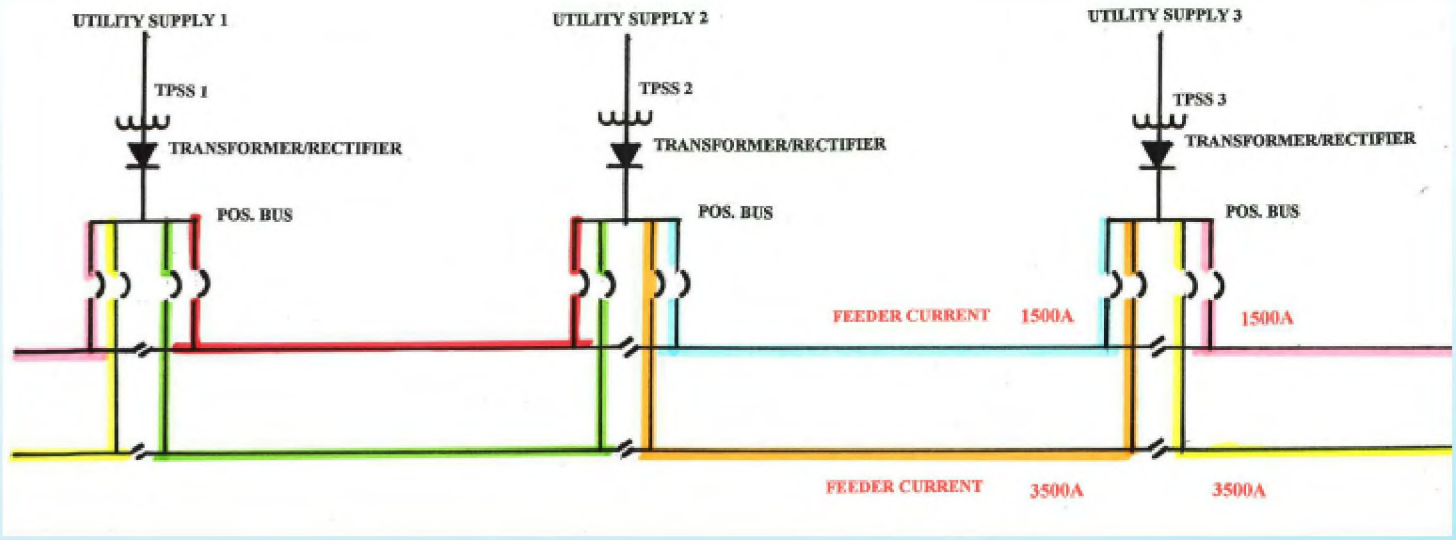
Sectionalizing of TPS

- Mainline isolated from MSF
- Mainline supplies MSF in case of MSF TPSS failure
- MSF is isolated from shops stinger supply

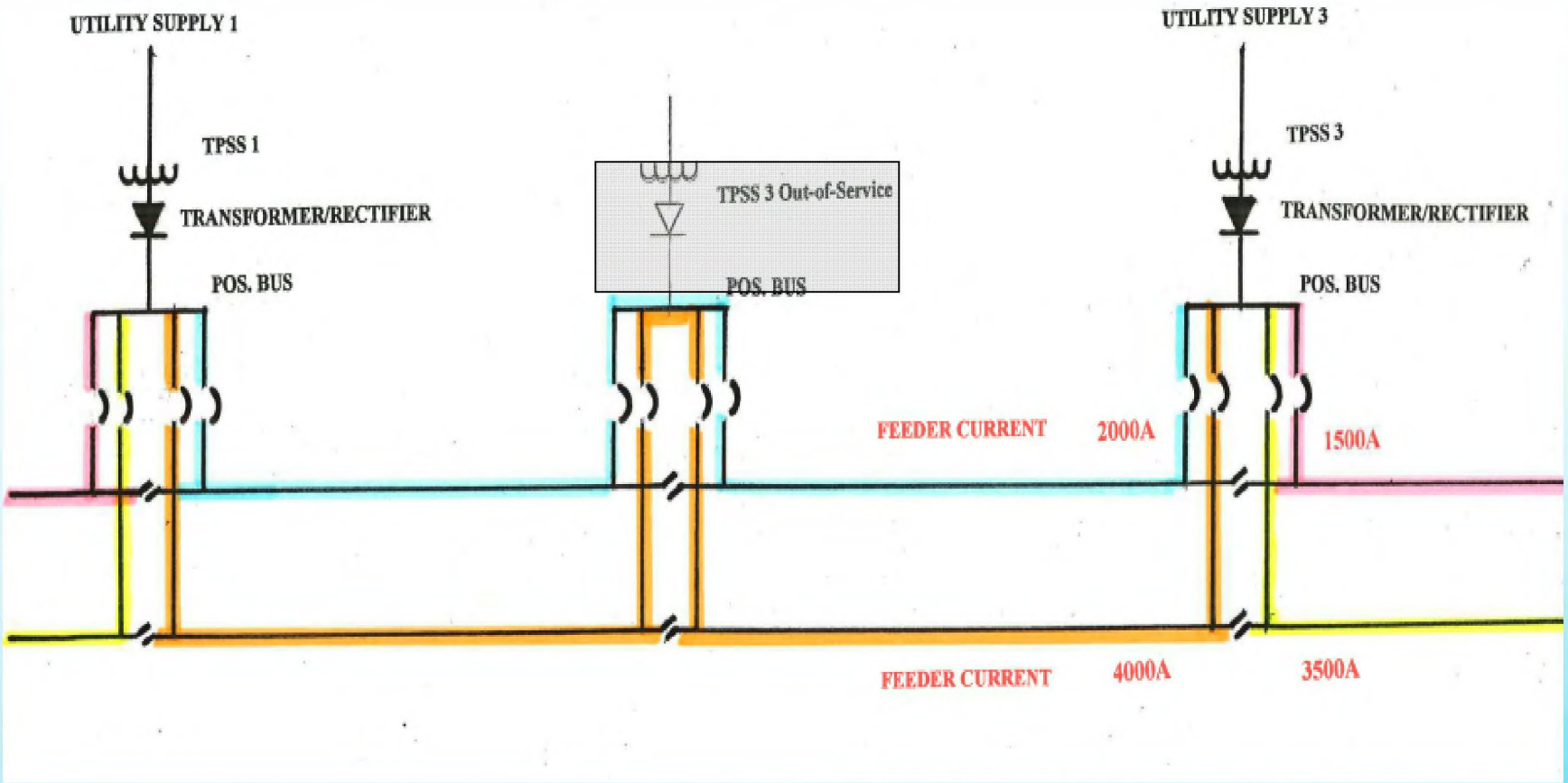
Simplified Single Line



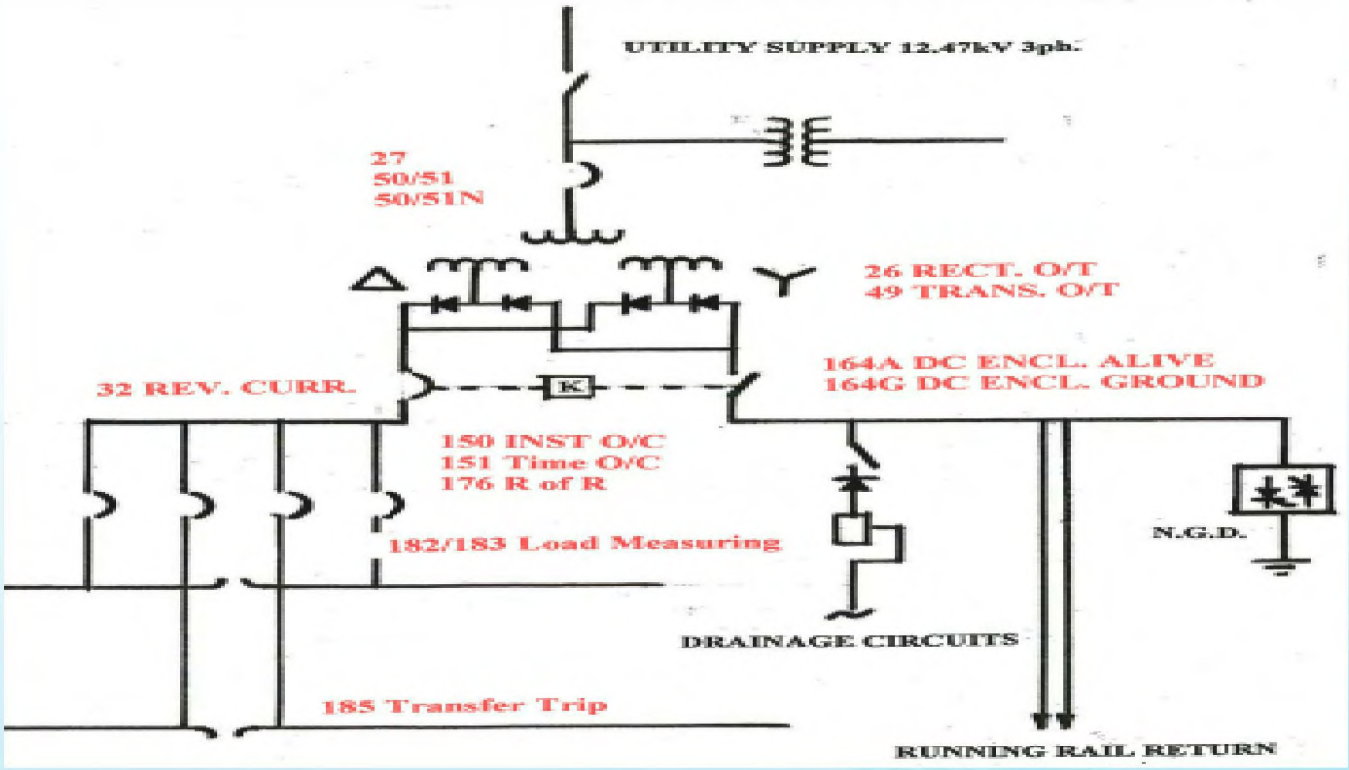
Simplified DC Supply Arrangement



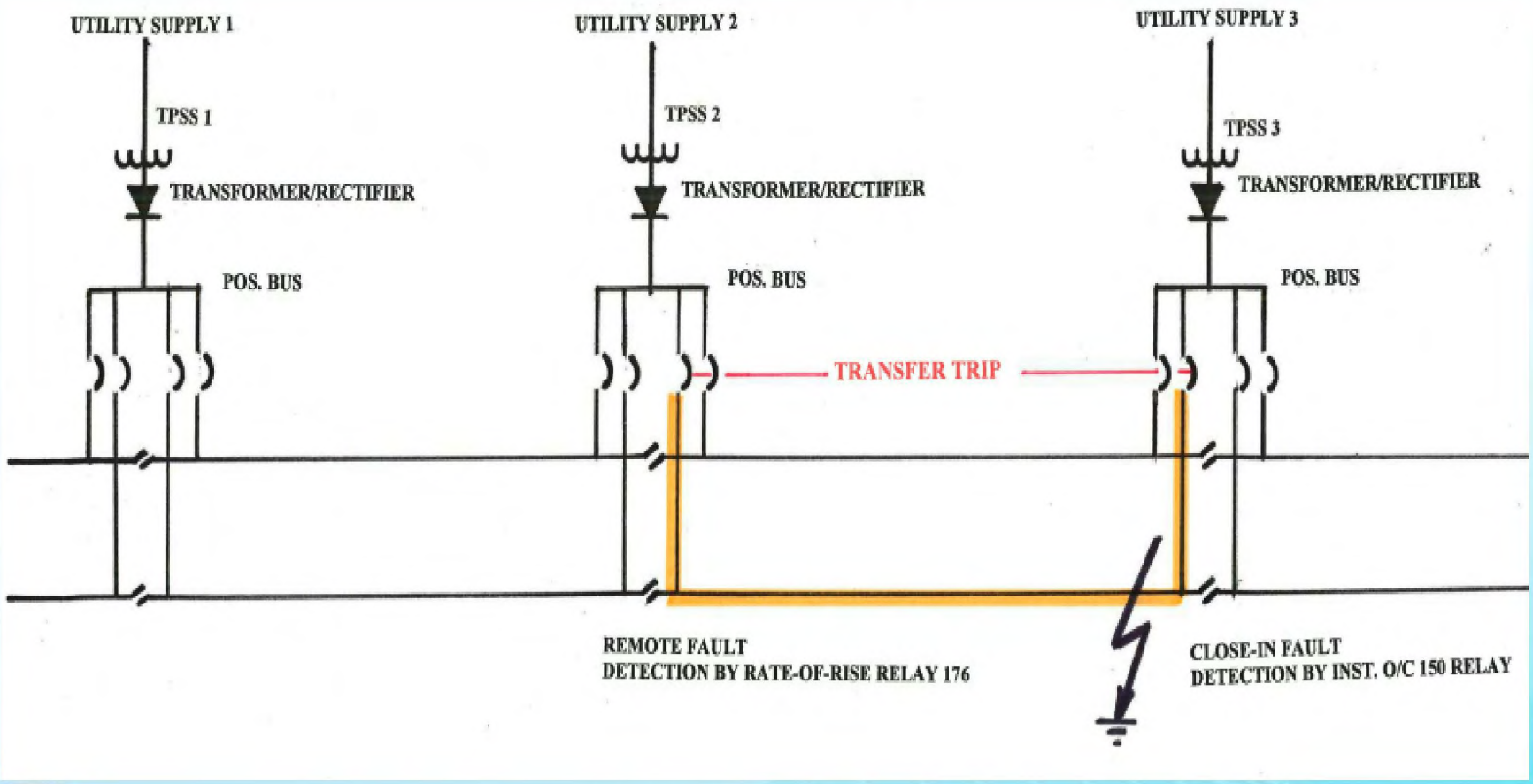
Simplified DC Supply arrangement
Contingency Supply (One TPSS Out)



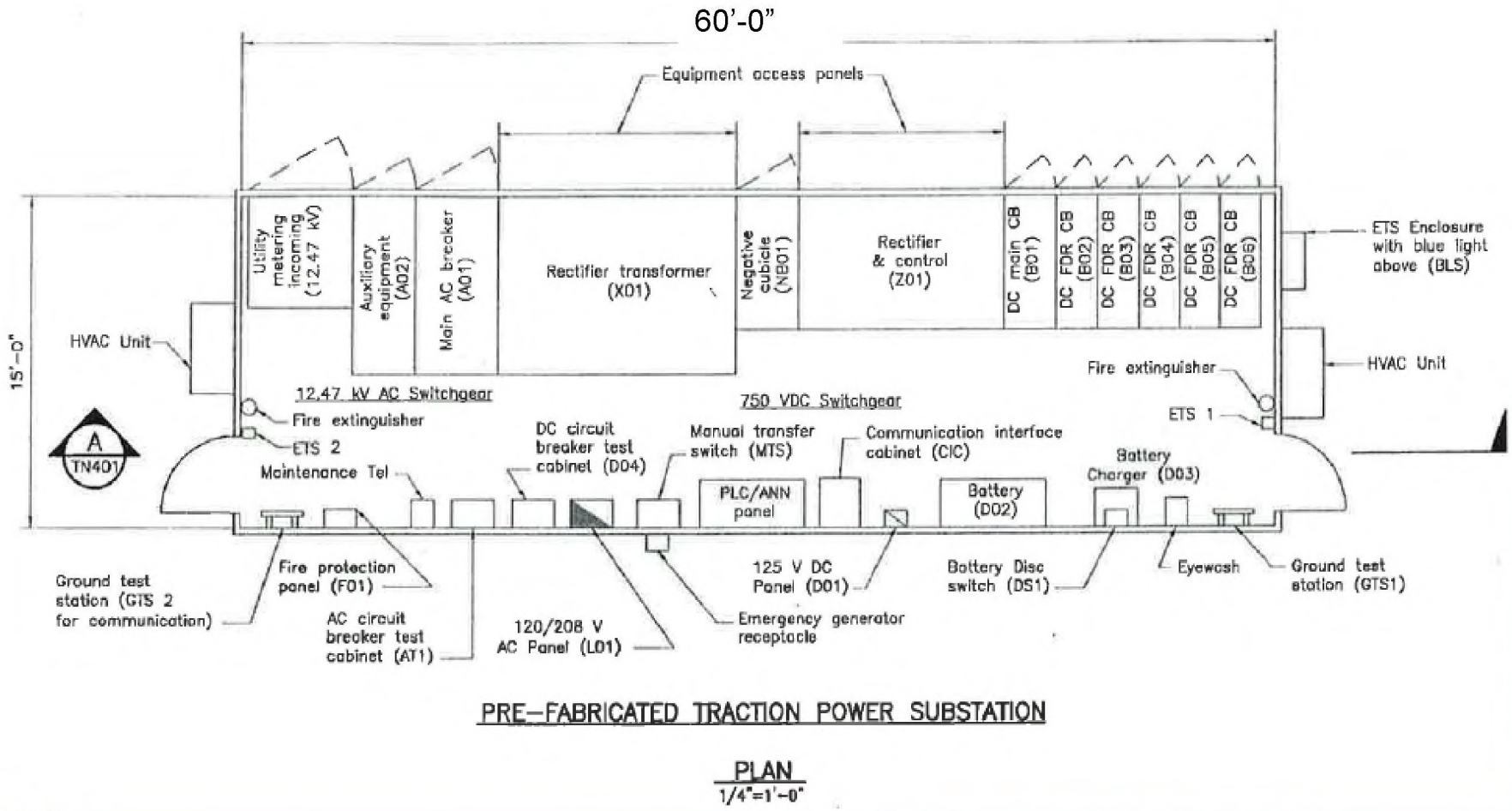
Simplified Relay Protection



Fault Protection



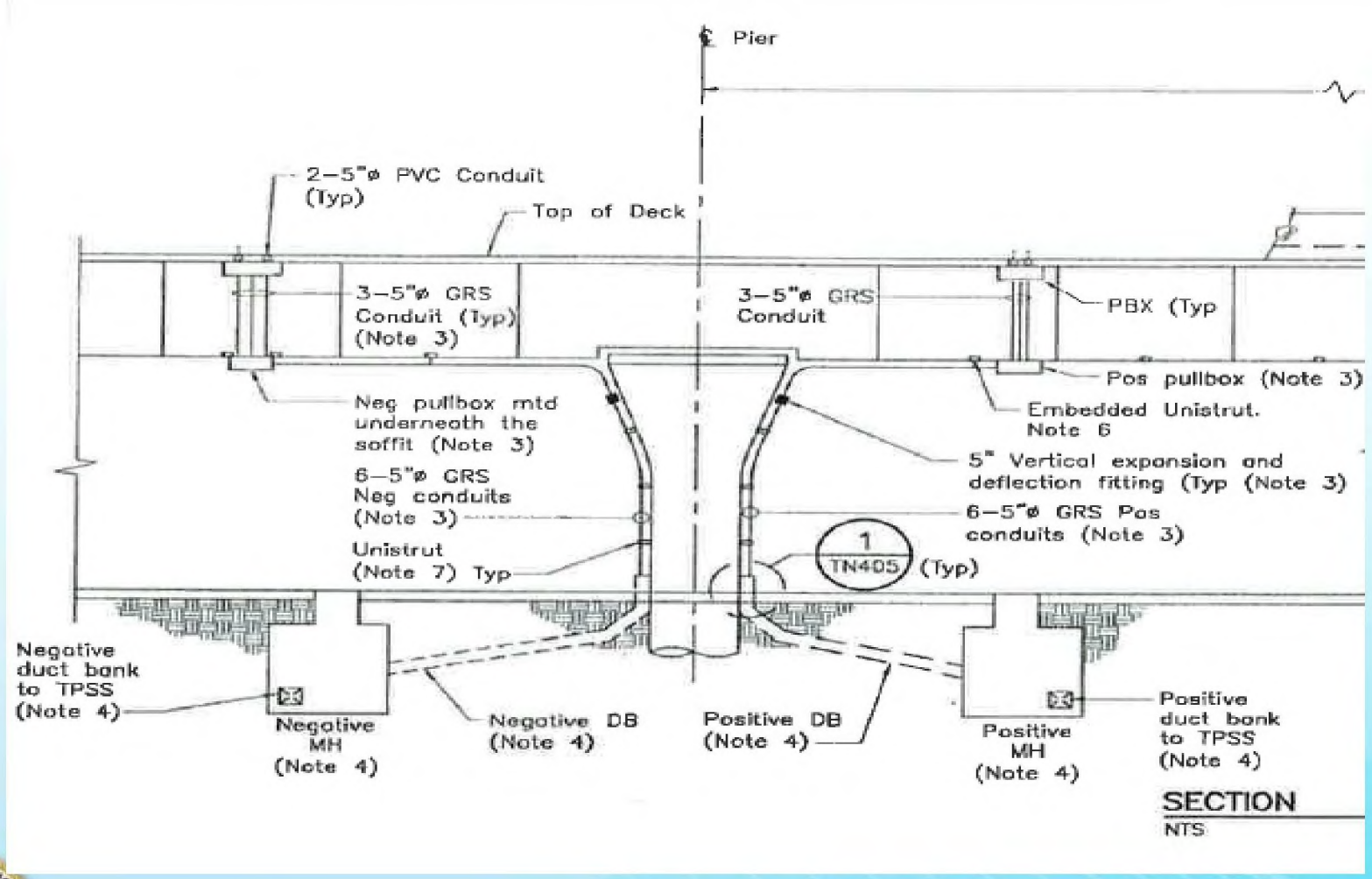
TPSS Equipment Layout Plan



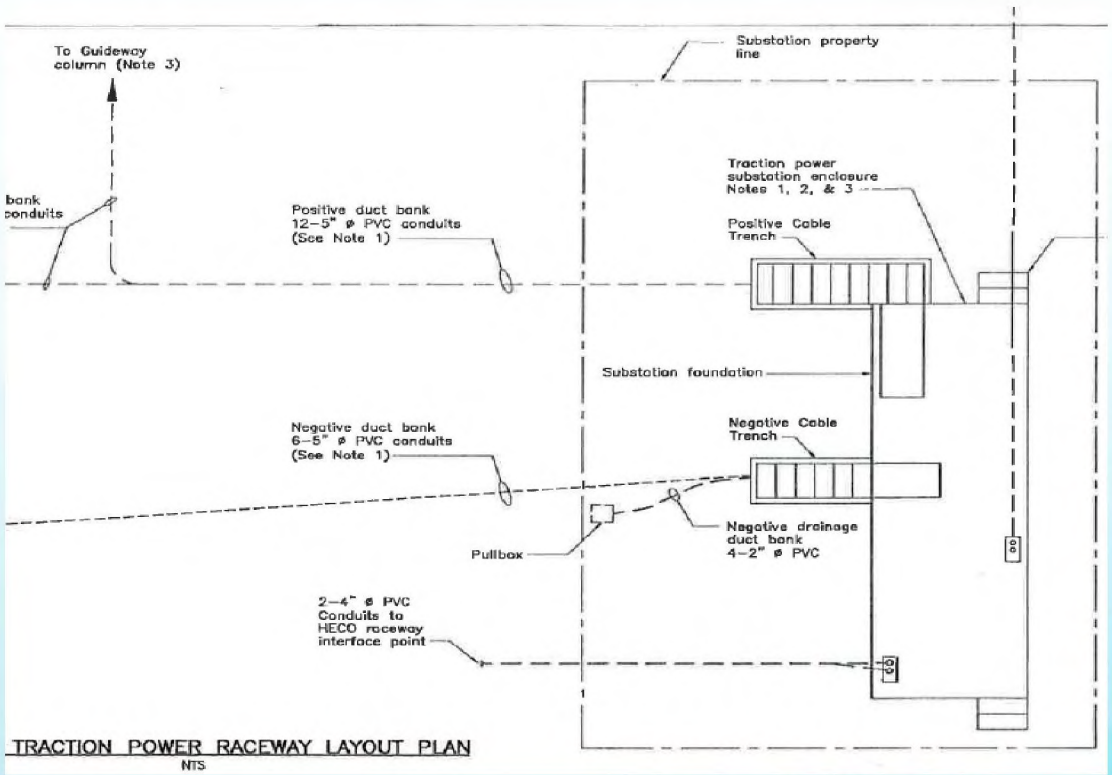
PRE-FABRICATED TRACTION POWER SUBSTATION

PLAN
1/4"=1'-0"

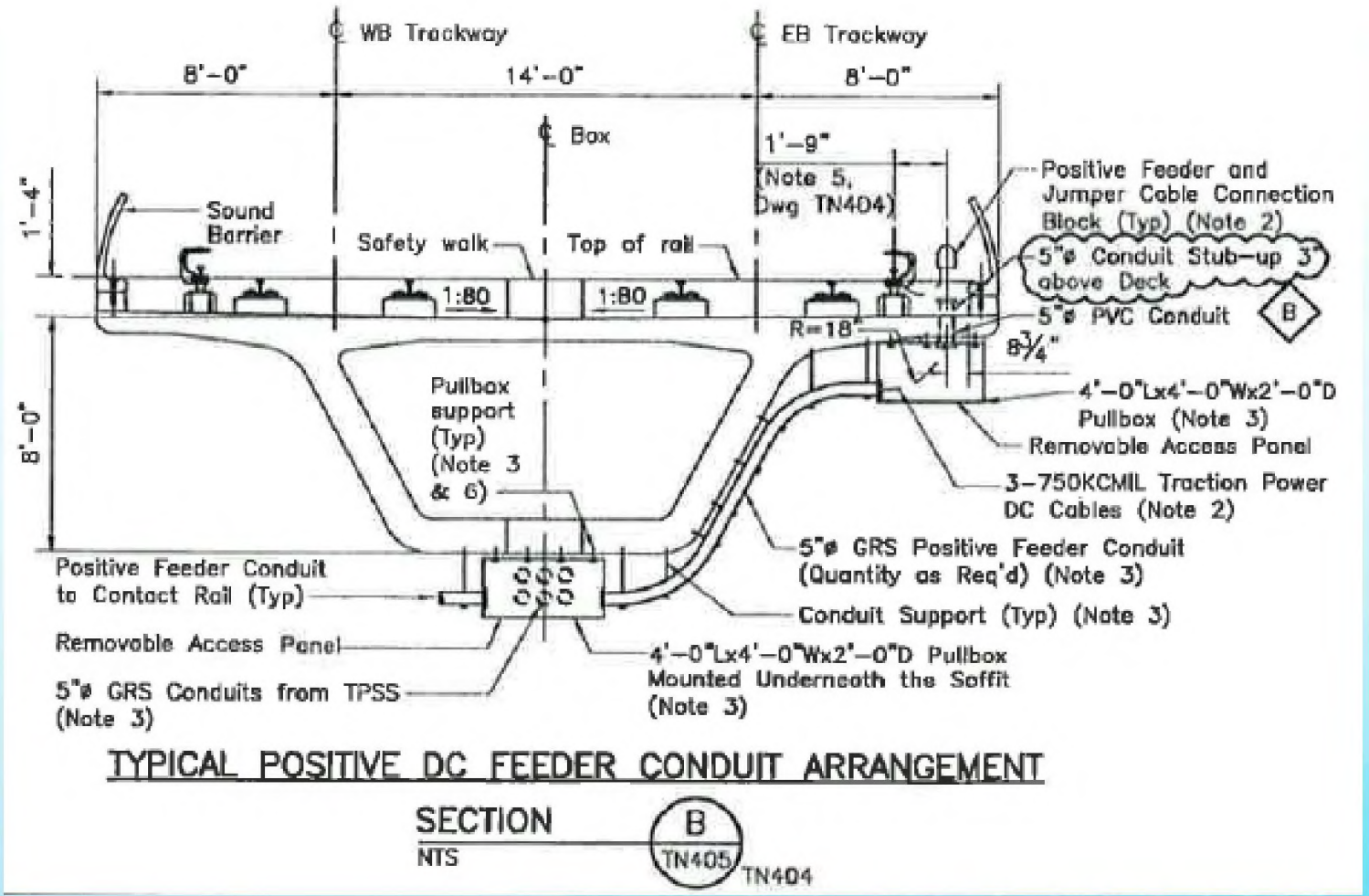
TPSS Cables to Guideway



Power Duct Bank



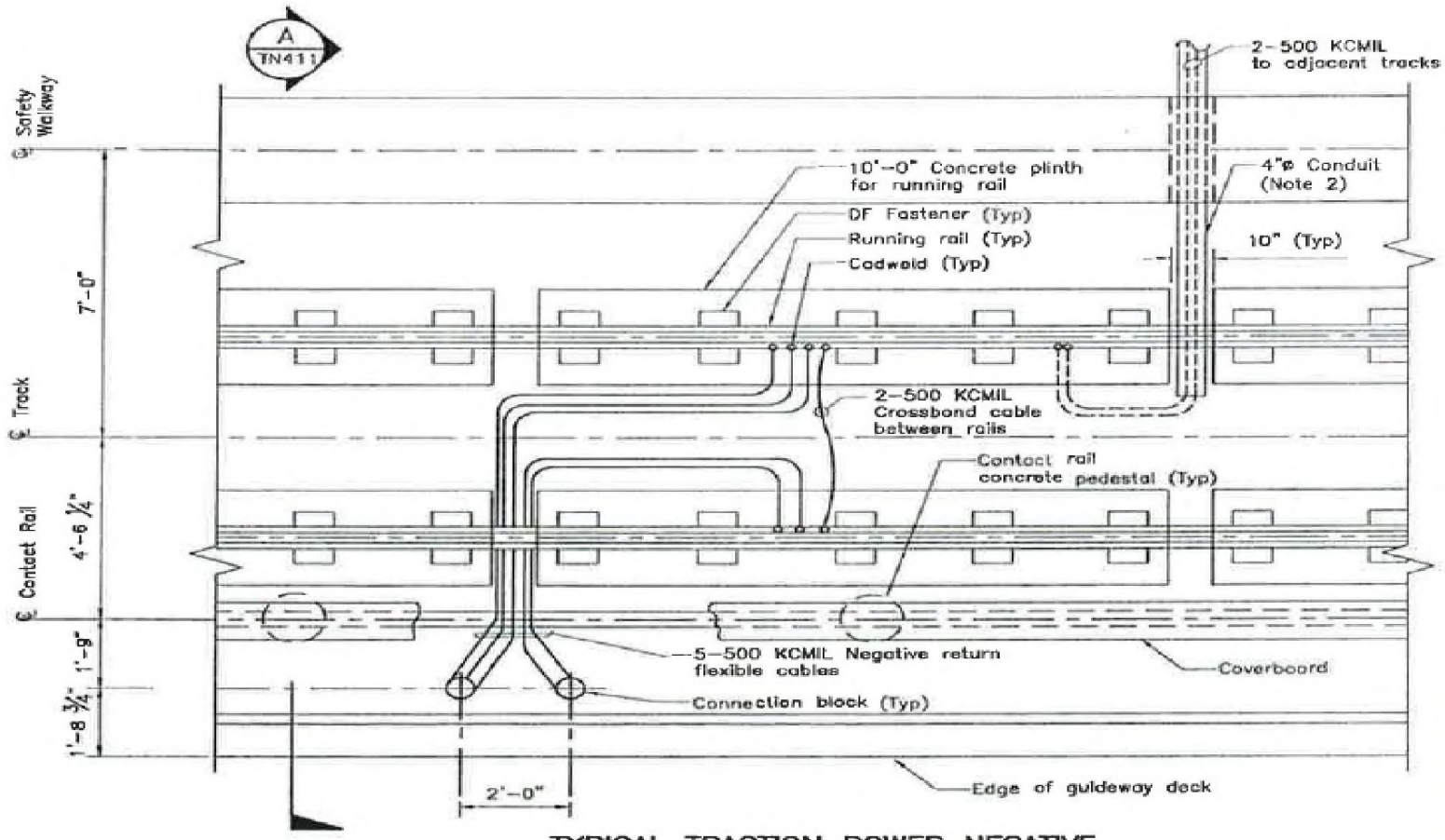
(+) & (-) Feeder Conduit Arrangement



TYPICAL POSITIVE DC FEEDER CONDUIT ARRANGEMENT

SECTION B
NTS TN405 TN404

Cable Routing on Deck



TYPICAL TRACTION POWER NEGATIVE FEEDER CONNECTION TO RUNNING RAILS (IN ABSENCE OF IMPEDANCE BONDS)
(TYPICAL FOR TANGENT TRACKS WITH CENTER WALKWAY)

Questions?

Agenda

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Passenger Vehicles

Vehicles Requirements

- Mandatory Requirements-ADA & Ergonomics
- Smoke & Flammability- NFPA-130:2007, CH 8
- Fully automated per Recommended Practices – ASCE-21-98, Automated People Mover Standards – Part 2
- Design life of 30 years- with recommendations for mid-life overhaul
- Assumed annual mileage: 63,500 miles
- Operate with consist E-E up to E-M-M-E (2, 3 or 4 vehicles)
- Service proven design and Off the shelf

Critical Dimensions

- Length of vehicle: 60’nom.
- Width of vehicle: 10’nom.
- Clear width of passenger side doors: 48” min. 66”max.
- Clear height of passenger side doors: 78”min. 80”preferred.
- Passenger doors not protrude more than 2.5”.
- Height of floor TOR: 45” nom.
- Under-floor mounted equipment clearance: 11.4” min.
- Interior height, center-line floor to ceiling: 80.0”min.
- Vehicle roll angle: 4.0 degrees max.

Vehicle Characteristics

- **Load Capacity: 50 seated plus 112 standees @ comfort loading**
- **Performance:**

  Speed: 55 mph max initial operating, 65 mph maximum

  Acceleration: 3.0 mph/sec

  Braking: Service: 2.2 mph/sec to 3.0 mph/sec

  Emergency: ≥ 3.0 mph/sec
- **Wide gangways between vehicles**
- **Level boarding (no extendable ramps)**
- **Video recording / link to OCC**

Vehicle Characteristics (Continued)

- Controlled collapse ends / ASME RT-1 crashworthiness
- Shock absorbing automatic couplers / intermediate couplers
- Air conditioning
- Third rail power collection
- Derailment mitigation
- Wheel lubrication

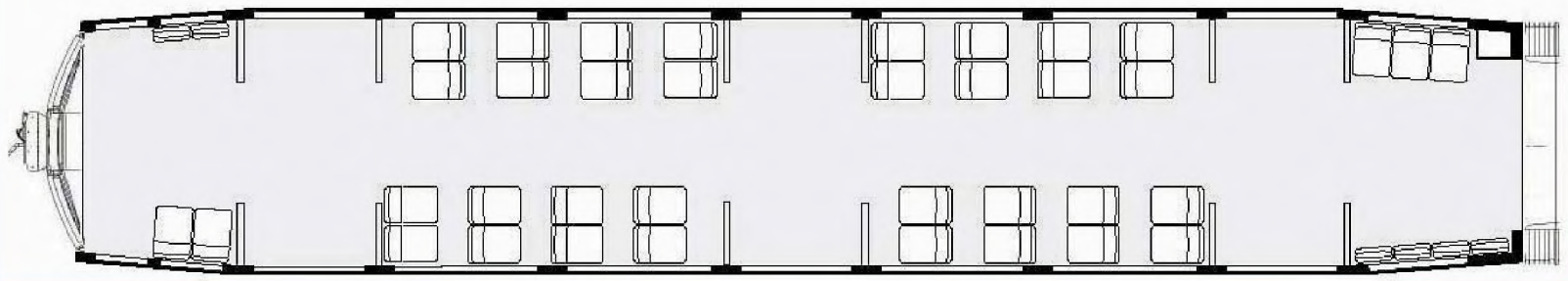
Doors

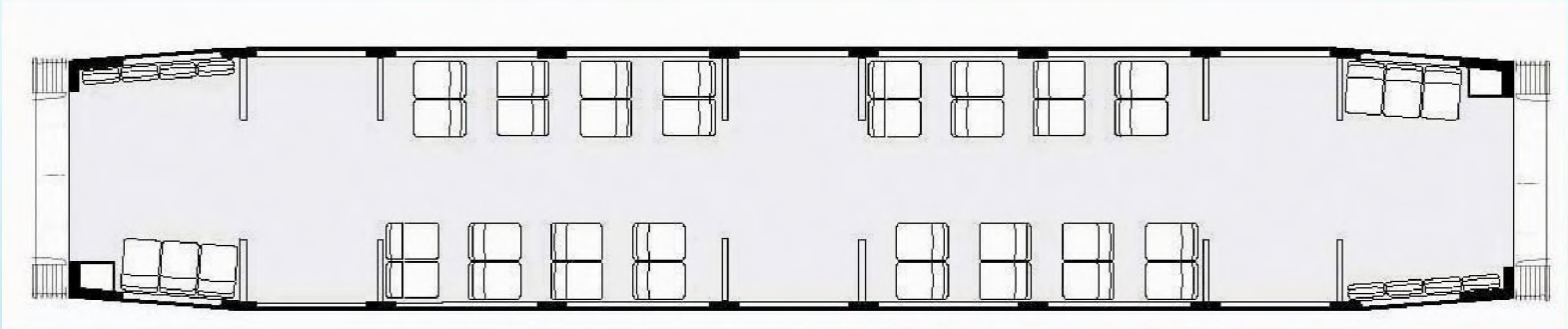
- Bi-parting 2 or 3 per side
- Prefer Fully Glazed per TP 4.4.2
- Sliding-plug type
- Control of doors per side
- Emergency release
- Non-contact & sensitive edge obstruction detection

Passenger Seating

- Aisle 32” wide for ADA
- Seat spacing no less than 28”
- Ergonomically designed

Passenger Seating Arrangement





Multi-Purpose Area

- Each vehicle shall provide accommodations for baggage and at least two (2) wheelchairs, four (4) small to medium sized surfboards and three (3) bicycles.
- These areas shall be provided with longitudinal tip-up seats.
- Bicycles are placed in the racks provided, the aisle width shall not be reduced.

Windows

- Windshield to be FRA Type I
- Doors & Side windows to be ANSI Z 26.1

Couplers

- Type A
  - Fully automatic
  - Capable of coupling from the cab
- Type B
  - Semi permanent
  - Use of TL cables

Propulsion & Braking

- Current limited (by software) to 1200 A max
- Spin-Slide
- Dynamic brake designed for AW2
- Friction brake designed for AW3
- Emergency braking should consist of friction, dynamic, and track brake

HVAC

- Fresh air to be 1200 CFM min.
- Air velocity 1200 FPM max.
- Layover mode required.
- EER=9.1 min.
- Capacity for AW2

Wireless (Mainline)

Utilizing wireless LAN the following information shall be transmitted from the vehicle to wayside:

- Audio and Video camera feeds from an active Train Telephone (T-TEL) or manual door release
- On demand video streams from individual vehicle cameras to OCC
- Real-time Maintenance and Diagnostic data from the vehicle
- Basic vehicle travel log data such as vehicle ID, location, mileage, time, etc.

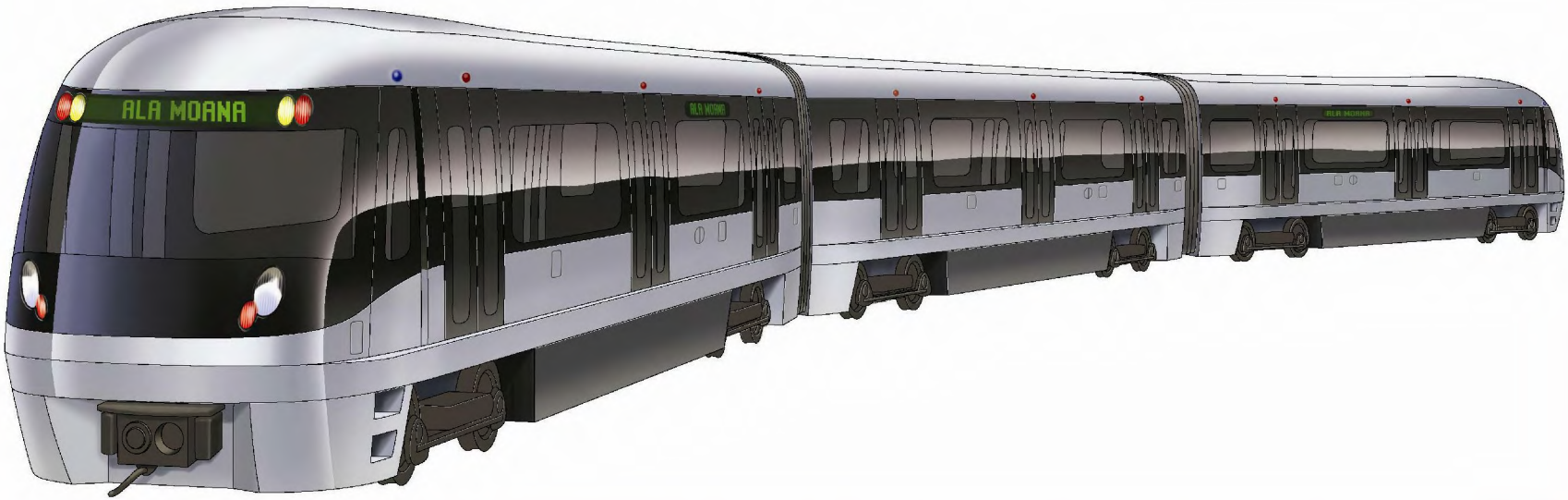
Wireless (Yard)

- All raw automatic passenger counter (APC) data.
- Logged Maintenance and Diagnostic data since last download.
- Any changes to the messages to be displayed on the vehicle destination or passenger information displays.
- Any new audio messages to announced on the vehicle auto-announcer.
- Any new advertising messages to be displayed on the vehicle advertising displays (future).
- Any changes to the operating points for the intelligent flange lubrication system.

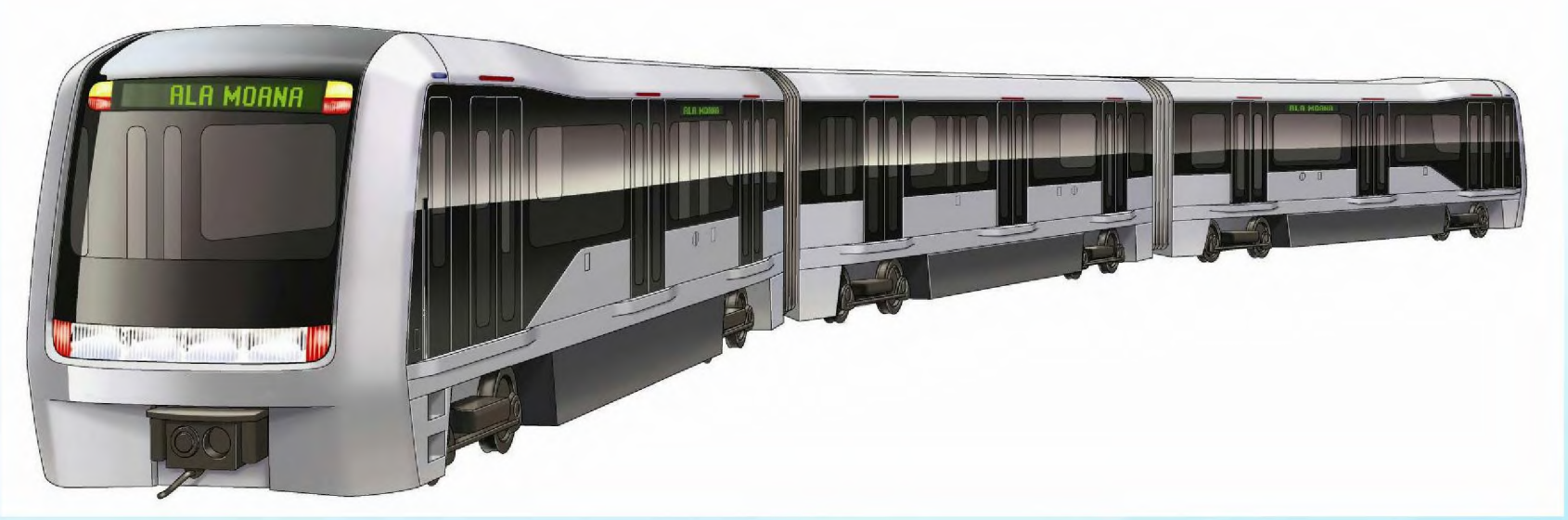
Noise

- Interior
  - Vehicle moving, empty, on horizontal tangent track at 65 km/hr [40 mph]: 75 dBA
- Exterior
  - Vehicle moving, empty, on horizontal tangent track at 65 km/hr [40 mph]: 75 dBA
  - wheel squeal in curves not exceed 78 dBA.

Exterior Concept 1



Exterior Concept 2

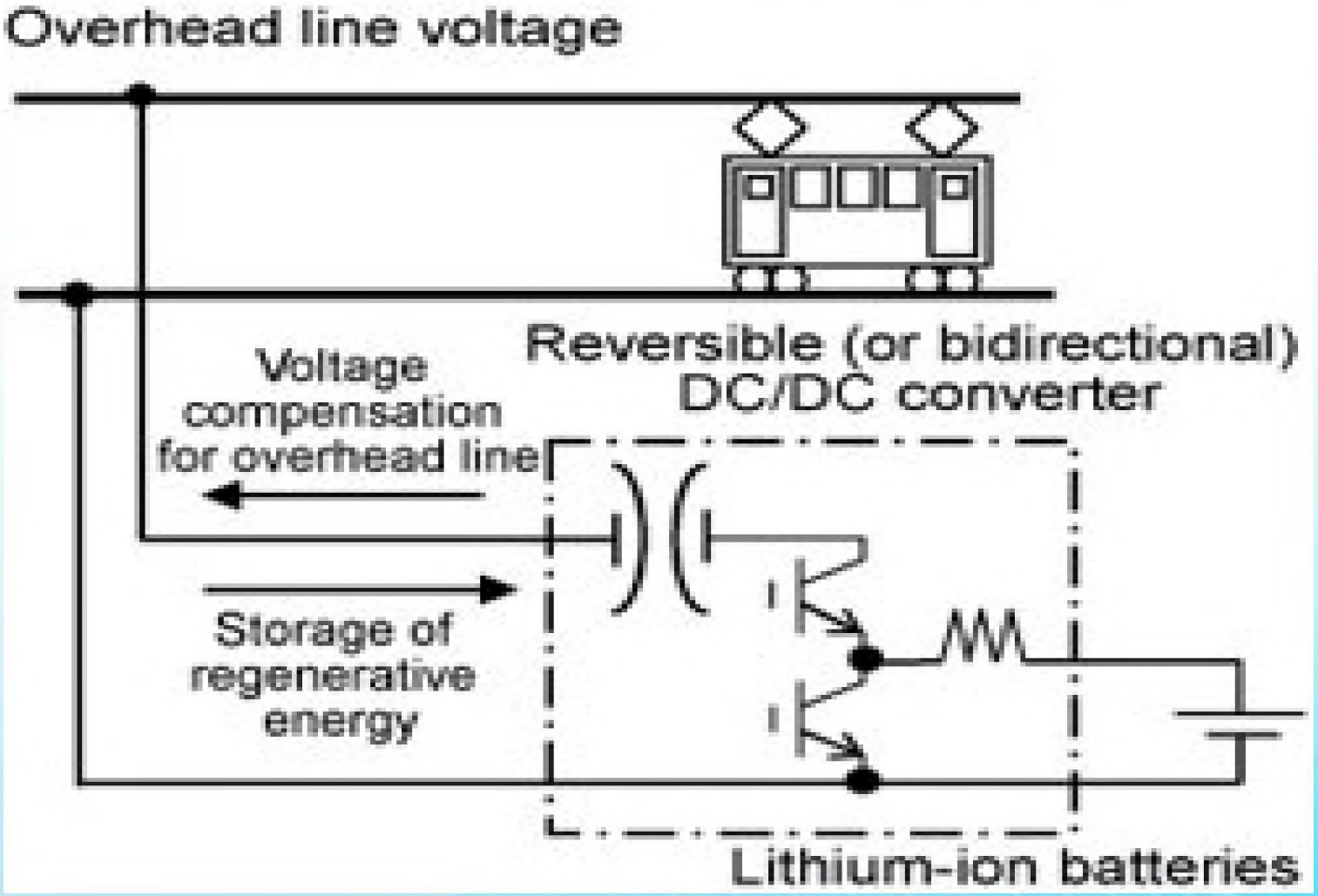


Interior Concept

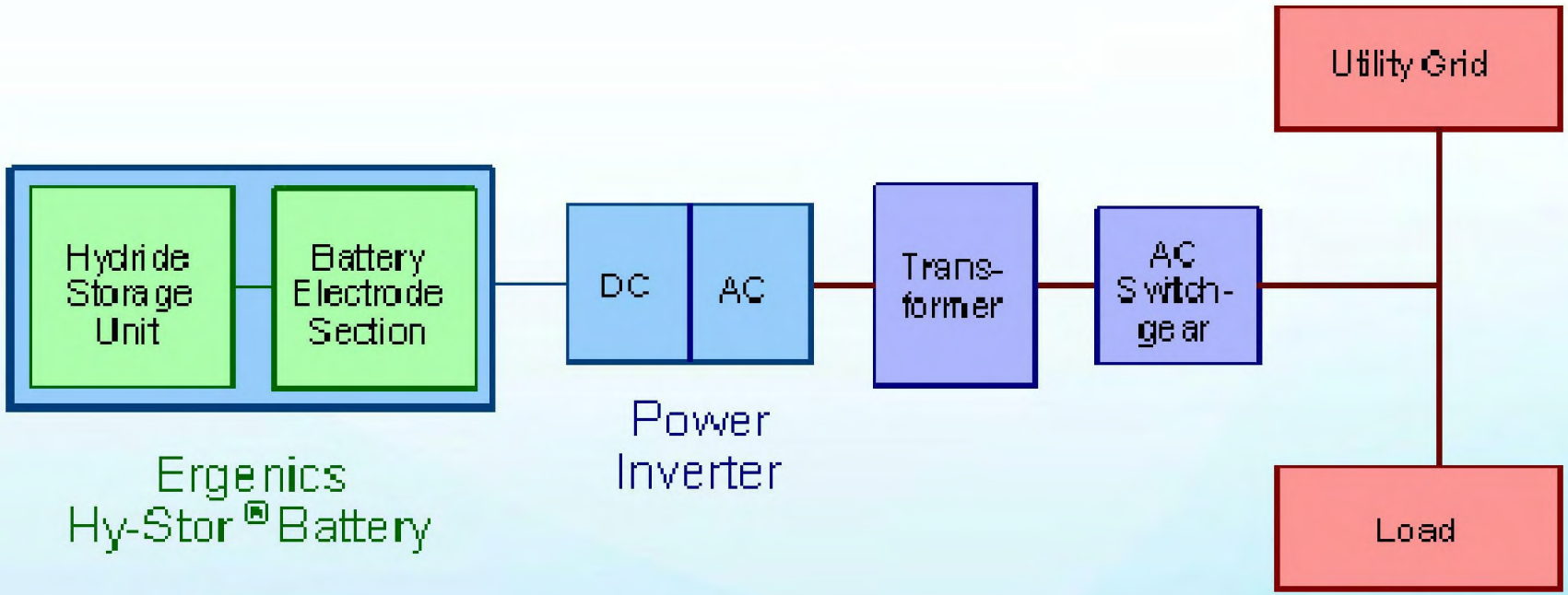
Requirement of Energy Storage Option

- Maximize recuperation of braking energy (27 to 30% lower overall energy costs)
- Reduce traction power system peak power consumption
- Assist in stabilization of traction power voltage levels and allow continuous operation of all vehicle systems and equipment through rail gaps or other momentary interruptions of power.
- Accomplished by means of energy storage devices such as batteries, ultracapacitors.
- Sufficient energy storage power shall be available to propel an AW2-loaded train a distance of one mile on level tangent track.
- Sufficient energy storage power shall be provided to enable all trains on the system to move to the nearest station during a sustained power outage.

Energy Storage – On-Board



Energy Storage – Wayside



Peak Shaving Battery Energy Storage System

Questions?

Agenda

- Operations & Maintenance (O&M) Concepts and Plan
- Fare Collection Concepts and Plan
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- Passenger Vehicles
- **Communications**
- Project Interface Systems Integration Management
- Potential MSF Modification
- Verification Testing and Acceptance/Safety & Security

Communications

Communications System Functions

- Equipment control and monitoring
- Security monitoring (video and alarms)
- Voice communications
  - Passengers (PA, telephones)
  - O&M Personnel (telephones, radio)
- Data storing, retrieval, analysis and reporting

Communications System Approach

- All systems on common fiber optic Internet Protocol (IP) network
- High availability, fault tolerant, open-standard and industry accepted communication protocol
- All sub-system applications (SCADA, Telephone, CCTV, PA/VMS) are IP based and Virtual Private LAN (VPN)
- Support standard TCP/IP protocol
- Voice Radio provided by existing City and County of Honolulu
- Fiber Optic Cable supports data rates at least 10Gbps
- 800 MHz trunked radio system

Communications System Approach

- SCADA facilitates transmission of indications/alarms from field Remote Terminal Units(RTUs) and PLCs to the OCC and transmission of control from OCC to the field
- Each passenger station equipped with CCTV, PA/VMS, telephone, intrusion detection and access control
- All emergency telephones on private VoIP telephone system
- OCC located at Maintenance and Storage

Major Elements

- Communication Transmission System (CTS)
- Supervisory Control and Data Acquisition (SCADA)
- Telephone system
- CCTV system
- Passenger Information system
- Local Area Network (LAN)
- Wireless communication
- Maintenance Management Information System (MMIS)

Communication Transmission System

- Single Mode Fiber Optic Network (FOCN)
  - Two separate 48-strand single mode fiber cables for network backbone
  - Single 24-strand single mode Fiber Optic Drop Cable Network
- Optical network node
- Carrier Grade switches at major facilities
- Ethernet switches at network access locations
- Metro Area Network connects Gigabit Ethernet LANs into one network

SCADA

- Train operation
- Traction power equipment
- Facility fire alarm system
- Intrusion detection system
- Seismic detection system
- Elevators and escalators
- Station, yard, and OCC communication equipment

Telephone System

- Administrative Telephone
- Blue Light Station
- Emergency Telephones
- Passenger Assistance Telephones
- Train Emergency Speaker phones
- Redundant switching equipment with interface to E911 network
- Redundant application, database servers and VoIP Call Managers
- Voice logging and archiving

CCTV System

- Fixed and PTZ cameras
- Video storage, retrieval and archiving equipment
- On-board CCTV
- One exterior camera on each end-unit
- On-board recording equipment and storage
- CCTV monitors at OCC and back-up OCC
- Wall mounted video display bank at OCC

Passenger Information System

- Station Variable Message Sign
- Station Public Address
- Vehicle Variable Message Sign
- Vehicle Public Speakers System
- Passenger Emergency Telephone
- Yard Public Address System

Other Communications Subsystems

- LAN
  - Passenger Station Communications
  - MSF Admin Communications
  - OCC Operational and Administrative Communications
  - 1000 mbps
- Wireless Communications System
- Voice Radio
  - Existing EDACS 800 MHz trunked radio system

Wireless Communication System includes:

Mobile Data system

Maintenance yard and shop wireless

Voice radio comm (city's exiting Provoice 800 Mhz EDACS)

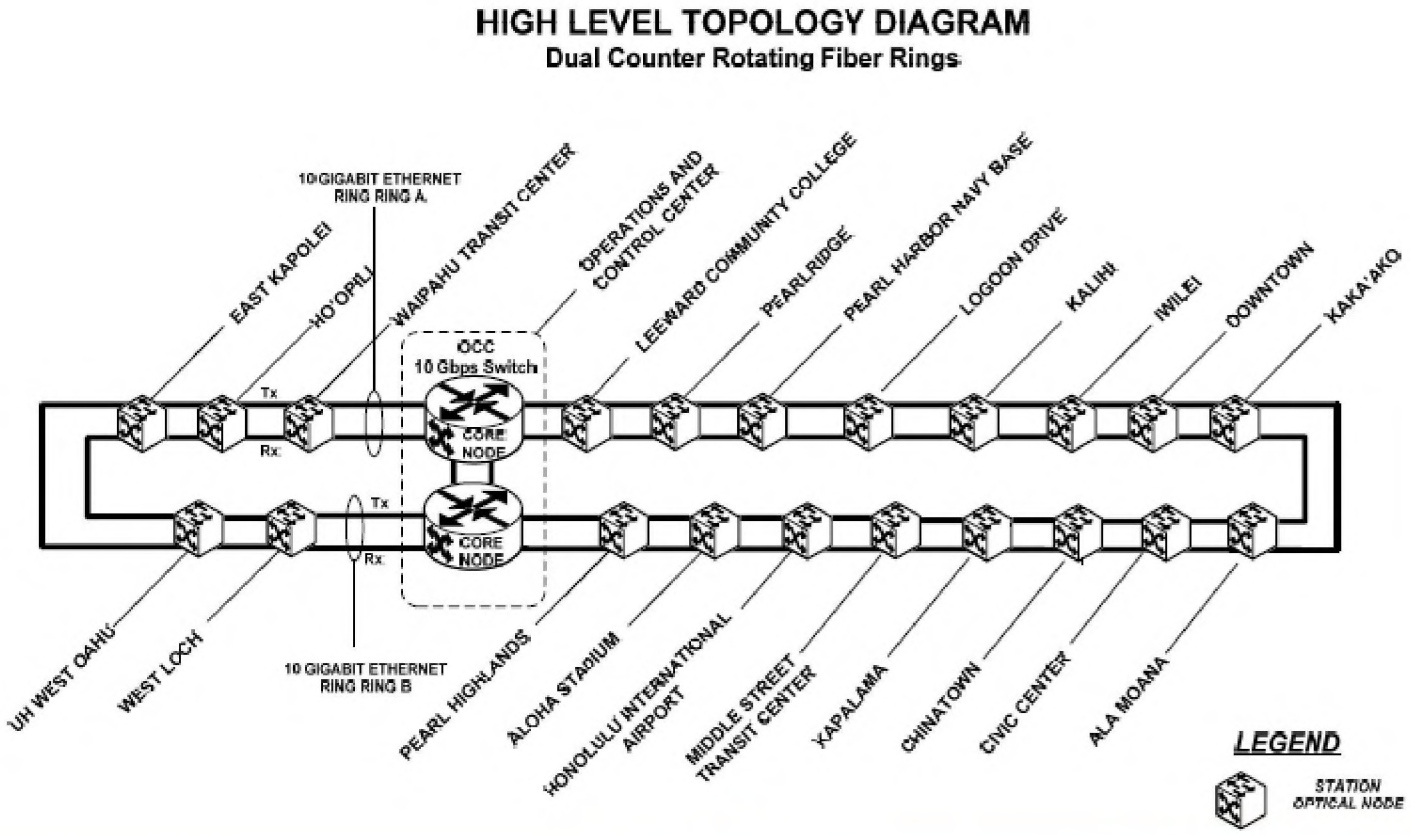
Other Communications Subsystem

- Yard WLAN
  - Automated upload of maintenance, passenger counting data, CCTV data
- Mobile Data System (MDS)
- Master Time Base
- Network management software
- MMIS

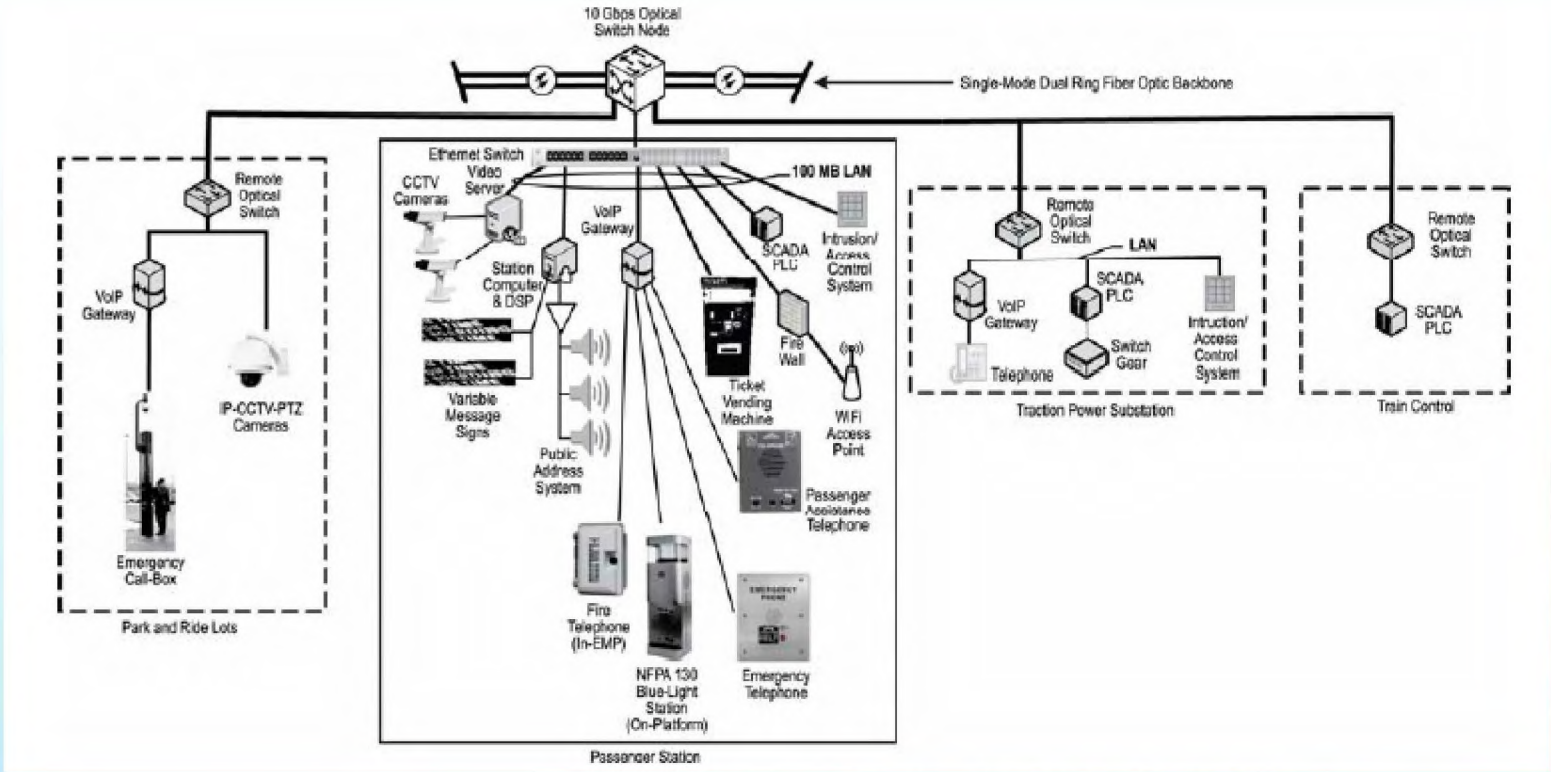
Operation Control Center (OCC)

- Monitor and control of System's operation and activities
- Mainline operator workstations
- MSF operator workstations
- Security workstations
- Supervisor workstation
- System Display
- CCTV wall

Communication Transmission System



Typical Station Network



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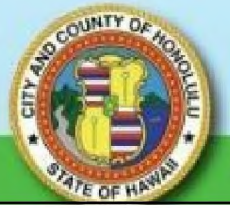
Project Interface
Systems Integration Management



HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT

Project Interface Management

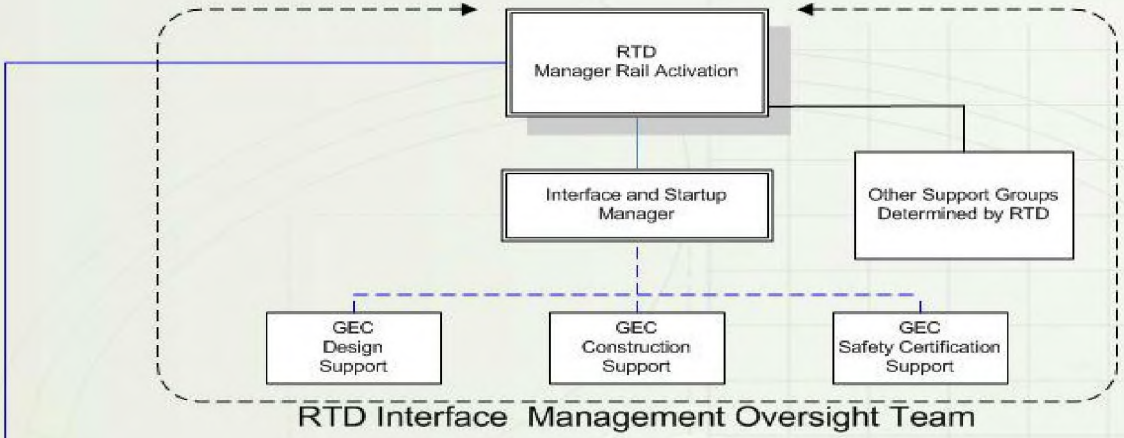
- Project Scope
- Identification of Key Areas
- Project Approach
- Systems Interfaces and Coordination
- Facilities Interfaces and Coordination
- Interface Management and Information Flow Chart

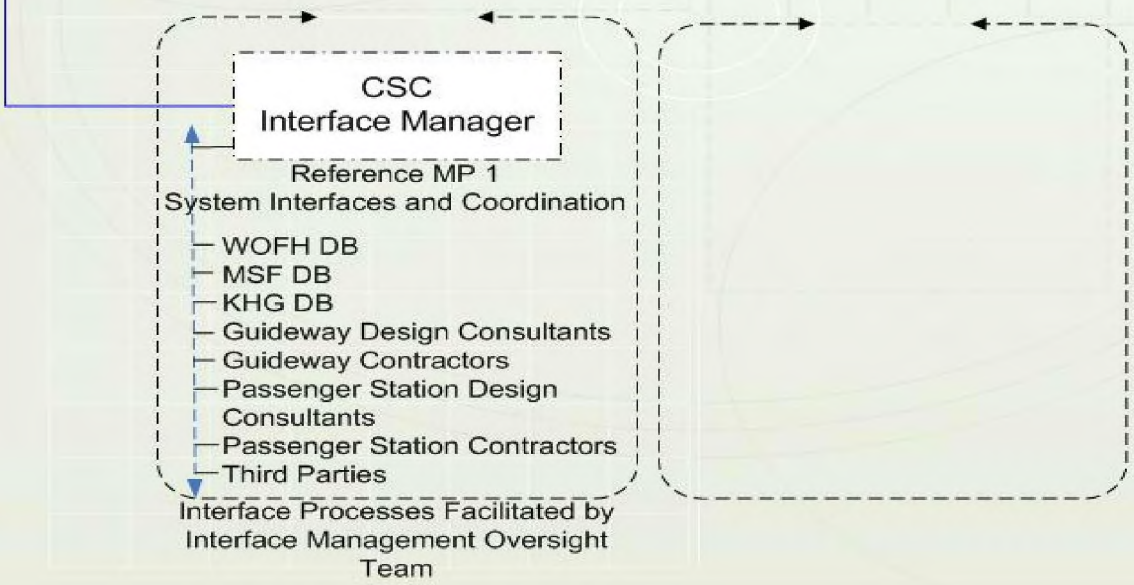
Project Scope

- HHCTCP includes multiple Contractors
- There are multiple Delivery Methods:
  - Design-Build
  - Design-Bid-Build
  - Design-Build-Maintain
  - Design-Build-Operate-Maintain
- There are multiple Construction Segments
- There are multiple Phased Openings

Identification of Key Areas

- Interface Management is considered a "High Risk" Project category
- Each Contractor is mandated to manage individual Interface Programs and participate with interfacing Contractors
- RTD is responsible for facilitating the Project Interface Management Program and will form the RTD Interface Management Team





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Systems Interfaces and Coordination

- The Core Systems Contractor has the largest role in the Interface Process
- The Core Systems activities are mandated via Contract Provision MP-1 Systems Interfaces and Coordination
- RTD has included as a Reference Document:

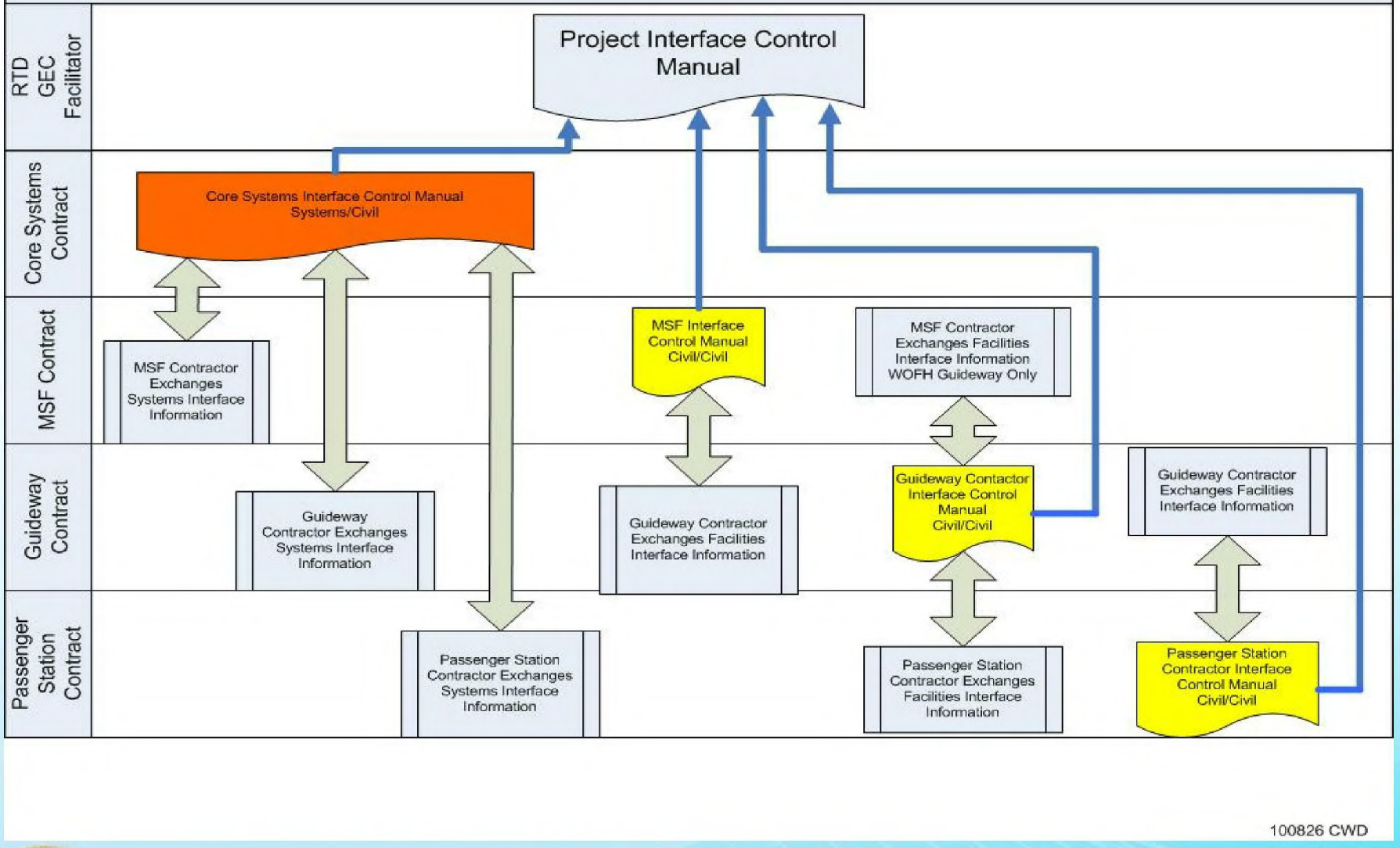
  Interface Control Manual (DRAFT) which is intended to be a template for Project use

Facilities Interfaces and Coordination Example

Impedance Bond Box Installed by Facility Contractor

Impedance Bond Box ready for Systems Follow on Contractor

Project Interface Management and Information Flow Chart

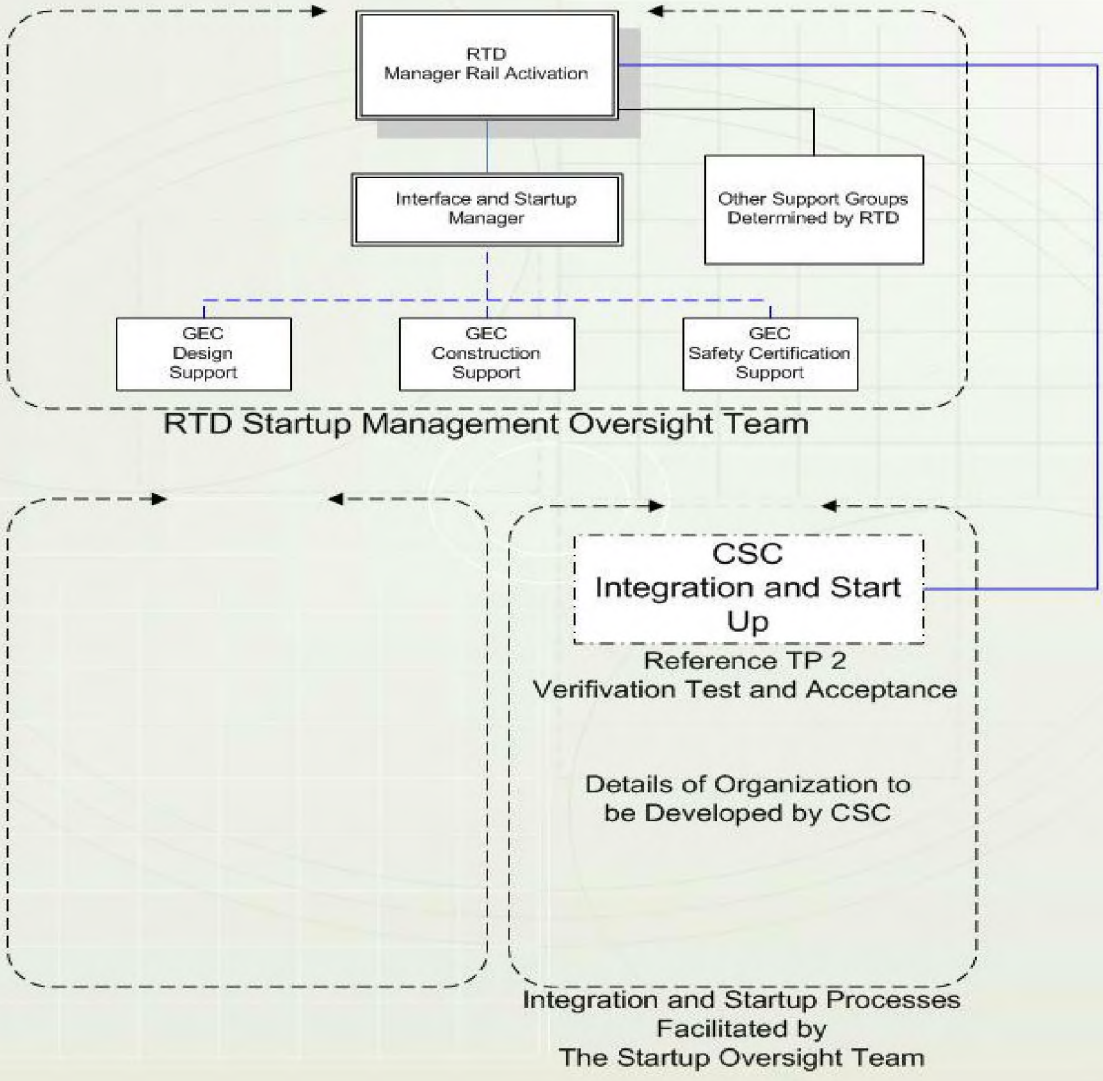


Systems Integration

- Core Systems activities are mandated via Contract Provision TP-2:
  - Test Management Plan
  - Software Verification Plan
  - Systems Integration Plan
  - Integrated System Demonstration Plan
  - Cutover Plan (when extending existing Operational Segment)

Systems Integration

- RTD is responsible for facilitating the Project Start Up Management Program and will form the RTD Start Up Oversight Team
- Systems Integration is part of the Start Up Process



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Questions?

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- **Potential MSF Modification**
- Verification Testing and Acceptance/Safety & Security

Potential MSF Modifications

Revised MSF Yard Layout Concept

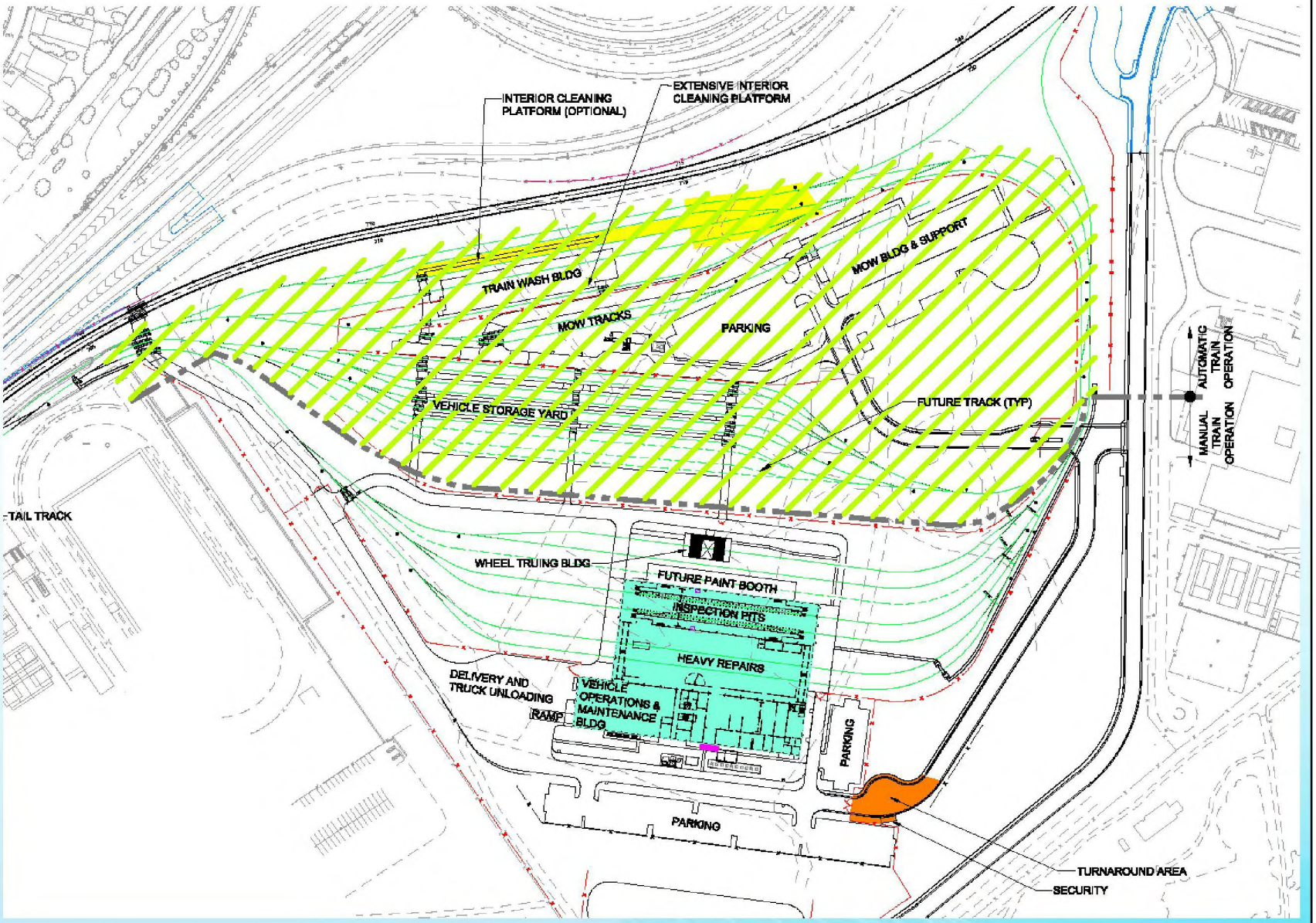
- Reviewed CSC RFP Proposals
- Reviewed CSC comments during discussions
- Filtered information
- Re-visited Existing Yard Layout
- Considered Revising Yard – Improving Match

Constraints

General Site Layout Consistent with Original

Maintain basics to minimize Changes to MSF DB

- Grading
- Buildings - Size & Function
- Road Layout & Parking
- Functional Yard Layout
- Operational Concept (except ATO)

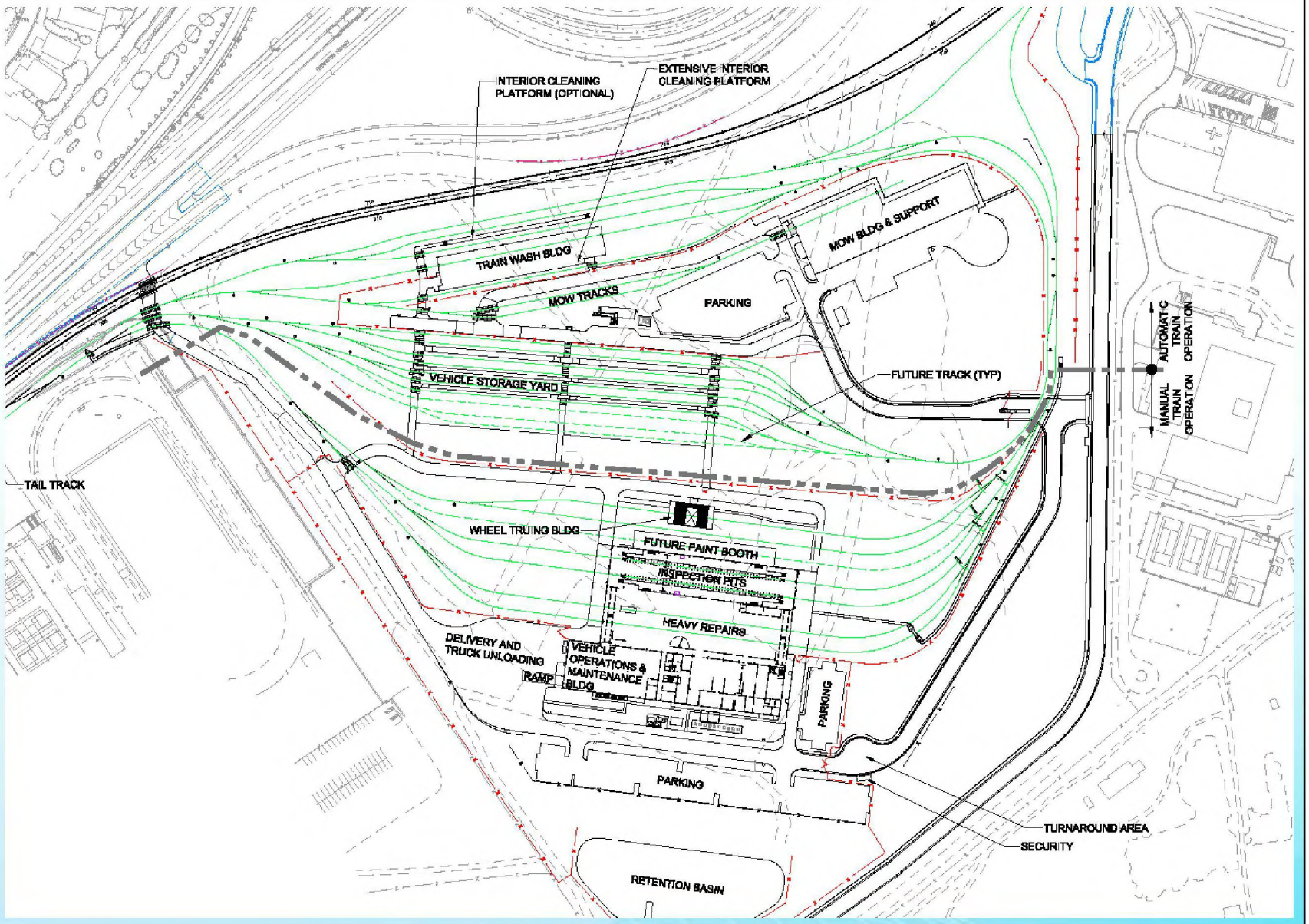


HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT

AR00073690

Yard Layout Changes

- Eliminate Yardmaster Observation Post
- Automate Yard except OSB tracks
- Flip the OSB (mauka / makai)
- Revise Ready / Layover Tracks
  - Realign EB RL@ into RL3
  - Lengthen RL2 to accommodate 2/4-car train sets
  - Widen track centers of RL2 / RL3 (allowance ICP)
  - Vehicle Turnaround & Relocate Security Booth



HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT

AR00073692

ROM Cost

Estimate of Cost Impact to MSF DB Contract

- **Revised Yard Layout Changes**

Eliminate Yardmaster's Observation Post	($115k)
ATO Yard except OSB	$0
Flip Bldg	$0
Track Changes	
a. Lengthen RL2	$45k
b. Shift OSB tracks	($72k)
Provide Vehicular Turnaround Area	$3k
Move Security Booth	($8k)
Total Cost	($147k)

Potential Options

- **Based on Selected CSC DB**
  - **Add fencing to separate Peds from ATO areas**
  - **Optional Interior Cleaning Platform (ICP)**
  - **Automate OSB Tracks with ATO**

ROM Cost

Potential Options

- **Optional Revisions**

Add fencing to separate PED / ATO areas	$68k
Provide Interior Cleaning Platform (ICP)	$760k
Make OSB tracks ATO	$860k

Questions?

Agenda:

- Operations & Maintenance (O&M) Concepts and Plan
- Fare Collection Concepts and Plan
- Train Control
- Traction Power
- Passenger Vehicles
- Communications
- Project Interface Systems Integration Management
- Potential MSF Modification
- **Verification Testing and Acceptance/Safety & Security**

Verification, Test and Acceptance (VTA)
Safety and Security

VTA

General Requirement

The CSC shall subject individual systems and the complete rail system to comprehensive test program to:

- Verify the design and performance characteristics; and
- Determine compliance with safety , reliability, maintainability, and dependability requirements

VTA

VTA Program

The VTA Program shall identify all design and performance requirements, assign appropriate verification efforts, define method(s) for verification.

VTA Program Categories

System Final Definition	Emergency procedures
Subsystem design and performance	Maintenance hardware verification
Component assembly acceptance testing	Software verification program (SVP)
Subsystem acceptance testing	Integrated System Demo Program (ISDP)
Subsystem interface verification	Reporting format for each verification/test
Systems integration testing	Identification of City supplied materials/equip
Hard/software integration	City defined test

VTA

Key Submittals

VTA Plan

Describes the methods and procedures to verify systems compliance prior to attaining Acceptance. Includes procedures for implementing corrective action after failed inspections, test or demonstration.

Test Management Plan

Identifies the CSC VTA organization and individual responsibilities that are to be available for test planning, scheduling, performance, analysis, review of data and reporting efforts. Test shall be classified as safety critical, performance critical, or non-critical.

VTA

Key Submittals

VTA Reports

Formal reports shall be provided of all verification activities to confirm compliance with design and performance requirements. Interim, summary and failure/incident reports are to be submitted during the various stages of the project. The depth of detail will vary depending complexity of the tests being conducted.

Software Verification Plan (SVP)

All software is subject to design, verification and configuration control requirements equivalent to those imposed on systems hardware. Software shall be tested and verified on a simulator prior to interfacing hardware.

VTA

Key Submittals

Performance Verification Plan (PVP)

CSC shall test and qualify the functional performance of selected components, assemblies or subsystems prior to final construction, installation and/or assembly as indentified in the contract.

Systems Integration Plan (SIP)

CSC shall define the on-site integration activities for subsystems acceptance and systems integration test. Plan to address: trackwork, passenger vehicle, train control, communications, traction power, ticket vending, and MSF equipment,

VTA

Key Submittals

Integrated System Demonstration Plan (ISDP)

CSC shall develop and implement an ISDP that encompasses all verification efforts and shall include: proof of design (plant and field), post delivery acceptance, pre-passenger, start-up, demonstration service and maintainability testing.

Acceptance Plan

Describes the methods and procedures that will verify to the City that CSC has complied with the contract requirements, for acceptance by the City.

VTA

Key Submittals

Operating System Acceptance Test Plan

Purpose of this plan is to demonstrate by tests and inspections that the operating systems meets the requirements of the contract. Each activity is to be conducted in accordance with written procedures prepared by the CSC and approved by the City.

VTA – Safety and Security

VTA Requirements for Safety and Security

- **TP-2.2.1-General**
  - Comprehensive test program to verify design and performance for safety and security
  - Utilize induced or simulated failures to demonstrate acceptable degree of safety and security for failure modes
- **TP-2.2.2-VTA Program**
  - System/Subsystem Testing
  - Systems Integration Tests
  - Emergency Procedures and Drills
  - Software Verification Program

VTA – Safety and Security

VTA Requirements for Safety and Security

- **TP-2.4.7-Test Criticality**
  - Verification requirements assessed for criticality to system performance and safety
  - Safety-critical design and performance requirements verified by test
- **TP-2.9.3-Operating System Acceptance Plan**
  - Describe results of inspections/tests impacting safety
- **MP-6.2-Safety and Security Certification Program**
  - Certification Manager
  - Implement certification for CSC contract certifiable elements
  - Support/facilitate certification for other contracts

Questions?