CONTRACT

THIS CONTRACT, made and entered into by and between the **CITY AND COUNTY OF DENVER**, a municipal corporation of the State of Colorado ("City"), and **BOMBARDIER TRANSPORTATION (HOLDINGS) USA INC.**, a Delaware corporation authorized to do business in Colorado ("Contractor").

W I T N E S S E T H:

WHEREAS, the City owns and operates Denver International Airport ("DIA" or the "Airport"), and

WHEREAS, the City desires to upgrade the Central Control System for its Automated Ground Transportation System (AGTS), as well as replace the Automated Train Control (ATC); and

WHEREAS, the Contractor has submitted a proposal to the City for those AGTS upgrades and replacement; and

WHEREAS, the Contractor is fully qualified and ready, willing and able to provide those goods and services to the City at DIA, in accordance with its proposal submitted to the City;

NOW, THEREFORE, for and in consideration of the premises and other good and valuable consideration, the parties hereto agree as follows:

1. DEFINITIONS

(a) "Contract Schedule" or "Schedule" shall mean the detailed schedule which is developed by the Contractor and approved by the City detailing all of the events required for completion of the Work. The Schedule will be developed from the Contractor's work breakdown schedule (WBS) and prepared in compliance with the contract documents.

(b) "Summary Project Schedule" shall mean the schedule that appears in this Contract as ***Exhibit D-1***, which will govern the contract until such time as the Contract Schedule is developed and approved by the City.

(c) "Work" shall mean all of the required engineering, software development, materials, manufacturing, installation, testing and project management required to successfully complete the requirements of this Contract. "Work" may also be referred to as "Scope of Work" or "Works".

2. CONTRACT DOCUMENTS; ORDER OF PRECEDENCE

This Contract consists of Sections 1 through 46, the signature page, and the following attachments that are incorporated herein and made a part hereof by reference:

Appendix 1	Standard Federal Assurances
Exhibit A	Contractor's Proposal - Excerpts
Exhibit B	Technical Specifications for AGTS Central Control Upgrade and Automated Train Control Replacement
Exhibit C	Project Management Provisions
Exhibit D-1	Summary Project Schedule
Exhibit D-2	Payment Milestone Schedule
Exhibit E-1	Certificate of Final Completion
Exhibit E-2	Certificate of Substantial Completion
Exhibit F	Prevailing Wage Rate Schedules
Exhibit G	Insurance Requirements
Exhibit H	Performance Bond

Together with this Contract, all such documents constitute and are referred to as the "Contract Documents" or the "Contract."

In the event of (i) an irreconcilable conflict between a provision of Sections 1 through 46 or any of the listed attachments, such that it is impossible to give effect to both, or (ii) an irreconcilable conflict between provisions of any attachments, such that is impossible to give effect to both, the order of precedence to determine which document shall control to resolve such conflict, is as follows, in descending order:

1. Appendix 1
2. Sections 1 through 46
3. Exhibits E-1 and E-2
4. Exhibit D-1
5. Exhibit D-2
6. Exhibit C
7. Exhibit B
8. Exhibit A
9. Exhibit H
10. Exhibit G

3. CITY'S LINE OF AUTHORITY; CONTRACTOR'S CONTACTS

The day to day administration of this Contract shall be under the direction of the Manager of Aviation or her designated representative. Changes in the details of the work to be performed may be ordered by, and all the City's design review activities shall be performed by, the City's Project Manager, who is: David I. Rhodes, P.E., Deputy Manager of Aviation – Planning and Development. The City may from time to time

designate a different Contract Administrator by notice to the Contractor in writing signed by the Deputy Manager of Aviation – Planning and Development.

The Project Manager is authorized to approve changes in the design, specifications, and technical requirements of the AGTS Central Control Upgrade and ATC Replacement, and to perform review and inspection of the AGTS Central control Upgrade and ATC Replacement at the manufacturing plant and on site at Denver International Airport. The Project Manager is the City's representative with day to day responsibility for administration of this Contract, and for all decisions except those reserved to the Manager of Aviation, the Deputy Manager of Aviation, or the Director of Purchasing. The Contractor shall direct all correspondence concerning this Contract to the Project Manager.

Certificates of Final Completion and Substantial Completion, in the forms attached as **Exhibits E-1 and E-2**, shall be issued by the Deputy Manager of Aviation – Planning and Development, subject to the approval of the Manager of Aviation.

The terms and conditions of this Contract may not be changed except by a duly executed written amendment, except for the details of the design, specifications, schedules, and technical requirements, which may be changed by the Project Manager if such changes do not increase the maximum contract amount.

The Contractor shall designate a representative to whom the City shall direct communications under this Contract, and the Contractor shall disclose in writing to the City its line of authority for the engineering, manufacturing and testing work to be performed hereunder.

4. SCOPE OF WORK

The Contractor agrees to and shall furnish all labor, tools, supplies, equipment, materials and everything necessary for and required to do, perform and complete the following, in accordance with the schedule set out in this Contract:

(a) AGTS Central Control Upgrade: provide and install an Alternate Control Center in the main conference area of the APM Maintenance Facility, and upgrade the current Central Control facility currently located in the Airport Office Building, as described in this Contract, including in the attached Exhibits, including but not limited to ***Exhibits A, B, and C***.

(b) AGTS Automated Train Control (ATC) Replacement: design, manufacture, delivery, installation, integration, performance and testing and commissioning of a new ATC system, specifically the Bombardier CITYFLO 550 to control the AGTS connecting Concourse A, B, C, Main Terminal and Maintenance Facility at Denver International Airport, as described in this Contract, including in the attached Exhibits, including but not limited to ***Exhibits A, B and C***.

5. COMMENCEMENT OF WORK; PROJECT SCHEDULES

Following delivery to the Contractor of a fully executed copy of this Contract, the City will issue a written Notice to Proceed. Within three (3) days after receipt of a Notice to Proceed, the Contractor shall commence the work, in accordance with the Summary Project Schedule in **Exhibit D-1,** or in accordance with the Contract Schedule, as agreed to by the parties.

Contractor will develop the Contract Schedule from the Summary Contract Schedule and in accordance with the Technical Specifications and Project Management Provisions PM -14. The Contract Schedule is subject to change by the City upon notice to the Contractor. Changes in project schedule originated by the City may be subject to additional cost and time. Such additional cost and time shall be mutually negotiated by the parties. However, the maximum contract amount stated in Section 6(e) may not be increased except by an amendment to this Contract.

6. COMPENSATION AND PAYMENT

(a) Fee: The City shall pay and the Contractor shall accept as the sole compensation for services rendered and costs incurred under the Contract **TWENTY-FOUR MILLION EIGHT HUNDRED THOUSAND AND NO/100 DOLLARS ($24,800,000.00).** Amounts billed may not exceed the budget set forth in the Payment Milestone Schedule, Exhibit **D-2.**

(b) Reimbursable Expenses: There are no reimbursable expenses allowed under the Contract. All of the Contractor's expenses are contained in the budget in the Payment Milestone Schedule, Exhibit **D-2.**

(c) Additional Services: The Contractor shall also perform work requested by the Manager of Aviation which relates to the work covered by this Contract but which is not specified in the Contract, hereafter referred to as Additional Services. If the Manager requests Additional Services, the Contractor shall submit a proposal for performing such services along with an estimate of the cost. The Contractor and the City shall agree on payment procedures and cost in writing for these services. Additional Services are to be performed to meet circumstances or requirements occurring or discovered after this Contract is executed, in order that the purposes of this Contract may be accomplished without interruption or delay. The total amount which the City may authorize under this Contract for Additional Services shall not exceed **Seven Million and No/100 Dollars ($7,000,000.00).** The approval of Additional Services and the cost of performing them shall not under any circumstances be deemed to constitute any basis for or an agreement by the City to an increase in the Maximum Contract Liability.

(d) Invoicing: The City will make progress payments to the Contractor in accordance with the Payment Milestone Schedule, attached as ***Exhibit D-2***, upon invoices submitted by the Contractor documenting that the Work described in the applicable payment milestone has been completed. The Contractor's invoices shall be in

the form prescribed by the City and shall be subject to review and approval by the City, and paid in accordance with the City's prompt payment ordinance, D.R.M.C. §§ 20-107 to 20-118. The Contractor will provide, when requested, such additional supporting documentation as the Project Manager may request in order to process any invoice. The failure of the City to timely make payment to the Contractor shall not permit the Contractor to stop or suspend work hereunder. The City's payment of an invoice before Final Acceptance of the equipment, goods and/or services for which the invoiced work was performed, shall neither:

(1) constitute an acknowledgment of the acceptance of such work, nor

(2) affect the obligation of the Contractor to repair, correct, renew, or replace, at its expense, any defects, imperfections, errors or omissions in the design, fabrication, installation, construction of such equipment or work, which the City discovered on or before Final Acceptance of such work.

(e) **Maximum Contract Amount**:

(1) Notwithstanding any other provision of the Contract, the City's maximum payment obligation will not exceed **THIRTY-ONE MILLION EIGHT HUNDRED THOUSAND AND NO/100 DOLLARS ($31,800,000.00).** (the "Maximum Contract Amount"). The City is not obligated to execute an agreement or any amendments for any further services, including any services performed by Contractor beyond that specifically described in ***Exhibits A, B and C*.** Any services performed beyond those in ***Exhibits A, B and C*** are performed at Contractor's risk and without authorization under the Contract.

(2) The City's payment obligation, whether direct or contingent, extends only to funds appropriated annually by the Denver City Council, paid into the Treasury of the City, and encumbered for the purpose of the Contract. The City does not by the Contract irrevocably pledge present cash reserves for payment or performance in future fiscal years. The Contract does not and is not intended to create a multiple-fiscal year direct or indirect debt or financial obligation of the City.

7. TERM

The term of this Contract shall commence on the date of issuance of this Contract and shall terminate when (a) all obligations of the Contractor hereunder have been performed or (b) the Contract is terminated in the manner provided Section 11, whichever date is earlier; but in no event later than September 30, 2016.

8. INSURANCE

(a) The Contractor shall obtain and keep in force during the entire term of this Contract, insurance policies as described in the City's form of insurance certificate, **Exhibit G.** The certificate specifies the minimum insurance requirements the Contractor and any subcontractors must satisfy in order to perform work under this Contract. The original of such certificate shall be executed before a notary by the authorized party as specified on the certificate.

(b) Upon execution of this Contract, the Contractor shall submit to the City a fully completed and executed original of the insurance certificate form, which specifies the issuing company or companies, policy numbers and policy periods for each required coverage. In addition to the completed and executed certificate, the Contractor shall submit a copy of a letter from each company issuing a policy identified on the certificate, confirming the authority of the broker or agent to bind the issuing company, and a valid receipt of payment of premium.

(c) The Contractor may submit proof of insurance in a form different from **Exhibit G;** however, the City's acceptance of any submitted insurance certificate is subject to the approval of the City's Risk Management Administrator. All coverage requirements specified in the certificate shall be enforced unless waived or otherwise modified in writing by the City's Risk Management Administrator.

(d) The Contractor shall comply with all conditions and requirements set forth in the insurance certificate for each required coverage during all periods in which coverage is in effect.

(e) Unless specifically excepted in writing by the City's Risk Management Administrator, the Contractor shall include all subcontractors performing services hereunder as insured's under each required policy or alternatively, shall furnish a separate certificates of insurance for key subcontractors specifying the issuing company or companies, policy numbers and policy periods for each required coverage for each subcontractor. All coverages for subcontractors shall be subject to all of the requirements set forth in the form certificate.

(f) The parties hereto understand and agree that the City and County of Denver, its officers, officials and employees, are relying on, and do not waive or intend to waive by any provisions of this agreement, the monetary limitations or any other rights, immunities and protections provided by the Colorado Governmental Immunity Act, §§ 24-10-101 to 120, C.R.S., or otherwise available to the City and County of Denver, its officers, officials and employees.

9. DEFENSE AND INDEMNIFICATION

(a) Contractor hereby agrees to defend, indemnify, reimburse and hold harmless City, its appointed and elected officials, agents and employees for, from and against all

liabilities, claims, judgments, suits or demands for damages to persons or property arising out of, resulting from, or relating to the work performed under this Contract ("Claims"). This indemnity shall be interpreted in the broadest possible manner to indemnify City for any acts or omissions of Contractor or its subcontractors either passive or active, irrespective of fault.

(b) Contractor's duty to defend and indemnify City shall arise at the time written notice of the Claim is first provided to City regardless of whether Claimant has filed suit on the Claim. Contractor's duty to defend and indemnify City shall arise even if City is the only party sued by claimant and/or claimant alleges that City's negligence or willful misconduct was the sole cause of claimant's damages.

(c) Contractor will defend any and all Claims which may be brought or threatened against City and will pay on behalf of City any expenses incurred by reason of such Claims including, but not limited to, court costs and attorney fees incurred in defending and investigating such Claims or seeking to enforce this indemnity obligation. Such payments on behalf of City shall be in addition to any other legal remedies available to City and shall not be considered City's exclusive remedy.

(d) Insurance coverage requirements specified in this Contract shall in no way lessen or limit the liability of the Contractor under the terms of this indemnification obligation. The Contractor shall obtain, at its own expense, any additional insurance that it deems necessary for the City's protection.

(e) This defense and indemnification obligation shall survive the expiration or termination of this Contract.

10. LIABILITY OF CONTRACTOR

Except for claims for bodily injury and notwithstanding any other provision of this Agreement, the liability of the Contractor, its subcontractor and supplier, including liability for claims for customers of the City, for any damages, including loss or damage to property of the City or third parties and items delivered under this Agreement, cost of temporary equipment, loss of profits or revenue and cost of capital, whether in contract, in tort (including negligence and strict liability) or otherwise, shall not exceed TWENTY-FOUR MILLION EIGHT HUNDRED THOUSAND AND NO/100 DOLLARS ($24,800,000.00), plus the amount of any additional work authorized by the City under paragraph 6(c) herein.

11. PATENT INDEMNITY BY CONTRACTOR

The Contractor shall at its expense, defend or, at its option, settle any claim, suit or proceeding brought against the City insofar as it is based on an allegation that the AGTS Central Control Upgrade or the AGTS ATC Replacement, or any part thereof, furnished by Contractor, infringe a claim of any U.S. patent. This obligation shall be effective only if the Contractor is notified promptly in writing and is given authority, information, and

assistance for the defense of said claim, suit or proceedings. The Contractor shall pay all damages and costs in the claim, suit or proceeding so defended. In the event the AGTS Central Control Upgrade or the AGTS ATC Replacement become the subject of any claim, suit or proceeding for infringement of any U.S. patent, or in the event of any adjudication that the AGTS Central Control Upgrade or the AGTS ATC Replacement infringe any U.S. patent, the Contractor shall, at its option and its own expense, either (a) procure for the City the right of continue using said AGTS Central Control, as upgraded, or said AGTS ATC Replacement or any part thereof; or (b) with the City's consent, modify the AGTS Central Control Upgrade or the AGTS ATC Replacement so they become non infringing.

12. TERMINATION

This Contract may be terminated in accordance with the following conditions:

(a) Termination Upon Final Completion. Except for the Warranty provision hereof, this Contract shall terminate when a Certificate of Final Completion has been issued to the Contractor by the City for the Central Control Upgrade and for the AGTS ATC Replacement, and the City has paid to the Contractor all of the amounts due to the Contractor and properly invoiced in accordance with this Contract.

(b) Termination for Default. The City may terminate this Contract for an event of default by the Contractor. The City shall provide Contractor a written notice of any default, and the Contractor shall submit to the City a plan for curing the default within five business days of the date of the City's notice of default. If Contractor fails to cure the default within 30 calendar days of the notice of default, the City may terminate the Contract. The following events shall be considered defaults under this Contract:

(i) The Contractor fails to commence work upon receipt of applicable Notice(s) to Proceed, following the delivery of this Contract by the City.

(ii) The Contractor fails to maintain satisfactory progress of any of the work hereunder.

(iii) The Contractor breaches any material term of this Contract.

(c) Procedures Following Termination for Default. If the City terminates this Contract for default, the Contractor shall upon receipt of notice of termination, terminate its work under this Contract in an economical and orderly manner. The City shall pay the Contractor for the portion of the work hereunder satisfactorily performed by the Contractor prior to termination, and for materials and completed items delivered to the City and accepted by the City prior to termination that meet all requirements of this Contract.

(d) Termination for Convenience. The City may terminate this Contract for convenience on thirty (30) days written notice to the Contractor.

(e) Procedures Following Termination for Convenience. If the City terminates this Contract for convenience, the Contractor shall upon receipt of such notice of termination, take all necessary actions so that it shall have, within thirty days after receipt of notice of termination, terminated its work under this Contract in an economical and orderly manner. The Contractor shall not at any time after receipt of such notice of termination purchase additional materials or incur avoidable costs in pursuit of its work hereunder. The City shall pay the Contractor for the portion of the work hereunder satisfactorily performed by the Contractor prior to termination, and for materials and completed items delivered to the City and accepted by the City prior to termination that meet all requirements of this Contract. In addition, the City shall reimburse the Contractor for any actual restocking charges incurred by Contractor for items ordered prior to termination of this Contract, and returned as a result of the termination of this Contract.

13. PAYMENT OF PREVAILING WAGES

Employees of Contractor or its subcontractors may be subject to the payment of prevailing wages pursuant to D.R.M.C. § 20-76, depending upon the nature of the Work. By executing this Contract, Contractor covenants that it is familiar with this Code Section and is prepared to pay or cause to be paid prevailing wages, if any, applicable to the work conducted by the Contractor's or its subcontractor's employees. The schedule of prevailing wage is periodically updated and Contractor is responsible for payment of then current prevailing wage. The Contractor may obtain a current schedule of prevailing wage rates at any time from the City Auditor's Office. The current applicant prevailing wage rate schedule is attached as **Exhibit F**.

14. LIQUIDATED DAMAGES

Time is of the essence. If Contractor fails to complete the work within the approved contract schedule time or if Contractor causes any delay to the scheduled availability of the AGTS operation, the City will incur damages in amounts that will be difficult to calculate. Contractor shall be liable to the City for liquidated damages, and not as a penalty, in the following amounts:

(a) Delays in achieving substantial completion: $5,000.00 per day for the first 30 days; $20,000.00 per day for every day after 30 days beyond substantial completion.

(b) Delays in service availability attributable to the work: $50.00 per minute up to one hour, and $20,000.00 per hour for any delays in any given month of the approved Contract Schedule.

Liquidated damages are cumulative. The total amount of liquidated damages assessed under this Section, if any, shall not exceed ten percent (10%) of the Maximum Contract Amount.

15. PERFORMANCE BOND

A Performance Bond in the amount of fifty percent (50%) of the Maximum Contract Liability and in the form attached as **Exhibit H** shall be furnished covering all Work performed hereunder. Contractor shall submit a Performance Bond in the initial amount of TWELVE MILLION FOUR HUNDRED THOUSAND AND NO/100 DOLLARS ($12,400,000.00). The Performance Bond in the initial amount shall be submitted at the time of execution of the Contract by Contractor. Contractor shall provide bond riders, the form to be approved by the City, in the amount of 50% of any issued work orders, up to the total amount of fifty percent of the Maximum Contract Liability. The Surety must be issued from a surety corporation or bank authorized to do business in the State of Colorado and which is acceptable to the City. Such Surety shall be payable to the City upon demand for the Contractor's failure to perform as required under this Contract and/or failure to pay all amounts owed to laborers, mechanics, subcontractors, and materialmen for work performed or materials, supplies, rental items, tools, and equipment provided for the Work under this Contract. The Surety shall also assure the repair or replacement of any Work found to be defective or otherwise not in compliance with this Contract. The Surety shall remain in effect or be promptly renewed or replaced by another Surety acceptable to the City during the Term of the Contract, or any extension thereof, through substantial completion of the Work, or other period prescribed by law. Satisfactory proof of renewal or acceptable replacement must be provided to the Manager at least sixty (60) days prior to the date of expiration or termination of the Surety. The Contractor's obligations set out in this section shall survive the termination of this Contract and failure to obtain or maintain said Surety shall be grounds for immediate termination.

16. NOTICES

Notices concerning termination of this Contract notices of alleged or actual violations of the terms or provisions of this Contract, and other notices of similar importance shall be made in writing by the party giving the notice to the appropriate party or parties at the following addresses:

By the Contractor to:	Manager of Aviation City and County of Denver 9th Floor, Airport Office Building 8500 Peña Boulevard Denver, CO 80249
and a copy to:	City Attorney's Office Airport Legal Services Section 8500 Pena Boulevard, Room 9810 Denver, CO 80249

By the City to: Bombardier
1501 Lebanon Church Road
Pittsburgh, PA 15236-1491
Attn: David Barry

Said notices shall be delivered personally during normal business hours to the appropriate office, above or by prepaid U.S. certified mail, return receipt requested. Mailed notices shall be deemed effective upon deposit with the U.S. Postal Service when sent as described above. The parties may from time to time designate substitute addresses or persons where and to whom such notices are to be mailed or delivered but such substitutions shall not be effective until receipt of written notification.

17. WAIVER OF BREACH

Payment by the City, and its acceptance by the Contractor shall not be construed to be a waiver of any breach which may then exist on the part of the Contractor.

18. ASSIGNMENT AND SUBCONTRACTING

The Contractor shall not assign, transfer or sublet this Contract without first obtaining the written consent of the City's Deputy Manager of General Services for Purchasing, which consent shall not be unreasonably withheld. However, the City agrees that the Contractor may subcontract to affiliates within the Bombardier Group of companies.

19. COOPERATION WITH OTHERS

The Technical Specifications (**Exhibit B**) and Project Management Provisions (**Exhibit C**) describe the constraints on the physical work site areas at DIA. These descriptions are not exhaustive and the Contractor is required to coordinate its activities and work as may be required to meet TSA, FAA or City requirements while performing work on the Airport.

20. FEDERAL PROVISIONS

The Contract is subject and subordinate to the terms, reservations, restrictions and conditions of any existing or future agreements between the City and the United States, the execution of which has been or may be required as a condition precedent to the transfer of federal rights or property to the City for airport purposes, and the expenditure of federal funds for the extension, expansion or development of the Denver Municipal Airport System. The provisions of ***Appendix No. 1*** hereto are incorporated herein by reference.

21. NO WAIVER OF RIGHTS

No assent, expressed or implied, to any breach of any one or more of the terms and conditions of this Contract shall be deemed to be or taken to be by the City as a waiver of

any subsequent breach of such terms and conditions.

22. PROHIBITION AGAINST EMPLOYMENT OF ILLEGAL ALIENS

(a) This Contract is subject to Division 5 of Article IV of Chapter 20 of the Denver Revised Municipal Code, and any amendments (the "Certification Ordinance").

(b) The Contractor certifies that:

i. At the time of its execution of this Contract, it does not knowingly employ or contract with an illegal alien who will perform work under this Contract.

ii. It will participate in the E-Verify Program, as defined in § 8-17.5-101(3.7), C.R.S., to confirm the employment eligibility of all employees who are newly hired for employment to perform work under this Contract.

(c) The Contractor also agrees and represents that:

(1) It shall not knowingly employ or contract with an illegal alien to perform work under the Contract.

(2) It shall not enter into a contract with a sub-consultant or subcontractor that fails to certify to the Contractor that it shall not knowingly employ or contract with an illegal alien to perform work under the Contract.

(3) It has confirmed the employment eligibility of all employees who are newly hired for employment to perform work under this Contract, through participation in either the E-Verify Program.

(4) It is prohibited from using either the E-Verify Program procedures to undertake pre-employment screening of job applicants while performing its obligations under the Contract, and that otherwise requires the Contractor to comply with any and all federal requirements related to use of the E-Verify Program including, by way of example, all program requirements related to employee notification and preservation of employee rights.

(5) If it obtains actual knowledge that a sub-consultant or subcontractor performing work under the Contract knowingly employs or contracts with an illegal alien, it will notify such sub-consultant or subcontractor and the City within three (3) days. The Contractor will also then terminate such sub-consultant or subcontractor if within three (3) days after such notice the sub-consultant or subcontractor does not stop employing or contracting with the illegal alien, unless during such three-day period the sub-consultant or subcontractor provides information to establish that the sub-consultant or subcontractor has not knowingly employed or contracted with an illegal alien.

(6) It will comply with any reasonable request made in the course of an investigation by the Colorado Department of Labor and Employment under authority of § 8-17.5-102(5), C.R.S., or the City Auditor, under authority of D.R.M.C. 20-90.3.

(d) The Contractor is liable for any violations as provided in the Certification Ordinance. If Contractor violates any provision of this section or the Certification Ordinance, the City may terminate this Contract for a breach of the Contract. If the Contract is so terminated, the Contractor shall be liable for actual and consequential damages to the City. Any such termination of a contract due to a violation of this section or the Certification Ordinance may also, at the discretion of the City, constitute grounds for disqualifying Contractor from submitting bids or proposals for future contracts with the City.

23. COMPLIANCE WITH ALL LAWS AND REGULATIONS

The Contractor shall comply with all local, state and federal laws, rules, codes and regulations which are applicable to the work to be performed under this Contract, including the design and manufacture of Central Control and ATC Equipment and their delivery to and installation at DIA.

24. BOND ORDINANCES

This Contract and the City's obligations herein are in all respects subject and subordinate to any and all City bond ordinances applicable to the Denver Municipal Airport System, and to any other bond ordinances which amend, supplement or replace such bond ordinances.

25. SEVERABILITY

In the event any of the provisions, or applications thereof, of this Contract are held to be unenforceable or invalid by any court of competent jurisdiction, the validity and enforceability of the remaining provisions, or applications thereof, shall not be affected.

26. NO THIRD PARTY BENEFICIARIES

The enforcement of the terms and conditions of this Contract and all rights of actions relating to such enforcement shall be strictly reserved to the City and the Contractor, and nothing contained in this Contract shall give or allow any such claim or right of by any other third person on this Contract.

27. GOVERNING LAW

This Contract shall be deemed to have been made in, and shall be construed and interpreted in accordance with the laws of the State of Colorado.

28. TIME IS OF THE ESSENCE

The Contractor agrees that in the performance of its duties and obligations under this Contract, time is of the essence.

29. FORCE MAJEURE

Neither party to this Contract shall be liable to the other party for any failure, delay or interruption of the performance of its obligations, hereunder due to causes or conditions beyond that party's control, including, without limitation, acts of God, explosions, fire and accidents. For the purposes hereof, strikes, lockouts and labor disputes involving the Contractor's employees or subcontractors shall not be considered to be causes or conditions beyond the control of the Contractor, and will not relieve the Contractor of liability caused by any failure, delay or interruption in its performance under this Contract. In the event of a Force Majeure event that prevents contract performance for more than 180 days, the parties agree to meet to discuss material amendments that may be needed to this Contract.

30. TAXES

The Purchase Price for the materials and equipment under this Contract do not include Colorado or City sales/use taxes or City property taxes for which the City is exempt. The City's Federal Registration Number is A-13850 dated April 5, 1960, Denver, Colorado, Department of Internal Revenue. The City's Colorado State Sales Tax Exemption Number is 98-02890.

Any employee working for the contractor or one of its subcontractors who earns at least $500 working in the City or County of Denver during a calendar month, is subject to payment of the Employee Occupational Privilege Tax. The Contractor or any of its subcontractors who have any employee, working in the City and County of Denver, who earns the amount set forth above must withhold the employee occupational privilege tax from the wages of each employee subject to it, remit it to the City and pay to the City the correlative business Occupational Privilege Tax imposed on the employer for such employee.

31. SURVIVAL OF CERTAIN PROVISIONS

The terms of the Contract and any exhibits and attachments that by reasonable implication contemplate continued performance, rights, or compliance beyond expiration or termination of the Contract survive the Contract and will continue to be enforceable. Without limiting the generality of this provision, the Contractor’s obligations to provide insurance and to indemnify the City will survive for a period equal to any and all relevant statutes of limitation, plus the time necessary to fully resolve any claims, matters, or actions begun within that period.

32. ADVERTISING AND PUBLIC DISCLOSURE

The Contractor shall not include any reference to the Contract or to services performed pursuant to the Contract in any of the Contractor's advertising or public relations materials without first obtaining the written approval of the Manager. Any oral presentation or written materials related to services performed under the Contract will be limited to services that have been accepted by the City. The Contractor shall notify the Manager in advance of the date and time of any presentation. Nothing in this provision precludes the transmittal of any information to City officials. Nothing herein, however, shall preclude the Contractor's use of this contract and its components parts in GSA form 254 or 255 presentations, or the transmittal of any information to officials of the City including without limitation, the Mayor, the Manager, any members of City Council, and the Auditor.

33. CITY EXECUTION OF CONTRACT

The Contract will not be effective or binding on the City until it has been fully executed by all required signatories of the City and County of Denver, and if required by Charter, approved by the City Council.

34. CONTRACT AS COMPLETE INTEGRATION-AMENDMENTS

The Contract is the complete integration of all understandings between the parties as to the subject matter of the Contract. No prior, contemporaneous or subsequent addition, deletion, or other modification has any force or effect, unless embodied in the Contract in writing. No oral representation by any officer or employee of the City at variance with the terms of the Contract or any written amendment to the Contract will have any force or effect or bind the City.

35. USE, POSSESSION OR SALE OF ALCOHOL OR DRUGS

The Contractor shall cooperate and comply with the provisions of Executive Order 94 and its Attachment A concerning the use, possession or sale of alcohol or drugs. Violation of these provisions or refusal to cooperate with implementation of the policy can result in contract personnel being barred from City facilities and from participating in City operations.

36. CITY SMOKING POLICY

Contractor acknowledges that smoking is not permitted in Airport buildings and facilities except for designated Airport Smoking Concessions, and so agrees that it will prohibit smoking by its employees and the public in indoor areas and within 15 feet of entryways of the Airport Premises, except as may otherwise be permitted by the Colorado Clean Indoor Air Act, C.R.S. §§ 25-14-201 to 209. Contractor and its officers, agents, and

employees shall cooperate and comply with the provisions of the Denver Revised Municipal Code §§ 24-301 to 317, et seq., the Colorado Clean Indoor Air Act, C.R.S. 25-14-201 to 209, City's Executive Order No. 99, dated December 1, 1993, and Executive Order No. 13, dated July 31, 2002.

37. NO AUTHORITY TO BIND CITY TO CONTRACTS

The Contractor lacks any authority to bind the City on any contractual matters. Final approval of all contractual matters that purport to obligate the City must be executed by the City in accordance with the City's Charter and the Denver Revised Municipal Code.

38. CONFLICT OF INTEREST

No employee of the City shall have any personal or beneficial interest in the services or property described in the Contract. The Contractor shall not hire, or contract for services with, any employee or officer of the City that would be in violation of the City's Code of Ethics, D.R.M.C. §2-51, et seq. or the Charter §§ 1.2.8, 1.2.9, and 1.2.12.

The Contractor shall not engage in any transaction, activity or conduct that would result in a conflict of interest under the Contract. The Contractor represents that it has disclosed any and all current or potential conflicts of interest. A conflict of interest shall include transactions, activities or conduct that would affect the judgment, actions or work of the Contractor by placing the Contractor's own interests, or the interests of any party with whom the Contractor has a contractual arrangement, in conflict with those of the City. The City, in its sole discretion, will determine the existence of a conflict of interest and may terminate the Contract in the event it determines a conflict exists, after it has given the Contractor written notice describing the conflict.

39. DISPUTES

All disputes between the City and Contractor arising out of or regarding the Contract will be resolved by administrative hearing pursuant to the procedure established by D.R.M.C. § 5-17. For the purposes of that administrative procedure, the City official rendering a final determination shall be the Manager as defined in this Contract.

40. HEADINGS

The headings contained in this Contract are for reference purposes only and shall in no way affect the meaning or interpretation of this Contract.

41. EXAMINATION OF RECORDS

(a) Records of the Contractor's direct personnel, Contractor, and reimbursable expenses pertaining to this Project and records of accounts between the City and the Contractor shall be kept on a generally recognized accounting basis. The Contractor agrees that the Manager and the Auditor of the city or any of their duly authorized representatives, until the expiration of three (3) years after the final payment under this

Agreement, shall have access to and the right to examine any books, documents, papers and records of the Contractor, involving transactions related to this Agreement, without regard to whether the work was paid for in whole or in part with federal funds or was otherwise related to a federal grant program. The Contractor, upon request by either shall make all such books and records available for examination and copying in Denver, Colorado.

(b) In connection with any services performed hereunder on items of work toward which federal funds may be received under the Airport and Airway Development Act of 1970, as amended, the City, the Federal Aviation Administration, the Comptroller General of the United States, and any of their duly authorized representatives, shall have access to any books, documents, papers and records of the Contractor which are directly pertinent to a specific grant program for the purpose of making audit, examination, excerpts and transcriptions. The Contractor further agrees that such records will contain information concerning the personnel, hours and specific tasks performed, along with the applicable federal project number.

42. NO DISCRIMINATION IN EMPLOYMENT

In connection with the performance under this Contract, the Contractor agrees not to fail or refuse to hire, discharge, promote or demote, or to discriminate in matters of compensation, against any person otherwise qualified, solely because of race, color, religion, national origin, gender, age, military status, sexual orientation, marital status, or physical or mental disability; and the Contractor further agrees to insert the foregoing provision in all subcontracts hereunder.

43. LEGAL AUTHORITY

Contractor represents and warrants that it possesses the legal authority, pursuant to any proper, appropriate and official motion, resolution or action passed or taken, to enter into the Contract. Each person signing and executing the Contract on behalf of Contractor represents and warrants that he has been fully authorized by Contractor to execute the Contract on behalf of Contractor and to validly and legally bind Contractor to all the terms, performances and provisions of the Contract. The City shall have the right, in its sole discretion, to either temporarily suspend or permanently terminate the Contract if there is a dispute as to the legal authority of either Contractor or the person signing the Contract to enter into the Contract.

44. COLORADO OPEN RECORDS ACT

The City is subject to the Colorado Open Records Act, C.R.S. §§ 24-72-201, et. seq. ("CORA"). If Contractor believes that any information, data, process or other material submitted to the City constitutes trade secrets, privileged information, or confidential commercial, financial, geological, or geophysical data, then Contractor shall mark those items as confidential or proprietary and provide a list of those items with specificity as to the page and paragraph and on what basis it believes the material is confidential or proprietary. The City is not bound by Contractor's determination as to whether materials

are subject to disclosure under CORA and reserves the right to independently determine whether the materials are required to be made available for inspection or otherwise produced under CORA.

If the City receives a request for such information marked as confidential, it will notify the Contractor. If a suit is filed to compel disclosure of such information, the City will notify the Contractor, and the Contractor shall be responsible for taking appropriate action to defend against disclosure of its confidential information.

In the event of the filing of a lawsuit to prevent or compel disclosure, the City will tender all responsive materials to the court for judicial determination of the issue of disclosure. The Contractor agrees 1) to intervene in any lawsuit arising out of a request for its materials to protect and assert its claims of privilege against disclosure of such material; 2) that its failure to object or intervene and assert claims of privilege against disclosure in relation to its proprietary or confidential information results in waiver the same; 3) to release and defend, indemnify and save and hold harmless the City, its officers, agents and employees, from any claim, damages, expense, loss or costs, including reasonable attorneys' fees, arising out of or in any way relating to requests for disclosure of material provided or produced to the City.

45. COUNTERPARTS OF THE CONTRACT

The Contract may be executed in counterparts, each of which is an original and constitute the same instrument.

46. ELECTRONIC SIGNATURES AND ELECTRONIC RECORDS

Contractor consents to the use of electronic signatures by the City. The Contract, and any other documents requiring a signature hereunder, may be signed electronically by the City in the manner specified by the City. The Parties agree not to deny the legal effect or enforceability of the Contract solely because it is in electronic form or because an electronic record was used in its formation. The Parties agree not to object to the admissibility of the Contract in the form of an electronic record, or a paper copy of an electronic document, or a paper copy of a document bearing an electronic signature, on the ground that it is an electronic record or electronic signature or that it is not in its original form or is not an original.

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Contract Control Number:

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals at Denver, Colorado as of

SEAL

CITY AND COUNTY OF DENVER

ATTEST:

By_____

_____

APPROVED AS TO FORM:

REGISTERED AND COUNTERSIGNED:

By_____

By_____

By_____

Contract Control Number:

By: _____

Name: _____
(please print)

Title: _____
(please print)

ATTEST: [if required]

By: _____

Name: _____
(please print)

Title: _____
(please print)

APPENDIX NO. 1

STANDARD FEDERAL ASSURANCES AND NONDISCRIMINATION

NOTE: As used below the term "contractor" shall mean and include the Contractor, and the term "sponsor" shall mean the "City".

During the term of this contract, the contractor, for itself, its assignees and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. Compliance with Regulations. The contractor shall comply with the Regulations relative to nondiscrimination in federally assisted programs of the Department of Transportation (hereinafter "DOT") Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

2. Nondiscrimination. The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, creed, color, sex, national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

3. Solicitations for Subcontractors, Including Procurements of Materials and Equipment. In all solicitations either by competitive bidding or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, or national origin.

4. Information and Reports. The contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto and shall permit access to its books, records, accounts other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration (FAA) to be pertinent to ascertain compliance with such Regulations, orders, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor shall so certify to the sponsor of the FAA, as appropriate, and shall set forth what efforts it has made to obtain the information.

5. Sanctions for Noncompliance. In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the sponsor shall impose such contract sanctions as it or the FAA may determine to be appropriate, including, but not limited to:

a. Withholding of payments to the contractor under the contract until the contractor complies, and/or

b. Cancellation, termination, or suspension of the contract, in whole or in part.

6. Incorporation of Provisions. The contractor shall include the provisions of paragraphs 1 through 5 in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontract or procurement as the sponsor or the FAA may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the sponsor to enter into such litigation to protect the interests of the sponsor and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

7. The Contractor for itself, representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree as a covenant running with the land that in the event facilities are constructed, maintained, or otherwise operated on the said property described in this agreement for a purpose for which a DOT program or activity is extended or for another purpose involving the provision of similar services or benefits, the Contractor shall maintain and operate such facilities and services in compliance with all other requirements imposed pursuant to 49 CFR Part 21, Nondiscrimination in Federally Assisted Programs of the Department of Transportation, and as said Regulations may be amended.

8. The Contractor for itself, representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree as a covenant running with the land: (1) that no person on the grounds of race, color, sex, creed or national origin shall be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities, (2) that in the construction of any improvements on, over, or under such land and the furnishing of services thereon, no person on the grounds of race, color, sex, creed or national origin shall be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination, (3) that the Contractor shall use the premises in compliance with all other requirements imposed by or pursuant to 49 CFR Part 21, Nondiscrimination in Federally Assisted Programs of the Department of Transportation, and as said Regulations may be amended.

9. **NONDISCRIMINATION IN AIRPORT EMPLOYMENT OPPORTUNITIES**

The Contractor assures that it will comply with pertinent statutes, Executive Orders and such rules as are promulgated to assure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or handicap be excluded from participating in any activity conducted with or benefiting from Federal assistance.

It is unlawful for airport operators and their lessees, tenants, concessionaires and contractors to discriminate against any person because of race, color, national origin, sex, creed, or handicap in public services and employment opportunities.

1. Project Overview

In 2009, the Denver International Airport requested Bombardier provide a bid to build an alternate central control in a secure area located in the Operations, Maintenance and Service Facility (OM&SF). Since that initial request, the City has made several plans for expanding the system, including adding new switches to the South end of the guideway. As a result, the City asked Bombardier to revise the Central Control Relocation bid to include an upgraded Automatic Train Control (ATC) system to allow for system expansion.

This bid details Bombardier's proposed solution for building an alternate central in the OM&SF, installing new *BOMBARDIER CITYFLO** 550 Automatic Train Control (ATC) wayside equipment, and finally upgrading the existing Central Control on the 10th floor of the Airport Office Building (AOB).

The new ATC system and Central Control Centers (CCCs) will use the fiber optic Data Transfer System (DTS) that has been provided under a separate project. The DTS system has been designed to provide fiber optics for ATC, Communications, and other applications.

1.1 Scope

Bombardier will provide an alternate central control in the Maintenance area, *CITYFLO* 550 train control for the existing system, and a back up central control located on the 10th floor of the AOB. The new equipment will connect to the fiber optic DTS.

The DTS equipment supplied by Bombardier will provide DTS nodes in each equipment room. This will allow the new central control, ATC cabinets, and related equipment to use the fiber optic network.

The new *CITYFLO* 550 equipment will be installed alongside the existing relay interlocking cabinets. New equipment will be added to:

- Main Terminal Equipment room
- Concourse A
- Concourse B
- Concourse C
- OM&SF area

New Central Control and Operational Radio System (ORS) equipment will also be installed in the following locations:

- OM&SF (conference room converted to Operation Control Center (OCC))
- 10th floor of the AOB (CC)
- Concourse C (New ORS cabinet)

An upgraded interface to the Power Distribution System (PDS) will also be provided with new Programmable Logic Controllers (PLCs). The PLCs will be designed to work with the new central control.

1.2 Key Assumptions

The following list contains the key assumptions Bombardier used in developing this proposal:

1. The technical specifications and project management provisions as presented in your email dated 4/27/2012 are acceptable; therefore Bombardier takes no exceptions to these two documents.
2. The current functionality of the operating system will continue to operate properly at the conclusion of this project.
3. Any room finishing requirements for the AOB central control room are the responsibility of the City.
4. Any upgrades or changes required to the Heating, Ventilation and Air Conditioning (HVAC) system to support the new equipment are the responsibility of the City.
5. The finish in the OM&SF Central Control will be in Bombardier's scope.
6. The cutover will take place during the nightly shutdown (1:00 a.m. to 4:00 a.m.).
7. The installation of the new central control equipment can be performed during daylight hours without interruption or reduction to service.
8. The installation of the new ATC equipment and PLCs will be performed during the nightly shutdown.
9. No signaling equipment will be supplied under this contract for the connectivity and control of the new switches.
10. No signaling equipment will be supplied under this contract for the future system expansion.

2. Proposed Central Control Upgrade

Bombardier will provide an alternate CCC in the existing OM&SF. This central control room will consist of:

- Three wall-mounted Guideway System Displays (GSDs) — from these displays, the operator can see the entire system at once along with the PDS and other functions.
- The console includes two (2) ATC workstations each containing a computer, keyboard, mouse and dual monitors. The central control workstations provide detailed information for supervisory control of the Automated People Mover (APM) system.
- Dedicated consoles will provide the operator the ability to control and monitor communications and override recorded messages through the ORS and Public Address (PA) systems.
- Each central control location will have an Ethernet interface to provide a connection to the Maximo computer.

Bombardier will also provide new ORS cabinets and consoles as part of this project. The existing ORS cabinet in the AOB central control will receive an upgrade so that it can interface with the existing fiber optic DTS. Also, new PDS PLCs will be installed to allow for the new central control equipment to interface with the PDS.

Once the alternate central control room and the *CITYFLO* 550 signaling system has been tested and commissioned, the existing central control in the AOB will be upgraded to provide the same functionality as in the alternate central control.

Interfaces

Each Central Control Room will require interfaces to other elements that comprise the Denver AGTS system. Bombardier will be providing the equipment and related interfaces for the following:

- CITYFLO 550 Signaling
- PDS equipment through updated PLCs
- ORS & PA systems
- DTS cabinets to connect the new equipment to the existing fiber optic network

Per the technical specification, 3rd party suppliers will provide other equipment and interfaces. These interfaces include:

- Telephone System
- Maintenance Radio System
- Station CCTV and Video Storage
- Audio Recording
- CCTV Monitors

Bombardier will design each Central Control Room layout to accommodate the equipment and interfaces listed above. The final layout will be submitted to the City for review and approval during the design stage.

3. Proposed ATS Central Control Architecture

The Automatic Train Supervision (ATS) central control architecture consist of a STRATUS (redundant) server to run the central train control software and all of its interfaces and to manage the SQL server database on RAID disks. Central control runs on its own redundant network, interfacing with other subsystems on the DTS network through network switches.

A backup CCC will have the ability to monitor train operations while not in supervisory control of system operations. The backup central control will not have the ability to override supervisory controls as performed by the primary CCC unless it is assigned as the primary system. To enable supervisory control at the backup CCC, a supervisor with proper authorization privileges will be required to log onto the central control system to assign control to the backup CCC. Immediately following the control transfer, the primary CCC will become disabled to control system operations. The backup CCC will immediately be in full supervisory control of the APM system as previously performed at the primary control center. Note, only one CCC can be in control of the APM system at any given time. The other center, not in control, will only monitor system operations without operator override control functions. The Central Control Operator (CCO) workstation displays at both centers will clearly indicate if it has supervisory control of system operations.

In addition to the switchover between the primary and backup central control operator workstations, the Man-Machine Interface (MMI) panel will also be electronically switched between the primary and backup control room centers.

The following describes the hardware associated with the ATS Central Control Architecture:

- Train Control/Data Base server – Redundant server to provide supervisory train control and log alarm/event data for reporting
- Central Control Operator (CCO) Workstations– Central control operator workstations to monitor system operations and to perform operator overrides to automatic operations
- Laser Printer – To print reports initiated by the CCO
- Overhead Monitors – Large monitors to be viewable from across the room. Ability to display various graphics as requested by the operator
- Diagnostic PC – Located in central cabinet to support software diagnostics from the equipment room
- Maintenance PC – Workstation having the ability to monitor the system from an office area

- Test Track Operator – Provide an operator to manage only test track operations separate from central control

Figure 1 illustrates the ATS Central Control Architecture.

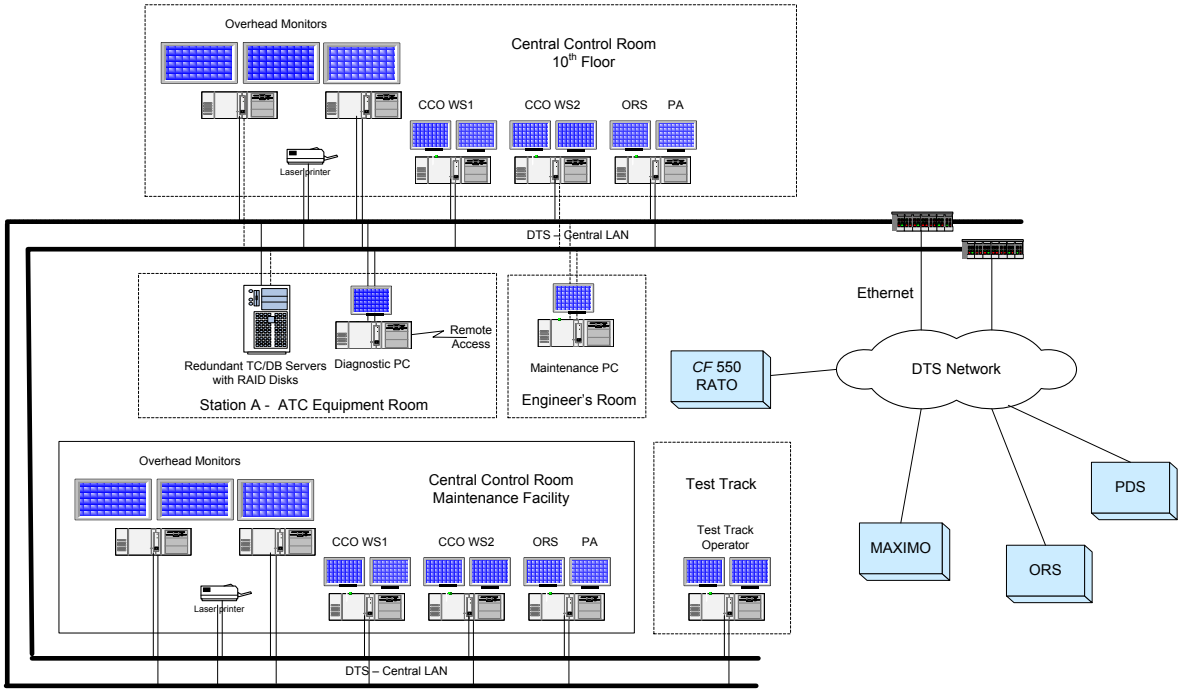

Figure 1: ATS Central Control Architecture

4. Proposed *CITYFLO* 550 System Architecture

The *CITYFLO* 550 architecture will replace the current vital relay system, the legacy Automatic Train Operation (ATO) and the central control system operating the Automated Guided Transport System (AGTS) at Denver International Airport. The *CITYFLO* 550 system proposed comprises *CITYFLO* 550 CBI subsystem, Delphi ATOs and central control. As illustrated in Figure 2, the field termination and Tx/Rx cabinets will be reused. Note, the new field termination cabinets, Tx/Rx cabinets and the remote ATO cabinets for the future expansion area are not included in this proposal.

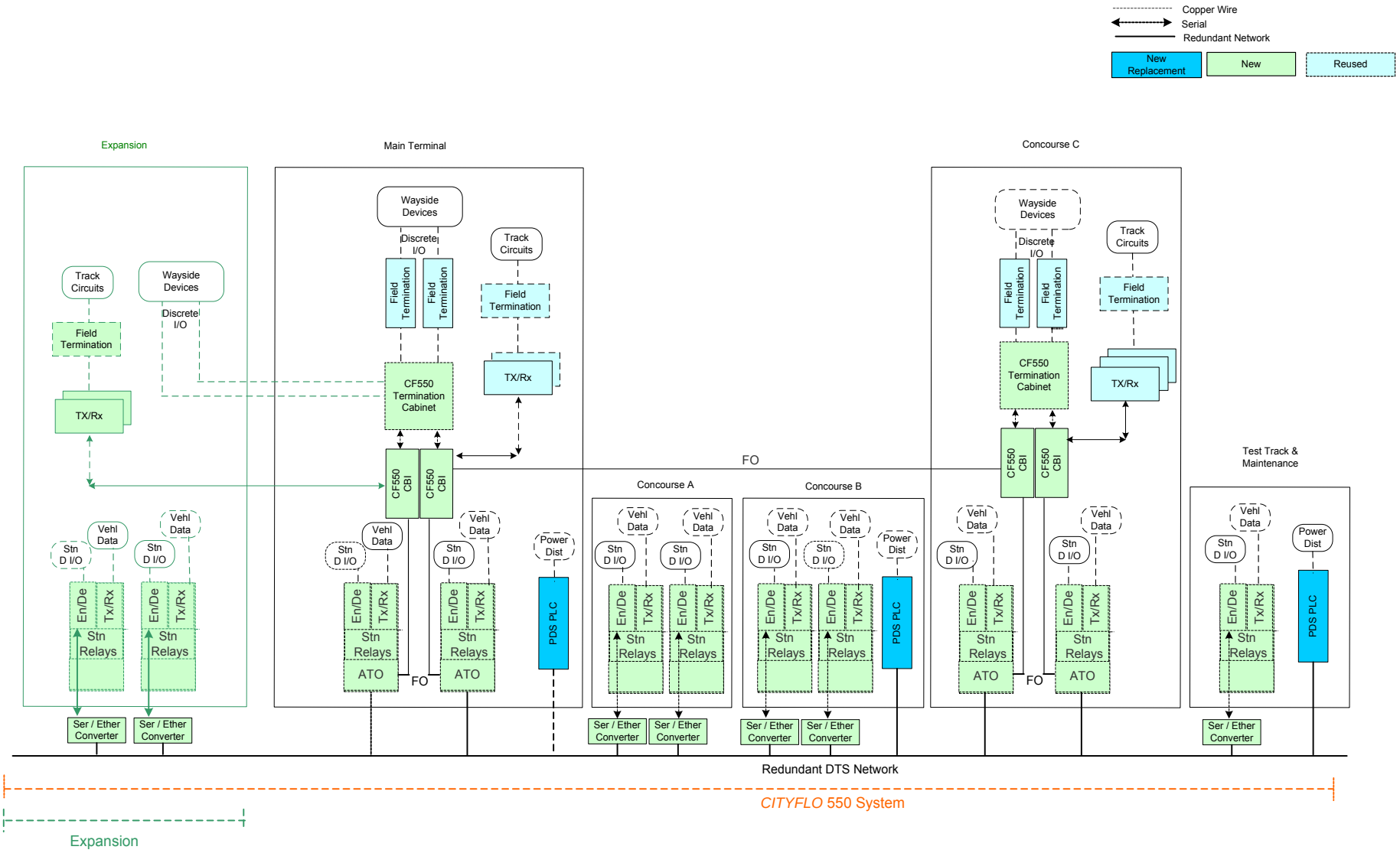

Figure 2: *CITYFLO* 550 System Configuration

5. Bill of Materials

The Bill of Materials contained in this proposal, and shown in Table 1, is sufficient to fulfill the technical requirements of the project. Any additional material or labor that may be required and is not a result in a change of scope will be provided at no additional cost to the City. Any additions that result as a change in scope and directed by the City will be agreed to between both parties prior to such additional work being completed as a change order to the program.

Table 1: Bill of Materials

DESCRIPTION	QTY
Wayside PA	
PA Central Console Remote Control	2
Wirelist	1
CIC PC Assembly	1
Audio Subassembly	1
12 Port CAT5e Patch Panel	1
Computer Speakers	1
Microphone	1
Keyboard	1
Mouse	1
21" LCD	1
ORS	
ORS Central Cabinet	1
Cabinet	1
Cabinet Grounding Assembly	1
Pulizzi power supply	1
EI installer cover plate	1
Cable routing tray	1
Audio Distribution Sub-assembly	1
Audio Distribution Sub-assembly	1
PC Extender Assembly	1
Wayside Comm Controller	1
Fuse and Termination Panel Assembly	1
Termination Panel Assembly	1
ORS Computer Assembly	1
Power Supply Assembly	1
Termination Panel Assembly	10
Standard mounting angle	1
Termination Panel Assembly	2
ORS Cables	1
Short Mounting Angle Right	2
Short Mounting Angel left	1
Fiber Audio Assembly	2
Fiber Patch panel Assembly	1
Fiber Optic Cable Assembly	9
Power Cables	10
Power Outlet panel	1
Terminal block assembly	2
Terminal block assembly	1
Pc Extender Assembly	1

DESCRIPTION	QTY
KVM extender	1
Audio Distribution Sub-assembly	1
ORS Cables	1
Outlet Strip 6-pos	1
Wheel Mouse	1
Keyboard	1
Microphone	1
LCD Monitor	1
ORS Console - Remote Control	
Remote Control Cabinet	2
Power Outlet panel	2
Terminal block assembly	3
Pc Extender Assembly	1
KVM extender	1
ORS Cables	1
ORS Computer Assembly	1
Fiber Optic Cable Assembly	4
Terminal Block Assembly	1
Audio Control Panel Assembly	1
Outlet Strip 6-pos	1
Wheel Mouse	1
Keyboard	1
Microphone	1
LCD Monitor	1
Audio Distribution Sub-assembly	1
Fuse and Termination Panel Assembly	1
Power Supply	1
Power Cord Assembly	1
Fiber Patch panel Assembly	1
Fiber Audio Assembly	2
Terminal block assembly	1
Terminal block assembly	1
ORS Base Station Fiber Extension	
Audio Distribution Sub-assembly	1
19" Cabinet	1
Pulizzi power supply	1
EI installer cover plate	1
Cable grip	1
Locknut	1
Cable routing tray	1
Power Cables	8
Cabinet Grounding Assembly	1

DESCRIPTION	QTY
Terminal Block Assembly	1
Fiber Patch panel Assembly	1
Terminal Block Assembly	1
Fiber Splice Tray	1
Fiber Audio Assembly	2
Fiber Optic Cable Assembly	1
Power Supply Shelf Assembly	1
ORS cables	1
Fiber Optic Cable Assembly	1
Fiber Optic Cables	4
Relay Switch Over Panel Assembly	1
Central Console	
Central Console Cabinet	2
Intellitrac T-30 base frame module	12
Single level upper rack module	9
Sliding upper shelf modular with cable grommet	2
Upper shelf, removable	1
Trac mount LCD arm-long throw	12
Transition base modules	2
Thermofoil side panels	2
Linoleum countertop - per linear foot	24
Cable collar	3
Printer Console	2
TracWall Monitor Wall	2
2 trac horizontal frame - per linear foot	11
Double base cabinet	3
Trac mount LCD fixed with tilt bracket	3
Seismic anchoring arm	3
Modicon M340	2
Central Control OCC Equipment	
Laser Report Printer and stand	2
Operator Workstation Monitor Dell 20" LCD	12
Operator Workstation Mouse, Intelli Optical	6
Operator Workstation Keyboard, USB	6
Operator Workstation PC (computer & hardware only)	6
GSD 40" monitors and wall cabinet & wall mount	2
Engineer Maintenance Workstation Monitor Dell 20" LCD	1
Engineer Maintenance Mouse, Intelli Optical	1
Engineer Maintenance Keyboard, USB	1
Engineer Maintenance PC (computer only)	1
Test Track Console with PC and monitors	1
Central Computer Cabinet 1 (TC & DB) (Stratus 2510 Server)	1

DESCRIPTION	QTY
Central Server Licenses - Iconics FtServer V9	1
Central Server Licenses - Iconics DWX	1
Central Server Licenses - Iconics Browser - Main OCC	9
Central Server Licenses - Iconics Browser - Backup OCC	5
Central Server Licenses - ISQL Server	1
Central Server Licenses - Kepware	1
Misc Hardware (cables, connectors, etc.)	2
***CITYFLO* 550 Equipment**	
MMI prohibit zone panel	2
CFMS Console	2
CITYFLO 550 - ATP Doublebay Cabinet	2
CITYFLO 550 - ATP Termination Cabinet	2
CITYFLO 550 - ATP Cutover Cabinet	2
CITYFLO 550 - ATP IC Cables	2
Misc Hardware (cables, connectors, et)	2
Station ATO / Remote ATO Wayside ATC Equipment	
Remote ATO Cabinets (without ATO PC)	5
ATO Cabinets (with ATO PC)	4
ATO IC Cables	9
Tx/Rx IC Cables (for ATO cabinet)	9
Non Vital Switchover Box for ATO	9
Vital Switchover Box for ATO	9
Serial to Ethernet converter	5
Misc Hardware (cables, connectors, etc.)	2
Denver Expansion ATC Equipment **The following hardware is not included in this proposal. Referenced for future expansion only.**	
Expansion - Tx/Rx Termination Cabinet (for *CITYFLO* 550)	2
Expansion - Tx/Rx Cabinet (for *CITYFLO* 550)	2
Expansion - Tx/Rx IC Cables (for *CITYFLO* 550)	2
Expansion - Remote ATO Cabinets (without ATO PC)	2
Expansion - ATO IC Cables	2
Tx/Rx IC Cables (for ATO cabinet)	9
Expansion - Non Vital Switchover Box for ATO	2
Expansion - Vital Switchover Box for ATO	2
Expansion - Serial to Ethernet converter	2

6. Proposed Cutover

The installation of the new central control equipment, both in the new location and the existing AOB, can be performed during daylight hours without interrupting or reducing service. There will be a number of days required for testing and commissioning of this equipment that will require full system access during the nightly shut down periods (between 0100 and 0400) and alternate transportation for passengers will be provided by the City. The days that require full system access will be defined more precisely as the detailed cutover is developed and agreed to with the City during the design review process. Bombardier currently anticipates that 70 working days will be required for these activities.

Bombardier has developed a preliminary cutover plan for the Denver AGTS upgrade that minimizes impact to revenue service by using the process and lessons learned from the recent Atlanta signaling upgrade project. Bombardier will install cutover cabinets which will reduce the amount of time required to cut over between the existing system and the upgraded system for testing. The cutover cabinets will reduce the number of times the wires and cables are connected and reconnected, thus reducing the possibility of damaging a wire or cable by limiting the number of times they are handled.

The Local Control Panel (LCP) will be replaced with an MMI panel and a *CITYFLO* Monitoring System (CFMS) workstation to be located in the central control operation room. The MMI panel and workstation will directly interface with *CITYFLO* 550 for vital and non-vital functions respectively.

Figure 3 is a block diagram overview to illustrate the cutover cabinet configuration to cutover from Denver's existing relay system to a *CITYFLO* 550 system.

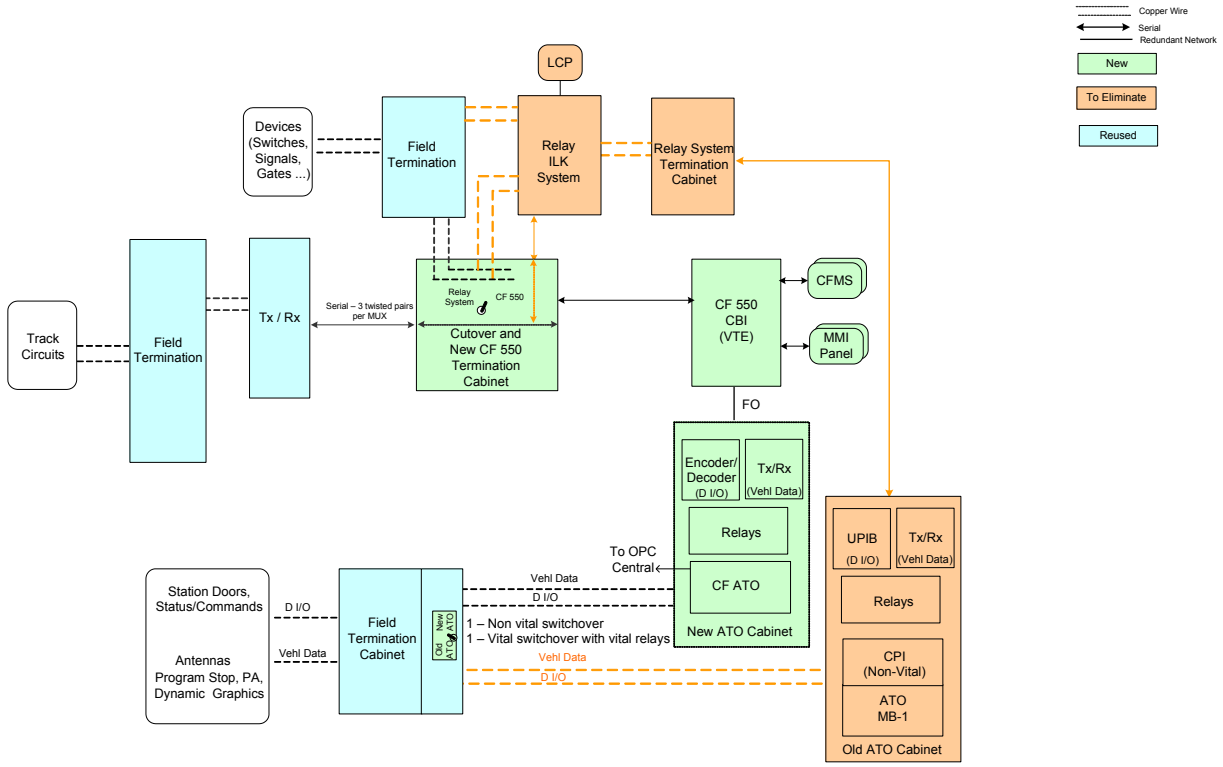

Figure 3: Existing Equipment Cutover to *CITYFLO* 550 System

Figure 4 shows the preliminary cutover process from Denver's existing vital relay system to *CITYFLO* 550 system. This process will be altered based on further evaluation during the design phase of the project. A system cutover plan will be provided detailing the high-level planning and execution of the cutover activities at the site and will be updated as required as the project proceeds.

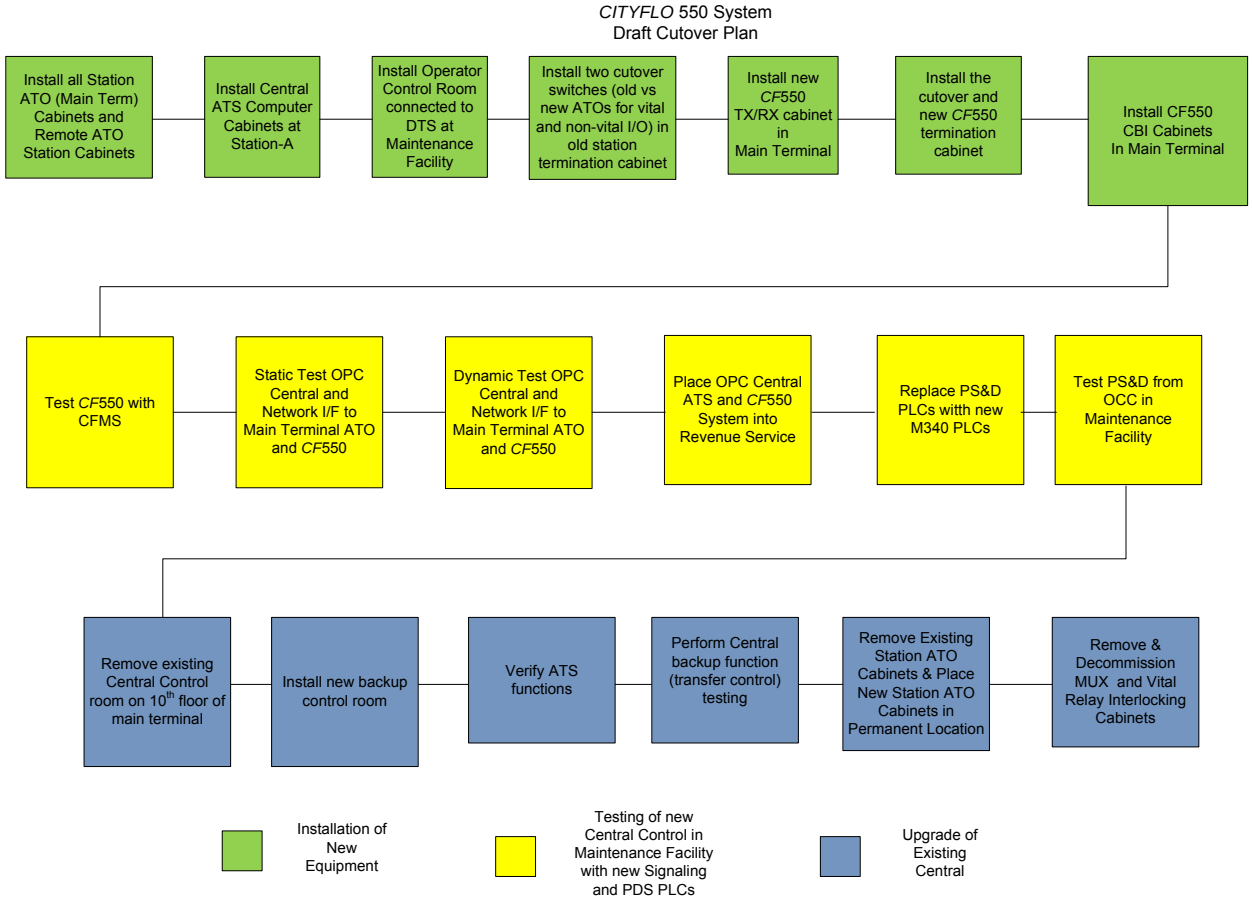

Figure 4: Draft Cutover Plan

The overall process will start with installing the new central control equipment in the alternate central control location in the Maintenance Facility and installing the new *CITYFLO* 550 and ORS equipment in the equipment rooms. Once this equipment has been installed, the entire system will be tested and verified from the alternate central during the nightly shutdown. This will allow the system to continue to operate on the existing relays until the new signaling and central control are certified for revenue service. Once the new signaling and central control are operating in revenue service and the 60 day demo has been completed, the existing Central Control will then be upgraded. Once the upgrade is complete, a smaller set of tests will be performed, including one to verify the proper switchover between the Central Control locations. The existing ATC equipment will remain in place until both central controls are fully functional and tested with the *CITYFLO* 550 signaling equipment.

Bombardier will submit a detailed cutover plan for the City to review and approve as part of the design review process.

7. Equipment Location

The new equipment will be installed in existing equipment rooms in each concourse and the main terminal. Each room will have a cutover cabinet and a redundant pair of ATC cabinets. The final equipment room configuration will be determined during the design phase. The following list details the equipment and locations as proposed in this bid.

7.1 Main Terminal

The main terminal will provide the space for most of the new equipment. This room will receive the following cabinets:

- Automatic Train Protection (ATP) *CITYFLO* 550 cabinets
- ATO cabinet (with ATC Computer) (qty 2)
- ATP cabinet (qty 1 dual cabinet)
- Cutover cabinet (qty 1)
- Termination cabinet (qty 1)
- Upgraded PDS PLC

7.2 Concourse A

- Remote ATO cabinet (without ATC computer) (qty 2)
- Upgraded PDS PLC

7.3 Concourse B

- Remote ATO cabinet (without ATC computer) (qty 2)
- Upgraded PDS PLC
- Cutover cabinet (qty 2)

7.4 Concourse C

- ORS Central Cabinet (qty 1)
- Central control cabinet (qty 1)
- ATO cabinet (with computer) (qty 2)
- ATP *CITYFLO* 550 cabinets (qty 1 — dual cabinet)
- Cutover cabinet (qty 1)
- Termination cabinet (qty 1)
- Upgraded PDS PLC

7.5 OM&SF

- New central control consoles, including workstations, monitors, furniture, etc.
- Remote ATO cabinet (qty 2)
- Workstation for test track
- Workstation in engineering room
- Upgraded PDS PLC
- MMI panel
- CFMS

7.6 Airport Office Building (AOB)

- New ORS cabinet equipment (fiber interface)

- New central control workstations, monitors, etc.
- MMI panel
- CFMS

8. Project Schedule

The Project Schedule has one Notice to Proceed (NTP) and is 39 months to substantial completion followed by a 60-day demonstration period, as shown in Figure 5. It contains design, build, installation and testing activities. The performance bond will be in force through substantial completion. Key milestone dates are found in Table 2.

Table 2: Key Milestone Dates

One NTP Schedule
Complete RCS hardware design: month 9
Complete RCS software requirements and design: month 12
Preliminary Design Reviews: months 3 and 5
Final Design Reviews: months 10 and 12
System Factory Acceptance Test: months 22-25
Ship Equipment month 26
Start Field installation (cables, conduits): month 24
Start Cabinet Installation month 27
Testing and Commissioning: months 29-39
Sixty Day Demonstration: months 40 – 41

9. Project Organization

9.1 Key Personnel

This section summarizes the responsibilities of the key positions for the project. Additionally, the organization chart provided in Figure 6 reflects the key project staff members and their reporting responsibilities. Resumes for each of the key project staff members are included at the end of this section.

Denver AGTS Central Control Upgrade and ATC Replacement
Project Organization

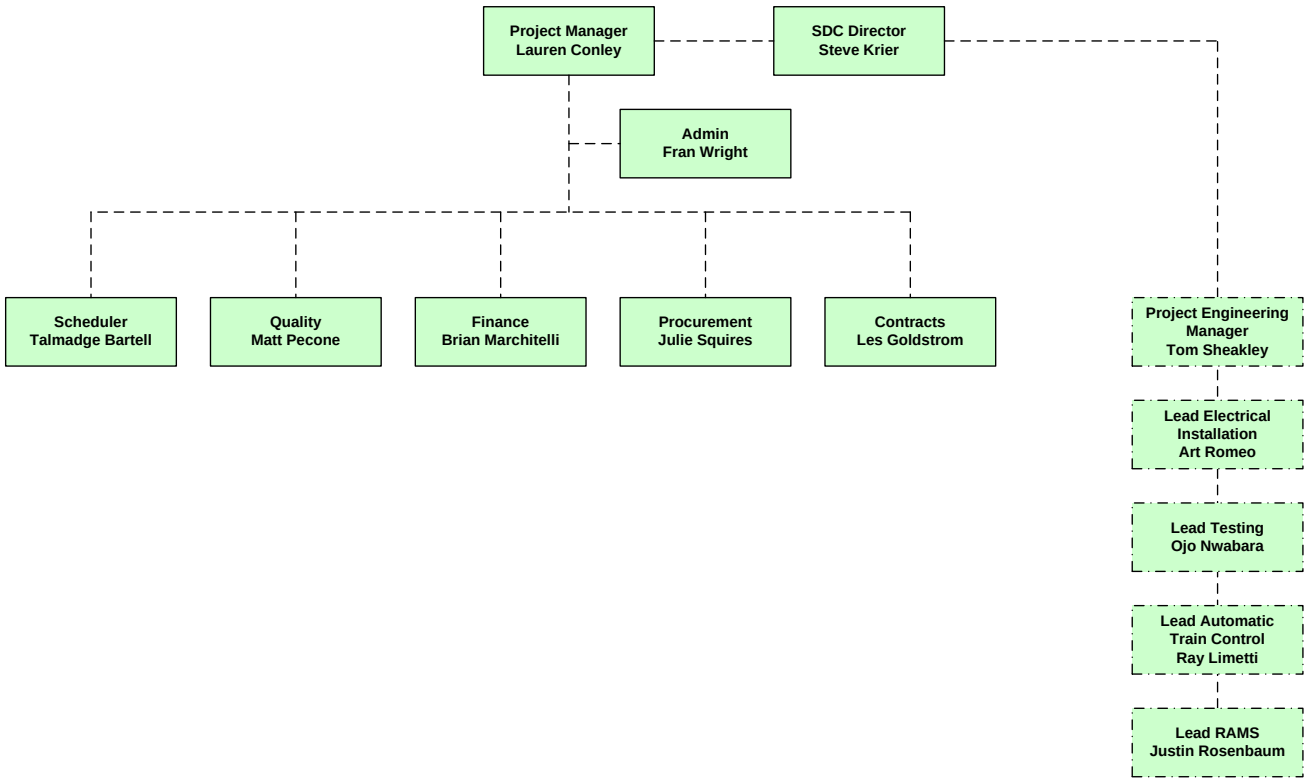

Figure 6: Project Organization Chart

Project Manager

The Project Manager is responsible for implementing the replacement ATC project and has full authority to act on behalf of the team in performance of the contract. Other project personnel assigned directly to the project will assist the project manager.

The Project Manager will be based in Pittsburgh and will frequently travel to Denver to interface with City representatives, to assess the progress of the project, and to attend project status meetings. The Project Manager will report to the Bombardier Manager of Programs, who is charged with the overall responsibility for successful completion of the project for Bombardier.

Service Delivery Center (SDC) Director

This individual, based in Denver, is presently the SDC Director of the Denver site and has extensive experience in program and site management. He is responsible for all site activities including start-up, construction, installation, testing and commissioning of the AGTS.

Project Engineering Manager

This senior engineering position will be based in Pittsburgh and is responsible for the design and coordination of systems and subsystems including wayside controls, central controls and communications. The Project Engineering Manager will report directly to the Project Manager. The Project Engineering Manager will frequently travel to Denver to work closely with the site team and subcontractor personnel to provide systems-level input to the ATC design and technical leadership for installation, testing, and start-up.

Project Scheduler

This individual, based in Pittsburgh, will be responsible for the development, maintenance and control of the Primavera project schedule and the integration of the internal manufacturing schedule. The Project Scheduler will be actively involved in the development of site installation, cutover and test schedules as well as the integration of electrical installation schedules. The Project Scheduler will provide schedule reports to manage project activities and will assist with project administration functions. The Project Scheduler will report directly to the Project Manager.

Lead Test Engineer

Based in Pittsburgh, this individual will be responsible for the detailed planning and coordination of the test and cutover activities with the SDC and the project scheduler. The Lead Test Engineer will travel to Denver during installation and lead the cutover activities. The Lead Test Engineer will report directly to the Project Engineering Manager.

EXHIBIT B

DENVER INTERNATIONAL
AIRPORT

Section 34 42 00
Railway Signalling and Control Equipment

Automated Guided Transport System (AGTS)
Central Control Upgrade and
Automated Train Control (ATC) Replacement

Technical Specifications

Division 34

Contact #	**Issued**	**Contractor**
201207703	May, 2011	Bombardier Transportation

Revisions

Revision	Date	Remark/Explanation of Changes
A	April 19, 2011	Initial document
B	August 24, 2011	Incorporated first set of comments
C	November 10, 2011	Address comments
D	February 02, 2012	Address comments; Defined new operating modes
E	April 24, 2012	Address comments and make clarifications
F	September, 2012	Issued for construction

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Figures

Tables

1 INTRODUCTION

1.1 PROJECT DESCRIPTION

1.1.a Denver International Airport (DIA) is operating a Bombardier CX-100 system between the Main Terminal and Concourses A, B and C. For Concourses B and C the installed Automated Guided Transportation System (AGTS) serves as the only passenger connection to the Terminal.

1.1.b The project described herein will replace the existing Automated Train Control (ATC) including the relay based Automated Train Protection (ATP) system with Bombardier's (BT) CITYFLO 550 system.

1.1.c As part of the Work, the existing Central Control facility installed in the Airport Office Building (AOB) will be upgraded and a new AGTS control facility in the maintenance facility will be added to the system.

1.1.d During the entire Work of this project the quality of passenger service and system availability has to be maintained. The contractor, Bombardier, is the operations and operations provider for the operating system under CCD Contract Number CE 1A1001. All activities related to this contract Work must be coordinated with the DIA operating team. Any scheduled impact on the operating system must be approved first by Bombardier Operations Group and second by the CCD project manager.

1.1.e The Work performed under this contract shall make provision to handle the functional and operational requirements for the ongoing South Expansion.

1.2 CONTRACTOR'S RESPONSIBILITIES

1.2.a Contractor shall be responsible for the Design, Delivery, Installation, Integration, Performance and Testing and Commissioning of a new Automated Train Control System specifically the BOMBARDIER CITYFLO 550 which controls the AGTS connecting Concourses A, B, C, Main Terminal and Maintenance Facility at Denver International Airport.

1.2.b Contractor shall provide and install an Alternate Control Center into the area currently occupied as the main conference area of the APM Maintenance Facility.

1.2.c Contractor shall upgrade the current Central Control facility located in the Airport Office Building (AOB).

1.2.d Contractor shall perform all work with the goal to minimize the system headways and shall cooperate closely with the Owner's Representative to implement the new work and analyze existing conditions. If required, the Scope shall not be limited to the South Terminal expansion, but shall also include potential upgrades required at the North Long Loop.

1.2.e Contractor is responsible for any and all equipment, labor, software, design, phasing etc. to provide a fully functional system whether specifically identified in this specification or not.

1.2.f Contractor shall promptly notify the City in writing of any conflict between these provisions and the existing ATC operations and the City shall respond to Contractor in writing, advising of the resolution of any such conflict.

1.2.g All Work performed under this specification shall make provision to handle the functional and operational requirements from the ongoing South Expansion (Description of South Expansion, see Section 2.3.1). All graphical control interfaces shall include the South Expansion and be capable to be upgraded with the South Expansion operation.

1.2.h No Wwork performed under this contract shall limit current or planned performance of the system including the South Expansion project. If future performance reductions are unavoidable, they need to be communicated to the Project Manager before contract negotiations and shall impact the commercial conditions of the contract.

1.2.i Specific references are made to the American Society of Civil Engineers (ASCE) Automated People Mover Standards, Parts 1, 2, 3 and 4 (ANSI/ASCE/T&DI 21-05, ASCE 21-98 and ASCE 21-00, respectively). These documents are available from ASCE. In the event of a conflict between any of these ASCE Standards and the requirements of this specification, the Contractor shall notify the Owner's Representative for direction.

1.2.j Contractor may be requested to maintain a website to access project related information in accordance to the City and County of Denver's requirements.

1.3 DEFINITIONS

1.3.a	Alternate Central Control	New, fully functional Central Control facility located in the AGTS maintenance facility.
1.3.b	Braking, Emergency	Irrevocable braking to a complete stop at a rate never less than the minimum guaranteed rate.
1.3.c	Braking, Service	Braking of vehicle motion at a rate that is regarded as comfortable for repeated use in service stopping and/or slowing and is within the comfort level specified herein.
1.3.d	Central Control	The location where Automated Train Supervision (ATS) is accomplished for the entire system; the train command center; in this specification synonymous for both Central Control (AOB) and Alternate Control (Maintenance Facility).
1.3.e	Central Control Operator	Any person authorized to operate the APM system from central control.
1.3.f	Commercial Operation	Scheduled operation of the APM during operating times as defined in this document
1.3.g	Contractor	Bombardier Transportation.
1.3.h	Failure	Inability to perform an intended function.

1.3.i	Fail-Safe	A characteristic of a system or its elements whereby any failure or malfunction affecting safety will cause the system to revert to a state that is known to be safe.
1.3.j	Owner	City and County of Denver
1.3.k	Project Manager	Logplan LLC
1.3.l	Safe State	System state that is deemed acceptable by the hazard resolution process (ANSI/ASCE/T&DI 21-05, Section 3.1.2).
1.3.m	Shall	In this contract, the word “shall” denotes a mandatory requirement.
1.3.n	System	A composite of people, procedures, facilities and/or equipment that are integrated to perform the functionality described in this document.
1.3.o	Train	Consists of one or more contiguous vehicles combined into an operating unit.
1.3.p	Vehicle	The smallest unit that can operate alone or that comprises one of the basic building blocks of a train.

1.4 ACRONYMS

1.4.a	AALA	American Association of Laboratory Accreditation
1.4.b	AFI	Air Filter Institute
1.4.c	AOB	Airport Office Building
1.4.d	AGTS	Automated Guided Transportation System
1.4.e	AISC	American Institute of Steel Construction
1.4.f	AISI	American Iron Steel Institute
1.4.g	AMCA	Air Moving and Conditioning Association
1.4.h	APEN	Air Pollution Emission Notes
1.4.i	APM	Automated People Mover
1.4.j	APWA	American Public Works Association
1.4.k	ARI	Air Conditioning and Refrigeration Institute
1.4.l	ASCE	American Society of Civil Engineers
1.4.m	ASME	American Society of Mechanical Engineers
1.4.n	ASTM	American Society for Testing and Materials
1.4.o	ATC	Automated Train Control
1.4.p	ATO	Automated Train Operation
1.4.q	ATP	Automated Train Protection

1.4.r	ATS	Automated Train Supervision
1.4.s	BID	Building Inspection Division, Department of Public Works
1.4.t	BT	Bombardier Transportation (Contractor)
1.4.u	CAR	Corrective Action Report
1.4.v	CCC	Central Control Console; referring to the Control Console in both locations: Central Control as well as Alternate Control
1.4.w	CCD	City and County of Denver
1.4.x	CCR	Contractor Change Request
1.4.y	CD	Change Directive
1.4.z	CDOH	Colorado Department of Highways or Colorado Department of Health
1.4.aa	CN	Change Notice
1.4.bb	CO	Change Order
1.4.cc	CPM	Critical Path Method
1.4.dd	CSC	Certificate of Substantial Completion
1.4.ee	DFD	Denver Fire Department
1.4.ff	DIA	Denver International Airport
1.4.gg	DOT	United States Department of Transportation
1.4.hh	DOR	Designer of Record
1.4.ii	DTS	Data Transmission System
1.4.jj	EEO	Equal Employment Officer or Equal Employment Opportunity
1.4.kk	EPA	Environmental Protection Agency
1.4.ll	FAA	Federal Aviation Administration
1.4.mm	FCC	Federal Communications Commission
1.4.nn	FS	Federal Specifications (U.S. General Services Administration)
1.4.oo		
1.4.pp	ICBO	International Conference of Building Officials
1.4.qq	ICEA	Insulated Cable Engineers Association
1.4.rr	IEEE	Institute of Electrical and Electronic Engineers
1.4.ss	IES	Illuminating Engineering Society

1.4.tt	ISA	Instrument Society of America
1.4.uu	ITA	Independent Testing Agency
1.4.vv	MMI	Man-Machine-Interface
1.4.ww	NACE	National Association of Corrosion Engineers
1.4.xx	NBS	National Bureau of Standards (Now called National Institute of Standards and Technology)
1.4.yy	NCR	Nonconformance Report
1.4.zz	NEC	National Electric Code (NFPA 70)
1.4.aaa	NECA	National Electric Contractors Association
1.4.bbb	NEMA	National Electrical Manufacturer's Association
1.4.ccc	NESC	National Electrical Safety Code
1.4.ddd	NFC	National Fire Code (as published by NFPA)
1.4.eee	NFPA	National Fire Protection Association
1.4.fff	NICET	National Institute for the Certification of Engineering Technologies
1.4.ggg	NIST	National Institute of Standards and Technology
1.4.hhh	NTP	Notice to Proceed
1.4.iii	ORS	Operational Radio System
1.4.jjj	OSHA	Occupational Safety and Health Administration
1.4.kkk	PA	Public Address
1.4.lll	PDM	Precedent Diagram Method
1.4.mmm	PDS	Power Distribution System
1.4.nnn	PLC	Programmable Logic Controllers
1.4.ooo	PS	Product Standard of NIST (U.S. Department of Commerce)
1.4.ppp	PM	Project Manager (DIA)
1.4.qqq	PMP	Project Management Provisions
1.4.rrr	QA	Quality Assurance
1.4.sss	QC	Quality Control
1.4.ttt	RAR	Remedial Action Request

1.4.uuu	RFI	Request for Information
1.4.vvv	SIMS	Site Information Management System
1.4.www	SSD	System Schematic Display
1.4.xxx	TCP	Traffic Control Plan
1.4.yyy	TSA	Transportation Security Administration
1.4.zzz	UBC	Uniform Building Code (published by ICBO)
1.4.aaaa	UL	Underwriters Laboratories, Inc.
1.4.bbbb	UMC	Uniform Mechanical Code (published by ICBO)
1.4.cccc	UPC	Uniform Plumbing Code (published by ICBO)
1.4.dddd	USC	United States Code
1.4.eeee	WBS	Work Breakdown Structure

1.5 CODES AND STANDARDS

1.5.a Contractor shall be responsible for identifying and applying codes and standards as required for this Work. All equipment and accessory items furnished and installed under this Contract shall be governed at all times by applicable provisions of Federal laws, including, but not limited to the latest revisions of the following:

1.5.1 Local Codes, Standards and Regulations

1.5.1.a Denver Building Code

1.5.1.b Colorado Department of Labor and Employment, Division of Oil and Public Safety, Conveyance Regulations

1.5.2 Automated People Mover Standards

1.5.2.a Part 1 – ASCE 21-05

1.5.2.b Part 2 – ASCE 21.2-08

1.5.2.c Part 3 - ASCE 21.3-08

1.5.2.d Part 4 – ASCE 21.4-08

1.5.2.e (American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400)

1.5.3 Occupational Safety and Health Standards

1.5.3.a Part 1910 – Occupational Safety and Health Standards, Chapter XVII of Title 29, Code of Federal Regulations.

1.5.3.b Part 1926 – Occupational Safety and Health Standards, Chapter XVII of Title 29, Code of Federal Regulations.

1.5.3.c ADA – Americans with Disabilities Act

1.5.4 American Welding Society

1.5.4.a AWS-A2.0 Standard Welding Symbols.

1.5.4.b AWS-C1.1 Recommended Practice for Resistance Welding.

1.5.4.c (Copies of AWS publications may be obtained from the American Welding Society, 550 NW LeJeune Road, Miami, FL 33126.)

1.5.5 American National Standards Institute

1.5.5.a A-12.1 Safety Code for Floor and Wall Openings, Railings and Toe Boards.

1.5.5.b Z-53.1 Safety Color Code.

1.5.5.c (Copies of ANSI Standards may be obtained from ANSI, 1819 L Street, NW, Washington, D.C. 20036.)

1.5.6 Underwriters Laboratory

1.5.6.a UL 50 – Enclosures for Electrical Equipment

1.5.6.b UL 797 – Electrical Metallic Tubing

1.5.6.c (Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062)

1.5.7 National Bureau of Standards

1.5.7.a Handbook H 28 – Screw Thread Standards.

1.5.7.b (Copies of handbook H 28 may be obtained upon application accompanied by a money order, coupon or cash, made out to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

1.5.7.c City and County Fire Protection Code

1.5.8 National Fire Protection Association

1.5.8.a NFPA 1 – Fire Prevention Code

1.5.8.b NFPA 10 – Portable Fire Extinguishers

1.5.8.c NFPA 13 – Standard for Installation of Sprinkler Systems

1.5.8.d NFPA 70 – 2002 National Electrical Code (2002 Ed.) National Fire Code.

1.5.8.e NFPA 78 – Lightning Code

1.5.8.f NFPA 80 – Standard for Fire Doors and Fire Windows

1.5.8.g NFPA 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems.

1.5.8.h NFPA 79 (Electrical Standards for Industrial Machinery).

1.5.8.i (Copies of the NFPA publications may be obtained from the NFPA, 1 Batterymarch Park Quincy, MA 02269-9101.)

1.5.9 National Electrical Manufacturers Association

1.5.9.a IC-S Industrial Controls and Systems.

1.5.9.b NEMA 4 – Enclosures

1.5.9.c NEMA TC-2 – Electrical Plastic Tubing and Conduit

1.5.9.d NEMA TC-3 – PVC Fittings for Use with Rigid PVS Conduit and Tubing

1.5.9.e NEMA TR-1 – Transformers, Regulators and Reactors

1.5.9.f NEMA VE-1 – Metallic Cable Tray Systems

1.5.9.g NEMA WC-3 – Rubber-Insulated Wire and Cable for the Transformers

1.5.9.h NEMA WC-8 – Cable Insulation Standards

1.5.9.i (Standards of NEMA are available from NEMA, 1300 North 17th Street, Suite 1847, Rosslyn, Virginia 22209.)

1.5.10 IATA Standards

1.5.10.a IATA Passenger services Conference Resolutions manual.

1.5.10.b IATA Airport Development Reference Manual (9th Edition - January 2004)

1.5.11 ICAO Standards

1.5.11.a International Civil Aviation Organization (ICAO)

1.5.11.b ICAO annex 17, Safeguarding International Civil Aviation Against Acts of Unlawful Interference

1.5.11.c ICAO 8973, Security Manual for Safeguarding Civil Aviation Acts of Unlawful Interference (Sixth Edition - 2002)

1.5.12 International Standards Organization

1.5.12.a ISO 9241, Ergonomics of Human System Integration.

1.5.13 International Standards

1.5.13.a BS EN 60204-1:2006 Safety of Machinery, Electrical Equipment of Machines, Part 1 General requirements

1.5.13.b ISO 13849-1:2006 Safety of machinery Safety-related parts of control systems - Part 1: General principles for design

1.5.13.c ISO 13849-2:2003 Safety of machinery Safety-related parts of control systems - Part 2: Validation

1.5.13.d BS EN 62061:2005 Safety of machinery, Functional safety of safety-related electrical, electronic and programmable electronic control systems

1.5.13.e ISO 13850:2005 Safety of machinery Emergency stop -- Principles for design

1.5.13.f BS EN 61131 Programmable logic controllers

1.5.13.g EU 781/2005 regulation

1.5.13.h EU 2320/2002 regulation

1.5.13.i IEC 60364-4-41 electrical grounding

2 PART 1 – GENERAL REQUIREMENTS

2.1 SCOPE OF WORK

2.1.a Contractor shall design, deliver, install, integrate, test and commission all Work described herein. Specifically, the following Work will be performed:

2.1.1 Replacement of Existing ATC System

2.1.1.a A new CITYFLO 550 system will be installed and replace the existing Automated Train Control (ATC).

2.1.1.b The new CITYFLO 550 equipment will be installed alongside the existing relay interlocking cabinets during phasing. After Final Completion of the CITYFLO 550 the relay interlocking system will be removed from the site or placed into storage at direction of the project manager.

2.1.1.c The project will also include the replacement of existing ATO equipment with a PC-based ATO system.

2.1.2 Upgrade of the Central Control Facility

2.1.2.a The existing Central Control Facility located on the 10th floor of the Airport Office Building (AOB) shall be replaced with new Central Control and ORS equipment. The replacement of the ORS shall be IP-based and shall use the Fiber Network for communications.

2.1.2.b Contractor shall furnish, install, test and commission the replacement equipment as well as any other interim or final equipment Contractor identifies as necessary to complete the Central Control Facility and ATC upgrade projects.

2.1.2.c The Local Control Panel (LCP) shall be replaced with a Man-Machine Interface (MMI) panel and a CITYFLO 550 monitoring system workstation (GEA drive) shall be located in both, the Central Control and Alternate Control Facility. The MMI panel and workstation will directly interface with CITYFLO 550 for vital and non-vital functions respectively. The MMI shall include a Prohibit Zone Switch and reset functionality for the CITYFLO 550 computers.

2.1.2.d If not stated otherwise, all requirements specified in this specification for the Central Control Facility are valid for the Alternate Control Facility as well.

2.1.3 Alternate Central Control Facility in Maintenance Facility

2.1.3.a A new Alternate Control Facility located within the AGTS' maintenance facility shall be installed with new Central Control and ORS equipment. The ORS equipment shall be connected in the cabinet via TCP/IP and use the Fiber Network for communications.

2.1.3.b Contractor shall furnish, install, test and commission the equipment as well as any other interim or final equipment Contractor identifies as necessary to complete the Alternate Control Facility and ATC Upgrade Projects.

2.1.3.c The necessary building modifications to the existing APM maintenance facility will be performed by others. The required space allotment, layout, mechanical, electrical and

Man Machine Interface (MMI) requirements shall be defined by Contractor and submitted to the City.

2.1.3.d The Local Control Panel (LCP) shall be replaced with a Man-Machine Interface (MMI) panel and a CITYFLO 550 monitoring system workstation (GEA drive) shall be located in both, the Central Control and Alternate Control Facility. The MMI panel and workstation will directly interface with CITYFLO 550 for vital and non-vital functions respectively. The MMI shall include a Prohibit Zone Switch and reset functionality for the CITYFLO 550 computers.

2.1.4 Long Loop Operation (Programming of Modes)

2.1.4.a After completion of the South Expansion work, the Long Loop Mode will be the preferred mode of operation. In this mode, the train starts at the West going Southbound stopping at the west platforms of Concourses C, B, A and Terminal.

2.1.4.b It shall be possible to perform the cross-over of the train before the change of direction (train runs into the East track) or after the change of direction (train runs into the West track). Each end of the track shall be equipped with a pseudo station located in the South Expansion area. After reversing the direction of travel the train proceeds Northbound, stopping at the east platforms of Main Terminal and Concourses A, B and C. The train crosses to the west guideway north of Concourse C using the existing long loop configuration.

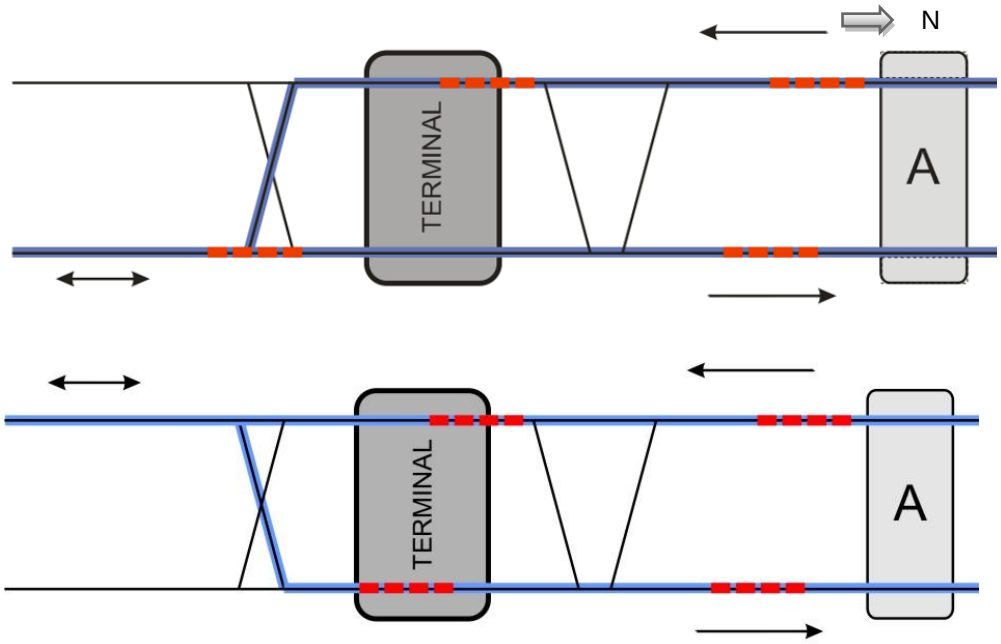


Figure 2-1: Future Long Loops

2.1.4.c Both south track extensions shall be equipped with a pseudo station for optimized turn-back operation through either side.

2.1.4.d Contractor shall provide all programming, software, visual displays and all other equipment except the wayside equipment required to operate the APM system in the Long Loop Mode within the performance requirements in Section 2.3.1.

2.1.4.e Contractor shall investigate the operation which allows for the shortest system headways. Station spacing shall be maintained with the new Future Long Loop Mode. The operation of the Future Long Loop Mode needs to be coordinated and approved with the Project Manager before implementation.

2.1.5 Operating Modes

2.1.5.a The system shall be capable to operate with the following operating modes.

2.1.5.b Contractor shall coordinate with the Project Manager, if during the implementation of the system only a sub-set of modes are available.

Mode No.	Mode
1	West Main Terminal Short Loop
1a	West Main Terminal Long Loop C West
1b	East Main Terminal Long Loop C West
1c	West Main Terminal Long Loop C East
1d	East Main Terminal Long Loop C East
2	East Main Terminal
3	Alternating Main Terminal
4	Bypass West C
4a	Bypass C West East Main Long Loop
4b	Bypass C West West Main Long Loop
5	Bypass East C
5a	Bypass C East East Main Long Loop
5b	Bypass C East West Main Long Loop
6	Bypass East Terminal and East A
6a	Bypass East A Main Long Loop
7	Bypass West Terminal and West A
7a	Bypass West A Main Long Loop
8	Bypass West B and West C
8a	Main to A Loop / A to C Shuttle
8b	Bypass B West Following Shuttle
9	Bypass East B and East C
9a	Bypass East B East Main Long Loop
10	Bypass East A and East B
10a	Bypass East A and East B Following Shuttle
11	Sync Double Shuttle
12	A to C Double Shuttle
13	West Single Shuttle
14	East Single Shuttle
15	West Terminal / Alt Turnback
16	East Terminal / Alt Turnback
17	Alternating Terminal / Alt Turnback
18	West A / A to C Loop
19	East A / A to C Loop
20	East Shuttle / West Main Terminal
21	West A / Alt Turnback A to C Loop
22	East A / Alt Turnback A to C Loop
23	West Shuttle / East Main Terminal
24	West A / A to C Loop Bypass West C
25	East A / A to C Loop Bypass West C
26	West A / A to C Loop Bypass East C
27	East A / A to C loop Bypass East C
28	East Terminal / Bypass East C
29	East Terminal / Bypass West C
30	Manual Mode

Table 2-1: Operating Modes

2.1.5.c Table 2-1 contains a preliminary list of operating modes, which the Contractor shall review. Upon finalization of modes and approval from the Owner's Representative the Contractor shall program the modes. Failure modes are a critical component and shall be programmed with the highest possible line capacity in mind. For all failure modes, a critical path analysis shall be performed.

2.1.6 Power Distribution System Interface

2.1.6.a An ATC interface to the Power Distribution System (PDS) shall be provided with new Programmable Logic Controllers (PLC)'s.

2.1.6.b The PLC's shall be designed to work with the new Central and Alternate Control Facilities.

2.1.7 Data Transfer System (DTS)

2.1.7.a All new equipment covered by this specification shall connect to the fiber optic Data Transfer System (DTS), which is a project being undertaken at DIA under a separate contract. This DTS project has been designed to provide fiber for ATC, Communications, and other applications.

2.1.7.b The DTS equipment supplied by Contractor will provide DTS nodes in each equipment room. This will allow the new Central Control, Alternate Control, ATC cabinets and other related equipment to use the fiber optic network.

2.2 EXISTING CONDITIONS

2.2.1 General

2.2.1.a Due to the "must-ride" nature of the AGTS, it is critical that the existing level of passenger service is maintained throughout the entire project duration.

2.2.1.b In order to maintain service, it is a requirement of this Contract that any installation and test activities that require complete shut-down of the System be undertaken only during the period normally scheduled for maintenance downtime and be subject to the coordination and approval by the City. Contractor shall develop a detailed installation plan, which minimizes AGTS shutdown requirements.

2.2.1.c Contractor shall be required to schedule all system shut-downs. All shut downs will be coordinated with and approved by Bombardier Operations Group, DIA operations and the project manager 10 days in advance of the planned shut-down. All such coordination shall be discussed at the weekly projects meetings as defined in the Project Management Provisions (PMP).

2.2.1.d On occasion, special circumstances may necessitate extending or reducing system operation beyond the normal operating hours or altering the mode of service. The City may therefore require the Contractor to alter the normal schedule to accommodate periodic, short-term high/low demand fluctuation in airport operations. In certain cases theses changes in operations will be required with little or no prior notice to Contractor. Therefore, these operating hours and train configurations may be adjusted by the City at no cost to the City to meet actual system ridership and operations requirements. However, the Operations schedule in Section 2.2.2 shall apply to all purposes in this Contract, at least through the issuance of the Certificate of Substantial Completion (CSC).

2.2.2 System Operating Hours (Commercial Service)

Time	Trains in System	Cars per Train	Operating Mode
24:00 - 05:00	1	4	4-car train shuttle
05:00-06:00	4	4	pinched loop
06:00-21:00	5 or 6	4	pinched loop
21:00-24:00	4	4	pinched loop

Table 2-2: System Operating Hours

2.2.3 Headway

2.2.3.a Headway is the elapsed time between the same part of consecutive trains operating in the same direction on the same guideway, measured at any given point on the guideway. Subsequent to the implementation of the replacement CITYFLO 500 ATC system, the operational headway shall not be greater than 119 seconds with 6 trains operating in Normal Short Loop Mode and the station dwell settings as shown in Section 2.2.4 below.

2.2.4 Dwell Times

2.2.4.a Dwell times are measured from “wheel stop” to “wheel start”.

Station	Seconds
Main Terminal West	39
Concourse A East	32
Concourse B East	26
Concourse C East	25
Concourse C West	23
Concourse B West	28
Concourse A West	32

Table 2-3: Dwell Times (Short Loop)

Station	Seconds
Main Terminal West	30
Main Terminal East	30
Concourse A East	32
Concourse B East	26
Concourse C East	25
Concourse C West	23
Concourse B West	28
Concourse A West	32

Table 2-4: Dwell Times (Long Loop)

2.2.5 Round Trip

2.2.5.a Round trip time is the time a train takes to complete one circuit around its route. Round trip time is equal to the sum of all travel times and station stop times on a route. Subsequent to the implementation upgraded ATC system, the round trip time shall not be greater than 714 seconds with 6 trains operating in Normal Short Loop Mode and the station dwell settings defined in 2.2.4.

2.2.6 Operating Modes

2.2.6.a

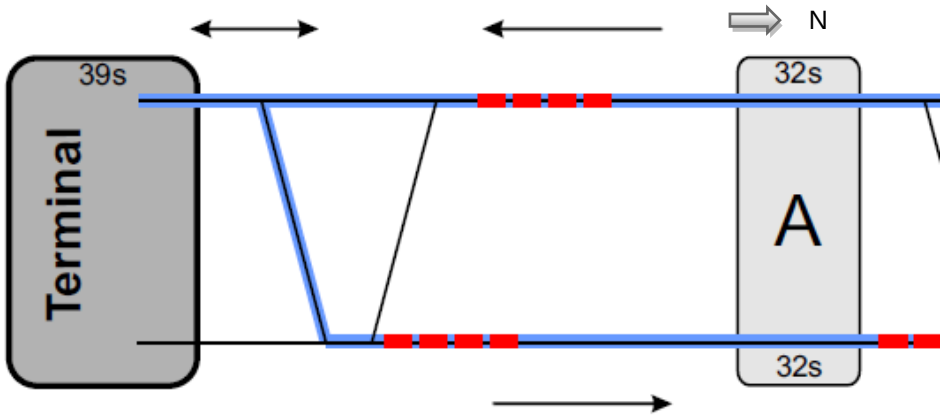
2.2.6.1 Manual Mode

2.2.6.1.a In this mode, the Automatic Train Operation (ATO) computer makes no automatic requests. This means that no switch requests, traffic direction requests, door

requests, hold requests, etc. are made automatically by either ATO computer. The central operator controls all wayside factors associated with train movement.

2.2.6.2 Short Loop Modes

2.2.6.2.a In this mode, the train starts at the West track going Southbound stopping at the west platforms of Concourses C, B, A and Terminal. The train then crosses back to the east guideway north of the Main Terminal going Northbound stopping at the east platforms of Concourses A, B and C. The train crosses to the west guideway north of Concourse C using the long loop configuration.



2.2.6.2.b

Figure 2-2: Normal Mode

2.2.7 Maintaining Existing Functionality

2.2.7.a After completion of the Work described herein, all currently existing functions at date of NTP shall be available and operational. Functionality which may render obsolete or is replaced with new functionality shall be reported to the City for review and approval.

2.2.7.b All currently installed functions shall perform at least with the same performance, reliability and set of features after completion of Work specified herein.

2.2.7.c Functions to be maintained by this project are, but not limited to:

1) The existing de-bunching function shall operate as is after installing the new system.
2) The existing station spacing function shall operate as is after installing the new system.
3) The existing door delay opening time at Main Station shall be adjustable as-is, after installing the new system.
4) The existing pseudo-station functions North of Concourse C shall operate as is after installing the new system. If required, headway optimizations at the North Long Loop shall be included in the Work.
5) The existing early releases of trains shall operate as is after installing the new system.

6) Adjustable dwell times on graphical controls shall represent “wheel stop” to “wheel start” times when no door-reversion occur.

7) Access of live and recorded operations using Epiphan for both Central Control locations.

2.2.8 Data Link

2.2.8.a The contractor shall maintain the data links to the City for Train Status and Alarm Line Printer at all times with the full functionality and without changing the data structure for both, Central Control and Alternate Central Control facilities. If changes to the installed data link are required, Contractor shall coordinate with the Project Manager. Changes are only acceptable with the approval of the Project Manager.

2.2.9 Existing ATC Architecture

2.2.9.a Figure 2-3 shows the current system configuration of the ATC system. Contractor shall verify and document the as-build condition and functionality at the beginning of the project.

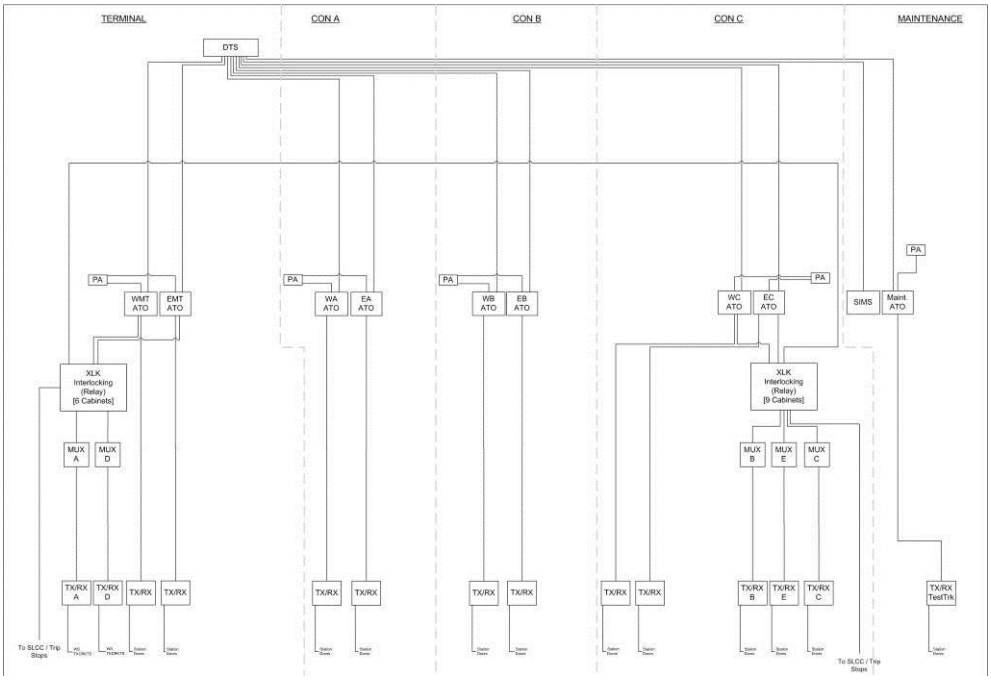


Figure 2-3: Existing System Architecture

2.3 SYSTEM INTERFACES AND COORDINATION

2.3.a This section addresses the coordination of the Work and interfaces between operating system elements being provided by Contractor and the existing facilities.

2.3.b This section is not intended to provide Contractor with a detailed description of all such interfaces; rather, it is a broad description focused on general interface areas and the division of responsibilities between Contractor and the City.

2.3.c Contractor is responsible for inspecting all Work, the reference drawings, and other drawings and documentation and to coordinate with the City's Representative to identify and successfully meet all interface requirements to provide a System that fulfills the requirements of the Contract.

2.3.d Contractor shall provide a breakdown to the City about responsibilities for the fixed facilities and operating system elements, organized in accordance with the Work Breakdown Structure (WBS). Contractor's responsibilities include, as a minimum, all required WBS elements. The Work is specified in further detail throughout the contract documents.

2.3.e Contractor shall provide a compliance matrix covering all aspects of the specification in the WBS.

2.3.f Contractor shall coordinate System interfaces to ensure that the system is properly integrated into the City’s facilities. This coordination shall be through the project manager, unless otherwise directed.

2.3.g All interim and final CITYFLO 550 ATC replacement equipment shall be located completely within the existing AGTS. Placement of any interim equipment shall not impede the access to existing equipment for operation or maintenance. Equipment layouts including required clearances shall be provided as part of the preliminary and final Design Review.

2.3.h The power requirements for the CITYFLO 550 ATC replacement equipment shall be identified for any interim and final equipment configurations as part of the Preliminary Design Review.

2.3.1 South Expansion

2.3.1.a The Work described as South Expansion within this contract describes the expansion of the AGTS to the South, enabling the operation of a long loop south of the Main Terminal Station. The goal of this expansion is to reduce the headway to 90 seconds. On-site installation work to be performed for the South Expansion is not part of this contract, but Contractor shall identify verify the compatibility of the Wwork herein with the South Expansion.

2.3.1.b The South Expansion work south of the Main Terminal Station is currently ongoing. Current work includes the track and switching work within the existing Terminal facility. Future extensions of the running surfaces beyond the existing terminal building tracks will be separate from the work currently performed.

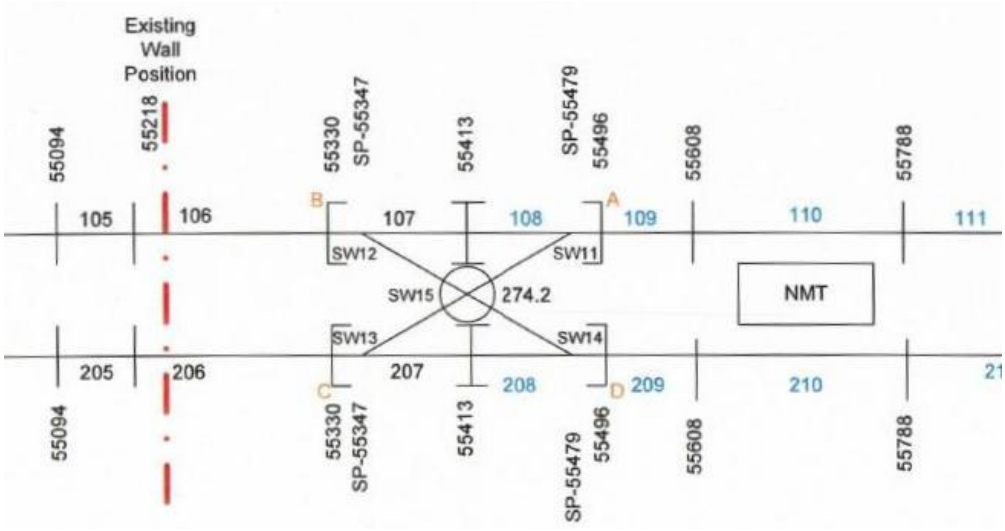


Figure 2-4: Overview of Ongoing South Expansion Project with Sample Block Sections

2.3.2 Fiber Optic Network

2.3.2.a The Work described herein shall use the currently installed fiber optic network. This network has been designed by Contractor to enable the facility with the data back-bone for the AGTS.

2.4 CONFLICTS

2.4.a Contractor shall be responsible for identifying any conflicting requirements within the Contract Documents, codes, standards, ordinances, rules and regulations and resolve the conflicts with the City's representative.

2.4.b All conflicts are to be identified by Contractor prior to negotiations. All conflicts after the signing of the contract are to be resolved at no cost to the city in time or money.

2.5 CONTRACT SCHEDULE AND PHASING

2.5.1 General

2.5.1.a Anticipating an NTP on or about XXX the project would be completed by XXX.

2.5.1.b Contractor shall develop a detailed Contract Schedule which will relate to the WBS. See Project Management and Special Requirements. The Contract Schedule prepared by Contractor shall be developed to minimize the impact to the operating APM.

2.5.1.c Contractor shall be responsible for the coordination of all installation and test activities with the on-site Operations and Maintenance staff.

2.5.1.d Monthly progress reports with payment applications are required as defined in Project Management Provisions.

2.5.2 ATC and Central Control Facility Equipment Cutover Plan

2.5.2.a Contractor shall prepare a detailed cut-over plan for both ATC Replacement and Central Control facility projects.

2.5.2.b The plan must address the prerequisites for the operation of all new or modified equipment prior to being placed into passenger service.

2.5.2.c Details of the cutover plan shall include system drawings identifying the installation of all new equipment, cutover cabinets, temporary or interim equipment, and any non-functional equipment. The plan shall identify any prerequisite activities prior to undertaking each phase of the cutover. It shall also identify the process of verifying the integrity of the existing ATC.

2.5.3 Cutover Plan for ATC Upgrade

2.5.3.a The main objective of the cutover plan shall be to install and test with minimal impact to the existing system operations and to minimize disruption to commercial AGTS operations.

2.5.3.b Contractor shall install new cutover cabinets. The new installed cutover cabinets shall reduce the time required to cut over between the existing system and the upgraded ATC system for testing.

2.5.3.c Contractor shall identify the provisions that will be invoked to ensure the integrity and safety of the existing system operation in all operating modes and for all cut-over or testing activities.

2.5.3.d The cut-over plan shall identify any special procedures or activities required by the Central Control Operator or other operations staff during or as a result of the cutover.

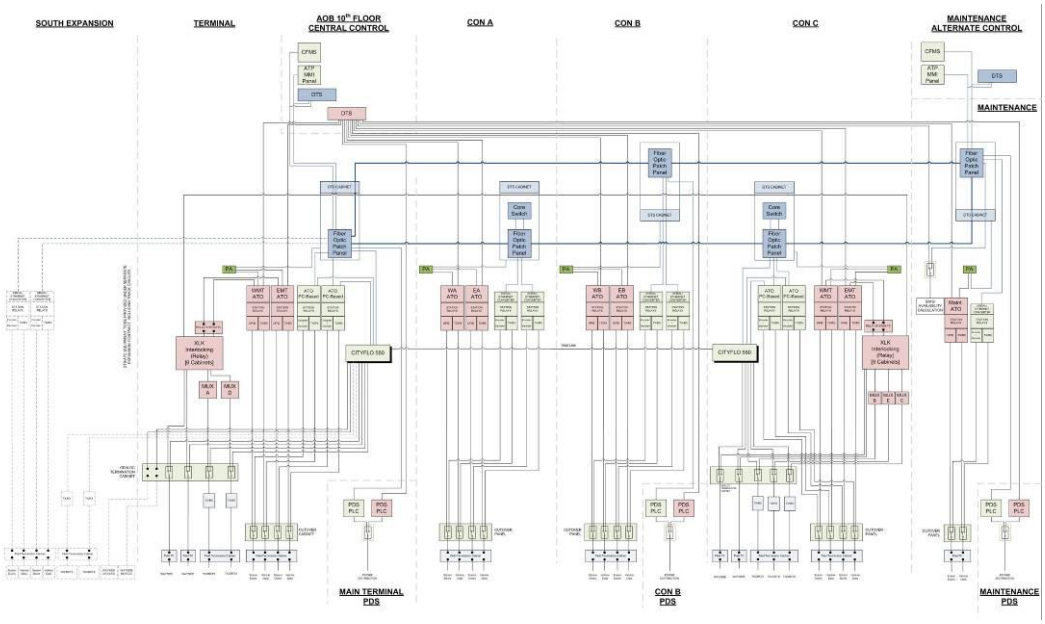


Figure 2-5: Cut-Over Cabinet Configuration

2.5.3.e Figure 2-5 is a sample diagram overview to illustrate the cut-over from the existing relay system to a CITYFLO 550 system configuration.

2.5.3.f This process may be revised based on further evaluation which may occur during the Design Review process of the project. A final system cut-over plan shall be developed and submitted to City's representative within 15 business days of completion of the Final Design Review.

2.5.3.g The cut-over plan shall detail all aspects of planning and execution of the cut-over activities and may be updated as required as the project progresses. Contractor shall be required to maintain a current cut-over plan and shall continue to submit a revised plan to City's representative within 24 hours of each cut-over plan revision.

2.5.3.h All cutover plans are not final until approved by the City's representative. The City has up to 5 days to approve any and all cut-over plans and revisions.

2.5.4 Fall Back Operation

2.5.4.a At all times it shall be possible to operate the system in the same manner it is operating before any Work under this contract has been performed. Contractor shall provide a switching function between new and legacy system.

2.5.4.b The commercial operation of the system shall at no time during this project, until notice of Final Completion has been granted, as a whole or in parts rely on un-tested or not approved systems, system components or control logic.

2.5.4.c Operations between 4:30 and 24:00 shall be performed using the existing control system and might be occasional extended due to operational requirements from DIA operations.

2.5.5 Site Access

2.5.5.a Contractor has full access to the site for 24 hours, 7 days a week.

2.5.5.b All personnel have to be badged by the City before conducting any Work on site. All rules and regulation in place when the badging is performed will be applied. Escorting is allowed but has to be within the rules and regulations of DIA. The City will not support the project with escorting personnel.

2.5.6 Milestones

2.5.6.a The overall Contract Schedule is 39 months. Key milestones are:

Task	Milestone from NTP
Complete hardware design	month 9
Complete software requirements and design	month 12
Preliminary Design Review (30%)	month 6,12
Final Design Review (100%)	month 18
Software development	months 6–23
Completion of Alternate Control Facility	month 24
System Factory Acceptance Test	months 23-25
Start Field installation	month 27
Testing and Commissioning	months 31-39

Table 2-5: Project Milestones

2.6 PERFORMANCE

2.6.1 Headway Normal Pinched Loop Mode

2.6.1.a Headway is the elapsed time between the same parts of consecutive trains operating in the same direction on the same guideway, measured at any given point on the guideway. Subsequent to the implementation of the replacement CITYFLO 550 ATC system, the operational headway shall not be greater than 119 seconds with 6 trains operating in Normal Loop Mode and the station dwell settings as shown Table 2-3.

2.6.2 Headway Long Loop Mode

2.6.2.a After the installation of the switch section south of Main Terminal Station and extension of tracks to the South, the APM system shall perform with the shortest possible headways when operated with the appropriate number of trains in the system. No Work performed under this Contract shall limit the ability of future performance improvements. Any limitations shall be identified during the Preliminary Design Review and coordinated with the Project Manager and require approval by the Project Manager.

2.6.2.b The Replacement CITYFLO 550 ATC system shall support 90 second headways when the turn-backs and track extensions South of Main Terminal are installed (South Expansion). Contractor shall identity any location/layout restrictions for the future turn-backs to support the headways as short as 90-seconds as part of the Preliminary Design Review.

2.7 ENGINEERING DESIGN REQUIREMENTS

2.7.1 System Safety

2.7.1.a A structured and systematic approach to system safety shall be used so that potentially unsafe conditions are identified before they are manifested in the operational system. The System Safety Program shall address any interim and final replacement ATC configurations.

2.7.1.b Safety shall be the primary design and performance requirement for the System. With all system elements operating without malfunction, each functional component and the entire system shall operate in a safe manner under all operating conditions. Each safety-critical component shall incorporate fail-safe configurations, parts reliability, selective redundancy, warning devices and protective elements, as required, to contribute to the achievement of the specified requirements and be designed according to the safety principles specified in 2.7.1.1, In addition, safety shall be assured when system elements have been, or are, malfunctioning.

2.7.1.c The safety of the system in the normal operating state shall not depend on correctness of actions or procedures used by operating personnel. At all other times, there shall be minimum dependence on correctness of actions or procedures used by operating and maintenance personnel. However, in no case shall procedures be substituted to accomplish any safety functions that are to be provided by specific aspects, components, or subsystems of the system. Frequency or infrequency of use shall not be a reason to justify unsafe or marginally safe design.

2.7.1.d Whenever any hazardous condition occurs, regardless of the cause, and the condition results in a conflicting concern for human safety versus equipment safety, the conflict shall be resolved in favor of human safety.

2.7.1.1 Safety Principles

2.7.1.1.a Two principles of safety, the Fail-safe Principle and the Checked-Redundancy Principle, shall govern the design of all safety-critical components and subsystems where specifically referenced in this section. One or both of these principles must be used to ensure that the system is not unsafe.

2.7.1.1.1 Fail-Safe Principle

2.7.1.1.1.a The fail-safe principle applies to hardware and/or software configurations and states that the occurrence of any frequent failure of a safety-critical hardware or software element or any combinations of independent frequent failures shall not result in a condition known to be unsafe. In applying the fail-safe principle, frequent failures are failures that are likely to occur more than once in one million (10^6) years.

2.7.1.1.1.b The CITYFLO 550 ATC System Fail Safe Design shall be in accordance with Section 3.3, ATC System Fail Safe Design, ANSI/ASCE/T&DI 21-05.

2.7.1.1.1.c A preliminary Safety Critical Component / Equipment Failure List is provided in Section 2.7.1.3. This list is composed of items typically used in railway-type command and control systems.

2.7.1.1.2 Checked Redundancy Principle

2.7.1.1.2.a The Checked-Redundancy Principle applies to safety-critical hardware and/or software configurations and states that the probability of any failure or combinations of such failures that can result in a condition known to be unsafe shall be controlled to produce a risk comparable to that associated with fail-safe design. Therefore, each function of a component or Subsystem which is designed in accordance with the Checked-Redundancy principle shall provide a level of safety equivalent to that provided by the same function designed in accordance with the Fail-Safe principle.

2.7.1.1.2.b The checked-redundant control configuration, whether it comprises hardware or software elements, must incorporate at least two parallel control units processing a common system characteristic and a means of comparing the output of the control units. If there is “agreement” from the comparison, then the system may be allowed to respond in accordance with the output of the control units. If there is disagreement, the action resulting from that output must not occur and the system must immediately revert to a safe state. For example, if a vehicle is in motion, the brakes must be applied, and if the vehicle is not in motion, it shall not be allowed to move.

2.7.1.1.2.c The following characteristics must be incorporated into the checked-redundancy design:

1) The checking process shall, in itself be fail-safe or checked-redundant; "agreement" shall not be indicated unless the control unit outputs agree.
2) The checking process shall include the comparison of all control units related to safety.
3) Any failure in any of the redundant channels which could affect the safety of the system shall be detected. Where a system element is implemented by software programming, errors in the programming shall be considered as failures.
4) The parallel control units must be completely independent from each other so that no common environmental or power fluctuations, errors, faults, etc., can cause related errors in the output of the control units. Elimination of the common mode failure for software programmed elements shall be accomplished by:
    a. Independent, different programming in the parallel control units, and or
    b. The use of complemented programs for the parallel elements of all functions involving the ATP subsystem.
5) The checking process shall be comprehensive and at least as frequent as the number of operations of the device or function being checked to ensure that the probability of occurrence of a combination or sequence of compensating errors causing agreement between comparisons shall be controlled to produce a risk comparable to that of fail-safe design.

6) Unless “agreement occurs”, timely action must result which assures safety.

2.7.1.2 Safety Critical Component/Equipment

2.7.1.2.a A preliminary Safety-Critical component/Equipment Failure List is provided in 2.7.1.3.

2.7.1.2.b This list is composed of items typically used in railway-type command and control systems. This list itemizes "frequent failure modes", that is, failure modes that are likely to occur more than once in one million years.

2.7.1.2.c Not listed for each item are certain failure modes that occur so rarely that they can be neglected in the circuit design considerations, i.e., they occur less than once in one million years. Relays certified as "vital" have failure characteristics as listed in 2.7.1.3.

2.7.1.2.d Contractor shall add other components/equipment to this preliminary list as necessary to assure that it is complete. Any components with other modes of failure must be identified and appropriate failure modes documented by Contractor.

2.7.1.2.e Other components identified by the City's Representative or Contractor that are used in a safety related function shall require appropriate failure mode documentation by Contractor.

2.7.1.2.f For Contractor to gain approval for the use of such components, the City may require Contractor at his expense and without additional compensation, to obtain a specific analysis and favorable conclusion on the use of such components from a recognized independent agency whose qualifications to perform such analysis are acceptable to the City.

2.7.1.2.g The Critical Component/Equipment Failures List shall be submitted as part of the Detailed Hazards Analysis.

2.7.1.3 Safety Critical Component/Equipment Failure List (Preliminary)

1) Relays (vital or safety-type as defined by AREMA) --back contacts closed when coil terminal energized, high contact resistance.
2) Relays (vital European type as defined by the Union International des Chemins de Fer) --back contacts closed when coil terminals energized, high contact resistance, front contacts closed when coil terminals de-energized.
3) Relays (non-vital) - back contacts closed when coil terminals energized, high contact resistance, front contacts closed when coil terminals de-energized, front contact(s) closed at same time as back contact(s).
4) Transformers (special vital-type) - open-circuited primary, open-circuited secondary, short-circuited turns, and combinations of the foregoing.
5) Transformer (non-vital) - open-circuited primary, open-circuited secondary, short circuited turns, primary to secondary short circuits, and combinations of the foregoing.
6) Inductors (safety type used in Vehicle Control) - open-circuited coil.

7) Capacitors (special vital-type) - open circuit, leakage, nominal change in value sufficient to affect safety.

8) Capacitors (non-vital type) - short circuit, open circuit, leakage, change in value sufficient to affect safety.

9) Resistors (special vital-type - increase in resistance, nominal decrease in resistance.

10) Resistors (non-vital) - increase in resistance, decrease in resistance sufficient to affect safety.

11) Semiconductor devices - short circuits, open circuit, leakage, and change in dynamic characteristics.

12) Diodes - short circuit, open circuit, and reverse leakage.

13) Coils (special vital-type) - open circuited turns.

14) Coils (non-vital) - open and short-circuited turns.

15) Printed Circuit Board (vital-type) - open circuit in any conductor or connector terminal, short circuit to ground for any conductor or connector terminal.

16) Printed Circuit Board (non-vital) - open-circuited in any conductor or terminal, short circuit to ground for any conductor or connector terminal, short circuit between adjacent connector terminals, signal feed-back from output to input.

17) Loss and degradation of power sources.

18) Abnormal signal levels, frequencies and delays.

19) Missing input signals.

20) Open and short circuits in internal and external circuitry at inputs and at outputs.

21) Drift and instability of amplifiers, receivers, transmitters, oscillators, switching circuits, and power supplies.

22) Deterioration of contacts, connectors, terminals, solder connections, printed circuits, circuit adjusting devices, and mechanical devices.

23) Loss of electrical power or pressure in a braking system.

24) Primary power voltage lower or higher than normal.

2.7.2 Reliability and Proven Technology

2.7.2.a The overall system performance and reliability shall be at least at the current level.

2.7.2.b The chosen system technology must use reliable and proven equipment, and the use of prototype components and the inherent risk of such must be excluded. The system components must be chosen with the highest possible reliability in mind. Individual system components must have proven their reliability either in other systems or at least during rigorous testing trials. Proof of reliability and/or test trial results may be required for review by the project manager.

2.7.2.c During the Design Review process Contractor shall submit a list with all unproven technology intended to be used and mark those components or technologies on the submittals. If new technologies are going to be used under this contract, a testing plan shall be submitted including a testing schedule, results of quality tests, and calculations for those components. Tests shall be signed by witnesses of the tests.

2.7.2.d To the maximum extent possible components shall be factory tested before being shipped on site for installation.

2.7.3 Redundancy

2.7.3.a Systems shall be designed in such a manner, that no single fault will result in a failure of the entire system. Contractor shall identify and submit a list of single faults, which create limitations of commercial operations, changes in operating the system (e.g. delayed system response times, reduction in functionality, etc.) as part of the Design Review.

2.7.3.b If possible, redundant systems and connections shall be physically separated in such a manner, that a single event (e.g. fire, water damage) is only affecting one of these redundant systems. Contractor shall submit a list of redundant systems including locations as part of the system Design Review.

2.7.4 System Availability

2.7.4.a Existing contractual AGTS operation, maintenance and functionality requirements shall be maintained by the new ATC system and if possible result in improvements.

2.7.4.b During all phases of the project the rules and regulations of the AGTS operations and maintenance contract shall apply. In cases where contractual requirements cannot be maintained, Contractor shall inform and coordinate with the Project Manager in advance and obtain approval for each deviation from normal service.

2.7.5 Expandability

2.7.5.a The equipment and software provided under this Work shall be compatible with the future South Expansion. It shall be possible to add track sections, switches, stations and other wayside equipment to the existing system by modular expansion of control components. Mechanical, electrical and computer systems shall be designed to the maximum extend in such a manner, that they can be easily expanded and reconfigured in the future without the need to replace components provided under this contract.

2.7.5.b Contractor shall identify and notify the Project Manager of any parts installed under this contract which will require replacement as part of such expansion.

2.7.5.c Except otherwise specified, all control, signal and communications installations shall include at least twenty (20) percent spare capacity.

2.7.6 Maintainability

2.7.6.a The system shall be fully maintainable within the hours of operations (see Chapter 2.2.2) without shutting down or reducing any of the commercial services provided during the hours of operations.

2.7.7 Equipment Naming Conventions

2.7.7.a The Contractor shall follow the existing naming conventions for equipment, functions, locations, etc. to the maximum extent possible.

2.7.7.b All labels and tags shall be made of permanent, corrosion free material and installed directly on the equipment, easily readable and attached permanently or at a minimum for the lifetime of the equipment.

2.7.7.c If installing the label/tag on the equipment itself is not possible, the label/tag shall be installed next to the equipment. In this case it has to be made clear which equipment is labeled. Each component shall have at least one label/tag readable from the typical point of access.

2.7.7.d All labels/tag shall be machine written in English. Handwritten labels are not acceptable.

2.7.8 Life Expectancy

2.7.8.a The system shall have a life expectancy of minimum 15 years. The system shall be capable to operate 24 hours a day 365 days a year. It must be guaranteed that the appropriate application of low levels of routine servicing and maintenance will ensure the specified service life for the entire system.

2.7.8.b Contractor shall ensure that mechanical and electrical components and the installed control system will be available and also expandable during the service life of the system.

2.7.8.c The service life of computer equipment such as hard drives, monitors, CPU, graphic cards shall be 10 years except auxiliary equipment as keyboards and mouse, which are exempt from an expected service life beyond normal warranty.

2.7.8.d Contractor shall ensure that the control system, PCs and processors, allow full forward or backwards compatibility for updates on hardware and software over time.

2.7.9 Safety and Security

2.7.9.1 Fire Safety

2.7.9.1.a System and subsystem design shall avoid the use of materials which are flammable or produce excessive or toxic smoke and gases.

2.7.9.1.b Electrical wire insulation shall be of flame-retardant, low smoke, non-toxic construction and shall meet the fire safety requirements of NFPA 130.

2.7.9.1.c Unless otherwise specified, all designs for the replacement CITYFLO 550 ATC System prepared by Contractor, and all material and equipment provided under this contract to upgrade the ATC System shall meet the fire and life safety requirements of NFPA 130 and the applicable local codes, standards and

regulations.

2.7.9.1.d Contractor shall ensure clear access to fire extinguishers, emergency exits and personal safety equipment during all phases of this project.

2.7.9.2 Electrical Safety

2.7.9.2.a All electrical and electronic systems and subsystems shall be enclosed in locked compartments accessible only to authorized personnel. Wiring shall be installed so it is inaccessible to anyone other than authorized personnel.

2.7.9.3 Operations and Maintenance Personnel Safety

2.7.9.3.a The System shall ensure the safety of maintenance and/or operations personnel working on the vehicles, on or near the guideway, in stations, at Central Control, in power substations, in the maintenance and storage facility or in the administration area. Activities necessary for the operation and maintenance of the system shall be convenient, safe, and simple to reduce possible hazards. Protective covers or screens for equipment and personal safety equipment shall be provided to protect maintenance personnel.

2.7.9.3.b Support equipment, handbooks, manuals, and procedures shall be analyzed or evaluated to incorporate provisions to inhibit hazards to personnel and equipment or property that could be generated by the use of the handbook, manual, or procedure in conjunction with related support equipment. This shall apply during systems installation and test, operations and maintenance, and training of AGTS operations and maintenance personnel.

2.7.9.3.c Special consideration to the operation and safety from two Central Control locations shall be given.

2.7.9.3.d The system shall allow shutdown of portions of the system for ordinary or emergency maintenance. Devices, such as disconnect switches and lockouts, shall be provided along the guideway to prevent the accidental activation of those portions of the system that are shut down for maintenance. These devices shall be designed and installed so that only maintenance personnel have access to them. There shall be similar provisions for station maintenance activities which require interface with the guideway.

2.7.9.3.e The Central Control room and Alternate Control room shall be provided with sufficient first aid equipment and means to summon Airport emergency services rapidly.

2.7.9.3.f The Contractor's procedures for emergencies and emergency equipment shall be submitted for review and be compliant with the PMSC.

2.7.9.4 Non-User Safety

2.7.9.4.a The system and all of its elements shall not jeopardize the safety of non-users who are near the system. Non-users shall be protected from system-generated debris, fluid leaks or other system by-products of normal operations, system failures, or the acts of passengers.

2.7.9.4.b The system shall minimize accessibility to the guideway and other hazardous areas

by unauthorized personnel.

2.7.9.4.c Adequate means shall be provided to alert airport emergency services personnel so that people in structures and areas adjacent to the system can be warned and/or protected from fire or other hazardous conditions on the system. Means shall also permit emergency operations for situations arising in or near the system.

2.7.9.5 Departure Test

2.7.9.5.a The new ATS system shall support the exact procedures for the departure test currently in place.

2.7.9.6 System Security

2.7.9.6.a This Section lists technical requirements related to assuring the security of passengers and property.

2.7.9.6.b The system shall minimize the occurrence of personal injury, property damage and loss and service disruptions resulting from acts of crime, vandalism or sabotage. The system shall satisfy the following as a minimum;

1) Prevention - System features to forestall such activity:
    a. Remote visual and auditory surveillance of station facilities.
    b. Barriers to unauthorized intrusion to non-public areas of the system and to non-public areas of the airport from the system.
    c. Protective covers to prevent damage or loss.
    d. Vandal-resistant materials.
2) Detection - System features to permit timely detection of criminal acts:
    a. Passenger activated alarms.
    b. Emergency communications devices in each car and station.
3) Restoration – System features to enable rapid responses to security problems and restoration of normal service:
    a. Ease of access for non-system emergency personnel and vehicles.
    b. Emergency training programs.
    c. Maintenance procedures which minimize repair-in-place time.
    d. Security training programs.

2.7.9.6.c Security shall be provided for all passengers and employees. Security equipment shall provide audio and visual information and be located conspicuously with instructions for use.

2.7.9.6.d Security communications equipment shall be easy for all passengers, including elderly and handicapped, to use. All security installations shall be tamper-resistant, with both wiring and equipment protected and monitored.

2.7.9.6.e Procedures and equipment shall be provided for periodic testing of security subsystems.

2.7.9.7 Surveillance, Alarms and Communications

2.7.9.7.a Communications shall be maintained to ensure rapid and effective coordination between Central Control and airport emergency services staffs. There shall be continuous 24-hour recording of all voice communications, both internal and external to the system. Please refer also to Section 3.8.12.

2.7.9.8 Power Substations

2.7.9.8.a Entrance to enclosures and rooms containing power distribution equipment shall be posted with suitable warning signs that, as a minimum meet applicable codes.

2.7.9.9 Wayside Facilities

2.7.9.9.a Wayside enclosures added under this contract shall be of stainless steel NEMA 4 construction and protected by tamper-resistant covers.

2.7.9.9.b All electrical connections shall be vandal resistant and shall be in vandal resistant enclosures.

2.7.9.9.c Enclosures with safety critical equipment shall have intrusion alarms provided by the Contractor that sound locally and send signals to Central Control.

2.7.9.9.d Contractor shall provide locks or lockable enclosures for all wayside equipment as required for electrical safety and prevention of unauthorized access. New or additional keys shall match the existing key system so that existing keys can be used for new equipment.

2.7.9.10 Power and Communications

2.7.9.10.a Power supply, telephone communications, CCTV and electronic security lines entering Central Control, at each of the stations and power substations, and the guideway shall be protected.

2.8 SYSTEM ENVIRONMENTAL DESIGN REQUIREMENTS

2.8.a The System shall be operated, stored and maintained as specified without impairment resulting from the environmental conditions of the following sections occurring either individually or in natural combinations.

2.8.b System operations and maintenance shall not cause or induce environmental consequences greater than specified in the appropriate following sections.

2.8.1 Temperature and Humidity

2.8.1.a The system shall be designed to operate in all natural combinations of a tunnel temperature range of minus 5°F to plus 110°F and relative humidity conditions from 0% to 100%, including periods of condensation. Any equipment which may be subjected to subfreezing temperatures shall have adequate provisions to:

1) Protect it from damage due to the subfreezing temperatures and/or condensation

2) Assure that normal system operations are not interrupted due to the subfreezing temperatures and/or condensation.

2.8.2 Electromagnetic Compatibility

2.8.2.a The system shall be electromagnetically compatible with its environment. The system shall not produce electromagnetic emissions, whether conducted, radiated, or induced, which in any way interfere with the normal operation of electromagnetic devices or any equipment items used in and around the airport prior to the issuance of the Certificate of Substantial Completion.

2.8.2.b Conversely, all system electrical and electronic equipment shall function satisfactorily in the presence of electromagnetic emissions, whether generated by other components within the System or devices within the surrounding environment. The environment includes, but is not limited to: communications systems, radio base stations, radar systems, computer equipment and accessories, magnetometers, electric motors, controls, power tools, welders, x-ray equipment, baggage handling equipment, power substations and equipment, automotive vehicles, aircraft, and airport equipment.

2.8.2.c At any time prior to the issuance of the Certificate of Final Completion, technical assistance shall be provided to the City by Contractor to resolve any electromagnetic compatibility questions, concerns, etc. and should the system, when installed and operating, either create electromagnetic emissions that adversely affect other equipment or be adversely affected by the surrounding electromagnetic environment, Contractor shall investigate the problem and successfully complete remedial measures that remove the adverse effect(s) without additional cost to the City.

2.8.2.d All transmitting and receiving equipment such as that required for ATC communications shall meet the licensing requirements of FCC Regulations, Part 90, or other applicable parts, and the interference requirements defined in FCC Regulations, Part 15. Permissible field intensity for unlicensed equipment containing oscillators or other continuous wave sources is given in Part 15.

2.8.3 Lightning Protection

2.8.3.a All contractor-provided equipment and facilities shall be protected against lightning incidences encountered in the Denver, Colorado area. Lightning protection shall comply with the requirements of UL96A, "Lightning Protection", where applicable.

2.8.4 Site Specific Environmental Conditions

2.8.4.a This project is located in the City and County of Denver annexed land of Adams County, Colorado. The project site is located approximately 18 miles northeast of Denver, Colorado center.

2.8.4.b The site has the following environmental conditions

Elevation	5300' +/-100
Frost depth	-36"
Thunderstorms	60 days/year mean
Lightning Risk Assessment	Severe
Relative humidity	50-67%
Seismicity	Zone 1, per USC
Snow Accumulation	15.26" average total
Temperature	-23°F to 101°F, 49.9°p' mean

Wind	90.0 mph max, 8.8 mph average

Table 2-6: Site Specific Environmental Conditions

2.9 VERIFICATION AND ACCEPTANCE AND THE WORKS

2.9.1 Definition of Failure

2.9.1.a Verification and Acceptance shall be performed in accordance with ASCE 21 and ASCE 21.4-08 – Part 4. Failures shall be defined by the classification scheme of ASCE 21 and Section 2.9.1.5.

Frequency	Hazard Category			
	I Catastrophic	II Critical	III Marginal	IV Negligible
A-Frequent	IA	IIA	IIIA	IVA
B-Probable	IB	IIB	IIIB	IVB
C-Occasional	IC	IIC	IIIC	IVC
D-Remote	ID	IID	IIID	IVD
E-Improbable	IE	IIE	IIIE	IVE

	Not acceptable
	Undesirable, requires written approval of the Project Manager
	Acceptable only with written notification to the Project Manager
	Acceptable

Table 2-7: Risk Assessment (ASCE 21)

A-Frequent:	MTBHE (Mean Time Between Hazardous Events) is less than 1,000 operating hours
B-Probable:	MTBHE is equal to or greater than 1,000 operating hours and less than 100,000 operating hours
C-Occasional:	MTBHE is equal to or greater than 100,000 operating hours and less than 1,000,000 operating hours
D-Remote:	MTBHE is equal to or greater than 1,000,000 operating hours and less than 100,000,000 operating hours
E-Improbable:	MTBHE is equal to or greater than 100,000,000 operating hours
I-Catastrophic:	Death, system loss or severe environmental damage
II-Critical:	Severe injury, severe occupational illness, major system or environmental damage
III-Marginal:	Minor injury, minor occupational illness or minor system or environmental damage
IV-Negligible:	Less than minor injury, occupational illness or less than minor system or environmental damage

Table 2-8: Classification of Frequency and Hazard Categories

2.9.1.b Relevant failures shall be any failure of a part or component, or performance that causes the equipment item characteristics to deviate beyond the normal ranges of the equipment specifications.

2.9.1.c Non-relevant failures shall be any failure caused by a condition external to the equipment.

2.9.1.d The Failure Analysis and Report shall address the detailed diagnosis of each failure and shall identify corrective actions, failed components and failure mode. All failure analyses shall address the subjects of independent, dependent, intermittent multiple or pattern failures.

2.9.1.1 Dependent Failure

2.9.1.1.a A failure caused by the failure of an associated item (dependent failures are not

necessarily present when simultaneous failures occur).

2.9.1.2 Independent Failure

2.9.1.2.a A failure that occurs without being caused by the failure of other parts of the equipment under test, test equipment, instrumentation, or the facility.

2.9.1.3 Intermittent Failure

2.9.1.3.a The momentary cessation of equipment operation.

2.9.1.4 Multiple Failures

2.9.1.4.a The simultaneous occurrence of two or more independent failures (when two or more failed parts are found during trouble shooting which cannot be shown to be interdependent, multiple failures are presumed to have occurred).

2.9.1.4.b Pattern failures: The occurrence of two or more failures of the same part in identical or equivalent application, which are caused by the same basic failure mechanism

2.9.1.5 Definition of Failures Resetting the Verification Operational Reliability Period

2.9.1.5.a In addition to all failures defined in Section 2.9.1, the following list of failures shall reset the Verification of Operational Reliability period. Any of these failures will result in a re-start of the 60 day period until the system has demonstrated to operate 60 consecutive days without any of the defined failures.

1) Component failures of the same type.
    a. More than two (2) failures of the same component on an individual assembly.
    b. More than five (5) failures of the same component across any assemblies.
2) Consistent performance below required minimums.
3) Unsafe conditions and/or unsafe operation.
4) High level control failures.
    a. Two (2) or more partial network outages.
    b. Two (2) or more software failures and/or loss of software across all equipment.
    c. Two (2) or more events where applications loose connectivity with another application across all equipment.
    d. More than two (2) system failure where a redundant piece of equipment is required to take over across all equipment.

2.9.2 Contract Compliance

2.9.2.a Contract compliance shall be accomplished through a combination of Design Reviews, analysis, qualification tests, acceptance testing, inspections, demonstration and demonstration of previous experience.

2.9.2.b Contract compliance will include the functional, performance and operational verification of all requirements of this specification, design criteria, and applicable regulations and codes.

2.9.3 Safety Certification

2.9.3.a Contractor shall certify the safety of the system as provided by Contractor and its subcontractors before the system is placed into commercial operation. This Certification shall include the system as a whole including interfaces to other systems and certify that, it meets all safety-related requirements of this contract, is consistent with Contractors system safety plan, and that the system meets or exceeds all applicable national, regional, local and airport specific laws, regulations, codes and other standards.

2.9.4 System Hazard Analysis

2.9.4.a A Preliminary Hazard Analysis (PHA) shall be employed to assist in the evaluation of potential hazards and to document their resolution in accordance with ASCE 21-05 3.1.2.1 including Annex A.2, A.3, A.4 and A.5.

2.9.4.b The analysis shall include information from previous similar projects including resulting improvements in design and procedures. If a system or sub-system is identified as unsafe it shall be eliminated.

2.9.5 Design Review

2.9.5.a The Design Review process is divided in two sub-phases. Each phase is building on the previous phase and is expected that City's comments from the previous phase are reflected in the following submittals. Refer to PMSC for details on the Design Review process.

2.9.5.b Upon request, Design Reviews can be conducted at Contractor's facilities in Pittsburgh.

2.9.5.c As part of the Design Review, the following phases shall be required:

1) Preliminary Design Review (30% Design Sub-Phase)
   Contains drawings and description of operation at a 30% design level including preliminary plans for all disciplines (e.g. demolition, phasing and construction) as required to verify the compliance of the design solution. In addition, draft versions of operation and maintenance handbooks, training manuals and a preliminary acceptance test plan shall be submitted.

2) Final Design Review (100% Design Sub-Phase)
   Contains final drawings and description of operation at a 100% design level including preliminary plans for all disciplines (e.g. demolition, phasing and construction) as required to verify the compliance of the design solution. In addition, final versions of operation and maintenance handbooks, training manuals, certificates and the acceptance test plan shall be submitted.

2.9.6 Acceptance Testing

2.9.6.a Contractor shall be responsible for developing a complete acceptance test plan for approval by the Project Manager. The test plan shall include as a minimum the testing schedule and test descriptions for factory and on-site tests. The Project Manager has the right to witness tests on his own discretion and without prior notice or approval.

2.9.6.b When Contractor is ready for acceptance testing, it shall request the acceptance testing according to the approved acceptance plan. The tests will be performed by Contractor and witnessed by the Project Manager. Costs associated with the acceptance testing shall be included in the lump sum proposal.

2.9.6.c As a minimum, the acceptance test shall include:

1) All required safety tests ensuring that the system operates in safe condition at all times
2) Test of all modes with various number of trains
3) Test of train control functionalities
4) Switch-over functionality of redundant systems
5) Switch-over from Central Control to Alternate Control
6) Function of PDS as required
7) Central Control equipment and functions
8) Spare parts list and inventory checks

2.9.6.d Unsuccessful or failed tests shall not result in additional costs for the City.

2.9.7 Certificate of Substantial Completion

2.9.7.a Upon successful completion of Design Reviews and acceptance testing, Contractor shall receive the Certificate of Substantial Completion. This certificate allows the system to enter commercial passenger service.

2.9.7.b The Certificate of Substantial Completion will be granted, when the following criteria are satisfactory met:

1) It has been demonstrated that the scope of Work of this specification has been completed and successfully met the requirements.
2) Maintenance handbooks, training manuals and all required certificates have been submitted and accepted.
3) As-build drawings have been submitted and accepted.
4) Safety Certificate (Section 2.9.3).

2.9.7.c With the City's permission, items not completed can be moved to a "punch list" for final Completion.

2.9.8 Verification of Operational Reliability

2.9.8.a After receiving the Certificate of Substantial Completion, the AGTS shall be operated for a period of 60 consecutive days in pinched loop mode as identified in Section 2.2.2 to demonstrate that the ATC replacement equipment does not fail.

2.9.8.b During this period, the system shall be operated in its final configuration and within Airport Operation's existing practice for full passenger service, modified maintenance and operations handbooks and in strict accordance with all other safety and security policies. If, during this period the ATC system fails, Contractor shall correct those items. Any failure defined as an unacceptable failure in Section 2.9.1.5 will reset the 60 day period.

2.9.8.c Any modifications made during this period shall be reflected in the system handbooks and procedures. Under no circumstances shall the as-build system deviate from the written documentation of the system. The revised operating and maintenance procedures and manuals shall be submitted to the Project Manager as a condition for Final Acceptance.

2.9.9 Final Completion

2.9.9.a Upon receiving the Certificate of Substantial Completion and successful verification of operational reliability, Final Completion will be granted when

1) All open items from the "punch list" have to be closed.
2) Successful verification of operational reliability has been achieved
3) Revised documentation as required in Section 2.9.8 has been submitted and approved
4) Spare parts are supplied and in storage as required
5) All temporary and legacy system components have been removed from the side
6) A final cleaning of all areas where Work was performed has been performed

2.10 MAINTENANCE

2.10.a The Work covered by this contract will interface with and be supported by the existing Maintenance Management Information System in operation at the time of turnover to the Airport and will be compatible with the proposed new system as defined in the AGTS O&M contract CE 1A001

2.10.b Contractor shall provide all tools and equipment required for pre-operations check-out, servicing, inspections, troubleshooting and repairs as required for the local maintenance and operations team for the upgraded system.

2.10.c Maintenance handbooks shall be updated reflecting new equipment, maintenance procedures, maintenance intervals and all other relevant documentation to ensure that the system is receiving the required maintenance.

2.11 SPARE PARTS

2.11.a Contractor shall plan, procure and provide all spare parts, equipment and consumables required to maintain and operate the upgraded system at least at existing levels.

2.11.b Contractor shall submit a revised list of spare parts for the entire system as part of the system Design Review including part name, supplier name and address, part numbers, required stock level, component cost and lead times.

2.11.c All existing documentation, maintenance manuals and plans shall be updated accordingly.

2.11.d Stock levels have to meet the identified levels at the time of Certificate of Substantial Completion (CSC). Any items removed before CSC have to be re-supplied at no costs to the City at the time of issuance of CSC.

2.11.e Contractor shall ensure that all identified spare parts or substitutions in equal or better quality are available for the expected life time of this product at fair and reasonable cost.

2.12 TRAINING

2.12.a Contractor shall be responsible for all training required on the upgraded system to at least maintain operations and reliability levels of the current system.

2.12.b Contractor shall provide a training program and schedule for training all local operators on the upgraded system as defined in ANSI/ASCE/T&DI 21.4-08-Part 4, section 15.8.

2.12.c Existing training manuals and plans shall be updated to meet the new training requirements and shall include new interfaces at Central Control/Alternate Control.

2.13 WARRANTIES

2.13.1 General

2.13.1.a The Contractor warrants that all parts, materials, components, equipment, systems and other items incorporated into the Work shall be new, unless otherwise specified, and suitable for the purpose used, and will be of good quality, free from faults and defects and in conformance with the Contract Documents.

2.13.1.b The Contractor also warrants that its workers will be sufficiently skilled to produce quality Work which is free of faults and defects.

2.13.1.c Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective.

2.13.1.d The Contractor, when requested, shall furnish the City with satisfactory evidence of the kind and quality of materials and equipment proposed to be incorporated into the Work.

2.13.1.e The Contractor further warrants that the construction processes and methods employed to perform the Work shall have in the past proven to be suitable for the results expected. If the Contractor proposes to use unproved or untried processes, products or methods, the City must be advised of that proposal, in writing, prior to

using the proposed process. The City may permit such experimentation, and it may require special guarantees of the Contractor to cover the Work produced by any new and untried process, method or product.

2.13.1.f The Contractor further warrants that it has full title to all parts, materials, components, equipment and other items conveyed to the City under the terms of the Contract, that its transfer of such title to the City is rightful and that all such parts, materials, components, equipment and other items shall be transferred free and clear from all security interests, liens, claims, or encumbrances whatsoever. The Contractor agrees to warrant and defend such title against all persons claiming the whole or any part thereof, at no cost to the City.

2.13.1.g The Contractor shall promptly investigate, repair, replace or otherwise correct any of its workmanship and any parts, materials, components, equipment or other items in thework which contain faults or defects whether such failures are observed by the City or Contractor at any time during the Contract Time or during the warranty and guarantee period.

2.13.1.h The Contractor shall bear all costs of investigating and correcting, which includes the design efforts necessary to correct such Work covered by the warranties and guarantees described in this Section or elsewhere in the Contract Documents. If repair or replacement of faulty items of the Work is necessary, proper temporary substitutes shall be provided by the Contractor in order to maintain the progress of the Work and/or keep systems operating without any additional costs to the City.

2.13.2 Design Warranty

2.13.2.a Contractor agrees to repair or replace components of the system to correct the failures listed below for a period of five (5) years, starting on the date of Final Completion.

1) Component failures of the same type.
    a. More than two (2) failures of the same component on an individual assembly within a six (6) month period of use.
    b. More than five (5) failures of the same component across any assemblies within a six (6) month period of use.
2) Consistent performance below required minimums, .Reference Contract CE1A001Bombareier Transportation / CCD Operations and Maintenance contract

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3) Unsafe conditions and/or unsafe operation.
4) High level control failures.
    a. Two (2) or more partial network outages within a six (6) month period of use.
    b. Two (2) or more software failures and/or loss of software within a six (6) month period of use across all equipment.

c. Two (2) or more events where applications loose connectivity with another application within a three (3) month period of use across all equipment.

d. More than two (2) system failure where a redundant piece of equipment is required to take over within a thirty (30) day period across all equipment.

3 PART 2 – PRODUCTS AND COMPONENTS REQUIREMENTS

3.1 GENERAL

3.1.a Contractor shall perform all of the project management, quality assurance, design, analysis, documentation, manufacture, supply, fabrication, shipping, expediting, storing of materials, installation, erection, training, testing and demonstration required to deliver an operable, safe and reliable Operating System in conformance with all the requirements of this Contract and the Contractor Proposal.

3.1.b Contractor shall be solely responsible for delivering all aspects of the Work, and integrating the existing and replacement CITYFLO 550 ATC system components and Central Control Facilities into a fully functional system, meeting all of the requirements of the Contract.

3.1.c Contractor shall provide all equipment required to maintain at a minimum the existing functionality of the Central Control facility. Please refer also to Section Audio and Visual Communications 3.8.6.

3.2 ALTERNATE CONTROL FACILITY

3.2.a Before upgrading the existing Central Control Facility in the AOB, Contractor will install a new Alternate Control Center in the existing conference area of the AGTS maintenance facility.

3.2.b Once the Alternate Control Center and CITYFLO 550 ATC is operational, the existing Central Control Facility in the AOB shall be modified to the exact same specifications and functionality as the Alternate Control Center in the maintenance facility.

3.2.1 General

3.2.1.a The console shall consist of three (3) ATC workstations, each containing a personal computer. The workstations will be ergonomically designed for detailed work and enabling the CCO with the ability to view any monitor within the Central Control facility.

3.2.1.b Along with the new ATC equipment installed within the console there will be communications equipment consisting of Public Address (PA) and ORS. ORS and PA shall be IP based communications with the servers being located in the Terminal switch room.

3.2.1.c An Ethernet interface will be provided for the SIMS (Site Information Management System)/MAXIMO Computer at each Central Control Console location.

3.2.2 Layout

3.2.2.a If possible, the Alternate Control Facility shall be built on a raised floor to allow all cabling to be accessible by removing individual floor segments.

3.2.2.b The layout shall provide space for two operators able to control the system independently from each other.

3.2.2.c The layout should allow that the system can be operated from a single operator without leaving the work position. All functions required to operate the system shall be accessible from the work position. Control interfaces which are shared between the operators shall be located between the work positions, so that they are in ergonomic reach for either of them.

3.2.3 Console

3.2.3.a The console shall consist of three (3) ATC workstations, each containing a personal computer. The workstations shall be ergonomically designed for detailed work and enabling the CCO with the ability to view any monitor within the Central Control facility.

3.2.3.b As a minimum, two (2) 21” color LCD monitors shall be provided for operator interfaces.

3.2.3.c Workstations shall conform to the City’s hardware. The preferred architecture for all workstations in common control centers is based on Dell Precision R5400 Rack workstations and Dell FX100 Zero Clients utilizing PC-Over-IP technology. In the event that the Dell R5400 workstations are deemed unsuitable for the AGTS client application, Contractor may elect to use another workstation model as long as it is equipped with a PC-over-IP host card that will allow the video services, USB services and two-way audio to be extended to a remote desktop appliance over an Ethernet connection.

3.2.3.d Denver International Airport is also implementing an enterprise wide display technology by Activu Inc. that will permit any image, any window(s) from any workstation to be displayed anywhere at any size in the system. This system will require that an Activu Inc. display system client be installed on any AGTS client machine that will be contributing display content to the system. The Activu Inc. client software and license will be provided and maintained by others. The Contractor shall verify that the implementation of the Activu Inc. software is compatible with their workstations and software.

3.2.3.e Contractor shall verify if this preferred hardware is suitable for the ATC workstations. If other hardware has to be used, Contractor shall notify the Project Manager at the 30% Design Review Submittal.

3.2.4 System Response Times

3.2.4.a Computers and systems shall be sized in such a way that response times of operator inputs typical for the supervision and control of the system are started and shown on the graphics without delay. No delay times due to Operating time overheads are acceptable. For less frequently used operations such as report functions, queries, etc., response times shall be within five (5) seconds.

3.2.5 Virus Protection

3.2.5.a All computers systems shall be protected from virus infections using industry standard anti-virus software. Local USB drives shall be made in-accessible for general use.

3.2.5.b Anti-Virus software shall be updated as required to keep the subscriptions up to date.

3.2.6 Guideway System Displays (GSD)

3.2.6.a The new Alternate Control Center shall consist of three (3) wall-mounted Guideway System Displays (GSD) which will enable the Central Control Operator to view the entire AGTS Graphic system as well as all other functions within the entire system.

3.2.7 Video Surveillance

3.2.7.a Please refer to Section 3.8.12.

3.2.8 Telephones

3.2.8.a Please refer to Section 3.8.9.

3.2.9 Power Outlets

3.2.9.a Power outlets shall be provided as required.

3.2.9.b Power outlets fed by UPS shall be marked with “UPS - NOT FOR PERSONAL USE” and have a red faceplate.

3.2.10 Uninterruptible Power Supply

3.2.10.a All equipment shall be connected to UPS (supplied by others), capable of maintaining operation for 1h after loss of primary power.

3.2.11 Printers and Plotters

3.2.11.a The printer and plotter installed in the control room shall be accessible from any workstation. The final positioning shall be coordinated with the City.

3.2.12 Ergonomics

3.2.12.a All equipment provided for the Alternate Control Facility shall be designed to meet national and local ergonomic guidelines. This includes, but is not limited to lighting, use of colors, glare, air quality, thermal conditions and noise.

3.2.13 Furniture

3.2.13.a Contractor shall provide all furniture including desks, chairs, shelves, desk lamps, mounting devices for monitors and all other equipment required to make the Alternate Control Facility functional.

3.2.13.b Ergonomic furniture should be designed to facilitate task performance, minimize fatigue and injury by fitting equipment to the body size, strength and range of motion of the user.

3.2.13.c Office furnishings shall have adjustable components that enable the user to modify the workstation to accommodate different physical dimensions.

3.2.13.d The provided equipment shall be task specific and prevent a static or awkward posture, repetitive motion, poor access or inadequate clearance and excessive reach, displays that are difficult to read and understand, and controls that are confusing to operate or require too much force.

3.2.13.1 Chairs

3.2.13.1.1 Seat Height

3.2.13.1.1.a Seat height should be pneumatically adjusted while seated. Adjustment range shall be between 16 - 20.5 inches off the floor. Thighs should be horizontal, lower legs vertical, feet flat on the floor or on a footrest. Seat height shall allow a 90 degree angle at the elbows for typing.

3.2.13.1.2 Seat Width and Depth

3.2.13.1.2.a Seats width shall be between 17-20 inches and shall be deep enough to permit the back to contact the lumbar backrest without cutting into the backs of knees. The front edge shall be rounded and padded. The seat slant shall be adjustable (0 to 10 degrees). Avoid bucket-type seats. The seat shall swivel easily.

3.2.13.1.3 Backrest

3.2.13.1.3.a The backrest shall offer firm support, especially in the lumbar (lower back) region, shall be 12-19 inches wide, and should be easily adjustable both in angle and height, while sitting. The optimum angle between seat and back shall permit a working posture of at least 90 degrees between the spine and thighs. Seat pan angle and backrest height and angle shall be coordinated to allow for the most comfortable weight load on the spinal column.

3.2.13.1.4 Seat Material

3.2.13.1.4.a A chair seat and back shall be padded enough to allow comfortable circulation. The seat fabric shall be made of "breathable" material to allow air circulation through clothes to the skin.

3.2.13.1.5 Armrests

3.2.13.1.5.a Armrests shall not restrict movement or impede the worker's ability to get close enough to the work surface.

3.2.13.2 Workstation Design

3.2.13.2.1 Height Adjustment

3.2.13.2.1.a The workstation environment shall be easily adjustable by the user in height to allow for a 90-100 degree elbow angle and straight wrists while keying. The height of an adjustable keyboard support should adjust between 23" and 28". 26" is a recommended compromise position while leg clearance must still be considered.

3.2.13.2.2 Leg room

3.2.13.2.2.a Knee spaces shall allow for a free working environment and allow for changes of position even with the keyboard support lowered to the correct level for use. The knee space shall be at least 30" wide by 19" deep by 27" high to comply with the requirements of the Americans with Disabilities Act. When using a footrest, clearance must be calculated with the legs in place on the footrest. Depth of the leg clearance for both legs and toes shall be evaluated while the workstation user is in a normal working position at the work station and determined by the design of the seating system and the way the user sits. Drawers and support legs (for furniture) should not go where human legs need

to fit.

3.2.13.2.3 Size

3.2.13.2.3.a The work station top should be big enough to allow space for all computer-related necessary equipment, paperwork, books, and other materials needed while working at the workstation. Frequently used items and controls should be kept close to avoid long reaches.

3.2.13.2.3.b The workstation thickness of work surface shall be one inch.

3.2.13.2.4 Cable Management

3.2.13.2.4.a Usable space of the workstation shall be maximized by using wire/cable management. All cables/wires not used for daily operation shall be installed inside a cable tray, away from the working environment.

3.2.13.2.5 Document Holder

3.2.13.2.5.a Provide a document holder or a nearby shelf instead of resting documentation and other paper copies on the table top.

3.3 CENTRAL CONTROL FACILITY UPGRADE

3.3.a New ORS cabinets and consoles shall be provided in the Central Control facility.

3.3.b The existing ORS cabinet in the AOB Central Control shall be replaced so that the CITYFLO 550 will interface with the Fiber Optic DTS.

3.3.c Before upgrading the existing Central Control Facility in the AOB, Contractor will install a new Alternate Control Center in the existing conference area of the AGTS maintenance facility.

3.3.1 General

3.3.1.a The console shall consist of three (3) ATC workstations, each containing a personal computer. The workstations will be ergonomically designed for detailed work and enabling the CCO with the ability to view any monitor within the Central Control facility.

3.3.1.b Along with the new ATC equipment installed within the console, there will be communications equipment consisting of Public Address (PA) and ORS. ORS and PA shall be IP based communications with the servers being located in the Terminal switch room.

3.3.1.c An Ethernet interface will be provided for the SIMS (Site Information Management System)/MAXIMO Computer at each Central Control Console location.

3.3.2 Layout

3.3.2.a If possible, the Central Control Facility shall be built on a raised floor to allow all cabling to be accessible by removing floor segments.

3.3.2.b The layout shall provide space for two operators able to control the system independently from each other.

3.3.2.c The layout should allow that the system can be operated from a single operator without leaving the work position. All functions required to operate the system shall be

accessible from the work position. Control interfaces which are shared between the operators shall be located between the work positions, so that they are in ergonomic reach for either of them.

3.3.3 Console

3.3.3.a The console shall consist of three (3) ATC workstations, each containing a personal computer. The workstations will be ergonomically designed for detailed work and enabling the CCO with the ability to view any monitor within the Central Control facility.

3.3.3.b As a minimum, two (2) 21” color LCD monitors shall be provided for operator interfaces.

3.3.3.c Workstations shall conform to the City’s hardware. The preferred architecture for all workstations in common control centers is based on Dell Precision R5400 Rack Workstations and Dell FX100 Zero Clients utilizing PC-Over-IP technology. In the event that the Dell R5400 workstations are deemed unsuitable for the AGTS client application, Contractor may elect to use another workstation model as long as it is equipped with a PC-over-IP host card that will allow the video services, USB services and two-way audio to be extended to a remote desktop appliance over an Ethernet connection.

3.3.3.d Denver International Airport is also implementing an enterprise wide display technology by Activu that will permit any image, any window(s) from any workstation to be displayed anywhere at any size in the system. This system will require that an Activu display system client be installed on any AGTS client machine that will be contributing display content to the system.

3.3.3.e Contractor shall verify if this preferred hardware is suitable for the ATC workstations. If other hardware has to be used, Contractor shall notify the Project Manager at the 30% Design Review Submittal.

3.3.4 System Response Times

3.3.4.a Computers and systems shall be sized in such a way that response times of operator inputs typical for the supervision and control of the system are instantaneous. Less frequently used operations such as report functions, queries, etc., response times shall be within five (5) seconds.

3.3.5 Virus Protection

3.3.5.a All computers systems shall be protected from virus infections using industry standard anti-virus software. Local USB drives shall be made in-accessible for general use.

3.3.5.b Anti-Virus software shall be updated as required to keep the subscriptions up to date.

3.3.6 Guideway System Displays (GSD)

3.3.6.a The new Central Control Center shall consist of three (3) wall-mounted Guideway System Displays (GSD) which will enable the Central Control Operator to view the entire AGTS Graphic system as well as all other functions within the entire system.

3.3.7 Video Surveillance

3.3.7.a Please refer to Section 3.8.12.

3.3.8 Telephones

3.3.8.a Please refer to Section 3.8.9.

3.3.9 Power Outlets

3.3.9.a Power outlets shall be provided as required.

3.3.9.b Power outlets fed by UPS shall be marked with “NOT FOR PERSONAL USE” and have a red faceplate.

3.3.10 Uninterruptible Power Supply

3.3.10.a All equipment shall be connected to UPS (supplied by others), capable of maintain operation for 1h after loss of primary power.

3.3.11 Printers and Plotters

3.3.11.a The printer and plotter installed in the control room shall be accessible from any workstation. The final positioning shall be coordinated with the City.

3.3.12 Ergonomics

3.3.12.a All equipment provided for the Central Control Facility shall be designed to meet national and local ergonomic guidelines. This includes, but is not limited to lighting, use of colors, glare, air quality, thermal conditions and noise.

3.3.13 Furniture

3.3.13.a Contractor shall provide all furniture including desks, chairs, shelves, desk lamps, mounting devices for monitors and all other equipment required to make the Central Control Facility functional.

3.3.13.b Ergonomic furniture should be designed to facilitate task performance, minimize fatigue and injury by fitting equipment to the body size, strength and range of motion of the user.

3.3.13.c Office furnishings shall have adjustable components that enable the user to modify the workstation to accommodate different physical dimensions.

3.3.13.d The provided equipment shall be task specific and prevent a static or awkward posture, repetitive motion, poor access or inadequate clearance and excessive reach, displays that are difficult to read and understand, and controls that are confusing to operate or require too much force.

3.3.13.1 Chairs

3.3.13.1.1 Seat Height

3.3.13.1.1.a Seat height should be pneumatically adjusted while seated. Adjustment range shall be between 16 - 20.5 inches off the floor. Thighs should be horizontal, lower legs vertical, feet flat on the floor or on a footrest. Seat height shall allow a 90 degree angle at the elbows for typing.

3.3.13.1.2 Seat Width and Depth

3.3.13.1.2.a Seats width shall be between 17-20 inches and shall be deep enough to permit the back to contact the lumbar backrest without cutting into the backs of knees. The front edge shall be rounded and padded. The seat slant shall be adjustable (0 to 10 degrees). Avoid bucket-type seats. The seat shall swivel easily.

3.3.13.1.3 Backrest

3.3.13.1.3.a The backrest shall offer firm support, especially in the lumbar (lower back) region, shall be 12-19 inches wide, and should be easily adjustable both in angle and height, while sitting. The optimum angle between seat and back shall permit a working posture of at least 90 degrees between the spine and thighs. Seat pan angle and backrest height and angle shall be coordinated to allow for the most comfortable weight load on the spinal column.

3.3.13.1.4 Seat Material

3.3.13.1.4.a A chair seat and back shall be padded enough to allow comfortable circulation. The seat fabric shall be made of "breathable" material to allow air circulation through clothes to the skin.

3.3.13.1.5 Armrests

3.3.13.1.5.a Armrests shall not restrict movement or impede the worker's ability to get close enough to the work surface.

3.3.13.2 Workstation Design

3.3.13.2.1 Height Adjustment

3.3.13.2.1.a The workstation environment shall be easily adjustable by the user in height to allow for a 90-100 degree elbow angle and straight wrists while keying. The height of an adjustable keyboard support should adjust between 23" and 28". 26" is a recommended compromise position while leg clearance must still be considered.

3.3.13.2.2 Leg room

3.3.13.2.2.a Knee spaces shall allow for a free working environment and allow for changes of position even with the keyboard support lowered to the correct level for use. The knee space shall be at least 30" wide by 19" deep by 27" high to comply with the requirements of the Americans with Disabilities Act. When using a footrest, clearance must be calculated with the legs in place on the footrest. Depth of the leg clearance for both legs and toes shall be evaluated while the workstation user is in a normal working position at the work station and determined by the design of the seating system and the way the user sits. Drawers and support legs (for furniture) should not go where human legs need to fit.

3.3.13.2.3 Size

3.3.13.2.3.a The work station top should be big enough to allow space for all computer-related necessary equipment, paperwork, books, and other materials needed while working at the workstation. Frequently used items and controls should be kept close to avoid long reaches.

3.3.13.2.3.b The workstation thickness of work surface shall be one inch.

3.3.13.2.4 Cable Management

3.3.13.2.4.a Usable space of the workstation shall be maximized by using wire/cable management. All cables/wires not used for daily operation shall be installed inside a cable tray, away from the working environment.

3.3.13.2.5 Document Holder

3.3.13.2.5.a Provide a document holder or a nearby shelf instead of resting documentation and other paper copies on the table top.

3.4 SWITCHING BETWEEN CONTROL FACILITIES

3.4.a It shall be possible to control the entire system from the Central Control or Alternate Control facility at any given time without the need that both Control Facilities are working. There shall be a full redundancy between the two facilities, so that during a complete loss of one of the two facilities, the system is fully operational and controllable without the loss of any functionality, performance or information even if the faulty Control Facility was in control at the moment of the fault.

3.4.b Switching between the two facilities shall be seamless, so that there is no interruption of service or downtime of commercial train operation during the switching process.

3.4.c It has to be ensured that at no time an unsafe condition arises due to manual or automatic conflicting commands from the two control facilities.

3.4.d If by design only one of the two Control facilities is able to operate at any given time, Contractor shall provide a secure switching mechanism which prevents the system from unwanted or unauthorized switching between the facilities.

3.4.e The switching functionality shall be part of the Design Review process.

3.5 ATS CENTRAL CONTROL ARCHITECTURE

3.5.a The Automatic Train Supervision (ATS) Central Control architecture shall consist of a STRATUS (redundant) server to operate the Central Train Control software and all of its interfaces as well as manage the SQL server database on RAID disks. Central Control shall continue to operate on its own redundant network thus, interfacing with other subsystems through network switches.

3.5.b The Alternate Control Center shall only have the ability to monitor AGTS operations unless circumstances dictate a need to physically transfer the main AGTS Central control from the 10th floor, (AOB) Central Control Facility to the Alternate Control Center. In this case it shall be possible to operate all the ATS functions from the Alternate Control Center similar to the Central Control Facility.

3.5.c The following describes the minimum hardware associated with this architecture (see also Section 3.8.6):

1) Train Control / Data Base server – redundant server to provide supervisory train control and log alarm/event data for reporting.

2) Two (2) Central Control Operator (CCO) workstations – Central Control Operator workstations to monitor system operations and to perform operator overrides to automatic operations.

3) Color Laser Printer – To print reports initiated by the CCO.

4) Overhead Monitors - Large monitors to be viewable from any location within the Central Control facility. Ability to display various graphics as requested by the operator. Monitor size to be coordinated with the Project Manager.

5) Diagnostic PC – Located in central cabinet to support software diagnostics from the equipment room.

6) Maintenance PC – workstation having the ability to monitor the system remotely from an office area.

7) Test Track Operator – Provide an operator to manage only test track operations separate from Central Control.

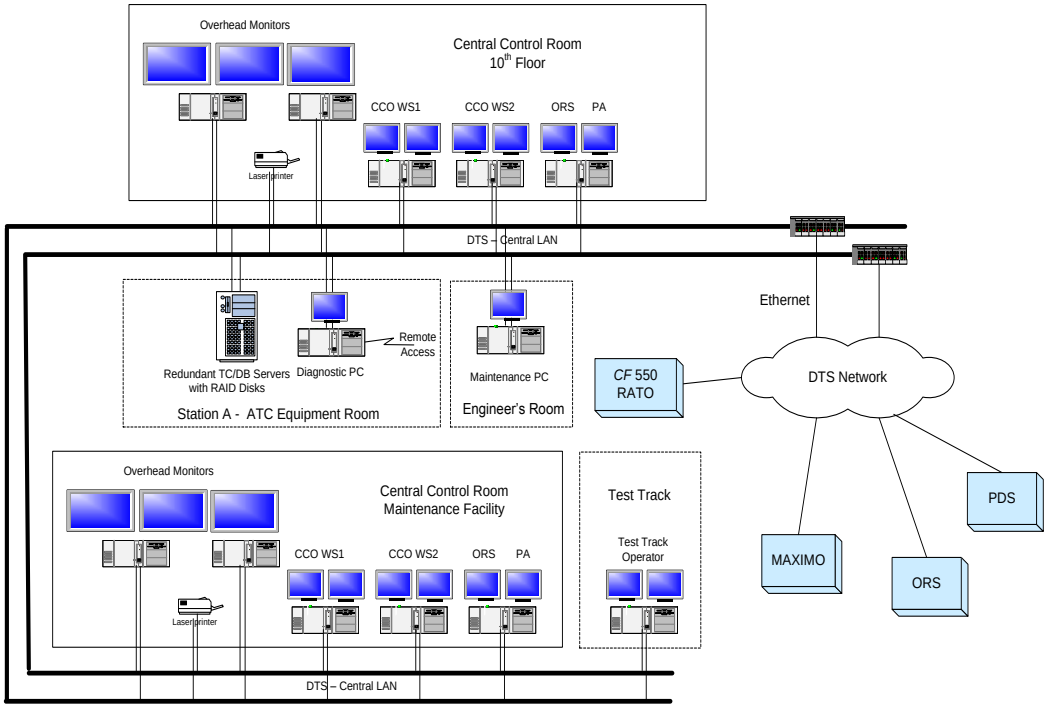


Figure 3-1: AGTS Central Control Architecture

3.6 CITYFLO 550

3.6.1 System Architecture

3.6.1.a The CITYFLO 550 architecture shall replace the current Vital Relay ATC system, the legacy ATO and the Central Control system.

3.6.1.b The CITYFLO 550 system shall be comprised of CITYFLO 550 Computer Based Interface (CBI) subsystem, Delphi ATOs and Central Control. As illustrated in Figure 3-2, the existing field termination and Tx/Rx cabinets shall be utilized for this project.

3.6.1.c

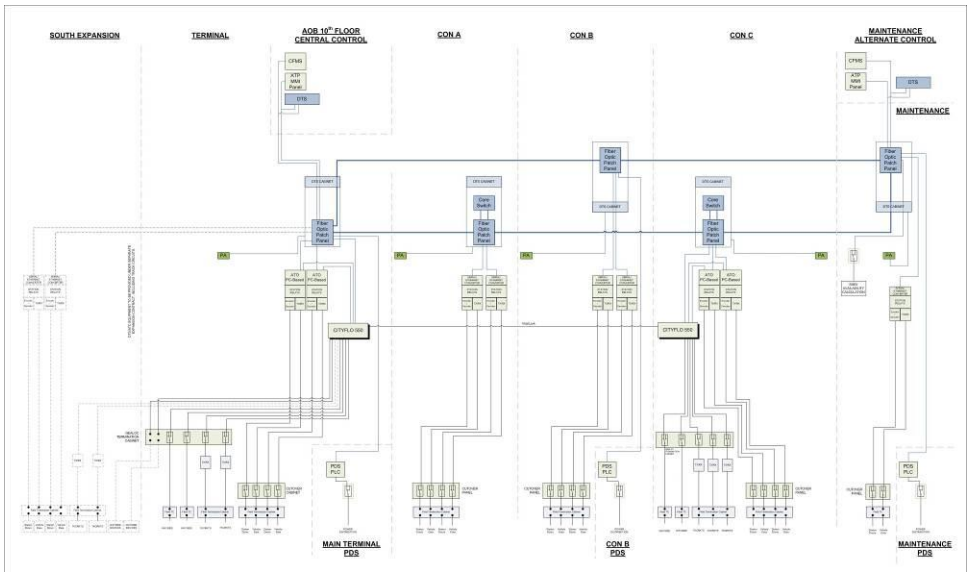


Figure 3-2: ATC CITYFLO 550 System Configuration

3.6.2 Location of Installed Equipment

3.6.2.a The new equipment shall be installed in existing equipment rooms in each concourse A, B, C, and the main terminal. Each room shall receive a cutover cabinet and a redundant pair of ATC cabinets. The final equipment configuration will be determined during the scheduled Design Reviews and shall be developed and submitted to Project Manager within 5 business days of completion of the Final Design Review.

3.6.2.1 Main Terminal

1) ORS Cabinet
2) Two (2) ATO Cabinet (with ATC computer)
3) Two (2) cutover cabinets
4) Replacement CITYFLO 550 PDS PLC

3.6.2.2 Concourse A

1) Central Control cabinets (wired to OM&SF and AOB central controls through DTS network)
2) Remote ATO cabinet (without ATC computer) (qty 2)
3) Replacement CITYFLO 550 PDS PLC
4) Two (2) cutover cabinets
5) MCIC cabinet
6) PA Central Control assembly
7) ORS console

3.6.2.3 Concourse B

1) Two (2) remote ATO cabinets (without ATC computer)

2) Replacement CITYFLO 550 PDS PLC

3) Two (2) Cutover cabinets

3.6.2.4 Concourse C

1) Two (2) ATO cabinets (with computer)

2) Two (2) Cutover cabinets

3) Replacement CITYFLO 550 PDS PLC

3.6.2.5 Maintenance Facility

1) New Central Control consoles, including complete finish-out.

2) Two (2) remote ATO cabinets

3) Workstation for test track

4) Workstation in Engineering Room

5) Replacement CITYFLO 550 PDS PLC

3.6.2.6 Airport Office Building (AOB)

1) New ORS cabinet equipment (fiber interface)

3.7 POWER DISTRIBUTION SYSTEM AND BACK-UP POWER SUPPLIES

3.7.a Contractor provided equipment shall be powered from the same source as the existing ATC equipment. Any additional circuits or power protection required to support any interim or final configuration of the replacement CITYFLO 550 ATC equipment shall be provided by Contractor.

3.7.b Contractor shall identify any additional power requirements as part of the Preliminary Design Review.

3.7.c If the CITYFLO 550 equipment requires uninterrupted power, Contractor shall determine the required UPS capacity and submit the result with the Design Submittals.

3.7.d Equipment and design provided under this Contract shall support the networked monitoring of UPS units.

3.8 COMMAND, CONTROL AND COMMUNICATIONS

3.8.a The requirements reflect the existing system operation except as specifically noted otherwise. Contractor shall immediately notify the Project Manager of any discrepancy between the specified requirements and the existing system for resolution.

3.8.b The Command and Control subsystems are:

1) Automatic Train Protection (ATP)

2) Automatic Train Operation (ATO)

3) Automatic Train Supervision (ATS)

4) Audio-Visual Communications.

3.8.c The Automatic Train Control (ATC) includes the ATP, ATO, and ATS subsystems and their means of communication. The ATC system shall automatically regulate the movement of all trains except those temporarily under on-board manual control. The ATC system shall control vehicle separation, routing, speed, precision stopping, traffic direction, door operation, acceleration, jerk, velocity envelope, safety interlocks, and on-vehicle automatic announcements. The ATC system shall also monitor the system operations.

3.8.d The ATP subsystem shall provide protection against train collision, switch malfunction, overspeeds, door malfunctions, and other safety-related operational problems.

3.8.e The ATO subsystem shall provide the automatic safe speed, including acceleration, deceleration, and jerk control, station stops, and door operation.

3.8.f The ATS subsystem shall provide a link between the Central Control operator and the System, giving all pertinent information about the System and means for the Central Control Operator to control various functions of the System. The ATS subsystem shall also provide System supervision, including automatic routing, schedule keeping, and management data acquisition and reporting.

3.8.g The provisions of this section shall apply to both interim and final equipment configurations. The designs of Contractor's replacement CITYFLO 550 ATC equipment and its interfaces to the existing ATC system shall be addressed in their respective Preliminary and Final Design.

3.8.h Equipment additions or changes in New Central Control Facility and the Central Control Console shall be identified in the Central Control Design Layout.

3.8.i All new equipment shall be installed in such a way that operation of the system, access to existing equipment, safety and security regulations like exit routes and fire extinguisher access are not limited at any phase during this project.

3.8.1 Automatic Train Protection (ATP)

3.8.1.a The ATP subsystem shall provide for safe operation of individual vehicles and trains and perform the following operating functions, the requirements for which are given in subsequent sections.

3.8.1.1 General Operation Functions

1) Presence detection
2) Safe train separation assurance
3) Unauthorized motion prevention
4) Overspeed protection
5) Parted-train protection
6) Signal transmission and detection
7) Unscheduled door opening protection
8) Vehicle/Station alignment and door interlocks

9) Departure interlocks

10) Reverse operation interlocking

11) Propulsion/braking interlocks

12) Merge/diverge safety functions

13) Service brake failure protection

14) Zero speed detection

15) End of track protection

3.8.1.b All ATP functions shall be performed in accordance with the safety principles of Section 2.7.1.1.

3.8.1.c The safety provided by the ATP subsystem shall exist under all circumstances of guideway power, vehicle power, automatic operations, and with malfunctions in the ATP subsystem itself.

3.8.1.d Should the above conditions occur, or should the ATP subsystem become inoperable, no unsafe condition shall result.

3.8.1.e The ATP subsystem shall react appropriately whether or not an indication to the Central Control Operator is provided or not, and it shall react to an indication regardless of whether a failure has actually occurred.

3.8.1.f If the ATP subsystem fails, all automatic train operations shall cease and affected trains shall brake to a stop.

3.8.1.2 Presence Detection

3.8.1.2.a The ATP subsystem shall ensure that the presence of all cars, vehicles, and trains or any other System-related vehicle such as the maintenance vehicle and maintenance carts, moving or stationary, under automatic or manual control, shall be continuously detected throughout the entire system. The presence detection mechanism of the wayside ATP shall systematical track the progress of each car, vehicle, train, or other system-related vehicle around the system in a manner which will enable it to detect lost occupancy wherein a previously detected car becomes undetected (check-in/check-out). In the event of the detection of lost occupancy, the system shall assume a safe state in that the undetected car, vehicle, train, or system-related vehicle shall stop (preferably at the next station) and any following cars, vehicles, trains, or system-related vehicles shall stop clear of the point at which detection was lost in accordance with safe train separation assurance requirements. Recovery from a lost occupancy condition shall be by restoration of the presence detection mechanism and re-initialization of the wayside ATP as described in the following paragraph.

3.8.1.2.b The presence detection function shall be self-initializing in the event of any interruption to power, ATC computer, or ATC communication activity. When any such interruption ceases, the location, to the degree of resolution normally known to the operating system, of all vehicles in the system shall automatically become known to the ATP subsystem within five seconds after the interruption is cleared. In

no case shall presence detection depend on input of vehicle location the Central Control Operator nor shall manual vehicle operations be required for the ATP subsystem to have knowledge of all vehicle locations.

3.8.1.2.c In no case shall any reset permit the ATP subsystem to detect or indicate an unoccupied status for a track section which is occupied. In those rare cases where failure has resulted in an all guideway (or an all guideway zones) occupancy indication ATP fail-safe attributes; then the ATP true train occupancy re-initialization may be accomplished by local manual train or wayside action.

3.8.1.3 Safe Train Separation Assurance

3.8.1.3.a Protection against collisions shall be provided throughout the entire System by the ATP subsystem. This protection shall be based upon the assumption that any detected entity may instantly stop ("brick wall stop"). This protection shall accommodate the allowed maximum speed limit of any detected entity travelling in its assigned direction of travel or two such detected entities travelling in opposed assigned directions. Such protection shall also provide protection for trains in merge-diverge switch conflicts and at end of track terminus.

3.8.1.3.b Train speed command aspects shall be arranged and dynamically controlled on the basis of detected train presence and detected switch position/award status. ATO speed regulation control shall affect normal service braked stops short of safe train separation encroachment. In the event that ATO control fails or otherwise allows safe separation encroachment, the ATP shall enforce safe train separation assurance by the immediate application of emergency brakes and the immediate withdrawal of train propulsion. The worst-case performance of emergency brakes must be capable of stopping trains to prevent collision and shall be a fundamental consideration in the implementation of safe train separation assurance design. Both manual on-train and Central Control remote reset of emergency brakes shall be provided.

3.8.1.4 Unauthorized Motion Prevention

3.8.1.4.a The ATP subsystem shall ensure that irrevocable emergency brakes are applied if there is train movement of greater than 0.50 mph when the train is supposed to be in a stopped (zero speed) or when the train moves in a direction other than the commanded direction of travel (rollback) for a time greater than two seconds. Reset and restart shall be possible both remotely from Central Control and manually on board the train.

3.8.1.5 Over Speed Protection

3.8.1.5.a The safe train separation assurance function using presence detection and switch merge/diverge protection together with guideway civil constraints based upon vertical and lateral curve geometry shall generate safe speed limits for any and each segment of the system. Such speed limits shall be dynamical imposed traffic or route conditions, whether by other trains, unlocked or conflicting switches or geometry, whichever is most restrictive. When plotted as a function of distance along the guideway, these speed limits shall constitute a safe speed-distance profile of the system guideway for a specific case of the existent guideway and

traffic conditions.

3.8.1.5.b The ATP subsystem shall provide the overspeed protection function by ensuring that the speed of a train does not exceed the safe speed-distance profile anywhere along the entire system guideway. To accomplish this, the overspeed protection subsystem shall include fail-safe or checked-redundant speed measuring subsystems which furnish signals that are a measure of the actual speed of the train. If the actual speed of the train is below the safe speed limit, the emergency brakes shall be held off. If the actual speed of the train exceeds or imminently approaches the safe speed limit, the overspeed protection subsystem shall immediately cease holding off the emergency brakes so they are applied to bring the train to a full stop.

3.8.1.5.c Brake reset shall be by remote command from Central Control or locally on-board the affected train. To ensure that the safe speed limit is not exceeded, emergency brakes shall be applied at some speed lower than the safe speed limit and/or at a lead time prior to the attainment of the safe speed limit. The normal operating ATO command speed of the train must be sufficiently below the safe speed limit so that an overspeed condition can be detected and corrective action taken before the train exceeds the safe speed limit. This requires the establishment of an "initiate emergency brakes" speed which is greater than the normal ATO commanded operating speed, but less than the safe speed limit. Overspeed protection shall apply emergency brakes whenever a train speed reaches the "initiate emergency brakes" speed. Both manual on-train and remote emergency brake reset from Central Control shall be provided.

3.8.1.5.d Certain sections of guideway may have civil speed restrictions requiring trains to reduce speed when traversing them. If a train is traveling within such a restricted zone, all portions of the train must maintain a speed not greater than the zone speed limit. If two or more speed restricting conditions exist, the train shall be governed by the lowest of these.

3.8.1.5.e At the ends of guideways, the overspeed protection function shall ensure that under the worst conditions the train shall not overshoot the stopping point and strike the buffer at a speed greater than 2 mph.

3.8.1.6 Parted Train Protection

3.8.1.6.a The ATP subsystem shall ensure that if a train is parted, all vehicles of the train shall immediately and irrevocably apply their service brakes or emergency brakes. The presence detection system shall be aware of the presence and location of all vehicles of the parted train.

3.8.1.7 Signal Transmission and Detection

3.8.1.7.a All signals that involve the ATP subsystem shall be continuous or of such a repetitive nature that interruption of any such signal shall initiate emergency braking, unless otherwise specified herein. Remote brake reset command from Central Control or locally on-board the affected vehicle shall be permitted when communications are re-established. The maximum time in initiating such braking

shall be included as one of the parameters in the ATC system Design Review.

3.8.1.7.b If the speed/command signal is lost, the vehicle shall perform a service stop. If the speed/command signal is subsequently restored, and the brakes properly reset, the vehicle/train shall reacquire the safe speed-distance profile under jerk and acceleration limits.

3.8.1.8 Unscheduled Door Opening Protection

3.8.1.8.a The ATP subsystem shall ensure that no automatic mode failure shall result in the unlocking or opening of a vehicle or station door.

3.8.1.8.b If any vehicle door or emergency exit unlocks for any reason while a train is in motion, the train shall be irrevocably service braked to a stop. Actuation of the emergency release on any regular vehicle door or the unlocking of any vehicle emergency exit at any time shall also cause irrevocable service braking. For all instances in this paragraph only manual reset on board the train shall be permitted.

3.8.1.8.c If any station platform or emergency door is unlocked for any reason, vehicles shall be prohibited from entering or leaving that station platform. If any station platform or emergency door is unlocked for any reason after a vehicle has entered the station platform area, the vehicle shall be emergency braked or irrevocably service braked to a stop. Brake reset shall be only local manual reset onboard the vehicle. For any unscheduled vehicle or station door unlocking or opening, regardless of the cause, an alarm shall be automatically annunciated at the central Control Console indicating that this emergency condition has occurred.

3.8.1.9 Door Alignment and Door Interlocks

3.8.1.9.a The ATP subsystem shall ensure that automatic opening of train and station doors shall occur only if all of the conditions listed below are met and ATP subsystem verified. Automatic train and station door opening under any other conditions shall not be possible pursuant to the safety principles described herein.

1) The train speed is zero.
2) The train is properly aligned with the station doors.
3) The brakes have been applied and power has been removed from the propulsion motor (s).

3.8.1.10 Departure Interlocks

3.8.1.10.a The ATP subsystem shall ensure that a train stopped in a station shall not be allowed to move unless all train and station platform doors are properly closed and locked and the train brakes have been released. Once these conditions are satisfied, the service brakes shall be applied and an alarm shall be sent to Central Control if the train does not move within ten (10) seconds of being commanded to do so. Manual and remote brake reset shall be provided.

3.8.1.11 Reverse Operation Interlocks

3.8.1.11.a Reversing train direction shall be possible at all locations where automatic train operation is possible. Except for reversing at stations as part of normal or ATO-governed failure management operations, the train revers command shall originate

with the Central Control operator. Once set in motion, the train shall proceed automatically. ATP interlocks shall ensure that an automatically controlled reversed train does not violate the requirements of Section 3.8.1.3 and that the protection provided by those requirements applies.

3.8.1.11.b The provisions of this Section and shall specifically apply when the system has bi-directional operations on any segment of guideway, for example: as a means of operating around a stalled train or failed guideway segment.

3.8.1.12 Propulsion and Braking Interlocking

3.8.1.12.a Interlocking of emergency braking and propulsion subsystem controls is described in this section and shall conform to section 2.7.1.1.

3.8.1.12.b The emergency brakes shall stop the train whenever a potentially dangerous condition occurs.

3.8.1.12.c The emergency brakes shall be irrevocable, that is once the command is issued for them to be applied, will remain applied until the train comes to a complete stop, even if the initiating command is removed. After the train has stopped, the emergency brakes may be reset for normal operation by a manual reset on the train by authorized personnel; additionally, the emergency brakes may be reset by a control signal to that train from the Central Control Operator. If conditions are not safe for the train to move, the emergency brakes shall remain applied regardless of any reset signals or actions. If, when safe conditions exist and the train is allowed to move, a subsequent malfunction occurs, the emergency brake shall be applied as before.

3.8.1.12.d The emergency brake controls shall be interlocked with the propulsion controls, to include removal of propulsion power during emergency braking, in a fail-safe or checked-redundant manner such that braking commands dominate.

3.8.1.13 Merge/Diverge Safety Function

3.8.1.13.a The merge/diverge safety functions and conflict detection subsystem shall conform to section 2.7.1.1.

3.8.1.14 Service Brake Failure Protection

3.8.1.14.a In the event that train service brakes fail, the train emergency brakes shall be applied in a manner consistent with section 2.7.1.1.Brake reset shall be remote command from Central Control or locally on-board the train.

3.8.1.15 Zero Speed Detection

3.8.1.15.a As used in these Technical Provisions, “zero speed" is defined as a velocity of 1 foot per second or less. The ATP system shall ascertain when a train reaches zero speed in accordance with 2.7.1.1.

3.8.2 Automatic Train Operation (ATO)

3.8.2.a The ATO subsystem shall include the equipment necessary to perform the following functions within the constraints of the ATP subsystem:

1) Execute programmed station stops, dwell times, and departures at stations

2) Control operation of train and station doors

3) Operate trains at speeds within limits imposed by the ATP subsystem

4) React to a loss of propulsion power

5) Initiate/control operating modes

3.8.2.1 Programmed Station Stop

3.8.2.1.a A programmed station stop is the control of train speed and final application of brakes, under jerk and acceleration limits, to make a precise station stop. Programmed station stops shall be made so that the train and station door centerlines are aligned to within six (6) inches of each other in at least 99% of all station stops. The final application of brakes shall be made when zero speed is detected.

3.8.2.1.b When the train and station door centerlines are misaligned by more than six (6) inches but the doors still provide a clear opening of at least thirty-two (32) inches, the doors shall open automatically and an alarm shall be sent to Central Control. This alarm shall indicate the misalignment and identify the train and station involved.

3.8.2.1.c If the doors are misaligned by more than the amount permitted in the preceding paragraph, the doors shall not open automatically and shall not be open upon a command from the Central control Operator. An alarm at Central Control shall alert the Operator to this condition and automatic announcements shall be made on the train and in the station involved. If this condition occurs, the train shall remain at the station for the duration of its dwell with all doors remaining closed. At the termination of dwell, the train shall depart to the next station.

3.8.2.1.d Any train/vehicle jog movements implemented in Contractor's design to allow recovery from an initially missed position station stop shall be invoked only upon remote command from the Central Control Operator and the moves accumulated one or more successive jog commands shall not collectively exceed four (4) feet of reverse direction distance. Jog maneuvers shall not be considered to satisfy the 0.99 percent station stop alignment criteria above.

3.8.2.1.e If, during a programmed station stop the train brakes to a stop for other reasons and the conditions which caused the stop are subsequently removed and the brakes are properly reset, the train shall reacquire the programmed speed-distance profile under jerk and acceleration limits and proceed in the programmed station stop as though the premature stop had not occurred.

3.8.2.2 Door Operation

3.8.2.2.a Corresponding station and train doors at a boarding/deboarding position shall be controlled as a set. Door control signals shall ensure that all doors can be opened and closed only on the side of the train facing a station platform. Vehicle and station door sets shall operate independently and shall have no shared drive components with any other door sets.

3.8.2.2.b Vehicle and station doors shall operate as matched sets; if one cannot operate,

operation of the other shall be automatically inhibited. It shall be possible to manually (at the door) disable the operation of a vehicle or station door set, in which case the prior requirement applies. The requirement pertains to ATO; local manually controlled operation either on-board the vehicle or in the station shall supersede the above.

3.8.2.2.c The station and train doors shall be commanded to open automatically and simultaneously after successful completion of a programmed stop at a station. At the Main Terminal Station, the side platform station doors and corresponding vehicle doors shall be commanded open first followed by the center platform doors. The length of the interval between these two commands shall be an operator-settable parameter.

3.8.2.2.d If for any reason the doors fail to open, automatic corrective action shall be undertaken. An alarm shall be sent to the Central Control Console. The Central Control Operator shall be able to attempt to open the doors remotely, hold the train for local manual intervention by maintenance personnel, or dispatch the train to the next station after observing that exiting if possible) has been completed for that vehicle.

3.8.2.2.e Upon receiving the automatic door closing signal, station dwell all vehicle and station doors shall close unless a door hold command has been issued through the ATS subsystem.

3.8.2.2.f Train doors shall be automatically controlled except when a train is under local manual control, when the operation of all train doors shall be controlled by the train operator. When a train under manual control is properly berthed in a station and the train operator commands the train doors to open or close, the ATO subsystem shall also open or close, respectively the corresponding station door.

3.8.2.3 Train Movement Control

3.8.2.3.a The starting, stopping, and operation of the trains shall be controlled by ATO so that the speed is maintained within the speed limits imposed the ATP subsystem under all conditions.

3.8.2.3.b The replacement CITYFLO 550 ATC system shall incorporate all design features and equipment to assure bi-directional operation of vehicles and trains.

3.8.2.4 Loss of Propulsion Power

3.8.2.4.a If propulsion power is interrupted for 5 seconds or more, the train(s) shall coast under ATO control and under the protection of the ATP subsystem. Should the train(s) reach zero speed, service or parking brakes shall be irrevocably applied; otherwise normal train operation shall automatically resume upon restoration of propulsion power as permitted by the ATP and ATO subsystems. If zero speed occurs and parking brakes are set, restart shall be possible only by remote Central Control Operator command or by local reset command, subject to ATO and ATP restrictions and speed command permits. Vehicle stoppage due to propulsion power loss shall automatically be alarmed at the Central Control Console. The train number, location, and fault condition shall be identified.

3.8.2.5 Shuttle and Loop Operating Modes

3.8.2.5.a When initiated by the Central Control Operator, the operation of the system in the single or double shuttle modes or loop mode shall be accomplished automatically through the ATO subsystem. Shuttle and loop mode operation commands shall be initiated from the Central Control console to vehicles anywhere in the subject to the constraints of Section 3.8.1.11.

3.8.2.5.b Each of the two lanes shall have a separate control so that either one or both can be operated in shuttle mode. The shuttle mode and loop mode includes a train trip between any stations designated the Central Control Operator including all designated Intermediate stations. Shuttle and loop routes shall be pre-determined and included in the ATO subsystem for Central Control Operator selection. Station dwell times shall be controlled by the ATO. The dwell time at each station shall be individually adjustable by the Central Control Operator.

3.8.3 Automatic Train Supervision (ATS)

3.8.3.a The ATS subsystem shall monitor and manage the overall operation of the system. The ATS subsystem shall not be essential to continuing automatic system operations by the ATO and ATP subsystems once such operations have been started. ATS shall provide the interface between the system and the Central Control Operator. Through audio and visual displays, information shall be presented describing the status of the system on a real-time basis. This information shall allow the Central Control Operator to assess conditions throughout the system and to take appropriate actions. The Central Control Operator shall be able to issue commands to initiate and terminate system operations, override any normal and degraded operating modes, and perform other system management functions subject to the constraints of section 3.8.3.1.

3.8.3.b The ATS subsystem shall provide:

1) displays of system performance and status
2) messages and alarms of abnormal/malfunction conditions
3) remote intervention to control and override system operations
4) automatic supervisory control of normal operations
5) communications
6) data recording and reporting

3.8.3.c Unless specifically stated otherwise, the functions and capabilities of the ATS subsystem that are described in this section shall be incorporated in the Central Control Facility and Alternate Control Facility. The Contractor shall furnish all equipment computer hardware and software, and associated efforts necessary to provide the functions and capabilities described in this section and its subsections.

3.8.3.1 Safety Constraints on ATS

3.8.3.1.a The ATS subsystem shall be such that no action or lack of action by the Central Control Operators, either purposeful or inadvertent, or any malfunction of the ATS equipment, can cause an unsafe condition, or otherwise subvert or compromise the

ATP subsystem functions.

3.8.3.1.b Thus, both the ATP and ATO subsystems shall take precedence over the ATS subsystem. Should the ATS subsystem become completely inoperative for any reason, the system shall continue to operate in the automatic mode under the ATO subsystem and fully protected by the ATP subsystem, unless a system shutdown is commanded by the Central Control Operator.

3.8.3.1.c Emergency controls on the Central Control Console and Alternate Control Console shall, independent of the ATS subsystem, provide at least two (2) system emergency shutdown functions:

1) all trains stop
2) all propulsion power shut off

3.8.3.2 Performance Monitoring

3.8.3.2.a System performance information at Central Control and Alternate Control shall be provided on the displays required the subsequent sections. All of the related functional capabilities listed in this section, and those capabilities of sections 3.8.3.5 and 3.8.5, shall be incorporated in a single console unit, which shall be designed for efficient use by the Central Control Operators.

3.8.3.2.b The Central Control Console unit shall be designed so that one operator can respond to all system requirements during off-peak conditions. The design, layout, displays, information displayed, controls, and operator interfaces of this console shall be developed by Contractor based on a human factors analysis and submitted for review as part of the Central Control Console Design Reviews .

3.8.3.3 System Schematic Display (SSD)

3.8.3.3.a The SSD shall provide a visual representation of real-time operating conditions throughout the System. The display adhering to ergonomic principles shall:

1) Consist of one or more color LCD monitor(s), activated and updated a digital computer system that are of sufficient size and resolution to be viewed with ease from the normal area of the Central Control Operator Consoles.
2) Show approximately scaled graphical representations of the guideway, stations, switches, Maintenance and Storage Facility, and any other relevant physical features.
3) Incorporate dynamic, colored displays that graphically depict operating conditions for all parts of the automatic system, including at least:
    a. The location and identification of all trains in all parts of the system designed for automatic operation. This shall be accomplished by dividing the schematic into zones, representing the stations and physical segments of the guideway and control blocks. The occupancy any train of a zone or block shall be identified.
    b. The direction of travel of all active trains.

c. The number of cars/vehicles comprising each train.

d. The identification number the ATC and Central Control Operator uses to interact with the train.

e. The status of the train relative to its scheduled position.

f. The status of all switches in the system, including:

i. the direction a vehicle would follow through a switch,

ii. if the switch is moving or stopped and locked, and

iii. if the switch has any faults.

g. The operating mode and status of selected items of wayside equipment, such as ATC, and back-up power equipment.

h. The active or inactive status of each station, the current active dwell for each station, and any significant station equipment malfunctions, including doors.

All normal conditions shall be indicated by a green color, all abnormal conditions shall be indicated by a red color, and all ATS override conditions shall be indicated an amber color.

4) Incorporate such other visual aids as may be necessary to permit the Central Control Operator (s) to manage the system efficiently. Examples of such aids include: signal blocks, train parking and storage locations, train entry point(s) (transition zones), speed zone areas, power zone boundaries, power feed points, substation locations, and electrical switchgear locations.

5) Incorporate the capability of selecting and viewing any area and element, and its status, in more detail on at least one master monitor.

3.8.3.4 PDS Status Displays (PSD)

3.8.3.4.a The PSD shall provide the Central Control Operator(s) an immediate visual indication of the power distribution system status throughout the system. The PSD shall be separate from the System Schematic Display. It shall be designed adhering to ergonomic principles and be one or more color LCD monitor(s) that are large enough to permit easy from the normal seating area of the Central Control Consoles.

3.8.3.4.b The PSD shall clearly display the following conditions as a minimum:

1) The presence, designated a red color, or absence, designated by a green color, of electrical power in each segment of the guideway which may be individually energized or de-energized with propulsion power.

2) The status, closed, opened and if positioned for local control, of circuit breakers, and switches in the power supply system. The status indication would include breakers operated from the control room, at the substations or

from shutoff devices in the stations and along the guideway. A tripped condition shall be alarmed.

3) The presence or absence of backup power.

3.8.3.4.c The PSD shall have the selectable capability of viewing any area and element, and its status, in more detail by a zoom feature on at least one master monitor to provide an exploded view with increased information of a section of a previous screen. Override conditions shall be indicated an amber color. Indication of power status shall be by both voltage monitoring and switch position indication. Implementation of the PSD and PSD controls shall use redundant and separately routed paths such that remote signaling and control of the power distribution system are not subject to single path failures.

3.8.3.5 Other Displays

3.8.3.5.a Alarm information from the ATC, power distribution, fire detectors, intrusion detectors, restricted access system, system equipment, and other such subsystems shall also be displayed at the Central Control Console and Alternate Control Console (see section 3.8.3.9). This information may be on separate alarm panels, but shall always be at the location(s) where control functions are exercised.

3.8.3.6 Performance Control and Override and Adjustments

3.8.3.6.a Management and operation of the system shall be accomplished by the control and override functions described in this section. The software and hardware shall be sized for the AGTS including the South Expansion with only minor modifications. Implementation of the new system's related software and hardware shall be accomplished with no disruption to normal airport AGTS operations. Some of the performance control functions shall be accomplished automatically by the ATS subsystem, as described in section 3.8.3.7. Other functions shall be exercised manually the Central Control Operator.

3.8.3.7 Automatic Control Functions

3.8.3.7.a The ATS subsystem shall perform the control and coordination functions necessary to achieve fully supervised automatic operation of the system. All of the automatic control functions described in this section shall be provided as part of the system.

3.8.3.7.1 Pinched Loop Service Modes

1) Regulated operation with equal train spacing of the end-to-end double-lane loop operating mode shall be accomplished by automatic adjustments to station dwell time determined and imposed by the ATS subsystem. The Central Control Operator shall be able to select the desired nominal station dwell for each station. The ATS subsystem shall permit the pre-programming of desired nominal station dwell times for different time periods of the day and week.

2) The Main Terminal Station has a center-platform and two side platforms. The Automatic Train Supervision subsystem shall have the capability to command each successive train to alternate with respect to which side of the center platform each one stops.

3) The ATS system shall incorporate automatic "anti-bunching" and "de-bunching" capabilities to assure that trains are properly spaced throughout the system. These features all operate without human intervention but may be overridden or rescheduled by the Central Control Operator. Anti-bunching shall limit the maximum variation from equal train spacing to within twenty (20) seconds or +/-15% of the average scheduled headway. De-bunching shall restore the train spacing to the above value within one round trip after a "worst-case" system perturbation, i.e. all trains stopped as close together as possible.

3.8.3.7.2 Failure Modes

3.8.3.7.2.a Failure modes shall be a fully automated, regulated operation. These modes are similar to the pinched loop mode except that one or more sections of the guideway are excluded from the trains' route, and trains shall automatically be directed to by-pass such section or sections. This will result in bi-directional traffic on other sections of the guideway. Operator commands shall specify the route; trains shall automatically follow. The Operator command selection shall be from a pre-determined list of routes and of a menu driven input format. The failure modes normally will only be utilized when a failure or maintenance action makes a particular guideway section or system element unavailable for normal passenger service.

3.8.3.7.3 Shuttle Service Modes

3.8.3.7.3.a Synchronization of the double-lane shuttle operating mode shall selectable and be accomplished by automatic adjustments to station dwell time determined and imposed by the ATS subsystem. The Central Control Operator shall be able to select the desired nominal station dwell for each station. Additional the ATS shall permit the pre-programming of desired nominal station dwell times for different time periods of the day and week.

3.8.3.7.3.b In the event of a failure that results in the inability to operate the system in the synchronized double shuttle mode, those trains in operation at the time of failure shall automatically, without human intervention, revert to an unsynchronized mode of operation with station dwell times being determined by the setting of the ATO station dwell timers.

3.8.3.7.4 Automatic Record Keeping

3.8.3.7.4.a The ATS subsystem shall automatically keep a record of the train length, including the identification number of the vehicles operating in each train; the operating mode in which the System is functioning; and the guideway to which each train is assigned. It shall also record schedule adherence performance. Any unscheduled stoppage or delay including time of occurrence and time of resumption of operation, with the identification number(s) of any train(s) affected and its variance in seconds from its proper position to maintain equal headway. Software, hardware, procedures and training needed to retrieve and analyze this data shall be supplied by Contractor.

3.8.3.8 Operator Control Functions

3.8.3.8.a The capabilities and functions described in this section shall be incorporated in the Central Control Console and Alternate Control Console and shall be able to be performed by one Central Control Operator working at the Control Console. All equipment, computer hardware and software peripherals, equipment, data storage equipment, furniture, other devices and associated efforts necessary to provide the functions and capabilities described in this section shall be furnished by Contractor. This console shall be useable by one operator in off-peak periods and two operators in peak periods. Generally, the controls and displays will be separated into two functional groups:

1) system operation, consisting of the ATC and power distribution systems
2) Passenger interaction, consisting of surveillance and communication audio and visual devices and related alarms.

3.8.3.8.b Common operator interface equipment safety devices and switches and voice communication shall be located at each Central Control Console, in conjunction with the SSD, the PSD, and the other displays so that together they constitute an ergonomically-designed, well-coordinated, efficient, and easily operable system. Control Operator inputted vehicle/train identification number shall be the same as the number/marking on the vehicle/train. Due to Contractor design, similar functions may be achievable by the same Central Control Operator action. The Contractor's design of the Central Control Operator control functions shall be subject to review.

3.8.3.8.c Contractor shall submit changes and or modifications made to the existing Control Console with regards to ergonomics, operations and equipment selection under this contract to the Project Manager as part of the Design Review.

3.8.3.8.d Subject to Section 3.8.3.1 the Central Control Console shall have the control functions described below. The Contractor shall identify and describe control functions during the Design Review.

1) Train Dispatching -The Central Control Operator shall be responsible for dispatch trains into the system. Trains shall be located in active storage areas at or near the Maintenance and Storage Facility. The Central Control Operator shall be able to insert these trains into service individually initiating automatic dispatching procedures. The merging of the train into the operating fleet shall be controlled and scheduled by the ATO to fill a vacant position in the operating fleet and not create the need for "anti-bunching" actions.
2) Train Routing - The ATS shall be designed so that each train can be assigned to a specific operating mode or lane, or route, via an instruction from Central Control.
3) Initiation of Service - The Central Control Operator shall be able to initiate system service by proper actions at the Control Console. This shall include multiple automatic train dispatching and implementing one of a set of pre-determined schedules.

4) Termination of Service - The Central Control Operator shall be able to terminate system service. This command shall initiate automatic, system-wide audio announcements about the system closing activities. Trains shall continue to the next end station to allow passengers to deboard and then proceed to pre-designated storage locations and stop.

5) Operating Mode Selection - The Central Control Operator shall be able to select any of the following operating modes:

    a. Loop (Short Loop and Long Loop)

    b. Other Operating Modes, including: synchronized Double Shuttle, Unsynchronized Double Shuttle, Single-Lane Shuttle, and Failure Modes.

6) Station Graphics - The Central Control Operator shall be able to activate pre-set messages from the control room to override the ATO messages in an expeditious manner for any and all dynamic signs in the stations.

7) Audio Announcements - The Central Control Operator shall be able to make public announcements, in vehicles and stations, for any individual train or station, all trains on a specific route, any set of trains and/or stations, or simultaneously throughout the system for single or multiple zones within the Maintenance and Storage Facility. The Central Control operator shall control digital pre-recorded audio announcements and have them transmitted to any or all trains and stations.

8) Video Surveillance - The Central Control operator shall have complete control of the station video surveillance equipment.

9) Guideway Power - The Central Control Operator shall be able to control the application and removal of propulsion power, other guideway equipment power, auxiliary power, separately or in combinations, for the entire system and for each individually powered segment of the system guideway. In addition, master controls shall permit all propulsion and auxiliary power on the entire system to be shut off immediately. These master controls shall be fail-safe, direct links to the power distribution systems. To avoid indiscriminate reapplication of electrical power, a distinct and positive preliminary action shall be required (e.g. keyed release of switch, Central Control Operator input through console equipment. etc.) before restoration action can be accomplished. The Central Control Operator shall not be able to override local manual lockouts of power but shall be informed of their status.

10) Video Recording - The Central Control Operator shall have complete control of the video recording equipment.

11) Train/Station Door Actions - The Central Control Operator shall be able to control the following train and station door actions, including overriding automatic door operations, for door sees on each side of a train:

a. Open and close train/station doors: all door sets, all door sets on each side of a platform.

b. Recycle train/station doors: all door sets, all door sets on each side of a platform.

c. Hold train/station doors open or closed: all door sets, all door sets on each side of a platform.

12) Modify Train Operations - The Central Control Operator shall be able to issue the following commands which modify normal train operations:

a. Reset brakes: each train.

b. Dispatch a train from a station and/or a specified location on the guideway to a station and/or specified location on the guideway: each train, each station, all locations on the guideway.

c. Stop command: each train, all trains; anywhere in the system.

d. Modify train speeds: each train, all trains.

13) Remove Train - The Central Control Operator shall be able to direct a train to proceed out of service to the active storage area(s) at the Maintenance and Storage Facility and/or elsewhere. This command shall initiate automatic announcements in the affected trains and stations about the train going out of service. Trains shall continue to the next station to allow passengers to deboard and then proceed to the storage areas and stop.

14) Failure Mode - The Central Control Operator shall be able to convert the system from its normal operating mode to a lesser operating mode for failure management purposes. During shuttle operation, it shall be possible for the Central Control Operator to change lane assignment of any train, and that train shall change lanes automatically.

15) Stop and Proceed - The Central Control Operator shall be able to stop any train at any location in the system for an indefinite period and then restart that train.

16) Modify System Dwell - The Central Control Operator shall be able to vary the dwell time for each station independently for any service mode. The range of dwell shall be from a minimum of which results in doors closing immediately after opening to a maximum of 60 seconds. Changes shall be in increments of one second.

17) By-pass Station - The Central Control Operator shall be able to command any or all trains to proceed without stopping at any station or set of stations in the system. This will invoke a corresponding change in the on-board audible destination announcements.

18) Hold Trains - The Central Control Operator shall be able to hold any train in any station or all trains in stations. If a train fails to align properly within the

station, the Central Control Operator shall have the capability of allowing the train to proceed without opening its doors, holding it in the station.

19) Zero Speed - The Central Control Operator shall be able to impose a zero speed constraint on any guideway segment, effectively blocking that segment to traffic.

20) Train Location Log - The ATC line printer shall print on 5-minute intervals or otherwise as commanded by the Central Control Operator) train identification and location track section or station (on revenue guideway and in the MSF). In addition, this information shall be stored on a digital storage medium.

21) Alarm Fault or Change of State Message Display Processing - The Central Control Operator shall be able to receive from several subsystems, acknowledge, store and recall alarm message displays and acknowledge accompanying audible alarms.

22) Status a Vehicle/Train Available or Unavailable - The Central Control Operator shall be able to select as Available or Unavailable a vehicle or train for a particular state or mode of service.

23) Failure Mode Selection - The Central Control Operator shall be able to select the trains, route, stations, and dwells for a Failure Mode of operation.

24) Service Brake All Trains - The Central Control Operator(s) shall be able to service brake all trains on the guideway by activation of a single-action button or switch. One button shall be located near each of the work areas for Central Control Operators incorporated in the Central Control Console design. A deliberate and positive action shall be required to release the button and thus eliminate the service brake condition.

25) Intrusion Alarm Acknowledge - The Central Control Operator shall be able to acknowledge audible alarms results from the report of an intrusion.

26) Side Platform Door Open Delay - The Operator shall be able to set a parameter that shall determine the interval between the time the Main Terminal side platform doors are commanded open and the center platform doors are commanded open. The range shall be 0-15 seconds.

27) Other - The Contractor shall provide any other performance control functions necessary for proper operation, maintenance and failure management of the system.

3.8.3.8.e The above functions shall be incorporated into the Central Control Console in a manner that allows maximum flexibility of operation. Except for single event commands, once a command is imposed by the central Control Operator and accepted by ATP, these actions shall remain operative until subsequently removed by the Operator.

3.8.3.9 Alarms and Malfunction Reporting

3.8.3.9.a The upgraded ATC system shall, at a minimum, maintain the existing alarms and

malfunctions reporting functionality, as specified in this section and its subsections. Additional alarms required to annunciate other alarms and malfunction of the replacement equipment, shall be added as necessary.

3.8.3.9.b For safe and efficient operation of the system, major components shall be automatically monitored for malfunctions, failures, fire/life safety problems, and/or intrusions. The Central Control Console shall incorporate both an incident (message) display and audible alarms for the benefit of the Central Control Operator. Within four (4) seconds of detection the occurrence of an incident or condition shall be reported on a display, indicating the time of the incident, the nature and classification of the incident or condition, the identification of the vehicle and train, and or the specific guideway or station location involved. An audible alarm shall also sound. Each alarm shall be indexed, time-tagged as to when the fault was detected; stored; re-displayable by an index number, type, hardware it is associated with (e.g. train, substation, passenger station, switch), individually, by priority and by order of occurrence.

3.8.3.9.c Acknowledgment of the alarm by the Central Control Operator shall cause the audible alarm to cease; however, the malfunction indication shall persist until the malfunction is cleared. All alarm reports and clearing shall be recorded on a digital storage medium and on a line printer including time of occurrence/reporting and acknowledgement.

3.8.3.9.d Fire and/or smoke-related incidents shall sound an audible alarm clearly different from the audible alarms for other incidents.

3.8.3.9.e All alarms reported shall be recorded and logged on digital storage media and in real time on a line printer. Logged data shall be both accessible and capable of being archived. Logged and archived data shall be accessible by the Central Control Operator and from authenticated remote locations and be available in report format and RAW format. Report information shall include all alarm related information as well as commands from the Central Operator.

3.8.3.10 System Alarms

3.8.3.10.a System operations malfunction alarms and reporting shall be primarily for security, safety and unscheduled stoppage problems. The alarm system shall be expandable to accommodate future track extensions with only minor hardware and software modifications.

3.8.3.10.b As a minimum, system operations malfunctions shall be reported in one of two priority classifications, as described below. The level of classification and reporting of faults shall be sufficiently detailed to allow operating and maintenance personnel to make rational decisions in reacting to the reports, consistent with the functions required of them in the operation and maintenance plans, procedures and manuals.

3.8.3.10.c Priority 1 malfunctions are those which pose an immediate threat to passenger safety and/or safe System operations, thus require immediate action. These include at least:

1) Train overspeed/improperly accelerate rate.
2) Service brake failure.
3) Unscheduled train or station door unlocking or opening, including emergency door.
4) Parted train.
5) Unauthorized Motion Prevention.
6) Loss of signals
7) Loss of traction power from a substation.
8) Propulsion power subsystem trip on a vehicle.
9) Low service brake pressure.
10) Overload trip of vehicle air compressors or propulsion motors.
11) Loss of presence detection for any vehicle or any uncertainty regarding its location.
12) Emergency brake application.
13) Vehicle fire/smoke alarm.
14) Violation of any other ATP controlled condition.
15) Vehicle HVAC failure.
16) Low vehicle tire pressure.
17) Others as suggested by the Contractor.

3.8.3.10.d Priority 2 malfunctions are those which do not pose an immediate threat to either passenger safety or system operations, but which could cause a potential threat to safety or system operation if not corrected quickly. Priority 2 malfunctions include at least:

1) Failure of train to depart a station within 10 seconds after all doors are closed and locked and brakes are released.
2) Failure of doors to open in station within 10 seconds after train stops.
3) Failure of doors to close and/or lock when commanded of a train at a station.
4) Train-station door alignment tolerance exceeded.
5) A significant "bunch control" problem, i.e., a train that exceeds the requirements
6) Loss of vehicle emergency radio or station emergency telephone communication.
7) Other power distribution system overload or fault.
8) Vehicle batteries low.

9) Vehicle equipment over-temperature pre-warning.

10) Loss of public address in vehicles or stations.

11) UPS malfunction.

12) Removal of a vehicle file extinguisher.

3.8.3.10.e Contractor shall develop a list of Priority I, and II, malfunctions and others if necessary. The list shall reflect both the unique characteristics of the contractor's equipment and the proposed operational and response procedures and shall be provided at the appropriate Design Review.

3.8.4 Facility Fire and Security Alarms

3.8.4.a Facility fire and smoke alarms within the system or alarm signals provided by others shall be annunciated separately and redundantly on the Central Control Console. The location of the alarm point shall be indicated.

3.8.4.b Facility emergency egress door alarms and intrusion alarms from doors to restricted areas shall be indicated on the Console. The alarm location shall be indicated.

3.8.5 Data Recording and Reporting

3.8.5.a The upgraded ATC system shall, at a minimum, maintain the existing data recording and reporting functionality. Additional data, as needed to record other status of the Upgrade equipment, shall be added as necessary.

3.8.5.b All reports shall be retrievable by authorized users from the system as a Comma-Separated Values (CSV) file or in a data format compatible with Microsoft Excel.

3.8.6 Audio and Visual Communications

3.8.6.a The upgraded ATC system shall, at a minimum, maintain the existing audio communication and video surveillance functionality.

3.8.6.1 Passenger Assistance/Emergency Telephone

3.8.6.1.a A two-way telephone communications network linking Central Control/Alternate Control and the stations shall include the existing telephones on each platform. Each telephone shall automatically ring the Central Control which currently controls the system when activated. A display on the Central Control Console shall indicate which station telephone is calling and the number of such calls in the queue and the number by which each call may be responded to. If telephone equipment requires replacement, it shall be of heavy duty, vandal-resistant design (including flush-mounted telephones without handsets) and shall be monitored to indicate malfunctions (e. g. power loss, etc.). The system shall permit eavesdropping in the stations by the Central Control Operator for safety and security purposes. This passenger assistance/emergency telephone subsystem shall be separate from the service telephone subsystem.

3.8.6.1.b The Passenger Assistance/Emergency telephones provide two-way communications between the active Control Center and the station. When the push-to-call button is activated the patron operating the telephone shall receive an

audible indication that the unit has been activated.

3.8.6.1.c Communications stations at the stations shall consist of a push-to-call button, speaker with instructions, and matching transformer housed in a tamper-resistant enclosure.

3.8.6.2 Vehicle Voice Communications

3.8.6.2.a A full-duplex communications system shall be provided to permit two-way voice communications between Central Control and Alternate Control and all cars of each train, a Central Control Operator-selectable set of trains, or all trains simultaneously. Activation of two-way voice communications between Central Control and the train(s) shall be possible from Central Control. Passenger initiated communications requests from a train shall automatically select for Central Control Operator's activation the communications link to Central Control and the train identification number from which the request is received shall be displayed on the Central Control Console. The display shall also show any queue of such communication requests. The Central Control Operator shall activate by selection of the queued voice communications upon receiving an indication of the passenger-initiated communication request.

3.8.6.2.b A vehicle public address system mode shall be provided for the Central Control Operator to make direct, and initiate digitally pre-recorded, announcements on all cars of any train or any combination of trains in the system. Automatic, digitally pre-recorded messages shall also be provided.

3.8.6.2.c The vehicle voice communication shall permit eavesdropping on each car by the Central Control Operator for safety, security, and operational purposes. No indication that the eavesdrop mode is in effect shall be displayed on board the train.

3.8.6.2.d To verify transmission quality of the vehicle communications system, a random sequence of 100 spoken consonants shall be broadcast from each car to the Central Control who shall then send the received list back to the vehicle and 95% accuracy shall be demonstrated.

3.8.7 Recorded Information Aids

3.8.7.a An audio announcement subsystem shall be provided and shall interface with the station and vehicle public address systems. This subsystem shall include at least 25 digitally pre-recorded announcements to be used as of regular system operation and failure management. Recordings shall be on a voice synthesized digital medium. Some announcements shall be automatic, such as on-board announcements naming the next station and announcements in trains and stations that a train is being removed from service and shall be driven by the ATC system. Selection of other pre-recorded announcements, such as those for temporary delays and operating mode changes, shall be under the control of the Central Control operator. This subsystem shall permit recording additional or modified announcements of both types for subsequent use.

3.8.8 Radio Communications

3.8.8.a A radio subsystem shall be provided by the Others for communications between Central Control/Alternate Control and maintenance personnel. If required, Contractor shall provide the necessary technical and project management support for such a new radio communication system where such a system is interfacing with Contractors system or operations. This maintenance radio subsystem shall be licensed with the FCC. The Contractor shall be responsible for all preliminary Work, including as a minimum, preparing applications and filling with the FCC.

3.8.8.b The Radio Communications System hardware shall include at least Central Control/Alternate Control equipment including base station, audio recording subsystem interface, radio transceiver, radio console control head with microphone and speakers, and antenna all with digital interconnect cabling.

3.8.8.c The power operating all fixed and radio equipment shall be from an uninterruptible power source ensuring radio operation for a minimum of one hour after loss of primary power.

3.8.8.d Transmit and receive audio broadcast over the radio system shall be input to a continuous recorder. These audio signals shall be compatible with the recorder input circuitry.

3.8.8.e The radio subsystem shall use the same microphones as the public address system and the Central Control operator shall have the capability of selecting the communications subsystem to be accessed by the microphone.

3.8.8.f The base station shall be located in the Central Control or Maintenance and Storage Facility. The antenna shall be determined by the Contractor and coordinated with and approved by the City to be compatible with other transmissions. The Contractor shall provide all connecting conduit and wiring. The radio transmission station shall provide high-quality communications among all locations within the Denver International Airport AGTS. To verify transmission quality of the radio system a random sequence of 100 spoken words shall be broadcast to the Central Control operator, who shall then transmit the received list in random order to the sender and a 90 percent accuracy shall be demonstrated. This test shall be repeated for all representative areas of the system to ensure that no system blind spots exist.

3.8.9 Standard Service Telephone Communications

3.8.9.a A standard telephone communication shall be provided by Others. If required, Contractor shall provide the necessary technical and project management support for such a telephone communication system where such a system is interfacing with Contractors system or operations.

3.8.9.b The chosen Contractor shall install a telephone system at Central Control and Alternate Control and other System locations that provides the following functions:

1) A programmable, flexible telephone control subsystem to operate the internal and external telephone links.

2) Central Control operator-activated auto-dial voice communications with operations and emergency services. The number of numbers and organizations to receive communications shall be established by the City, but shall be at least five (5) and no more than ten (10).

3) Communications using push-button-type service telephones in the Maintenance Area, administrative offices, station equipment rooms, power substations and at propulsion power circuit locations.

3.8.9.c The telephone subsystem shall be controlled from the Central Control or Alternate Control Console. It shall be possible to transfer some or all service telephone calls during selected hours to an administration office/reception area location. The console/concentrators and related connecting and interfacing equipment for the administration area shall be supplied, installed, and tested by Contractor. The Central Processing Unit (CPU) shall be programmable from the Central Control Console. Programming and changes of restriction shall be accomplished on-line.

3.8.9.d The Central Control, Maintenance Superintendent and administration office telephones shall have access to the public telephone system. Other telephones in non-public areas shall be direct inside dialing only. The final determination of restricted and non-restricted telephones shall be made prior to final programming by the telephone supplier.

3.8.9.e The telephones of the Operations Manager, Operations Supervisor, Maintenance Superintendent, and at least five (5) others shall have the ability to access the public address system in the Maintenance and Storage Facility.

3.8.9.f The telephone consoles shall have access to the vehicle communications subsystem, the maintenance radio subsystem, the station emergency telephone subsystem, and the public address subsystem.

3.8.9.g This telephone subsystem shall have two (2) direct ring-down lines to the City-specified, on-Airport administration building for direct communications with Airport emergency services. Wiring and conduit between the Maintenance and Storage Facility communications room and this administration building shall be provided by Contractor as necessary.

3.8.10 Transmission Equipment for Audio-Visual Communications Subsystems

3.8.10.a This section describes the operational, redundancy and quality requirements of the transmission system to interconnect the public address, passenger assistance/emergency telephones, service telephones and the CCTV subsystems.

3.8.10.b Redundant transmission subsystem(s) shall be provided to interconnect the audio-visual communications subsystems between Central Control/Alternate Control and the stations, maintenance areas, guideway points, and other communications equipment locations. The paths to Central Control/Alternate Control shall be configured such that upon failure or loss of one path or link, the transmission equipment automatically transfers to an alternate path or link.

3.8.10.c The transmission link shall be a high-speed, high-quality, interference-free video and voice transmission for the temperature and humidity conditions specified herein.

3.8.10.d Communications wire-way/conduit, lines and cables shall be installed in dedicated communication trough, wire-ways, and conduit fixtures provided by Contractor as required with at least 20% spare capacity.

3.8.11 Recording of Audio Transmissions

3.8.11.a An audio recording device shall be provided to record all Central Control/Alternate Control -vehicle audio, passenger assistance/emergency telephones, voice monitors, radio, address, service telephone communications, and control room conversation of operators at the consoles. Each drive of this dual drive device shall be capable of recording at least 48 hours of continuous transmissions on at least 20 separate channels, one channel indicating date and time. This device shall interface with all audio subsystems in Central Control/Alternate Control and shall include appropriate transmission equipment. Sufficient digital media shall be provided so that each day's recording can be stored for one month before being re-used.

3.8.12 Video Surveillance

3.8.12.a The Contractor shall coordinate with the Project Manager during the Design Review the layout of the new Control Facilities to support the spacial and ergonomic requirements for the following Video Surveillance system.

3.8.12.b A color video system shall be provided by Others and installed to the Central Control and Alternate Control facility to monitor passenger activities at all stations in the system. As a minimum current functionality and performance of the video surveillance system shall be maintained.

3.8.12.c

3.8.12.d Up to eight (8) selectable camera feeds shall be displayable simultaneously on the Master Monitor. Monitor size shall be such that video streams from displayed cameras are clearly visible from the Control Operators desk. Upon Control Operators request, a variable number of camera feeds (up to eight) can be displayed on the Master Monitor. Feeds shall automatically be sized to maximize the usage of the screen size.

3.8.12.e The Master Monitor shall be capable to display an IP-based video streams from other sources than the camera feeds.

3.8.12.f Eight (8) smaller Scene Monitors shall be provided on which any of the camera feeds can be viewed as a single picture. Monitor size shall be such that displayed feeds are clearly visible from the Control Operators desk.

3.8.12.g Monitors shall provide a clear picture in the ambient light level of the Central Control/Alternate Control area. Monitors shall be arranged so that the Central control Operator can easily view the screens.

3.8.12.h Video recording shall be provided for all feeds simultaneously for a 24-hour-window on a digital storage medium. Playback of recorded feeds shall be possible on any of the

video monitors. Storage of data and video feeds shall comply with the regulations of the airport.

3.8.12.1 Uninterruptible Power Supply

3.8.12.1.a All equipment (provided by Others) shall be connected to UPS, capable of maintaining the operation for 1h after loss of primary power.

3.8.12.2 Monitors

3.8.12.2.a Eight (8) 21" color monitors shall be provided by Others (one for each passenger station). The image from the cameras at each station shall be displayed on these scene monitors.

3.8.12.2.b One 55" color Master Monitor shall be provided by Others.

3.8.12.2.c All monitors shall be identical in type and vendor.

3.8.12.3 Video/Audio Recording and Playback

3.8.12.3.a A digital audio/video recording device shall be provided by Others capable of storing all simultaneous audio/video feeds for a 24-hour-window.

3.8.12.3.b Automatic archiving of stored audio/video shall be possible. Archive shall be capable of storing up to 1-week of continuous recording. Storage capacity shall be easily expandable by adding additional hardware without losing stored information.

3.8.12.3.c System shall be capable of synchronized playback of up to eight (8) audio/video feeds, selectable by the Operator. Playback speed shall be capable of synchronized fast forwarding, jumping to alarms, single frame advances, pausing and capable of saving single frames as screenshots.

3.8.12.4 Switching Equipment

3.8.12.4.a The switching equipment required to select the cameras for viewing on the master monitor shall provide manual control of the camera signal being called. The control shall be activated through the control keyboards at the Control Console. The switching equipment shall be rack mounted in the Central Control communications equipment room. The switching hardware shall interface with control keyboards and the transmission equipment.

3.8.13 ATC Reliability

3.8.13.1 Redundancy

3.8.13.1.a To assure safety and reliability, all ATC computers/processors, essential peripherals, and wayside transmission equipment, except for physical vehicle-wayside signal coupling devices that pertain to safety or provide safety information shall contain checked-redundant elements to provide automatic on-line and frequent self-checking diagnostic features to detect failure or loss of any function. Upon detection of such failure or loss of function, the diagnostic feature shall notify the Central Control Operator by audible alarm and displayed message identifying the failure.

3.8.13.1.b The design and operation of these system elements shall be such that normal train operations, including full Central Control Room display and command capabilities,

are not disrupted for a period exceeding one minute. This design feature may be accomplished by automatic switchover to hot stand-by equipment or manual switchover to stand-by redundant equipment a single person provided the one minute disruption criterion is satisfied.

3.8.13.2 Software Requirements

3.8.13.2.a Existing, proven software shall be used to the maximum extent possible. Any computer software used in the ATC system shall be structured in a functional hierarchical system. In this top-down approach to software design, successive levels within the hierarchy shall be obtained by de-segregating and partitioning the software into blocks with progressively greater functional detail. Software design and documentation shall conform to current established engineering standards and use IEEE Standard 729 and 730.

3.9 GUIDEWAY EQUIPMENT

3.9.a To the maximum extent possible, and in accordance with all safety and operational requirements, guideway components that require testing, servicing, adjusting, removal, replacement or repair shall be located to maximize accessibility by:

1) locating items requiring visual inspection so that they can be directly viewed with removal of covers or other components
2) locating components requiring maintenance in such a manner as to provide direct access without removal of other components

3.9.b The Contractor shall provide any required cable trays, conduit or equipment enclosures to be mounted along the guideway for power distribution, command, control, and communication; or other subsystems. Conduit shall conform to NFPA 130 for specific of locations.

3.10 STATION EQUIPMENT

3.10.a Contractor shall incorporate all existing station equipment in the Work under this contract. All existing equipment shall at least provide the same functionality, system integration and reliability after the Work has been conducted.

3.10.b If additional station related components are required, Contractor shall be responsible for furnishing, installation and testing at no additional costs to the City.

END OF SECTION 34 42 00

4 ATTACHMENTS

4.1 ATTACHMENT A: LIST OF DELIVERABLES

No.	Title	Deliverable	For	Section
1	Alternate Control Facility Design	The required space allotment, layout, mechanical, electrical and Man Machine Interface (MMI) requirements shall be defined by Contractor and submitted to the City.	30% and 100% Design Submittals	2.1.3.c
2	Future Long Loop Study	Contractor shall investigate the operation which allows for the shortest system headways. Station spacing shall be maintained with the new Future Long Loop Mode. The operation of the Future Long Loop Mode needs to be coordinated and approved with the Project Manager before implementation.	30% and 100% Design Submittals	2.1.4.d
3	Compliance Matrix and WBS	Contractor shall provide a compliance matrix covering all aspects of the specification in the WBS	30% Design Submittal	2.3.e
4	Equipment Layout	All interim and final CITYFLO 550 ATC replacement equipment shall be located completely within the existing AGTS. Placement of any interim equipment shall not impede the access to existing equipment for operation or maintenance. Equipment layouts including required clearances shall be provided as part of the preliminary and final Design Review. This information will also be presented as a BIM code Book	30% and 100% Design Submittals	2.3.g
5	Power Requirements	The power requirements for the CITYFLO 550 ATC replacement equipment shall be identified for any interim and final equipment configurations as part of the Preliminary Design Review. This information will also be presented as a BIM code Book	30% and 100% Design Submittals	2.3.h
6	Cut-Over Plan/Phasing Plan	Contractor shall prepare a detailed cut-over plan for both ATC Replacement and Central Control facility projects.	30% and 100% Design Submittals and update as required	2.5.2.a
7	Future Pinched Loop Study	After the installation of the switch section south of Main Terminal Station and extension of tracks to the South the AGTS will perform with shorter headways. No limitations of future improvements shall result from any of the Work performed under this specification. Any limitations shall be identified and coordinated with the Project Manager and require approval by the Project Manager.	30% and 100% Design Submittals	2.6.2.a
8	Future Pinched Loop Study	The Replacement CITYFLO 550 ATC system shall support 90 second headways when the turn-backs and track extensions South of Main Terminal are installed (South Expansion). Contractor shall identity any location/layout restrictions for the future turn-backs to support the headways as short as 90-seconds as part of the Preliminary Design Review.	30% and 100% Design Submittals	2.6.2.b
9	List of Unproven Technology	During the Design Review process Contractor shall submit a list with all unproven technology intended to be used and mark those components or technologies on the submittals. If new technologies are going to be used under this contract, a testing plan shall be submitted including the testing schedule, results of quality tests, and calculations for those components. Tests shall be signed by witnesses of the tests.	30% and 100% Design Submittals	2.7.2.c

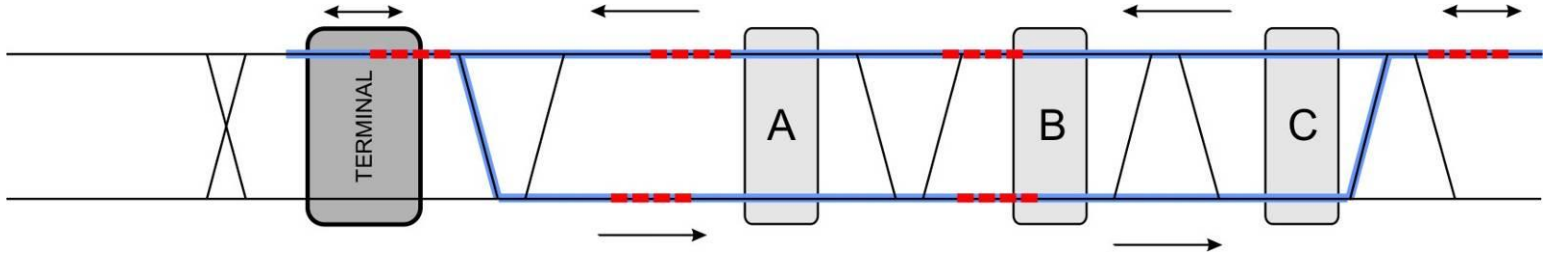
No.	Title	Deliverable	For	Section
10	Single Fault List	Systems shall be designed in such a manner, that no single fault will result in a failure of the entire system. Contractor shall identify and submit a list of single faults, which create limitations of commercial operation, changes in operating the system (e.g. delayed system response times, reduction in functionality, etc.) as part of the Design Review. This information will also be presented as a BIM code Book	30% and 100% Design Submittals	2.7.3.a
11	Redundant Systems List	If possible, redundant systems and connections shall be physically separated in such a manner, that a single event (e.g. fire, water damage) is only affecting one of these redundant systems. Contractor shall submit a list of redundant systems including locations as part of the system Design Review. This information will also be presented as a BIM code Book	30% and 100% Design Submittals	2.7.3.b
12	Expandability Limitations	Contractor shall identify and notify the Project Manager of any parts installed under this contract which will require replacement as part of such expansion. This information will also be presented as a BIM code Book	30% and 100% Design Submittals	2.7.5.b
13	Emergency Procedures and Equipment	The Contractor's procedures for emergencies and emergency equipment shall be submitted for review and be compliant with the PMSC.	30% and 100% Design Submittals	2.7.9.3.f
14	Safety Certification	Contractor shall certify the safety of the system as provided by Contractor and its subcontractors before the system is placed into commercial operation. This Certification shall include the system as a whole including interfaces to other systems and certify that, it meets all safety-related requirements of this contract, is consistent with Contractors system safety plan, and that the system meets or exceeds all applicable national, regional, local and airport specific laws, regulations, codes and other standards.	Substantial Completion	2.9.3.a
15	System Hazard Analysis	A Preliminary Hazard Analysis (PHA) shall be employed to assist in the evaluation of potential hazards and to document their resolution in accordance with ASCE 21-05 3.1.2.1 including Annex A.2, A.3, A.4 and A.5. 2.9.4.b The analysis shall include information from previous similar projects including resulting improvements in design and procedures. If a system or sub-system is identified as unsafe it shall be eliminated.	30% and 100% Design Submittals	2.9.4.a

No.	Title	Deliverable	For	Section
16	Design Review	As part of the Design Review, the following phases shall be required : 1) Preliminary Design Review (30% Design Sub-Phase) Contains drawings and description of operation at a 30% design level including preliminary plans for all disciplines (e.g. demolition, phasing and construction) as required to verify the compliance of the design solution. In addition, draft versions of operation and maintenance handbooks, training manuals and a preliminary acceptance test plan shall be submitted. 2) Final Design Review (100% Design Sub-Phase) Contains final drawings and description of operation at a 100% design level including preliminary plans for all disciplines (e.g. demolition, phasing and construction) as required to verify the compliance of the design solution. In addition, final versions of operation and maintenance handbooks, training manuals, certificates and the acceptance test plan shall be submitted.	30% and 100% Design Submittals	2.9.5.c
17	Acceptance Testing	Contractor shall be responsible for developing a complete test plan for approval by the Project Manager.	30% and 100% Design Submittals	2.9.6.a
18	Verification of Operational Reliability	The revised operating and maintenance procedures and manuals shall be submitted to the Project Manager as a condition for Final Completion	30% and 100% Design Submittals	2.9.8.c
19	Maintenance Handbook	Maintenance handbooks shall be updated reflecting new equipment, maintenance procedures, maintenance intervals and all other relevant documentation to ensure that the system is receiving the required maintenance	30% and 100% Design Submittals	2.10.c
20	Spare Parts List	Contractor shall submit a revised list of spare parts for the entire system as part of the system Design Review including part name, supplier name and address, part numbers, required stock level, component cost and lead times.	30% and 100% Design Submittals	2.11.b
21	Training Program	Contractor shall provide a training program and schedule for training all local operators on the upgraded system as defined in ANSI/ASCE/T&DI 21.4-08-Part 4, section 15.8.	30% and 100% Design Submittals	2.12.b
22	Training Manuals	Existing training manuals and plans shall be updated to meet the new training requirements and shall include new interfaces at Central Control/Alternate Control.	30% and 100% Design Submittals	2.12.c
23	Hardware Requirement for Console; Alternate Control	Contractor shall verify if this preferred hardware is suitable for the ATC workstations. If other hardware has to be used, Contractor shall notify the Project Manager at the 30% Design Review Submittal.	30% Design Submittal	3.2.3.e
24	Hardware Requirement for Console; Central Control	Contractor shall verify if this preferred hardware is suitable for the ATC workstations. If other hardware has to be used, Contractor shall notify the Project Manager at the 30% Design Review Submittal.	30% Design Submittal	3.3.3.e
25	Switching Between Control Facilities	The switching functionality shall be part of the Design Review process.	30% and 100% Design Submittals	3.4.e
26	ATC Equipment and Interfaces	The designs of Contractor’s replacement CITYFLO 550 ATC equipment and its interfaces to the existing ATC system shall be addressed in their respective Preliminary and Final Design.	30% and 100% Design Submittals	3.8.g

No.	Title	Deliverable	For	Section
27	ATC Equipment and Interfaces	Equipment additions or changes in New Central Control Facility and the Central Control Console shall be identified in the Central Control Design Layout.	30% and 100% Design Submittals	3.8.h
28	Human Interface Layout	The Central Control Console unit shall be designed so that one operator can respond to all system requirements during off-peak conditions. The design, layout, displays, information displayed, controls, and operator interfaces of this console shall be developed by Contractor based on a human factors analysis and submitted for review as part of the Central Control Console Design Reviews .	30% and 100% Design Submittals	3.8.3.2.b
29	Human Interface Functions	Subject to Section 3.8.3.1 the Central Control Console shall have the control functions described below. The Contractor shall identify and describe control functions during the Design Review.	30% and 100% Design Submittals	3.8.3.8.d
30	System Alarms Reporting	Contractor shall develop a list of Priority I, and II, malfunctions and others if necessary. The list shall reflect both the unique characteristics of the contractor's equipment and the proposed operational and response procedures and shall be provided at the appropriate Design Review.	30% and 100% Design Submittals	3.8.3.10.e

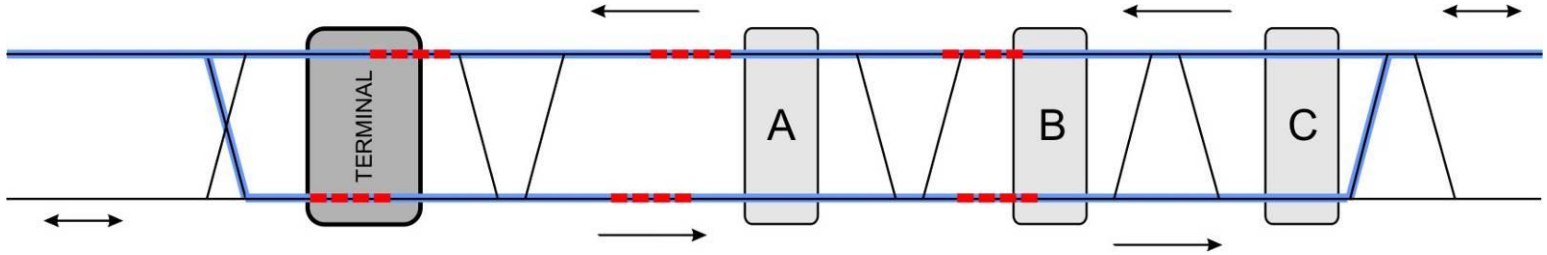
4.2 ATTACHMENT B: MODES (TRAINS SHOWN FOR ILLUSTRATION ONLY)

4.2.1 Mode 1: West Main Terminal



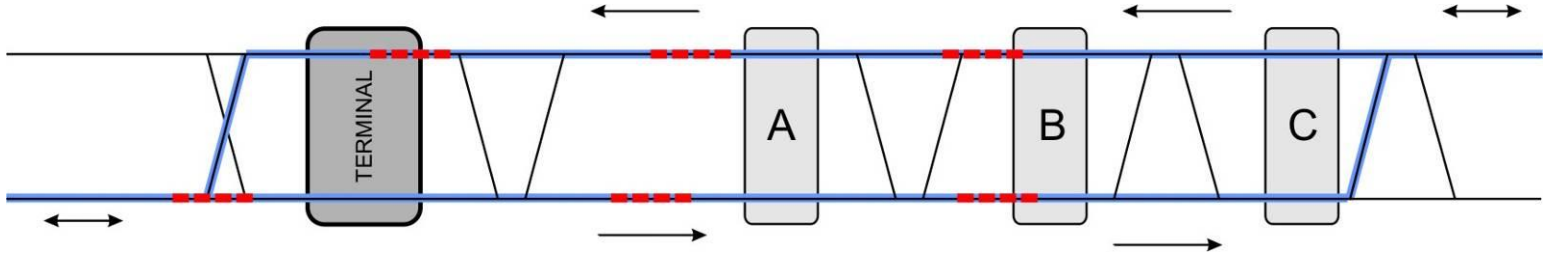
4.2.1.a

4.2.2 Mode 1a: West Main Terminal Long Loop C West



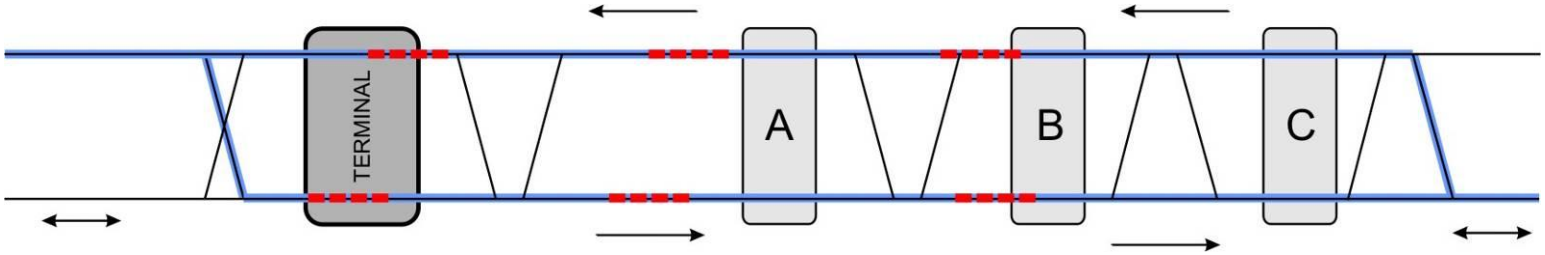
4.2.2.a

4.2.3 Mode 1b: East Main Terminal Long Loop C West



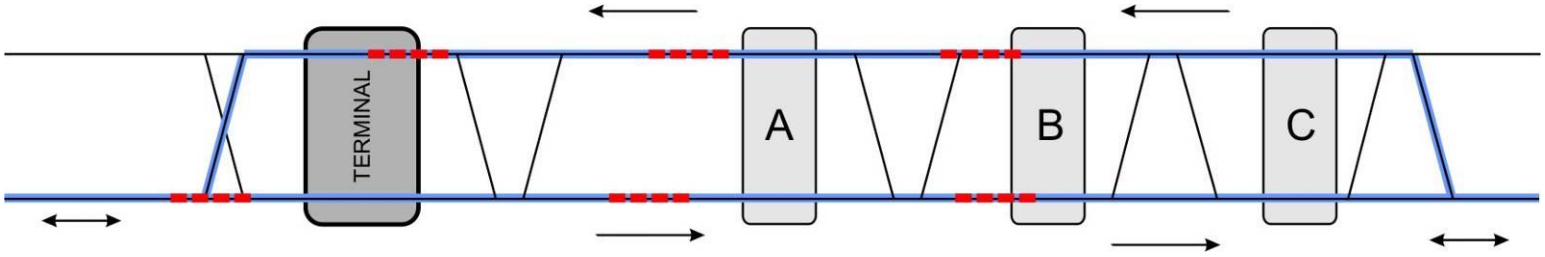
4.2.3.a

4.2.4 Mode 1c: West Main Terminal Long Loop C East



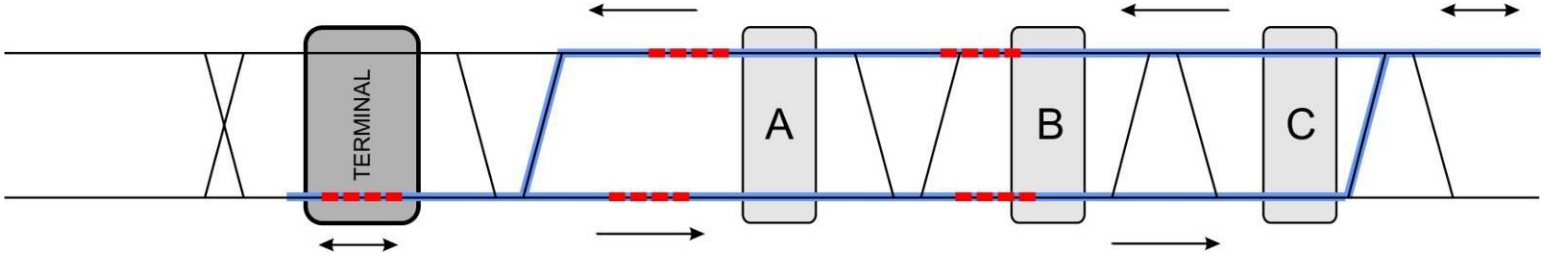
4.2.4.a

4.2.5 Mode 1d:East Main Terminal Long Loop C East



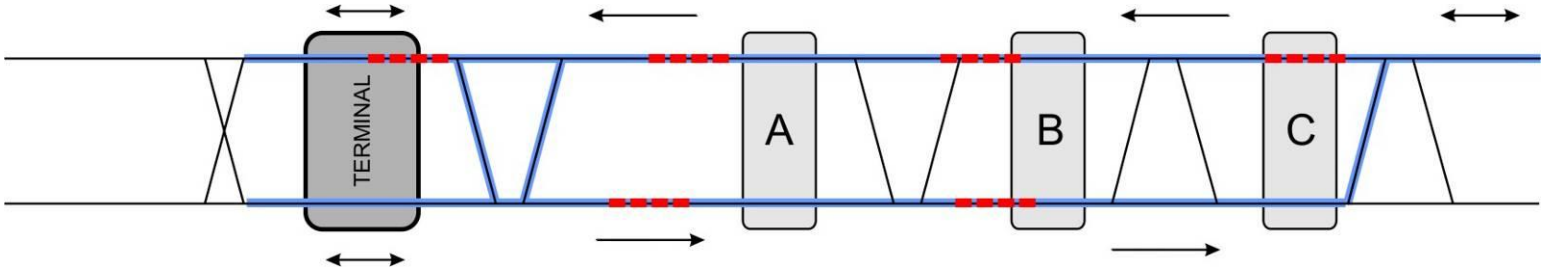
4.2.5.a

4.2.6 Mode 2: East Main Terminal



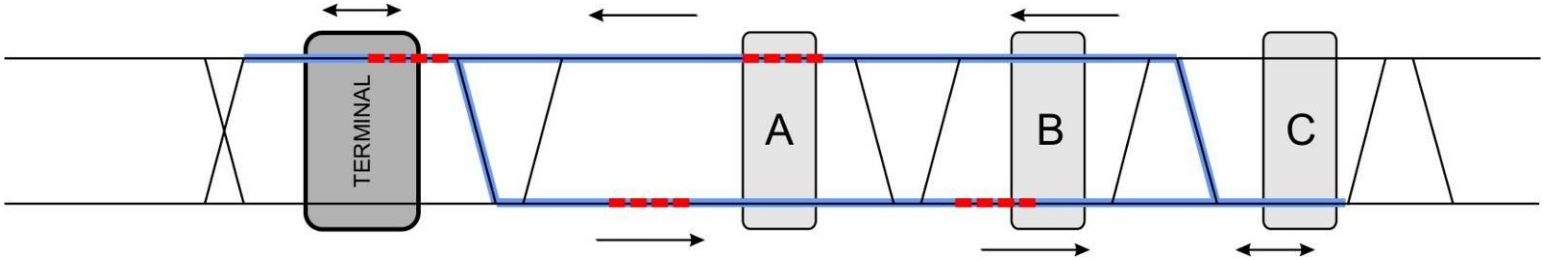
4.2.6.a

4.2.7 Mode 3: Alternate Main Terminal



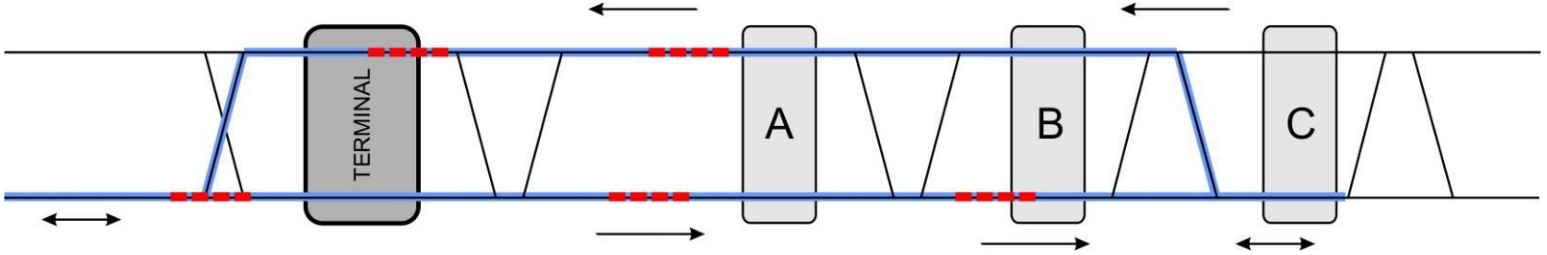
4.2.7.a

4.2.8 Mode 4: Bypass West Concourse



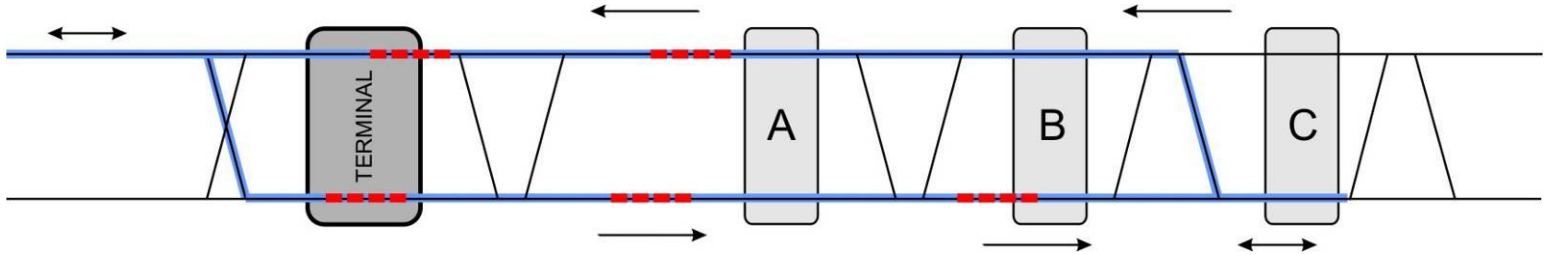
4.2.8.a

4.2.9 Mode 4a: Bypass C West East Main Long Loop



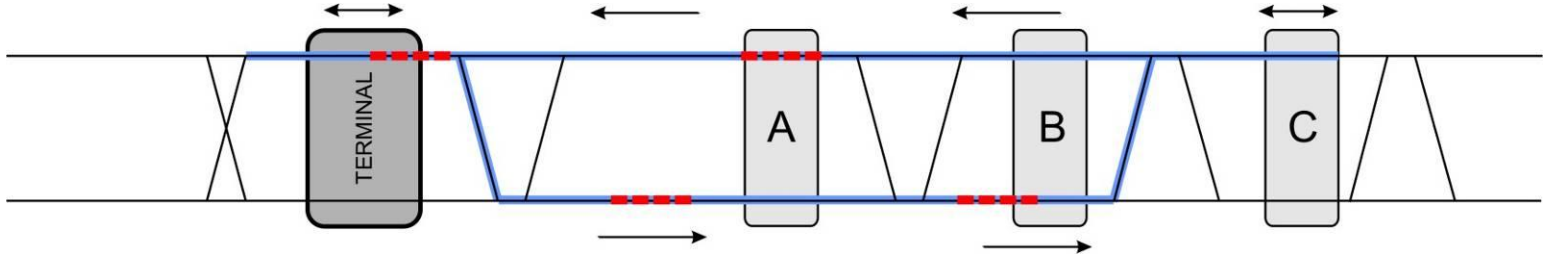
4.2.9.a

4.2.10 Mode 4b: Bypass C West West Main Long Loop



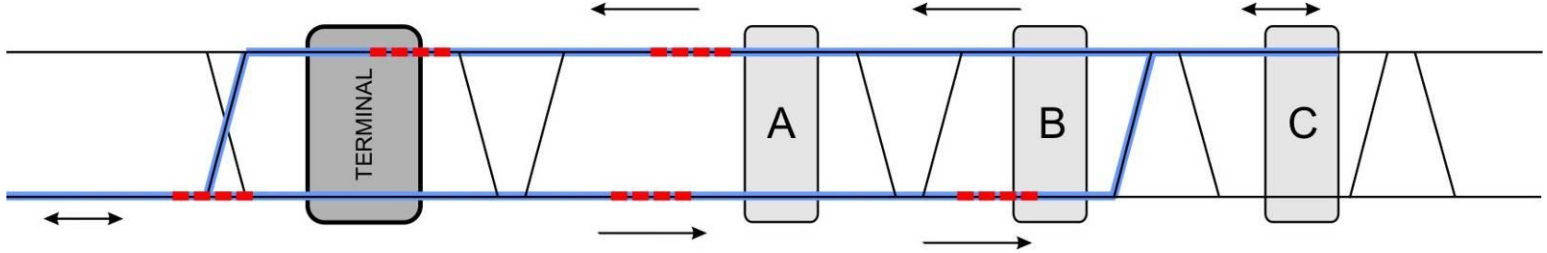
4.2.10.a

4.2.11 Mode 5: Bypass East Concourse C



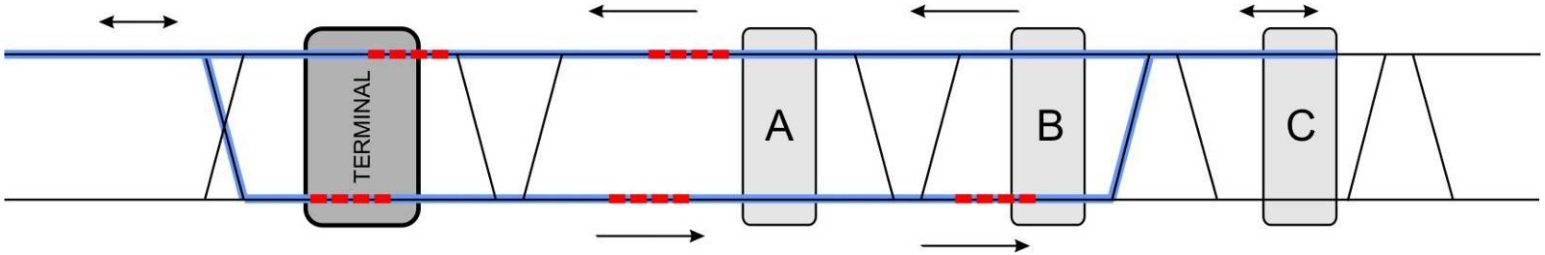
4.2.11.a

4.2.12 Mode 5a: Bypass C East West Main Long Loop



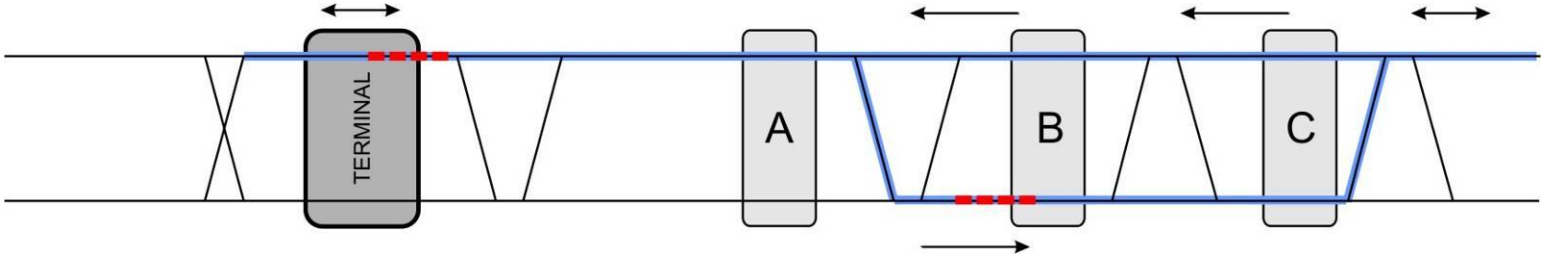
4.2.12.a

4.2.13 Mode 5b: Bypass C East West Main Terminal



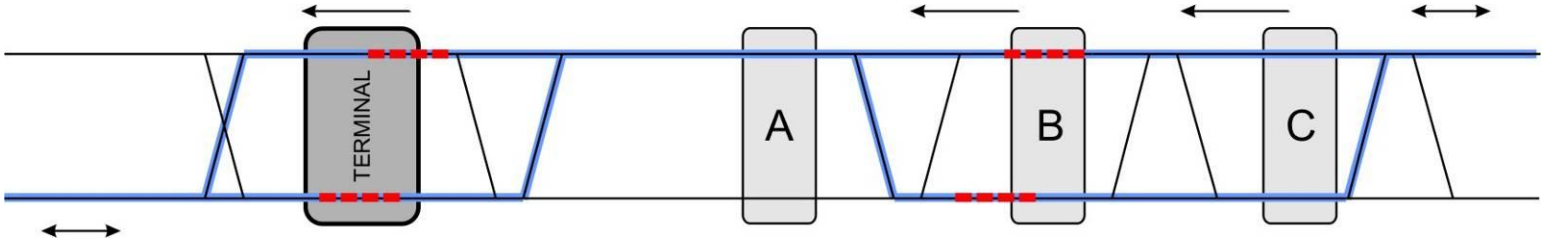
4.2.13.a

4.2.14 Mode 6: Bypass East Main Terminal and East A



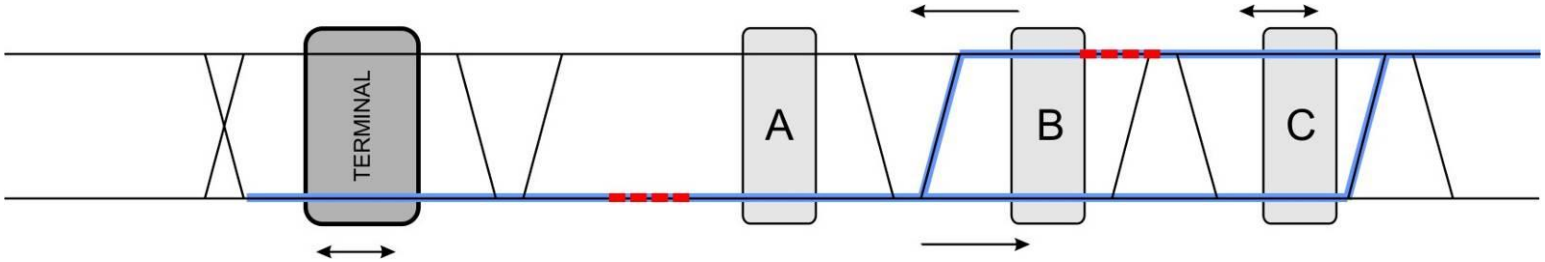
4.2.14.a

4.2.15 Mode 6a: Bypass East A Main Terminal Long Loop



4.2.15.a

4.2.16 Mode 7: Bypass West Main Terminal and West A



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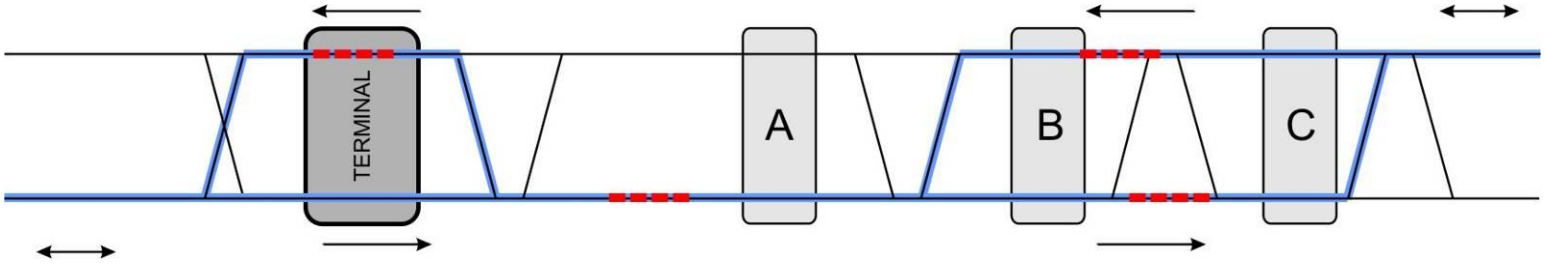
4.2.17 Mode 7a: Bypass West A Main Terminal Long Loop



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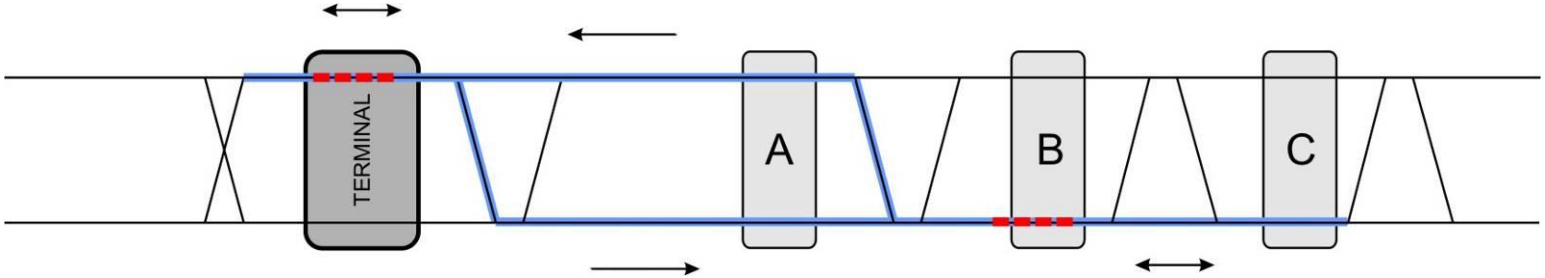
4.2.18 Mode 8: Bypass West B and West C



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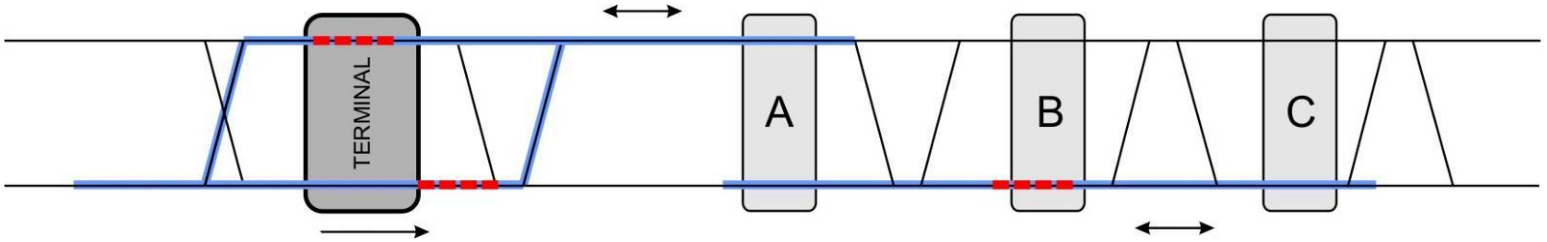
4.2.19 Mode 8a: Main Terminal A Loop / A to C Shuttle



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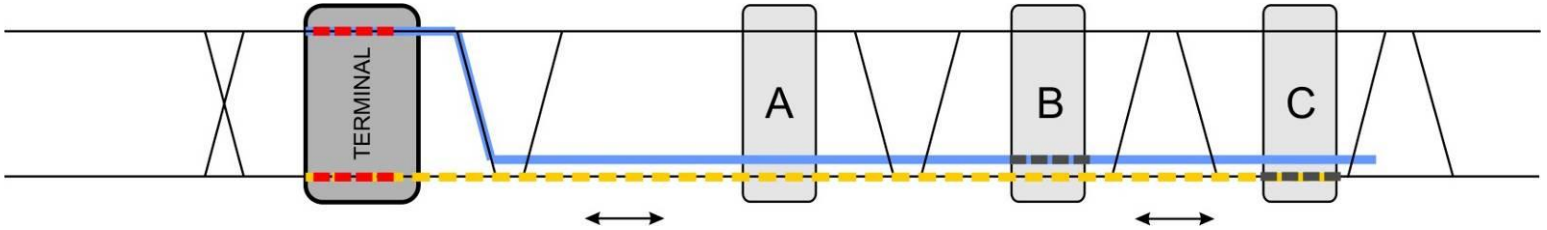
4.2.20 Mode 8b: Bypass B West Following Shuttle



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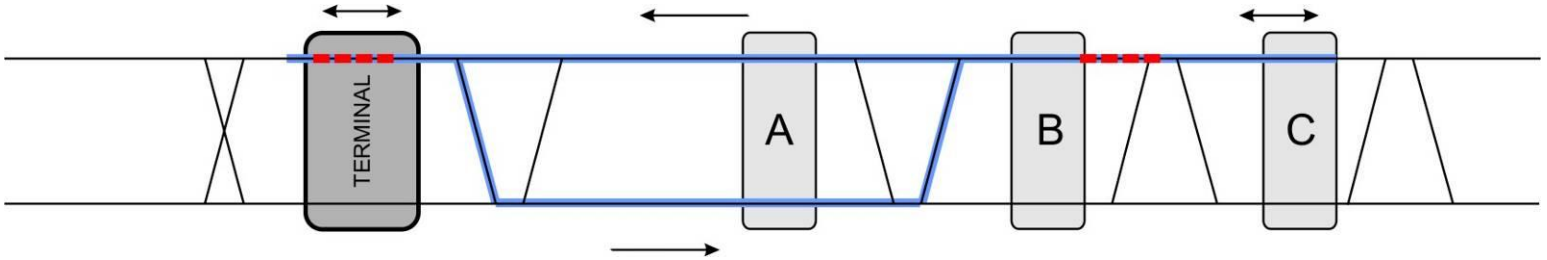
4.2.21 Mode 9: Bypass East B and East C



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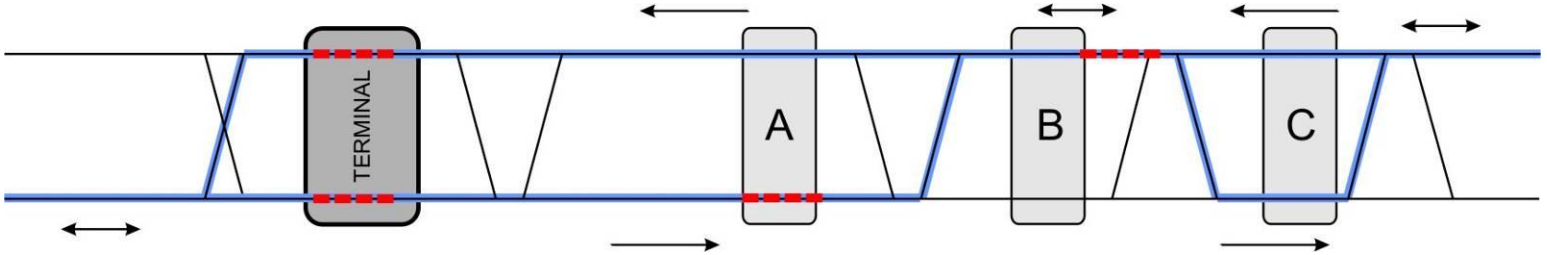
4.2.22 Mode 9a: Bypass East B East Main Terminal Long Loop



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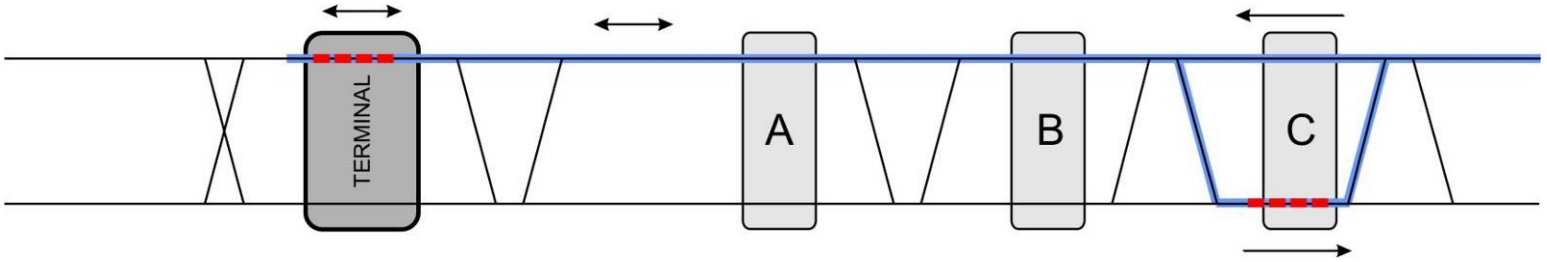
4.2.23 Mode 10: Bypass East A and East B



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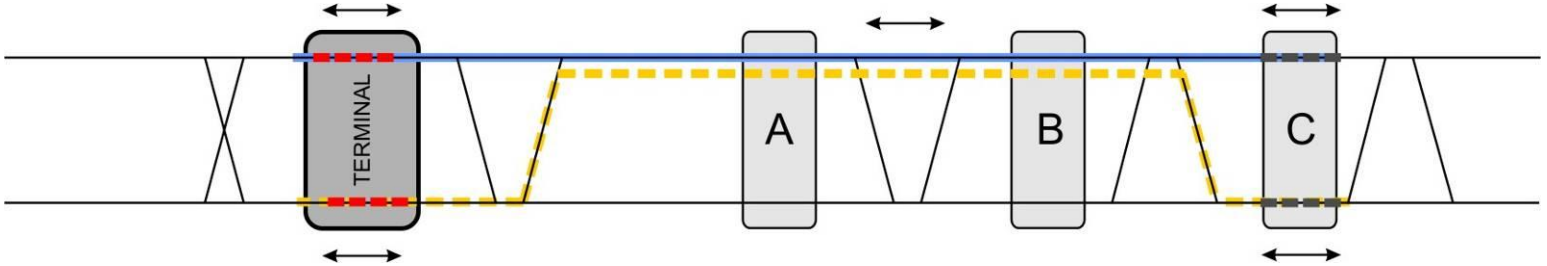
4.2.24 Mode 10a: Bypass East A and East B Following Shuttle



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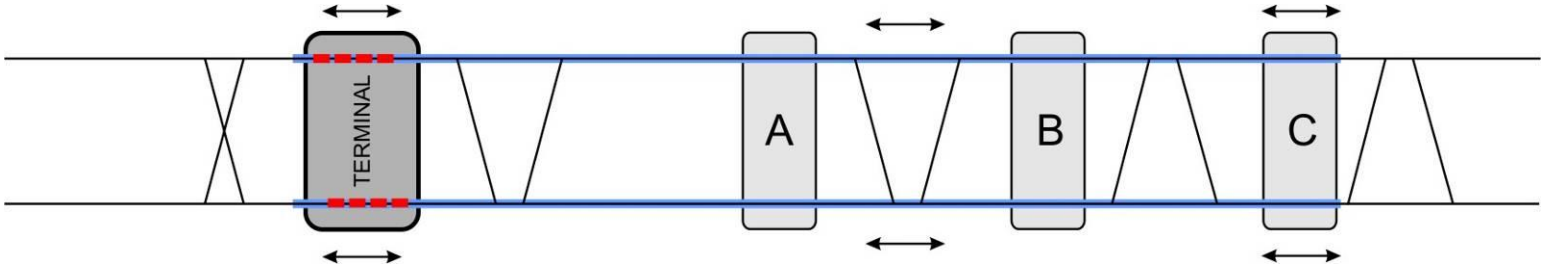
4.2.25 Mode 11: Synchronized Double Shuttle



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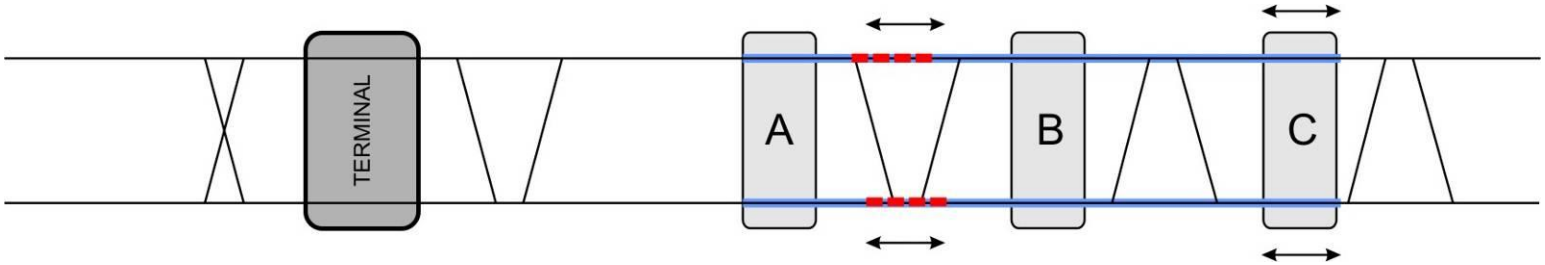
4.2.26 Mode 12: Concourse A to C Double Shuttle



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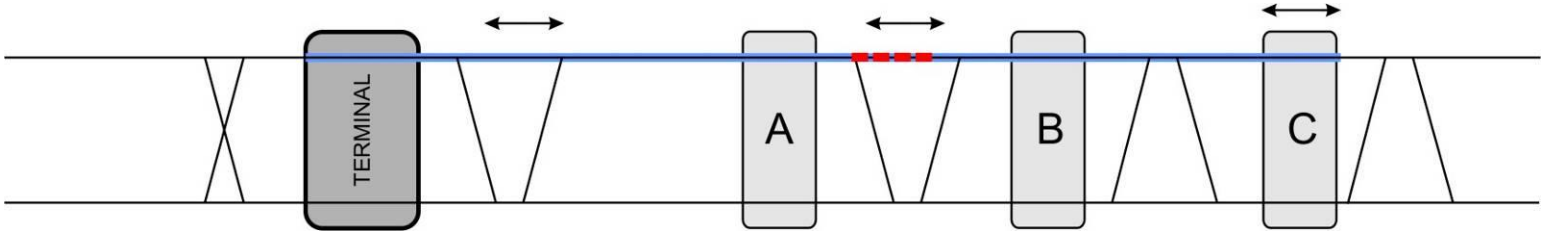
4.2.27 Mode 13: West Single Shuttle



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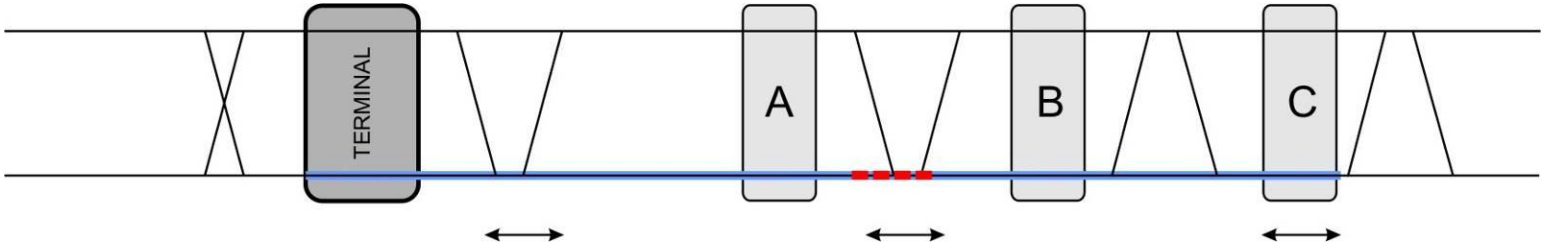
4.2.28 Mode 14: East Single Shuttle



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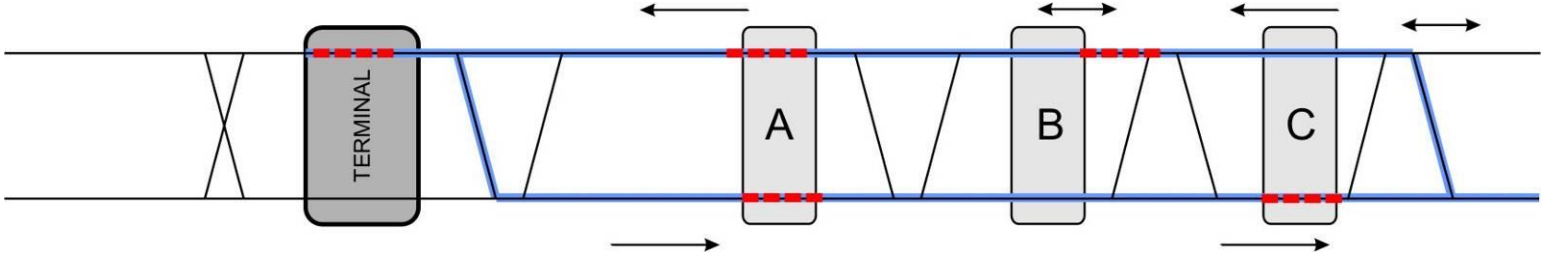
4.2.29 Mode 15: West Main Terminal / Alternate Turnback



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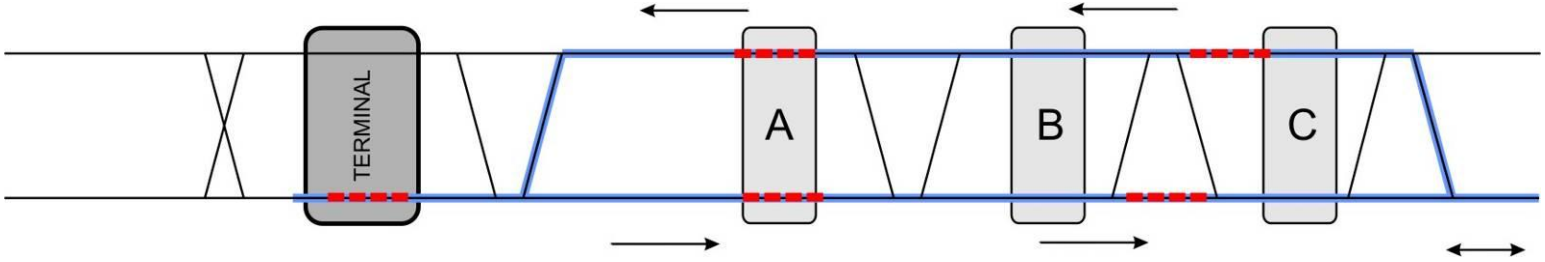
4.2.30 Mode 16: East Main Terminal / Alternate Turnback



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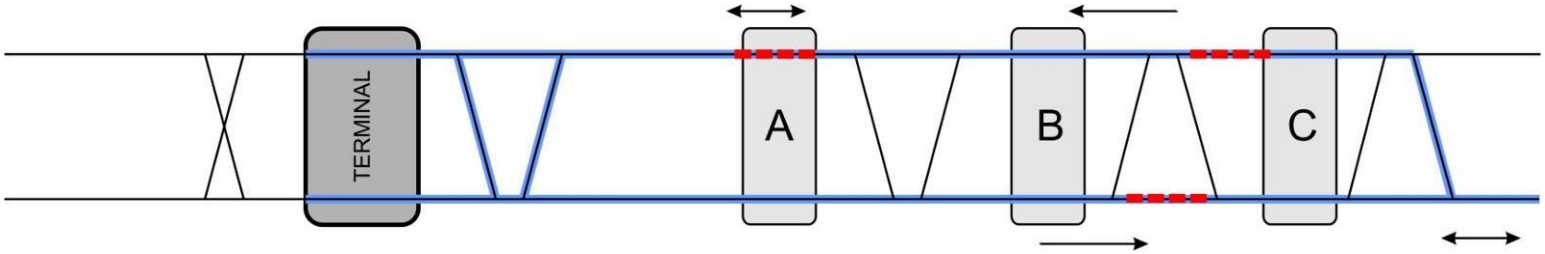
4.2.31 Mode 17: Alternating Main Terminal / Alternate Turnback



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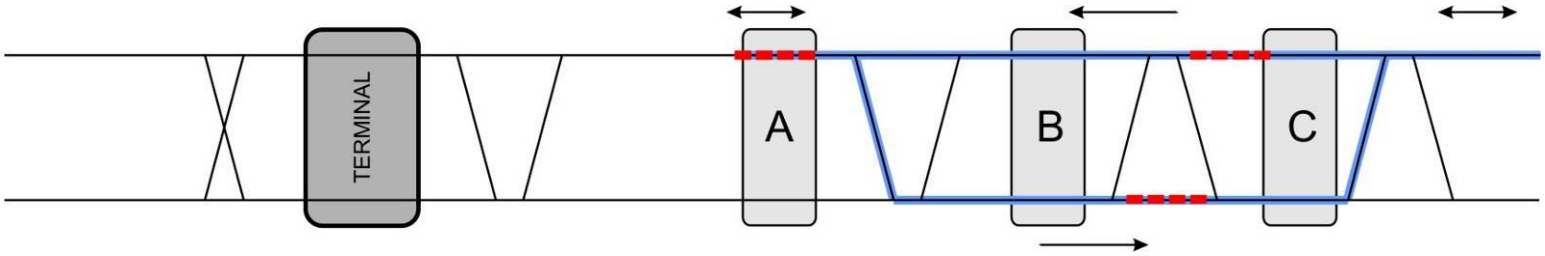
4.2.32 Mode 18: West A / A to C Loop



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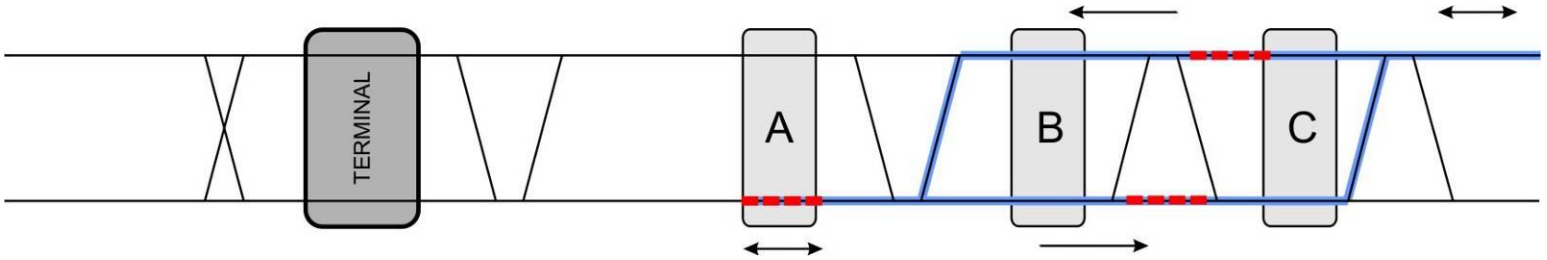
4.2.33 Mode 19: East A / A to C Loop



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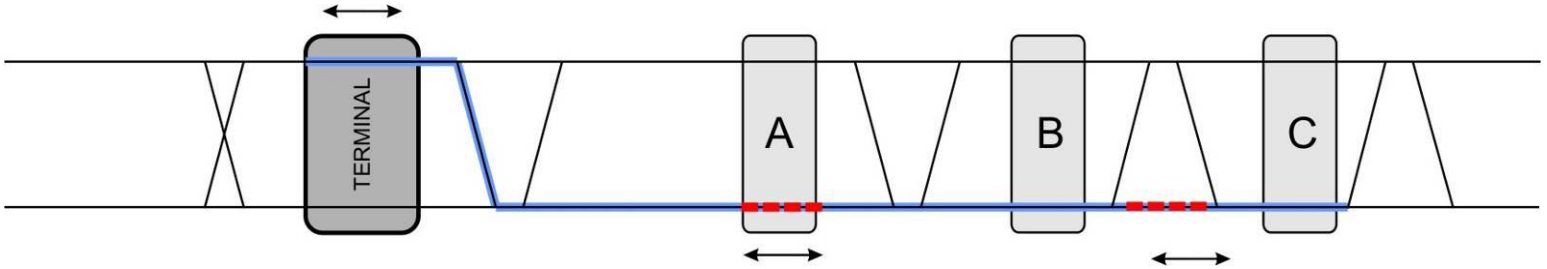
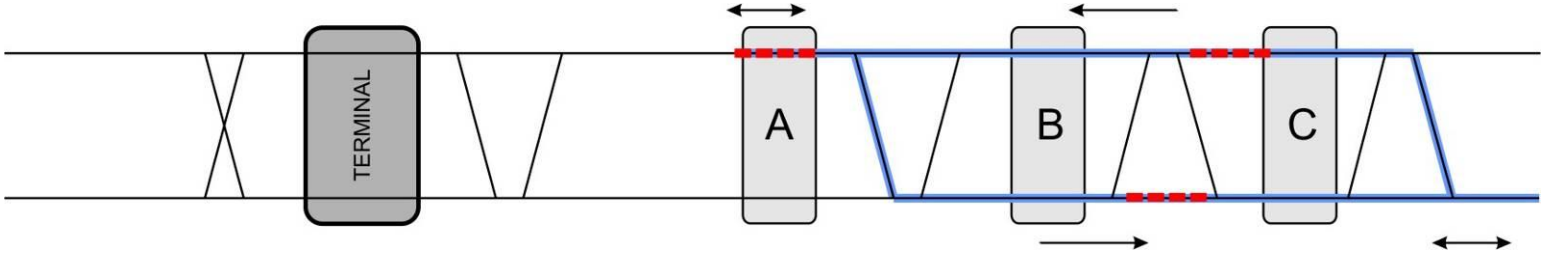
4.2.34 Mode 20: East Shuttle / West Main Terminal



4.2.34.a

4.2.35 Mode 21: West A / Alternate Turnback / A to C



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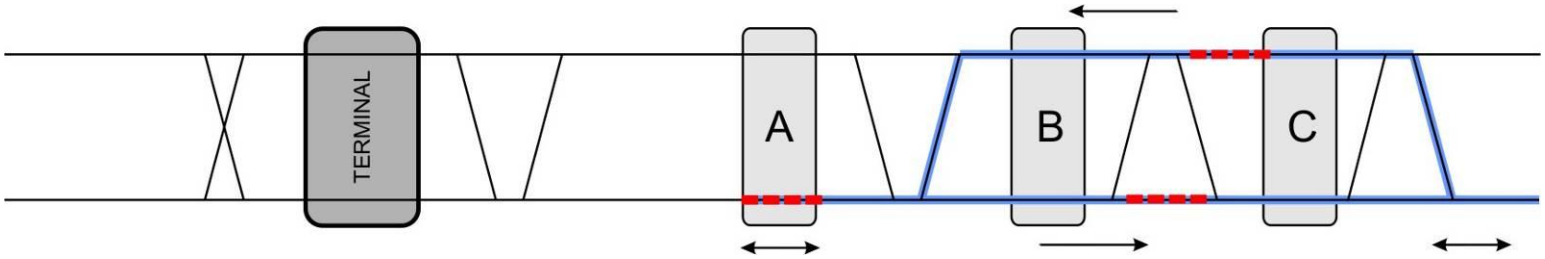
4.2.36 Mode 22: East A / Alternate Turnback / A to C



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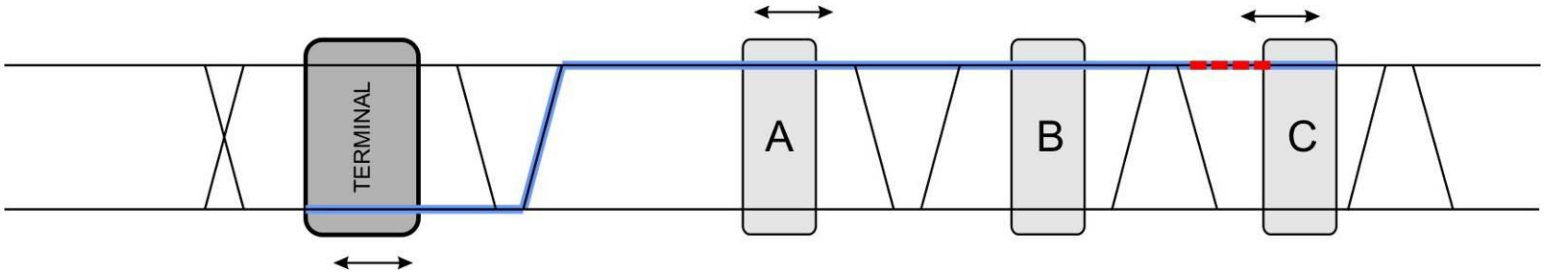
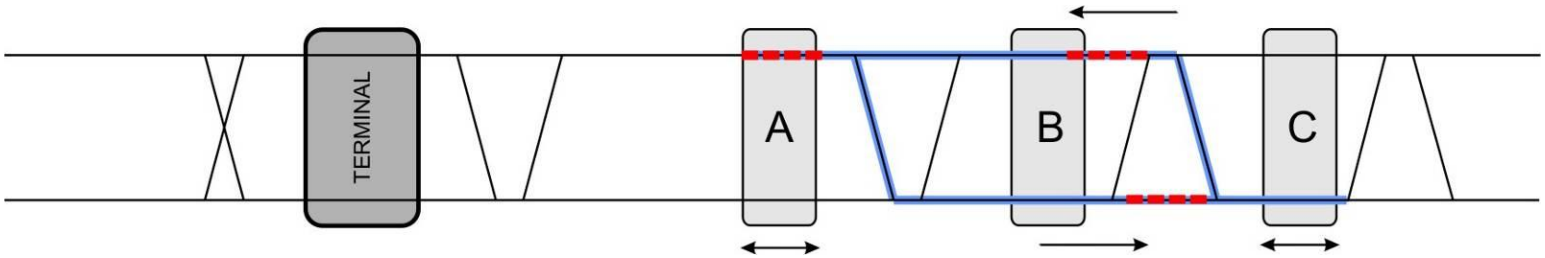
4.2.37 Mode 23: West Shuttle / East Main Terminal



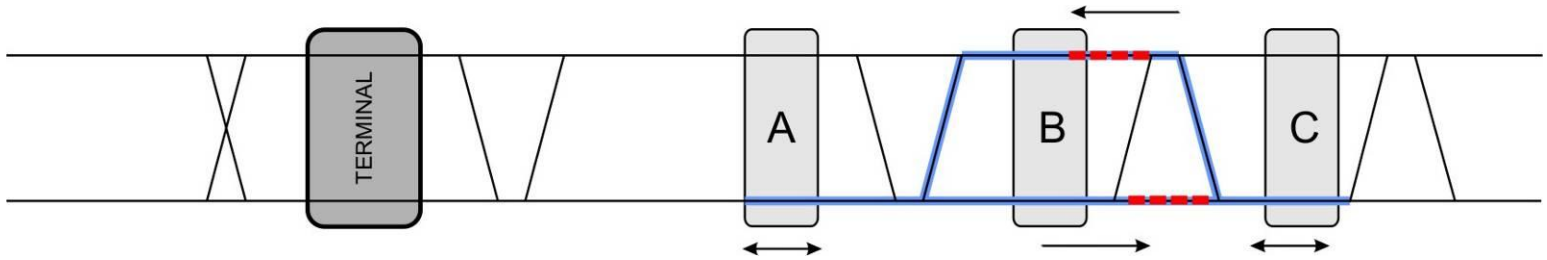
4.2.37.a

4.2.38 Mode 24: West A / A to C Loop Bypass West C



4.2.38.a

4.2.39 Mode 25: East A / A to C Loop Bypass West C



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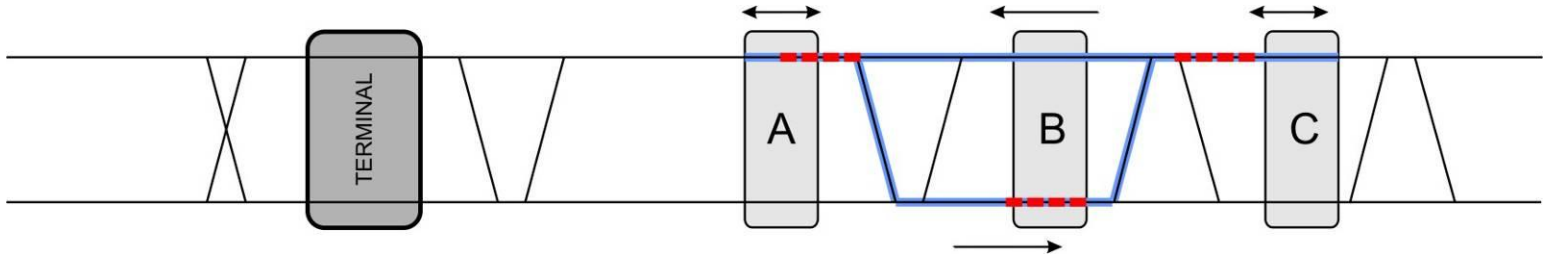
4.2.40 Mode 26: West A / A to C Loop Bypass East C



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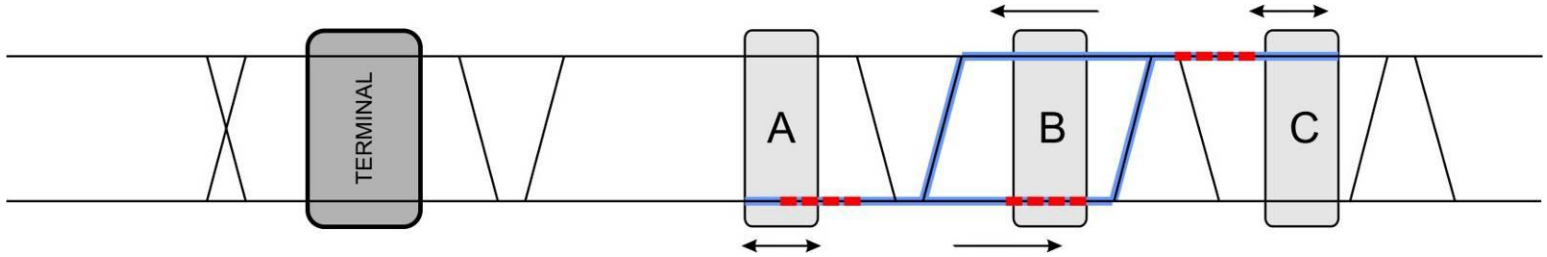
4.2.41 Mode 27: East A / A to C Loop Bypass East C



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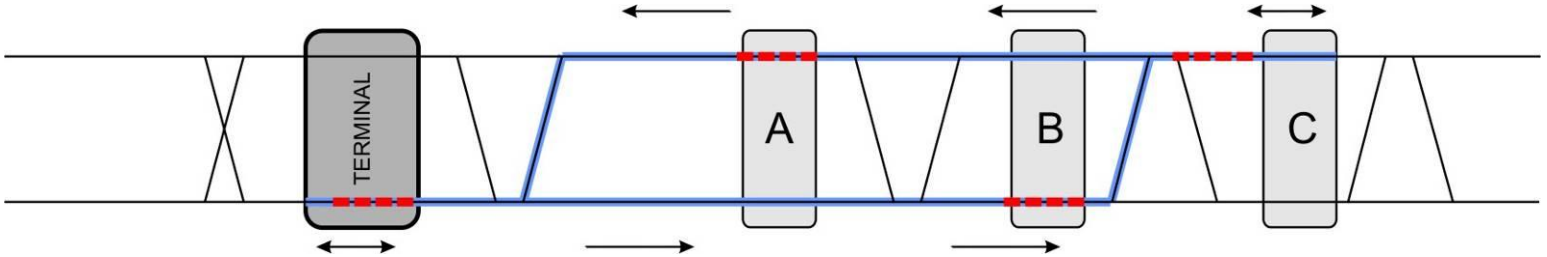
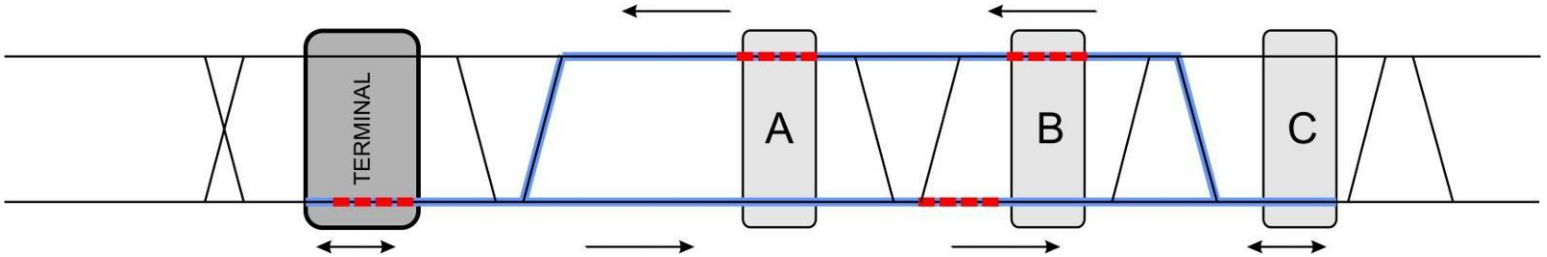
4.2.42 Mode 28: East Main Terminal / Bypass East C



4.2.42.a

4.2.43 Mode 29: East Main Terminal / Bypass West C



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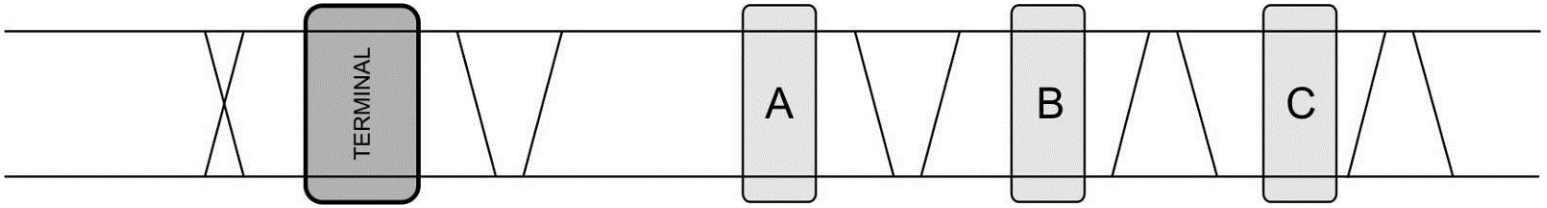
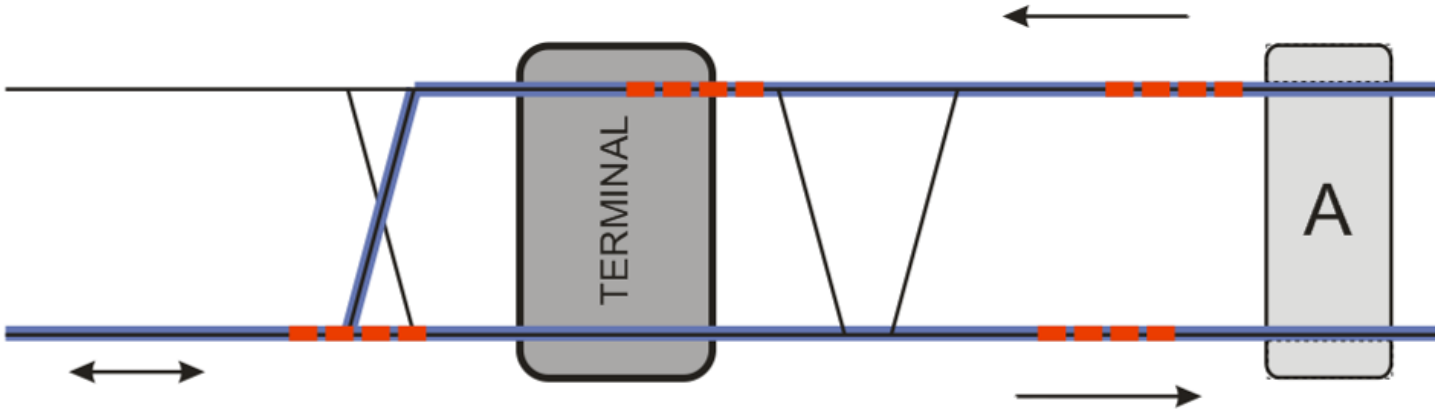
4.2.44 Mode 30: Manual Mode



4.2.44.a

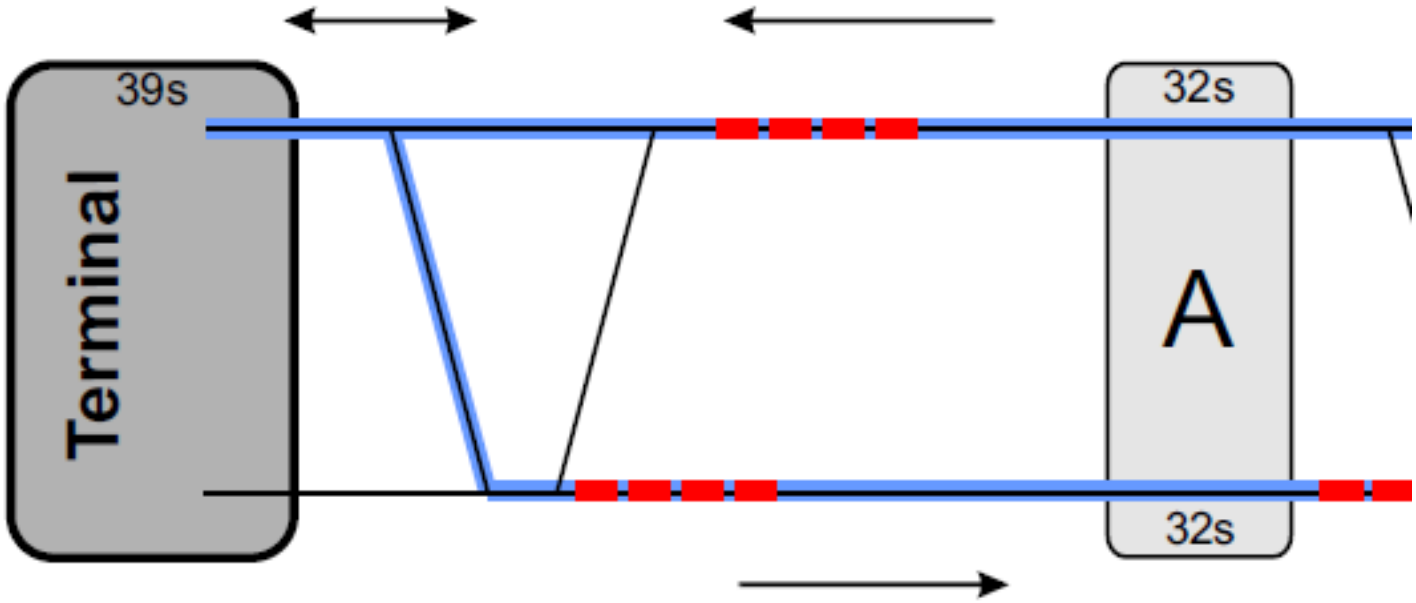
4.3 ATTACHMENT C: FIGURES

4.3.1 Figure 2-1: Future Long Loop



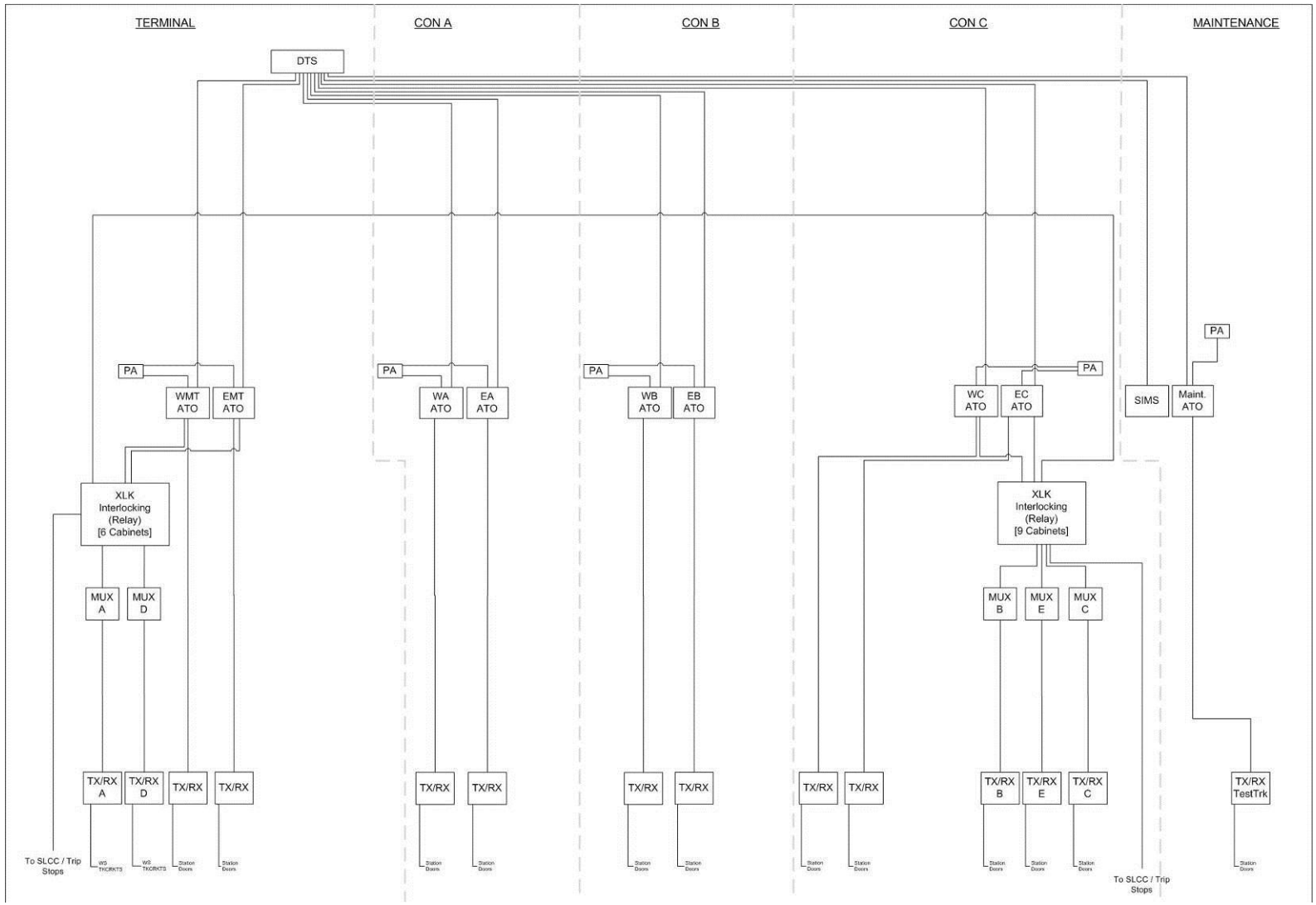
4.3.1.a

4.3.2 Figure 2-2: Normal Mode



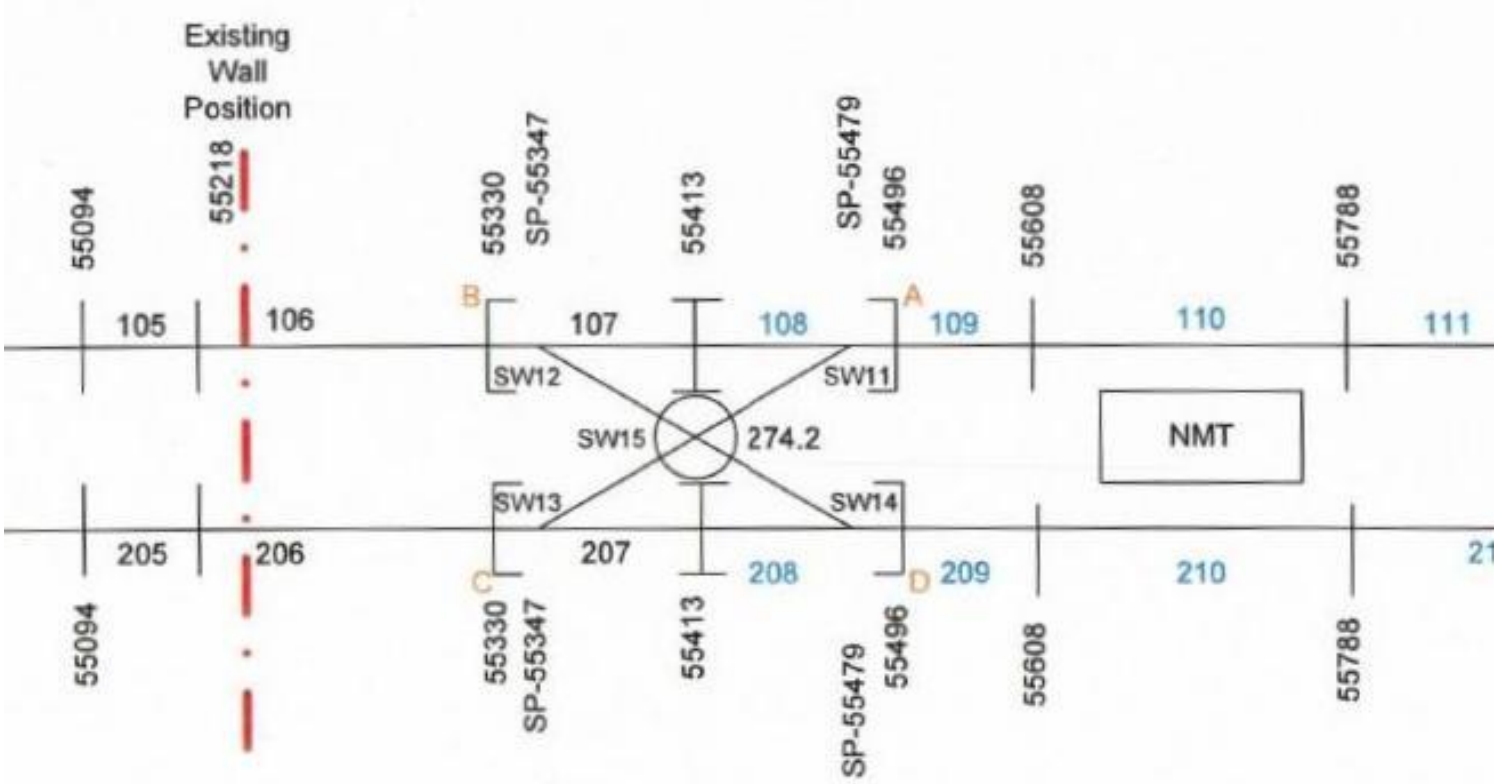
4.3.2.a

4.3.3 Figure 2-3: Existing System Architecture



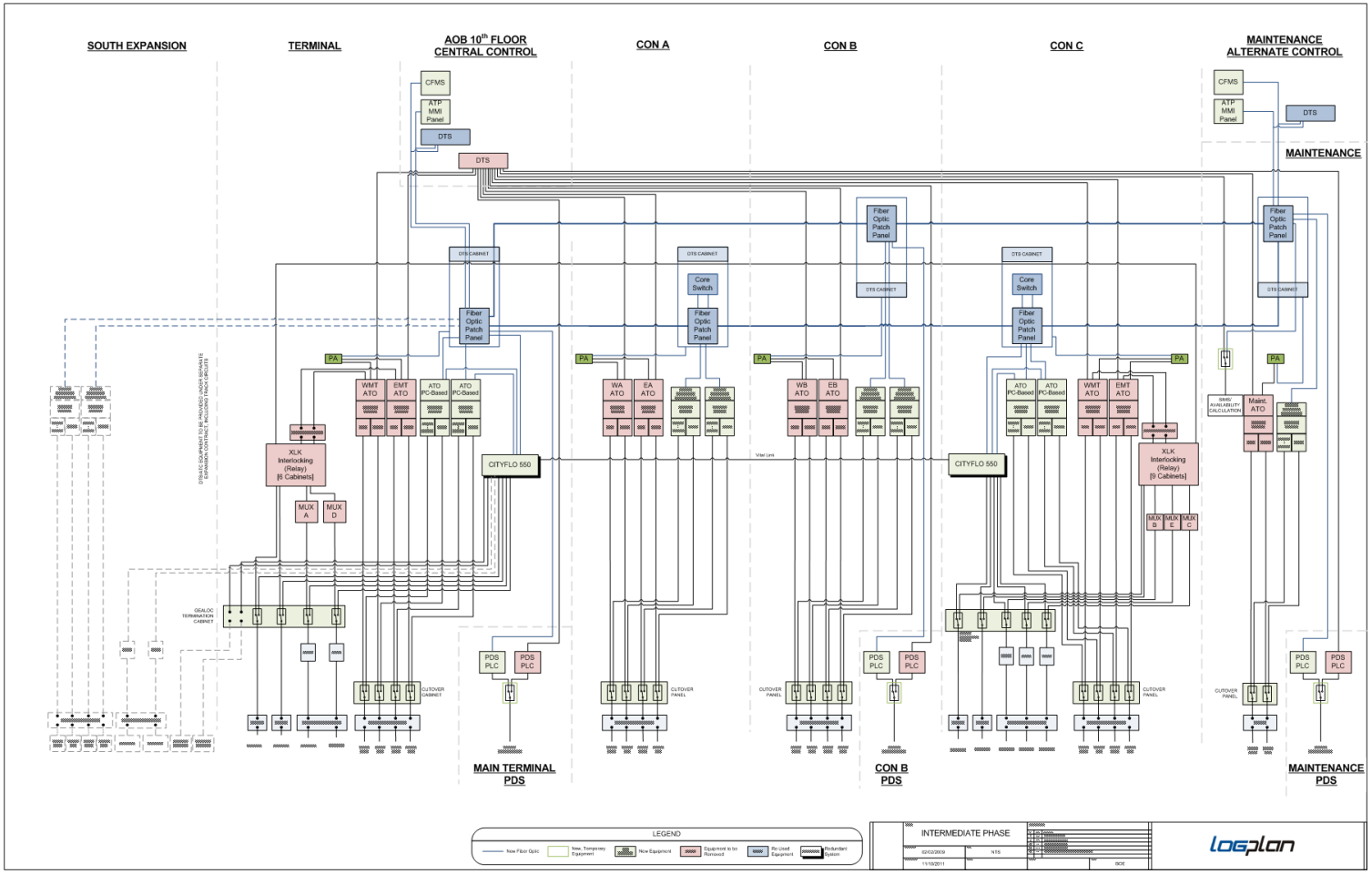
4.3.3.a

4.3.4 **Figure 2-4: Overview of Ongoing South Expansion Project**



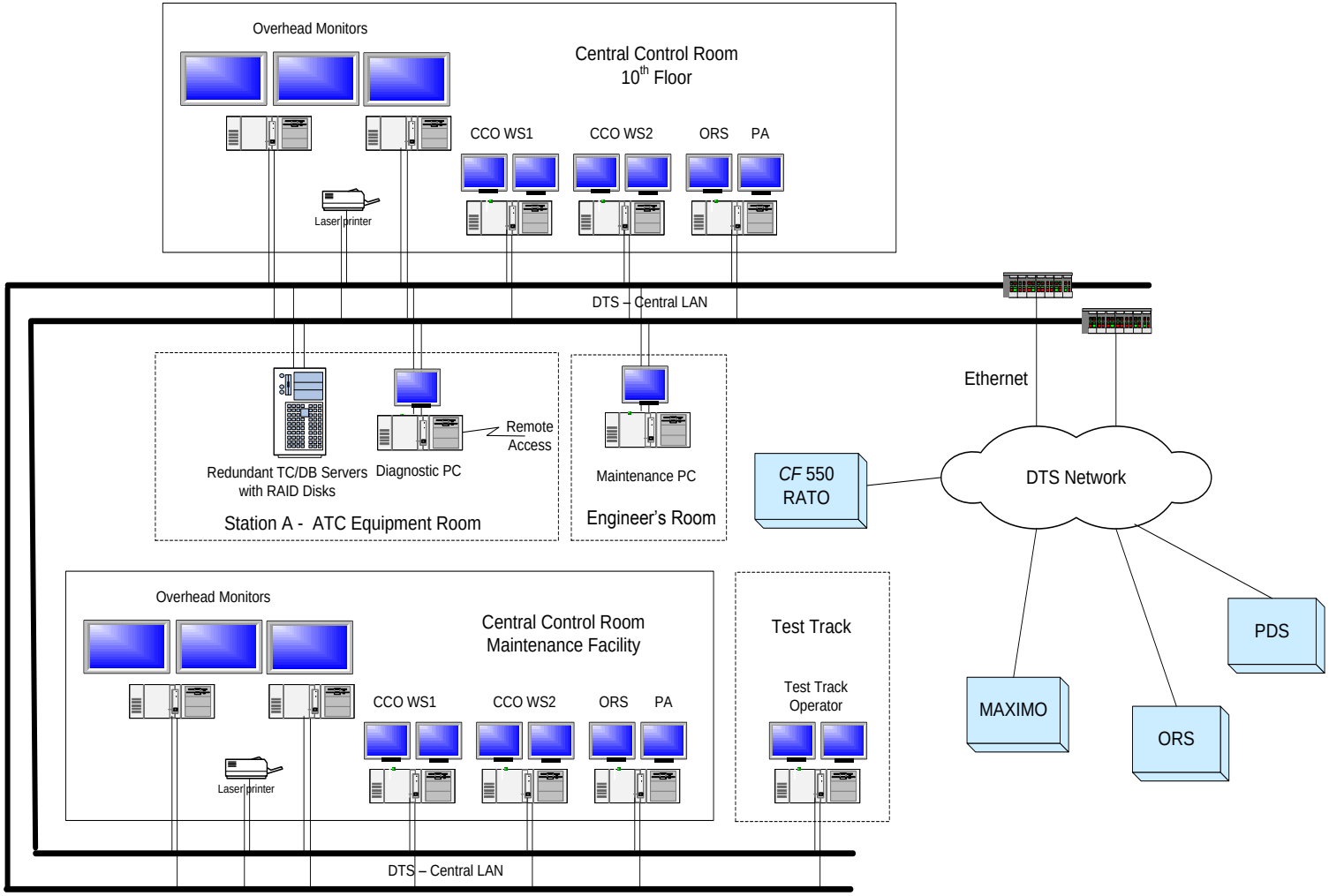
4.3.4.a

4.3.5 Figure 2-5: Cut-Over Cabinet Configuration



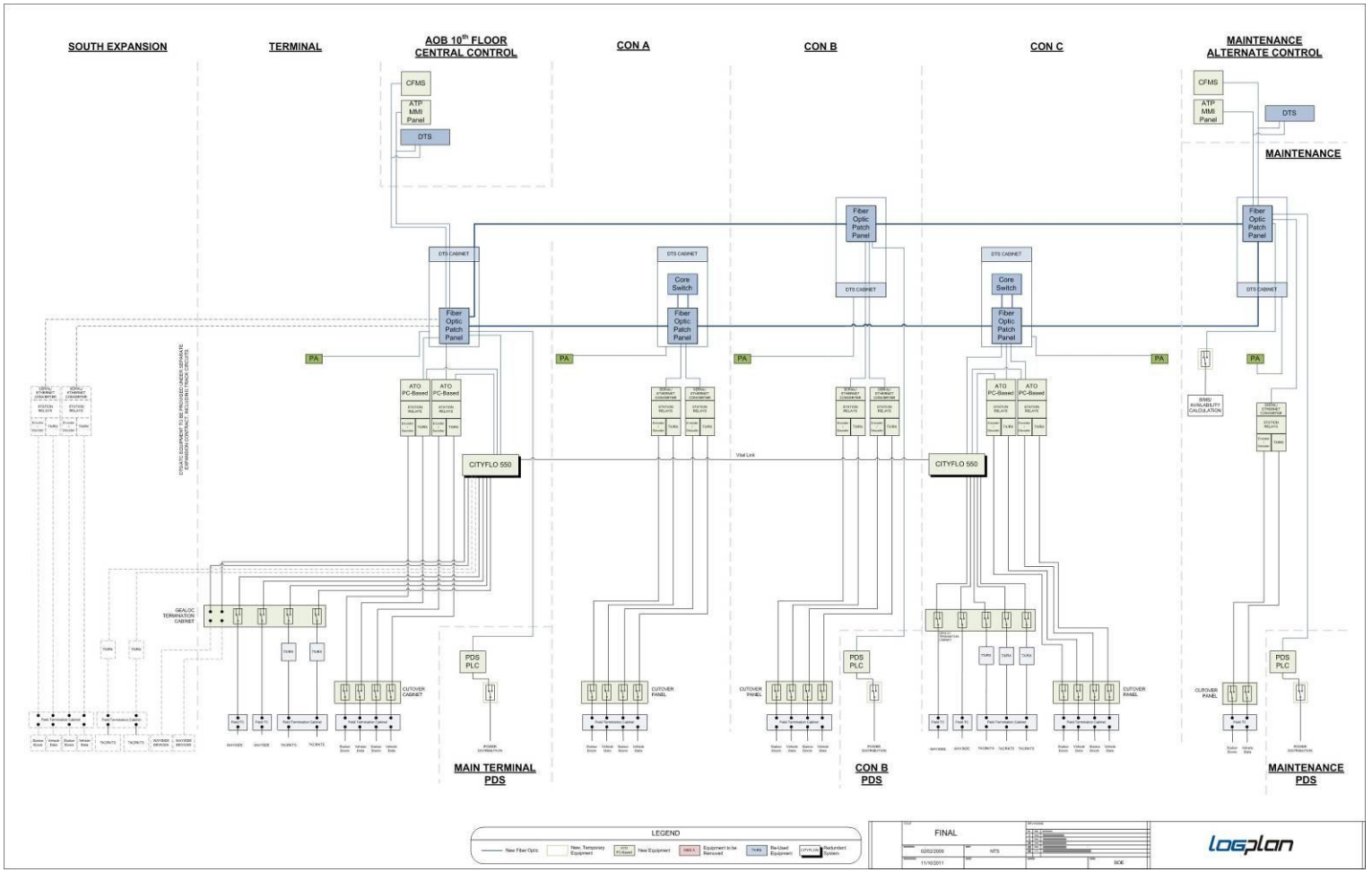
4.3.5.a

4.3.6 Figure 3-1: AGTS Central Control Architecture



4.3.6.a

4.3.7 Figure 3-2: ATC CITYFLO 550 System Configuration



4.3.7.a

PROJECT MANUAL

DENVER INTERNATIONAL AIRPORT

CONTRACT NO.
201207703

Exhibit C

Project Management Provisions

Issued for Construction September 2012

CITY & COUNTY OF DENVER
DEPARTMENT OF AVIATION

Project Management Provisions
Contract No. 201207703

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PROJECT MANAGEMENT PROVISIONS

PM-1 AIRPORT RULES AND REGULATIONS

Any and all City and Airport, safety, security, badging, vehicle permitting environmental requirements , radio and cell phone communications, necessary for the performance of this Contract will be coordinated and identical to those in place or modified by CE 1A001. This list is not complete.

PM-2 ON-SITE WORK SEQUENCE AND CONSTRAINTS

The Contractor has the Operation and Maintenance Contract for the AGTS System under CCD Contract Number CE 1A001. The Work in this Contract must be performed in strict compliance with the availability requirements of the operating system. The Contractor's Project Manager for this Contract must ensure that all activities associated with the Work is coordinated with the Denver on-site AGTS Operation and Maintenance team.

A. Project Field Office, Equipment Storage and Staging

The Contractor is expected to use an office location dedicated to the project within the existing AGTS Maintenance Facility. The office or the maintenance facility must provide the necessary furnishings and equipment to conduct the project meetings and communicate with the Contractor's engineering and production facility. In addition the contractor will use space within this facility for the receipt of equipment and the staging of the Work required in this contract. If additional space is required the contractor shall coordinate this request with the DIA Project Manger

B. Work Sequence and AGTS System Access

The Work sequence shall be in compliance with the Contract Documents and in accordance with the approved WBS and Contract Schedule developed by the Contractor. The Contract Schedule shall be in compliance with the requirements indicated in the Contract documents. All AGTS access is to be coordinated with the on-site AGTS O&M team.

The Contractor shall coordinate its access and construction activities with the affected Airlines and Airport operations through the DIA Project Manager.

PM-3 SYSTEM INTERRUPTIONS

AGTS system interruptions or changes in operating availability that is required as a result of the Work in the Contract must be coordinated and scheduled with the Project Manager and the AGTS O&M team and may only be scheduled during times specified in the technical specifications. A special system service alteration form will be developed by the Contractor and submitted for approval by the Project Manager prior to any alterations or changes in service are approved.

The request forms shall be submitted only during the normal work week (Monday through Friday) between 8:00 AM and 4:00 PM unless otherwise noted all shutdown requests are required 72 hours before the requested shutdown time. For the

Electrical System and Fire Systems, submit requests five (5) working days prior to the time of requested interruption.

Upon approval of a system shutdown, the Contractor's representative and the individuals performing the Work shall remain at the Work site and in contact with Maintenance Control at (303) 342-2800, until such time as the system is restored to working condition. The requesting party shall assume liability for the system until the system is restored to proper working order.

The Contractor shall not proceed with the system shutdown without a signed copy of the appropriate System Shutdown Request and authorized City representative at the system shutdown location.

The complete shutdown of the system where no automated service is available for passengers or Airport employees will require approval and scheduling with the City Project Manager. The City will provide seventy (70) days of alternate transportation service from the hours of 1AM until 4AM. These seventy (70) days are to be identified and are to appear on the Contract Schedule. An approved shutdown request is required for these non-shuttle service days.

It is understood that the AGTS operation is critical and that at any time is may be necessary to alter these complete shutdown periods. Due to unforeseen issues which develop due to airport operations, all efforts will be made by both the airport and the contractor to work together to resolve any difficulties with these shut down days. If, due to airport operations, the contractor is not permitted to work on an approved shutdown period, the City will grant the Contractor additional time in the Contract Schedule to complete the Work.

PM-4 COMMUNICATIONS AND DOCUMENTATION BETWEEN THE PARTIES

Denver International Airport Planning and Development Division is actively working towards a complete paperless exchange process for contracts managed in this division. To this end it will be a goal of the contract to provide the required communications and documentations exchange in an electronic paperless fashion where ever possible.

PM-5 OWNERSHIP AND TITLE

Upon the City's issuance of a Certificate of Substantial Completion for the Work, title to the equipment installed under this Contract shall transfer from the Contractor to the City subject to the City's rights under this Contract.

PM-6 MAINTENANCE AND REPAIR

Prior to the issuance of a Certificate of Final Completion for the AGTS Central Control System Upgrade and ATC Replacement, the Contractor shall be solely responsible for the maintenance and repair of the AGTS Central Control System Upgrade and ATC Replacement components. After issuance of the Certificate of Final Completion for the AGTS Central Control System Upgrade and ATC Replacement, responsibility for maintenance and repair of equipment shall rest solely on the City, subject to the

City's rights under warranty according to this Contract. Software components of the AGTS Central Control System Upgrade and ATC Replacement shall remain the property of the Contractor, subject to the applicable software license agreement and escrow between the parties.

PM-7 LOSS AND DAMAGE

Until a Certificate of Substantial Completion for the AGTS Central Control System Upgrade and ATC Replacement is issued by the City, the Contractor shall assume the risk of loss, including theft or destruction, and the risk of damage to such AGTS Central Control System Upgrade and ATC Replacement from any and every cause whatsoever, whether or not such loss is covered by insurance.

PM-8 CONTRACTOR'S WARRANTY

The Contractor will guarantee that spare parts will be available for ten years. If original parts or components are no longer available, compatible parts or components can be used if all the requirements of the Technical Specifications will be met by such items The Warranty period for materials and workmanship shall be limited to a period of one year. Warranty shall begin with the begin of the Verification of Operational Reliability phase and start over in the event of a failure during this phase. The Warranty period for the system design shall be limited to five (5) years as specified in the Technical Specifications.

PM-9 CONTRACTORS MANAGEMENT PLAN

The Contractor shall be responsible for the total management of the design, construction, installation, testing, acceptance and demonstration of the system provided under this Contract, pursuant to the terms and conditions thereof. The Contractor shall be responsible for establishing the required organization, procedures and providing personnel and supporting equipment/ facilities to ensure that the project is completed within the time schedule set forth herein. These Contractor responsibilities shall apply from the initial Notice to Proceed until completion of the Work, and final Completion of the Contract.

The organization chart shall identify a single point of contact within the Contractor's organization with the overall technical responsibility of the Work. This individual shall have the authority to make all technical decisions independent from internal organizational structures.

All of the contractor's activities shall be under the direction of its Project Manager who shall be the principal contact between the Contractor and the City. The City shall have the right to approve (or reject) the Contractor's Project Manager and his key technical staff at any time during the contract. All of the Contractor's correspondence, submittal, manuals, analysis, plans, schedule, etc. shall be in the English language.

A. Project Management Plan

Within thirty (30) days after receiving a Notice to Proceed, the Contractor shall submit a Project Management Plan for review and acceptance by the City. This plan shall include, as a minimum, the following items:

1) A listing of key personnel, together with their qualifications, responsibilities and involvement in the Project.

2) A complete Work Breakdown Structure (WBS).

3) A preliminary Contract Schedule.

4) A Schedule of Values proposed as the payment schedule.

5) A preliminary submittal schedule for all deliverables and design review data, as required.

6) A revised and updated Contract Data Requirements List (CDRL).

7) An organization chart showing the Contractor's organization (including subcontractors' organizations) and explanation of how each entity will be involved in this Project, defining their general and project-specific responsibilities and discussing how the individual entities will coordinate their work on this Project.

8) The chart shall also include the responsibilities between departments, communication flows and lines of authority.

It should be noted that certain elements of the Project Management Plan are first to be provided as preliminary and updated/expanded as necessary to reflect the Work progress later in the program.

PM-10 REGULATORY REQUIREMENTS

This Section identifies primary compliance with the State of Colorado and City and County of Denver's regulatory requirements, including the Department of Aviation, Colorado Department of Transportation, the Division of Wastewater Management, Colorado Department of Labor and Employment Division of Oil and Public safety Conveyance Section and the Department of Public Works standards which govern design and construction projects at Denver International Airport.

The Work shall be based on the latest edition of the referenced codes including additions and revisions thereto that are in effect at the time of project bidding.

A. APM Alteration Permit State of Colorado Conveyance Section

The Contractor is responsible to provide the City with the necessary documentation to obtain an alteration permit for the Work covered by this Contract. The Contractor is directed 7 C.C.R.to Section 2.2.1 & 2.2.3 of the state statute for the detailed information that is required for this permit.

B. Building Code

All design and construction Work shall be governed by the Building Code for the City and County of Denver, latest edition, which is based upon the International Building Code with Denver Amendments. Appendix N of the amendments addresses Airport Buildings and Structures.

C. Permits and Certifications

The Contractor shall maintain records on-site of all permits acquired by federal, state, and local agencies. Posting of permits shall conform to requirements of the respective agencies.

At the completion of any inspection by other agencies, the Contractor shall forward copies of the status of the inspection and copies of any approved or "signed-off" inspections by the respective agencies to the Project Manager.

PM-11 PROJECT MEETINGS AND REPORTING

The Work specified in this Section requires the Contractor's Project Manager, Lead Technical Engineer and Quality Control representative to attend project progress meetings to be scheduled as the Work demands by the City for the collection and dissemination of information related to the subject contract. These meetings will take place at DIA and will be attended by the local on-site project team. Attendees from the Contractor's facility can attend by teleconference.

The City's Project Manager will prepare the minutes of each meeting and distribute them to each of the participants.

A. Project Kick-off Meeting

A Project Kick-off Meeting will be scheduled by the City after the Contract has been signed by all parties. The purpose of this meeting is to introduce the City's Representatives to their counterparts in the Contractor's organization and to establish lines of communication between these representatives and outline some contract requirements. The Contractor's Project Manager, Technical Representative and Quality Control Representative(s) shall attend this meeting.

The City's Project Manager will distribute a notice of this meeting, along with an agenda of the subjects to be addressed.

The City's Project Manager will explain and discuss the responsibilities and authorities of the City, the Designer, and the Project Manager's organization.

The Project Manager will provide highlights of the following information at this meeting:

1) Procedures for submitting deliverables, including design review materials.

2) Monthly pay estimate cutoff dates.

3) Payment procedures.

4) Request for information procedures.

5) Communication procedures.

While work is being performed on-site, a daily report showing the quantitative progress of the Work, the use of men, material and equipment, problems, potential delays, weather, shift, down equipment, material and equipment received and

information received from the City. Daily reports will be submitted to the Project Manager within 48 hours of start of the on-site Work. Daily Reports are required every day, including weekends and holidays.

The scheduled meetings will include:

1) Scheduling and coordination requirements including a two-week look-ahead for all scheduled Work activities. Any new
2) work will require a pre-construction meeting to review implementation plan, contingency plans for the new Work.

3) Quality control/assurance procedures.

4) Environmental requirements and permits.

5) As-built documents.

The Contractor will introduce the Contractor's representatives and briefly describe each person's responsibilities. The Contractor will provide the following:

1) A list of all subcontractors.

2) 60 day preliminary Contract Schedule.

B. Pre-construction Meeting

When the Work is scheduled to begin on-site a pre-construction meeting will be scheduled by the Project Manager. An agenda will be distributed prior to the meeting. The purpose of the meeting is to review, and discuss all activities related to the on-site Work to include but not limited to:

1) Coordination of all planned and scheduled activities related to the AGTS operation.

2) Deliveries and priorities of major equipment.

3) The Contractor will introduce their on-site team and their associated responsibilities.

4) The Contractor will present their 60 day preliminary Contract Schedule.

5) CDRL submittals discussion and status update.

6) Quality Control discussion.

C. On-Site Work Progress Meetings

Progress meetings will be scheduled based upon the volume of Work but no less frequent than monthly. There is a need for frequent communications to ensure a complete and timely execution of the contract. As the Work volume dictates progress meetings may be scheduled weekly.

The meetings will be held at the Work site or at a location selected by the Project

Manager. Meetings will be chaired by the Project Manager or the Project Manager's representative.

The Project Manager will be responsible for publishing minutes of the meetings.

At a minimum, the following items will be addressed at each meeting. The items addressed in the meeting do not waive notification or submittal requirements as required elsewhere in the contract.

1) The Project Manager will present and discuss issues regarding quality control and quality assurance.

2) Design activities: open discussion

3) CDRL submittals discussion

4) The Contractor shall provide four (4) copies of and review the Contractor's submittal schedule and provide any updated information and/or changes to the submittal schedule.

5) The Contractor shall provide information on the status of submittals requiring re-submittal.

6) The Contractor shall review any accepted submittals that the Contractor plans to re-submit with changes.

7) Work activities: Open discussion to include coordination items with other Contractors and or agencies.

8) The Contractor shall provide to the Project Manager four (4) copies of the Contractor's four-week look-ahead schedule and review at the meeting the items on the schedule. The schedule shall be in bar chart format based on the approved CPM, and shall include dates of testing activities, anticipated dates of inspection by DIA and other agencies, items in progress, percentage of completion of items, responsible subcontractor for the items.

Explanations provided by the City will not amend, supersede or alter the terms or meaning of any contract document and the Contractor shall not claim reliance on such explanations as a defense to any breach or failure by the Contractor to perform as specified in the Contract.

D. Schedule

PM-12 CONTRACT SCHEDULE

The Contractor shall, in accordance with the requirements of the technical specifications, submit a Contract Schedule that shall provide for the expeditious and practicable execution of the Work.

The Contract Schedule for the performance of the Work shall be a Critical Path

Method (CPM) system, with reasonable detail including a time scaled network and computer printout as more fully detailed in the Technical Specifications.

The Contractor shall submit a monthly progress report and Contract Schedule update in accordance with the scheduling provisions of the Technical Specifications.

The Contractor shall complete the Work within the contract time and in accordance with the most recent Contract Schedule submittal that has been approved in writing by the City.

A. Planning

The total contract time, including project milestones as indicated in the contract documents is the maximum allowable for the completion of the contract including final Completion and contract close out.

In addition to the design activities, assembly and installation activities the Contract Schedule shall include activities for furnishing materials and equipment and any vendor shop drawing preparation. The Contract Schedule, a supporting narrative, and the overall progress curve shall be submitted for approval within thirty (30) days after Notice to Proceed. Within fourteen (14) days the City will respond with approval or direction to revise and resubmit within ten (10) days. Failure of the Contractor to have a Contract Schedule approved by the City will be considered cause for withholding progress payment(s).

To the extent that the Contract Schedule or any revisions thereof contains anything not jointly agreed upon in writing, or fails to show anything jointly agreed upon in writing, it shall not be considered to have the approval of the City. Failure to include any Work item required for performance of this Contract shall not excuse the Contractor from completing all Work within applicable completion dates, regardless of the City's approval of the Contract Schedule.

DIA reserves the right to impose any additional Contract Schedule development and reporting requirements.

Failure of the Contractor to comply with this Section will be considered cause for withholding progress payment(s) or termination for default.

B. Execution

The Contractor will take the Contract Summary Schedule and develop and expand the schedule to comply with the requirements of the Project Management Provisions. The total contract time must fall within the time provided for in the contract.

The Contract Schedule shall be a computerized CPM schedule that includes:

1) The Work Breakdown Structure (WBS) for activity identification, which shall correspond with the content of the Technical Specifications

2) The order, sequence and interdependence of all significant Work items including design, procurement, fabrication, testing, startup and inspection and delivery of critical or special materials and equipment, submittals and approvals of critical design review documentation, samples, shop drawings,

procedures, or other documents that could have a schedule impact.

3) Work items by the City, other Contractors, utilities and other third parties that may affect or be affected by Contractor's activities.

4) Proper referencing of all Work items to identify applicable subcontractors or other performing parties.

5) Work item duration not to exceed fifteen (15) working days, unless approved by the Project Manager. No more than 25 percent of the Work item may be on the critical path.

6) Work items shall be resource loaded to show the direct craft man-hours estimated to perform the Work including Work by subcontractors.

7) A narrative that explains the basis for the Contractor's logical progression of the Work. It shall include estimated quantities and production rates, hours per shift, work days per week, and types, number and capacities of major equipment to be used and whether the Contractor plans to work weekends or holidays.

The Contract Schedule shall be prepared to include the data for the total contract duration, and the critical path shall be identified, including critical paths for interim completion dates. Scheduled start or completion dates imposed on the Contract Schedule by the Contractor shall be consistent with contract milestone dates. Milestone events shall be the Contract Schedule dates specified in the Contract documentation and shall be prominently identified and connected to the appropriate Work item, denoting its start or completion. Work items related to any interim milestones shall be coded for that milestone.

The Contractor shall submit the following documents to the City upon completion of the Contract Schedule:

1) A time phased plot of the CPM Contract Schedule showing all logic ties.

2) Various computer generated Contract Schedule reports that contain the following data for each Work item: Identification, description, responsibility, duration, early start and early finish, late start and late finish, total float, and resources. The Work items shall be sorted by float, early start, subcontractor or other sorts mutually agreed to. The reports shall also show the logic ties of successor and predecessor Work items.

3) A physical progress curve showing either manpower or other appropriate key contract items derived from the Contract Schedule and against which physical progress performance will be measured for schedule and payment purposes.

PM-13 PROGRESS REPORTING

The Contractor shall submit a monthly progress report at the end of each month following the Notice to Proceed. At the end of each month, the Contractor and Project Manager shall agree on the progress of the Work and the Contractor shall update the

Contract Schedule accordingly. The updated Contract Schedule is a prerequisite to the submittal of the Contractor's application for progress payment. This review does not constitute an approval of the Contract Schedule and shall not be used for the purposes of modifying the initially approved Contract Schedule.

The Contractor shall submit the monthly progress report consisting of a written narrative that describes the overall progress of the Work, provides a critical path analysis, discusses significant problems with proposed corrective action, highlights potential or upcoming problems, and shows the status of any changes in sequence of the Work.

If the latest completion time for any Work item does not fall within the time allowed by the Contract Schedule, the sequence of Work and/or duration shall be revised by the Contractor through concurrent operations, additional manpower, additional shifts or overtime, additional equipment or alternative methods until the Contract Schedule produced indicates that all significant contract completion dates, and milestones will be met. No additional costs will be allowed if such expediting measures are necessary to meet the agreed completion date or dates except as provided elsewhere in the Contract Documents unless the delay was caused by the City and agreed to by both parties.

The updated CPM Contract Schedule will be used as a guide for verifying estimates of Work completed for whom payment is requested, and must accurately represent the Project's current status.

A. Recovery Schedule

The Contractor will maintain an adequate Work force and the necessary materials, supplies and equipment to meet the current approved Contract Schedule. In the event that the Contractor, in the judgment of the City, is or is projected as failing to meet any Milestones, then the Contractor shall submit a "recovery schedule."

The recovery schedule will set forth a plan to eliminate the Contract Schedule slippage. The plan must be specific to show the methods to achieve the recovery of time, i.e., acceleration of the Work, increasing manpower, working overtime, weekend work, employing multiple shifts. All costs associated with implementing the recovery schedule will be the responsibility of the Contractor.

Upon receipt of the recovery schedule, the City will review the schedule for conformance with the Contract Documents and degree of detail. The City, within fourteen (14) days after receipt of the recovery schedule and supporting documents, will accept the recovery schedule or reject it with written comments. If the detailed recovery schedule is rejected, the Contractor must submit a revised recovery schedule within seven (7) days after the date of rejection.

B. Schedule Changes

The Contractor's request for Contract Schedule changes shall be made on the latest approved Contract Schedule and shall be accompanied by a narrative description and justification for the change, and shall be submitted to the City for review and consideration. Minor revisions submitted at monthly progress review meetings are not considered as changes in this context.

The Contract Schedule may be changed when one or more of the following occur:

1) When a change order significantly affects the contract completion date or sequence of Work items.

2) When the Contractor elects to change the sequence or duration of Work items affecting the critical path.

3) When the City directs a change that affects a milestone date(s) specified in the Project Management Provisions or alters the length of a critical path.

If, after submitting a request for change to the Contract Schedule, the Project Manager does not agree with the request, the Project Manager will schedule a meeting with the Contractor to discuss the differences. If a settlement cannot be reached on the change in the Contract Schedule or if the Contractor has failed to submit revisions to the Contract Schedule, the Project Manager has the option of providing suggested logic and/or duration times in all subsequent updating reports. The suggested logic and/or duration times will remain in effect until the change in the Contract Schedule is settled or until the logic and duration are superseded.

If the Contractor has any objections to the data furnished by the Project Manager, he shall advise the Project Manager within ten (10) days in writing, fully supporting the objections with a counterplan. The revisions suggested by the Project Manager shall be used for updating reports until the Project Manager approves the counterplan.

If the Contractor does not submit a counterplan and data within ten (10) days after the date of the Project Manager's suggested logic, the Contractor is deemed to concur with the Project Manager's suggested logic/duration time changes. The Project Manager's plan will be the basis of negotiations for any adjustment of the time and cost for performance of the Work.

C. Contract Extensions

If the Contractor is granted an extension of time for completion of any milestone or contract completion date under the provisions of the Contract, the determination of the total number of extended days will be based upon the analysis of the baseline Contract Schedule, the latest updated Contract Schedule, and all data relevant to the extension. Such data shall be incorporated in the next monthly update of the Contract Schedule.

The Contractor acknowledges and agrees that delays in Work items which, according to the Contract Schedule analysis do not affect any milestone dates or contract completion date shown on the critical path at the time of the delay, will not be the basis for a contract extension.

D. As-Built Contract Schedule

After all contract Work items are complete, the Contractor shall submit an As-built Contract Schedule showing actual start and finish dates for all Work items and milestones.

PM-14 DESIGN REVIEWS

The purpose of the design review is to build the confidence of both the City and the Contractor that the Contractor's designs, as implemented, will meet all the requirements of this Contract, and to exchange information regarding interfaces between the Contractor's and the City's other work. It will alert the Contractor to areas where requirements might not be met, in order that the Contractor may allow time for refinement of designs and thus avoid future delays and costs due to any re-work necessary to meet requirements.

None of the review comments provided by the City shall be interpreted as directives to the Contractor to carry out any Work that is not required by this Contract. Depending on the extent of any comments, design review meetings will be held with the Contractor to discuss the City's review comments.

A. Execution

There will be two levels of Design Reviews held at 30% and 100%. The contractor shall present all the submittal requirements outlined in the Contract Documents for the Design Reviews that are related to the Technical Specifications.

All printed, audio and/or video information presented for design review shall be in the English language. As the basis for the design reviews, the Contractor shall submit Design Review Data to document the designs of the System and subsystems, and to facilitate the review and understanding of such designs.

Unless otherwise specified, the Contractor shall submit five (5) copies of all printed matter, drawings, audio and/or video material as part of each Design Review Data package.

Contract Schedule dates for submissions of the design review material shall be developed by the Contractor and approved by the City.

The City reserves the right to request additional Design Review Data as it, in its sole discretion, deems necessary, and the Contractor shall furnish such materials as requested. Additional information requested in writing by the City shall be provided by the Contractor within two weeks after receipt of a written request. In such cases the time allowed by the City for completing the design review shall be extended accordingly.

B. Procedure

The entire design review process shall begin and be completed within the time specified in the approved detailed Contract Schedule. The schedule and content of each design review meeting will be developed jointly by the Contractor and the City. Contract compliance for some aspects of the System may be verified through review of analyses submitted by the Contractor as part of the design review process. At the time of the design reviews, the City will examine the design review material and, in its sole discretion, will make decisions regarding the extent of its applicability for contract compliance purposes.

After reviewing the material, the City will provide the Contractor its review comments on each submittal. If necessary, subsequent meetings shall be scheduled and organized by the Contractor for the purpose of clarifying and discussing design issues.

The Contractor and the City will mutually develop and distribute an agenda of topics for such meetings in advance of the meeting date. If so requested, the Contractor shall present an overview of the design information at the meeting, using standard engineering drawings, specifications, catalog cuts and other similar material, and respond to comments raised by the City in its review. At the conclusion of the meeting, the City and Contractor will mutually identify any remaining problems to be resolved. Prior to termination of the design review meeting, a list of action items and assigned responsibilities will be mutually agreed upon between the City and the Contractor. Within thirty (30) days thereafter, the Contractor will prepare a memorandum Record of Design Review (RDR) to document the review questions, discussions, and resolutions.

Copies of each RDR will be forwarded to the City for its records. Any exceptions taken by the City to the information contained in the RDR shall be sent to the Contractor within 21 days after receipt; otherwise, the RDR shall stand as the official record of the design review process for the affected component and subsystem.

Any issues which cannot be resolved shall be identified as “critical issues” and carried as open items on the Contractor’s monthly progress report, along with a date for their ultimate resolution. Resolution of any dispute item arising during the design review process will be resolved in accordance with the provisions of the Contract regarding dispute resolution.

C. Location

Upon request, The City Project Manager may agree to design reviews being conducted at Bombardier’s facilities in Pittsburgh PA.

PM-15 SUBMITTALS

The Work specified in this Section summarizes the requirements for the submittal of documents to the City that are defined in these Contract Documents. It also describes the procedures for "supplemental" submittals.

A. Submittal Schedule

The Contractor shall provide a submittal schedule within fourteen (14) days after Notice to Proceed. The submittal schedule shall be directly related to the Contract Schedule and the Work Breakdown Structure (WBS). It shall identify all the submittals, and shall include the following information for each submittal item:

1) CDRL line item reference, Contract Article, or Specification Section or Project Management Provisions.

2) Item description

3) Date the submittal shall be submitted

4) Name of subcontractor or supplier.

The submittal schedule shall be updated monthly by the Contractor and submitted with the progress payment request.

Unless stated otherwise, two (2) copies and one (1) CD of all submittals shall be furnished. Two-sided submittals will not be accepted.

B. Initial Submittal

Each submittal document shall include a title block showing the following information:

1) Date of submittal and revision dates

2) Contract title and number.

3) The names of Contractor, subcontractor, supplier, manufacturer and when applicable, the seal and signature of an engineer registered in the State of Colorado, for the involved discipline.

4) Identification of product by description, model number, style number or lot number.

5) Subject identification by contract drawing or specification reference.

6) Include a blank space on each sheet, three inches by four inches, in the lower right corner, just above the title block, in which the City may indicate the action taken.

7) Make submissions sufficiently in advance so that the City review may be completed not less than 30 days before the Work represented by those submittals is scheduled to be performed.

8) Allow a minimum cycle of 30 days for review of each submittal by the City.

Accompany submittal documents with DIA transmittal form CM-30 that shall contain the following information:

1) Contractor's name, address and telephone number.

2) Submittal number and date.

3) Contract title and number.

4) Supplier's, manufacturer's or subcontractor's name, address and telephone number.

5) Identification of variations from Contract Documents.

6) Contractor's stamp and signature certifying his review.

7) Identification of submittal:

a) If the submittal is being made on a Project Management Provisions, reference the Provision number.

b) If the submittal is being made under a specification section, reference the specification number, paragraph number and subparagraph number.

c) If the submittal is being made under a drawing, reference the drawing(s) number and sub number.

The Contractor shall at the time of submission describe variations from the contract documents in writing, separate from the submittal document. If the Project Manager approves any such variations, an appropriate contract change order shall be issued except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued. If a submission contains variations and the variation column is not marked on the transmittal form, it will not be considered for review and acceptance. Along with marking the transmittal as a variation, a description must be included which outlines all the differences including maintenance and utility services along with any cost savings from an item not containing the variation.

Changes in accepted submittal documents will not be permitted unless those changes have been accepted, in writing, by the City.

An electronic copy of the CM-30 and CM-30 Supplement forms are available from the Project Manager.

C. Supplemental Submittals

Supplemental submittal documents initiated by the Contractor for consideration of corrective procedures shall contain sufficient data for review. Make supplemental submittals in the same manner as initial submittals with the appropriate primary transmittal referenced.

D. Execution

a) Contractor's Review

The Contractor shall review submittal documents, stamp and sign as reviewed and approved as complying with Contract Documents prior to submission to the City.

b) City Review

Submittal documents will be reviewed by the City, the designer and the Project Manager for conformance to requirements of the contract drawings and specifications. Review of a separate item will not constitute review of an assembly in which the item functions. The City will withhold approval of submittals that depend on other submittals not yet submitted. Review and acceptance will not relieve the Contractor from his responsibility for accuracy of submittals, for conformity of submittal document to requirements of contract drawings and specifications, for compatibility of described product with contiguous products and the rest of the system, or for protection and completion of the Contract in accordance with the Contract drawings and Specifications.

The City, the designer, and/or the Project Manager will review the submittal documents for general conformance with the contract documents and mark the Action Code, sign and date the transmittal.

The Action Codes have the following meanings:

1) **A - ACCEPTED** is an approval, and means that the illustration and description appears to conform to the respective requirements of the contract documents.

2) **B - ACCEPTED AS NOTED** is an approval, and means that the illustration and description will conform to the respective requirements of the contract documents after changes in recognition of the reviewer's comments. Submittals so marked need not be resubmitted.

3) **C - REVISE AND RESUBMIT** means that the submittal is unacceptable and must be revised and resubmitted.

4) **E - NOT ACCEPTED** means that the submittal is not approved and that a new submittal in accordance with the contract documents shall be made.

5) **F - RECEIPT ACKNOWLEDGED** means an item is received by the Project Manager but no review was made. This mark is for use in resubmitting items that were previously accepted as noted and the Contractor has incorporated the notes and wants the Project Managers' staff to have the same material that the Contractor's field staff is using.

E. Contractor's Responsibilities

Coordinate each submittal document with the requirements of the Work; place particular emphasis upon ensuring that each submittal of one trade is compatible with other submittals of that trade and submittals of other trades including producing as needed drawings showing the relationship of the Work of different trades.

Contractor's responsibility for errors and omissions in submittal documents and associated calculations is not relieved by the City's review, correction and acceptance of submittals.

Contractor's liability to the City, in case of variations in the submittal document from the requirements of the contract documents, is not relieved by the City's review and acceptance of submittals containing variations unless the City expressly approves the deviation in writing, in which the City describes the variation.

The Contractor shall maintain a file of all approved submittal documents at the Work site. The complete file of approved submittal documents shall be turned over to the City with the as-built documents at the end of the job.

Contract Schedule impact due to resubmittal requirements is the responsibility of the Contractor.

PM-16 SHOP AND WORKING DRAWINGS, PRODUCT DATA AND SAMPLES

The Work specified in this section consists of preparing and submitting shop and working drawings, product data, samples and record documents required by other Technical Specifications sections. This information is to be submitted during the

Design Review process as specified in the Contract Documents.

The Project Manager will return one copy of the shop drawings, working drawings and product data to the Contractor with a written transmittal within the time periods noted in the Contract documents.

The Contractor shall not submit as shop drawings copies or reproductions of drawings issued to the Contractor by DIA.

A. All submittals shall be delivered to the DIA Project Manager in electronic format. All submittals must be of a consistent format (all Acrobat or all Word, etc). No combination of electronic file types will be allowed unless required by a specific specification section..

1. Acceptable electronic formats
    a. Adobe Acrobat 8.0 or newer. All files shall be fully compatible with Adobe Acrobat 8.0
    b. Microsoft Office 2007 or newer. All files shall be fully compatible with Microsoft Office 2007.
    c. AutoDesk AutoCAD 2007 or newer. All files shall be fully compatible with AutoDesk AutoCAD 2007.
        1) AutoCAD files shall be self-contained with no external x-references.
    d. Other files pre-approved by the DIA Project Manager
2. Adobe Acrobat Requirements:
    a. Drawings shall have security set to “No Security”. Commenting, printing, adding photos, form fields and document signing must be allowed.
    b. PDF submittals shall be one continuous file. No external links are allowed.
    c. All individual components of submittals shall be bookmarked inside the PDF file.
    d. All original documents shall be directly converted from the original electronic format to PDF. Scanning of files shall only be allowed by the DIA Project Manager when the original electronic information is not obtainable.
    e. Failure to comply with these requirements will result in a return of file to the Contractor for immediate revision.

i. Quantities

1. One DVD-ROM or CD-ROM containing electronic files of each shop or working drawing, manufacturer's standard schematic drawings, manufacturer's calculations and manufacturer's standard data, manufacturer's printed installation, erection, application and placing instructions.
2. Two samples of each item specified in the various specification sections, unless otherwise specified.
3. One DVD-ROM or CD-ROM containing electronic files

of inspections and test reports.

Note: If manufacturer's printed information is in color, all copies of submittals must be in color.

A. Changes

Changes in products for which shop or working drawings, product data or samples have been submitted will not be permitted unless those changes have been accepted and approved in writing by the Deputy Manager of Aviation.

B. Quality Control

Shop drawings and record documents shall be prepared to a high standard of quality such as that set forth in ASME Y14.100M, Engineering Drawing Practices, or other equivalent specification defining equal drafting quality for microfilming.

C. Shop and Working Drawings

Prepare shop and working drawings in a reproducible electronic format supporting a sheet size of 24 x 36 inches to a scale large enough to easily depict and annotate each of the drawing details.

Include the following as they apply to the subject:

1) Contract title, work order and number.

2) Respective contract drawing numbers.

3) Applicable specification section numbers.

4) Relation to adjacent structure or materials.

5) Field dimensions clearly identified as such.

6) Applicable standards such as ASTM or Federal Specification number, AASHTO and pertinent authority specifications or standards.

7) Identification of deviations from the contract drawings and specifications.

8) Drawing name, number and revision.

9) Contractor's stamp, initialed or signed, certifying:

    a) Verification of field measurements.

    b) Review of submittals for compliance with contract requirements.

    c) Compatibility of the Work shown thereon with that of affected trades.

    d) Blank space on each sheet per section 10 of this specification

Drawings of equipment and other items that contain multiple parts shall include exploded views showing the relationship of parts and the description of the parts into

the smallest units that may be purchased or serviced.

D. Product Data

Modify manufacturer's standard and/or schematic drawings to delete information which is not applicable to the contract. Supplement standard information with additional information applicable to this contract.

Modify manufacturer's standard(s), diagrams, schedules, performance charts, illustrations, calculations and other descriptive data to delete information which is not applicable to the contract. Indicate dimensions, clearances, performance characteristics and capacities. Include with the submittal electrical, plumbing, HVAC and any other diagrams, as applicable.

Modify erection, application and placing instructions to delete information that is not applicable to the contract or work order.

Include the following:

1) Contract title, work order and number

2) Respective contract drawing numbers

3) Applicable contract technical specification section numbers

4) Applicable standards such as ASTM or Federal Specification number, FAA, AASHTO and pertinent authority specification or standards

5) Identification of deviations from the contract drawings and specifications

6) Contractor's stamp, initialed or signed, certifying:

    a) Dimensional compatibility of the product with the space in which it is intended to be used

    b) Review of submittals for compliance with contract requirements

    c) Compatibility of the product with other products with which it is to perform or which will be next to it.

    d) The products electrical, plumbing, control and HVAC requirements conform to contract documents and the necessary utilities are provided for in the contract documents.

E. Samples

Submit samples of sizes and quantities to clearly illustrate full color range and functional characteristics of products and materials including attachment devices.

Erect field samples and mock ups at the Work site as specified in the several technical specifications sections and at locations acceptable to the Project Manager. All field samples shall be erected in a location that will be readily visible throughout

the life of the contract to allow comparison of the Work as it progresses to the field sample.

The Contractor shall verify, through appropriate inspections and tests, that the samples submitted meet the specifications and shall provide inspection and test data with the samples. The review and comments on the sample shall not relieve the Contractor of his responsibility for completion of the Contract.

Show the following information:

1) Contract title and number

2) Respective contract drawing numbers

3) Applicable technical specification section numbers

4) Applicable standards such as ASTM or Federal Specification number

5) Identification of deviations from the contract drawings and specifications

6) Contractor's stamp, initialed or signed, certifying:

    a) Dimensional compatibility of the product with the space in which it is intended to be used

    b) Review of submittals for compliance with contract requirements

    c) Compatibility of the product with other products with which it is to perform or which will be next to it

If multiple samples are submitted and the Project Manager is requested to make a choice, each sample shall have a unique identification number attached to it so the returned transmittal can state the identification number of the accepted sample and the Contractor will know which one it is.

F. Review by the City

One copy of the marked-up shop and working drawing and one copy of the product data will be returned to the Contractor by the Project Manager. Only the transmittal form, appropriately marked, will be returned on sample submittals.

Contractor's responsibility for errors and omissions in submittals for compatibility will not be reduced, waived or otherwise limited by the review and acceptance of submittals by the City.

PM-17 CONTRACTOR QUALITY CONTROL

This section identifies the Quality Control activities to be performed during all phases of the Contract by the Contractor.

All materials required for the Contract shall be new except where specified otherwise. The Project Manager may elect to perform additional inspections and/or tests at the

place of the manufacture, the shipping point or at the destination to verify conformance to applicable specifications. Inspections and tests performed by DIA shall not relieve the Contractor from the responsibility to meet the specifications, nor shall such inspections/tests be considered a guarantee for acceptance of materials that will be delivered at a later time.

The Contractor is obligated to correct or remove non-conforming materials, whether in place or not. If necessary, the Project Manager will send written notification to the Contractor to correct or remove the defective materials from the project. If the Contractor fails to respond, the Project Manager may order correction, removal and/or replacement of defective materials by others, in which case the Contractor shall bear all costs incurred by such actions.

Materials accepted on the basis of a Certificate of Compliance may be sampled and inspected/tested by DIA or its designer at any time. The fact that the materials were accepted on the basis of such certification shall not relieve the Contractor of his responsibility to use materials that conform to the specifications.

The Contractor shall impose upon his suppliers the same quality control requirements, including inspection and test procedures, as imposed upon him by the specifications and referenced standards. The Contractor shall apply appropriate controls, designed to ensure that all materials supplied meet the requirements and specifications.

The Contractor shall have in place his Quality Control Program as necessary to ensure that all materials and Work are completed in compliance with Contract Documents. The Contractor is solely responsible for Quality Control with the exception of those tests and/or audits that may be conducted by the City as defined in the Contract Documents. The Quality Control Program covers all Work on the contract including Work performed at the contractors manufacturing facility.

A. Quality Control Plan

Within ten (10) days after Notice to Proceed, the Contractor shall submit a Quality Control Plan for review and acceptance. Acceptance by the Project Manager does not relieve the Contractor of compliance with the Contract requirements. The Contractor Quality Control Plan shall address the following as a minimum:

1) Provide a general description of Quality Control monitoring to be performed until Final Completion. Include monitoring activities of Work and the Work site during times no construction activity is scheduled to take place.

2) The Contractor shall designate an employee as the Quality Control Manager qualified to perform quality control monitoring of the Work. The designated individual shall have the authority to direct Work changes required to bring the Work into conformance with contract requirements including stopping non-conforming Work in progress.

3) The Quality Control Plan shall address each technical specification division's requirements for quality control. The Contractor shall identify each item requiring submittal and approval/acceptance prior to installation of Work. Also, the Contractor shall identify each item of Work requiring testing by the

independent testing agency.

4) The Quality Control Plan shall address and establish controls and documentation format to ensure that items or materials that have been accepted through receiving inspection are used or installed. Identification and traceability shall be provided throughout all inspections, test activities and records. For stored items, provisions shall be made for the control of item/material identification, consistent with the expected duration and type of storage.

5) Provide methodology of monitoring, testing and exercising of all equipment, valves and/or assemblies to ensure the Work installed is in proper working order.

6) The Contractor shall submit a list of suppliers and subcontractors. This list shall include items to be supplied by each supplier and/or subcontractor and shall identify Work to be performed by each subcontractor. The list shall be updated and resubmitted as required.

B. Daily Quality Control Report

1) Once Work begins on-site at DIA, the on-site Quality Control representative will furnish the Project Manager with a daily report.

2) A Daily Quality Control Report shall be submitted on the form (form to be provided by the City). The Contractor may add sheets of information to this form as required. The report shall address as a minimum the following:

   a) Identify number of workers on-site each day by trade,

   b) Identify notifications and discussions with/by DIA Quality Assurance Inspectors and other agency inspectors,

   c) Identify quality of Work placed that day and any deviations and/or corrections required to bring the Work into conformance with the contract,

   d) Daily reporting may not be computerized or typed. Only legible, hand written reports on the approved form shall be accepted,

   e) Submit two copies of the Daily Quality Control Report to the Project Manager the day following the Work. The report shall be signed by the Contractor's Quality Control Representative and the Contractor's Superintendent.

C. Documentation

The Contractor shall not change or alter approved submittals, procedures, specifications, drawings or other pertinent documentation without the Project Manager's written authorization.

All records and documents that are quality related shall be prepared, identified and maintained by the Contractor and shall be made available to DIA upon request.
The Contractor shall maintain records at the actual work site and at Contractor's

office to show the inspection status of materials and items installed in order to ensure that the required inspections and tests have been performed in a timely and correct manner. Retention time for all quality records shall be not less than three years from date of Final Completion of the Contract.

PM-18 INSPECTIONS AND TESTS

Inspection and tests, conducted by persons or agencies other than the Contractor, shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications, the referenced standards and all the elements of the approved design reviews. The Contractor's designated Quality Control Representative shall inspect the Work and shall ensure the Work complies with the contract requirements prior to any requests for inspection or testing.

When the specifications, laws, ordinances, rules, regulations or orders of any public agency having jurisdiction require the Project Manager's surveillance of inspections or tests, the Contractor shall notify the Project Manager of the place, date and time 48 hours prior to the inspection and/or test. The Contractor shall be responsible for notifying and requesting inspection by other agencies including but not limited to the Denver Building Inspection Division, Denver Fire Department and Denver Water Department. Prior to request for other agency inspections, the Contractor shall meet and plan inspection times with the Project Manager and or the Project Manager's designated representative.

Special inspections or tests may be required by the Technical Specifications, City, State and/or Federal Agencies in addition to those tests already performed. The Contractor shall notify the Project Manager at least 48 hours in advance of the additional inspections or tests.

A. Inspection Plan

The Contractor shall utilize the following four-point inspection plan to ensure the conformance of the Work performed by the Contractor meets the requirements of the contract drawings and specifications, the referenced codes and standards and the approved submittals:

B. Prework Coordination:

Prior to the start of construction Work on the Airport site and prior to the start of Work under each separate type of Work and prior to the start of any cut over, testing or interfacing with the live operating system is contemplated by the Contractor and prior to a new subcontractor starting Work, a coordination meeting will be held with the Contractor's superintendent, Quality Control and Safety representative(s), the DIA Project Manager and DIA inspectors. Supervisory, Safety and Quality Control, representatives of all applicable subcontractors will also attend. The Contractor's Quality Control Representative shall chair, prepare and distribute minutes of Quality Control meetings. Meeting minutes shall be distributed within 24 hours of the meeting.

The purpose of the meeting is to ensure that the Contractor's personnel have no misunderstandings regarding their safety and quality procedures as well as the technical requirements of the contract and the individual Work element to be performed. The following items shall be presented and reviewed by the Contractor:

1) A clear presentation of the Work element and its impact to the operating system.

2) An identification of the risks associated with the Work

3) A recovery plan if the Work will impact morning startup

4) Testing and inspection program and procedures

5) Familiarity and proficiency of the Contractor's and subcontractor's workforce to perform the operation to required.

6) Safety, security and environmental precautions to be observed

7) Any other preparatory steps dependent upon the particular operation

8) The Contractor's means and methods for performing the Work.

C. Initial Inspection:

Upon completion of a representative sample of a given feature of the Work and no later than two weeks after the start of a new or changed operation, the Project Manager and/or the Project Manager's designated representatives will meet with the Contractor's Quality Control representative and applicable subcontractor's supervisor and their Quality Control representatives to check the following items, as a minimum:

1) Workmanship to established quality standards.

2) Conformance to contract drawings, specifications and the accepted shop drawings.

3) Results of inspection and testing methods.

4) Adequacy of as-built drawings maintained daily.

Once accepted, the representative sample will become the physical baseline by which ongoing Work is compared for quality and acceptability. To the maximum practical extent, approved representative samples of Work elements shall remain visible until all Work in the appropriate category is complete. Acceptance of a sample does not waive or alter any contract requirements or show acceptance of any deviation from the contract not approved in writing by the Project Manager.

D. Completion Inspection:

Forty-eight hours prior to the completion of an item or segment of Work and prior to covering up any Work, the Contractor will notify the Project Manager who will verify that the segment of Work is substantially complete, all inspections and tests have been completed and the results are acceptable. The purpose of this inspection is to allow further corrective Work upon, or integral to, the completed segment of Work. THIS IS NOT AN ACCEPTANCE INSPECTION. If any items are determined to be deficient, need correction or are non-conforming, a Deficiency List will be prepared

and issued to the respective Contractor for correction, repair or replacement of any deficient or non-conforming items. The Project Manager and Contractor's Quality Control representative will verify the correction of the deficient and/or non-conforming items prior to the start of the next operation.

E. Final Completion Inspection:

After the Contractor has completed all items on the Deficiency List he shall request a Final Completion Inspection. The request shall be made in writing at least 72 hours in advance of the inspection. All areas must be cleaned and ready for turnover prior to this inspection. The Project Manager, the design consultant) and other interested parties will inspect the subject Work to ensure that all deficiencies have been satisfactorily attended to and that no new deficiencies have appeared and that all systems are completely functional. Any outstanding or additional deficient items will be noted and until the Work is acceptable to the Project Manager.

PM-19 DIA QUALITY ASSURANCE

This Section identifies DIA Inspection activities that may be performed by inspectors employed by DIA and working under the direction of the Project Manager.

Inspection and tests, conducted by persons or agencies other than the Contractor, shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications and the referenced standards.

The inspection and approval of Work by other agencies above does not constitute inspection or acceptance of Work required by DIA. Technical specifications may contain requirements more stringent than Building Inspection Division or other code agency requirements.

PM-20 MANUFACTURING AND FABRICATION REQUIREMENTS

The Project Manager may elect to perform additional inspections and/or tests at the place of the manufacture, the shipping point or at the destination to verify conformance to applicable specifications. Inspections and tests performed by DIA shall not relieve the Contractor from the responsibility to meet the specifications, nor shall such inspections/tests be considered to be a guarantee for acceptance of materials that will be delivered at a later time.

The Project Manager or his authorized representative may inspect at its source any material or assembly to be used in the Work. Manufacturing plants may be inspected periodically for the purpose of determining compliance with specified manufacturing methods or materials to be used in the Work and to obtain samples for testing and further inspection.

Should the Project Manager conduct plant inspections the following conditions shall exist:

1) The Project Manager shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.

2) The Project Manager shall have full access during scheduled production or warehousing working hours to parts of the plant that are concerned with the manufacture, production, storage or shipping of materials being furnished.

3) The Contractor shall arrange for adequate office or working space that can reasonably be needed for conducting a plant inspection. Office or working space shall be conveniently located with respect to the plant and/or warehouse as required by the Project Manager.

4) It is understood and agreed that DIA shall have the right to re-test at DIA's expense any materials that have been tested and accepted at the source of supply after it has been delivered to the site.

A. Inspections and Tests

It is understood and agreed that DIA shall have the right to take samples and perform testing of samples at different intervals or at intervals concurrent to the Contractor's testing program. The Contractor shall be issued a Nonconformance Report or a Remedial Action Request in the event DIA tests fail.

Materials accepted on the basis of a certificate of compliance may be sampled and inspected/tested by DIA or its designer at any time. The fact that the materials were accepted on the basis of such certification shall not relieve the Contractor of his responsibility to use materials that conform to the specifications.

DIA inspection can include but not be limited to Initial Inspection, Follow-up Inspection, Completion Inspection, Pre-Final Completion Inspection, and Final Completion Inspection.

B. Remedial Action Request (RAR)

The Project Manager will request the Contractor to take remedial action when nonconforming Work is discovered and/or when test results indicate nonconforming Work.

The Project Manager will document remedial action that cannot be taken immediately (the same day) by issuing a Remedial Action Request form to the Contractor. Remedial Action Requests are appropriate when the affected element of Work is in-progress and discrepancies can be rectified as the Work proceeds. RAR's shall be written when Work can be brought back into conformance with the contract documents.

When issued, a Remedial Action Request will preclude payment for elements noted and will remain in effect until corrective actions have been submitted, approved and performed.

Upon satisfactory completion of the remedial action, the Contractor shall transmit the RAR form with the Contractor's statement of action taken (including any applicable test results) to the Project Manager. The Project Manager will perform a follow-up inspection to verify the RAR has been satisfactorily completed. The RAR then will be closed.

C. Nonconformance Report (NCR)

The Project Manager will issue a Nonconformance Report to the Contractor whenever there are violations of the terms of the contract that cannot be immediately brought back into conformance, including materials received and/or items of the Work found not to be in conformance with Contract requirements. When issued, a Nonconformance Report will preclude payment for elements noted and will remain in effect until corrective actions have been submitted, approved and performed.

The Nonconformance Report form will describe the nature and extent of nonconforming elements and will include space for the Contractor's corrective action proposal, the designer's review of the Contractor's proposal, reinspection and/or verification of approved corrective rework and a space for the Project Manager's disposition of the nonconformance matter. Copies of the Nonconformance Report, at each step of its processing (i.e., initial issuance to Contractor through final disposition) will be sent to the Project Manager.

The Project Manager will make the disposition of nonconforming items/materials.

The Contractor is obligated to correct any item deemed deficient.

PM-21 SYSTEM IMPLEMENTATION, PHASING PLAN, STARTUP, TESTING AND TRAINING

Provide complete startup, testing and operator training services to ensure complete contract compliance of the operating system and all of its existing components.

A. Submittals

Submittals for the system implementation, phasing, startup, testing and training shall include all procedures, programs, interfaces, shutdown or impact on other systems, staffing for each phase of the Work.

B. Field Tests and Adjustments

All electrical and mechanical equipment including the interfaces with control systems and the communication system, and all alarm and operating modes for each piece of equipment shall be tested by the Contractor to the satisfaction of the Project Manager before any facility is put into operation. Tests shall be as specified in the contractors approved WBS and shall be made to determine whether the equipment has been properly assembled, aligned and connected. Any changes, adjustments or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the Work.

At least 30 days before the time allowed in the Contract Schedule for commencing startup and testing procedures, the Contractor shall submit to the Project Manager two copies of the detailed procedures he proposes for testing and startup of all electrical and mechanical equipment. These procedures are submitted for review and acceptance.

The Contractor's startup and testing procedures shall include detailed descriptions of all pre-operational hardware, electrical, mechanical and instrumentation used for testing Work. Each control device, item of electrical, mechanical and instrumentation equipment, and all control circuits shall be considered in the testing procedures which shall be designed in a logical sequence to ensure that all equipment has been

properly serviced, aligned, connected, wired, calibrated and adjusted prior to operation. The Contractor is advised that failure to observe these precautions may place the acceptability of the equipment in question, and he may either be required to demonstrate that the equipment has not been damaged, or replace it as determined by the Project Manager.

Testing procedures shall be designed on the final installed system wherever possible. In case testing requires the simulation of functions, the test shall be designed to duplicate as close and realistic as possible all conditions of operations and shall be carefully selected to ensure that the equipment is not damaged. Once the Project Manager has accepted the testing procedures, the Contractor shall provide checkout, alignment, adjustment and calibration signoff forms for each item of equipment and each system that will be used. The Contractor and the Project Manager shall use the signoff forms in the field jointly to ensure that each item of electrical, mechanical and instrumentation equipment and each system has been properly installed and tested. Any special equipment needed to test equipment shall be provided to the City at no cost for a period of 30 days during startup.

Before starting up the equipment, the Contractor shall properly service it and other items, which normally require service in accordance with the maintenance instructions.

The Contractor shall be responsible for the startup, adjustment, preliminary maintenance and checkout of all equipment and instrumentation. All systems shall be carefully checked for conformance with the design criteria.

If any equipment or system does not operate as specified in the Contract, the Contractor shall immediately replace or repair components until it operates properly.

C. Systems Start-up and Testing

The Contractor shall be responsible for a 60-day startup period as per Technical Specification, Section 2.9.8, during which time all hardware, electrical and mechanical equipment, communications, alarm systems and associated devices shall be energized and operated under local and automatic controls. The Contractor shall be present during the startup period with adequate labor and support personnel to adjust equipment and troubleshoot system failures that might arise.

When a piece of electrical or mechanical equipment is found to be in conflict with specific criteria, an experienced representative of the manufacturer shall make an adjustment to the item.

If adjustments fail to correct the operation of a piece of equipment or fixture, the Contractor shall remove the equipment or fixture from the project site and replace it with a workable replacement that meets the specification requirements.

The Contractor shall submit a test report to the Project Manager within 30 days after completion of the system startup period.

D. Final Instructions and Operations Training

The City can at their discretion participate in all training sessions provided to the O&M Contractors personnel. The Contractor will provide the City ten (10) days' notice of

any and all training sessions. The City may send up to four individuals to the training sessions.

PM-22 OPERATION AND MAINTENANCE DATA

The Contractor will update or replace all the manuals and documentation in the same format containing no less than all the same type of information as currently being used by the on-site O&M team.

The Contractor will submit a sample draft of the required manuals to the on-site O&M team for their review and approval prior to submitting to the City Project Manager. The Project Manager will review the sample draft of the manual and data prior to production of the final documentation to ensure consistency with the existing documentation.

The Contractor shall submit the O&M manuals and documentation to the City, including a table of contents, not less than 45 days prior to the beginning of acceptance testing and final inspection.

The Contract shall submit two paper copies and one electronic, reproducible copy to ensure that the updated information is incorporated into the existing documents 30 days prior to system startup.

PM-23 CONTRACT RECORD DOCUMENTS

The Work specified in this Project Management Provision consists of maintaining, marking, recording and submitting contract record documents which include shop drawings, warranties, contract documents, software documentation and contractor records.

A. Maintenance of Documents

The Contractor shall maintain at the Work site on a current basis one record copy of all drawings, specifications, addenda, change orders, approved design review documents, working drawings, product data and samples in good order and marked currently to record all changes made during execution of the Work.

Maintain at the field office one copy of the following record documents:

1) Contract Documents

2) Contract drawings with all clarifications, requests for information, directives, changes and as-built conditions clearly posted.

3) Contract specifications with all clarifications, requests for information, changes, directives and record of manufacturer actually used along with product trade name.

4) Details not on original contract drawings but obtained through requests for information or by other communications with the City.

5) Contractor Records

6) QC Reports

7) Certificates of compliance for materials used in construction

8) Nonconformance Reports (NCRs)

9) Remedial Action Requests (RARs)

10) Completed inspection list

11) Inspection and test reports

12) Test procedures

13) Qualification of personnel

14) Approved submittals

15) Material and equipment storage records

16) Safety Plan

17) Hazardous material records

18) First report of injuries

B. Monthly Review

Prior to any application for payment, the Project Manager or his designated representative will inspect the record documents to ensure that they are being maintained and contain the most current correct data with particular attention to as-built drawings.

If, during the inspection, the Project Manager determines that the documents are not being maintained and kept current as to as-built conditions, an amount may be withheld from the payment request and deducted from the contract value to cover the City's cost of collecting and recording the as-built contract data. This cost will be determined on the basis of $75.00 per man-hour of effort.

The As-built record contract documentation shall be submitted prior to Substantial Completion.

Each submittal of record documents shall be marked “PROJECT RECORD” and contain the following information:

1) Date

2) Project title and numbers

3) Contractor's name and address

4) Title and number of each record document

5) Certification that each document as submitted is complete and accurate

6) Signature of the Contractor or his authorized representative

7) At the completion of this contract, deliver all record documents including the following:

   a. As-built shop drawings, diagrams, illustrations, schedules, charts, brochures and other similar data.

   b. Project Technical Specifications and drawings shall be legibly marked to record:
   c. Manufacturer, trade name, catalog number and supplier of each product and item actually installed

   d. Changes made by change orders, requests for information, substitutions and variations approved by submittals.

   e. Warranties, guarantees and bonds

   f. Documents including the record of delivery of software to the required escrow noted below

   g. Contractor records.

System software and as-built documentation for software is to be delivered to the Guard it escrow account. The Contractor is to coordinate this activity with the City Project Manager.

Special attention shall be given to documentation procedures for all computer software programs supplied. For all software unique to the System and not commercially available, the as-built documentation shall include, at a minimum, functional, performance and interface requirements; descriptions of the supervisory, control, and operating software; source listings; flow charts; configuration control documentation; and programmer and user manuals incorporating appropriate modification and control procedures, including the name of any subcontractor if employed for preparation of this software.

The Contractor shall for the benefit of the City also retain possession of the as-built documentation for software which is not commercially, available which is necessary for the operation and maintenance of the AGTS in a separate file and shall allow an authorized representative of the City to inspect that file at any time upon reasonable notice. Such documentation shall be kept up to date and shall include any upgrades or modifications which have been or are in the future incorporated in software programs which are used to operate the System.

Upon the occurrence of any of the conditions specified below, such software documentation which is not commercially available shall be delivered to the City at no

cost as soon as reasonably possible and shall become the property of the City.

1) The commencement of any case or proceedings, whether voluntary or involuntary, under any applicable Federal or State bankruptcy, insolvency, reorganization or other similar law.

2) The Contractor ceases to provide APM Systems of an equivalent quality and capability to the one being upgraded under this Contract.

3) The Contractor is acquired by or merges with another entity which in the City's reasonable opinion does not have the capability to build, operate and maintain AGT Systems of the same quality as that provided by the Contractor.

The parties may enter into a separate software escrow agreement to accomplish the requirements of this section, or they may include the software covered by this Contract in any existing software escrow agreement between the parties which involves AGTS software.

For all commercially available software used, the as-built documentation shall include all of the documentation which is available from the supplier for such software. One (1) reproducible master and two (2) copies of all programmer and user manuals and other similar material will be provided to the City with the as-built drawings and documents along with a complete and fully documented listing of all software programs (one (1) copy on tape, two (2) printed copies).

PM-24 STANDARD FORMS

A. Forms

The forms listed below and appended to this Section will be used for performance of the Work as indicated. This is not a complete listing of all required forms. The Contractor shall properly complete all forms required by the contract or the Project Manager. The Project Manager shall review and approve all submitted forms. If submitted forms are not acceptable the Contractor shall resubmit forms in an acceptable format.

B. Appendices

Attached to these Project Management Provisions are the following forms:

These forms will be customized for use on this contract,by agreement between the City and the Contractors Project Mangers

1) Contractor's Daily Activity Report (Form CM-13) (1 Page)

2) Request for Information (Form CM-17) (1 Page)

3) Pay Application Form (Form CM-18) (1 Page)

4) Contractor's Certification of Payment (Form CM-19) (1 Page)

5) Subcontractor Partial Lien Release (Form CM-26) (1 Page)

6) Certificate of Current Cost or Pricing Data (Form CM-69) (1 Page)

7) Subcontractor Final Lien Release (Form CM-70) (1 Page)

8) Submittal (Form CM-30) (1Page)

SUBMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE (Read instructions on the reverse side prior to initiating this form)	DATE:	☐ New Submittal ☐ Resubmittal

Section I REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the Contractor)

TO: City and County of Denver 8500 Pena Boulevard Denver, Colorado 80249 Attention:	FROM:	CONTRACT NO.	SUBMITTAL NO. PREVIOUS SUBMITTAL NO.

SPECIFICATION SECTION NO. (Cover only one section with each submittal)	PROJECT TITLE AND LOCATION

ITEM # a.	DESCRIPTION OF ITEM SUBMITTED (Type, size, model number, etc.) b.	MFG. OR CONTR. CAT. CURVE DRAWING OR BROCHURE NO. (See Instruction No. 7) c.	No. of Copies d.	CONTRACT REFERENCE DOCUMENT		VAR. (See Instruction No. 5) g.	FOR CCD ACTION CODE h.
				SPEC. PARAGRAPH NO. e.	DRAWING SHEET NUMBER f.		

REMARKS:

Section II APPROVAL ACTION

CONTRACTOR'S CERTIFICATION:
(SEAL & SIGNATURE OF CONTRACTOR P.E. (as required)

I certify that the above submitted items have been reviewed in detail, and are correct and in strict conformance with the Contract Drawings and Specifications except as otherwise noted.

NAME AND SIGNATURE OF CONTRACTOR:

ENCLOSURES RETURNED (List by Item No.)

PROJECT MANAGER REVIEW:

A	[ ]	**ACCEPTED**	Item Nos.
B	[ ]	**ACCEPTED AS NOTED**	Item Nos.
C	[ ]	**REVISE & RESUBMIT**	Item Nos.
E	[ ]	**NOT ACCEPTED**	Item Nos.
F	[ ]	**RECEIPT ACKNOWLEDGED**	Item Nos.

Review is only for conformance to the respective requirements of the Contract Documents. Confirmation of dimensions, fabrication processes, construction techniques and coordination of the work of all trades are the sole responsibility of the Contractor. Permission to proceed with procurement, fabrication and/or construction is general only and shall not relieve nor diminish the responsibility of the Contractor for full compliance with the requirements of the Contract Documents.

Contract No. Submittal No. Date:

Name of Project Manager:

Signature of Project Manager:

COMMENTS BY PROJECT MANAGER ATTACHED (if applicable)

DENVER INTERNATIONAL AIRPORT
PARTIAL LIEN RELEASE – CONSTRUCTION
(Subcontractor)

Project: _____ Date: _____

City Contract No. _____ Current Subcontract Amount: $_____

FROM:
Subcontractor _____

(1) Last Progress Payment for billing period ending _____ 20___

Address: _____ $_____

City/State: _____

(2) Progress invoiced for previous billing period (if unpaid) _____ 20___

Telephone: _____ $_____

TO:
Contractor _____

(3) Progress invoiced for current billing period ending _____ 20___

Address: _____ $_____

City/State: _____

(4) **Total Paid to Date:**

$_____

( ) MBE/WBE ( ) SBE ( ) DBE ( ) Non

The undersigned Subcontractor hereby (1) acknowledges receipt of the progress payment referred to above as the Last Progress Payment which, when added to the total of all previous progress payments, constitutes full payment, less retainage, for all labor, services, material and supplies which the undersigned has provided for use in and upon the project described above through _____, 20____ and, (2) hereby releases the Contractor, surety, the City and County of Denver, and any intermediate subcontractor or supplier of any tier from any and all claims prior to the above mentioned date, except for the withheld retainage.

The Subcontractor also hereby agrees that the Contractor, Surety, the City and County of Denver, and any intermediate subcontractor or supplier of any tier shall be released from any and all claims arising out of its performance or non-performance of any contract associated with the above project through _____, 20____, except for withheld retainage after it has received full payment, less retainage, of the amount invoiced for the current billing period.

Subcontractor: _____

Certified by: _____

Title: _____

Date: _____

DENVER INTERNATIONAL AIRPORT

REQUEST FOR INFORMATION

RFI No.:	
Procurement No.:	
Date Logged:	
Logged by:	

Contractor: _____
Subcontractor: _____
Contract Title: _____
Site Location: _____

Subject:	Reply Required by:	URGENT?
Dwg./Spec. No.:	Detail/Sec. No.:	

Problem:

Proposed Solution from Contractor by:	Date:	Reviewed By:

Response by Project Manager:			
Solution by:	Date:	Reviewed By:	Date:

DENVER INTERNATIONAL AIRPORT
FINAL LIEN RELEASE – CONSTRUCTION
(Subcontractor)

Project: _____ Date: _____

City Contract No. _____ Subcontractor Contract No. _____

Dated: _____, 20 ___

FROM:
Subcontractor: _____ (1) Last Progress Payment for billing period ending _____, 20 ___

Address: _____ $_____

City/State: _____ (2) Does not apply

Telephone: _____

TO:
Contractor: _____ (3) Does not apply

Address: _____

City/State: _____ (4) **Total Paid to Date:**

$_____

( ) SBE ( ) DBE ( )MBE ( )WBE ( ) Non

The undersigned Subcontractor hereby (1) acknowledges receipt of the progress payment referred to above as the Last Progress Payment which, when added to the total of all previous progress payments, constitutes full payment for all labor, services, materials and supplies which the undersigned has provided for use in and upon the project described above through _____, 20____ and, (2) hereby releases the Contractor, Surety, the City and County of Denver, and any intermediate subcontractor or supplier of any tier from any and all claims prior to the above mentioned date.

The Subcontractor also hereby agrees that the Contractor, Surety, the City and County of Denver, and any intermediate subcontractor or supplier of any tier shall be released from any and all claims arising out of its performance or non-performance of any contract associated with the above project.

Subcontractor: _____

Certified by: _____

Title: _____

Date: _____

DENVER INTERNATIONAL AIRPORT

CERTIFICATE OF CURRENT COST OR PRICING DATA

Contract Title:

Contract No.:

This is to certify that, to the best of my knowledge and belief, the cost of pricing data submitted in writing to the City in support of _____ is accurate, complete and current as of _____ and represents the best price that is available from suppliers and subcontractors.

This certification includes the cost of pricing data supporting any advance agreements and forward pricing rate agreements between the offeror and the City that are part of the proposal.

FIRM
NAME
TITLE
DATE

CONTRACTOR'S CERTIFICATION OF PAYMENT

CITY AND COUNTY OF DENVER
DEPARTMENT OF AVIATION

PROJECT NAME:

CONTRACT NO.:

CONTRACTOR NAME:

PAYMENT NO.:

TELEPHONE NO.:

CONTRACT ENCUMBRANCE NO.:

PROJECT MANAGER:

CURRENT COMPLETION DATE:

ORIGINAL CONTRACT AMOUNT: $

PERCENT COMPLETE:

REVISED CONTRACT AMOUNT THRU C.O. NO. : $

SUBCONTRACTOR NAME	TIER OR SUPPLIER	SUBCONTRACTOR PERSON TO CONTACT	SUBCONTRACTOR TELEPHONE NO.	SUBCONTRACT AMOUNT ($)	DBE, SBE or NON	PERCENT OF ORIGINAL CONTRACT	PERCENT OF REVISED CONTRACT	NET PAID TO DATE ($)	NET PAID PERCENT COMPLETE	NET DUE THIS MONTH ($)

( ) Check here if all undisputed CERTIFIED PAYROLLS have been submitted to the CITY AUDITOR for this Pay Application

( ) Check here if copies of documentation for all disputed CERTIFIED PAYROLLS for this Pay Application have been attached

The undersigned certifies that the information contained in this document is true and accurate and that the payments shown have been made to all subcontractors and suppliers used on the project and listed herein.

Contractor Name (print): _____ Date: _____

Contractor Signature: _____ Page _____ of _____

CM-19 Revised Dec. 2000

DENVER INTERNATIONAL AIRPORT

Contractor's Daily Construction Report

Contract Name:

Contractor: _____ Contract No.:

Date:

Prepared by: Report No.:

Weather: ☐ Sunny ☐ Fair ☐ Cloudy ☐ Rain _____ inches ☐ Snow _____ inches

Max. Wind: _____ mph Max/Min Temp. _____ deg F/ _____ deg F

DAILY ACTIVITIES WITH LOCATION (SHIFT START _____ STOP _____)	LOAD COUNTS	COMPLIES WP&S YES	COMPLIES WP&S NO

QUANTITY COMPLETE	MAJOR SHIPMENTS RECEIVED

									EQUIPMENT AT SITE		
Subcontractors									DESCRIPTION	NO.	HRS.
Crafts											
PERSONNEL											

Work Delayed and Reason			
Rework and Reason			
Potential Future Delays			
Problems and Unusual Conditions	**UNDER REPAIR**		
Direction Received			

CERTIFIED BY (signature required):

Contractor QC Representative: _____

Contractor Superintendent: _____ Page ____ of _____

NOTE: This report must be completed with legible handwriting and submitted to the City and County of Denver Project Manager with original signatures. Use a separate sheet per shift.

FORM CM-13
Rev. January 2011

CITY AND COUNTY OF DENVER
DEPARTMENT OF AVIATION
DENVER INTERNATIONAL AIRPORT

Date of Invoice: _____
Contract No.: _____
Contract Title: _____
Contractor: _____
Application for Progress Payment No.: _____
For the Period: _____ to _____

CONSTRUCTION CONTRACT
APPLICATION FOR PROGRESS PAYMENT
SUMMARY AUTHORIZATION

CONTRACTOR:

I hereby warrant that: 1) The title to the Work covered by this estimate of Work completed will pass to the City by incorporation into the completed work; 2) The Work covered by previous estimates of Work completed is free and clear of liens, claims, security interests or encumbrances, except for any interest created by retainage; and 3) No Work covered by this estimate of Work completed is subject to an agreement under which an interest therein, or an encumbrance thereon, is retained by the seller or otherwise imposed by the Contractor or any other person or entity.

SIGNATURE/TITLE _____ DATE _____

CITY AND COUNTY OF DENVER:

I hereby certify that, to the best of my knowledge, this payment application represents a true and correct statement of the work performed and is in conformance with the terms of the Contract documents.

Project Manager
DIA Planning & Development _____ DATE _____

Michael H. Steffens
Assistant Deputy Manager of Aviation
DIA Planning & Development _____ DATE _____

APPROVED FOR PAYMENT:

Margo Blu
Senior Agency Budget Analyst
Finance & Administration _____ DATE _____

CONTRACT STATUS

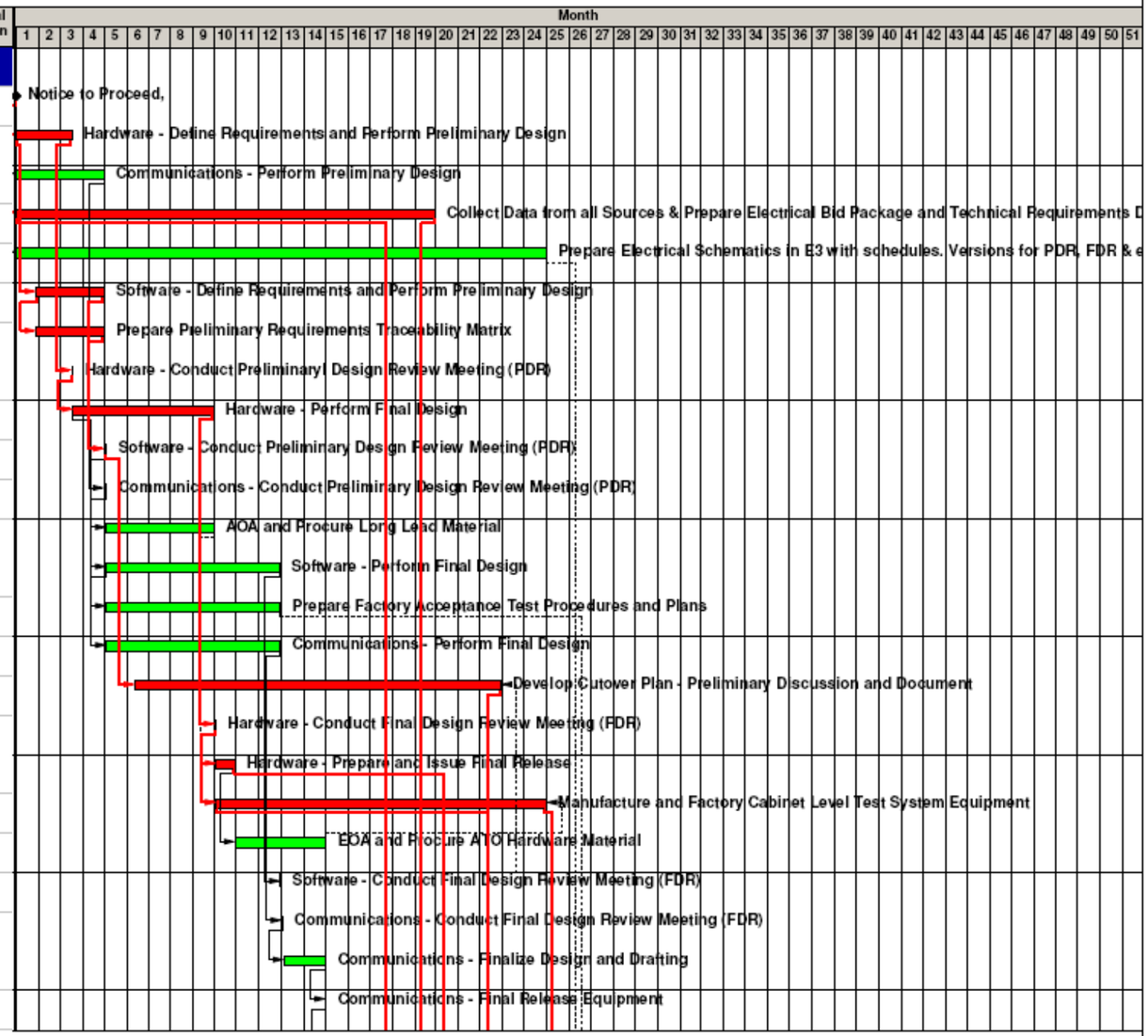
			TOTAL CONTRACT	CURRENT APPLICATION	PREVIOUS PAYMENT
a)	ORIGINAL CONTRACT AMOUNT		$ -		
b)	PREVIOUS CHANGE ORDERS NOS.	(+ or -)			
c)	NEW CHANGE ORDERS NO.	(+ or -)			
	NO.	(+ or -)	$ -		
	NO.	(+ or -)	$ -		
d)	ADJUSTED TOTAL CONTRACT d = [a + b + c]		$ -		
e)	PREVIOUS EARNINGS				$ -
f)	EARNINGS THIS APPLICATION			$ -	
g)	TOTAL CURRENT EARNINGS g = [e + f]		$ -		
h)	TO COMPLETE h = [d - g]		$ -		
i)	PREVIOUS RETENTION				$ -
j)	RETENTION THIS APPLICATION	10%		$ -	
k)	TOTAL RETENTION k = [i + j]		$ -		
l)	OTHER DEDUCTIONS				
m)	BALANCE DUE ON CONTRACT m = [h + k + l]		$ -		
n)	TOTAL PREVIOUS PAYMENTS n = [e - i - l]				$ -
o)	PAYMENT THIS APPLICATION o = [f - j - l]			$ -	

CM-18 Rev. October 2008

Note: Items a, b, c, d, g, h, k and m amounts - place only in TOTAL CONTRACT column.

Denver APM Central Control & ATC Upgrade

Activity ID	Activity Name	Original Duration
Denver APM ATC Upgrade Proposal - One NTP		**934**
DN1000	Notice to Proceed	0
DN2005	Hardware - Define Requirements and Perform Preliminary Design	54
DN3605	Communications - Perform Preliminary Design	84
DN2120	Collect Data from all Sources & Prepare Electrical Bid Package and Technical Requirements Description (TRD)	390
DN2100	Prepare Electrical Schematics in E3 with schedules. Versions for PDR, FDR & end of factory test	495
DN3005	Software - Define Requirements and Perform Preliminary Design	64
DN3105	Prepare Preliminary Requirements Traceability Matrix	64
DN2070	Hardware - Conduct Preliminaryl Design Review Meeting (PDR)	2
DN2010	Hardware - Perform Final Design	128
DN3070	Software - Conduct Preliminary Design Review Meeting (PDR)	2
DN3670	Communications - Conduct Preliminary Design Review Meeting (PDR)	2
DN2040	AOA and Procure Long Lead Material	98
DN3010	Software - Perform Final Design	160
DN4010	Prepare Factory Acceptance Test Procedures and Plans	162
DN3610	Communications - Perform Final Design	162
DN3505	Develop Cutover Plan - Preliminary Discussion and Document	346
DN2090	Hardware - Conduct Final Design Review Meeting (FDR)	2
DN2105	Hardware - Prepare and Issue Final Release	18
DN4505	Manufacture and Factory Cabinet Level Test System Equipment	309
DN2140	EOA and Procure ATO Hardware Material	86
DN3090	Software - Conduct Final Design Review Meeting (FDR)	2
DN3690	Communications - Conduct Final Design Review Meeting (FDR)	2
DN3615	Communications - Finalize Design and Drafting	40
DN3620	Communications - Final Release Equipment	1



Preliminary Project Schedule

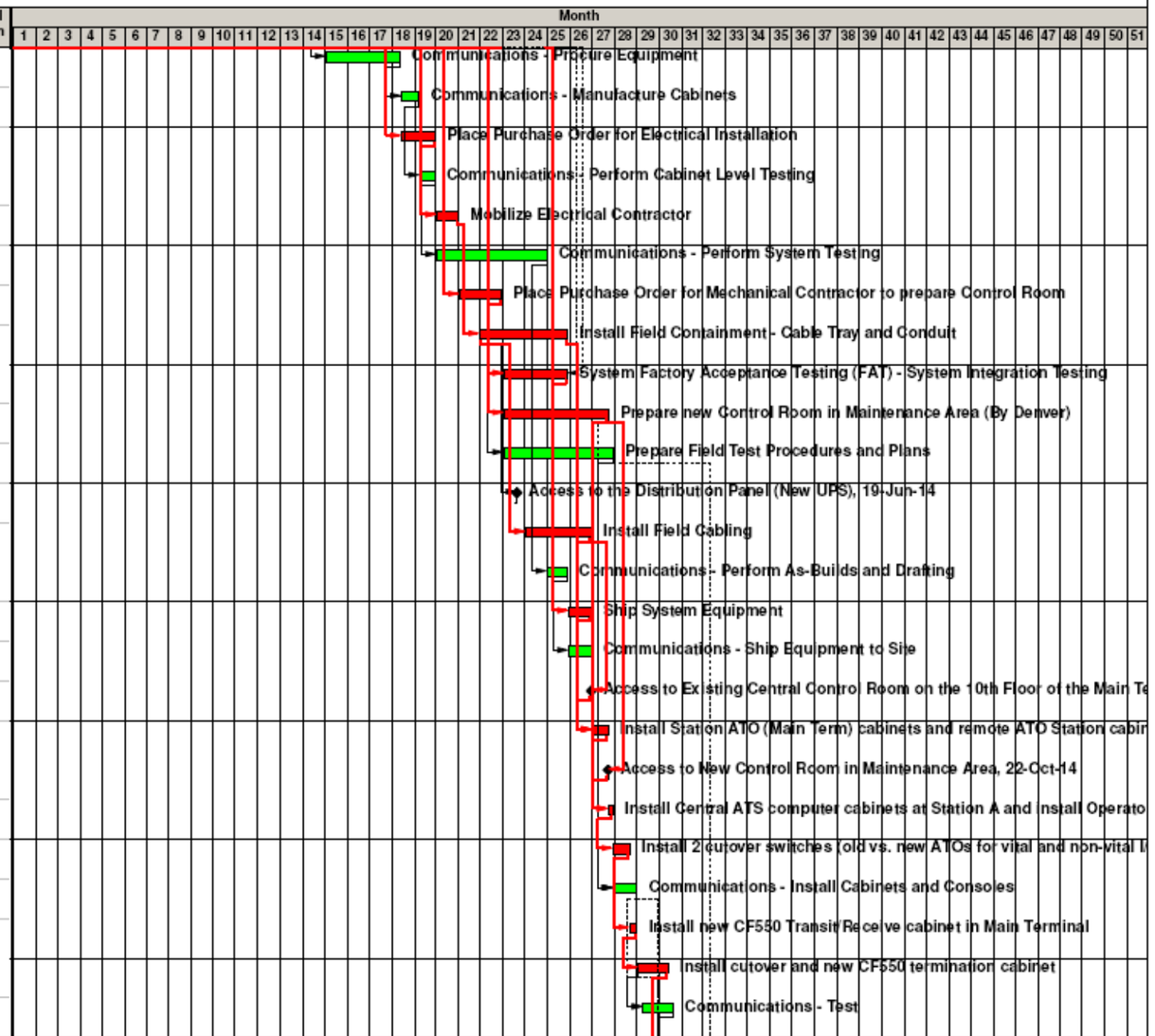
Page 1 of 3

Bombardier

Figure 5: One NTP Preliminary Project Schedule (Page 1 of 3)

Denver APM Central Control & ATC Upgrade

Activity ID	Activity Name	Original Duration
DN3640	Communications - Procure Equipment	64
DN3645	Communications - Manufacture Cabinets	19
DN2130	Place Purchase Order for Electrical Installation	35
DN3650	Communications - Perform Cabinet Level Testing	16
DN2135	Mobilize Electrical Contractor	22
DN3655	Communications - Perform System Testing	105
DN2150	Place Purchase Order for Mechanical Contractor to prepare Control Room	41
DN7000	Install Field Containment - Cable Tray and Conduit	84
DN5005	System Factory Acceptance Testing (FAT) - System Integration Testing	63
DN7030	Prepare new Control Room in Maintenance Area (By Denver)	101
DN4210	Prepare Field Test Procedures and Plans	106
DN7005	Access to the Distribution Panel (New UPS)	0
DN7010	Install Field Cabling	64
DN3660	Communications - Perform As-Builds and Drafting	21
DN6005	Ship System Equipment	22
DN3665	Communications - Ship Equipment to Site	22
DN7015	Access to Existing Central Control Room on the 10th Floor of the Main Terminal	0
DN7020	Install Station ATO (Main Term) cabinets and remote ATO Station cabinets	16
DN7031	Access to New Control Room in Maintenance Area	0
DN7035	Install Central ATS computer cabinets at Station A and install Operator control room connected to DTS at Maint. Bldg.	5
DN7050	Install 2 cutover switches (old vs. new ATOs for vital and non-vital I/O) in old station termination cabinet	16
DN3675	Communications - Install Cabinets and Consoles	21
DN7065	Install new CF550 Transit/Receive cabinet in Main Terminal	5
DN7080	Install cutover and new CF550 termination cabinet	23
DN3680	Communications - Test	23



Preliminary Project Schedule

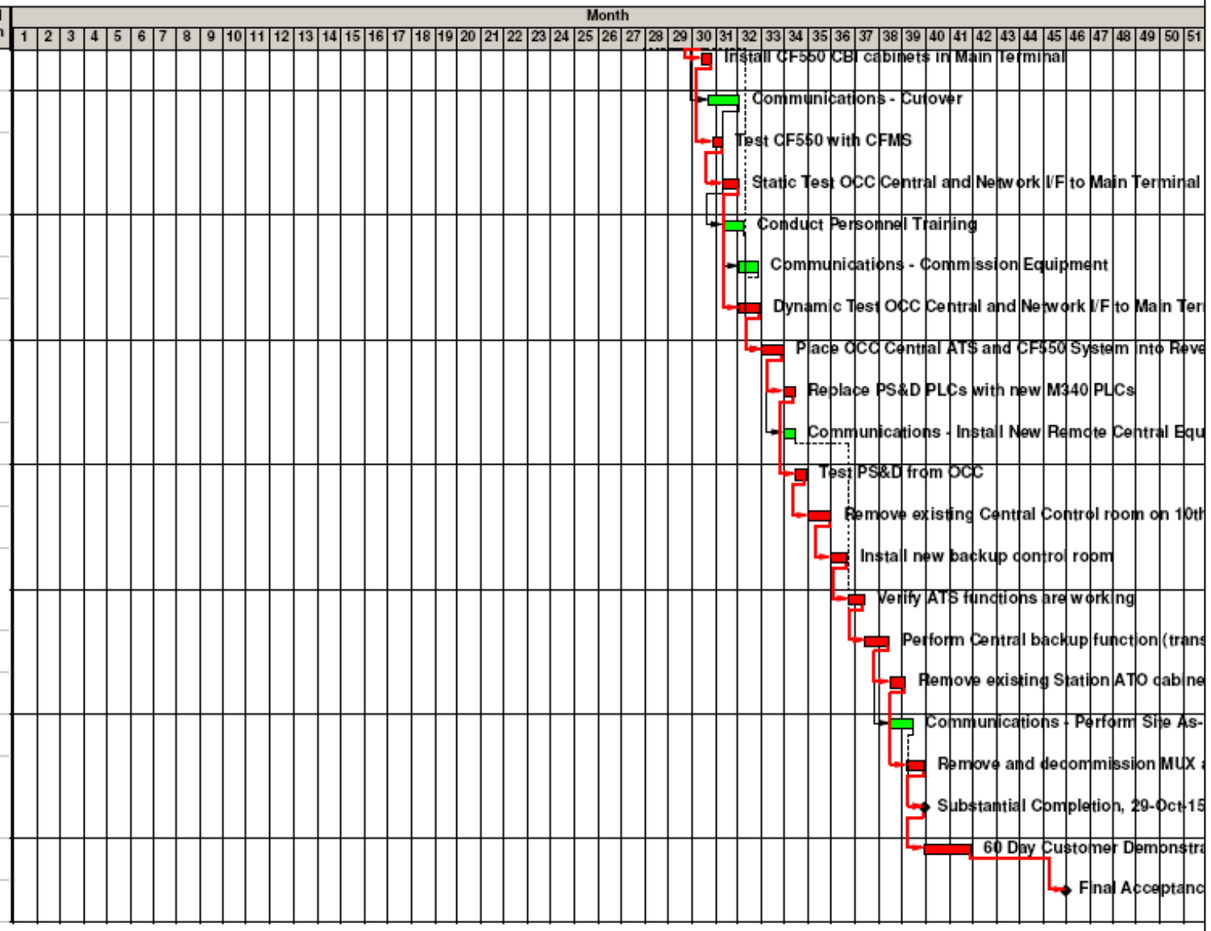
Page 2 of 3

Bombardier

Figure 5: One NTP Preliminary Project Schedule (Page 2 of 3)

Denver APM Central Control & ATC Upgrade

Activity ID	Activity Name	Original Duration
DN7095	Install CF550 CBI cabinets in Main Terminal	10
DN3681	Communications - Cutover	30
DN7110	Test CF550 with CFMS	10
DN7125	Static Test OCC Central and Network I/F to Main Terminal and CF550	15
DN8005	Conduct Personnel Training	20
DN3685	Communications - Commission Equipment	19
DN7140	Dynamic Test OCC Central and Network I/F to Main Terminal ATO and CF550	21
DN7155	Place OCC Central ATS and CF550 System into Revenue Service	20
DN7170	Replace PS&D PLCs with new M340 PLCs	12
DN3688	Communications - Install New Remote Central Equipment	12
DN7185	Test PS&D from OCC	10
DN7200	Remove existing Central Control room on 10th floor of Main Terminal	22
DN7215	Install new backup control room	15
DN7230	Verify ATS functions are working	15
DN7245	Perform Central backup function (transfer control) testing	22
DN7260	Remove existing Station ATO cabinets & place new station ATO cabinets in permanent locaton	15
DN3695	Communications - Perform Site As-Builds	22
DN7275	Remove and decommission MUX and vital relay interlocking cabinets	18
DN9000	Substantial Completion	0
DN9100	60 Day Customer Demonstration	61
DN9010	Final Acceptance	0



Preliminary Project Schedule

Page 3 of 3

Bombardier

Figure 5: One NTP Preliminary Project Schedule (Page 3 of 3)

11. Schedule of Values

Table 4: Single Notice to Proceed

Month	Activity Description	Dollar Amount	Percent
1	Project Management/Engineering Management Month 1	$ 99,200	0.40%
1	Notice to Proceed	$ 2,480,000	10.00%
2	Project Management/Engineering Management Month 2	$ 99,200	0.40%
3	Project Management/Engineering Management Month 3	$ 99,200	0.40%
3	Hardware - Conduct Preliminary Design Review Meeting (PDR)	$ 968,025	3.90%
4	Project Management/Engineering Management Month 4	$ 99,200	0.40%
5	Software - Conduct Preliminary Design Review Meeting (PDR)	$ 968,025	3.90%
5	Project Management/Engineering Management Month 5	$ 99,200	0.40%
6	Project Management/Engineering Management Month 6	$ 99,200	0.40%
7	Project Management/Engineering Management Month 7	$ 99,200	0.40%
8	Project Management/Engineering Management Month 8	$ 99,200	0.40%
9	Project Management/Engineering Management Month 9	$ 99,200	0.40%
9	AOA and Procure Long Lead Material	$ 1,195,414	4.82%
10	Hardware - Conduct Final Design Review Meeting (FDR)	$ 968,025	3.90%
10	Project Management/Engineering Management Month 10	$ 99,200	0.40%
11	Project Management/Engineering Management Month 11	$ 99,200	0.40%
12	Project Management/Engineering Management Month 12	$ 99,200	0.40%
12	Software - Conduct Final Design Review Meeting (FDR)	$ 968,025	3.90%
13	Prepare Factory Acceptance Test Procedures and Plans	$ 968,025	3.90%
13	Project Management/Engineering Management Month 13	$ 99,200	0.40%
14	Project Management/Engineering Management Month 14	$ 99,200	0.40%
14	EOA and Procure ATO Hardware Material	$ 1,195,414	4.82%
15	Communications - Final Release Equipment	$ 968,025	3.90%
15	Project Management/Engineering Management Month 15	$ 99,200	0.40%
16	Project Management/Engineering Management Month 16	$ 99,200	0.40%
17	Project Management/Engineering Management Month 17	$ 99,200	0.40%
18	Project Management/Engineering Management Month 18	$ 99,200	0.40%
19	Communications - Manufacture Cabinets	$ 1,170,614	4.72%
19	Project Management/Engineering Management Month 19	$ 99,200	0.40%
19	Place Purchase Order for Electrical Installation	$ 580,471	2.34%
19	Prepare & Release Electrical Bid Package and Technical Requirements Description (TRD)	$ 968,025	3.90%

Month	Activity Description	Dollar Amount	Percent
20	Project Management/Engineering Management Month 20	$ 99,200	0.40%
21	Project Management/Engineering Management Month 21	$ 99,200	0.40%
22	Project Management/Engineering Management Month 22	$ 99,200	0.40%
23	Project Management/Engineering Management Month 23	$ 99,200	0.40%
24	Project Management/Engineering Management Month 24	$ 99,200	0.40%
24	Manufacture and Factory Cabinet Level Test System Equipment	$ 939,037	3.79%
25	Project Management/Engineering Management Month 25	$ 99,200	0.40%
26	Project Management/Engineering Management Month 26	$ 99,200	0.40%
26	Ship System Equipment	$ 997,533	4.02%
27	Project Management/Engineering Management Month 27	$ 99,200	0.40%
27	Install Station ATO (Main Term) cabinets and remote ATO Station cabinets	$ 1,160,942	4.68%
27	Install Central ATS computer cabinets at Station A and install Operator control room conne	$ 1,160,942	4.68%
28	Project Management/Engineering Management Month 28	$ 99,200	0.40%
28	Install 2 cutover switches (old vs. new ATOs for vital and non-vital I/O) in old station termi	$ 580,471	2.34%
29	Install new CF550 Transit/Receive cabinet in Main Terminal	$ 968,025	3.90%
29	Project Management/Engineering Management Month 29	$ 99,200	0.40%
30	Install cutover and new CF550 termination cabinet	$ 580,471	2.34%
30	Project Management/Engineering Management Month 30	$ 99,200	0.40%
30	Install CF550 CBI cabinets in Main Terminal	$ 332,471	1.34%
31	Project Management/Engineering Management Month 31	$ 99,200	0.40%
32	Project Management/Engineering Management Month 32	$ 99,200	0.40%
33	Project Management/Engineering Management Month 33	$ 99,200	0.40%
34	Communications - Install New Remote Central Equipment	$ 614,824	2.48%
34	Project Management/Engineering Management Month 34	$ 99,200	0.40%
35	Project Management/Engineering Management Month 35	$ 99,200	0.40%
36	Project Management/Engineering Management Month 36	$ 99,200	0.40%
37	Project Management/Engineering Management Month 37	$ 99,200	0.40%
38	Project Management/Engineering Management Month 38	$ 99,200	0.40%
39	Project Management/Engineering Management Month 39	$ 99,200	0.40%
39	Substantial Completion	$ 99,200	0.40%
	Final Acceptance	$ 99,200	0.40%
	Grand Total	$ 24,800,000	100.00%

EXHIBIT E-1

Certificate of Final Completion

AGTS Central Control Upgrade and ATC Replacement

CONTRACT NO:	XXXXXXXX
DESCRIPTION:	Central Control System Upgrade and ATC Replacement
CONTRACTOR:	Bombardier Transportation (Holdings) USA Inc.
DATE/TIME:	

This Certificate of Final Completion is issued under the above-described Contract (the "Contract" or the "Contract") between the City and the Contractor, and applies to the AGTS Central Control Upgrade and the ATC Replacement.

The City agrees that the Contractor's responsibilities as contained in the Contract, including the Technical Specifications, are complete to the point that the City can fully utilize the AGTS Central Control Upgrade and the ATC Replacement for the purpose intended. This Certificate is intended to constitute evidence of Final Acceptance of the AGTS Central Control Upgrade and the ATC Replacement under the Contract. There is no remaining work to be performed by the Contractor under the provisions of the Contract with respect to the AGTS Central Control Upgrade and the ATC Replacement except warranty obligations.

ACCEPTANCE FOR THE CONTRACTOR:

I, as the Authorized Representative of the Contractor on this project, agree:

That the Contractor has met all obligations and responsibilities contained in the Technical Specifications of the Contract; and

That the Contractor agrees to its warranty obligations, as provided in the Contract.

Date: _____ Bombardier Transportation (Holdings) USA Inc.

Name: _____

Title: _____ By:_____

APPROVAL FOR THE CITY AND COUNTY OF DENVER:

I recommend approval of this Certificate of Final Completion:	APPROVED:
_____ Deputy Manager of Aviation – Planning & Development	_____ Manager of Aviation
_____ Date	_____ Date

EXHIBIT E-2

Certificate of Substantial Completion

AGTS Central Control Upgrade and ATC Replacement

CONTRACT NO:	XXXXXX
DESCRIPTION:	Central Control System Upgrade and ATC Replacement
CONTRACTOR:	Bombardier Transportation (Holdings) USA Inc.
DATE/TIME:	

This Certificate of Substantial Completion is issued under the above-described Contract (the "Contract" or the “Contract”) between the City and the Contractor, and applies to the AGTS Central Control Upgrade.

With reference to the AGTS Central Control Upgrade and ATC Replacement, the City agrees that the Contractors' responsibilities as contained in the Technical Specifications of the Contract are complete to the point that the City can fully utilize the AGTS Central Control Upgrade and ATC Replacement for the purpose intended, as determined by the City at its sole discretion. This Certificate is intended to constitute evidence of Substantial Acceptance of the AGTS Central Control Upgrade and ATC Replacement under the Contract. There is no remaining work to be performed by the Contractor under the provisions of the Contract with respect to the AGTS Central Control Upgrade and ATC Replacement except the work identified on the attached "Punch List of Remaining Work.”

ACCEPTANCE FOR THE CONTRACTOR

I, as the Authorized Representative of the Contractor on this project, agree:

That the Contractor has met all obligations and responsibilities contained in the Contract, including the Technical Specifications, except for the work identified on the attached "Punch List of Remaining Work:" and

That the Contractor will endeavor to complete the work on the "Punch List of Remaining Work" as soon as possible, but in no case later than _____; and

That the Contractor agrees to abide by responsibilities for warranties, as provided in the Contract.

Date: _____ Bombardier Transportation (Holdings) USA Inc.

Name: _____

Title: _____ By:_____

APPROVAL FOR THE CITY AND COUNTY OF DENVER

I recommend approval of this Certificate of Substantial Completion: _____ Deputy Manager of Aviation – Planning & Development _____ Date	APPROVED: _____ Manager of Aviation _____ Date

EXHIBIT F

Prevailing Wage Rate Schedules

DENVER
THE MILE HIGH CITY

TO: All Users of the City of Denver Prevailing Wage Schedules

FROM: Seth Duhon-Thornton, CSA Compensation and Classification

DATE: September 7, 2012

SUBJECT: Latest Update to Prevailing Wage Schedules

Please find an attachment to this memorandum all of the current Career Service Prevailing Wage Schedules issued in accordance with the City and County of Denver's Revised Municipal Code, Section 20-76(c). This schedule does not include the Davis-Bacon rates. The Davis-Bacon wage rates will continue to be published separately as they are announced.

Modification No. 101
Publication Date: 9-7-2012
(9 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to, and individually registered in, a bona fide apprenticeship program registered with the U.S. Department of Labor. The employer and the individual apprentice must be registered in a program, which has received prior approval, by the U.S. Department of Labor. Any employer, who employs an apprentice and is found to be in violation of this provision, shall be required to pay said apprentice the full journeyman scale.

Questions call (720) 913-5664

Attachments as listed above.

APPLIANCE MECHANIC

Last Revision: 02-19-2009
Effective: 02-19-2009

Classification:	Base Wage	Fringes
Appliance Mechanic	$22.34/hour	$5.82/hour

Plus 10% shift differential for regularly scheduled hours worked between 6:00 p.m. and 6:00 a.m.

The Appliance Mechanic installs, services and repairs stoves, refrigerators, dishwashing machines, and other electrical household or commercial appliances, using hand tools, test equipment and following wiring diagrams and manufacturer's specifications. Responsibilities include: connects appliance to power source and test meters, such as wattmeter, ammeter, or voltmeter, observes readings on meters and graphic recorders, examines appliance during operating cycle to detect excess vibration, overheating, fluid leaks and loose parts, and disassembles appliances and examines mechanical and electrical parts. Additional duties include: traces electrical circuits, following diagram and locates shorts and grounds, using ohmmeter, calibrates timers, thermostats and adjusts contact points, and cleans and washes parts, using wire brush, buffer, and solvent to remove carbon, grease and dust. Replaces worn or defective parts, such as switches, pumps, bearings, transmissions, belts, gears, blowers and defective wiring, repairs and adjusts appliance motors, reassembles appliance, adjusts pulleys and lubricates moving parts, using hand tools and lubricating equipment.

Note: This position does not perform installations done at new construction.

BAGGAGE HANDLING SYSTEM MAINTENANCE

Last Revision: 10-22-2010
Effective: 10-21-2011

Classification:	Base Wage	Fringes
Entry-Support Mechanic	$15.26/hour	$5.35/hour
Machinery Maintenance Mechanic	$19.33/hour	$5.82/hour
Controls System Technician	$24.90/hour	$6.46/hour

Plus 10% shift differential for regularly scheduled hours worked between 6:00 p.m. and 6:00 a.m.

Entry Support Mechanic
Under direct supervision, assists the Machinery Maintenance Mechanic in maintaining the operational status of the baggage handling system. Duties include but are not limited to; assisting with adjustments with belt tracking, belt tension, and gearbox.

Machinery Maintenance Mechanic
Performs routine and basic adjustments of baggage handling system equipment including but not limited to, belt tracking, belt tension, and gearbox and bearing lubrication. Performs daily and periodic shift inspections, cleaning, and diagnostics of mechanical system components based on an established preventive maintenance program. Dismantles, repairs, and reassembles equipment or machines for stock replacement or to restore baggage handling system equipment to operational status. Preventive maintenance and overhauling machines includes, but is not limited to, motors, clutches, brakes, transporting telecars, bearings, drive belts, drive shafts, pulleys, gearboxes (speed reducers), and conveyor belting. Maintains daily turnover reports and hourly labor time sheets for warranty reimbursement and statistical tracking of repairs.

Controls System Technician
Performs a variety of functions such as installation, maintenance, and repair of devices which control and are controlled by the baggage handling system and related equipment. Such devices include, but are not

limited to, personal computers, programmable logic controllers and peripherals, motor control panels, photoelectric sensors, sync-pulse tachometers, laser and RF readers, linear induction motors and servo-drives. Troubleshoots and repairs all control system and electrical failures by applying comprehensive technical knowledge to solve problems by interpreting manufacturer manuals or similar documents. Work requires familiarity with the interrelationships of electro-mechanical devices.

Removes and replaces plug-in type boards and components. Aligns, replaces, and cleans photocells. Makes minor repairs of connectors, wiring and fuses on-site, and cleans and performs diagnostic routines of electrical and control system components. Performs scheduled routine maintenance on all control system components and reporting devices (including personal computers), based on recommended manufacturer practices. Uses a personal computer to diagnose and correct PLC and operating system software problems. Diagnoses, repairs and aligns laser array (baggage tag reader) and RF reader hardware and software.

Note: Incumbents must posses an Electrician's license when work warrants.

BUILDING ENGINEER

Last Revision: 07-21-2011
Effective: 07-19-2012

Classification:	Base Wage	Fringes
Building Engineer	$28.85/hour	$7.04/hour

This classification of work is responsible for operating, monitoring, maintaining/repairing the facilities mechanical systems to ensure peak performance of the systems. This includes performing P.M. and repair work of the building mechanical systems, inspecting, adjusting, and monitoring the building automation and life safety systems, contacting vendors and place order replacement parts, responding to customer service requests and performing maintenance/repairs I tenant or public spaces, performing routine P.M. i.e. light plumbing an electrical repairs, ballast lamp and tube replacement, operating mechanical systems both on site and via a remote laptop computer, maintaining inventory of spare parts and tools, painting and cleaning mechanical equipment and machine rooms, etc.

FUEL HANDLER SERIES

Last Revision: 10-22-2010
Effective: 10-21-2011

Classification:	Base Wage	Fringes
Fuel Distribution System Operator	$18.97/hour	$5.78/hour
Lead Fuel Distribution System Operator	$19.83/hour	$5.88/hour
Fuel Distribution System Mechanic	$23.46/hour	$6.30/hour
Lead Fuel Distribution System Mechanic	$24.53/hour	$6.42/hour

Plus 10% shift differential for hours worked between 6:00 p.m. and 6:00 a.m.

Fuel Distribution System Operator:

Receives, stores, transfers, and issues fuel. Performs various testing procedures and documentation on fuel samples. Gauges tanks for water, temperature and fuel levels. Performs temperature and gravity testing for correct weight of fuel. Checks pumping systems for correct operating pressure or unusual noises. Inspects fuel receiving, storage, and distribution facilities to detect leakage, corrosion, faulty fittings, and malfunction of mechanical units, meters, and gauges such as distribution lines, float gauges, piping valves, pumps, and roof sumps. Operates a 24-hour control center; operates various computer equipments

to determine potential equipment failure, leak and cathodic protection systems, pump failure, and emergency fuel shutoff systems. Monitors quality of fuel and drains excess condensation from fuel sumps and underground fuel pits. Inspects fuel tank farm for such items as leaks, low pressure, and unauthorized personnel. Performs general housekeeping and grounds maintenance for terminal, pipeline and dock areas, including fuel pits and valve vault cleaning and pump out activities. May connect lines, grounding wires, and loading and off loading arms of hoses to pipelines. May assist Fuel Distribution System Mechanics by preparing work areas. Maintains record of inspections, observations and test results.

Lead Fuel Distribution System Operator:

Performs lead duties such as making and approving work assignments and conducting on-the-job training as well as performing the various tasks performed by the Operator classification.

Fuel Distribution System Mechanic:

Maintains and repairs fuel storage and distribution systems, equipment and filtration systems, and differential pressure valves. Corrects leakage, corrosion, faulty fittings, and malfunction of mechanical units, meters, and gauges such as distribution lines, float gauges, piping valves, pumps, and roof sumps. Inspects electrical wiring, switches, and controls for safe-operating condition, grounding, and adjustment; may make minor repairs. Lubricates and repacks valves. Lubricates pumps, replaces gaskets, and corrects pumping equipment misalignment. May clean strainers and filters, service water separators, and check meters for correct delivery and calibration. Overhauls system components such as pressure regulating valves and excess valves. Disassembles, adjusts, aligns, and calibrates gauges and meters or replaces them. Removes and installs equipment such as filters and piping to modify system or repair and replace system component. Cleans fuel tanks and distribution lines. Removes corrosion and repaints surfaces. Overhauls vacuum and pressure vents, floating roof seals, hangers, and roof sumps. Some positions maintain fuel-servicing equipment such as hydrant and tanker trucks. Maintains record of inspections and repairs and other related paperwork as required.

Lead Fuel Distribution System Mechanic:

Performs lead duties such as making and approving work assignments and conducting on-the-job training as well as performing the various tasks performed by the Mechanic classification.

These classifications are recommended to be inclusive and to supersede any previously adopted classifications.

CUSTODIANS

Last Revision: 01-01-2012
Effective: 09-06-2012

Classification	Base Wage	Fringes
Custodian I	$13.33/hour	$3.82 SINGLE $5.30 2-PARTY $6.52 FAMILY
Custodian II	$13.68/hour	$3.87 SINGLE $5.36 2-PARTY $6.57 FAMILY

Benefits and Overtime

Parking	With valid receipt from approved parking lot, employees are reimbursed the actual monthly cost of parking.
RTD Bus Pass	Employer will provide employees with the Bus Pass or pay ($0.11) per hour for travel differential.
Shift Differential	2nd shift (2:30 p.m.-10:30 p.m.): $.50/hr 3rd shift (10:31 p.m.-6:30 a.m.): $1.00/hr.
Overtime	Time worked in excess of seven and one-half (7 ½) hours in one (1) day or in excess of thirty-seven and one-half (37 ½) hours in one week shall constitute overtime and shall be paid for at the rate of time and one-half (1 ½) at the employee's basic straight time hourly rate of pay.
Lunch	Any employee working seven and a half (7.5) hours in a day is entitled to a thirty (30) minute paid lunch.
Note	The Career Service Board in their public hearing on March 15, 2007 approved to amend prevailing wages paid to the Custodian as follows: "All contractors shall provide fringe benefits or cash equivalent at not less than the single rate amount. Contractors who offer health insurance shall provide an employer contribution to such insurance of not less than the 2-party or family rate for any employee who elects 2-party or family coverage. Contractors who offer such coverage will be reimbursed for their employer contributions at the above rates under any City contract incorporating this wage specification."

Position Descriptions:

Custodian I	Any employee performing general clean-up duties using equipment that does not require special training: i.e., dust mopping, damp mopping, vacuuming, emptying trash, spray cleaning, washing toilets, sinks, walls, cleaning chairs, etc.
Custodian II	Any employee performing specialized cleaning duties requiring technical training and the use of heavy and technical equipment, i.e., heavy machine operators floor strippers and waxers, carpet shampooers, spray buffing, re-lamping, mopping behind machines, high ladder work, chemical stripping and finishing of stainless steel.

FIRE EXTINGUISHER REPAIRER

Established date: 09/06/2012

Proposed			
Base Wage (per hour)	Fringes (per hour)	Total (per hour)	% Increase
$18.97	$5.90	$24.87	N/A

Fire Extinguisher Repairer

The Fire Extinguisher Repairer performs the following duties: repairs and tests fire extinguishers in repair shops and in establishments, such as factories, homes, garages, and office buildings, Using hand tools and hydrostatic test equipment, this repairer dismantles extinguisher and examines tubings, horns, head gaskets, cutter disks, and other parts for defects, and replaces worn or damaged parts. Using hand tools, this repairer cleans extinguishers and recharges them with materials, (such as soda water and sulfuric acid, carbon tetrachloride, nitrogen or patented solutions); tests extinguishers for conformity with legal specifications using hydrostatic test equipment, and may install cabinets and brackets to hold extinguishers.

FURNITURE MOVERS
(Moving, Storage and Cartage Workers)

Last Revision: 10-22-2010
Effective: 10-21-2011

Classification:	Base Wage	Fringes
Laborer/Helper	$17.36/hour	$5.59/hour
Driver/Packer	$17.43/hour	$5.60/hour
Lead Worker	$18.22/hour	$5.69/hour

LANDSIDE PARKING ELECTRONICS TECHNICIAN

Last Revision: 10-22-2010
Effective: 10-21-2011

Classification:	Base Wage	Fringes
Landside Parking Electronics Technician	$22.14/hour	$6.14/hour

Plus 10% shift differential for regularly scheduled hours worked between 6:00 p.m. and 6:00 a.m.

This classification of work installs, modifies, troubleshoots, repairs and maintains revenue control equipment at manned and unmanned parking entrance and exit gates. Replaces consumable items such as tickets, printer ribbons, and light bulbs. Replaces modules and related equipment as needed to repair existing equipment, modify applications, or resolve unusual problems. Troubleshoots, tests, diagnoses, calibrates, and performs field repairs. Performs preventive maintenance such as inspection, testing, cleaning, lubricating, adjusting and replacing of serviceable parts to prevent equipment failure for electromechanical control in order to minimize repair problems and meet manufacturers' specifications.

SIGN ERECTOR

Last Revision: 10-15-2009
Effective: 10-15-2010

Classification:	Base Wage	Fringes
Sign Erector	$20.19/hour	$3.80/hour

This classification of work erects, assembles, and/or maintains signs, sign structures and/or billboards using various tools. Erects pre-assembled illuminated signs on buildings or other structures according to sketches, drawings, or blueprints. Digs and fills holes, places poles. Bolts, screws. or nails sign panels to sign post or frame. Replaces or repairs damaged or worn signs. May use welding equipment when installing sign. This classification is not a licensed electrician and therefore cannot make connections to power sources (i.e., provide exit lighting).

TELEDATA TECHNICIAN

Last Revision: 07-22-2011
Effective: 07-19-2012

Classification:	Base Wage	Fringes
Teledata Technician	$35.31/hour	$7.78/hour

This classification of work is responsible for telephone installation, removal, relocation, problem resolution, cable maintenance and repair ; installs and maintains large programmable PBX systems (Panasonic 1, 2, & 3 line sets, ISDN 6504, 6508, 7504, 7505, 7506, 7507; Northstar stations and systems; Northern Telecom Option 11 system, Vodavi Executive sets and systems, AT&T system 75, Eagle sets and systems; 2/06, 4/10, 8/20, 10/30, 30/70 Merlin systems; 3/8, 6/16,12/24, and 24/48 Vodavi systems). Duties also include testing circuits, analyzing results, repairing and modifying circuits and equipment in a step by step XY all relay and/or electronic switch system. This classification of worker locates electrical, electronic, and mechanical failures in telephone switching and carrier equipment; repairs equipment by replacing defective parts by such procedures as setting clearances, adjusting spring tensions, wipers, relay contacts and other interrelated mechanisms ; installs or rearranges equipment frames and shelves, and such equipment as line finders, switch banks, selectors, connectors, repeaters, peg counters, restricting post cams, and various interrelated truck circuits. Workers resolve complex problems between exchange, both government and commercial and may direct, instruct, and assist lower level employees with their overall assignments.

TILE SETTER-MARBLE MASONS-TERRAZZO FINISHERS, FLOOR GRINDERS, AND BASE GRINDERS

Last Revision: 07-07-2011
Effective: 09-06-2012

Classification:	Base Wage	Fringes
Finisher (Tile-Marble-Terrazzo)	$17.82 /hour	$9.33/hr

Effective May 1, 2008, Local Union 7 of Colorado combined three classes of Finishers, Floor Grinders, and Base Grinders into Finisher using one pay schedule.

Journeymen Rates for the Tile Setter classification of work (Tile Setter, Marble Mason, and Terrazzo Worker) are provided by the Davis-Bacon Act.

TRANSIT TECHNICIANS

Last Revision: 02-17-2011
Effective: 01-01-2012

Classification:	Base Wage	Fringes
Transit Technician - Entry	$22.21/hour	$6.15/hour
Transit Technician - Senior	$24.28/hour	$6.39/hour
Transit Technician - Lead	$25.38/hour	$6.52/hour
Elevator Mechanic/Repairer	$39.34/hour	$27.41/hour (< 5 yrs service) $28.19/hour (> 5 yrs service)

In addition, Shift differentials of eight percent (8%) of the employee's straight time pay rate for the second shift and ten percent (10%) for the third shift for straight time work regularly scheduled providing lore that (50%) of the employee's work occurred on such shift.

Transit Technician-Entry: Associates in this position will be given instruction by on-the-job and/or classroom training to perform corrective and preventive maintenance, inspections, repairs, and adjustments to all systems, subsystems, and components of an electronic, mechanical, electro/mechanical, hydraulic, and pneumatic nature. This classification of workers may assist with routine preventive maintenance, inspection, and adjustment. Tasks and procedures are well established and require close supervision. Incumbents will follow the direction of higher level personnel in preventive or corrective maintenance phases of work. Most tasks will be of an apprentice nature and will require close supervision. Incumbents will progress to the journey level after one year as a Transit Technician-Entry.

Transit Technician-Senior: This is a full performance level class performing various corrective and preventive maintenance, inspections, repairs, and adjustments to all systems, subsystems, and components of an electronic, mechanical, electro-mechanical, hydraulic, and pneumatic nature; monitors the transit system via a central computer system to make automated adjustments in the operation and maintenance of the transit system.

Transit Technician-Lead: Performs lead technical duties such as making work assignments and conducting on-the-job informal training as well as performing various tasks involved with the operation and maintenance of the transit system. The Lead Transit Technician is the specialist in terms of hands-on diagnosis and troubleshooting various problems that may arise on the transit system.

23210-Elevator Repairer: The SCA-Directory of Occupations describes, Elevator Repairer as, "repairs and maintains "Automated People Movers" and like named devices used in the transportation of people and materials including, but not limited to elevators, escalators, dumbwaiters, and moving walkways to meet safety regulations and building codes. This worker trouble shoots and determines causes of trouble in brakes, electrical motors, switches, signal and control systems, using computers, test lamps, voltmeters, ammeters, and oscilloscopes, disassembles defective units and repairs or replaces parts such as electrical door locks, cables, electrical wiring and faulty safety devices installs push button control systems, complete control systems, and other devices to modernize automated people mover systems, and cleans and lubricates bearing and other parts to minimize friction."

TREE TRIMMERS

Last Revision: 10-15-2009
Effective: 10-15-2010

Classification:	Base Wage	Fringes
Tree Trimmer	$16.77/hour	$2.48/hour

This classification of work trims, removes, and applies insecticides to trees and shrubbery including trimming dead, diseased, or broken limbs from trees utilizing rope and saddle, chain, handsaw and other related equipment common to the care of trees and shrubs. Removes limbs, branches and other litter from the work area, observes safety rules, inspects and identifies tree diseases and insects of the area distinguishing beneficial insects and environmental stress, takes samples form diseased or insect infested trees for lab analysis, operates a wide variety of heavy and power equipment in trimming and removing trees and shrubbery i.e. mobile aerial tower unit, tandem trucks, loaders, chipper, etc., maintains all equipments.

WINDOW CLEANERS

Last Revision: 01-20-2011
Effective: 09-06-2012

Classification:	Base Wage	Fringes
Window Cleaner	$21.25 /hour	$6.61/hr (Single) $8.34/hr (2-Party) $9.12/hr (Family)

Benefits/Overtime

Parking	With valid monthly parking receipt from approved parking lot, employees are reimbursed for the cost of parking. The employer shall reimburse employees for parking expenses from other parking lots up to the amount reimbursed for DIA Employee Parking Lot upon the submission of a monthly parking receipt. Only (1) one receipt per month.
Shift Differential	$0.75 per hour for employees assigned to 3rd shift (11:00 p.m. to 7:00 a.m.)
Overtime	One and one-half (1½) times the basic rate of pay in excess of 7.5 hours worked per day or 37.5 hours worked per week.
Lunch	Any employee working seven and a half (7.5) hours in a day is entitled to a thirty (30) minute paid lunch.
Lead Work	$1.25 per hour above highest paid employee under supervision
High Work	$1.75 per hour (21 feet or more from ground (base) to top of surface/structure being cleaned)
Training	$0.25 per hour
ECOPASS	Employer will provide employees with the ECOPASS
Note:	The Career Service Board in their public hearing on April 3, 2008, approved to amend prevailing wages paid to the Window Cleaners as follows: "All contractors shall provide fringe benefits or cash equivalent at not less than the single rate amount. Contractors who offer health insurance shall provide an employer contribution to such insurance of not less than the 2-party or family rate for any employee who elects 2-party or family coverage. Contractors who offer such coverage will be reimbursed for their employer contributions at the above rates under any City contract incorporating this wage specification."

Pest Controller

Established: 08-02-2012

Classification:	Base Wage	Fringes
Pest Controller	$20.41/hour	$6.07/hour

The Pest Controller sprays chemical solutions or toxic gases and sets mechanical traps to kill pests that infest buildings and surrounding areas, fumigates rooms and buildings using toxic gases, sprays chemical solutions or dusts powders in rooms and work areas, places poisonous paste or bait and mechanical traps where pests are present; may clean areas that harbor pests, using rakes, brooms, shovels, and mops preparatory to fumigating; and may be required to hold State license

DENVER
THE MILE HIGH CITY

Career Service Authority
Denver's Human Resource Agency

201 W. Colfax, Department 412
Denver, CO 80202
p: 720.913.5751
f: 720.913.5720
www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules

FROM: Seth Duhon-Thornton, Staff Human Resources Professional

DATE: Friday September 7, 2012

SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway construction trades have not been updated by the United States Department of Labor (DOL) since March 1, 2002. The Career Service Authority Board, in their meeting held on April 21, 2011, approved the use of the attached supplemental wage rates until prevailing wage rates for these classifications of work are again published by the United States Department of Labor in accordance with the Davis-Bacon Act. The rates will be provided as a supplemental to the Davis-Bacon Building rates issued by CSA.

The attached Prevailing Wage Schedule is effective as of **Friday September 7, 2012** and applies to the City and County of Denver for **BUILDING CONSTRUCTION PROJECTS** (does not include residential construction consisting of single family homes and apartments up to and including 4 stories) in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO120004
Superseded General Decision No. CO20100004
Modification No.12
Publication Date: 08/31/2012
(5 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to, and individually registered in, a bona fide apprenticeship program registered with the U.S. Department of Labor (DOL). The employer and the individual apprentice must be registered in a program, which has received prior approval, by the DOL. Any employer, who employs an apprentice and is found to be in violation of this provision, shall be required to pay said apprentice the full journeyman scale.

For questions call (720) 913-5018

Attachments as listed above.

General Decision Number: CO120004 08/31/2012 CO4

Superseded General Decision Number: CO20100004

State: Colorado

Construction Type: Building

County: Denver County in Colorado.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	01/06/2012
1	01/13/2012
2	01/27/2012
3	02/24/2012
4	04/06/2012
5	04/13/2012
6	05/18/2012
7	06/01/2012
8	07/27/2012
9	08/03/2012
10	08/10/2012
11	08/17/2012
12	08/31/2012

ASBE0028-001 07/01/2010

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems)	$ 30.23	11.53

BRCO0007-001 01/01/2011

	Rates	Fringes
BRICKLAYER	$ 22.13	9.89

BRCO0007-005 06/01/2011

	Rates	Fringes
TILE SETTER	$ 25.15	9.18

CARP0001-004 05/01/2009

	Rates	Fringes

Carpenters:
Acoustical, Drywall
Hanging/Framing and Metal
Stud, Form Building/Setting.$ 26.60 8.89

CARP1607-002 06/01/2012

	Rates	Fringes
MILLWRIGHT	$ 28.95	11.10

ELEC0068-002 06/01/2011

	Rates	Fringes
ELECTRICIAN (Includes Low Voltage Wiring and Installation of Fire alarms, Security Systems, Telephones, Computers and Temperature Controls)	$ 31.60	12.57

ELEV0025-002 01/01/2012

	Rates	Fringes
Elevator Constructor	$ 39.34	23.535

FOOTNOTE:
a. Employer contributes 8% of basic hourly rate for over 5 years' service and 6% basic hourly rate for 6 months' to 5 years' service as Vacation Pay Credit.

PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Veterans Day; Thanksgiving Day; Friday after Thanksgiving Day; and Christmas Day.

ENGI0009-003 06/25/2012

	Rates	Fringes
Power equipment operator - crane		
141 tons and over	$ 25.48	8.62
50 tons and under	$ 24.42	8.62
51 to 90 tons	$ 24.57	8.62
91 to 140 tons	$ 24.72	8.62

IRON0024-001 07/01/2011

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 23.80	10.91

LABO0720-003 05/01/2009

	Rates	Fringes
Laborers:		
Concrete/Mason Tenders	$ 16.52	6.84

PAIN0079-002 08/01/2010

	Rates	Fringes
Drywall Finisher/Taper		
Hand	$ 18.69	6.11
Tool	$ 19.04	6.11
Painters:	$ 17.99	6.11
PAPERHANGER	$ 18.69	6.11

PAIN0930-001 07/01/2012

	Rates	Fringes
GLAZIER	$ 27.77	7.42

PLAS0577-001 08/01/2011

	Rates	Fringes
Cement Mason/Concrete Finisher	$ 23.00	10.75

PLUM0003-001 07/01/2012

	Rates	Fringes
PLUMBER		
(Excluding HVAC work)	$ 33.18	11.44

* PLUM0208-001 07/12/2012

	Rates	Fringes
PIPEFITTER		
(Including HVAC pipe)	$ 30.10	11.52

SFCO0669-001 04/01/2012

	Rates	Fringes
SPRINKLER FITTER	$ 32.44	18.45

SHEE0009-001 01/01/2011

	Rates	Fringes
Sheet metal worker (Includes HVAC duct and installation of HVAC systems)	$ 31.66	10.98

SUCO2001-011 12/20/2001

	Rates	Fringes
Carpenters:		
All Other Work	$ 16.12	2.84
Ironworkers:		
Reinforcing	$ 18.49	3.87
Laborers:		
Brick Finisher/Tender	$ 12.78	1.41
Common	$ 10.62	2.09
Power equipment operators:		
Mechanic	$ 18.48	

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Career Service Authority
Supplemental to the Davis-Bacon *Building* Construction Project rates
(Specific to the Denver projects)
Supp #100, Date: 03-02-2012

Classification		Base	Fringe
Boilermakers		$30.97	$21.45
Power Equipment Operators (Concrete Mixers):			
	Less than 1 yd	$23.67	$10.67
	1 yd and over	$23.82	$10.68
	Drillers	$23.97	$10.70
	Loaders over 6 cu yd	$23.82	$10.68
	Oilers	$22.97	$10.70
Soft Floor Layers		$16.70	$9.81
Ironworkers (Ornamental)		$24.80	$10.03
Plasters		$24.60	$12.11
Plaster Tenders		$10.79	-
Laborers: Concrete Saw		$13.89	-
Power Equipment Operators:			
	Backhoe	$23.67	$10.67
	Loader up to and incl 6 cu yd	$23.67	$10.67
	Motor Grader	$23.97	$10.70
	Roller	$23.67	$10.67
Truck Drivers (Dump Trucks):			
	6 to 14 cu yds	$19.14	$10.07
	15 to 29 cu yds	$19.48	$10.11
	Flatbed	$19.14	$10.07
	Semi	$19.48	$10.11

- To determine the Tile Setters-Marble Mason-Terrazzo mechanic rates—Use Davis Bacon-Building rates adopted by the Career Service Board.
- To determine the Tile Finisher-Floor Grinder-Base Grinder—Use current Career Service Prevailing Wage Schedules.
- Caulkers—Receive rate prescribed for craft performing operation to which caulking is incidental .i.e. glazier, painter, brick layer, cement mason.
- Use the "Carpenters—All Other Work" rates published by the federal Davis Bacon rates for batt insulation, pre-stress concrete and tilt up concrete walls, Roofers (including foundation waterproofing).
- Use the "Laborer—Common", rates published by the federal Davis Bacon rates for General Housekeeping, Final Cleanup and Fence Installer.

EXHIBIT G

CITY AND COUNTY OF DENVER
CERTIFICATE OF INSURANCE FOR DEPARTMENT OF AVIATION

☒Original COI ☐ Advice of Renewal ☐ Change

Party to Whom this Certificate is Issued:

CITY AND COUNTY OF DENVER
Attn: Risk Management, Suite 8810
Manager of Aviation
Denver International Airport
8500 Peña Boulevard, Room 8810
Denver CO 80249

Name and Address of Insured:

CONTRACT NAME & NUMBER TO WHICH THIS INSURANCE APPLIES: 201207703 – AGTS Central Control Upgrade

I. MANDATORY COVERAGE

Colorado Workers' Compensation and Employer Liability Coverage

Coverage: COLORADO Workers' Compensation

Minimum Limits of Liability (In Thousands)

WC Limits: $100, $500, $100

And Employer's Liability Limits:

Any Policy issued under this section must contain, include or provide for the following:

1. All States Coverage or Colorado listed as a covered state for the Workers' Compensation
2. Waiver of Subrogation and Rights of Recovery against the City and County of Denver (the "City"), its officers, officials and employees.

Commercial General Liability Coverage

Coverage: Commercial General Liability (coverage at least as broad as that provided by ISO form CG0001 or equivalent)

Minimum Limits of Liability (In Thousands):

Each Occurrence:	$1,000
General Aggregate Limit:	$2,000
Products-Completed Operations Aggregate Limit:	$2,000
Personal & Advertising Injury:	$1,000
Fire Damage Legal - Any one fire:	$1,000

Any Policy issued under this section must contain, include or provide for the following:

1. City, its officers, officials and employees as additional insureds, per ISO form CG2010 and CG 2037 or equivalents.
2. Coverage for defense costs of additional insureds outside the limits of insurance, per CG0001.
3. Liability assumed under an Insured Contract (Contractual Liability).
4. The full limits of coverage must be dedicated to apply to this project/location, per ISO form CG2503 or equivalent.
5. Waiver of Subrogation and Rights of Recovery, per ISO form CG2404 or equivalent.
6. Separation of Insureds Provision required
7. General Aggregate Limit Applies Per: Policy ___Project ____Location_____, if applicable

Business Automobile Liability Coverage

Coverage: Business Automobile Liability (coverage at least as broad as ISO form CA0001)

Minimum Limits of Liability (In Thousands): Combined Single Limit $1,000

Any Policy issued under this section must contain, include or provide for the following:

1. Symbol 1, coverage for any auto. If no autos are owned, Symbols 8 & 9, (Hired and Non-owned) auto liability.
2. If this contract involves the transport of hazardous cargo such as fuel, solvents or other hazardous materials may occur, then Broadened Pollution Endorsement, per ISO form CA 9948 or equivalent and MCS 90 are required.

II. ADDITIONAL COVERAGE

Umbrella Liability

Coverage:

Umbrella Liability, Non Restricted Area		
Minimum Limits of Liability (In Thousands)	Each Occurrence and aggregate	$1,000
Umbrella Liability Restricted Area	Each Occurrence and aggregate	$9,000

Any Policy issued under this section must contain, include or provide for the following:

1. City, its officers, officials and employees as additional insureds.
2. Coverage in excess of, and at least as broad as, the primary policies in sections WC-1, CGL-1, and BAL-1.
3. **If operations include unescorted airside access at DIA, then a $9 million Umbrella Limit is required.**

Professional Liability only as applicable Information Technology Contracts

Coverage: Professional Liability including Cyber Liability for Errors and Omissions
(If contract involves software development, computer consulting, website design/programming, multi-media designers, integrated computer system design, data management, and other computer service providers.)

Minimum Limits of Liability (In Thousands)	Per Claim	$1,000

Any Policy issued under this section must contain, include or provide for the following:

1. The insurance shall provide coverage for the following risks:

   a. Liability arising from theft, dissemination and / or use of confidential information (a defined term including but not limited to bank account, credit card account, personal information such as name, address, social security numbers, etc. information) stored or transmitted in electronic form

   b. Network Security Liability arising from the unauthorized access to, use of or tampering with computer systems including hacker attacks, inability of an authorized third party, to gain access to your services including denial of service, unless caused by a mechanical or electrical failure

   c. Liability arising from the introduction of a computer virus into, or otherwise causing damage to, a customer's or third person's computer, computer system, network or similar computer related property and the data, software, and programs thereon.

2. Policies written on a claims-made basis must remain in full force and effect in accordance with CRS 13-80-104. The Insured warrants that any retroactive date under the policy shall precede the effective date of this Contract; and that either continuous coverage will be maintained or an extended discovery period will be exercised for a period of two (2) years beginning at the time work under the Contract is completed.

3 Any cancellation notice required herein may be provided by either certified or regular mail.

4. The policy shall be endorsed to include the City, its elected officials, officers and employees as additional insureds with respect to liability arising out of the activities performed by, or on behalf of the Insured

5. Coverage must include advertising injury, personal injury (including invasion of privacy) and intellectual property offenses related to internet.

III. ADDITIONAL CONDITIONS

It is understood and agreed, for the benefit of the City, that the following additional conditions shall apply to all coverage specified herein

- All coverage provided herein shall be primary and any insurance maintained by the City shall be considered excess.
- With the exception of professional liability and auto liability, a Waiver of Subrogation and Rights of Recovery against the City, its officers, officials and employees is required for each coverage period.
- The City shall have the right to verify or confirm, at any time, all coverage, information or representations contained herein, and the insured and its undersigned agent shall promptly and fully cooperate in any such audit the City may elect to undertake.
- Advice of renewal is required.
- All insurance companies issuing policies hereunder must carry at least an A -VI rating from A.M. Best Company or obtain a written waiver of this requirement from the City's Risk Administrator.
- Compliance with coverage requirement by equivalent herein must be approved in writing by the City's Risk Administrator prior to contract execution.
- No changes, modifications or interlineations on this Certificate of Insurance shall be allowed without the review and approval of the Risk Administrator prior to contract execution.

NOTICE OF CANCELLATION

It is understood and agreed that should any Policy issued hereunder be cancelled or non-renewed before the expiration date thereof, or sustain a material change in coverage adverse to the City, the issuing company or its authorized Agent shall give notice to the Department of Aviation in accordance with policy provisions.

EXHIBIT H

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned BOMBARDIER TRANSPORTATION (HOLDINGS) USA INC., a corporation organized under the laws of the State of DELAWARE, hereinafter referred to as the "Contractor" and TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA, a corporation organized under the laws of the State of CONNECTICUT and authorized to transact business in the State of Colorado, hereinafter referred to as Surety, are held and firmly bound unto the CITY AND COUNTY OF DENVER, a municipal corporation of the State of Colorado, hereinafter referred to as the "CITY", in the penal sum of TWELVE MILLION FOUR HUNDRED THOUSAND AND NO/100 Dollars ($12,400,000.00), lawful money of the United States of America, for the payment of which sum the Contractor and Surety bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally by these presents.

WHEREAS, the above Contractor has entered into a written contract with the City for furnishing all labor, materials, equipment, tools, superintendence, and other facilities and accessories for the construction of Contract No. 201207703, AGTS CENTRAL CONTROL UPGRADE, Denver International Airport, in accordance with the Technical Specifications, Project Management Provisions, and all other Contract Documents therefor which are incorporated herein by reference and made a part hereof, and are herein referred to as the Contract.

NOW, **THEREFORE**, the condition of this performance bond is such that if the Contractor:

1. Promptly and faithfully observes, abides by and performs each and every covenant, condition and part of said Contract, in the time and manner prescribed in the Contract, and

2. Pays the City all losses, damages (liquidated or actual, including, but not limited to, damages caused by delays in the performance of the Contract), expenses, costs and attorneys' fees, that the City sustains resulting from any breach or default by the Contractor under the Contract, then this bond is void; otherwise, it shall remain in full force and effect.

IN ADDITION, if said Contractor fails to duly pay for any labor, materials, team hire, sustenance, provisions, provender, or any other supplies used or consumed by said Contractor or its subcontractors in its performance of the work contracted to be done or fails to pay any person who supplies rental machinery, tools, or equipment, all amounts due as the result of the use of such machinery, tools, or equipment in the prosecution of the work, the Surety shall pay the same in an amount not exceeding the amount of this obligation, together with interest as provided by law.

PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that any and all changes in the Contract or compliance or noncompliance with the formalities in the Contract for making such changes shall not affect the Surety's obligations under this bond and the Surety hereby waives notice of any such changes.

(End of Page)

EXHIBIT H

IN WITNESS WHEREOF, said Contractor and said Surety have executed these presents as of this ____ day of _____, _____.

_____
CONTRACTOR

By:_____
President

_____
SURETY

By:_____
Attorney-in-Fact

(Accompany this bond with Attorney-in-Fact's authority from the Surety to execute bond, certified to include the date of the bond.)

CITY AND COUNTY OF DENVER

By:_____
MAYOR

By:_____
Manager of Aviation

APPROVED AS TO FORM:

DOUGLAS J. FRIEDNASH, Attorney for the City and County of Denver

By:_____
Assistant City Attorney