TERMINAL BUILDING: MEMORANDUM OF UNDERSTANDING AND ADMINISTRATIVE MODIFICATION DATABASE

Terminal Building: Memorandum of Understanding and Administrative Modification Database

Prepared by Jensen Hughes: April, 19, 2017

This document has been prepared by Jensen Hughes at the request of DEN. This document addresses all identified MOUs from 1990 through 2016 associated with the Terminal Complex at the Airport. It is intended to identify the scope of these MOUs and to identify whether they have been partially or completely superseded or if the MOU remains in effect. Note that superseded MOUs are often recommended to be retained for historic information.

Color Key
Remove MOU from active list with no other action
Remove MOU in favor of some other document and suggested move to other archive
MOU action by DIA, DFD and/or Denver Development Services needed
MOU retained with suggest to combine with other MOUs

File Name	Date	Title/Subject	From	To	Description of MOU	Current Status	Revised Code Reference and/or Rationale	Recommended Action	Building
90032700_Jensen_1.pdf	March 27, 1990	Fire Safety Issues, Landside Terminal Complex, New Denver International Airport, Denver, Colorado	Rolf Jensen and Associates, Inc.	N/A	Establishes approach to fire and life safety in Terminal. Does not dictate protection, but provides philosophy and discussion of pertinent design features. Does not give significant credit to detection for life safety. Does not provide in-depth analysis of any particular area, zone or issue.	Still Applicable	Information in MOU establishes design basis information for the Terminal building.	See resolution to MOU 90122800.	Complex
90043000.pdf	March 30, 1990	Fire Alarm Systems	N/A	N/A	Appears to be same as MOU 90072600. See that entry for more information.	Superseded	See MOU 90072600.	Remove MOU 90043000.	Complex
90052901.pdf	May 29, 1990	Emergency Power Supply	N/A	N/A	File includes a group of documents that, in total, form the design basis direction for the dual power supply approach for emergency power for the airport. See MOU 92030400 for amendment.	Still Applicable	The basis and approach for the existing buildings, as expressed in MOU 90052901, is still the accepted approach for existing facilities and any modifications therein. The MOU is updated by information in Administrative #15. New facilities such as the South Terminal Redevelopment Project follow current requirements, as indicated in Appendix N of the 2011 Denver Amendments to the 2009 International Building Code.	Retain MOU 90052901. Consider combining with MOU 92070200, MOU 94020900, MOU 94021900 and Administrative Modification #15, with indication that new facilities must follow current codes.	Complex
90092700_Jensen_2.pdf	September 27, 1990	Preliminary Fire Protection and Life Safety Plan for Phase I of the Landside Terminal, Denver International Airport	Rolf Jensen and Associates, Inc.	C.W. Fentress J.H. Bradburn & Associates, P.C.	Page 8 - Section V.A discusses smoke detection and alarm. Identifies three basic locations - elevators (lobbies and machine rooms), beam detection for great hall and duct detection per NFPA 90A and at outside air intake for stairwell and elevator shaft pressurization. Smoke detector zones coordinated with smoke control zones. Page 9 - Section V.C discusses heat detection and alarm. Heat detectors located in transformer rooms, electrical switchgear rooms, electrical and telephone equipment rooms, FCC and cabling rooms and lounges. Page 9 and 10 - Section V.D - Manual pull stations at all exits and within 200 ft. A single manual pull station may support a group of doors. Page 13 - Indicates that stairwell and elevator shaft pressurization are automatic and activated by either suppression system alone or smoke detection plus one other device (another smoke detection, suppression activation, manual pull, etc.). Page 13 - Proposes manual activation of smoke control only. Page 26 - Provides basis for replacement of spot-type smoke detection with beam smoke detectors. Reasoning primarily based on stratification and time to detection. Page 26 - Provides basis for deletion of smoke detection in Bag Make-Up Level 3. Reasoning is primarily based on potential for unwanted alarms.	Still Applicable	Information in MOU establishes design basis information for the Terminal building.	See resolution to MOU 90122800.	Complex
90122800.pdf	January 24, 1991	Denver Building Inspection Division and Fire Department Response To December 28, 1990, Correspondence and DIA Terminal Complex Fire Protection Alternatives	Paul Spurgeon, DFD Chief of Fire Prevention	Brit Probst, Project Manager, Fentress, Bradburn and Associates, PC	Letter dated January 24, 1991 agrees to follow the Memorandum dated October 11, 1990 for revisions to the September 27, 1990 Life Safety Plan. Also requires additional clarification and explanation for certain sections and issues.	Superseded	Provides the acceptance conditions for the proposed performance-based approaches outlined in MOU 90032700_Jensen_1 and MOU 900927_Jensen_2. However, smoke control activation is now addressed by Administrative Modification #3.	Suggest revising/rewriting into a single MOU, combining this document with MOU 90032700_Jensen_1 and MOU 900927_Jensen_2, MOU 91020400, information from Administrative Modification #3 and any Administrative Modifications from the South Terminal Redevelopment Project that affect the Terminal design basis.	Terminal
		Denver International Airport, Landside Terminal Complex Fire Protection Alternatives	Brit Probst, Project Manager, Fentress, Bradburn and Associates, PC	Cliff Hennig, Building Inspection Division Chief	Letter dated December 28, 1990 discusses the need to move forward in regards to fire/life safety planning and design for the airport in accordance with the modifications discussed in the October 11, 1990 Memorandum to the Life Safety Plan. Also attached is the October 11, 1990 Memorandum that is discussed in the December 28, 1990 letter.				
		DIA Fire Protection Alternatives as Presented in September 27, 1990 Fire Protection and Life Safety Plan by Rolf Jensen and Associates	Cliff Hennig, Building Inspection Division Chief	Brian Olson, Rolf Jensen & Associates, Inc.	Requires that beam type smoke detectors must be cross-zoned for smoke evacuation.				
			Paul Spurgeon, DFD Chief of Fire Prevention	Brit Probst, Project Manager, Fentress, Bradburn and Associates, PC	Allows deletion of smoke detection in Bag Make-up Level 3 in areas with 25 ft or higher ceilings if quick-response sprinklers are used. Detection not required in areas with less than 25 ft ceilings if sprinklered based on Position Statement on detection in spaces with ceilings less than 25 ft (see 90092700.pdf). Requires smoke control system to be activated automatically.				
91050100.pdf	May 1, 1991	DIA Landside Terminal Complex Black & Veatch Fire Protection Letter	Thomas Walsh, Fentress, Bradburn and Associates, PC	Reginald Norman, Assistant Project Manager, New Denver Airport Office	Letter requesting clarification on various fire protection issues originating from Black and Veatch. Mentions use of ESFR sprinklers in lieu of smoke detection in Baggage Make-Up Areas. See MOU 91060600 for more information.	Superseded	See MOU 91060600.	Suggest combining with effort recommended for MOU 90122800.	Terminal

91060600.pdf	June 6, 1991	Denver Building Inspection Division and Fire Department Response to May 1, 1991, Correspondence Regarding Clarification of DIA Terminal Complex Fire Protection Alternatives	Steve Rondinelli, Senior Fire Protection Engineer	Thomas Walsh, Fentress, Bradburn and Associates, PC	Provides response to Thomas Walsh letter of May 1, 1991 (see MOU 91050100). Provides approval for improved sprinkler density in lieu of automatic detection in Baggage Make-Up Areas.	Still Applicable	The administrative modification provided within the document is still applicable.	Suggest combining with effort recommended for MOU 90122800.	Terminal
91070101.pdf	Effective July 1, 1991	Fire Protection Elevator Shafts and Elevator Machinery Rooms In Fully Sprinklered Buildings	Paul Spurgeon, DFD Chief of Fire Prevention	N/A	Reverses previous decision that elevator shafts and elevator machinery rooms do not require sprinklers, but is not retroactive. Requires elevators over 4 stories in height to be provided with pre-action sprinkler system. In elevators less than 4 stories, pre-action is not required but strongly recommended. Requires smoke detection at top of shaft and in machinery rooms to initiate recall and place building into alarm.	Superseded	Sprinkler design for elevators was not modified by the Fire Alarm Replacement project and has not been extensively changed by other projects. Detection and control of the elevators is now addressed through the project Design Analysis and Administrative Modification #14. Note: A revised interpretation to this requirement is addressed in MOU 93010101, and is further revised by MOU 93090800. Implementation information is provided in MOU 94072900.	Remove MOU 91070101, MOU 93010101, and MOU 93090800, in favor of Fire Alarm Project Design Analysis, Administrative Modification #14 and MOU 94072900.	Complex
			Cliff Hennig, Building Inspection Division Chief		Requires at least one 135°F rate-of-rise heat detector in vicinity of sprinkler. Circuitry for the heat detector is to be separate from smoke detector. Heat detector signal must be interlinked with recall; once recall has been initiated, car has stopped and doors open, shunt trip of power is to occur (requires both heat and verification of position). If pre-action sprinkler protection, heat detector is to trip system.				
91081400.pdf	Effective August 14, 1991	Fire Protection of Electrical Rooms in Fully Sprinklered Buildings	Paul Spurgeon, DFD Chief of Fire Prevention	N/A	Indicates that electrical rooms will not be required to be sprinklered in the AGTS and baggage structure, terminal complex, parking structures, concourses (A, B, and C), and AOB. Photo and ionization detectors are required to be connected to the FA system in these areas. Sprinklered electrical rooms to be required going forward for all other airport buildings.	Superseded	Electrical room sprinkler provision is superseded by MOU 91061100. MOU is not retroactive.	Remove the August 14, 1991, memorandum from the file and retain MOU 91081400.	Complex
	August 8, 1991	DIA/ARFF Stations One-hour Fire Rated Corridor	Cliff Hennig, Building Inspection Division Chief		Eliminates the 1-hour rating required by DBC Section 3309(d) for the corridor connecting the stairs to the storage and observation area on Level 2 based on a fully sprinklered building and the area being less than 1500 square feet.	Still Applicable	The approval provided in the memorandum is still applicable to the building.		
91061100.pdf	Effective September 1, 1991	Fire Protection of Electrical Rooms in Fully Sprinklered Buildings	Denver Building Inspection Division	N/A	Provides requirement for sprinklering of electrical rooms, with exception of those rooms (1) separated by one hour fire resistance rating from the rest of the building, (2) containing equipment operating above 600 V, (3) the room is dedicated to electrical distribution equipment AND (4) the room is provided with smoke detectors connected to a fire alarm system monitored by a central station.	Still Applicable	The policy is still in effect for some existing locations at DIA. New locations are controlled via current codes and standards.	Retain MOU 91061100. Suggest combining with MOU 98110900 and MOU 03012700.	Complex
91120302.pdf	December 3, 1991	Request for Waiver of Dual Fed Exit Signs	Charlotte Szynskie, Roos Szynskie, Inc.	Cliff Hennig, Building Inspection Division Chief	Seeks waiver from DBC 3314(d) via the use of both building power and emergency power wired to both lamps of exit lights instead of one lamp (normal)/one lamp (emergency) as required by code.	Still Applicable	The approval provided in the memorandum is still applicable to the exit signs in the Airport Office Building.	Retain MOU 91120302.	Terminal
93070200.pdf	July 2, 1993	Sprinkler Head Interference with Signs in Terminal Building	Jorge Cortes	Steve Rondinelli, Senior Fire Protection Consultant	Notes two locations in Terminal Building (Level 5 - NTA and Level 6 - Passenger Bridge) where signage is within 6 inches of sprinklers, obstructing the protection. Agreement to the conditions is provided, however the mentioned attachment to verify the locations is not included.	Still Applicable	Existing condition is still in effect at DIA. New conditions would be expected to meet current codes and standards.	Retain MOU 93070200.	Terminal
93070600.pdf	July 6, 1993	Clarification on NFPA 13 Vertical Distance from Sprinkler Head to Sign	Jorge Cortes	Steve Rondinelli, Senior Fire Protection Consultant	Requests relief from 18 inch required separation between top of BIDS casework and sprinkler deflector, in lieu of 12 inch separation. Request approved by Paul Spurgeon	Still Applicable	Existing condition is still in effect at DIA. New conditions would be expected to meet current codes and standards.	Retain MOU 93070600.	Terminal
93113001.pdf	November 30, 1993	Beam Smoke Detectors, Terminal Building Great Hall	Charlotte Szynskie, Roos Szynskie, Inc.	Scott Jack, Black and Veatch	Validates that the proposed Simplex beam-type smoke detectors are in conformance with Rolf Jensen design requirements included in MOU 90032700_Jensen_1 and MOU 90092700_Jensen_2.	Still Applicable	Fire alarm project will replace these detectors with ones meeting similar requirements. Until such replacement occurs, document remains in effect.	Retain MOU 93113001 until fire alarm project replaces devices.	Terminal
94010300.pdf	January 3, 1994	Terminal Smoke Control Clarification	Airport Engineering Office	N/A	The document presents several requirements clarifications for the smoke control system in the Terminal complex. Item 1 and 4 dictate means of activation, Item 2 identifies required draft stops and Item 3 describes groupings of monitoring modules for damper end switches and exhaust fan operation.	Still Applicable	Fire alarm project will address Items 1, 3 and 4 via new design documentation. Noted draft stops appear to have been randomly deleted over time, but their impact to the overall design appears to be minimal.	Suggest retaining MOU 94010300 until fire alarm project revises sequence of operation and device monitoring. The MOU can then be deleted.	Terminal
94061000.pdf	June 10, 1994	Denver International Airport Main Terminal and North Terminal Smoke Control Systems Fan Override Meeting Minutes	Donald Riegel, Riegel Associates, Inc.	Jeff Hilleary, Chief Mechanical/Fire Protection BID Steve Rondinelli, Senior Fire Protection Engineer	Documentation of meeting minutes to discuss the manual override sequences for the smoke control fans in the Terminal Building.	Still Applicable	Provides documentation of sequence of operations for the smoke control systems in the Terminal Building. This sequence will likely be retained by the fire alarm project.	Retain MOU 94061000.	Terminal
98110900.pdf	November 9, 1998	Terminal Level 5 & 6 Electrical and Communication Room Wall & Door Construction Acceptance	Jack Bartels, Planning and Development, DIA	Peter Bemelen, Denver Building Department	Identifies a number of inconsistencies in fire resistance rated construction for electrical and communications rooms, pursuant to MOU 91061100 (Electrical Rooms) and MOU 940.0101 (Communications Rooms). The construction issues were accepted.	Still Applicable	The rooms and conditions still exist, making the MOU still valid.	Retain MOU 98110900. Suggest incorporating into both MOU 91061100 and 94030101 (see both entries for more information) to create complete files on each topic.	Terminal
02020600.pdf	February 6, 2002	Terminal Building Level 5 Customs Area - Modification to Fire Alarm, Fire Protection and Smoke Zones	Robert Busch, Design Manager, Life Safety Team	David Clark, DFD Chief Fire Protection Engineer	Requests to combine two smoke control zones serving the Terminal Level 5 Customs Area into a single smoke control zone, since the zoning of the smoke control, automatic sprinklers and fire alarm system were not consistent. Approval was granted.	Still Applicable	The alignment of the various zones is being addressed by the fire alarm project. Approval of project drawings, which include the various fire/smoke zones, will obviate the need for this MOU.	Retain MOU 02020600 until completion of fire alarm project, then delete.	Terminal

PNSU AM #8	June 7, 2011 (Rev 0)	Permission to Utilize Presignal Feature	David I. Rhodes, Assistant Deputy Manager of Aviation, Maintenance and Engineering Scott A. Craig, Senior Fire Protection Engineer, Hughes Associates Wayne D. Moore, Principal, Hughes Associates	Chief Joseph Gonzales, Denver Department of Fire	Requests permission to utilize presignal feature, as allowed with Fire Marshal approval in 2011 Denver Amendments to 2009 International Fire Code, Section 907.6.1. Presignal methods will be as specified by NFPA 72 (2010), Section 23.8.1.2.	Approved June 16, 2011 Active	Additional information in the 2016 Denver Building Code Appendix S Section 4.5.2.4.	Retain	Terminal & All Concourses
PNSU AM #19	August 20, 2013 (Rev 0)	Visual Notification Design Approach	Dave LaPorte, Deputy Manager of Aviation, Airport Infrastructure Management Scott A. Craig, Senior Fire Protection Engineer, Hughes Associates	Chief Joseph Gonzales, Denver Department of Fire	Provides the approach for visual notification methodologies that will be provided as part of the Public Notification System Upgrade project (which was the then-current name for the expanded fire alarm replacement project). References PNSU AM #7.	Approved September 3, 2013 Active		Retain	Terminal & All Concourses
PNSU AM #21	October 24, 2013 (Rev 0)	Smoke Control System - Basis of Design Modification	Dave LaPorte, Deputy Manager of Aviation, Airport Infrastructure Management Scott A. Craig, Senior Fire Protection Engineer, Hughes Associates	Chief Joseph Gonzales, Denver Department of Fire	Requests that smoke control systems in the terminal buildings (Main Terminal and Concourses) be realigned to be in conformance with requirements of Appendix N of the 2011 Denver Amendments to the 2009 International Building Code, as opposed to the original design requirements (as documented in Chapter 59 of the 1990 Denver Amendments to the 1988 Uniform Building Code). The primary change is removing requirement for supply air from surrounding zones, but realignment of zones due to misalignment with sprinkler zones or redundancy of sequence is also covered. References PNSU AM #4.	Approved October 29, 2013 Active	Additional information in the 2016 Denver Building Code Appendix S Section 4.6.7.	Retain	Terminal & All Concourses
PNSU AM #24	June 5, 2014	Modification of Evacuation Pre-Message Tone	Dave LaPorte, Deputy Manager of Aviation, Airport Infrastructure Management Scott A. Craig, Senior Fire Protection Engineer, Hughes Associates	Chief Joseph Gonzales, Denver Department of Fire	Requests the use of a slow-whoop tone for the pre-message tone in lieu of the three-pulse temporal pattern tone required by NFPA 72 (2010), Section 18.4.2. The request is based on the use of a similar tone to the three-pulse temporal pattern tone by the Transportation Security Administration for security breach alarm pre-message tone.	Approved July 7, 2013 No Longer Applicable	Per The 2016 Denver Building Code Appendix S Section 4.5.2.3.1 Admin Mod 24 is no longer applicable.	Remove Admin Mod 24	Terminal & All Concourses
PNSU AM #26	April 6, 2015	Fire and Smoke Dampers with Multiple Temperature Sensors	Dave LaPorte, Deputy Manager of Aviation, Airport Infrastructure Management Scott A. Craig, Senior Fire Protection Engineer, Jensen Hughes	Chief Joseph Gonzales, Denver Department of Fire	Obtaining concurrence regarding the method of control for specialized dampers based on the different temperature sensors. Dampers used for exhaust should close at the 350 degree F setting because the temperature of smoke would close the lower setting too soon making the system ineffective (use thermal override). Dampers for smoke control supply should close at the 165 degree F setting since stairways have pressurization ducts, therefore not wanting to discharge elevated temperature air here. Dampers for passive protection should close at the 165 degree setting due to IBC section 716.3.3.1(2) that states that they must close at 160 degrees F.	Approved April 22, 2015 Active		Retain	Terminal
PNSU AM #28	February 26, 2016	Combine Smoke Control Zones in the Jeppesen Terminal on Levels 5 and 6	Somer Shindler, Senior Director, Airport Infrastructure Management Scott A. Craig, Senior Fire Protection Engineer, Jensen Hughes	Chief Joseph Gonzales, Denver Department of Fire	Requests to combine the three north-south smoke zones for the east, center (Great Hall), and west areas. This combination would improve the ability to hold smoke within the activated zone.	Approved April 15, 2016 Active		Retain	Terminal

Rolf Jensen & Associates, Inc.

FIRE PROTECTION ENGINEERS • BUILDING CODE CONSULTANTS

Ron Reggie 4/16/99
1. Look at Fentress D.D. Submittal for more of this analysis.
2. Failing this, get Reggie copy & make a copy of it for Van Tabb's Ready.

FIRE SAFETY ISSUES
LANDSIDE TERMINAL COMPLEX
NEW DENVER INTERNATIONAL AIRPORT
DENVER, COLORADO

Prepared for:

C.W. FENTRESS J.H. BRADBURN and ASSOCIATES, P. C.
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March 27, 1990

D6456.01

APPENDIX C

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EXECUTIVE SUMMARY

As part of our contract with C.W. Fentress J.H. Bradburn and Associates, P.C., Rolf Jensen & Associates, Inc. has evaluated the current status of building code requirements and life safety systems for the Landside Terminal Complex at the New Denver Airport. The plan to adopt the Uniform Building Code with Denver Amendments has created an opportunity to address the unique requirements of Airport buildings in the code itself (Chapter 59, Construction of Airport Buildings and Structures).

It appears that the current status of the proposed code, and the interpretations being rendered, do not properly address the actual requirements for fire and life safety for the Landside Terminal Complex. While history suggests that the inherent design and occupancy of a terminal is a relatively low hazard environment, it appears that increasingly complex systems are being added to the design. In particular, a host of code sections emanating from high rise office buildings are being applied to this building, though there is no fundamental linkage between the two. Based on our extensive experience with these systems, we believe that the current approach, and particularly the Denver Amendments, will add millions of dollars of initial cost, and cause unnecessary and potentially dangerous operational difficulties, while adding little if any increase in actual safety to building occupants.

Clearly it is imperative to create a safe environment, where occupants and emergency personnel alike are able to function in an organized manner. However we note a growing tendency to confuse state-of-the-art systems (i.e. smoke evacuation, detection, etc.) with increased safety. In many cases we have observed that the application of these systems results in actual degradation of safety, such as pressurization systems which make exit doors impossible to open or detection systems which result in frequent false alarms. All too often expensive systems are required to be installed, and then are required to be disabled based on their impracticality in the field.

The design of the terminal has now evolved to a point where it is possible to assess the unique aspects of the building and judiciously apply logic and engineering knowledge to the problems of fire and life safety. We propose that an integrated plan, a Fire Protection and Life Safety Plan be presented by the design team, in conjunction with the New Denver Airport Office, to the appropriate agencies. The Fire Protection and Life Safety Plan would address the needs of the building, the requirements of the applicable codes, and would recommend ways to address fire and life safety issues in a responsible and effective manner. This plan might not strictly comply with the requirements of the proposed Chapter 59 Denver Amendments, but would favorably respond to its intent and would be able to meet the unique needs of the structure as the design evolves.

It is important that representatives of the Building Inspection Division and the Fire Department are amenable to this approach, or we foresee significant cost and operational problems ahead. We believe that Chapter 59 of the Denver Amendments does not, in itself, address the real issues.

INTRODUCTION

This work should be viewed as the preliminary phase in developing a Fire Protection and Life Safety Plan. The objectives of the Plan would be the rapid recognition and control of a fire in order to limit potential exposure to occupants, fire fighters, and the building structure. The Plan would provide a level of safety consistent with the intent of current codes and meeting the design & development needs of the complex mix of uses which form modern airport terminals.

Compliance with the applicable building codes would be one of the objectives of the Fire Protection and Life Safety Plan. However, there may be many areas where strict application of the code requirements are impractical to meet, as has been experienced in other cities. In these cases alternatives will be proposed that are in line with the intent of the UBC, NFPA Standards, and other national codes.

In this report we have outlined the current status of the design, which is based upon the requirements of the Uniform Building Code with Denver Amendments (UBC/DA), compared this status with the requirements of the Uniform Building Code (UBC), reviewed the fire protection design features of other airport terminals for comparison, and provided a discussion of the issues. Specific recommendations will be made at a future date in the form of a Fire Protection and Life Safety Plan.

The comparable airports reviewed were:

Ontario International Terminal, (California)

The Rotunda Building at the new Central Terminal Complex at John F. Kennedy Airport in New York

Houston International Terminal

Austin, Texas Airport Expansion

Permanent International Terminal at O'Hare

New TWA terminal at JFK

Western Airlines (Delta) Terminal at Los Angeles

Since the design of the terminal provides fire department access at the highest occupied floor, the structure is not a high rise. Yet the terminal building has been classified as a high rise due to a proposed connection to an airport hotel. While a hotel may be considered at the airport, its location is not finalized, and it seems appropriate that the terminal should be addressed based upon its own requirements, and adequately separated from the hotel that may be built.

None of the other terminals reviewed were classified as a high rise. High rise life safety features were specifically designed to overcome the hazards of tall office buildings. We seriously question whether an airport terminal should be required to incorporate these same features, such as zoned pressurization, smoke exhaust, stair pressurization, smoke and fan control, and elaborate detection systems.

SMOKE CONTROL

Current Status of Design

The proposed code requires smoke removal systems with 4 air changes per hour throughout public areas in the terminal, with adjacent zones providing 100% outside air to pressurize the adjacent zones. Smoke removal is separate for the tenant areas and shall be located in zones that are not more than 52,000 sq. ft. and coincide with the sprinkler zones. The stairs and the elevators require pressurization.

Draft curtains are required to be a minimum of 6 feet deep. There are no requirements for draft stops for roofs over 25 feet high.

Uniform Building Code

The Uniform Building Code requires smoke control systems in atria (1715), but would not require a smoke control system in an airport without an atrium.

The UBC does not specifically discuss airport terminal buildings in the Assembly or the Business occupancy chapters. Based upon the exemption for offices and retail stores, it makes sense to also exempt airport terminal buildings from smoke control and draft curtain requirements. The fire potential in the terminal building and the expected severity of a fire are less than in other types of buildings within the same occupancy classification, such as office buildings, retail stores, and significantly less than in a factory or warehouse.

Design Features of Other Airports

Only three of the seven airport terminals reviewed provided some sort of smoke control system. The three systems were limited to atrium spaces. The Denver airport has a great hall, but it is not classified as an atrium.

The Western Airlines (Delta) Terminal at Los Angeles International Airport has a three story atrium interconnecting floors. In this space, the smoke control system provides six air changes per hour with 18" draft curtains around the perimeter of the atrium. The smoke control system at O'Hare includes only the automatic shut down of the HVAC system. The Rotunda at JFK does not have smoke control systems or draft curtains.

None of the other airports had draft curtains as part of their design.

Discussion

The primary purpose for smoke control is the need to provide a relatively smoke-free environment for occupants exiting the building. In this large structure, with the ceiling height ranging from 20 to 120 feet, there is little likelihood of smoke banking down from the ceiling to a level where it will impact the occupants. Occupants would be able to exit before the smoke reached their level. The large volume of the building adds safety to the occupants rather than detracting from it. This fact tends to indicate that automatic smoke control may not be necessary, and that draft curtains would serve no useful purpose.

Invoking all of the smoke control provisions from Section 1807 (High Rise Buildings) and Chapter 59, as currently written, may not be appropriate and might even create system performance and exiting problems such as:

1. Excessive negative pressure and wind tunnel effect at openings to large volume spaces which are under smoke exhaust mode.

2. Inability to open egress (exit) doors due to high pressure drop across closed doors caused by push / pull smoke control.

3. Potential for freezing HVAC coils & piping due to false alarms and outside air pressurization.

4. Difficulty and cost in performing semi-annual testing of systems.

5. Smoke control system could cause damage to building elements due to excessive pressure differences.

All of these problems were encountered during the preliminary testing of life safety systems at the new Colorado Convention Center. Clearly, the smoke control strategies for the Terminal should be developed on a space by space basis to meet the specific requirements of each area.

DETECTION SYSTEMS

Current Status of Design

The UBC/DA requires detectors to activate the smoke control system for the terminal. Detectors are to be spaced at a minimum of 2500 sq. ft per detector where the ceiling height exceeds 25 feet. Thermal detectors or cross zoned beam detectors can be used in lieu of smoke detectors. Detector zones may not exceed 20,000 sq. ft., and detector zones must match the smoke zones. Tenant spaces over 7500 sq. ft. require separate zones. Smoke detectors are required in all occupiable areas.

Uniform Building Code

The UBC requires a smoke detection system only in atrium areas. The detection system is required at the ceiling of the atrium, on the underside of projections into the atrium, and around the perimeter of the atrium. The spacing of the detectors must be in accordance with their listing.

Design Features of Other Airports

Seven airports included smoke detectors in either the atrium spaces or elevator lobbies and machine rooms. Smoke detection was not required in all areas.

Discussion

The purpose of smoke detectors generally evolved from the need to detect fires in areas where people would not be able to, i.e. unoccupied spaces and sleeping rooms. In an environment such as the terminal, the building occupants are generally alert and will notice a fire promptly. A manual fire alarm can be activated and exiting can take place before detectors are activated.

Adding detectors does not necessarily increase life safety. Installing a detection system that is not needed creates the opportunity for many false alarms, resulting in the failure of occupants to respond to true emergencies.

Fire suppression systems (sprinklers) are another form of detection, and they offer significant advantages because: they both detect and extinguish fires; and they are much less prone to false alarms. It seems appropriate to limit electronic detection systems to areas that are not sprinklered or occupied.

SUPPRESSION SYSTEMS

Current Status of Design

The UBC/DA requires the entire facility to be sprinklered in accordance with NFPA 13, divided into zones that do not exceed 52,000 sq. ft. or 400 feet in any one direction. The entire terminal has to be sprinklered before it can be occupied. Sprinklers are required six feet on center at draft stops separating buildings. Some areas are allowed to be without sprinkler protection such as portable vendor carts that are constructed of non combustible materials and are less than four feet by eight feet.

The code is presently being interpreted to also require sprinklers in the open parking garages.

Uniform Building Code / NFPA

The UBC has no specific requirements for airport terminal buildings. NFPA 416 (Standard on Construction & Protection of Airport Terminal Buildings) requires a complete automatic sprinkler system throughout terminal buildings.

Design Features of Other Airports

Automatic supervised sprinkler systems are in use in all of the airports reviewed. In instances where an existing terminal is being substantially renovated, such as Western Airlines, the experience has been to fully sprinkler the existing portions of the complex. Open parking garages were not sprinklered due to the low fuel load.

Discussion

Wet pipe automatic sprinkler systems is the industry standard for fire and life safety protection throughout most buildings. The systems are economical and very cost effective, and the consensus is to use these systems throughout the Terminal building.

The UBC/DA requires dry pipe sprinkler protection throughout the open parking garage. Dry pipe systems are more complex and require more maintenance than wet pipe sprinklers to prevent the system from freezing. The incidence of freezing reduces the reliability of these systems. The fire history of open parking garages suggests that these structures do not constitute a hazard, which is why sprinkler systems are normally not provided. It would seem appropriate that open parking garages should not be sprinklered.

AUTOMATED GROUND TRANSPORTATION SYSTEM

Current Status of Design

The airport will have an AGTS system running through the terminal building. Of particular interest is the design of the transition from the train tunnel to the station and from the station to the terminal area. The UBC/DA requires the transit tunnels to be sprinklered at the transit stations, have a smoke removal system, a minimum separation between tunnels of 2 hours, and separation between the tunnel and the station of 2 hours.

Uniform Building Code & NFPA

The UBC does not address the AGTS issue, but NFPA 130 (Standard for Fixed Guideway Transit Systems) does. The primary purpose of NFPA 130 is for the mass movement of passengers within a metropolitan area in a electrified system of transit vehicles. NFPA 130 requires that the AGTS be separated from non transit areas.

Design Features of Other Airports

Two of the airports reviewed, the Central Terminal Complex at JFK and O'Hare International Airport include ground transportation stations. The Rotunda at JFK integrates the train stations into the building. The trains arrive into a 2-hour, fully sprinklered tube enclosure which is open at both ends. Openings in this 2-hour tube enclosure are sprinklered metal doors or sprinklered glass. The design for the AGTS stations at the TWA Terminal at JFK is currently in the design process.

Discussion

NFPA 130 requires a separation between transit areas and non transit areas. However, NFPA 130 envisions a major subway system rather than an intra airport transit system. The potential fire exposure is considerably different.

Previous studies done for the Vancouver BC rapid transit system indicated that the fire exposure from a subway system is limited. Therefore the primary purpose of a separation between the AGTS and terminal should be to prevent the spread of smoke.

A fire from a transit vehicle can be expected to be limited if the specifications call for limited combustibility. The expected fire is further reduced by the requirement for sprinkler protection in the tunnel. The degree of fire resistance needed between the tunnel and the station/terminal should be evaluated based on the fuel load, rate of heat release, the potential for other fires in the space, and the impact of sprinklers. The current requirements appear rather conservative.

SUMMARY

The treatment of many fire and life safety issues within the proposed UBC/DA is not consistent with other airport terminals. The other terminals are typically engineered in accordance with accepted national practices.

The fire protection features for the Terminal should be reviewed in detail to determine appropriate alternatives. At present there appears to be an imbalance between the proposed requirements and the actual risks posed.

The cost of this imbalance can be modified with the development and implementation of an overall Fire Protection and Life Safety Plan designed to provide reliable and effective protection. This plan would be specifically tailored to the unique needs of the Terminal. It would address many of the issues briefly described herein and provide engineering solutions to some of the more difficult issues.

Computer models can be used to determine the time of detector or sprinkler actuation during a fire, the height and temperature of the smoke at that time, and compare that information to the amount of time needed to evacuate the building. Other models can determine the radiative and convective heat transfer from a fire in a portion of the building to the structure.

All major projects, such as the Landside Terminal at the new Denver International Airport, should take advantage of the available fire safety information rather than falling back on prescriptive code language.

The result can be a safer more cost-effective building complex.

Prepared by:

Brian C. Olson 3/27/90

Brian C. Olson, P.E. Date

Professional Service from Offices Located in Metropolitan Areas of:

CHICAGO
Rolf Jensen & Associates, Inc.
Deerfield, Illinois
(312) 948-0700

DENVER
Rolf Jensen & Associates, Inc.
Denver, Colorado
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HOUSTON
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Houston, Texas
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APPENDIX C

Fire Alarm Systems

FEDERICO PEÑA
Mayor

CITY AND COUNTY OF DENVER

5/30/90
Signed Copy.

DEPARTMENT OF PUBLIC WORKS

AIRPORT ENGINEERING OFFICE
CITY AND COUNTY OF DENVER
STAPLETON INTERNATIONAL AIRPORT
TERMINAL BUILDING, 4TH FLOOR
DENVER, COLORADO 80207
(303) 270-1600

MEETING ON
CODE RELATED PROCEDURES
IN CONJUNCTION WITH
FIRE ALARM AND DETECTION
NEW DENVER AIRPORT
April 30, 1990
3:30 p.m.
Conference Room # 1
Stapleton International Airport

Attendes:

Al Horne	Jim Dunlap
Steve Rondinelli	Paul Spurgeon
Steve Blessing	Tom Hawkins
Rom Cordero	Philip Goldrosen
Emil Gadeken	

M I N U T E S

Approved Fire Alarm System The fire alarm system and components shall be listed, approved, compatible, and electrically supervised.

Fire Alarm Signaling, shall consist of a horn/speaker and strobe light as part of the fire alarm system. These horn/speaker and strobe unit will be the primary notification for the occupants with any voice announcement on the PA/Emergency Communications System being secondary. Fire alarm speakers must be listed for fire service use and in an approved rated enclosure. Strobe lights must be visible from all areas per Denver Building Code Chapter 64. It is recommended that the strobe lights be placed only by the exit doors when visible from all areas. Strobes must continue to flash until the fire alarm system is reset.

PA/Emergency Communication System Discussion occurred regarding the use of digitized public address evacuation system for shared use by operations, and fire department (with priority to

emergency and fire department use occurring). Although some concerns exist from Building and Fire, this type system should also be investigated further as a secondary Fire Alarm signaling system. Fire alarm voice announcements may be made over a separate PA system. Any automated voice announcement over the PA system must receive the activation signal from the auxiliary fire alarm port and not by any direct connection to the Fire Alarm Control Panel. Prerecorded messages must be approved by the Fire Department.

Fiber Optics if proposed is to be listed as part of the system. The Building and Fire Department are willing to review and possibly approve the use of fiber optics and cable connections based on ANSI approval.

Smoke Detection Clarification for the use of smoke detection was provided by the Building and Fire Departments. Smoke detection is only required in non-pubic, non-sprinklered areas, such as electrical, communication and elevator equipment rooms. It is also required in areas with ceiling heights greater than 25'-0". Since the concourse area is 24'-9" detectors are not required. Duct smoke detectors are required in the mechanical equipment with remote indicating lights and reset capabilities. These detectors will activate the smoke control system in a fire condition.

A system smoke detector is required outside the elevator door at each level served as well as in the elevator equipment room. A sprinkler head is required at the top of the elevator shaft but no detector required.

Fixed Temperature Heat Detectors are required in the trashrooms in addition to automatic sprinkler protection in the room and trash chute.

UBC Section 3304 references the required installation of an

automatic extinguisher and detection system throughout a building when utilizing special security locking devises as proposed at the new airport. The system previously discussed including a complete sprinkler system, duct smoke detection and pull stations meets this intent of the code and would permit the use of these special devices. The special security doors are to be automatically released upon the activation of any two fire alarm devices. Consideration is being given to the fire alarm also activating with any two fire alarm devices has still required Fire and Building Department approval. However, the Denver Fire Department will be notified and respond to the activation any single alarm device.

Automatic Sprinkler Protection is required in all areas (including basement) except those previously exempted, including electrical, communication, and elevator equipment rooms.

Unfinished Tenant Areas are required to be protected by sprinklers and smoke removal. However, areas separated by 1 hr. construction and having no storage or occupancy may be provided with only smoke detection. All unfinished tenant areas below grade (basement) areas are required to be sprinklered regardless of storage or occupancy.

Leaky Coaxial Cable connected to the central antenna center will be considered by the Building and Fire Department for emergency Communication via Denver Fire Department portable radio system. This may permit the deletion of Firefighter communication system if approved by the Building and Fire Department. A letter and request should be formulated for the proposed used of this cable for agency approval.

Thermistor 9090 coaxial wire proposed by Parsons for use as a detection device in a preaction sprinkler system in the AGTS Baggage requires further discussion and development by the consultant. The Fire Department wants to re-evaluate dry

sprinkler system response time and water supply prior to approval of a preaction system.

Security/Fire Alarm System Demo Jim Dunlap is preparing a mock-up of the security and fire alarm system for Building and Fire Department review and consideration.

APPROVED: G. E. Hennig Date 30 May 90
Ciff Hennig, Bldg. Insp.

Paul D. Spurgeon Date 21-Mar. 90
Paul Spurgeon, Fire Prev.

Ginger Evans Date 5-22-90
Ginger Evans, New Denver Airport

K:\51004
SR/egg
cc: Attendees
File 23-5.1

0430MTG.FA

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
(303) 640-5522
(303) 640-2540

July 26, 1990 MEM-1341

MEMORANDUM

TO: Emil Gadeken, Chief Code Coordinator SIA/NDAO
Jim Dunlap, Deputy Director of Aviation/Operations SIA

FROM: Steve Rondinelli R.A., Fire Protection Consultant
Denver Fire Department/DIA Fire Prevention

SUBJECT: Primary and Alternate Controls of Life Safety System at New Denver International Airport

The Denver Fire Department supports the capability of primary and alternate control of the required life safety systems. These controls are approved for the from the following locations:

Terminal Building - Primary control at F.D. operations control center. (To be located and approved by DFD). Alternate control at F.D./Airport Operations Center. (located in Terminal Building).

AGTS Train and Tunnel - Primary control at F.D./ Airport and AGTS Operations Center. Alternate Control at the F.D. Operation Center located in Concourse C.

Concourse Buildings - Primary control at each Concourse F.D. Operation Center. (location as approved) Alternate control at the F.D./Airport Operations Center.

The approval of these primary and alternate control locations is contingent on the Denver Fire Department having prioritized control of these systems at all times from either location.

D.F.D. also requires that the reset of the fire alarm system is to be by fire department personnel only with reset capabilities from either the primary or alternate control center.

cc: Paul Spurgeon, Division Chief Fire Prevention, DFD
Jim Monseu, Division Chief Fire Operation, DFD
16-5.5.1
Eng. File 72603

September 27, 1990 MEM-1385

Memorandum of Interpretation and Administrative Approval

RE: Smoke Detector Placement And Requirements At DIA Per Denver Building Code Chapter 59.

This interpretation and administrative approval is a result of previous discussion and meetings regarding the requirement for smoke detectors in protected areas with ceilings less than 25 feet above an occupied floor.

Area Smoke detectors required by DBC-Chapter 59 shall be deleted according to the following requirements:

- Roof/Ceilings must be less than 25 feet above any occupied floor level.
- Area shall be protected by an approved automatic extinguishing system.
- Required duct-mounted smoke detectors shall be located in the supply and return air streams of normal air handling units and connected to the fire alarm system.
- Smoke control system shall activate by either smoke detection/fire alarm system or the automatic extinguishing system.
- Regardless of ceiling height smoke detectors shall be located in electrical, elevator equipment and communication rooms which do not have automatic sprinkler protection.

Administrative
Approval by:

G.E. Hennig 28 Sept 90
Cliff Hennig, Director Building Inspection Division/Date

Paul D Spurgeon 9/28/90
Paul Spurgeon, Division Chief Fire Prevention Bureau/Date

Ginger Evans 10-1-90
Ginger Evans, Chief of Construction DIA/Date

cc: Steve Rondinelli, R.A. Fire Protection Consultant
Emil Gadeken, Chief Code Coordinator, DIA

SR/p

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
(303) 640-5522
(303) 640-2540

September 13, 1990

MEM-1375

TO: Emil Gadeken, Chief Code Coordinator, SIA/NDAO

THRU: Paul Spurgeon, Division Chief Fire Prevention, DFD PDS
Jim Mouseu, Division Chief Operations, DFD

FROM: Steve Rondinelli, R.A., Fire Protection Consultant
Denver Fire Department/DIA Fire Prevention

RE: Amended Memorandum Of Attached 7/26/90 Memorandum On Primary and Alteration Controls of Fire and Life Safety Systems at NDIA.

This memorandum is provided to clarify the reset capability of the DIA Fire Alarm System. It is still the intent of the DFD to have the primary and alternate prioritized control as outlined. However, DIA Operations will be permitted Fire Alarm reset capabilities from their control panel in the Central Operations Control Center, only when authorized by responding F.D. personnel upon their investigation of the alarm.

attachment

91302
SR/p

FEDERICO PENA
Mayor

CITY AND COUNTY OF DENVER

DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
(303) 640-5522
(303) 640-2540

November 15, 1990

M E M O R A N D U M

TO: Jerry Kiel, P.E. Swanson-Rink Consultants
Emil Gadeken, P.E. Chief Code Coordinator
Jim Dunlap, Director of Airport Operations

THROUGH: Paul D. Spurgeon, Division Chief, FPB PDS

FROM: Steve Rondinelli, R.A. Fire Protection Consultant SR

SUBJECT: FIRE ALARM SYSTEM AND GRAPHIC ANNUNCIATION AT DENVER INTERNATIONAL AIRPORT

Due to the complex nature of the DIA site and unmanageable scale of a traditional hard-graphic annunciator, The Denver Fire Prevention Bureau supports the pursuit and use of video/computer generated graphic annunciation for the Denver International Airport.

SR:rs/11-15.sr

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
(303) 640-5522
(303) 640-2540

May 1, 1991

MEMORANDUM OF INTERPRETATION AND ADMINISTRATIVE APPROVAL

Re: Additional Fire Alarm Initiation Devices and Exempted Areas Fire Alarm Detection.

This interpretation and administrative approval is a result of recent clarification of fire protection requirements for all newly constructed facilities at Denver International Airport.

1. The addition of non-required smoke detectors or other fire alarm initiating devises will not be permitted, except on a case-by-case basis as approved by the Building and Fire Departments.

2. Fire Alarm Detectors are not required in bathrooms or boiler rooms since these rooms are sprinklered.

Paul D. Spurgeon, Division Chief
Fire Prevention & Investigation Div.

C. E. Hennig 3 May 91
Cliff Hennig, Director
Building Inspection Division

Ginger Evans, Chief of Construction
Denver International Airport

SR:rs/4-23.sr

Attachments

CITY AND COUNTY OF DENVER

WELLINGTON E. WEBB
Mayor

DEPARTMENT OF AVIATION

James C. DeLong
Manager of Aviation

Denver International Airport
Airport Office Building
8500 Peña Boulevard
Denver, Colorado 80249-6340
(303) 342-2200

January 7, 1997

9612022

MEMORANDUM

TO: Steve Rondinelli, Denver Fire Department

FROM: Harry Lindmark, DIA Planning & Development Divsion

SUBJECT: Fire Alarm serving 10th Floor A.O.B Control Rooms

8500 PENA BLVD.

The fire alarm and protection system serving control rooms on the 10th floor of the AOB shall be controlled as follows:

1. The bell, light and silence button at the doors to the hallways, are only to indicate that the sprinkler system has an air leak. The button below the bell is only a silence switch. The equipment (bell, silence button) will be re-labeled to indicate that fact and that if the bell goes off, Maintenance control should call plumbing shop (Fire Protection) to investigate and repair the dry system.

2. The dry system air level will be increased to 30 psi to allow for quicker indication of a leak in the pipes. The presure at which the "trouble" bell and light activate will be adjustable.

3. The pipes in the two zones will be and pressurized to a maximum of 30 psi air..
   - **Zone 1** is the northwest part of the floor (Comm Center) and the Incident Command Center (ICC). The offices directly east of the Comm Center are included as is the battery room directly east of the ICC.
   - **Zone 2** is the southwest corner of the flor including Maintenance Control, AGTS Control Room and the UPS rooms just to the east.

4. All detectors in the two zones are base building units (Edwards). If a detector is activated in one of the zones, the building Fire Alarm System activates (DFD is called, automatic smoke control is initiated, horns and strobes activate). If a second detector is activated in the same zone, the building fire alarm system will send a signal to the Potter Fire Control Panel (PFC 2000RC) in the 10th floor janitors closet which will activate the solenoid valve on the Multinatic Valve. This action will allow water to flow into the sprinkler pipes in preparation for when a head is fused by heat in the space.

5. There is a manual switch on each Multimatic Valve that can activate the water valve for a paticular zone.

If this is acceptable, please sign and return to the Airport. 1-7-97

cc: H. Rocek, J. Dunlap, T. West, D. Brown, S. Draper, B. Castilla, T. Lai, S. Eldridge, F. Odland

Emergency Power Supply

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF PUBLIC WORKS

AIRPORT ENGINEERING OFFICE
CITY AND COUNTY OF DENVER
STAPLETON INTERNATIONAL AIRPORT
TERMINAL BUILDING, 4TH FLOOR
DENVER, COLORADO 80207
(303) 270-1600

MEM 1275

May 29, 1990

TO: Cliff Hennig, Director
Denver Building Department

FROM: Ginger Evans, Chief of Construction
New Denver Airport

SUBJECT: **EMERGENCY POWER SOURCE/NEW DENVER AIRPORT STATEMENT OF UNDERSTANDING.**

This memorandum supercedes the letter signed by Building Inspection Division and the Fire Department, dated November 16, 1989, concerning emergency power at the new Denver International Airport.

The unique situation at the Denver International Airport of having two independent substations each of which is serviced by multiple generation stations providing power satisfies the requirement of NEC 700-12-d for emergency power being provided by the second service.

The design and installation of the emergency power distribution system shall be approved by the New Denver Airport Office, Denver Building Inspection Division, and Denver Fire Department.

Specific technical issues will be agreed upon in the latest revision of the Technical Memorandum of Understanding.

APPROVED: C. E. Hennig Date 30 May 90
Cliff Hennig, Bldg. Insp.

Paul D. Spurgeon Date May 30 1990
Paul Spurgeon, Fire Prev.

Ginger Evans Date May 30, 1990
Ginger Evans, New Denver Airport

16 - 5.5.1

EMERGENCY POWER SOURCE/NEW DENVER AIRPORT

TECHNICAL MEMORANDUM OF UNDERSTANDING

ISSUE	**A**	**June 1, 1990 - Issue by Behrent Engineering**
REVISION	**B**	**June 4, 1990 - Acceptance by all Parties**
REVISION	**C**	**September 24, 1990 - Proposed Revisions Approved in Meeting**
REVISION	**D**	
REVISION	**E**	

The intent of this document is to provide a format for recording the concurrent understanding of the technical issues (associated with the emergency power source) by the Building Inspection Division. the Fire Department, and the Denver International Airport.

This document is a further development of Mr. Al Horne's letter dated May 11, 1990.

Bold type indicates approved revisions proposed in a review meeting between Denver Building Inspection, Denver Fire Department, New Denver Airport representatives and consultants.

APPROVED:

C. E. Hennig — **Date** 16 Oct 90

Cliff Hennig, Building Inspection

Paul D. Spurgeon — **Date** 12 Oct 1990

Paul Spurgeon, Fire Prevention

Ginger Evans — **Date** 10-17-90

Ginger Evans, New Denver Airport

EMERGENCY POWER SOURCE/NEW DENVER AIRPORT

TECHNICAL MEMORANDUM OF UNDERSTANDING

LIST OF ABBREVIATION

Abbreviation	Remarks
ANSI	American National Standards Institute
DBC	Denver Building Code
NDA	New Denver Airport
NDAO	New Denver Airport Office
NEC	National Electrical Code
NESC	National Electrical Safety Code
PSCo	Public Service Company of Colorado
UL	Underwriters Laboratories Incorporated

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REVISION

B 1. Design shall be based on the following alternates:

B A. Alternate #4B (which is attached).

- The emergency transformer shall be sized for the connected emergency load per NEC 220 minimum with NEC 700-5(b) load shedding so the emergency transformer is never overloaded per NEC 700-5(a).

- The load shedding equipment shall be part of the normal service entrance switchgear and the normal service entrance switchgear shall be U.L. labeled. The load shedding sensors may be located outside the service entrance switchgear, if necessary.

- The load shedding device shall be lockable if it has manual adjustment devices so only supervisory personnel have access to the adjustment. It shall be arranged so multiple locks may be used.

B B. Alternate #4B with the load shedding deleted.

- The emergency transformer shall be sized for the connected emergency and normal load per NEC 220.

B C. Alternate #4B with two normal transformers and two emergency transformers.

- The emergency transformers shall be sized for the connected emergency load per NEC 220.

- Delete the load shedding.

B D. Alternate #4B with two normal transformers and one 4160 volt transformer. The 4160 volt transformers would be located inside the building and be NDA owned.

The single PSCo transformers that would provide the 4160 volts for the entire facility shall be sized for the connected emergency load per NEC 220.

1.1 PSCo shall be satisfied that the two sources can not be connected together at the 480 volt level via transfer switches, interlocking (electrical and mechanical), or other approved means.

1.2 NDA and PSCo shall designate a normal source and an emergency source at each building service entrance relative to the building as a given feeder can feed more than one building.

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B Each service disconnect shall be labeled and state the area served, location of all other disconnects, and state if it is normal or emergency service.

1.3 Any given 25 kV feeder may be a normal source at one building and an emergency source at a second building.

1.4 North airport substation feeders shall be separated from South airport substation feeders, but any given feeder may be distributed as required.

1.5 It is acceptable to install a single normal transformer to serve a large tenant load.

C **1.6 Each facility Engineer-of-Record will be responsible for designating "Normal" and "Emergency" power sources once inside the facility.**

C **1.7 CLARIFICATION: The intent of Items 1.2, 1.3 and 1.4 is to allow PSCO to install, operate, and load balance their system safely, and meet the intent of NEC 700-12(d) (second service) simultaneously. The words "building" and "building service entrance" are used interchangeably in Items 1.2, 1.3 and 1.4.**

C 2. Third-party coordination **(Behrent Engineering for the initial airport construction through Phase 1)** shall be provided to facilitate the observation, review, and approval process of the design and installation of the emergency power distribution system by the **NDAO**, Denver Building Inspection Division, and Denver Fire Department. It is understood that the NEC shall govern on the building side of the service point and the NESC shall govern on the **PSCo**, side of the service point.

C **2.1 PSCo electrical distribution design will be the responsibility of PSCo. Once the design is complete it will be forwarded to NDA's Project Manager for PSCo Work.**

B C **2.2** The procedure for review of **the** PSCo **design** is:

- **NDA will forward the design to Behrent Engineering for its review and comments. Behrent will forward courtesy copies to City Inspection and the Fire Department for their concurrent review to determine if the PSCo design** meets the intent of the Alternative #4B concept, this document, and NEC 700 12(d). **Upon completion of his review, the Behrent engineer will** staple a letter stating ". . . I have reviewed these drawings and they meet the intent of Alternative #4B, the intent of the document

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2.2 Con't "Technical Memorandum of Understanding", and the intent of NEC 700 12(d) . . .". The letter shall be stamped and signed. Two complete packages required for review by Denver Building Inspection Division.

Should there be a conflict in interpretation of the "Technical Memorandum of Understanding", NDA will arrange a meeting to resolve the conflict. Turn around time for design review is ten calendar days.

C 2.3 The third-party coordinator's primary responsibility will be to confirm the two utility sources are independent as agreed upon by the items in this document, PSCo drawings, and field observation.

C 3. **The third-party coordinating engineer will observe the PSCo installation and he will report his findings to concerned parties.**

B 4. The primary emergency transformer protection shall be ANSI-37 certified via a "certificate of conformance" from the manufacturer. The emergency transformers shall be con-structed and certified to ANSI-57 via a "certificate of con-formance" from the manufacturer. The transformer secondary protection shall be part of the building emergency distri-bution equipment. The transformer service lateral to the overcurrent protection shall be sized according to NEC 230-90.

5. A "no potential" alarm with an adjustable time delay or equivalent shall be installed at the emergency supply and the normal supply to each transfer switch so that PSCo can be notified and emergency precautions taken if the emergency supply is lost.

C **5.1 Clarification of Note 2 and Note 6 on attached Dwg. #4B: The 3-phase "no potential" alarm on the normal supply and emergency supply at each service entrance shall be monitored through the building fire detection system or equivalent and alarmed at the Fire Command Center. A "trouble" alarm would notify the Fire Command Center of the problem. These circuits should be on dedicated circuits. The monitoring alarm circuits shall be standard fire detection system monitored circuits or equivalent. All three alarms may be grouped into one alarm point per service. There shall be one alarm point per service entrance or equivalent. The Dwg. #4B Note 2 and Note 6 alarms may be grouped into one alarm.**

C 6. The Fire Department shall have control of all sources of power through use of remote shunt trip disconnects located in the Fire Command Centers. **The remote shunt trip shall be lockable with a Fire Department limited-access key.**

C 7. **In the event overhead service is used within the property limits of NDA, the overhead lines shall be provided with shielding (overhead ground conductor). Intermediate class arrestors should be used at all riser poles to discharge the possible lightning surges to a level safely below the basic insulation level (BIL) of the cable installation.**

8. The bottom of duct banks are planned to be five feet deep which will result in the top of the duct bank being 36 inches below the paving concrete. PSCo should install concrete encased (red dyed), steel reinforced duct banks with warning marker tape. PSCo shall map or make record drawings of all duct banks.

B 9. Total loss of power MUST be expected even on rare occasions of relatively short durations. Proper precautions must, there-fore, be taken. Battery-powered exit fixtures and exit illumination shall be provided throughout the complex in accordance with DBC Div. 1 Section 5910(c) and tested monthly as required by DBC Div. 5 Section 1009f. The batteries MUST be properly maintained.

10. It is assumed that the separate utility sources will not be in phase. The transfer arrangement shall be provided with an in-phase monitor. This would also motor loads to be reconnected without damage.

C 11. Transfer switches having overlapping neutral transfer contacts or four poles should be provided to prevent nuisance tripping of ground fault interrupters. Transfer switches having bypass isolation (which will not connect the two sources) means should be provided to allow proper maintenance without power interruption. Automatic transfer switches should have yearly in-depth **maintenance** testing **and monthly load testing shall be the responsibility of the NDA.** Cleanliness is most important for reliability.

12. The fire pumps shall be diesel powered or electric powered from two utility sources <u>whichever</u> is the preference of the Fire Department.

C 13. **Deleted.**

14. NEC Article 700-12-d states "this service shall be in accordance with NEC Article 230 with service drops or laterals widely separated electrically and physically from the normal service to minimize the possibility of simultaneous interruption of supply".

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14.1 "Widely separated" shall mean:

The first source lateral and the second source lateral be separated by twenty-five feet at the point where the laterals enter the building providing the laterals are concrete encased underground, the associated transformers and switch cabinets are separated by twenty-five feet, the transformers and switch cabinets are physically protected by a suitable barrier such as a removable metal guard rail, and that the transformers and switch cabinets are twenty-five feet from a fueling point.

A smaller distance separation than twenty-five feet may be considered in special cases where it can be shown that the likelihood of common mode failure is remote.

15. Separation of the 25 kV Source 1 and Source 2 underground primary conductors are not service laterals; however, inde-pendence of the two sources is important.

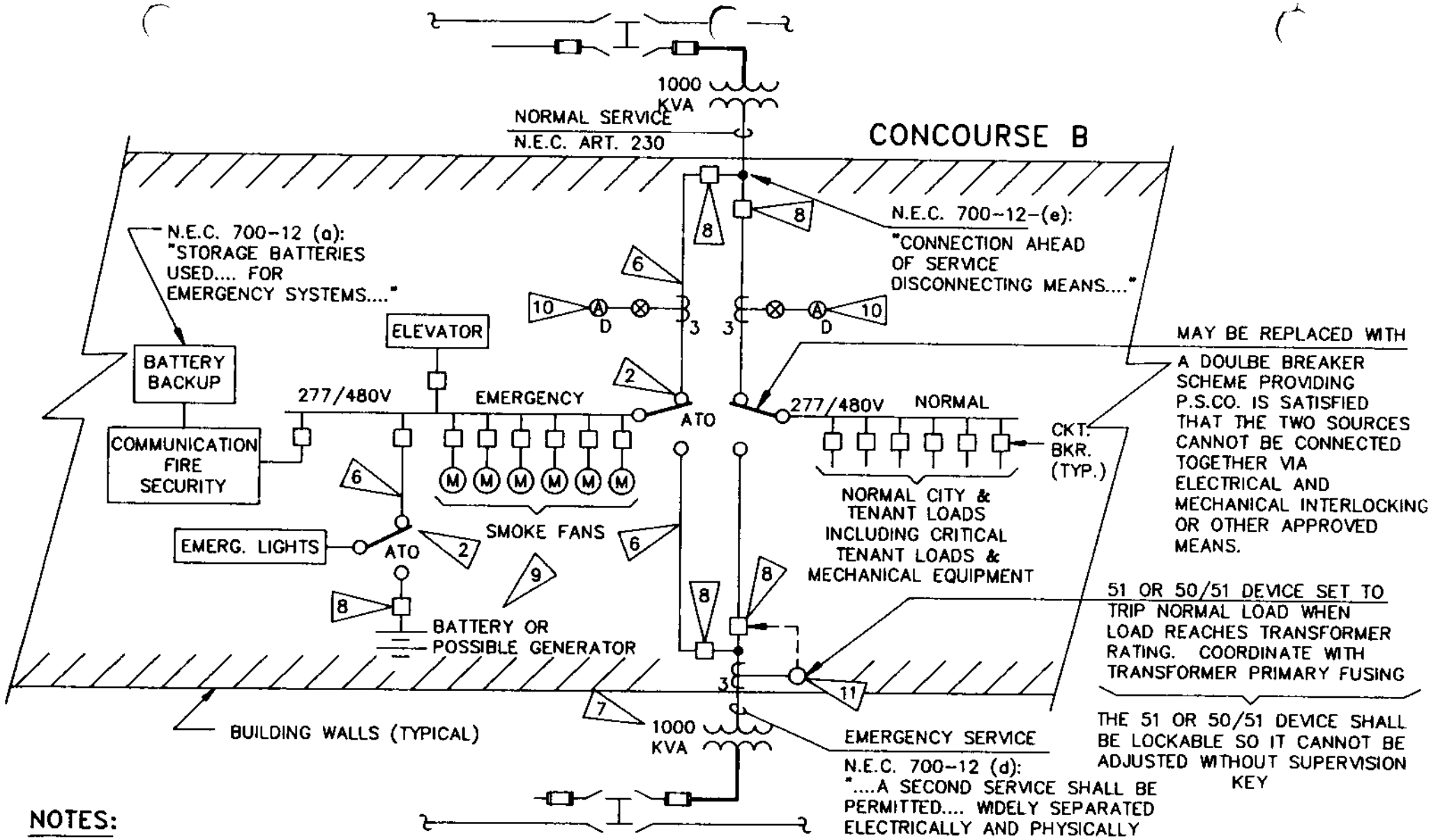
B 15.1 It is understood that 25 kV Source 1 and Source 2 feeder conduits are independent providing they are in individual concrete-encased duct banks and manhole systems separated as follows:

- By an expansion strip under protective aprons.
- By approximately three feet (as outlined in the PSCo book "Guidebook for Electric Installation and Use") outside protective apron areas.
- By an expansion strip at crossover points.

The 25 kV Source 1 and Source 2 feeder conduits may be classified as independent if they are both in the same concrete-encased duct bank and if it is shown that common-mode failure is not plausible.

B 15.2 It is also understood that the 25 kV Source 1 and Source 2 concrete-encased duct banks may cross over each other at an angle (separated by an expansion strip) due to the fact that a common mode failure at a crossover point is not plausible.

16. The transfer equipment used on the emergency circuits need to be approved for the use per NEC 700-6. Typically emergency transfer equipment needs to be UL 891 and UL 1008 listed as a minimum.



NOTES:

2 ATO = MAINTAINABLE AUTOMATIC THROW OVER SWITCH (TYPICAL), WITH NOTIFICATION TO FIRE COMMAND CENTER WHEN ACTUATED. TRANSFER EQUIPMENT ON EMERGENCY CIRCUITS SHALL BE APPROVED FOR THE USE PER N.E.C. 700-6.

6 ALARM OUTAGE TO FIRE COMMAND CENTER.

7 TEMPORARY EMERGENCY SERVICE PROVIDED WHEN NORMAL EMERGENCY SERVICE IS DOWN FOR EXTENSIVE MAINTENANCE (TYPICAL).

8 CIRCUIT BREAKER SHALL BE SHUNT TRIPPABLE FROM THE FIRE COMMAND CENTER.

9 ATO TO BE REMOVED IF CENTRAL BATTERY OR BATTERY PACKS ARE USED.

10 3 PHASE AMMETER WITH A RESETTABLE PUSH HAND, AND A SHORTING BLOCK AND CURRENT TEST BLOCK (NOT SHOWN). MAY BE LOCATED ON EMERGENCY BUS AND NORMAL BUS.

11 51 (A-C TIME OVERCURRENT) OR A 50/51 (INSTANTANEOUS/A-C OVERCURRENT) LOCKABLE DEVICE.

ALTERNATE "AD"

Rolf Jensen & Associates, Inc.
FIRE PROTECTION ENGINEERS • BUILDING CODE CONSULTANTS

PRELIMINARY

FIRE PROTECTION AND LIFE SAFETY PLAN

for

PHASE I

of the

LANDSIDE TERMINAL

DENVER INTERNATIONAL AIRPORT

PREPARED FOR:

C. W. FENTRESS J.H. BRADBURN & ASSOCIATES, P. C.
1800 GRANT STREET SUITE 600
DENVER, COLORADO

D6456.01

SEPTEMBER 27, 1990

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TABLE OF CONTENTS

INTRODUCTION/PURPOSE

This report describes the Fire Protection and Life Safety Plan for the Landside Terminal at the new Denver International Airport. The Plan describes the fire protection and life safety features intended to safeguard building occupants, fire fighting personnel, building contents, structure, and operations in case of fire. The Fire Protection and Life Safety Plan describes features which differ from some of the literal requirements of the Uniform Building Code with Denver Amendments 1990 Edition , hereinafter referred to as the Code. These requirements and the means by which the Fire Protection and Life Safety Plan provides an equivalent level of safety, are discussed in the CODE CONSIDERATIONS section.

The Fire Protection and Life Safety Plan is meant to form the basis for a detailed agreement between the Building and Fire Departments which will supplement and, in some cases, supersede the building code.

This Report covers only the Phase I Terminal Building.All construction North of column line N32, the Hotel, and the AGTS Guideway are not included in this Fire Protection Program.

BUILDING DESCRIPTION

Terminal

The Landside Terminal is a multiple use facility consisting of Ticketing, Baggage Claim, Security Checkpoint, AGTS to Concourses, and misc support services such as Restaurants, Shops, and Airline Offices on Levels 3 through 6. The total building area is approximately 1,400,000 sq. ft. The Terminal Building contains the following functions by floor:

Level 3 Baggage Make Up
Level 4 AGTS Station,Mech.Rooms,Exit Corridors/Stairs/Vestibules
Level 5 Great Hall, Baggage Claim, Offices, and Retail
Level 6 Ticketing, upper level of Great Hall, Offices, and Retail

The construction classification for the Terminal is Fire Resistive Type I, and the primary occupancy classification is B-2. The restaurants on Level 6 are classified as A-3.

The facility is classified as a fully sprinklered building. It may not be practical to provide automatic sprinkler protection at the ceiling of the Great Hall due to it's height and geometry.

The lowest level of fire department access is Level 5. The highest occupied floor is Level 6, which is 20 feet above the level of fire department access. The facility is not a high rise building.

Parking Structure

There is an adjacent open parking structure that consist of six similar modules, each one has a capacity of 1400 cars. The total capacity of all of the parking garages is 8400 cars. The occupancy of the parking structure by level is as follows:

Level 1 Rental Car Vestibules, and Parking
Level 2 Electrical Equipment Rooms, and Parking
Level 3 Parking
Level 4 Parking

The construction classification is Fire Resistive Type I although only Type II-FR is required. The occupancy classification is B-1 or B-3 in accordance with the Denver requirements.

The parking structure will not be sprinklered due to the low combustible loading and it's fire resistive construction. If sprinklers were installed in this area they would be required to be the dry pipe type that is subject to freezing and vandalism. Dry pipe systems require a high level of maintenance with associated high costs.

Roadway and Curbside

The construction classification for the elevated Roadway is Fire Resistive Type I. The Roadway is classified as a Public Way.

The roadway is used by passengers for accessing the terminal at Levels 5 & 6. The roadway will be used for accessing the Arrival and Departure levels similar to the existing Denver Airport and will not be used for commercial trucks.

FIRE SAFETY APPROACH

In order for the terminal to fulfill its function, large open spaces are needed. Large crowds, inherent in the building use, must be able to circulate freely. The designers and the City and

County of Denver Building Inspection Division and Fire Prevention Bureau officials recognized that these functional requirements are necessary and to permit the full and efficient use of the building a rational approach to fire safety is required.

The fire protection features incorporated into this building are based on analytical fire modeling and on experience gained through involvement in other similar facilities. We have attempted to comply with the full intent of the Code by using an engineered approach to evaluate alternatives to provide an overall equivalent level of safety.

The active systems will include fully supervised automatic sprinkler systems, fire standpipe systems, and smoke control systems using the HVAC systems. These systems will be designed for a high degree of performance and reliability.

OVERVIEW OF FIRE PROTECTION FEATURES

The Fire Protection and Life Safety Plan consists of the following major elements:

1. Fire pump boosted sprinkler and standpipe systems.

2. Hydraulically designed automatic sprinkler systems throughout areas of the terminal building.

3. Mechanical smoke exhaust and pressurization systems throughout the terminal building where appropriate to limit the spread and relieve products of combustion within the general area of fire origin.

4. Mechanical pressurization systems for egress stairs and selected elevator hoists ways.

5. Zoned egress to provide adequate, efficient exiting of the building occupants.

6. Alarm and control systems to notify the Landside Terminal Fire Department Operations Center, and remote Fire Department facility, of emergency conditions and to permit manual and/or automatic control of the smoke control systems, as described hereinafter.

7. Communication systems for each area of the building consisting of 2-way communication via Fire Department radio system assisted by leaky coaxial cable and antenna; and 1-way

communication from the Fire Department Operations Center to the building occupants using the terminal and curbside public address system.

8. Fire protection system supervision intended to provide prompt notification of system malfunctions and quick response in the event of system operation.

9. Emergency power to fire pumps and smoke control for the continuity of required operations. Onsite emergency power supply in the form of diesel driven engine generators, or DC batteries for fire alarm and emergency lighting

10. Automatic fire detectors in non sprinklered areas of the terminal building as permitted by code.

11. Fire resistive construction.

FIRE PROTECTION & LIFE SAFETY PLAN

I. OCCUPANCY CLASSIFICATION

A. Terminal - B2

B. Offices - B2

C. Restaurants - B2 (A3 if greater than 30 occupants)

D. Retail Shops - B2

E. Parking Structure - B3 or B1

F. Baggage Storage & Handling B1

II. CONSTRUCTION

A. General Construction Classification - Type I, Fire Resistive

B. Walls

		Minimum Fire Resistance - Hrs.
1.	Exterior Bearing Walls	4
2.	Exterior Non bearing Walls	0, NC
3.	Non bearing Interior Partitions	0, NC
4.	Exit Stair Enclosures and Elevator Enclosures	2
5.	Public Corridor Walls	0, NC
6.	Horizontal Exit Fire Walls	2
7.	Folding Partitions	0

Minimum Fire

		Resistance - Hrs.
8.	Occupancy Separations	
	B1 to B2	1
	B1 to B3	1
	B1 to A3	3
	B2 to A3	NR
9.	Fire Wall between Terminal and Parking Garage (by Agreement)	2
10.	Enclosure of Areas of Special Risk Including Furnace, boiler room and emergency power equipment rooms	1
C.	Roof Construction (including supporting beams)	
1.	Great Hall with roof height greater than 25'	O, NC
2.	Other areas	2
D.	Floor Construction	
1.	Mezzanine floors	1
2.	Other Floor	2
E.	Structural Frame - Columns and Primary Beams	3

III. INTERIOR FINISH

	Maximum Flamespread	Smoke Developed
A. Public Corridors	200	450
B. Exit Stairs	75	450
C. Elsewhere	200	450
D. Insulation	75	450
D. Carpeting on Walls	25 (mechanical fastening only)	50

IV. EGRESS

	Occupant Load Factor (Sq.Ft./occupant)
A. OCCUPANCY	
1. Passenger Circulation (B2) to include ticketing, check-in & baggage Claim Area	100
2. Offices (B2)	100
3. Retail (B2)	30
4. Dining/Restaurant (B2 or A3)	15
5. Baggage/Storage areas (B1)	300

B.	MAXIMUM EXIT CAPACITY	50 persons/ft. of exit
C.	MAXIMUM TRAVEL DISTANCE	300 ft.(See Code Considerations)
D.	MAXIMUM DEAD END CORRIDOR	20 ft.
E.	HORIZONTAL EXITS	2 Hour Construction

F. EGRESS ZONES

1. The terminal is divided into zones for smoke control. An egress zone is an area in which an evacuation tone would sound in response to a fire alarm input signal from that zone.

2. Zones are established to provide for limited initial occupant movement. Only those persons in the zone from which the fire signal is received will alerted.

3. The zones for occupant evacuation will be coordinated with zoning of other fire protection systems.

V. DETECTION AND ALARM

A. Smoke Detectors

1. Location

a. Elevator machine rooms

b. Elevator lobbies

c. Great Hall beam detection at sixth floor ceiling level

d. Duct mounted detectors as per NFPA 90A, and at outside air intake to stair and elevator hoist way pressurization.

2. Zoning and annunciation

a. Smoke Detector zones coordinated with, and contained within, smoke control zones

b. Smoke Detectors annunciated by zone.

B. Waterflow indicators

1. Location

a. Waterflow switch connection at each sprinkler zone for each floor and at the main water supply line(s);

2. Zoning and annunciation

a. Sprinkler system zones coordinated with, and contained within, egress zones.

b. Waterflow indicators annunciated by individual sprinkler system zone and by main water supply.

C. Fixed Temperature/Rate Compensated Heat Detectors

1. Location

a. Transformer Rooms

b. Electrical switchgear rooms

c. Electrical and Telephone Equipment Rooms

d. FCC and Cabling rooms

e. Lounges

2. Zoning and annunciation

a. Heat detector zones coordinated with, and contained within respective detected zones.

b. Annunciated by zone and type of device

D. Manual Fire Alarm Stations

1. Location

a. Manual fire alarm stations located on every level of the terminal building near exits, or groups of exit doors. Manual pull stations will

not be provided in the parking structures.

b. Manual fire alarm stations shall be located as near as possible but not more than 5 ft. from doors to each exit stair and groups of doors to the exterior.

c. The maximum travel distance to a manual pull station will be 200 feet.

2. Zoning and Annunciation

a. Manual fire alarm station zones coordinated with, and contained within respective egress and other detection/sprinkler/smoke control zones.

b. Manual fire alarm stations annunciated by individual device.

VI. SUPPRESSION

A. Hydraulically designed automatic sprinkler systems in accordance with NFPA standards and the following criteria:

1. Office, ticketing, baggage claim, and passenger circulation areas: Light Hazard with a minimum density of 0.15 gpm/sq.ft.

2. Retail shops: Ordinary Hazard Group II.

3. Baggage Handling Area: Ordinary Hazard Group II

4. Food preparation areas: Ordinary Hazard Group II.

5. Escalator floor, open stair openings, shall be a water curtain with closed head sprinklers spaced at 6 ft. - 0 in. on center around the openings; 0.3 gpm/lineal ft.

6. Sprinklers located in all areas except for the Great Hall, Parking Structures, Roadway, transformer and electrical switchgear rooms, electrical rooms, elevator equipment rooms, telephone rooms, FCC and data cabling rooms.

VII. SMOKE CONTROL SYSTEMS

A. Provided to limit smoke movement and exhaust smoke in the area of fire origin

1. Maintain tenable paths of egress.

2. Apply technology developed by ASHRAE and guidelines adopted by NFPA 92A and 92B

3. Utilize nationally accepted approaches that have proven results.

B. Zoning using individual zones of smoke control exhaust and pressurization. Means to relieve air will be provided accordingly to avoid over-pressurization. Containment and removal for one-sixth of the terminal, both vertically and horizontally will be provided as follows:

1. Level 1 Car Rental (3 zone exhaust, 3 zone pressurization on both east and west rental areas)

2. Levels 3 / 4 Bag Make-up (6 zones exhaust, 6 zones pressurization)

3. Level 4 AGTS Platform (3 zone exhaust, 3 zone pressurization on inbound and outbound platforms)

4. Level 5 Baggage Claim/Retail and Offices (6 zones exhaust, 6 zones pressurization for baggage claim; 6 zones exhaust, 6 zones pressurization for office/retail)

5. Level 6 Ticketing/Retail and Offices (6 zones exhaust, 6 zones pressurization for ticketing; 6 zones exhaust, 6 zones pressurization for office / retail)

6. Levels 5 / 6 Great Hall (3 zones exhaust, 3 zones pressurization)

7. Required stairways

8. Designated fire fighter use elevator hoist ways

B. Standpipe System

1. Located within 10 feet of stairways;

2. Maximum distance to a standpipe will be 200 feet;

3. Class I wet standpipes to be provided throughout the terminal in accordance with NFPA 14.

4. Class I standpipes, connected to a dry pipe valve, shall be provided in the parking structures in accordance with NFPA 14.

C. Water Supply

1. The water supply to the airport is from a single feed 42" main. The 42" main feed two 24" and one 30" mains. The 24" mains parallel each other on opposite sides of the terminal/parking complex and feed the terminal and concourses. There is one connection to each 24" main that feeds the terminal on the north end.

2. Fire pump(s)

3. Fire department connections

a. Unimpaired access from all principal directions

b. Marked as to floors and/or zones served.

c. Provided in locations approved by the Denver Fire Department.

d. Garage access/ special fire fighting equipment (mobile).

D. Portable fire extinguishers will be provided throughout, in accordance with NFPA 10.

Smoke Control Systems

Service Reference	Fan Location	Sizing Criteria	Code Reference
Level 1 Rental Car East Exhaust	L6 Roof	Greater of 20,000 cfm or 4 ac/hr. No mech. make-up.	5907(e) 5.
Level 1 Rental Car West Rental	L6 Roof	Greater of 20,000 cfm or 4 ac/hr. No mech. make-up.	5907(e) 5.
Elevator Hoistway Pressurization - (Designated for Fire fighter use)	L4 Mech. Rm.	Greater of 6 A.C./ Hr.,10,000 cfm + 400 cfm/landing door, or ASHRAE 58/ NFPA 92A/92B	5908(k)
Stairway Pressurization (Total of 6 systems)	L4 Mech. Rm.	Greater of 15000 cfm +200 cfm/door or ASHRAE 58/NFPA 92A/92B	5908(k)
L3/L4 Bag Make-up Exhaust (Total of 6 Zones)	L6 Roof	4 A.C./Hr. or ASHRAE 58 NFPA 92A/92B	Tenant Areas 5907(e) 5.
L3/L4 Bag Make-up Pressurization (Total of 6 Zones)	L3 or L4 Mech Rm.	2 A.C./Hr. or ASHRAE 58/NFPA 92A/92B	5907(f) 3. & 5907 (g) 1. Required for smoke containment and exhaust make-up
AGTS Platform Exhaust (Total of 3 Zones)	L6 Roof	4 A.C./Hr., Engineered or ASHRAE 58/ NFPA 92A/92B	5907(e) 3.
AGTS Platform Pressurization (Total of 3 Zones)	L4 Mech. Rm.	3 A.C./Hr. Engineered or ASHRAE 58/ NFPA 92A/92B	5907(f) 3. & 5907(g) 1.&2.

C. Zoning will be coordinated with fire detection and fire suppression zoning.

D. Manual control from the Landside Terminal Fire Department Operations Center will allow flexibility for fire fighters to adjust overall system operation to meet specific smoke control needs, particularly for fires at zone interface points. Control from remote locations will not be provided.

E. Automatic actuation of smoke pressurization of stairwells and elevator hoistways will be provided. Sprinkler zone water flow alarm activation would automatically activate the smoke exhaust component of the system. Additionally, a cross-zoned or dual device (smoke detector and water flow) could automatically activate the smoke exhaust and the pressurization systems.

F. Manual activation of the smoke control systems is proposed for all public and occupied areas on the basis of minimizing disruption to terminal operations, occupant discomfort and potential freeze damage due to false alarms.

G. Smoke control supply and exhaust fans shall have motorized dampers and smoke detectors at their points of intake and motorized dampers at their points of exhaust to allow 100% fresh air supply and 100% exhaust without circulation.

Smoke control supply and exhaust fans shall have a status indication and manual control from the Landside Terminal Fire Department Operations Center.

H. The following is a preliminary list of proposed smoke control systems, their location, design criteria and code reference.

Service Reference	Fan Location	Sizing Criteria	Code Reference
L5 Baggage Claim Exhaust (Total of 6 Zones)	L6 Roof	4 A.C./Hr. or ASHRAE 58/ NFPA 92A/92B	5907(e) 3
L5 Baggage Claim Pressurization (Total of 6 Zones)	L4 Mech Rm	2 A.C./Hr. or ASHRAE 58/ NFPA 92A/92B	5907(f) 3. & 5907(g) 1 Required for Smoke Containment & Exhaust Make-up
L5 Retail/Office Exhaust (Total of 6 Zones)	L6 Roof	4 A.C./Hr. or ASHRAE 58/ NFPA 92A/92B	5907(e) 5.
L5 Retail/Office Pressurization (Total of 6 Zones)	L4 Mech Rm.	2 A.C./Hrs. or ASHRAE 58/ NFPA 92A/92B	5907(f) 3. & 5907(g) 1
L5/L6 Great Hall Exhaust (Total of 3 Zones)	Great Hall Roof	2 A.C./Hr. or ASHRAE 58/ NFPA 92A/92B	5907(e) 3.
L5/L6 Great Hall Pressurization (Total of 3 Zones)	L4 Mech Rm.	1 A.C./Hr. or ASHRAE 58/ NFPA 92A/92B	5907(f) 3. & 5907(g) 1.
L6 Ticketing Exhaust (Total of 6 Zones)	L6 Roof	4 A.C./Hr. or ASHRAE 58/ NFPA 92A/92B	5907(e) 3.
L6 Ticketing Pressurization (Total of 6 Zones)	L4 Mech Rm.	2 A.C./Hr. ASHRAE 58/ NFPA 92A/92B	5907(f) 3. & 5907(g) 1.
L6 Ticketing Office/Retail Exhaust (Total of 6 Zones)	L6 Roof	2 A.C./Hr. or ASHRAE 58/ NFPA 92A/92B	5907(e) 5.
L6 Ticketing Office/Retail Pressurization (Total of 6 Zones)	L4 Mech Rm.	2 A.C./Hr. or ASHRAE 58/ NFPA 92A/92B	5907(f) 3. & 5907(g) 1.

VIII. VOICE COMMUNICATION SYSTEM

A. One-way voice communication will be provided using the building public address system.

1. Design features

a. Loud speakers located in:

1) Ticketing Lobby

2) Baggage Claim

3) Elevator lobbies

4) Elevators

5) Stair enclosures

6) Great Hall

7) Any room or space over 1,000 sq. ft.

8) Mechanical and electrical rooms, except other distinctive types of fire alarm devices (audible or visual) may be provided in lieu of or to supplement loudspeakers

b. System activated by signal from:

1) Sprinkler system waterflow indicator

2) Manual actuation at Fire Department Operation Center.

2. Operational Sequence

a. Tone signal broadcast to emergency egress zone

b. Fire department personnel can exercise manual control of alarm signal or voice instructions

B. Two-Way Communication System

1. Two-way fire department communication system via

radios

IX. FIRE DEPARTMENT OPERATIONS CENTER

A. General

1. The Fire Department Operations Center will be provided in a location approved by the Fire and Building Departments. The Operations Center for the terminal and parking structures will be located within the terminal.

2. Capability to monitor and/or control fire protection related systems.

3. Fire alarm signals monitored by operations and transmitted directly to fire department line shop.

B. Monitor and Control Capabilities

1. Fire alarm and detection system control panel

   a. Fire alarm (input) systems

      1) Monitor

         (a) Waterflow switches on automatic sprinkler systems and standpipe systems

         (b) Smoke detectors

         (c) Heat detectors

         (d) Manual fire alarm stations

      2) Control - none

   b. Smoke Control System

      1) Monitor

         (a) Status of smoke control exhaust and pressurization fans hand-off-auto switch

(b) Status of other fans which are part of smoke control system

(c) Status

2) Control

(a) Operation of smoke control pressurization and exhaust fans (on/off)

(b) Operation of smoke control dampers - open/close

c. Fire Pump(s)

1) Monitor - off/running status in accordance with NFPA 20.

2) Control - automatic and manual start

d. Sprinkler Systems

1) Monitor

(a) Position of all gate valves controlling waterflow into sprinkler systems

(b) Waterflow at base of each riser and into each sprinkler system zone

2) Control - none

e. Standpipe System
1) Monitor

(a) Position of all gate valves controlling waterflow into standpipe systems

(b) Waterflow at base of each standpipe

2) Control - none

f. One-way voice communication system

1) Monitor - system operation

2) Control

(a) Manual announcement capability

(b) Activate loudspeakers on any floor or combination of floors by egress zone

g. Firemen's two-way communication system

1) via radios

h. Graphic annunciator panel

1) Lamp test switch

2) Fan and dampers

(a) Monitor

(1) On/off of fans

(2) Open/close of dampers

(b) Control

(1) On/off of fan

(2) Open/close of damper

3) Fire alarm system

(a) Monitor - zone annunciation

(b) Control - none

4) Fire pump

(a) Monitor - off/running status and other features in accordance with NFPA 20.

(b) Control - start

5) Elevators

(a) Monitor

(1) Position of each elevator

(2) Power supply

(b) Control

(1) Return of elevators

6) Emergency power

(a) Monitor - off/running

(b) Control - none

X. GENERATED EMERGENCY POWER

There will be six 200 KW systems

A. Fire Alarm and Detection Systems
B. Voice Communication Systems
C. Emergency Lighting and Exit Signs
D. Security

XI. DUAL ELECTRICAL SOURCE EMERGENCY POWER

A. Elevators
B. Mechanical equipment for smoke control (Supply and Exhaust) Fans
C. Fire Pumps
D. Delay panic hardware (if provided)

ALTERNATE MEANS OF PROTECTION

The Denver International Airport Landside Terminal has been designed to provide a level of fire safety equal to or greater than that required by the Uniform Building Code with Denver Amendments.

Because of the unique functional requirements of the facility, several building features do not meet the literal requirements of the Code.

Where strict compliance could not be accomplished, an alternative solution is used to provide an equivalent level of safety, in accordance with Section 111 of the code. Each area where this has occurred is discussed in detail in the following sections and includes a reference to the applicable code requirement, identifies the proposed design feature, and documents the basis for approval. The suitability of the proposed alternatives should be viewed with the entire Fire Protection and Life Safety Plan in mind.

EXITING

CODE REQUIREMENT:

5904 (a) Building Exits: All building exits shall comply with Chapter 33 unless specially provided for in this chapter.

3303 (d) Distance To Exits: the maximum distance of travel from any point to an exit, shall not exceed 200 feet in a building equipped with an automatic sprinkler system throughout. These distances may be increased 100 feet when the last 150 feet is within a corridor, complying with section 330.5.

5904 (f) Exterior Doors: Exterior doors shall include doors opening onto roadways on grade or elevated which provide public access/egress to passenger terminals, provided that:

1. The roadways have sidewalks, width based on occupant load, that lead to a dispersal area at grade.

2. Covered roadways are sprinklered and have at least one side open.

CODE INTENT

The intent of the code requirements is to assure that the exits provided are accessible, so that the distance of travel from any occupied point in the building to an exit is not excessive. Indirectly the code is establishing a time factor on the ability of an occupant to safely evacuate the floor or building.

For airports, exterior exits doors often discharge to an adjacent roadway. The Code's intent here is to provide a safe area for exit discharge, equivalent to a public way.

PROPOSED CONDITION

The maximum travel distance to an exit will be in compliance with section 3303(d) except that in the Great Hall a maximum travel distance of 300 feet will be used.

Exterior exit doors will be provided that discharge to the upper open roadway and to the lower covered roadway. The roadways are open to the outside on both sides. Automatic sprinkler protection will not be provided for the roadways (see Code Considerations - Roadways).

Horizontal exits may be used for exiting more than 50% of the occupants from the Bag make-up room and interior stairs. Horizontal exits in this location discharge into the Level 4 Arrivals Curbside.

BASIS FOR APPROVAL

An increase in exit travel distance from 200 feet to 300 feet for the Great Hall should be permitted on the basis that the Great hall has such a large volume that adequate time will be available for occupants to safely exit before a descending smoke layer would obstruct their exit paths. This has been demonstrated by fire models (shown in detail in Appendix C) which indicate sufficient safe egress time to permit a travel distance increase. The Great Hall, in addition to its large volume, will be provided with a mechanical smoke removal system that will increase the available safe egress time.

This is consistent with other code requirements at other airports, such as O'Hare International, that permits an increase in exit travel distance to 300 feet.

Exiting to the covered roadway is to a public way because the large volume and ambient conditions will minimize the possibilities of hazardous conditions being present during exit discharge. Sufficient area is provided for dispersal of evacuating building occupants. The Roadway structure is constructed of Type I Fire Resistive construction to protect it against fire exposure.

Horizontal exits are used for 100% of the exits from the bag make-up room and the interior stairs serving Levels 3-6. In this case, horizontal exits provide the most direct path of escape.

FIRE PROTECTION FOR THE GREAT HALL

CODE REQUIREMENT:

5908(a)1. Fire Sprinkler Systems. Terminal/Concourse buildings shall be fully sprinklered in accordance with NFPA 13.

EXCEPTION: Equipment Rooms and areas approved by the Building Department and Fire Department.

CODE INTENT:

The code requires automatic sprinkler protection to protect the occupants and the building from the effects of a fire in areas of the building where a sufficient combustible load is likely to exist which could cause an uncontrolled fire to be a threat to the occupants or to the building. The intent of the exception is to permit non sprinklered areas where sprinklers are considered to be of limited fire protection value as in areas where significant combustible load is not likely to exist.

PROPOSED CONDITIONS:

The Landside Terminal Building will be fully sprinklered in accordance with the Denver Building Code. In the Great Hall Automatic Sprinkler protection will be provided by means of sidewall sprinklers to protect the level six areas open to the Great Hall. Sprinklers will not be provided over the level five portion of the Great Hall as permitted by code.

BASIS FOR APPROVAL:

Deletion of Automatic Sprinklers in the great Hall is based on several factors:

1. The Great Hall is a large open space. Because of the function of the space and the high pedestrian traffic moving through the space, the building finishes are generally of noncombustible materials. The combustible load of the Great Hall is expected to be very low.

2. The Roof structure varies in height from 65 to 120 feet. Because of these heights, a very large fire would be needed to activate automatic sprinklers at the ceiling level.

3. The geometry of the roof is such that it is difficult to predict whether the heat from a fire on the floor would collect at the ceiling in a manner that would activate sprinklers over the fire. The possibility exists that sprinklers remote from the fire would be activated.

4. The Great Hall is a highly supervised environment. The space will be used 24 hours a day and will be provided with security.

5. The airport will place operational limits on the quantity and arrangement of combustible contents within the space. These operational limits are based on fire models contained in appendix C. The fire models were developed to determine how great a combustible load was needed to activate automatic sprinklers at the roof level. By limiting the combustible load to a quantity less than that needed to activate automatic sprinklers, the need for sprinklers is eliminated. If isolated fuel arrays are introduced, either on a temporary or permanent basis, protection would be provided for these specific areas.

6. The fire model clearly indicates that sprinkler protection and smoke control are not required to satisfy life safety issues. The occupants in the terminal have more than enough time to exit the terminal before conditions become untenable.

7. Other fire protection features are provided in the Great Hall to provide increased fire safety. These include smoke detectors to detect the presence of a fire while it is small, Smoke exhaust to evacuate smoke from the Great Hall, and Fire department hose valves for fire fighting operations.

SMOKE DETECTORS

CODE REQUIREMENT:

5907 (f) Smoke detection: Smoke detection shall be provided as follows:
1.There shall be an average of one detector per 2500 sq. ft. for areas with roof/ceilings over 25 feet above an occupied floor. EXCEPTION: Thermal detectors or cross zone beam detectors where approved by the Department and Fire Department.

CODE INTENT:

The smoke detectors required by this section are intended to cause automatic activation of the smoke control system. This is not a requirement of the UBC. Smoke detectors are required in general areas where the roof or ceiling is over 25 feet because of potential delays in causing the smoke control system to operate from sprinkler activation alone.

PROPOSED CONDITION:

The requirement for smoke detectors in areas where the space is more than 25 feet high affects the Great Hall and Bag Make-Up Level 3, where ceiling heights greatly exceed 25 feet.

In lieu of placing area spot type smoke detectors below the fabric roof it is proposed that projected beam type smoke detectors be used, spanning the width of the Great Hall and spaced appropriately 50 feet apart. These detectors can be cross zoned.

Smoke detectors in addition to sprinklers should not be installed in the 300,000 sq. ft. Bag Make-Up Level 3.

BASIS FOR APPROVAL:

The use of the exception to 5907 (f) should be permitted on the basis that due to the high ceiling heights concern about smoke stratification must be considered. The projected beam smoke detectors would be installed significantly lower than the roof and consequently would be less prone to problems due to smoke stratification.

Also, an important factor that must be considered in locating smoke detectors is their accessibility for cleaning, maintenance and testing. The use of projected beam type smoke detectors is a much better choice from this standpoint.

In the case of the bag room the problem of unwanted alarms is much more severe due to the nature of the operations that occur in the bag make-up room. Unwanted alarms in this building severely compromise the integrity of the building security.

SMOKE CONTROL

CODE REQUIREMENT:

5907 Smoke Control.

(a) Required. A mechanically operated air-handling system shall be installed in the main passenger terminal building which will restrict the smoke to the general area of fire origin and maintain the exiting system in a condition that is safe for exiting.

(b) General. The smoke control systems shall be connected to the smoke detection and/or the automatic sprinkler systems, and shall automatically operate when either system is actuated.

(e)3. The terminal buildings public circulation area smoke removal systems shall provide at least 4 air changes per hour and be zoned consistent with the automatic sprinkler systems. The smoke removal system shall also be capable of manual operation from the F. D. Operations Center.

(e)4&5 The tenant space shall be part of a smoke control zone and shall be sized to exhaust a minimum of 4 air changes per hour or 20,000 cfm, from each zone, whichever is greater.

(g)1 The smoke control system shall be arranged to exhaust the zone of origin at the required rates and all adjacent zones shall be arranged to supply 100% outside air to prevent smoke migration to unaffected area.

5908(i) Zones. Zones for smoke control, sprinklers, detectors, etc. shall be coordinated to have the same zones or multiples thereof, not to exceed the maximum area required by other provisions of this code.

CODE INTENT:

The intent of the smoke control requirements is to limit smoke spread and exhaust smoke in the area of fire origin, while maintaining the tenability of the egress paths. These requirements are far in excess of those required by the UBC.

PROPOSED CONDITION:

A smoke control system will be provided in the terminal building. The system will be zoned consistent with horizontal and vertical barriers, automatic sprinkler system zones and fire detection and alarm zones. Each zone will have the capability to be exhausted (100% exhaust) or pressurized (100% fresh air supply).

The normal building HVAC system will be used for smoke control except that dedicated smoke exhaust fans will be provided at the top supports of the fabric roof structure and for pressurization fans at stairway and designated hoistways.

All smoke control functions will be initiated manually by fire fighting personnel from the Fire Department Operations Center, except for pressurization of stairwells and elevator hoistways.

A graphic control panel will be used to identify each zone and provide the controls so that each zone can be put into exhaust or supply on an individual zone basis.

BASIS FOR APPROVAL:

The present design of the smoke control system is such that it does not meet minimum air changes per hour in all areas and is activated manually rather than automatically. However, the proposed design does meet the intent of the Code by providing a zoned smoke control system that can easily be operated by the responding Fire Department and can cause each zone to be put into 100% exhaust or 100% supply. Smoke development models have shown that smoke control is not a life safety issue, since all the occupants could leave the terminal before the smoke layer would descend to a life threatening level.

Smoke development models have shown that smoke control is not a life safety issue, since all the occupants could leave the terminal before the smoke level would descend to a life threatening level.

This approach should be acceptable because the primary means for controlling smoke will be via the building's automatic sprinkler system. The sprinkler system, by controlling the size of the fire, also controls the amount of smoke produced. The smoke control system is a supplementary system which may best be used via manual controls at the hands of the Fire Department. With automatic operation of the smoke control system there is concern about spreading smoke to other zones should the wrong zone automatically operate. This is most likely to occur at a zone interface. Other benefits of this system include.

1. Simplifies design and thus improves reliability.

2. Allows Fire Department personnel flexibility to adjust overall system operations.

3. Normally used HVAC equipment is generally more reliable than dedicated smoke control system that only require semi-annual inspections and testing.

4. More logical zoning of systems can be provided so that wall and floor barriers are used to form natural boundaries of the smoke control system.

5. Manual activation of the smoke control system will minimize problems associated with false alarms, particularly disruption of business and potential for freezing.

DRAFT STOPS

CODE REQUIREMENT:

5907 (h) Draft Stops. Draft stops shall be required in all terminal/concourse buildings at the passenger level to prevent migration of smoke throughout the building. The draft stops should be of non-combustible materials and arranged to coincide with smoke control zones.

(h)2. For ceiling spaces, draft stops shall be provided through the ceiling space from ceiling to structure.

(h)5. Each zone created by the construction of draft stops shall be mechanically exhausted at 4 air changes per hour. Exception: For ceilings or roof structures not at an interface and over 25 feet above the floor at any occupied space, draft stops shall not be required.

CODE INTENT:

The intent of this code requirement is to limit migration of smoke throughout the building.

PROPOSED CONDITION:

It is proposed that no draft stops be provided. In the Great Hall the fabric roof will provide a natural draft curtained area at each pole, forming collection points for smoke. At the top of each pole smoke exhaust fans will be provided. In all other areas of the building, smoke control systems and sprinkler systems will limit smoke spread in lieu of the draft stops.

BASIS FOR APPROVAL:

Draft stops or curtain boards are generally provided in conjunction with smoke and heat vents or with deluge type sprinkler systems. Because of the size of each draft curtained area, it is unlikely to expect that ceiling sprinklers would operate any sooner. Other factors such as room height, fire size, or sprinkler sensitivity are more important factors. Also, mechanical smoke exhaust is being provided, therefore, draft curtains in conjunction with smoke and heat venting is not needed. This is the conclusion that was made in the Colorado Convention Center.

It also should be noted that in low ceiling height areas, sprinkler activation will cause the smoke to cool and actually fall down below the bottom of draft stops rendering them useless.

BASIS FOR APPROVAL:

Automatic sprinklers should not be required because the covered roadway is similar to an open parking garage, which by Section 709 and 3803 is not required to be sprinklered. The covered roadway is open on one side to an adjacent open parking garage.

The roadway will be used exclusively for passenger vehicles and buses, trucks will not be permitted. With the absence of truck traffic, hazardous material incidents, that would impact the safety of the occupants would not be expected.

A similar condition currently exists at Stapleton Airport, which is not sprinklered, and many other airports around the country. Sprinklers protecting the roadway would also require a significant amount of maintenance to keep these dry pipe systems functional.

OPEN PARKING GARAGE

CODE REQUIREMENT

3803(a)3 When any portion of a story is more than 75 feet in line of travel from required window openings, the entire story shall be provided with an approved fire sprinkler system. EXCEPTION: Where any portion of a story or tier of an open parking garage is more than 200 feet from required openings, an automatic fire sprinkler system shall be installed throughout that story or tier.

CODE INTENT:

The intent of these code requirements is to require automatic fire suppression in windowless buildings or in buildings where excessive distances are required to get to the interior of the building from the exterior walls. Neither of these conditions is present in the parking structures adjacent to the landside terminal building.

PROPOSED CONDITION:

The open parking garage should not be provided with automatic sprinkler systems. Adequate openings will be provided to meet the code requirement that all areas of every tier be within 200 feet of the required openings.

Also, it is proposed that a special piece of Fire Department apparatus be provided that can negotiate the low ceiling heights and turning radius found in the garage.

The code requires the construction of the parking garage to be Type II-FR. The structure has been upgraded to Type I.

BASIS FOR APPROVAL:

Parking garage studies have shown that these structures pose a low risk to occupants. Fires, for the most part are confined to the car of origin and don't spread any further. The lack of sprinkler protection does not increase the risk.

SPECIAL FLOOR OPENINGS

CODE REQUIREMENT:

Table 17-A Type I fire resistive construction, floors-ceilings/floors requires 2 hr fire rated construction.

CODE INTENT:

The code requires rated floor construction for two reasons, to serve as a fire barrier and to prevent building collapse.

PROPOSED CONDITION:

In several areas of the floor slab which separates the AGT station from Level 5, glass block is desired so that natural light can enter. Glass block rated for 45 min opening protection will be used in addition to locating side wall sprinklers adjacent to the floor openings, at the AGT Level and in the level six floor adjacent to the Great Hall.

BASIS FOR APPROVAL:

The glass block will be located above the loading platform only and the platform will be separated from the tunnel as required by Code. The use of sidewall sprinklers and rated glass block should help protect the glass block from premature failure as a result of a fire.

The rated glass block and sprinklers will form a protected opening. Other openings such as the escalator openings between the AGT and Level 5 will be provided as permitted by Code.

UNPROTECTED STEEL ROOF SUPPORTS

CODE REQUIREMENTS:

5903(a)1.b. Main Terminal Building. Where every part of the structural steel framework for the roof is more than 25 feet above any occupied level, the roof structure and its supports may be unprotected construction, except for the 25 feet of all support columns above the occupied level, which shall be fire-rated as required for the type of construction.

Table 17-A Type I construction. Structural frame requires 3 hour rated construction.

CODE INTENT:

The basis for the Code to allow unprotected construction when located over 25 feet above the floor below is that the temperatures at this elevation during most fires will be lower than the critical steel temperature.

PROPOSED CONDITION:

It is proposed that the fabric roof system and the structural columns supporting the fabric roof be of unprotected steel construction, including the first 25 feet of column.

BASIS FOR APPROVAL:

Automatic sprinklers will be placed at the columns to protect them against exposure from fire.

CONCLUSIONS

The Fire Protection and Life Safety Plan for the Landside Terminal is intended to provide a level of fire safety consistent with the building code requirements of the Uniform Building Code with Denver Amendments (1990). Where strict code compliance could not be achieved, alternative designs providing an equal level of protection have been provided.

This Fire Protection and Life Safety Plan is a cooperative effort between the Project Design Team, the Denver Building Department, and The Denver Fire Department.

Prepared by:

Brian C. Olson, P.E. — Date

Reviewed by:

James H. Antell, AIA — Date

Airport Project

Ontario International Airport

Honolulu International Airport

JFK International Airport

Houston International Airport

Austin Airport Expansion

O'Hare International Airport

TWA Terminal at John F. Kennedy International Airport

Western Airlines Terminal #5 at Los Angeles International Airport

TABLE 1

SUMMARY OF FIRE PROTECTION DESIGN FEATURES - AIRPORTS

Issue \ Airport	Ontario	Honolulu	Rotunda CTC JFK	Houston
Detection	None	Smoke detectors in atrium	Atrium smoke detection by zone.	Smoke detectors in Elevator Lobby & Machine Rooms, Duct detectors
Suppression	Fully sprinklered	Fully sprinklered	Fully sprinklered	Fully sprinklered
Smoke Control	None	In atrium Exhaust at ceiling top Supply via mech. over 55' 6 AC/hr - 600,000 cf atrium 4 AC/hr if over 600,000 cf	No Structure acts as draft curtain, creates smoke pockets in atrium	No
AGTS	None	Station on 3rd level 3 hr. verticle shafts Sprinklered train enclosure Trains use internal combustion engines	2 hr., sprinklered Tube enclosure of trains	None
Emergency Power	Lighting for emergency exits and elevators	Emergency and exit lighting, hoistway venting, smoke control in atrium	Fire pumps, alarm and detection, smoke exhaust, Lighting three elevators, Communication system	Alarm and detection Lighting Elevator communication

TABLE 1

SUMMARY OF FIRE PROTECTION DESIGN FEATURES - AIRPORTS

Issue \ Airport	Austin	O'Hare	TWA JFK	Western
Detection	Smoke detectors in Elevator Lobby and Machine Room only	Duct smoke detectors	Smoke detectors, in HVAC, electrical & mechanical rooms	Atrium, mechanical Elevator Lobby Concession areas
Suppression	Fully sprinklered	Fully sprinklered	Partially sprinklered all but terminal and departure hall	Fully sprinklered - new and existing
Smoke Control	Not generally Some areas 6 AC/hr.	HVAC Automatic shutoff	No	Atrium only- 6 AC/hr. Draft curtains
ACTS	None	Glazed partitions, sprinklered	Design in process (similar to CIC JFK)	None
Emergency Power	Alarm & Detection Smoke exhaust, lighting	Pumps - Alarm & Detection Lighting	Pumps, alarm detection, lighting, elevator	

SUMMARY OF FIRE PROTECTION DESIGN FEATURES

AIRPORTS

Name: Ontario International Airport
Location: Los Angeles Metropolitan Area
Date: 1986

Code Used: 1982 UBC; Title 24 (California State Building Code)

Local Occupancy Classification: A2.1 - assembly 300 or more with stage

Load Factor (Sq.Ft. per Person) 7 to 15

UBC Comparable Occupancy Classification: Same

Size: (Sq.Ft., No. of Gates)

Height: 2 stories

Construction Classification: Type I fire resistive

High-Rise: No
Classification:
(Y/N)(Max. Height)

Fire Suppression:	
Automatic Sprinkler	Yes
Deluge System	No
Standpipes	No
Water Supply	Number of sources
Detection & Alarm:	
Smoke Detection Actuated by	No
Automatic Alarm Audible Voice	No requirement
Manual Alarm	No
Warden Phones/Jacks	No
Stair Design Basis	No
Elevator:	No
Adjacent Zones	No
Size of Zone: Air Changes per Hour	(s.f., c.f.)
Draft Curtains	No Depth: Not applicable

Emergency Power:	
Fire Pumps	No
Fire Alarm & Detection	No
Dedicated Smoke Exhaust Fans	No
Emergency & Exit Lighting	Yes
Elevator lighting only	Yes

Exits:	
Travel Distance	200 ft. sprinklered; 300 ft. if last 150 ft. is in rated corridor
Use of Horizontal Exits (Low to High Hazards)	2 hr. walls
Occupancy Separations:	3 hr. between assembly (A2.1) and gas service stations (B-1) 1 hr. between gas station (B-1) and retaurant, retail, office (B-2) 1 hr. between (B-2) and (A2.1)
Exit Discharge (To What)	Stairs to exterior directly
Delayed Egress/Special Hardware	panic hardware
Area of Refuge	Not required in fully sprinklered buildings

AGTS:	
Transition to Terminal	Not applicable

Fire Department Access:

SUMMARY OF FIRE PROTECTION DESIGN FEATURES

AIRPORTS

Name: Honolulu International Airport Terminal
Location: Honolulu, Hawaii
Date: 1989

Code Used: UBC 1988; Honolulu Building Code (UBC 1985); NFPA 101 - 1988; NFPA 130 - 1988; NFPA 416 - 1987; NEC 1987; Honolulu Fire Code (UFC 1985)

Local Occupancy Classification: UBC A-2.1(Assembly Sub-Class A) (NFPA)

Load Factor (Sq.Ft. per Person): 7 to 15

UBC Comparable Occupancy Classification: A-2.1

Size: (Sq.Ft., No. of Gates): 14 gates total; 9 this phase; jumbo jets

Height: 2 stories with basement
Ride station on 3rd level

Construction Classification: UBC Type I Type I(332) - NFPA

High-Rise: Classification: (Y/N)(Max. Height): Not applicable

Atrium Requirements:
Minimum opening width 20 ft.
Minimum opening 400 sq. ft.
Travel distance of 100 ft.
Maximum combustible load = 9,000 BTU per pound
Openings of fixed glazing 3/4 hr. construction, maximum of 25% of wall, tempered glass in gasketed frame with sprinklers on both sides of glass where walking surfaces are present.

Fire Suppression:	
Automatic Sprinkler	Yes
Deluge System	No
Standpipes	No
Water Supply	public or private sources sprinkler demand, plus 500 gpm for hose streams
Detection & Alarm:	
Smoke Detection	In atrium, detectors are placed on ceiling, around perimeter, and under projections
Actuated by	Sprinklers, smoke detectors or manual by fire department
Automatic Alarm	No
Audible Voice	No
Manual Alarm	Yes
Warden Phones/Jacks	No
Smoke Control:	In atrium may be integrated with other air-handling systems

Atrium: Smoke exhaust via openings at ceiling, minimum height of top of highest level of doors in atrium.

Air supply via gravity if building height is 55' or less, mechanical if over 55 ft.

Air volume 6 AC/hour in 600,000 cubic ft. atrium. 4 AC/hour in atriums over 600,000 cubic ft.

Tenant spaces separated from atrium by walls or glazing may have supplemental air introduced at upper levels.

Pressurization:	
Stair	No
Design Basis	At this time, design is in schematics

Elevator: No

Adjacent Zones: No
Size of Zone: (s.f., c.f.)
Air Changes per Hour

Draft Curtains: No Depth: not applicable

Emergency Power:
Fire Pumps: No
Fire Alarm & Detection: No
Dedicated Smoke Exhaust Fans: No
Emergency & Exit Lighting: Yes
Elevator: Yes - Hoistway venting
Two-way communication between elevator and point outside hoistway.
Smoke control system in atrium.

Exits:
Travel Distance: 200 ft., sprinklered; 300 ft. if last 150 ft. is 1-hr. corridor.

Use of Horizontal Exits - May be used as an exit to accommodate up to 1/2 total occupant load.
(Low to High Hazards)
Exit Discharge (To What)

a. Main exits, in assembly occupancies must connect and discharge thru a continuous and unobstructed means of egress to a public way.

b. Side exits: discharge to public way.

c. Horizontal exits: discharge 1/2 the occupant load to minimum of 3 sq. ft. of net clear floor area per occupant exiting.

Delayed Egress/Special Hardware:	Push pad panic hardware, 15 lbs opening force, in assemblies over 500 persons.
Area of Refuge	No
AGTS:	
Transition to Terminal	Ride stations on 3rd level via verticle shafts of 3 hr. construction.
Fire Department Access:	on grade apronway

SUMMARY OF FIRE PROTECTION DESIGN FEATURES

AIRPORTS

Name: Rotunda Building
Central Terminal Complex
JFK Airport
Location: New York
Date: 1989

Code Used: New York City Building Code, 1988, Title 27

Local Occupancy Classification: Terminal F-3 (Assembly)
Load Factor (Sq.Ft. per Person) Peak passenger load of 9,810 people, at one time, for entire building.

UBC Comparable Occupancy Classification	A-2.1 Assembly, no stage, 300 persons or more
Size: (No. of Gates)	780' x 645' 1.3 million, no gates
Height:	199' level 6 @ 81"
Construction Classification:	1C
High-Rise: Classification: (Y/N)(Max. Height)	no 75'

Fire Suppression:	
Automatic Sprinkler	Yes - same system as standpipe
Deluge System	No
Standpipes	Yes - same system as AS, 125 ft. hose and 20 ft. stream
Water Supply	Number of sources - two automatic starting elective fire pumps
Detection & Alarm:	
Smoke Detection	Yes. identify by zone
Actuated by	Beam - in vaulted ceiling space
Automatic Alarm	fire alarm system to monitor all,
Audible Voice	with Fire Command Station
Audible Voice	
Manual Alarm	Yes
Warden Phones/Jacks	No
Sprinkler valve supervisory switches	
Smoke Control:	
Pressurization:	
Stair	No
Design Basis	
Elevator:	No
Adjacent Zones	No
Size of Zone:	(s.f., c.f.)
Air Changes per Hour	
Draft Curtains	No Depth: 12 or 16 pods, natural draft curtains @ structure itself 2-4' deep pocket.

Emergency Power:	
Fire Pumps	Yes
Fire Alarm & Detection	Yes
Dedicated Smoke Exhaust Fans	Yes
Emergency & Exit Lighting	Yes
Elevator	Yes - at least 3
Emergency Communication System	

Exits:	
Travel Distance	200 ft. (D-2), 180 ft. (office) 300 ft. (unoccupied)
Use of Horizontal Exits (Low to High Hazards)	Elevator lobbies - 3,000 sq. ft., through H.E. to parking
Exit Discharge (To What)	Most vertical exits discharge directly outside. One stairway exits to arrival/departures lobby - then 2 exit choices within 50 ft.
Delayed Egress/Special Hardware	
Area of Refuge	No

AGTS:	
Transition to Terminal	2 hour tube, sprinklered and exposed to air, sprinklers at openings metal doors or approved glass

Fire Department Access:

Provided at north & south from high occupancy vehicle roadways through garages to elevator lobbies.

Upon smoke detection - elevators return to Floor 1, available for use by fire department.

Four elevators serve all floors, available for use by fire department

SUMMARY OF FIRE PROTECTION DESIGN FEATURES

AIRPORTS

Name: Houston Intercontinental Airport
International Terminal
Location: Houston, Texas
Date: 1989

Code Used: Houston Building Code - 1985
State Handicap Requirements

Local Occupancy
Classification: A-2.1 Assembly, no stage, 300 or more persons

Load Factor
(Sq.Ft. per Person) 7

UBC Occupancy
Classification: UBC

Size:
(Sq.Ft., No. of Gates) Adding 11 gates for jumbo jets

Height: Approximately 56', plus penthouse. Roof is 22' above 121 floor level.

Construction
Classification: Type I

High-Rise:
Classification: No
(Y/N)(Max. Height) 75' maximum

Fire Suppression:	Fully sprinklered	
Automatic Sprinkler	Yes	not req'd but will be provided except in main entrance lobbies, which have glass ceiling, over drive areas, and pedestrian connection between terminal C and new international terminal
Deluge System	No	
Standpipes	Yes	
Water Supply	Number of sources	

Bulk sprinkler 0.16 gpm supply of water to all levels above 121 level.

Detection & Alarm:
Smoke Detection yes, elevator lobbies and machine rooms
Actuated by

Automatic Alarm - automatic wateflow/sprinkler alarm required
Audible Voice - duct detector, fire department communication.

Manual Alarm	No
Warden Phones/Jacks	No
Public Address	voice

Smoke Control: not required
Pressurization:
Stair No
Design Basis

Elevator: No

Adjacent Zones No
Size of Zone: (s.f., c.f.)
Air Changes per Hour

Draft Curtains No Depth:

Emergency Power:		
Fire Pumps	No	
Fire Alarm & Detection	Yes	
Dedicated Smoke Exhaust Fans	No	
Emergency & Exit Lighting	Yes	
Elevator	Yes	- communication & signaling devices

Exits:	
Travel Distance	200'
Use of Horizontal Exits (Low to High Hazards)	maximum of 50% of required exits not applicable
Exit Discharge (To What)	3 sq ft of net clear floor per ambulatory occupant
Delayed Egress/Special Hardware	
Area of Refuge	No

AGTS:	
Transition to Terminal	Not applicable

Fire Department Access:	To front along normal public ways and from apron.

SUMMARY OF FIRE PROTECTION DESIGN FEATURES

AIRPORTS

Name:	Austin Airport Expansion
	Project Status: (on hold anticipating construction of new facility at abandoned Berkstrom Air Force Base) preliminary design development phase
Location:	Austin, Texas
Date:	1987
Code Used:	UBC 1985, UFC 1985 State Handicap Requirements
Local Occupancy Classification:	A-2.1 Assembly w/stage, 300 people or more
Load Factor (Sq.Ft. per Person)	7
UBC Comparable Occupancy Classification	same
Size: (Sq.Ft., No. of Gates)	Adding approximately 9 gates 264,000 sq. ft. additions, renovations and existing building.
Height:	
Construction Classification:	Recommended Type II FR for expansion; Type II N for existing
High-Rise Classification: (Y/N)(Max. Height)	Not applicable

Fire Suppression:

Automatic Sprinkler	Yes	light hazard at 0.10 gpm/sf Ordinary hazard at 0.16/sf, gpm/, sf, 130 sf spacing ordinary hazard 2 - 0.19 gpm/ sf, 130 sf spacing
Deluge System	No	
Standpipes	Yes	
Water Supply	Number of sources	

City water to accommodate sprinkler demand plus 100 gpm for hose stream 500 gpm at 65 psi at highest standpipe outlet.

Detection & Alarm:

Smoke Detection	Not required by Code. Provided in elevator lobbies and machine rooms.
Actuated by	
Automatic Alarm	Automatic sprinkler alarm where more than 100 sprinklers
Audible Voice	Public address, and one way communication system with control facility.
Manual Alarm	No, maybe in existing
Warden Phones/Jacks	Yes

Two way fire department communication - with elevator and fire department connection locations. Not required, but will provide.

Smoke Control:

Pressurization:	Not required
Stair	No
Design Basis	
Elevator:	No
Adjacent Zones	Yes public areas, fan zones same as detection zones
Size of Zone:	(s.f., c.f.)
Air Changes per Hour	6
Manual controls	
Draft Curtains	No Depth: Not applicable

Emergency Power:	Emergency Generator
Fire Pumps	No
Fire Alarm & Detection	Yes
Dedicated Smoke Exhaust Fans	Yes
Energy & Exit Lighting	Yes
Elevator	Yes - communication, controls, illumination and devices.
Smoke Control Systems	fire zone and illumination of of each adjacent simultaneously
Exits:	
Travel Distance	150 - non-sprinklered, 200' sprinklered, 300' if sprinklered and last 150 is 1 hour construction.
Use of Horizontal Exits (Low to High Hazards)	2 hours with 1.5 hour openings, maximum of 50% of required exit width and capacity
Exit Discharge (To What)	provide minimum of 3 sq ft per occupant from horizontal exits
Delayed Egress/Special Hardware	yes - existing in
Area of Refuge	No not required
AGTS:	
Transition to Terminal	not applicable
Fire Department Access:	vehicles access at east/west ends firemen access via main entrance on south side ground floor

SUMMARY OF FIRE PROTECTION DESIGN FEATURES

AIRPORTS

Name: O'Hare International Terminal
Location: Chicago, IL
Date: 1990

Code Used: Chicago Building Code July 1988,
O'Hare Design and Construction Standards,
Illinois Accessibility Standard 1990
NFPA 130

Local Occupancy Classification: C1 Assembly

Load Factor (Sq.Ft. per Person) 15

UBC Comparable Occupancy Classification A-2.1 Assembly

Size: (Sq.Ft., No. of Gates) 20 gates

Height: Most of roof is 35' upper Lower Roadway Level portion of arched roof over ticket lobby is 85'.

Construction Classification: Type IB, fire resistive

High-Rise: No
Classification:
(Y/N)(Max. Height) 80'

Fire Suppression:

Automatic Sprinkler	Yes	
Deluge System	No	
Standpipes	Yes	- 100' hose and 30' water stream
Water Supply	Number of sources - 2 pumps	

Detection & Alarm:

Smoke Detection — yes, in HVAC ducts, and non-sprinklered electrical equipment and elevator machine rooms

Actuated by — Spot

fire alarm inputs - waterflow indicators in sprinkler zone, dry pipe sprinkler system pressure switch, heat and smoke detectors by zone, duct smoke detectors

Automatic Alarm
- Audible Voice - one way voice via public address system
- Fire Command Center - annunciation and supervision, system CRT display and printer

Manual Alarm — Yes
City fire alarm box 100" of main entrance

Warden Phones/Jacks — No

Smoke Control: HVAC automatic shut off

Pressurization:
- Stair — No
- Design Basis

Elevator: — No

Adjacent Zones — No
- Size of Zone: — (s.f., c.f.)
- Air Changes per Hour

Draft Curtains — No — Depth:

Emergency Power:

Fire Pumps	Yes
Fire Alarm & Detection	Yes
Dedicated Smoke Exhaust Fans	No
Emergency & Exit Lighting	Yes
Elevator	No

Fire Command Center

Dry pipe sprinkler system air maintenance compressors

Exits:

Travel Distance	300' - assembly with sprinkler; non-assembly 225'
Use of Horizontal Exits (Low to High Hazards)	- yes, lower level - 2 hr., 1 1/2 hr. doors
Exit Discharge (To What)	
Delayed Egress/Special Hardware	- Exit stairwell and secure door unlocking system controls at fire command center
Area of Refuge	Yes - 10 square feet in each exit stair on on a level of discharge

AGTS:

Transition to Terminal AGT station open and accessible to ticket lobby; AGT guideway separated from Meeter and Greeters lobby and from AGT platform by glazed partitions.

AGT Station and Guideway sprinklered.

Fire Department Access:

SUMMARY OF FIRE PROTECTION DESIGN FEATURES

AIRPORTS

Name: TWA Terminal at JFK Airport
Location: New York City
Date: 1990

Code Used: New York City Building Code, 1989-1990
Title 27

Local Occupancy
Classification: F3 Assembly

Load Factor
(Sq.Ft. per Person)

UBC Comparable
Occupancy
Classification — A-2.1 Assembly

Size:
(Sq.Ft., No. of Gates) — Approximately 500,000 sq. ft.

Height: — Approximately 40"

Construction
Classification: — IC non-combustible, or better sprinklered

High-Rise:
Classification:
(Y/N)(Max. Height) — Not applicable

Fire Suppression:		
Automatic Sprinkler	Yes	all but terminal & departure hall public areas not required recommended basement baggage conveyor
Deluge System	No	
Standpipes	Yes	
Water Supply	Number of sources	2 fire pumps to meet sprinkler demand plus 1,000 gpm hose streams
Detection & Alarm:		
Smoke Detection	in HVAC and electric switchgear and mechanical equipment rooms.	
Automatic Alarm Audible Voice and visual - yes		
Manual Alarm	Yes	
Warden Phones/Jacks		
Fire Command Station		
Auxiliary Annunciation Panel		
Waterflow indicators		
Smoke Control:		
Pressurization:		
Stair	No	
Design Basis		
Elevator:	No	
Adjacent Zones	No	
Size of Zone:	(s.f., c.f.)	
Air Changes per Hour		
Draft Curtains	No	Depth: Not applicable

Emergency Power:

Fire Pumps	Yes	Recommends emergency power for fire protection systems and emergency and exit lighting
Fire Alarm & Detection	Yes	
Dedicated Smoke Exhaust Fans	No	
Emergency & Exit Lighting	Yes	
Elevator	Yes	

Exits:

Travel Distance	100' - assembly, 200' business, 150' industrial and storage
Use of Horizontal Exits (Low to High Hazards)	No
Exit Discharge (To What)	to outside, except in upper level Terminal B discharge to sprinklered pathway through lower level and then to outside
Delayed Egress/Special Hardware	- panic hardware to sprinklered
Area of Refuge	No

AGTS:

Design in process; no recommendations yet

Fire Department Access:

Design in process; no recommendation yet

SUMMARY OF FIRE PROTECTION DESIGN FEATURES

AIRPORTS

Name: Western Airlines Terminal #5
Location: Los Angeles, California
Date: 1986

Code Used: Los Angeles City Building Code
UEC with amendments & page design criteria
for airports

Local Occupancy Classification:	C1 Assembly
Load Factor (Sq.Ft. per Person)	15
UBC Comparable Occupancy Classification	A-2.1 Assembly
Size: (Sq.Ft., No. of Gates)	

Height: Most of roof is 35' above Lower Roadway Level
portion of arched roof over ticket lobby is 85'.

Construction Classification:	Type I
High-Rise: Classification: (Max. Height)	Not Applicable

Airport Criteria
- FD Communication
- Exterior Exit door
- Concourse as Corridor
- Seats open to Corridor
- restrict combustibles
- occupancy load-very high

Fire Suppression:		
Automatic Sprinkler	Yes	entire building, including existing zone: 52,000 sq. ft.
Deluge System	No	existing zone: 52,000 sf
Standpipes	No - 100' hose and 30' water stream	
Water Supply	Number of sources - 2 pumps	
Detection & Alarm:		
Smoke Detection	elevator lobbies for elevator recall, concession areas, to release hold open devices or doors, atrium to initiate smoke control in mechanical equipment area	
Audible Voice	One way public address to elevators and lobbies, corridors, stairways and all rooms over 50 occupants	
Audible Voice	One way public address to elevators and lobbies, corridors, stairways and all rooms over 50 occupants	
Manual Alarm	Yes	manual pull stations
Warden Phones/Jacks		pull stations, stair exits, exterior every 200'
Warden Phones/Jacks Alarm	Fire Control Station Fire Control and Airport Master control sound and zone or general alarm, waterflow and trouble signals annunciated by zone	
Smoke Control:		
Pressurization:		
Stair	No	
Design Basis		
Elevator:	No	
Adjacent Zones	Yes	Atrium 3 interconnected lobby areas
Size of Zone:	(s.f., c.f.)	
Air Changes per Hour	6	
Draft Curtains	Yes	Depth: NA

Emergency Power:
- Fire Pumps
- Fire Alarm & Detection
- Dedicated Smoke Exhaust Fans
- Emergency & Exit Lighting
- Elevator

Fire Command Center

Dry pipe sprinkler system air maintenance compressors

Exits:

Travel Distance	LA not accept: quasi atrium w/3 levels-code modifications obtained
Use of Horizontal Exits Low to High Hazards	
Exit Discharge (To What)	100% exit to roadway
Delayed Egress/Special Hardware	- 50% exit to apron
Area of Refuge	Yes/No - 10 square feet in each exit stair on on a level of discharge

AGTS:

Transition to Terminal

Not applicable
Buses stop curbside along 2 level circulation roadway.

AGT station and guideway sprinklered.

Fire Department Access:

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF PUBLIC WORKS

AIRPORT ENGINEERING OFFICE
CITY AND COUNTY OF DENVER
STAPLETON INTERNATIONAL AIRP
TERMINAL BUILDING, 4TH FLOO
DENVER, COLORADO 80207
(303) 270-1600

Project # 8,908	File # 1.6.4	
	LETTER ONLY	ALL
Jim Bradburn		✓
Probst		✓
Walsh		✓
Salisbury		✓
Winters V		✓

MEETING ON
CODE RELATED PROCEDURES
IN CONJUNCTION WITH
FIRE ALARM AND DETECTION
NEW DENVER AIRPORT
April 30, 1990
3:30 p.m.
Conference Room # 1
Stapleton International Airport

Attendes:

Al Horne
Steve Rondinelli
Steve Blessing
Rom Cordero
Emil Gadeken
Jim Dunlap
Paul Spurgeon
Tom Hawkins
Philip Goldrosen

M I N U T E S

Approved Fire Alarm System The fire alarm system and components shall be listed, approved, compatible, and electrically supervised.

Fire Alarm Signaling, shall consist of a horn/speaker and strobe light as part of the fire alarm system. These horn/speaker and strobe unit will be the primary notification for the occupants with any voice announcement on the PA/Emergency Communications System being secondary. Fire alarm speakers must be listed for fire service use and in an approved rated enclosure. Strobe lights must be visible from all areas per Denver Building Code Chapter 64. It is recommended that the strobe lights be placed only by the exit doors when visible from all areas. Strobes must continue to flash until the fire alarm system is reset.

PA/Emergency Communication System Discussion occurred regarding the use of digitized public address evacuation system for shared use by operations, and fire department (with priority to

emergency and fire department use occurring). Although some concerns exist from Building and Fire, this type system should also be investigated further as a secondary Fire Alarm signaling system. Fire alarm voice announcements may be made over a separate PA system. Any automated voice announcement over the PA system must receive the activation signal from the auxiliary fire alarm port and not by any direct connection to the Fire Alarm Control Panel. Prerecorded messages must be approved by the Fire Department.

Fiber Optics if proposed is to be listed as part of the system. The Building and Fire Department are willing to review and possibly approve the use of fiber optics and cable connections based on ANSI approval.

Smoke Detection Clarification for the use of smoke detection was provided by the Building and Fire Departments. Smoke detection is only required in non-pubic, non-sprinklered areas, such as electrical, communication and elevator equipment rooms. It is also required in areas with ceiling heights greater than 25'-0". Since the concourse area is 24'-9" detectors are not required. Duct smoke detectors are required in the mechanical equipment with remote indicating lights and reset capabilities. These detectors will activate the smoke control system in a fire condition.

A system smoke detector is required outside the elevator door at each level served as well as in the elevator equipment room. A sprinkler head is required at the top of the elevator shaft but no detector required.

Fixed Temperature Heat Detectors are required in the trashrooms in addition to automatic sprinkler protection in the room and trash chute.

UBC Section 3304 references the required installation of an

automatic extinguisher and detection system throughout a building when utilizing special security locking devises as proposed at the new airport. The system previously discussed including a complete sprinkler system, duct smoke detection and pull stations meets this intent of the code and would permit the use of these special devices. The special security doors are to be automatically released upon the activation of any two fire alarm devices. Consideration is being given to the fire alarm also activating with any two fire alarm devices has still required Fire and Building Department approval. However, the Denver Fire Department will be notified and respond to the activation any single alarm device.

Automatic Sprinkler Protection is required in all areas (including basement) except those previously exempted, including electrical, communication, and elevator equipment rooms.

Unfinished Tenant Areas are required to be protected by sprinklers and smoke removal. However, areas separated by 1 hr. construction and having no storage or occupancy may be provided with only smoke detection. All unfinished tenant areas below grade (basement) areas are required to be sprinklered regardless of storage or occupancy.

Leaky Coaxial Cable connected to the central antenna center will be considered by the Building and Fire Department for emergency Communication via Denver Fire Department portable radio system. This may permit the deletion of Firefighter communication system if approved by the Building and Fire Department. A letter and request should be formulated for the proposed used of this cable for agency approval.

Thermistor 9090 coaxial wire proposed by Parsons for use as a detection device in a preaction sprinkler system in the AGTS Baggage requires further discussion and development by the consultant. The Fire Department wants to re-evaluate dry

sprinkler system response time and water supply prior to approval of a preaction system.

Security/Fire Alarm System Demo Jim Dunlap is preparing a mock-up of the security and fire alarm system for Building and Fire Department review and consideration.

APPROVED: _____Date_____
Ciff Hennig, Bldg. Insp.

_____Date_____
Paul Spurgeon,Fire Prev.

_____Date_____
Ginger Evans, New Denver Airport

K:\51004
SR/egg
cc: Attendees
File 23-5.1

0430MTG.FA

TABLE 1. DENVER INTERNATIONAL AIRPORT – FIRE MODELLING RESULTS

CEILING HEIGHTS	LEVEL 5		LEVEL 6		
	81 FT.	64.5 FT.	44.5 FT.	36 FT.	28 Ft.
ULTRAFAST FIRE GROWTH					
SPRK. ACTIVATION TIME (sec.) *1	413	314	232	201	170
PEAK RATE OF HEAT RELEASE (btu/s)	28,448	16,002	8,606	7,112	4,552
TOTAL HEAT RELEASED (btu)	3,793,067	1,600,200	631,071	474,133	242,756
APPROX. TOTAL HEAT AVAILABLE (btu) *2	5,057,423	2,133,600	841,428	632,177	323,675
APPROX. TOTAL MASS (lb.) *3	602	254	100	75	39
APPROX, EQUIVALENT AREA (sq.ft.) *4	60	25	10	8	4
MINIMUM SEPARATION (ft.) *5	21	16	11	10	8
FAST FIRE GROWTH					
SPRK. ACTIVATION TIME (sec.)	819	619	453	389	326
PEAK RATE OF HEAT RELEASE (btu/s)	29,922	17,106	8,615	6,426	4,557
TOTAL HEAT RELEASED (btu)	8,178,626	3,535,199	1,263,563	813,935	486,059
APPROX. TOTAL HEAT AVAILABLE (btu)	10,904,835	4,713,599	1,684,751	1,085,247	648,079
APPROX. TOTAL MASS (lb.)	1,298	561	201	129	77
APPROX, EQUIVALENT AREA (sq.ft.)	130	56	20	13	8
MINIMUM SEPARATION (ft.)	21	16	11	10	8
MODERATE FIRE GROWTH					
SPRK. ACTIVATION TIME (sec.)	1,626	1,2[illegible]5	893	765	637
PEAK RATE OF HEAT RELEASE (btu/s)	29,131	16,521	8,596	6,411	4,547
TOTAL HEAT RELEASED (btu)	15,730,650	6,718,638	2,521,446	1,624,211	969,933
APPROX. TOTAL HEAT AVAILABLE (btu)	20,974,200	8,958,184	3,361,928	2,165,615	1,293,244
APPROX. TOTAL MASS (lb.)	2,497	1,066	400	258	154
APPROX, EQUIVALENT AREA (sq.ft.)	250	107	40	26	15
MINIMUM SEPARATION (ft.)	21	16	11	10	8

* NOTES:

1. Sprinkler activation time based on 212 F, quick response sprinklers
2. Approx. Total Heat Available based on the assumption that 75% of the available fuel is consumed in reaching the peak rate of heat release.
3. Heat of Combustion = 8,400 btu/lb. (80% cellulosic, 20% hyrdocarbon)
4. Fuel Load – light hazard = 10 lb/sq.ft.
5. Ignition Flux = 1.76 btu/sq.ft-s (20 kw/sq.m.)
   Separation R=[Q / 12 x 3.14 x I.F.] exp.1/2

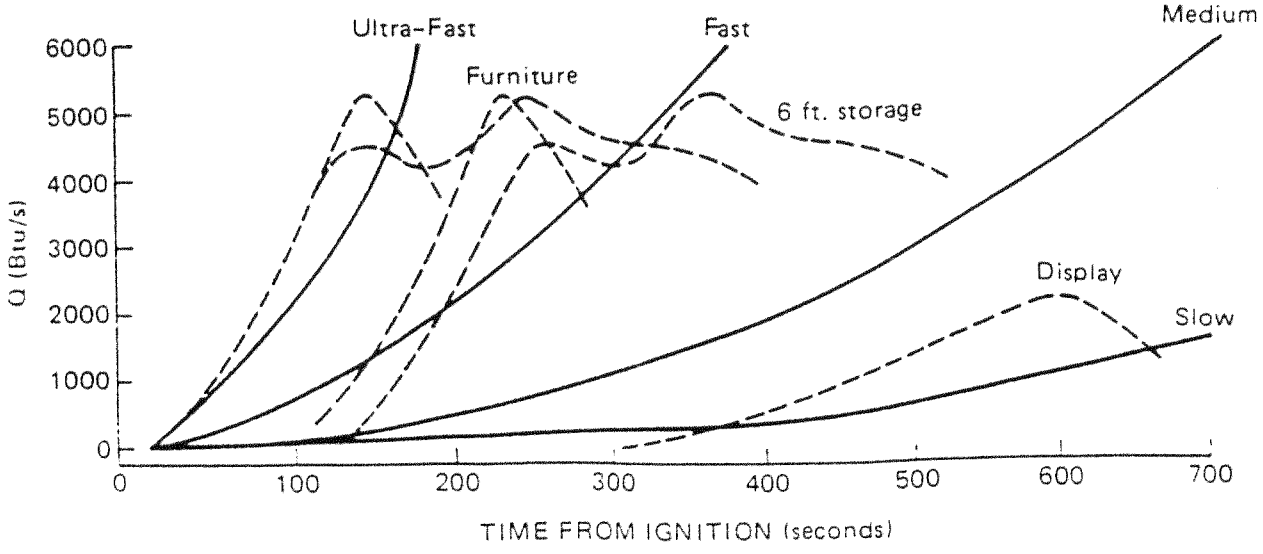


Figure C-2 T-Squared Fire, Rates of Energy Release.

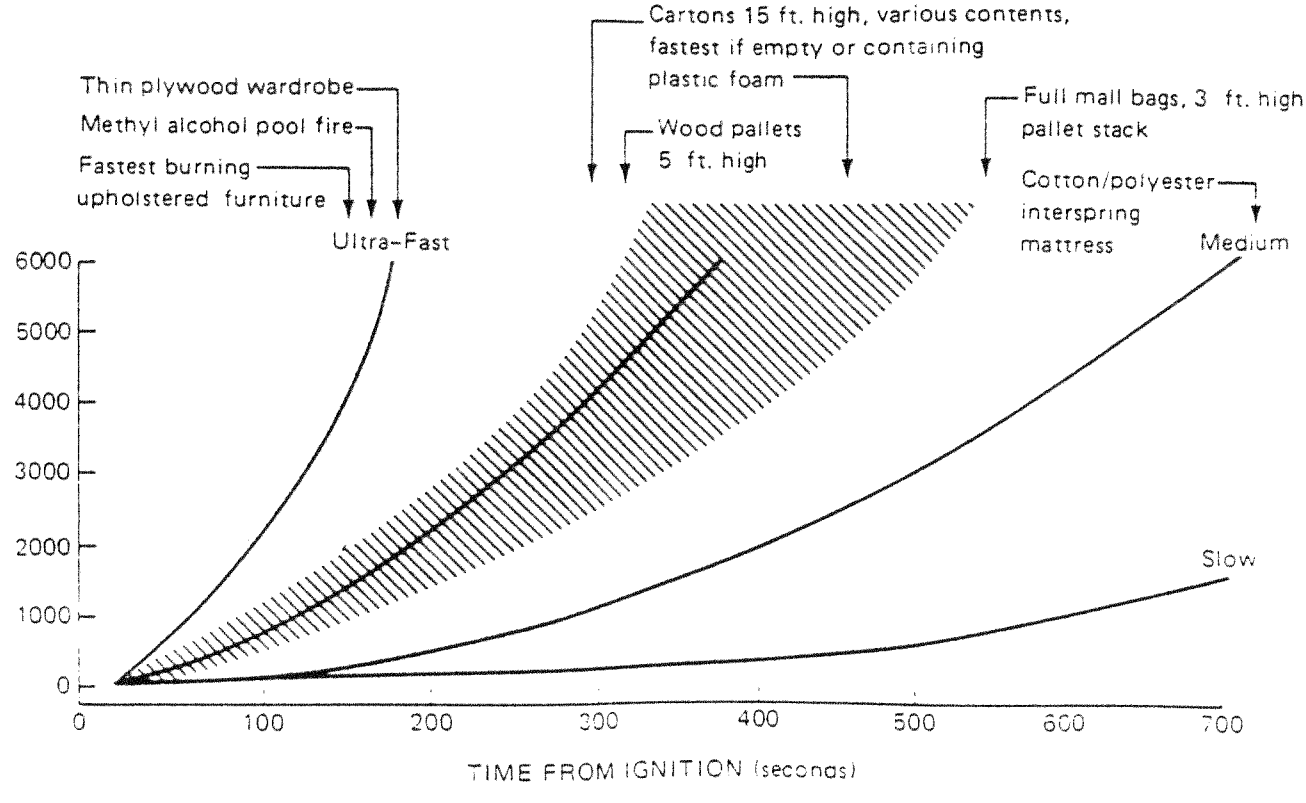
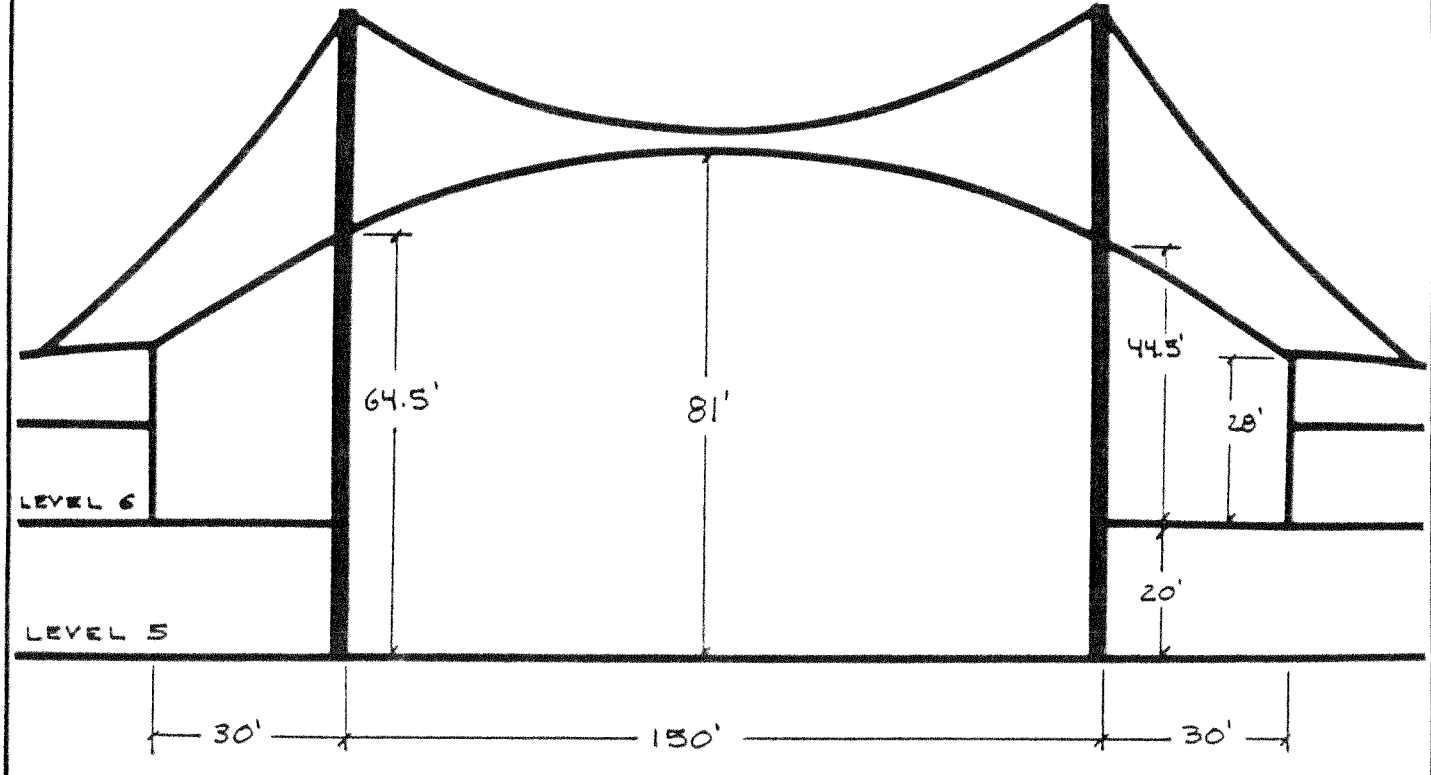


Figure C-3 Relation of T-Squared Fires to Some Fire Tests.



TITLE	Great Hall Cross Section		
PROJECT	Denver International Airport		
Rolf Jensen & Associates, Inc. FIRE PROTECTION ENGINEERS • BUILDING CODE CONSULTANTS		SCALE NTS	DATE 8-13-90
		DRAWN KJS	PROJECT D6456.01
		CHECKED	DRAWING 1

DENVER INTERNATIONAL AIRPORT - ULTRAFAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
81	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 30,565 kW

TIME(sec)	RHR(kW)	JET (F)	HEAD/DET. (F)
0	0	70	70
20	75	72	71
40	300	76	73
60	675	81	77
80	1199	86	82
100	1874	92	88
120	2699	98	94
140	3673	104	100
160	4797	111	107
180	6072	118	114
200	7496	125	121
220	9070	133	129
240	10794	141	137
260	12668	149	144
280	14692	157	153
300	16866	165	161
320	19190	174	170
340	21663	182	178
360	24287	191	187
380	27061	200	196
400	29984	210	206

---- DETECTOR ACTIVATION AT 413.5 SECONDS ----

DENVER INTERNATIONAL AIRPORT - ULTRAFAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
64.5	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 17,295 kW

0	0	70	70
20	75	74	71
40	300	79	75
60	675	86	81
80	1199	94	88
100	1874	102	96
120	2699	111	105
140	3673	120	114
160	4797	130	124
180	6072	140	134
200	7496	151	145
220	9070	162	156
240	10794	173	167
260	12668	185	179
280	14692	197	191
300	16866	209	203

---- DETECTOR ACTIVATION AT 314.1 SECONDS ----

.0111	1280 SEC	18,186	7,759,462	
.0111	1300 SEC	18,759	8,128,900	
.0111	1320 SEC	19,341	8,509,881	
.0111	1340 SEC	19,931	8,902,585	
.0111	1360 SEC	20,531	9,307,187	
.0111	1380 SEC	21,139	9,723,866	
.0111	1400 SEC	21,756	10,152,800	
.0111	1420 SEC	22,382	10,594,170	
.0111	1440 SEC	23,017	11,048,140	
.0111	1460 SEC	23,661	11,514,900	
.0111	1480 SEC	24,313	11,994,630	
.0111	1500 SEC	24,975	12,487,500	
.0111	1520 SEC	25,645	12,993,690	
.0111	1540 SEC	26,325	13,513,380	
.0111	1560 SEC	27,013	14,046,740	
.0111	1580 SEC	27,710	14,593,960	
.0111	1600 SEC	28,416	15,155,200	
.0111	1620 SEC	29,131	15,730,650	81'
.0111	1640 SEC	29,855	16,320,490	
.0111	1660 SEC	30,587	16,924,890	
.0111	1680 SEC	31,329	17,544,040	
.0111	1700 SEC	32,079	18,178,100	

.0111	620 SEC	4,267	881,814	
.0111	640 SEC	4,547	969,933	28'
.0111	660 SEC	4,835	1,063,735	
.0111	680 SEC	5,133	1,163,398	
.0111	700 SEC	5,439	1,269,100	
.0111	720 SEC	5,754	1,381,018	
.0111	740 SEC	6,078	1,499,329	
.0111	760 SEC	6,411	1,624,211	36'
.0111	780 SEC	6,753	1,755,842	
.0111	800 SEC	7,104	1,894,400	
.0111	820 SEC	7,464	2,040,062	
.0111	840 SEC	7,832	2,193,005	
.0111	860 SEC	8,210	2,353,407	
.0111	880 SEC	8,596	2,521,446	44.5'
.0111	900 SEC	8,991	2,697,300	
.0111	920 SEC	9,395	2,881,145	
.0111	940 SEC	9,808	3,073,161	
.0111	960 SEC	10,230	3,273,523	
.0111	980 SEC	10,660	3,482,410	
.0111	1000 SEC	11,100	3,700,000	
.0111	1020 SEC	11,548	3,926,469	
.0111	1040 SEC	12,006	4,161,997	
.0111	1060 SEC	12,472	4,406,759	
.0111	1080 SEC	12,947	4,660,935	
.0111	1100 SEC	13,431	4,924,700	
.0111	1120 SEC	13,924	5,198,234	
.0111	1140 SEC	14,426	5,481,713	
.0111	1160 SEC	14,936	5,775,315	
.0111	1180 SEC	15,456	6,079,219	
.0111	1200 SEC	15,984	6,393,600	
.0111	1220 SEC	16,521	6,718,638	64.5'
.0111	1240 SEC	17,067	7,054,509	
.0111	1260 SEC	17,622	7,401,392	

.0111	1280 SEC	18,186	7,759,462	
.0111	1300 SEC	18,759	8,128,900	
.0111	1320 SEC	19,341	8,509,881	
.0111	1340 SEC	19,931	8,902,585	
.0111	1360 SEC	20,531	9,307,187	
.0111	1380 SEC	21,139	9,723,866	
.0111	1400 SEC	21,756	10,152,800	
.0111	1420 SEC	22,382	10,594,170	
.0111	1440 SEC	23,017	11,048,140	
.0111	1460 SEC	23,661	11,514,900	
.0111	1480 SEC	24,313	11,994,630	
.0111	1500 SEC	24,975	12,487,500	
.0111	1520 SEC	25,645	12,993,690	
.0111	1540 SEC	26,325	13,513,380	
.0111	1560 SEC	27,013	14,046,740	
.0111	1580 SEC	27,710	14,593,960	
.0111	1600 SEC	28,416	15,155,200	
.0111	1620 SEC	29,131	15,730,650	81'
.0111	1640 SEC	29,855	16,320,490	
.0111	1660 SEC	30,587	16,924,890	
.0111	1680 SEC	31,329	17,544,040	
.0111	1700 SEC	32,079	18,178,100	

MODERATE FIRE GROWTH

CALCULATION OF A T SQUARED FIRE

alpha	time	RHR_0 (BTU/s)	TOTAL ENERGY $_0$ (BTU)
.0111	0 SEC		
.0111	20 SEC	4	30
.0111	40 SEC	18	237
.0111	60 SEC	40	799
.0111	80 SEC	71	1,894
.0111	100 SEC	111	3,700
.0111	120 SEC	160	6,394
.0111	140 SEC	218	10,153
.0111	160 SEC	284	15,155
.0111	180 SEC	360	21,578
.0111	200 SEC	444	29,600
.0111	220 SEC	537	39,398
.0111	240 SEC	639	51,149
.0111	260 SEC	750	65,031
.0111	280 SEC	870	81,222
.0111	300 SEC	999	99,900
.0111	320 SEC	1,137	121,242
.0111	340 SEC	1,283	145,425
.0111	360 SEC	1,439	172,627
.0111	380 SEC	1,603	203,026
.0111	400 SEC	1,776	236,800
.0111	420 SEC	1,958	274,126
.0111	440 SEC	2,149	315,181
.0111	460 SEC	2,349	360,143
.0111	480 SEC	2,557	409,190
.0111	500 SEC	2,775	462,500
.0111	520 SEC	3,001	520,250
.0111	540 SEC	3,237	582,617
.0111	560 SEC	3,481	649,779
.0111	580 SEC	3,734	721,914
.0111	600 SEC	3,996	799,200

DENVER INTERNATIONAL AIRPORT - MODERATE FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
28	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 4,526 kW

0	0	70	70
20	5	71	70
40	19	74	71
60	42	76	73
80	75	79	75
100	117	82	78
120	168	86	81
140	229	89	85
160	300	93	89
180	379	97	93
200	468	101	97
220	566	105	101
240	674	110	105
260	791	114	110
280	917	119	114
300	1053	123	119
320	1198	128	124
340	1353	133	129
360	1516	138	134
380	1689	143	139
400	1872	149	144
420	2064	154	149
440	2265	159	155
460	2476	165	160
480	2696	170	166
500	2925	176	171
520	3164	182	177
540	3412	187	183
560	3669	193	189
580	3936	199	195
600	4212	205	201
620	4497	211	207

---- DETECTOR ACTIVATION AT 637.3 SECONDS ----

MODERATE FIRE GROWTH

CALCULATION OF A T SQUARED FIRE

alpha	time	RHR (BTU/S)	TOTAL ENERGY (BTU)
.0111	0 SEC	0	0
.0111	20 SEC	4	30
.0111	40 SEC	18	237
.0111	60 SEC	40	799
.0111	80 SEC	71	1,894
.0111	100 SEC	111	3,700
.0111	120 SEC	160	6,394
.0111	140 SEC	218	10,153
.0111	160 SEC	284	15,155
.0111	180 SEC	360	21,578
.0111	200 SEC	444	29,600
.0111	220 SEC	537	39,398
.0111	240 SEC	639	51,149
.0111	260 SEC	750	65,031
.0111	280 SEC	870	81,222
.0111	300 SEC	999	99,900
.0111	320 SEC	1,137	121,242
.0111	340 SEC	1,283	145,425
.0111	360 SEC	1,439	172,627
.0111	380 SEC	1,603	203,026
.0111	400 SEC	1,776	236,800
.0111	420 SEC	1,958	274,126
.0111	440 SEC	2,149	315,181
.0111	460 SEC	2,349	360,143
.0111	480 SEC	2,557	409,190
.0111	500 SEC	2,775	462,500
.0111	520 SEC	3,001	520,250
.0111	540 SEC	3,237	582,617
.0111	560 SEC	3,481	649,779
.0111	580 SEC	3,734	721,914
.0111	600 SEC	3,996	799,200

DENVER INTERNATIONAL AIRPORT - MODERATE FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI
36	10.6	70/21.1°C	212	(English) 50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 6,598 kW

0	0	70	70
20	5	71	70
40	19	73	71
60	42	75	72
80	75	77	74
100	117	80	77
120	168	82	79
140	229	85	82
160	300	88	85
180	379	91	88
200	468	94	91
220	566	97	94
240	674	101	98
260	791	104	101
280	917	108	105
300	1053	112	108
320	1198	115	112
340	1353	119	116
360	1516	123	120
380	1689	127	124
400	1872	131	128
420	2064	135	132
440	2265	139	136
460	2476	144	140
480	2696	148	145
500	2925	152	149
520	3164	157	154
540	3412	161	158
560	3669	166	163
580	3936	170	167
600	4212	175	172
620	4497	180	177
640	4792	185	181
660	5097	189	186
680	5410	194	191
700	5733	199	196
720	6065	204	201
740	6407	209	206
760	6758	214	211

---- DETECTOR ACTIVATION AT 764.7 SECONDS ----

DENVER INTERNATIONAL AIRPORT - MODERATE FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
44.5	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 9,068 kW

0	0	70	70
30	12	72	70
60	42	74	72
90	96	77	74
120	168	80	77
150	264	83	81
180	379	87	85
210	517	91	88
240	674	95	93
270	854	99	97
300	1053	104	101
330	1275	108	106
360	1516	113	110
390	1781	118	115
420	2064	123	120
450	2370	128	125
480	2696	133	131
510	3044	138	136
540	3412	144	141
570	3803	149	147
600	4212	155	153
630	4645	161	158
660	5097	167	164
690	5572	172	170
720	6065	178	176
750	6582	184	182
780	7118	191	188
810	7678	197	194
840	8256	203	201
870	8857	210	207

---- DETECTOR ACTIVATION AT 892.8 SECONDS ----

DENVER INTERNATIONAL AIRPORT - MODERATE FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
36	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 6,598 kW

0	0	70	70
20	5	71	70
40	19	73	71
60	42	75	72
80	75	77	74
100	117	80	77
120	168	82	79
140	229	85	82
160	300	88	85
180	379	91	88
200	468	94	91
220	566	97	94
240	674	101	98
260	791	104	101
280	917	108	105
300	1053	112	108
320	1198	115	112
340	1353	119	116
360	1516	123	120
380	1689	127	124
400	1872	131	128
420	2064	135	132
440	2265	139	136
460	2476	144	140
480	2696	148	145
500	2925	152	149
520	3164	157	154
540	3412	161	158
560	3669	166	163
580	3936	170	167
600	4212	175	172
620	4497	180	177
640	4792	185	181
660	5097	189	186
680	5410	194	191
700	5733	199	196
720	6065	204	201
740	6407	209	206
760	6758	214	211

---- DETECTOR ACTIVATION AT 764.7 SECONDS ----

1080	13647	191	190
1100	14157	194	193
1120	14676	197	196
1140	15205	200	199
1160	15744	203	202
1180	16291	206	205
1200	16848	209	208
1220	17414	213	211

---- DETECTOR ACTIVATION AT 1226.2 SECONDS ----

DENVER INTERNATIONAL AIRPORT - MODERATE FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
64.5	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 17,295 kW

0	0	70	70
20	5	71	70
40	19	71	71
60	42	73	71
80	75	74	72
100	117	75	74
120	168	76	75
140	229	78	76
160	300	79	78
180	379	81	80
200	468	83	81
220	566	84	83
240	674	86	85
260	791	88	87
280	917	90	88
300	1053	92	90
320	1198	94	92
340	1353	96	94
360	1516	98	96
380	1689	100	99
400	1872	102	101
420	2064	104	103
440	2265	107	105
460	2476	109	107
480	2696	111	110
500	2925	113	112
520	3164	116	114
540	3412	118	117
560	3669	120	119
580	3936	123	121
600	4212	125	124
620	4497	128	126
640	4792	130	129
660	5097	133	131
680	5410	135	134
700	5733	138	136
720	6065	140	139
740	6407	143	142
760	6758	146	144
780	7118	148	147
800	7488	151	150
820	7867	154	152
840	8256	157	155
860	8653	159	158
880	9060	162	161
900	9477	165	163
920	9903	168	166
940	10338	171	169
960	10783	173	172
980	11237	176	175
1000	11700	179	178
1020	12173	182	181
1040	12655	185	184
1060	13146	188	187

1080	13647	191	190
1100	14157	194	193
1120	14676	197	196
1140	15205	200	199
1160	15744	203	202
1180	16291	206	205
1200	16848	209	208
1220	17414	213	211

---- DETECTOR ACTIVATION AT 1226.2 SECONDS ----

.0445	620 SEC	17,106	3,535,199	64.5'
.0445	640 SEC	18,227	3,888,469	
.0445	660 SEC	19,384	4,264,524	
.0445	680 SEC	20,577	4,664,075	
.0445	700 SEC	21,805	5,087,834	
.0445	720 SEC	23,069	5,536,512	
.0445	740 SEC	24,368	6,010,823	
.0445	760 SEC	25,703	6,511,478	
.0445	780 SEC	27,074	7,039,188	
.0445	800 SEC	28,480	7,594,667	
.0445	820 SEC	29,922	8,178,626	81'
.0445	840 SEC	31,399	8,791,776	
.0445	860 SEC	32,912	9,434,831	
.0445	880 SEC	34,461	10,108,500	
.0445	900 SEC	36,045	10,813,500	

DENVER INTERNATIONAL AIRPORT - MODERATE FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
81	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 30,565 kW

TIME(sec)	RHR(kW)	JET (F)	HEAD/DET. (F)
0	0	70	70
40	19	71	70
80	75	73	72
120	168	74	73
160	300	76	75
200	468	79	78
240	674	81	80
280	917	84	83
320	1198	86	85
360	1516	89	88
400	1872	92	91
440	2265	95	94
480	2696	98	97
520	3164	101	100
560	3669	104	103
600	4212	108	107
640	4792	111	110
680	5410	115	114
720	6065	118	117
760	6758	122	121
800	7488	126	124
840	8256	129	128
880	9060	133	132
920	9903	137	136
960	10783	141	140
1000	11700	145	144
1040	12655	149	148
1080	13647	153	152
1120	14676	157	156
1160	15744	161	160
1200	16848	165	164
1240	17990	170	169
1280	19169	174	173
1320	20386	178	177
1360	21640	183	182
1400	22932	187	186
1440	24261	192	191
1480	25628	196	195
1520	27032	201	200
1560	28473	205	204
1600	29952	210	209

---- DETECTOR ACTIVATION AT 1625.9 SECONDS ----

DENVER INTERNATIONAL AIRPORT - MODERATE FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
81	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 30,565 kW

TIME(sec)	RHR(kW)	JET (F)	HEAD/DET. (F)
0	0	70	70
40	19	71	70
80	75	73	72
120	168	74	73
160	300	76	75
200	468	79	78
240	674	81	80
280	917	84	83
320	1198	86	85
360	1516	89	88
400	1872	92	91
440	2265	95	94
480	2696	98	97
520	3164	101	100
560	3669	104	103
600	4212	108	107
640	4792	111	110
680	5410	115	114
720	6065	118	117
760	6758	122	121
800	7488	126	124
840	8256	129	128
880	9060	133	132
920	9903	137	136
960	10783	141	140
1000	11700	145	144
1040	12655	149	148
1080	13647	153	152
1120	14676	157	156
1160	15744	161	160
1200	16848	165	164
1240	17990	170	169
1280	19169	174	173
1320	20386	178	177
1360	21640	183	182
1400	22932	187	186
1440	24261	192	191
1480	25628	196	195
1520	27032	201	200
1560	28473	205	204
1600	29952	210	209

---- DETECTOR ACTIVATION AT 1625.9 SECONDS ----

FAST FIRE GROWTH

CALCULATION OF A T SQUARED FIRE

alpha	time	RHR (BTU/S)	TOTAL ENERGY (BTU)	
.0445	0 SEC	0	0	
.0445	20 SEC	18	119	
.0445	40 SEC	71	949	
.0445	60 SEC	160	3,204	
.0445	80 SEC	285	7,595	
.0445	100 SEC	445	14,833	
.0445	120 SEC	641	25,632	
.0445	140 SEC	872	40,703	
.0445	160 SEC	1,139	60,757	
.0445	180 SEC	1,442	86,508	
.0445	200 SEC	1,780	118,667	
.0445	220 SEC	2,154	157,945	
.0445	240 SEC	2,563	205,056	
.0445	260 SEC	3,008	260,711	
.0445	280 SEC	3,489	325,621	
.0445	300 SEC	4,005	400,500	
.0445	320 SEC	4,557	486,059	28'
.0445	340 SEC	5,144	583,009	
.0445	360 SEC	5,767	692,064	
.0445	380 SEC	6,426	813,935	36'
.0445	400 SEC	7,120	949,333	
.0445	420 SEC	7,850	1,098,972	
.0445	440 SEC	8,615	1,263,563	44.5'
.0445	460 SEC	9,416	1,443,817	
.0445	480 SEC	10,253	1,640,448	
.0445	500 SEC	11,125	1,854,167	
.0445	520 SEC	12,033	2,085,685	
.0445	540 SEC	12,976	2,335,716	
.0445	560 SEC	13,955	2,604,971	
.0445	580 SEC	14,970	2,894,161	
.0445	600 SEC	16,020	3,204,000	

DENVER INTERNATIONAL AIRPORT - FAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
28	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 4,526 kW

0	0	70	70
20	56	77	72
40	112	82	76
60	168	86	80
80	336	95	86
100	503	102	94
120	671	109	102
140	951	120	111
160	1230	129	120
180	1510	138	130
200	1901	149	140
220	2293	160	151
240	2684	170	162
260	3187	182	173
280	3691	193	185
300	4194	204	196
320	4809	217	208

---- DETECTOR ACTIVATION AT 326.0 SECONDS ----

DENVER INTERNATIONAL AIRPORT - FAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
28	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 4,526 kW

0	0	70	70
20	56	77	72
40	112	82	76
60	168	86	80
80	336	95	86
100	503	102	94
120	671	109	102
140	951	120	111
160	1230	129	120
180	1510	138	130
200	1901	149	140
220	2293	160	151
240	2684	170	162
260	3187	182	173
280	3691	193	185
300	4194	204	196
320	4809	217	208

---- DETECTOR ACTIVATION AT 326.0 SECONDS ----

DENVER INTERNATIONAL AIRPORT - FAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
36	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 6,598 kW

0	0	70	70
20	56	76	72
40	112	79	75
60	168	82	78
80	336	89	83
100	503	95	89
120	671	101	95
140	951	109	102
160	1230	116	110
180	1510	123	117
200	1901	132	125
220	2293	140	133
240	2684	148	142
260	3187	157	150
280	3691	166	160
300	4194	175	169
320	4809	185	178
340	5424	194	188
360	6039	203	197
380	6766	214	207

---- DETECTOR ACTIVATION AT 389.1 SECONDS ----

DENVER INTERNATIONAL AIRPORT - FAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
44.5	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 9,068 kW

0	0	70	70
20	56	75	71
40	112	77	74
60	168	80	77
80	336	86	81
100	503	90	86
120	671	95	91
140	951	101	96
160	1230	107	102
180	1510	113	108
200	1901	120	115
220	2293	126	122
240	2684	133	128
260	3187	140	135
280	3691	148	143
300	4194	155	150
320	4809	163	158
340	5424	170	166
360	6039	178	173
380	6766	186	181
400	7493	195	190
420	8220	203	198
440	9059	211	206

---- DETECTOR ACTIVATION AT 452.7 SECONDS ----

DENVER INTERNATIONAL AIRPORT - FAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
64.5	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 17,295 kW

0	0	70	70
20	56	73	71
40	112	75	73
60	168	76	75
80	336	80	77
100	503	83	80
120	671	86	84
140	951	90	87
160	1230	94	91
180	1510	98	95
200	1901	102	99
220	2293	107	104
240	2684	111	108
260	3187	116	113
280	3691	120	118
300	4194	125	122
320	4809	130	127
340	5424	135	132
360	6039	140	137
380	6766	146	143
400	7493	151	148
420	8220	156	153
440	9059	162	159
460	9898	168	165
480	10737	173	170
500	11687	179	176
520	12638	185	182
540	13589	191	188
560	14651	197	194
580	15714	203	200
600	16776	209	206

---- DETECTOR ACTIVATION AT 619.1 SECONDS ----

DENVER INTERNATIONAL AIRPORT - FAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
44.5	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 9,068 kW

0	0	70	70
20	56	75	71
40	112	77	74
60	168	80	77
80	336	86	81
100	503	90	86
120	671	95	91
140	951	101	96
160	1230	107	102
180	1510	113	108
200	1901	120	115
220	2293	126	122
240	2684	133	128
260	3187	140	135
280	3691	148	143
300	4194	155	150
320	4809	163	158
340	5424	170	166
360	6039	178	173
380	6766	186	181
400	7493	195	190
420	8220	203	198
440	9059	211	206

---- DETECTOR ACTIVATION AT 452.7 SECONDS ----

ULTRA FAST FIRE GROWTH

CALCULATION OF A T SQUARED FIRE

alpha	time	RHR (BTU/S)	TOTAL ENERGY (BTU)	
.1778	0 SEC	0	0	
.1778	20 SEC	71	474	
.1778	40 SEC	284	3,793	
.1778	60 SEC	640	12,802	
.1778	80 SEC	1,138	30,345	
.1778	100 SEC	1,778	59,267	
.1778	120 SEC	2,560	102,413	
.1778	140 SEC	3,485	162,628	
.1778	160 SEC	4,552	242,756	28'
.1778	180 SEC	5,761	345,643	
.1778	200 SEC	7,112	474,133	36'
.1778	220 SEC	8,606	631,071	44.5'
.1778	240 SEC	10,241	819,302	
.1778	260 SEC	12,019	1,041,671	
.1778	280 SEC	13,940	1,301,022	
.1778	300 SEC	16,002	1,600,200	64.5'
.1778	320 SEC	18,207	1,942,050	
.1778	340 SEC	20,554	2,329,417	
.1778	360 SEC	23,043	2,765,146	
.1778	380 SEC	25,674	3,252,081	
.1778	400 SEC	28,448	3,793,067	81'
.1778	420 SEC	31,364	4,390,949	
.1778	440 SEC	34,422	5,048,572	
.1778	460 SEC	37,622	5,768,780	
.1778	480 SEC	40,965	6,554,420	
.1778	500 SEC	44,450	7,408,334	

DENVER INTERNATIONAL AIRPORT - FAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
81	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 30,565 kW

TIME(sec)	RHR(kW)	JET (F)	HEAD/DET. (F)
0	0	70	70
20	56	72	71
40	112	73	72
60	168	74	73
80	336	77	75
100	503	79	77
120	671	81	79
140	951	84	82
160	1230	87	85
180	1510	89	87
200	1901	92	90
220	2293	95	93
240	2684	98	96
260	3187	101	99
280	3691	105	103
300	4194	108	106
320	4809	111	109
340	5424	115	113
360	6039	118	116
380	6766	122	120
400	7493	125	123
420	8220	129	127
440	9059	133	131
460	9898	137	135
480	10737	141	139
500	11687	145	143
520	12638	149	147
540	13589	153	151
560	14651	157	155
580	15714	161	159
600	16776	165	163
620	17950	169	167
640	19125	174	172
660	20299	178	176
680	21585	182	180
700	22871	187	185
720	24157	191	189
740	25555	196	194
760	26953	200	198
780	28351	205	203
800	29861	210	208

---- DETECTOR ACTIVATION AT 819.0 SECONDS ----

DENVER INTERNATIONAL AIRPORT - ULTRAFAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
36	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 6,598 kW

0	0	70	70
20	75	77	71
40	300	87	78
60	675	100	89
80	1199	115	102
100	1874	131	118
120	2699	147	135
140	3673	165	152
160	4797	184	171
180	6072	203	190
200	7496	224	211

---- DETECTOR ACTIVATION AT 201.3 SECONDS ----

DENVER INTERNATIONAL AIRPORT - ULTRAFAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
28	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 4,526 kW

0	0	70	70
20	75	79	72
40	300	92	80
60	675	109	93
80	1199	128	111
100	1874	148	130
120	2699	169	152
140	3673	192	175
160	4797	216	199

---- DETECTOR ACTIVATION AT 170.6 SECONDS ----

ULTRA FAST FIRE GROWTH

CALCULATION OF A T SQUARED FIRE

alpha	time	RHR (BTU/S)	TOTAL ENERGY (BTU)	
.1778	0 SEC	0	0	
.1778	20 SEC	71	474	
.1778	40 SEC	284	3,793	
.1778	60 SEC	640	12,802	
.1778	80 SEC	1,138	30,345	
.1778	100 SEC	1,778	59,267	
.1778	120 SEC	2,560	102,413	
.1778	140 SEC	3,485	162,628	
.1778	160 SEC	4,552	242,756	28'
.1778	180 SEC	5,761	345,643	
.1778	200 SEC	7,112	474,133	36'
.1778	220 SEC	8,606	631,071	44.5'
.1778	240 SEC	10,241	819,302	
.1778	260 SEC	12,019	1,041,671	
.1778	280 SEC	13,940	1,301,022	
.1778	300 SEC	16,002	1,600,200	64.5'
.1778	320 SEC	18,207	1,942,050	
.1778	340 SEC	20,554	2,329,417	
.1778	360 SEC	23,043	2,765,146	
.1778	380 SEC	25,674	3,252,081	
.1778	400 SEC	28,448	3,793,067	81'
.1778	420 SEC	31,364	4,390,949	
.1778	440 SEC	34,422	5,048,572	
.1778	460 SEC	37,622	5,768,780	
.1778	480 SEC	40,965	6,554,420	
.1778	500 SEC	44,450	7,408,334	

DENVER INTERNATIONAL AIRPORT - ULTRAFAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
44.5	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 9,068 kW

0	0	70	70
20	75	75	71
40	300	84	77
60	675	95	86
80	1199	106	97
100	1874	119	109
120	2699	133	123
140	3673	147	137
160	4797	162	152
180	6072	178	168
200	7496	194	184
220	9070	211	201

---- DETECTOR ACTIVATION AT 232.4 SECONDS ----

DENVER INTERNATIONAL AIRPORT - ULTRAFAST FIRE GROWTH
08-16-1990

FIRE TO CEILING (ft.)	DETECTOR AXIAL DIST. (ft.)	ROOM TEMP. (F)	DEVICE RATING (F)	RTI (English)
36	10.6	70/21.1°C	212	50

MINIMUM HEAT RELEASE RATE NECESSARY TO ACTIVATE THE DETECTOR AND LOCATION DESCRIBED IS 6,598 kW

0	0	70	70
20	75	77	71
40	300	87	78
60	675	100	89
80	1199	115	102
100	1874	131	118
120	2699	147	135
140	3673	165	152
160	4797	184	171
180	6072	203	190
200	7496	224	211

---- DETECTOR ACTIVATION AT 201.3 SECONDS ----

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12 pages

MAIN TERMINAL BUILDING

C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

DENVER INTERNATIONAL AIRPORT

LEVEL 1

20 SEPTEMBER 1990

MAIN TERMINAL BUILDING

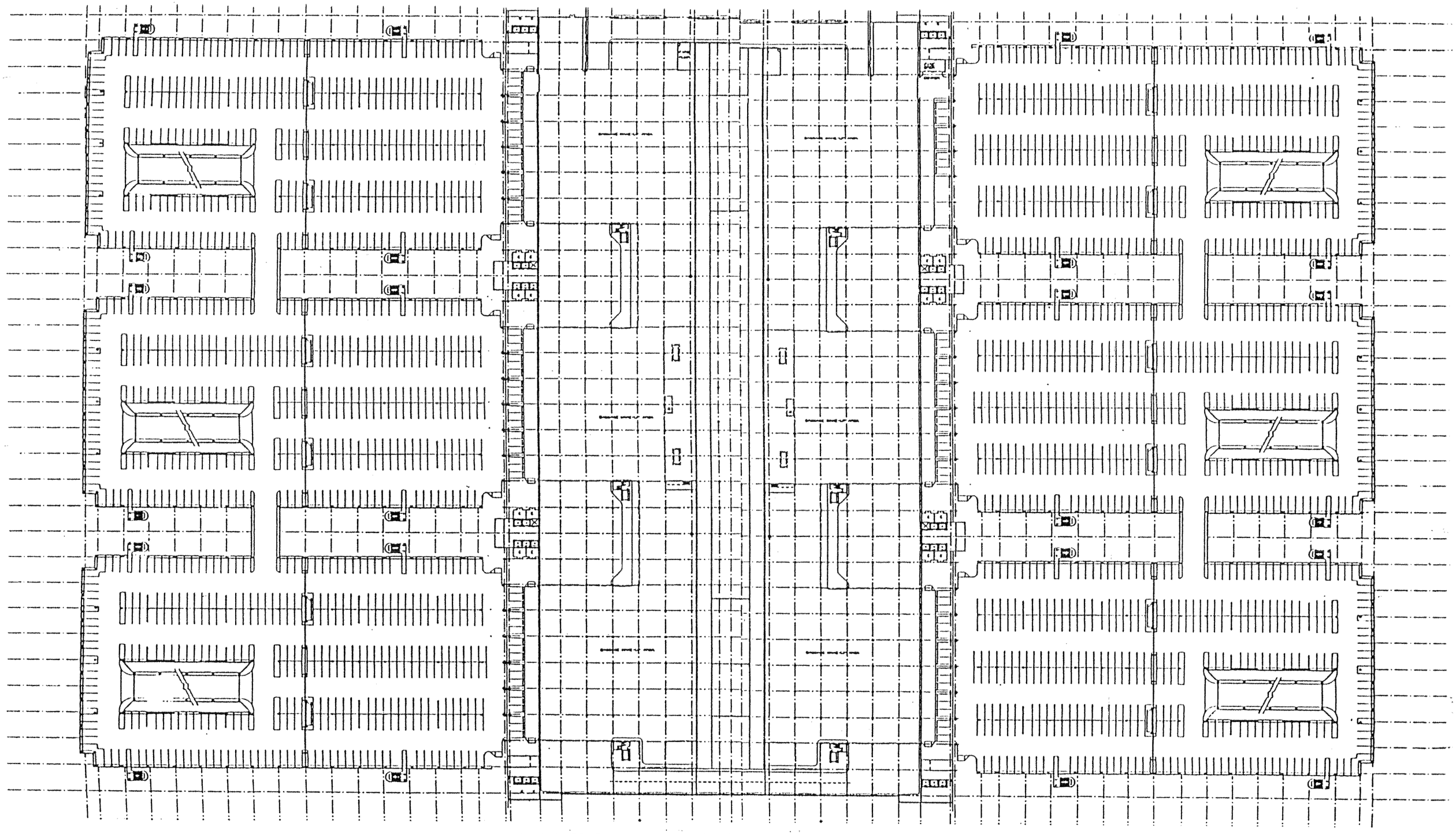
C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

DENVER INTERNATIONAL AIRPORT

20 SEPTEMBER 1990

LEVEL 2

APPENDIX C



MAIN TERMINAL BUILDING

C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

DENVER INTERNATIONAL AIRPORT

LEVEL 3

20 SEPTEMBER 1990

MAIN TERMINAL BUILDING

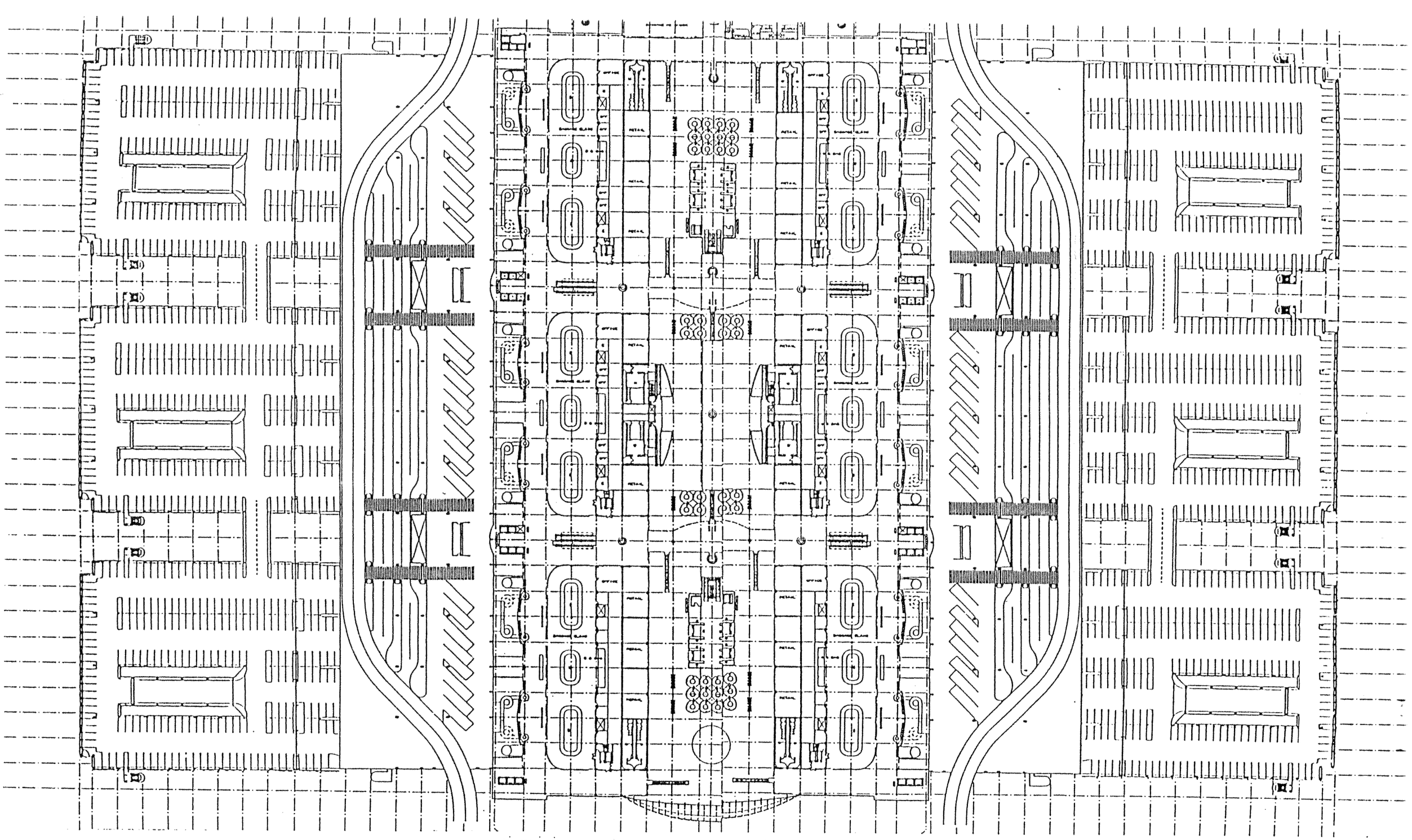
C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

DENVER INTERNATIONAL AIRPORT

20 SEPTEMBER 1990

LEVEL 4

APPENDIX C



MAIN TERMINAL BUILDING

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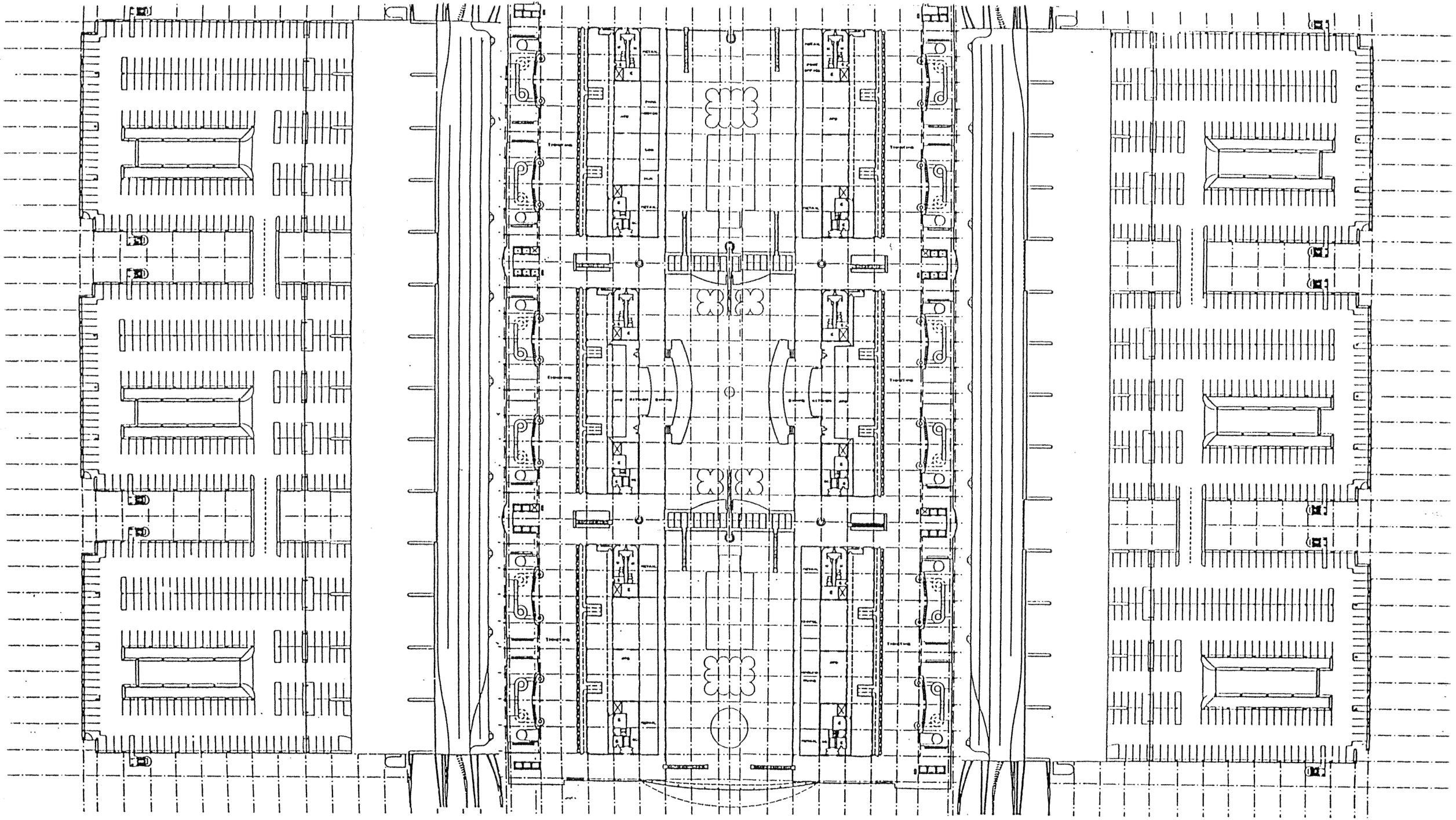
DENVER INTERNATIONAL AIRPORT

20 SEPTEMBER 1990

LEVEL 5

APPENDIX C



MAIN TERMINAL BUILDING

DENVER INTERNATIONAL AIRPORT

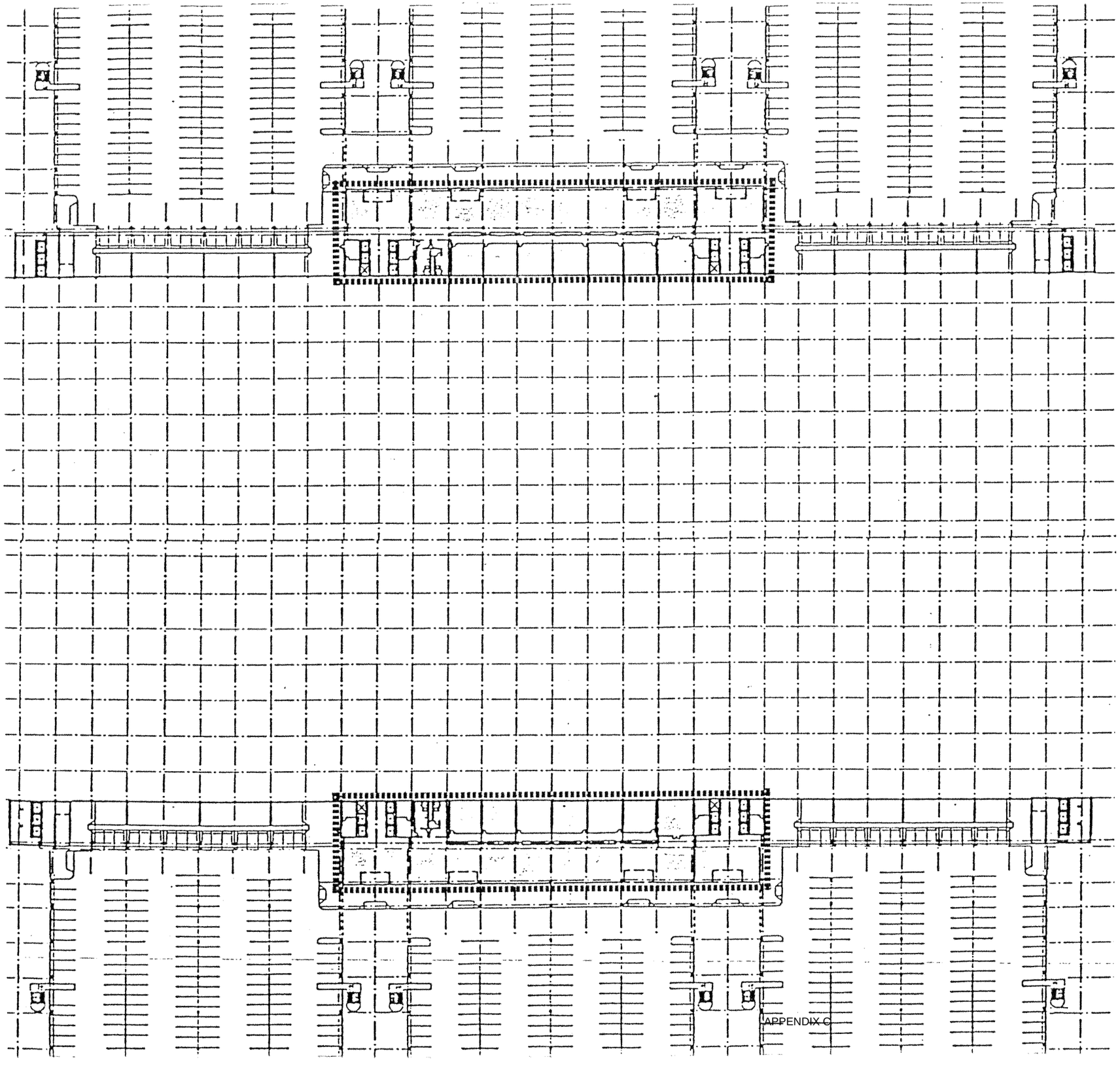
LEVEL 6

C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

20 SEPTEMBER 1990

DENVER INTERNATIONAL AIRPORT
LANDSIDE TERMINAL COMPLEX

LEVEL 1



SMOKE CONTROL / SMOKE DETECTION
FIRE ALARM / SPRINKLER ZONES

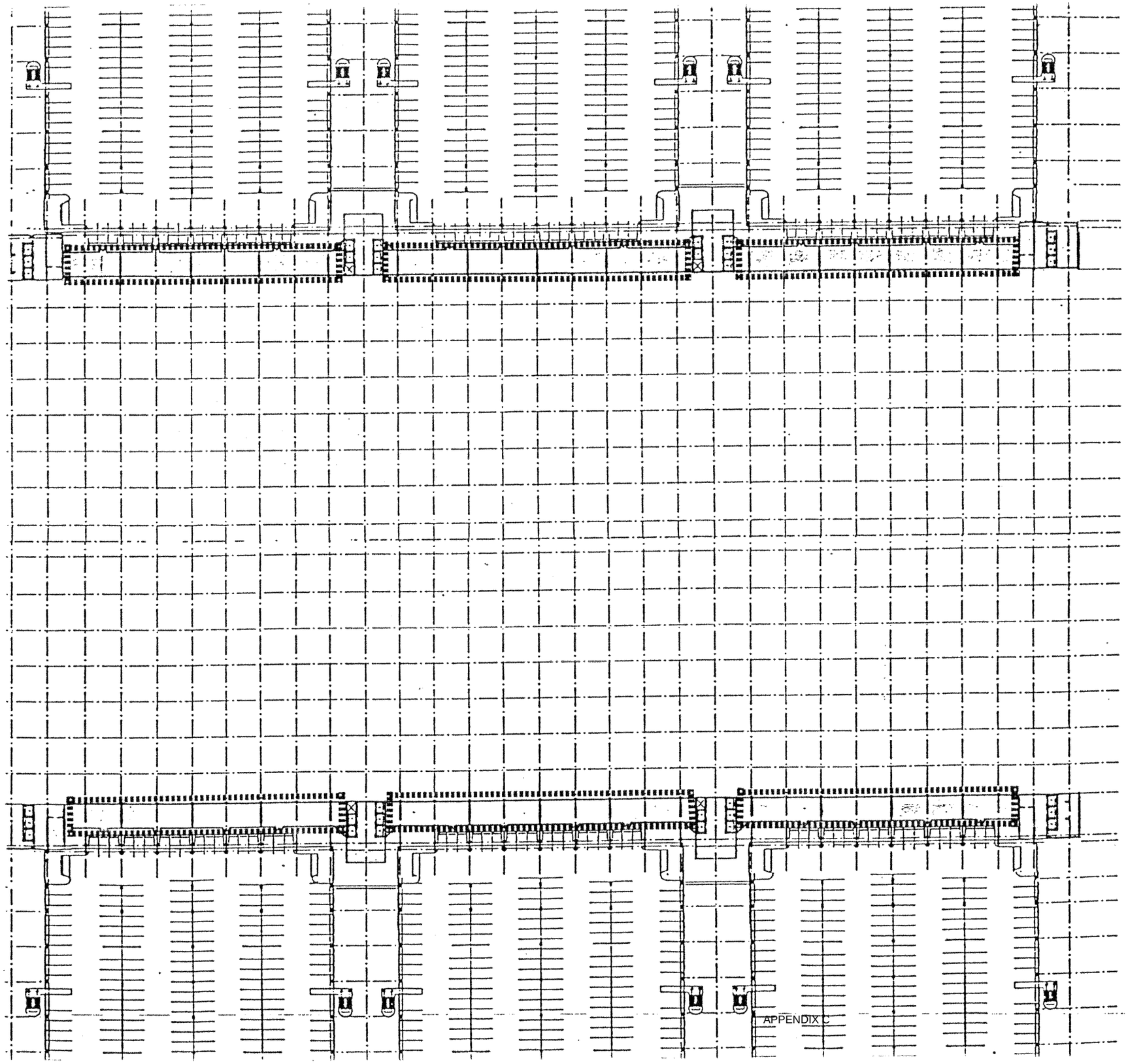
20 SEPTEMBER 1990

C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

APPENDIX C

DENVER INTERNATIONAL AIRPORT
LANDSIDE TERMINAL COMPLEX

LEVEL 2



SMOKE CONTROL / SMOKE DETECTION
FIRE ALARM / SPRINKLER ZONES

20 SEPTEMBER 1990

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DENVER INTERNATIONAL AIRPORT
LANDSIDE TERMINAL COMPLEX

LEVEL 3

SMOKE CONTROL / SMOKE DETECTION
FIRE ALARM / SPRINKLER ZONES

20 SEPTEMBER 1990

C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

APPENDIX C

DENVER INTERNATIONAL AIRPORT
LANDSIDE TERMINAL COMPLEX

LEVEL 4

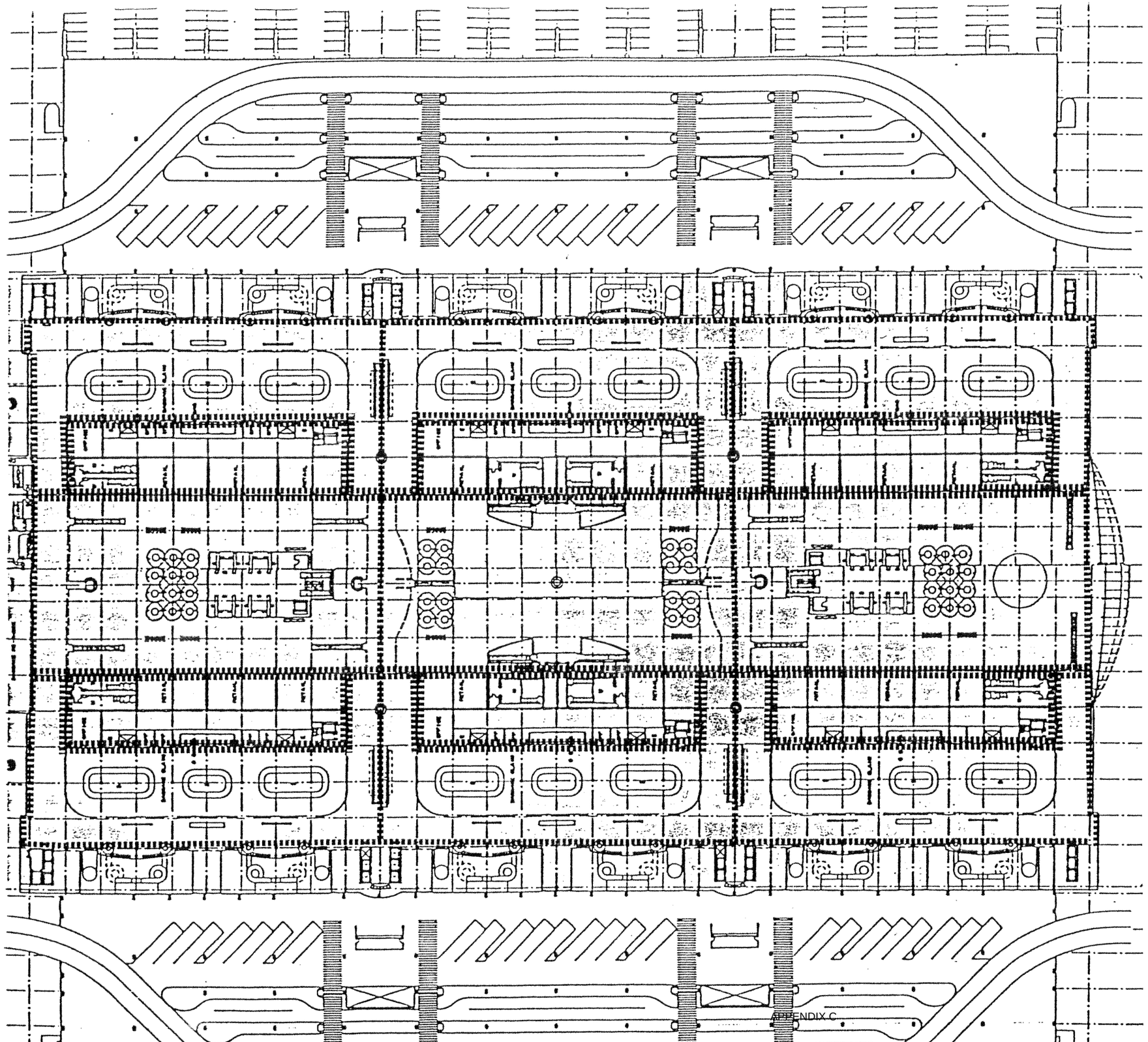
SMOKE CONTROL / SMOKE DETECTION
FIRE ALARM / SPRINKLER ZONES

20 SEPTEMBER 1990

C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

DENVER INTERNATIONAL AIRPORT
LANDSIDE TERMINAL COMPLEX

LEVEL 5



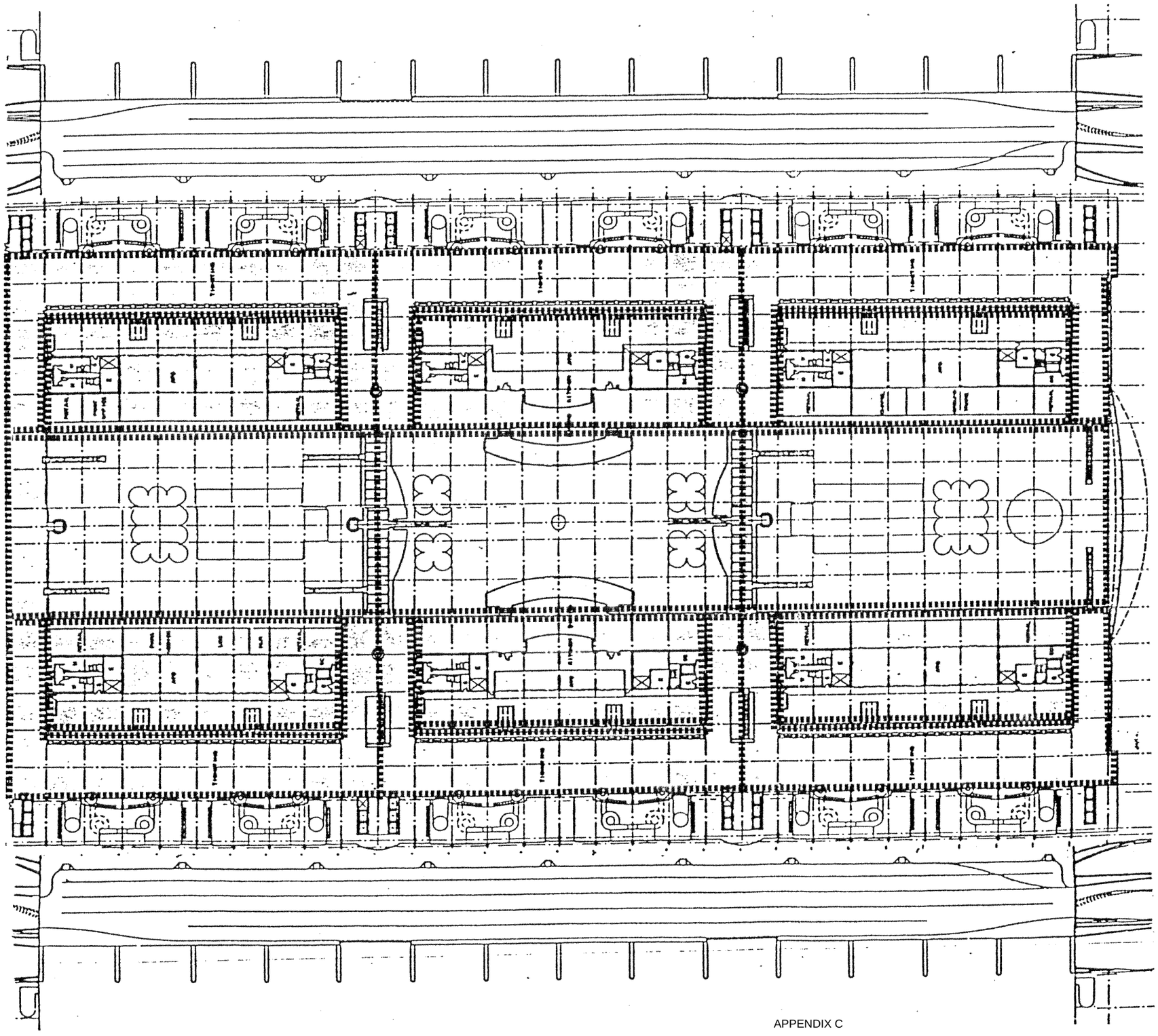
SMOKE CONTROL / SMOKE DETECTION
FIRE ALARM / SPRINKLER ZONES

20 SEPTEMBER 1990

C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

DENVER INTERNATIONAL AIRPORT
LANDSIDE TERMINAL COMPLEX

LEVEL 6



SMOKE CONTROL / SMOKE DETECTION
FIRE ALARM / SPRINKLER ZONES

20 SEPTEMBER 1990

C.W. FENTRESS J.H. BRADBURN & ASSOC., P.C.

Waiting Time at Barriers:

$W_f = W_2 - W_1$
W_2 = Concourse Occupant Load / Barrier Exit Capacity
W_2 = 1734 divided by 750 = 2.31
W_f = 2.31 - 2.75 = 0

Waiting Time at Concourse Exits

$W_c = W_3$ - Max. (W_2 or W_1)
W_3 = Concourse Occupant Load / Concourse Exit Capacity
= 1734 divided by 750 = 2.312
W_c = 2.312 - 2.31 = 0.001

Total Exit Time = $T + W_p + W_f + W_c$
= 2.70 + 0.05 + 0 + 0 = 2.75 Mins < 6 Mins.

3) TEST NO. 2, EVACUATE PLATFORM TO POINT OF SAFETY < 6 MIN.:

a) Arrival

Waiting Time at Platform

$WP = (W_1 - T_1)$

WP = 1.47 Min. - 1.01 Min. = .46 Min.

Concourse Occupant Load = Platform Occupant Load - (W_1 x Emergency Exit Capacity, Barriers)

C.O.L. = 440 - (1.47 x 200) = 146

Total Concourse Occupant Load = Concourse Load (Arrival) + Concourse Load (Departure) = 440 + 1734 = 2174.

Waiting Time at Barriers:

$W_f = (W_2 - W_1)$

W_2 = Concourse Occupant Load / Barriers Exit Capacity

W_2 = 440 divided by 147 = 2.99 Min.

W_f = 2.99 - 1.47 = 1.52 Min.

Waiting Time at Concourse Exits:

$W_c = (W_3 - \text{Max. } [W_2 \text{ or } W_1])$

W_3 = Concourse Occupant Load divided by Concourse Exit Capacity = 440 divided by (200) = 2.20

W_c = 2.20 - 2.99 = 0

Total Exit Time = $T + W_p + W_f + W_c$

= 1.01 + .46 + 1.52 + 0 = 2.99 Min. < 6 Min.

b) Departure

Waiting Time at Platform Exits:

$W_p = (W_1 - T_1)$

W_p = 2.75 - 2.70 = 0.05

Concourse Occupant Load = Platform Occupant Load - (W_1 x Emergency Stair Capacity)

C.O.L. = 1734 - (2.75 x 0) = 1734 Persons

Barriers (Magnetometers)

No.	Lanes	Capacity Per Lane	PPM
10	1 1/2 (36")	50	750

Walking Time for Longest Exit Route:

Center of Platform to Atrium Level

Horizontal Distance = 426 divided by 200 = 2.13 Min.
Vertical Distance Up = 20 divided by 35 = .57 Min.
Total = 2.70 Min.

C. Population

1. Arrival 440 Occ.
2. Departure 1,734 Occ.

Source: Lea and Elliot, Transportation Engineers
Report November 1988, Revised January, 1989

2) TEST NO. 1, EVACUATE PLATFORM , < 4 MINUTES

W_1 (Time to clear Platform) = $\frac{\text{Platform Occ. Load}}{\text{Platform Exit Cap.}}$

a) Arrival

W_{1A} = 440 divided by 300 = 1.47 Min. < 4 Min.

b) Departure

W_{1D} = 1734 divided by 630 = 2.75 Min. < 4 Min.

C. AGTS PLATFORM EXIT CALCULATIONS

Per NFFA 130.
Considered as 3 platforms (side platforms identical).

1) ESTABLISH CRITERIA - PPM AND WALKING TIME FOR LONGEST EXIT PATH

A) Arrivals (Side Platform)

Element	Direction	No.	Lanes	Capacity Per Lane	PPM
Stairs	Down	2	2	40	160
Escalators	Up	2	2	35	140
Total					300

Barriers

Element	No.	Lanes	Capacity Per Lane	PPM
Doors (3'-10")	2	2	50	200

Walking Time For Longest Exit Route:

Center of Platform to Atrium Level

Horizontal Distance = 88' divided by 200 PPM =	.44 Min.
Vertical Distance = 20' up divided by 35 PPM =	.57 Min.
Total =	1.01 Min.

B) Departure (Center Platform)

Element	Direction	No.	Lanes	Capacity Per Lane	PPM
Stairs	Up	2	5 (9'-6")	35	350
Escalators	Up	4	2	35	280
Total					630

C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.
ARCHITECTURE INTERIORS PLANNING
1800 GRANT STREET
SUITE 600
DENVER, COLORADO 80203
FAX 303-832-6918
303-830-2100

MEETING REPORT

PROJECT DIA Landside Terminal Complex
Code Issues Review Meeting No. 2

PROJECT NO. 8908-E121
CWF.5628

LOCATION City Office Building - Denver Building Department

FILE NO. 104

AUTHOR John Salisbury JS

DATE OF MEETING 03/08/91

DATE PRINTED 03/17/91

PRESENT

Emil Gadeken	New Denver Airport Office
Steve Rondinelli	Denver Fire Department
Paul Spurgeon	Denver Fire Department
Pete Bemelen	Denver Building Inspection Department
Marshall Ashmann	Denver Building Inspection Department
Eric Nelson	Abeyta Engineering Consultants, Inc.
Bob Jacobsen	C.W. Fentress J.H. Bradburn and Associates, P.C.
Thom Walsh	C.W. Fentress J.H. Bradburn and Associates, P.C.
Joseph Solomon	C.W. Fentress J.H. Bradburn and Associates, P.C.
John Salisbury	C.W. Fentress J.H. Bradburn and Associates, P.C.

The purpose of the meeting was to discuss outstanding code questions.

ACTION

OLD BUSINESS

None

NEW BUSINESS

2.1	Fire sprinklers need to be provided wherever utility piping and conduit lines run through the AGTS crawlspace, on a separate zone from that of the AGTS fire sprinkler system. This applies to the communication cable tray carrying teflon coated cabling through the crawlspace at the south end of the building.	Fire sprinklers to be provided at utility piping in AGTS crawlspace.
2.2	The Architect will investigate the need to provide freeze protection for the fire sprinkler system in the AGTS crawlspace with the Mechanical Engineer.	Architect to consult Mechanical Engineer on fire sprinkler freeze protection.
2.3	Pete Bemelen stated that drains should be provided under piping crossing through the crawlspace. Currently, drains are to be provided in the North AGTS Tunnel running under the Concourses.	Drain to be provided under utility piping in AGTS crawlspace.

COPIES TO: Those Present; S. Jack/BLAK; C. Szynskie/ROOS; M. Abeyta/ABEY; C. Kilper/HEIT; P. Benefield/TRA; B. Probst, M. Winters, R. Root, J. Mousseau, M. Gengler, J. Kudrycki, B. Chaffee/CFJBA

		ACTION
2.4	The exit door from the AGTS walkway to the AGTS arrivals platform which provides 3'-4" clear from the wall to the edge of the walkway before turning into the doorway was discussed and approved.	INFO.
2.5	The Architect will provide a set of overall plans showing proposed locations for fire extinguishers to the Fire Department for their review. Extinguishers will be located in each Fire Valve Cabinet and within a 75'-0" radius of each other. In public areas extinguishers should be placed behind counters and out of reach of the general public.	Architect to provide proposed extinguisher locations for review.
2.6	Eighteen inch deep draftstops in accordance with NFPA 13, Section 4-4.7.2.3 (see attached letter from Jeff Hillary to John Salisbury, dated 2/22/91) will be provided at all escalator and baggage conveyor floor openings.	INFO.
2.7	There is no requirement for a one-hour separation at the partition separating the Rental Car Offices from the Lobby space. Sprinklerheads being provided at the Exterior lobby wall should be the directional type (both sides of wall).	INFO.
2.8	The exterior walls, floor and roof of the Main Terminal Level 7 Fan Rooms shall be of 2-hour fire resistant construction.	INFO.
2.9	The Elevator Machine Rooms at the Roof Level may have non-rated, non-combustible wall and roof structures.	INFO.
2.10	The location of fire valve cabinets in the Main Terminal was reviewed and approved. (Valve cabinets will be located within ten feet of all exit stair enclosures.)	INFO.
2.11	The mechanical ductwork servicing the AGTS Platforms must be fitted with 1½ hour dampers as the ductwork passes through the 2-hour walls required at the Level 4. The Mechanical Room will be treated as an extension of the supply shafts.	INFO.
2.12	Electrical wiring may be run in the AGTS Tunnels in thin wall EMT conduit.	INFO.

		ACTION
2.13	The ceiling enclosure of the Level 6 Retail spaces shall be of non-combustible construction.	INFO.
2.14	The curbside baggage system enclosure will be of non-combustible construction and will not require fire sprinkler protection, except at the point where the baggage conveyors enter the building. Fire sprinklers will be required at the inside face of the wall above the opening. The curbside structures adjacent to the baggage systems at Levels 5 and 6 curbsides will be constructed of non-combustible non-rated construction.	INFO.
2.15	At Levels 5 and 6, the doors separating the public corridor from the corridor containing the fire valve cabinets do not present a problem for Fire Department access or egress.	INFO.
2.16	The egress lighting concept has been approved. The Electrical Engineer will directly confirm all requirements for data with the Denver Building Inspection Department.	Electrical Engineer to coordinate additional information required on egress lighting. DBID.
2.17	Access to the Janitor's closets, hot water heater closets and adjacent electrical rooms has been revised (see attached drawings). The revised layouts were reviewed and approved.	INFO.
2.18	The North Terminal Support Area 60% Construction Document review set was left for review (set included Architectural, Mechanical, Plumbing, Electrical and Baggage drawings).	INFO.
2.19	The Architect reviewed the exiting of the AGTS deboarding platform noting the Building Department's prior concern for exiting passengers across the Bag Make-up Level. The Architect noted that recent revisions requested by the Airport have modified the design to include two (2) additional escalators and an additional stair to the Level 5 Great Hall. The Architect requested that the exit stair from the station blown to the bag make-up be deleted and that all exiting be up through the Great Hall. The Building Department concurred with the Architect's proposal.	INFO.

FEDERICO PEÑA
Mayor

CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS

BUILDING INSPECTION DIVISION
200 W. 14th Avenue
Denver, Colorado 80204-2700

Date: _____ Time: _____ File: _____

Subject: _____ Address: _____

Location: Bldg. Dept. 200 W. 14th Ave. ☐
Fire Dept. 745 W. Colfax Ave. ☐
Other: _____

ATTENDEES

Name	Organization	Mailing Address	Telephone
Thom Walsh	CW Fentress JH Bradburn	1800 Grant St 80203	830-2100
Bob Jacobsen	" "	"	"
JOHN SALISBURY	" "	"	"
STEVE RONDINELLI	DFD/PMT		
Paul D Spurgeon	Denver Fire	745 W. Colfax Denver 80204	640-5522
PETE BEMELEN	DBID	200 W. 14 Ave	640-2840
MARSHALL ASHMANN	BI. D./ELECTRICAL	"	640-3640
JOSEPH SOLOMON	CWFENTRESS/JH BRADBURN	1800 GRANT	830-2100
ERIC NELSON	AFFETA ENG.	6300 S. SYRACUSE WAY ENGLEWOOD, CO. 80123	741-6300
Emil Gudekon	PMT	Stapleton Terminal Bldg 5th Denver 80207	270-1613

BLAK
ABSY
TEA - P.B.

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF PUBLIC WORKS

BUILDING INSPECTION DIVISION
200 W. 14th Avenue
Denver, Colorado 80204-2700

February 22, 1991

John Salisbury
C.W. Fentress - J.H. Bradburn and Assoc., P.C.
1800 Grant Street, Ste. 600
Denver, CO 80203

Mr. Salisbury:

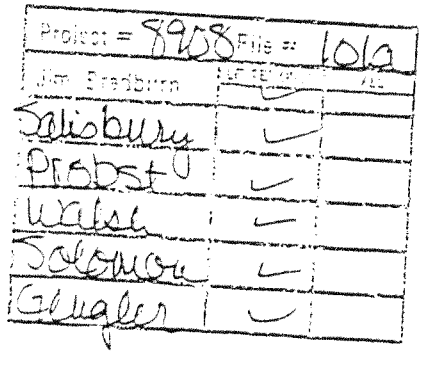
Item 1.03 of your DIA landside terminal complex meeting report calls for floor opening protection in accordance with NFPA 13 with a 12" draft stop and 6'-0" on center sprinklers.

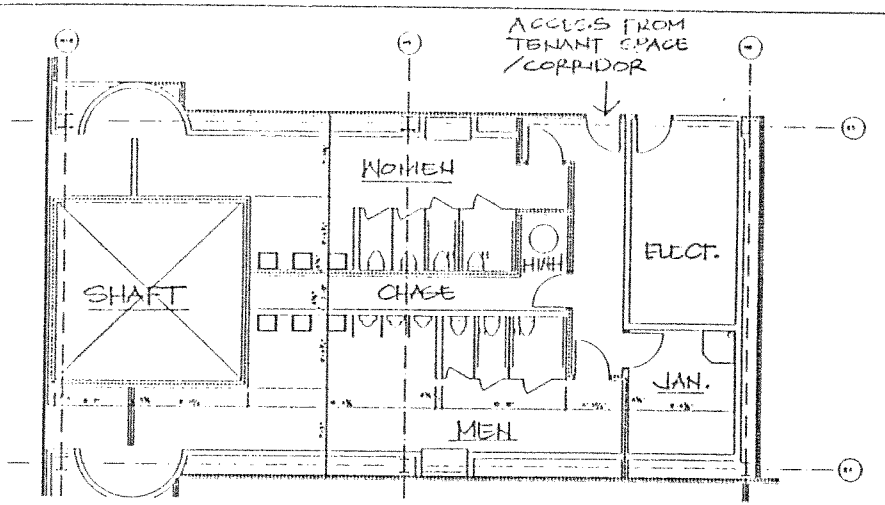
The 12" dimension should be noted as an 18" minimum draft stop requirement, as called for in NFPA 13 Section 4-4.7.2.3. The reference to 12" draft stops may have come from the Denver Building Code Section 3803(a)12a; however, Denver Building Code Section 102(d) states that the most restrictive of conflicting sections shall govern. In this instance, NFPA 13 must be the governing code.

Hopefully this point can be clarified with all concerned before it begins to show up in the design documents.

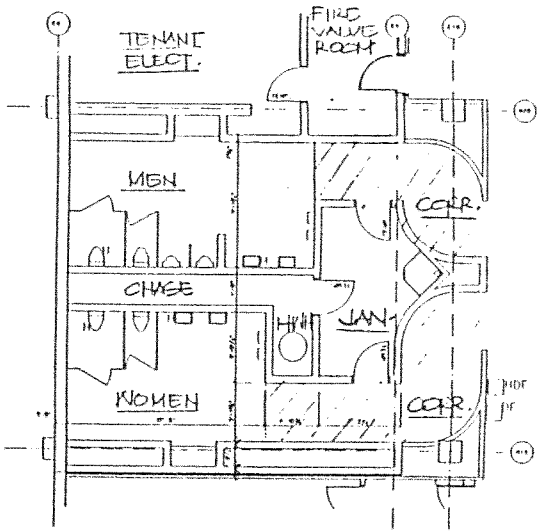
Sincerely,

Jeffrey D. Hilleary, P.E.
Chief Mechanical Engineer



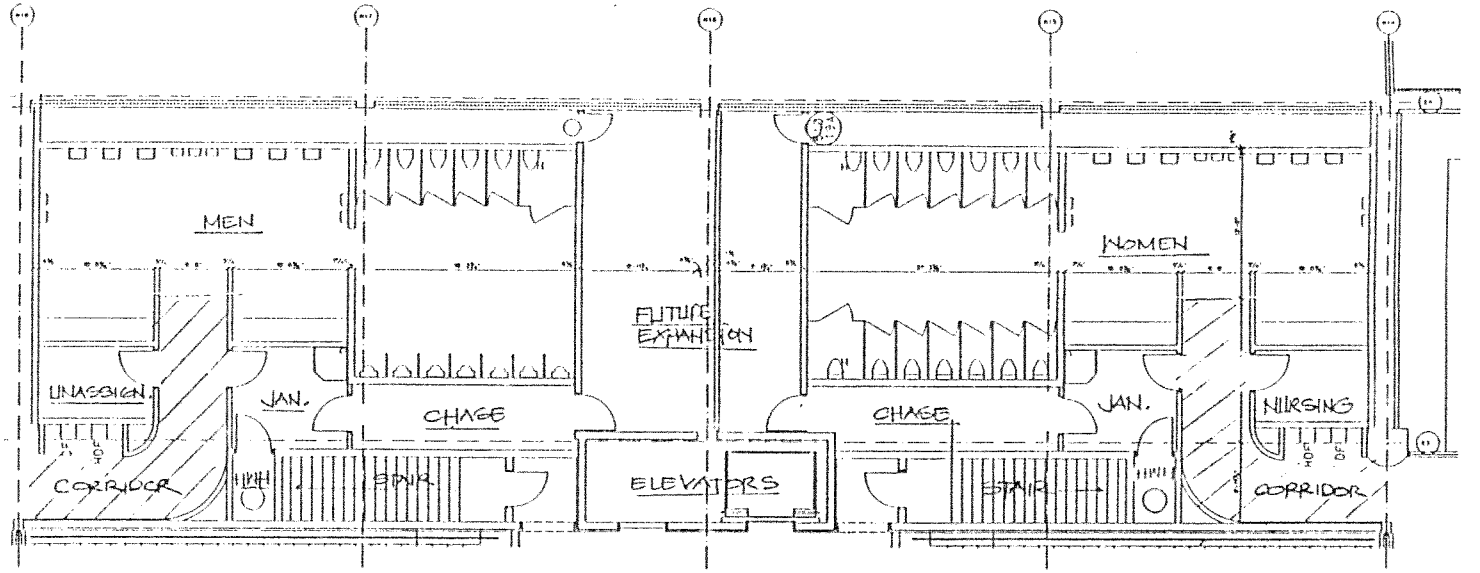


1 TOILET PLAN MEN WOMEN



1 TOILET PLAN MEN WOMEN

3-8-91



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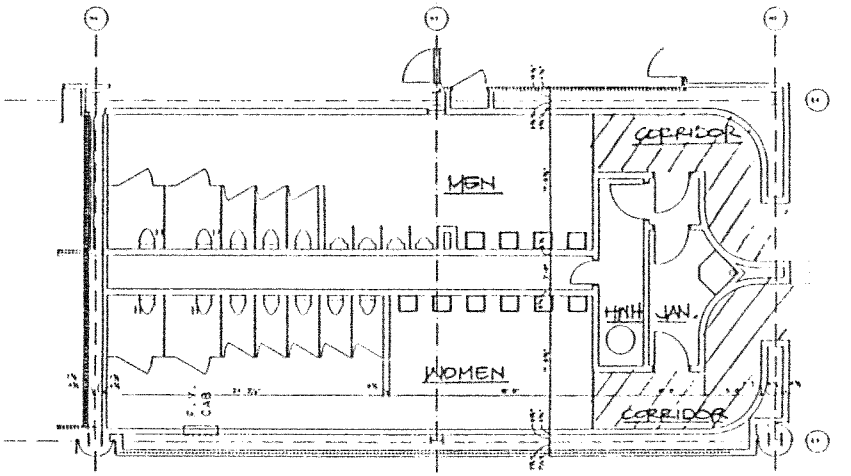

TOILET PLAN MEN WOMEN

3-8-91

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ARCHITECTURE, INTERIORS, PLANNING
1800 GRANT STREET
SUITE 600
DENVER, COLORADO 80203
FAX 303-832-6918
303-830-2100

MEETING REPORT

PROJECT	DIA Landside Terminal Complex Consultant Coordination Meeting Report #13	PROJECT NO.	8908-E121 CWF.12092
LOCATION	CFJBA Office	FILE NO. 104	
AUTHOR	Jim Carney	DATE OF MEETING	02/01/91
PRESENT	Emil Gadeken — NDAO Scott Jack — Black & Veatch Thom Walsh — CFJBA John Salisbury — CFJBA Jim Carney — CFJBA	DATE PRINTED	02/04/91

The purpose of this meeting was to discuss code clarifications or Denver Building Department code comments with the PMT Code Coordinator.

ACTION

OLD BUSINESS

None

NEW BUSINESS

13.1	Parking Shuttle elevators may not need to be pressurized as now documented. The Owner will discuss with the Denver Building Department today.	Owner will follow up.
13.2	Tenant area general smoke control (versus Tenant separated) acceptable, pending the Owner's further discussion with the Denver Building Department. The concourses will be handled similarly.	INFO.
13.3	The north freight elevators (E8N30) need to be pressurized.	INFO.
13.4	The baggage conveyor openings and escalator openings in the floors are to be protected by ceiling heat traps and water curtain sprinklering.	INFO.
13.5	The Fire Command Center is likely to be on the Third Level.	INFO.
13.6	The Fifth Floor Bag Claim area draft stops (structure to below ceiling) are to be one bay south of the escalators.	INFO.

COPIES TO: Those Present; P. Benefield, K. Brandon/TRA, W. Kirkpatrick/AERO, E. DePaola/SEVR, K. Stutsman/WICI, B. Probst, J. Solomon, R. Jacobsen, M. Winters, R. Root, J. Mousseau/CFJBA

		ACTION
13.7	The escalator openings shall be in accordance with NFPA; with the heat trap below the ceiling and sprinklers.	INFO.
13.8	The Fourth Floor Mechanical Rooms shall have vestibules at the exit corridor interface.	INFO.
13.9	In accordance with UBC 3309c, the one-hour protection requirement at the glass wall at the car rental, elevator lobbies, and garage interface with the Atrium exception for sprinklering is acceptable. Rental offices will be one-hour rated (20 min. opening and protected) from the Rental Lobby.	INFO.
13.10	Handicap access is to be in accordance with Chapter 64 (ANSI), (door approach clearances, handrails, etc.) throughout the public areas. Service and Tenant areas may need further review.	INFO.
13.11	Wheelchair access to the restaurant's lower seating will be necessary according to Pete Bemelen with the Denver Building Department. Dale Coski with the Commission for the Disabled may need to review this for a waiver. Handicapped access to the site and the South End was discussed. The Owner feels that handicapped access will be demanded by the Commission for the Disabled.	Architect to follow up.
13.12	The HVAC plenum at the Sixth Floor Roof and Elevator Machine Room needs to have two-hour rated roof and walls.	INFO.
13.13	The Retail area ceiling and roof on the Sixth Floor need not be rated but must be non-combustible.	INFO.
13.14	The AGTS crawl space need not be sprinklered or smoke detected and evacuated, but needs supply piping routed and sized to serve future uses.	INFO.
13.15	OSHA safety requirements will be reviewed with the individual from the State that the Owner suggests.	Owner to follow up with OSHA representative.

	ACTION
13.16 The Denver Building Department has requested that tight fitting doors at the Level One Rental Car Lobby wall for smoke control. This is not possible with the sliding doors currently planned. The Owner will discuss this with the Denver Building Department today.	Owner to follow up with DBD.

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF PUBLIC WORKS

JAN 1991
RECEIVED
CWF JHB AND ASSOCIATES, P.C.

BUILDING INSPECTION DIVISION
200 W. 14th Avenue
Denver, Colorado 80204-2700

	8908	101a
		ALL
Probst		✓
Walsh		✓
Salisbury		✓
Solomon		✓
Winters		✓

January 28, 1991

To : Joseph Solomon — CWFJHBA
Emil Gadeken P.E. — NDIA

From : PB Peter Bemelen P.E. — Denver Building Inspection Plan Review Engineer

Subject : NDIA Landside Terminal
Contract No. F-121B
Issue Date : December 21, 1990

General Comments:

A. The coordination between the Architectural and Mechanical drawings for damper locations in fire-resistive rated walls is essential to avoid field problems during the construction. The ratings of walls must be clearly identified on both drawings.

B. The handicapped accessibility per DBC UBC APPX 64
   a. Refuge area in the stairway enclosures, Section 3306 Denver amendments: some of the stair enclosures at the North Terminal are applicable to this provision.(Stairs at N42/E2, N42/W2 Level 6 and 7; vestibule 41B17 AGTS inbound platform stair E2/N17.)
   b. The balcony areas at Level 6 must be accessible and will require ramps.(61B16)
   c. Accessible routes must comply with figure 17, page 64-65 DBC Amendments. Specifically, review the areas where two doors are close together and the swings may interfer with the maneuvering space of the occupant in a wheelchair. (Corridor 48B03)
   d. Door hardware must comply with Section 6403 (m)9. Lever type handles may be required in most locations.

C. Travel Distances:

a. Great Hall	Level 5	300 ft
b. Terminal N1-N31	Level 6	200 ft
c. North Terminal	Typical	200 ft

D. Exit Corridors that are extensions of the stair enclosures at Level 4 : (41D10, 48D12, 44D03)
   a. Construction to be two-hour fire-resistive.
   b. Other corridors connected to these exit corridors must be separated by a 1 1/2 hour fire rated door.(44D03)

c. Section 3309(c) prohibits the exit doors from the Mechanical Rooms to open into these exit corridors that are extensions of the stair enclosures. (41D05, 48D08)

E. Elevator Lobby-Vestibule separation from the parking garage at Level 4 :

A one-hour occupancy separation is required between the Terminal and the Parking Garage. The lobby is within the Terminal occupancy and a separation is required between the lobby/vestibule and the garage.
An additional reason for this separation is that the escalator from the 5th Level to the 4th Level opens the elevator lobby area to the 5th level.
The Department will accept an Atrium Type separation as describe in Section 1715(c),exceptions 3(a)(b)(c) DBC Amendments. A draft stop is also requested in this area to develop smoke control at the door openings into the vestibule and at the escalator opening. Doors may the sliding type.

F. Elevator Lobbies at Level 1,2,and 3 :
No separation is required between the lobby and the garage.

G. Car Rental Area :
Provide Atrium Type separation Per Section 1715(c).

H. Dead End Corridors:
Section 3305(e) states that dead ends shall not exceed 20 ft.
Corridor 48B03 may lead occupants to the elevator lobby.
Corridor 61B13 will be a dead end corridor since no access thru the kitchen will be allowed.
Corridors on Level 4 in the North Terminal leading to the Truck Dock area have dead end corridors that exceed 20 ft.

I. Public Corridors:
Corridors in B2 occupancies may be constructed as non-fire rated and noncombustible. All other corridors shall be a minimum of one-hour fire-resistive construction, unless they are extensions of the stair enclosures.

J. Unprotected Steel Roof Structure:
Provide additional information of the protection of the columns. How are structural members protected from the HVAC units on top of the roof.

K. Provide a revised exit analysis for the North Terminal.

FAX MESSAGE

DATE: Jan 29 1991 TIME SENT: ~~to~~ 7:45 A.M.

TO: Joseph Solomon (name) FROM: Pete Bemelen (name)

CWFJHBA (location) Building Inspection (department/agency)

830 - 2100 (telephone number) 640-2840 (telephone number)

832-6918 (FAX number)

Number of Pages: 3 (including cover page)

COMMENTS/SPECIAL INSTRUCTIONS: Fax copy of 60% Terminal review. Official copy will follow with mechanical revisions. Please review and comment as soon as possible. Please forward to other designers in your office that may need is information.

Transmitting from:

City & County of Denver
Public Works Department - Building Inspection Division
FAX Number: (303) 640-5623

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OR IF THE QUALITY IS POOR, PLEASE CALL

640-5843

TOTAL P.03

C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.
ARCHITECTURE, INTERIORS, PLANNING

December 28, 1990

Mr. Cliff Hennig
Director, Building Inspection Division
CITY AND COUNTY OF DENVER
200 West 14th Avenue
Denver, Colorado 80204

E-121

Re: Denver International Airport, Landside Terminal Complex
Fire Protection Alternatives
Project 8908.000 File 207.1
Serial #CWF.11615

Gentlemen:

This letter responds to the October 11, 1990 Memorandum, authored jointly by the Fire Prevention Bureau and the Building Inspection Division, which contained your responses to the Fire Protection and Life Safety Plan issued September 27, 1990.

The October 11, 1990 Memorandum indicated that the Building and Fire Departments supported many of the special conditions proposed by the Fire and Life Safety Plan, "contingent on the provision of firefighting personnel, special low-profile firefighting apparatus and a facility in the terminal complex." On October 15, 1990, the Department of Fire issued a letter outlining in greater detail the requirements for the Fire Department Operations Center. Basically, these requirements amounted to a fire station in the Terminal building, which was not in accordance with previous discussions nor was it acceptable to the New Denver Airport Office.

Since these memoranda were issued, it became clear to us that the New Denver Airport Office and the Department of Fire needed to reach an agreement on the location, staffing and funding of Fire Department facilities, both for the Terminal complex as well as for the entire airport. At various times, it appeared that a resolution would be forthcoming. However, to the best of our knowledge, resolution is no closer now than in October.

We have curtailed our contact with your department and the Department of Fire, pending a resolution on these larger issues so we could subsequently conclude the more detailed issues of the building design. However, we can no longer proceed absent detailed interaction with the Building and Fire departments, and the project's schedule requires that we complete the documents by April, 1991. Therefore, we must proceed according to some concensus on how to deal with the unique aspects of this building, as identified in the original Fire and Life Safety Plan.

We believe it is appropriate to proceed in accordance with the conclusions stated in your October 11, 1990 Memorandum. These conclusions are sensible and defendable based strictly upon good engineering practice and upon the provision of enhanced life safety systems which would not normally be required. The question of the location and staffing

1800 GRANT STREET SUITE 800 DENVER, COLORADO 80203 FAX: 303-832-4915 303-830-2100

of Fire Department facilities needs to be resolved as soon as possible to the mutual satisfaction of all parties involved; however, it is beyond our aegis to deal with this issue. Our position is that the City and County of Denver has an irrefutable responsibility to make provisions for firefighting facilities with reasonable access to the Terminal Complex. Given that this must occur, we should be able to proceed with the design of the Terminal complex. Once there is greater clarity as to the final location of firefighting facilities, we will then re-evaluate detailed issues of access to each element in the complex.

We therefore request your endorsement of this approach: We will continue to develop the design in accordance with the guidelines developed in the Fire and Life Safety Plan, as modified by the October 11, 1990 Memorandum issued jointly by the Fire Prevention Bureau and the Building Inspection Division. The basic building design will continue to be developed in a manner which allows access between Level 3 of the Terminal and Garages, thereby maximizing firefighting access throughout the complex as well as into the tunnels. The Fire Department Operations Center will be as described in the report and will continue to be located at Level 3 of the Terminal on the west side of the complex. (Alternate locations may be acceptable, if so desired by the Fire Department). Adequate clearance for special low-profile firefighting apparatus will be maintained throughout the parking garages, and parking spaces adjacent to the Fire Operations Center can be made available. Also, in response to requests from the Fire Department, elevators at the north end of the Terminal have been increased in size so an electric cart apparatus could also be employed by firefighting or other emergency personnel at all levels of the Terminal.

We believe the above represents a reasonable solution which affords excellent life safety provisions for the complex. We request your response at your earliest convenience and would be happy to meet with you to discuss this further.

Respectfully,

C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.

Brit Probst

Brit Probst
Project Manager

BP:kjh
xc: Reggie Norman, Emil Gadeken/NDAO
Paul Spurgeon/DFD
Steve Rondinelli/DFD/DIA
Peter Bemelen/DBID
Dennis Reseutek/POUW
Thomas Walsh, John Salisbury/CFJBA

FEDERICO PEÑA
Mayor

CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS

NEW DENVER AIRPORT OFFICE
CITY AND COUNTY OF DENVER
STAPLETON INTERNATIONAL AIRPORT
TERMINAL BUILDING, 4TH FLOOR
DENVER, COLORADO 80207
(303) 270-1900

CWF-0125

BLAIR
ROOS
KOLF
POTW
Abeyta
Riegle

December 10, 1990

Mr. J. H. Bradburn
C.W. Fentress J. H. Bradburn and Associates
1800 Grant Street, Suite 600
Denver, Colorado 80203

8908 101a

Protost
Walsh
Salisbury
Solomon
Winters

Re: DIA Landside Terminal Complex
Fire Alarm System
Project 8909.000 File 101a
Serial CWF-5367

Dear Mr. Bradburn:

Your understanding of the application of the developing standard governing Fire Alarming and Reporting System for use at the Denver International Airport is correct. The standard, when complete (mid-march 1991), will require the use of systems which may be networked via a communications link to common reporting points and the Airport Command Center.

To accomplish this effort and using concepts of a master design to dictate the final system(s) specifications, it is necessary that the PMT coordinate the design, building, procure and install disciplines within the concerned systems. It is the responsibility of the Design Consultant to locate all end devices e.g., speakers, fire detectors, smoke detectors, telephone jacks, etc. (on a suitable drawing), for PMT review. Items such as typical detail for rough-in framing, rights-of-way, wiring node room locations, floor and wall configurations and device mounting detail will be available for the Design Consultants prior to the finish date of the Standards Document.

The tentative completion date for the Fire Alarm System Standards document is also the date for standard documents controlling the design and installation of Security Systems and the Public Address System. This task has been assigned to Swanson and Rink, Inc. under an additional service agreement to another active contract.

Other systems design which require similar disciplines, signal collection and controlling functions which may be unique to DIA will also be committed to following a standard. Those standards, following unique operating concepts, which will affect detail system design, will not be available until sometime after mid-year 1991. Again as the standard documents begin to evolve, the PMT will make every effort to provide certain required detail in advance of the finished document. Specific request for that type of detail should be made known to the PMT as soon as possible to circumvent delays the schedule wherever feasible.

The agreement to complete the standards for the remaining systems standards has not been finalized at this time, however, the PMT does expect such action by the end of January, 1991.

Scheduling is critical to project completion, the PMT desires to make all acceptable standards detail available to the Design Consultants at the earliest date practicable. Much of the detail required by the designers must be coordinated with the airport tenants, and that process is ongoing at this time.

Should other clarification become necessary, please contact the PMT at your convenience.

Sincerely,

William E. Smith, P.E.
Associate Director Of Aviation

WES/TH/em

cc: R. Haury
H. Rocek
R. Norman
R. Holmgren
T. Hawkins
11-51.2

TRA Fax

TRA.0093

Please deliver the following pages to:

Name Brit Probst

Firm C.W. Fentress/JH Bradburn

Fax number (303) 832-6918 Telephone number (303) 830-2100

Total number of pages (including this cover sheet) 4

Project: New Denver Airport - Landside Terminal Complex

Comments

Nancy Innes of the PMT agreed w/ sharing this letter w/ you. Hopefully we can talk soon about the impact all this will have on your projects.

Transmitted: cc of FAX of ltr. to Woodard from Busch (SLW-2134) dated Dec. 14, 1990 related to bldg systems, such as signage

Date 12/18/90 Time 1:30 pm

If you did not receive all the pages, please call at (206) 682-1133

TRA sender Kelly Brannen Project # 3840.01

1:34

Project:	File #:
Jim Bradburn	LETTER ONLY / ALL
Brit Probst	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
Jim Carpenter	✓

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(206) 682-5595 (5pm to 8am PST)

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DENVER, COLORADO 80207
(303) 270-1800

December 14, 1990 SLW-2134

Luci Woodard
Project Manager
Seracuse Lawler & Partners / TRA
1675 Lawrence, Suite 300
Denver, Colorado 80202

SUBJECT: Contract No. E-006

REFERENCE: Building Systems
Prepared by SLP/TRA

Ms. Woodard:

The following systems will be installed by contractor(s) other than the Contractor(s) of the Concourse buildings; this is an update of the information informally provided you on 13 December 1990.

Paging System, CCTV system, Security system, Fire Alarm system, Dynamic Signage system, clock system, FIDS system.

"System" is assumed to be actual wiring and devices pertinent to the system after discussions with SRI and SLP/TRA. Please verify this aspect. The concourse building contractor will be required to coordinate with the contractor of each of the systems, install all conduit and pull lines, power, casework, backing to support other Contractors work, etc.

Provide completed specifications sections for these systems in the construction documents. Insert in Part I: General, Paragraph 1.01, A, of EACH specification section (pertinent to these systems) language to the effect that the Contractor would be required to coordinate with the supplier and installer of the (name of system such as Paging System), including but not limited to providing access and staging area in a timely manner, coordinating finishes to allow installation of other work, making the same power source available to other contractors as is available to the Contractor's own subcontractors, and allowing in the contract schedule appropriate time for others to complete their work including inspection and testing for each phase. Provide clear definition of

Luci Woodard

what the Contractor should be installing with relation to these systems, and what the "system contractor" will be installing. ~~not in the scope of the contractor of F006C.~~

Please submit your proposed language to insert in the construction documents for each of these systems as soon as possible in order the PMT can review. It would be most helpful if your scheduling consultant could assist with wording that will limit the exposure of the City to claims due to scheduling. Please have them review your recommended language as soon as possible. This issue has been reviewed with SRI previously. Please submit a draft of the language for each of the system specifications for PMT review prior to proceeding.

The Hardware specification should have language added that informs the Contractor that Hardware will be bid as part of the project and installed by the Contractor of F006C. The Contractor for Project F006C will purchase the hardware from the vendor(s) selected by the City after the time of bid. A change notice will be issued for the difference between the final cost of hardware that is installed using the scheduled values obtained by the City from the selected vendor(s) and the allowance in the Contract. The City's selected vendor will require that the Contractor provide to the vendor the City's accepted hardware schedule at least 120 days prior to shipment of hardware and 120 days prior to the date templates are needed by the Contractor. The language your firm develops should be reviewed by your scheduler.

There should be a dollar amount in the bid forms listed as an allowance which shall represent SLP/TRA cost estimate for the material cost of the hardware. Please contact Dick Holmgren at the NDAO offices for clarification of the extent of hardware and agreement on the allowance value to be provided. As you are aware, cylinders and locking devices area required on escalators, moving walks, access doors, and a myriad of other items on the project.

Provide revised hardware and door schedule the week of 17 December in order the allowance dollar value can be established.

Static Signage will also be bid as a separate package. Provide all structural, conduit, attachment backing, etc. as part of the base building F006C project. This was discussed at the 13 December meeting. SLP/TRA stated they will review how many signage documents need to be included in order to give the Contractor definition of amount of interface to anticipate. Some definition of the amount of "interface" with another contractor is required in order to limit the claims by the Contractor that he could not have anticipated the amount of interface or scheduling due to lack of clarity in the bid documents for Project F006C.

The building systems not to be bid as part of the base building documents (F006C) remain in your firm's scope of work, and these systems will be packaged and bid as separate projects. Please arrange a meeting with the PMT to review the packaging of these projects.

If you have any questions, please contact me.

Sincerely,

Robert Busch

Robert Busch
Project Manager

RB/ps

cc: Dick Haury
Dick Holmgren
FAXED December 14 1990
11-38.2

C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.
ARCHITECTURE, INTERIORS, PLANNING

November 30, 1990

Mr. Reginald Norman
Assistant Project Manager
NEW DENVER AIRPORT OFFICE
Stapleton International Airport
Main Terminal, Fourth Floor
Denver, Colorado 80207

E-121

Re: DIA Landside Terminal Complex
Response to Fire and Life Safety Plan
Project 8908.000 File 101a
Serial #CWF.5416

Dear Reginald:

This letter is in response to our meeting earlier today with you and Emil Gadeken, relating to the status of the building and fire departments' approval of our Fire and Life Safety Plan. As we understand the current direction, the agreements reached with the Building and Fire Departments are now unacceptable to the Airport. The expected cost and schedule impacts related to this design are relatively high. Issues related to fire suppression, smoke control, smoke detection and fire alarm systems, if resolved unfavorably, could cause as much as three to five million dollar impact to the project alone. If issues such as exiting and fire separation are also impacted, some very basic design changes could become required to even construct the complex, and the cost and schedule exposure on these issues is expected to be much greater.

As you know, we submitted our Fire and Life Safety Plan on September 27, 1990. The plan documented our recommendations with respect to code compliance and requested specific waivers of various code requirements which were either impractical or ineffective in the Terminal Complex. The submitted report was developed in close coordination with the PMT. On October 11, 1990, the Building and Fire Departments responded to our plan, endorsing or slightly modifying many of its key aspects. However, they supported these recommendations "contingent on the provision of firefighting personnel, special low-profile firefighting apparatus and a facility in the terminal complex" which would have direct access to baggage handling areas, AGTS tunnels and parking structures.

At the time of their response, there was no agreement as to exactly what was intended regarding the provision of these facilities. The basic idea for this approach was a result of discourse between Fire Department staff and PMT staff. It appeared that there were several opportunities in the design which would facilitate a more rapid response for fire-fighting personnel throughout the Landside Terminal Complex, as well as to adjacent facilities. However, the eventual Fire Department response, which amounted to providing a small fire station inside the Terminal, was clearly more involved than had been envisioned by either the PMT staff or this office. We judged their response as the first step in additional negotiations between City departments to resolve the final scope and cost of this arrangement. This view was corroborated by PMT staff.

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Since that time, there has developed an apparent deadlock between the PMT and the Fire Department, and it is severely impacting our efforts. It is clear to us that the real issues pertain to the location of structural firefighting facility, the size of the facility, access to the Complex, and from what budget the operation is funded. While none of these issues are within our aegis, the fact that they are so unresolved at this late date makes it impossible for us to reach closure on vital areas of concern to both the Airport and our design team. It is difficult for the building and fire departments to take a holistic, creative view of code requirements for this complex when unresolved issues such as those mentioned above are coloring their attitudes.

To this point, our team has been proceeding in accordance with the Fire and Life Safety Plan, as modified by the Building and Fire Departments on October 11, 1990 with the full knowledge and concurrence of the PMT. Our hope is that responsible parties from the various City departments involved, will attempt to negotiate a solution for these "big-picture" issues, so we may more effectively deal with the detailed implementation of our plan. If the PMT elects to abandon this approach, then several months of work have been lost and definite cost and schedule impacts will be felt. This is clearly not in the best interests of any party involved, and from our perspective, represents a big step backward. It seems to us that the groundwork for a very favorable arrangement has been laid; now the parties need to complete the arrangement in a manner that all can support.

Our schedule mandates that we conclude the general Fire and Life Safety issues with the code agencies before the end of this year. This will require an agreement between the PMT and the City agencies. Until recently, we have been led to believe that this was possible, but today's input has dashed our hopes. We need the full attention and resources of the PMT directed at this issue. Please advise us as soon as possible as to your next steps.

Respectfully,

C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.

Brit Probst

Brit Probst
Project Manager

xc: Thom Walsh/CFJBA
John Salisbury/CFJBA
Mike Winters/CFJBA

BLANK PAGES

CITY AND COUNTY OF DENVER

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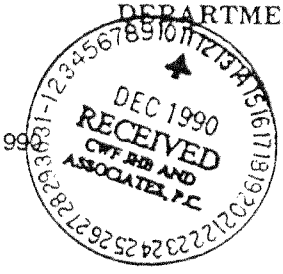

November 30, 1990

C.W.Fentress J.H. Bradburn and Associates, P.C.
1800 Grant Street, Suite 600
Denver, Colorado 80203

Attention: James Bradburn

Contract: E-121, Terminal Complex

Subject: Emergency Power Source/New Denver Airport
Technical Memorandum of Understanding
Revision "C"

Bldg. # 8908	Rm. # 101a	
Jo Pregitzer		✓
Probst		✓
Walsh		✓
Salisbury		✓
Holmgren		✓
Witteveen		✓

Dear Jim:

Attached, please find Revision "C" (dated September 24, 1990) to the Technical Memorandum of Understanding, approved by the Denver Building Inspection Division, Fire Prevention Bureau and New Denver Airport Office. This Revision supersedes all previous issues and all building designs utilizing a second electrical power source as emergency power, must comply with this document.

Included for information is the "Emergency Power Source/New Denver Airport, Statement of Understanding" (dated May 29,1990).

Please note that during the week of October 17, 1990, an unsigned copy of the Technical Memorandum of Understanding was distributed to your office. There is one difference between that copy and the approved copy included with this letter: Item 5.1 -the "trouble alarm" is to report to the Fire Command Center, not the Fire Department.

Please provide these documents to any subconsultants on your design team which may require them and verify that your design complies with the most current, signed version of the Technical Memorandum.

Sincerely,

William E. Smith

William E. Smith, P.E.
Associate Director of Aviation

WES/RRN/em

cc: Rocek H, Haury R, Lindmark H, Norman R, Holmgren R, 11-51.2, Witteveen N

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AIRPORT ENGINEERING OFFICE
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DENVER, COLORADO 80207
(303) 270-1600

MEM 1275

May 29, 1990

TO: Cliff Hennig, Director
Denver Building Department

FROM: Ginger Evans, Chief of Construction
New Denver Airport

SUBJECT: EMERGENCY POWER SOURCE/NEW DENVER AIRPORT STATEMENT OF UNDERSTANDING.

This memorandum supercedes the letter signed by Building Inspection Division and the Fire Department, dated November 16, 1989, concerning emergency power at the new Denver International Airport.

The unique situation at the Denver International Airport of having two independent substations each of which is serviced by multiple generation stations providing power satisfies the requirement of NEC 700-12-d for emergency power being provided by the second service.

The design and installation of the emergency power distribution system shall be approved by the New Denver Airport Office, Denver Building Inspection Division, and Denver Fire Department.

Specific technical issues will be agreed upon in the latest revision of the Technical Memorandum of Understanding.

APPROVED: C. E. Hennig Date 30 May 90
Cliff Hennig, Bldg. Insp.

Paul Spurgeon Date May 30 1990
Paul Spurgeon, Fire Prev.

Ginger Evans Date May 30, 1990
Ginger Evans, New Denver Airport

16 - 5.5.1

EMERGENCY POWER SOURCE/NEW DENVER AIRPORT

TECHNICAL MEMORANDUM OF UNDERSTANDING

ISSUE	A	June 1, 1990 - Issue by Behrent Engineering
REVISION	B	June 4, 1990 - Acceptance by all Parties
REVISION	C	September 24, 1990 - Proposed Revisions Approved in Meeting
REVISION	D	
REVISION	E	

The intent of this document is to provide a format for recording the concurrent understanding of the technical issues (associated with the emergency power source) by the Building Inspection Division. the Fire Department, and the Denver International Airport.

This document is a further development of Mr. Al Horne's letter dated May 11, 1990.

Bold type indicates approved revisions proposed in a review meeting between Denver Building Inspection, Denver Fire Department, New Denver Airport representatives and consultants.

APPROVED:

C. E. Hennig — Date 16 Oct 90

Cliff Hennig, Building Inspection

Paul D. Spurgeon — Date 12 OCT 1990

Paul Spurgeon, Fire Prevention

Ginger Evans — Date 10-17-90

Ginger Evans, New Denver Airport

EMERGENCY POWER SOURCE/NEW DENVER AIRPORT

TECHNICAL MEMORANDUM OF UNDERSTANDING

LIST OF ABBREVIATION

Abbreviation	Remarks
ANSI	American National Standards Institute
DBC	Denver Building Code
NDA	New Denver Airport
NDAO	New Denver Airport Office
NEC	National Electrical Code
NESC	National Electrical Safety Code
PSCo	Public Service Company of Colorado
UL	Underwriters Laboratories Incorporated

REVISION

B 1. Design shall be based on the following alternates:

B A. Alternate #4B (which is attached).

- The emergency transformer shall be sized for the connected emergency load per NEC 220 minimum with NEC 700-5(b) load shedding so the emergency transformer is never overloaded per NEC 700-5(a).

- The load shedding equipment shall be part of the normal service entrance switchgear and the normal service entrance switchgear shall be U.L. labeled. The load shedding sensors may be located outside the service entrance switchgear, if necessary.

- The load shedding device shall be lockable if it has manual adjustment devices so only supervisory personnel have access to the adjustment. It shall be arranged so multiple locks may be used.

B B. Alternate #4B with the load shedding deleted.

- The emergency transformer shall be sized for the connected emergency and normal load per NEC 220.

B C. Alternate #4B with two normal transformers and two emergency transformers.

- The emergency transformers shall be sized for the connected emergency load per NEC 220.

- Delete the load shedding.

B D. Alternate #4B with two normal transformers and one 4160 volt transformer. The 4160 volt transformers would be located inside the building and be NDA owned.

The single PSCo transformers that would provide the 4160 volts for the entire facility shall be sized for the connected emergency load per NEC 220.

1.1 PSCo shall be satisfied that the two sources can not be connected together at the 480 volt level via transfer switches, interlocking (electrical and mechanical), or other approved means.

1.2 NDA and PSCo shall designate a normal source and an emergency source at each building service entrance relative to the building as a given feeder can feed more than one building.

B Each service disconnect shall be labeled and state the area served, location of all other disconnects, and state if it is normal or emergency service.

1.3 Any given 25 kV feeder may be a normal source at one building and an emergency source at a second building.

1.4 North airport substation feeders shall be separated from South airport substation feeders, but any given feeder may be distributed as required.

1.5 It is acceptable to install a single normal transformer to serve a large tenant load.

C 1.6 **Each facility Engineer-of-Record will be responsible for designating "Normal" and "Emergency" power sources once inside the facility.**

C 1.7 **CLARIFICATION: The intent of Items 1.2, 1.3 and 1.4 is to allow PSCO to install, operate, and load balance their system safely, and meet the intent of NEC 700-12(d) (second service) simultaneously. The words "building" and "building service entrance" are used interchangeably in Items 1.2, 1.3 and 1.4.**

C 2. Third-party coordination **(Behrent Engineering for the initial airport construction through Phase 1)** shall be provided to facilitate the observation, review, and approval process of the design and installation of the emergency power distribution system by the **NDAO**, Denver Building Inspection Division, and Denver Fire Department. It is understood that the NEC shall govern on the building side of the service point and the NESC shall govern on the **PSCo**, side of the service point.

C 2.1 **PSCo electrical distribution design will be the responsibility of PSCo. Once the design is complete it will be forwarded to NDA's Project Manager for PSCo Work.**

B C 2.2 The procedure for review of the **PSCo design** is:

- **NDA will forward the design to Behrent Engineering for its review and comments. Behrent will forward courtesy copies to City Inspection and the Fire Department for their concurrent review to determine if the PSCo design** meets the intent of the Alternative #4B concept, this document, and NEC 700 12(d). **Upon completion of his review, the Behrent engineer will staple a letter stating** ". . . I have reviewed these drawings and they meet the intent of Alternative #4B, the intent of the document

2.2 Con't "Technical Memcrandum of Understanding", and the intent of NEC 700 12(d) . . .". The letter shall be stamped and signed. Two complete packages required for review by Denver Building Inspection Division.

Should there be a conflict in interpretation of the "Technical Memorandum of Understanding", NDA will arrange a meeting to resolve the conflict. Turn around time for design review is ten calendar days.

C 2.3 The third-party coordinator's primary responsibility will be to confirm the two utility sources are independent as agreed upon by the items in this document, PSCo drawings, and field observation.

C 3. **The third-party coordinating engineer will observe the PSCo installation and he will report his findings to concerned parties.**

B 4. The primary emergency transformer protection shall be ANSI-37 certified via a "certificate of conformance" from the manufacturer. The emergency transformers shall be con-structed and certified to ANSI-57 via a "certificate of con-formance" from the manufacturer. The transformer secondary protection shall be part of the building emergency distri-bution equipment. The transformer service lateral to the overcurrent protection shall be sized according to NEC 230-90.

5. A "no potential" alarm with an adjustable time delay or equivalent shall be installed at the emergency supply and the normal supply to each transfer switch so that PSCo can be notified and emergency precautions taken if the emergency supply is lost.

C **5.1 Clarification of Note 2 and Note 6 on attached Dwg. #4B: The 3-phase "no potential" alarm on the normal supply and emergency supply at each service entrance shall be monitored through the building fire detection system or equivalent and alarmed at the Fire Command Center. A "trouble" alarm would notify the Fire Command Center of the problem. These circuits should be on dedicated circuits. The monitoring alarm circuits shall be standard fire detection system monitored circuits or equivalent. All three alarms may be grouped into one alarm point per service. There shall be one alarm point per service entrance or equivalent. The Dwg. #4B Note 2 and Note 6 alarms may be grouped into one alarm.**

C 6. The Fire Department shall have control of all sources of power through use of remote shunt trip disconnects located in the Fire Command Centers. The remote shunt trip shall be lockable with a Fire Department limited-access key.

C 7. **In the event overhead service is used within the property limits of NDA, the overhead lines shall be provided with shielding (overhead ground conductor). Intermediate class arrestors should be used at all riser poles to discharge the possible lightning surges to a level safely below the basic insulation level (BIL) of the cable installation.**

8. The bottom of duct banks are planned to be five feet deep which will result in the top of the duct bank being 36 inches below the paving concrete. PSCo should install concrete encased (red dyed), steel reinforced duct banks with warning marker tape. PSCo shall map or make record drawings of all duct banks.

B 9. Total loss of power MUST be expected even on rare occasions of relatively short durations. Proper precautions must, there-fore, be taken. Battery-powered exit fixtures and exit illumination shall be provided throughout the complex in accordance with DBC Div. 1 Section 5910(c) and tested monthly as required by DBC Div. 5 Section 1009f. The batteries MUST be properly maintained.

10. It is assumed that the separate utility sources will not be in phase. The transfer arrangement shall be provided with an in-phase monitor. This would also motor loads to be reconnected without damage.

C 11. Transfer switches having overlapping neutral transfer contacts or four poles should be provided to prevent nuisance tripping of ground fault interrupters. Transfer switches having bypass isolation (which will not connect the two sources) means should be provided to allow proper maintenance without power interruption. Automatic transfer switches should have yearly in-depth **maintenance** testing **and monthly load testing shall be the responsibility of the NDA.** Cleanliness is most important for reliability.

12. The fire pumps shall be diesel powered or electric powered from two utility sources <u>whichever</u> is the preference of the Fire Department.

C 13. **Deleted.**

14. NEC Article 700-12-d states "this service shall be in accordance with NEC Article 230 with service drops or laterals widely separated electrically and physically from the normal service to minimize the possibility of simultaneous interruption of supply".

14.1 "Widely separated" shall mean:

The first source lateral and the second source lateral be separated by twenty-five feet at the point where the laterals enter the building providing the laterals are concrete encased underground, the associated transformers and switch cabinets are separated by twenty-five feet, the transformers and switch cabinets are physically protected by a suitable barrier such as a removable metal guard rail, and that the transformers and switch cabinets are twenty-five feet from a fueling point.

A smaller distance separation than twenty-five feet may be considered in special cases where it can be shown that the likelihood of common mode failure is remote.

15. Separation of the 25 kV Source 1 and Source 2 underground primary conductors are not service laterals; however, inde-pendence of the two sources is important.

B 15.1 It is understood that 25 kV Source 1 and Source 2 feeder conduits are independent providing they are in individual concrete-encased duct banks and manhole systems separated as follows:

- By an expansion strip under protective aprons.
- By approximately three feet (as outlined in the PSCo book "Guidebook for Electric Installation and Use") outside protective apron areas.
- By an expansion strip at crossover points.

The 25 kV Source 1 and Source 2 feeder conduits may be classified as independent if they are both in the same concrete-encased duct bank and if it is shown that common-mode failure is not plausible.

B 15.2 It is also understood that the 25 kV Source 1 and Source 2 concrete-encased duct banks may cross over each other at an angle (separated by an expansion strip) due to the fact that a common mode failure at a crossover point is not plausible.

16. The transfer equipment used on the emergency circuits need to be approved for the use per NEC 700-6. Typically emergency transfer equipment needs to be UL 891 and UL 1008 listed as a minimum.

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF FIRE

OFFICE OF
CHIEF OF FIRE DEPARTMENT
745 WEST COLFAX AVENUE
DENVER, COLORADO 80204

October 15, 1990

Brit Probst, Architect
C. W. Fentress J. H. Bradburn and Associates
1800 Grant Street
Denver, CO 80202

Dear Mr. Probst:

NDIA TERMINAL FIRE DEPARTMENT OPERATIONS CENTER

As suggested by Rolf Jensen and Associates and by your recommendations from our October 11, 1990 meeting, the Denver Fire Department supports, in concept, your request for administrative approval for altering the Denver Building and Fire Code. As outlined in the attached response, administrative approval would be contingent on the provision of special low-profile firefighting apparatus, a facility in the terminal complex at level 3, and firefighting personnel.

Listed below is the programming information you requested for the Fire Department Operations Center in the NDIA Terminal Building:

Architectural Space Program:

o	Low profile apparatus storage area (heated and secured with 8'6" overhead clearance) 20'x40'	800 s.f.
o	Fire Department Operations Center (watch room, access to outside)	200 s.f.
o	Dayroom/Living Area/Kitchen	240 s.f.
o	Office	120 s.f.
o	Quarters for 4 personnel @ 120 s.f. each	480 s.f.
o	Toilets/Showers/Laundry	200 s.f.
o	Storage and Circulation	200 s.f.
		2,240 s.f.

Access for this facility is at level 3 of the west parking structure, with direct access to the baggage handling area, remaining parking structure, and AGTS baggage tunnels. Access should also include a direct route to a freight elevator and stairwells to the other levels of the terminal.

Also enclosed is specification information for the special low profile firefighting apparatus required for this facility. This special apparatus will provide quick fire department response to the unsprinklered parking structures, terminal building, AGTS baggage tunnel, and concourse.

If you have any question or require further clarification, please contact my office at 640-3438, or Steve Rondinelli at the NDAO at 270-1972.

Sincerely,

James V. Monseu

James V. Monseu, Operations Division Chief

JVM:msr
enclosures

cc: Paul D. Spurgeon, Fire Prevention Division Chief
Steve Rondinelli, R.A. Fire Protection Consultant
Emil Gadeken, Chief Code Coordinator, NDIA/SIA
Regional Norman, Project Manager

Chief Morales
FYI

MARCO Combination Attack Apparatus

1 ton
Crew cab
4X4

Designed by Professionals for Urban/Wildland Fire Service

Check Out These Features—

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- High-pressure, low-volume pumping for outstanding wildland fire fighting.
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- Lightweight, compact units ideally suited for today's quick-response vehicles.

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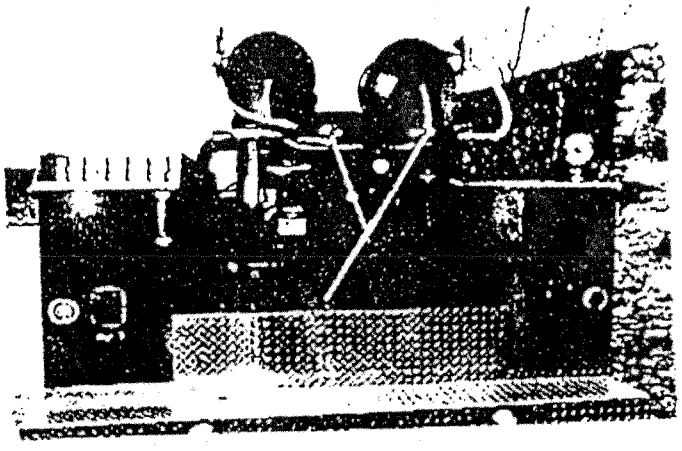

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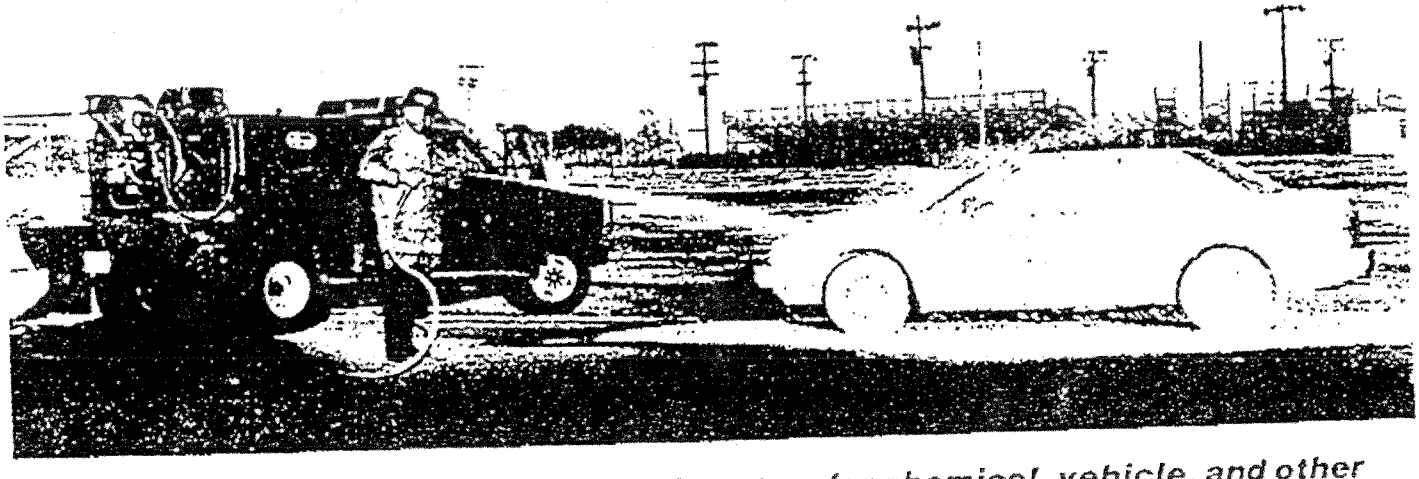

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Outside OK 1-800-527-1574

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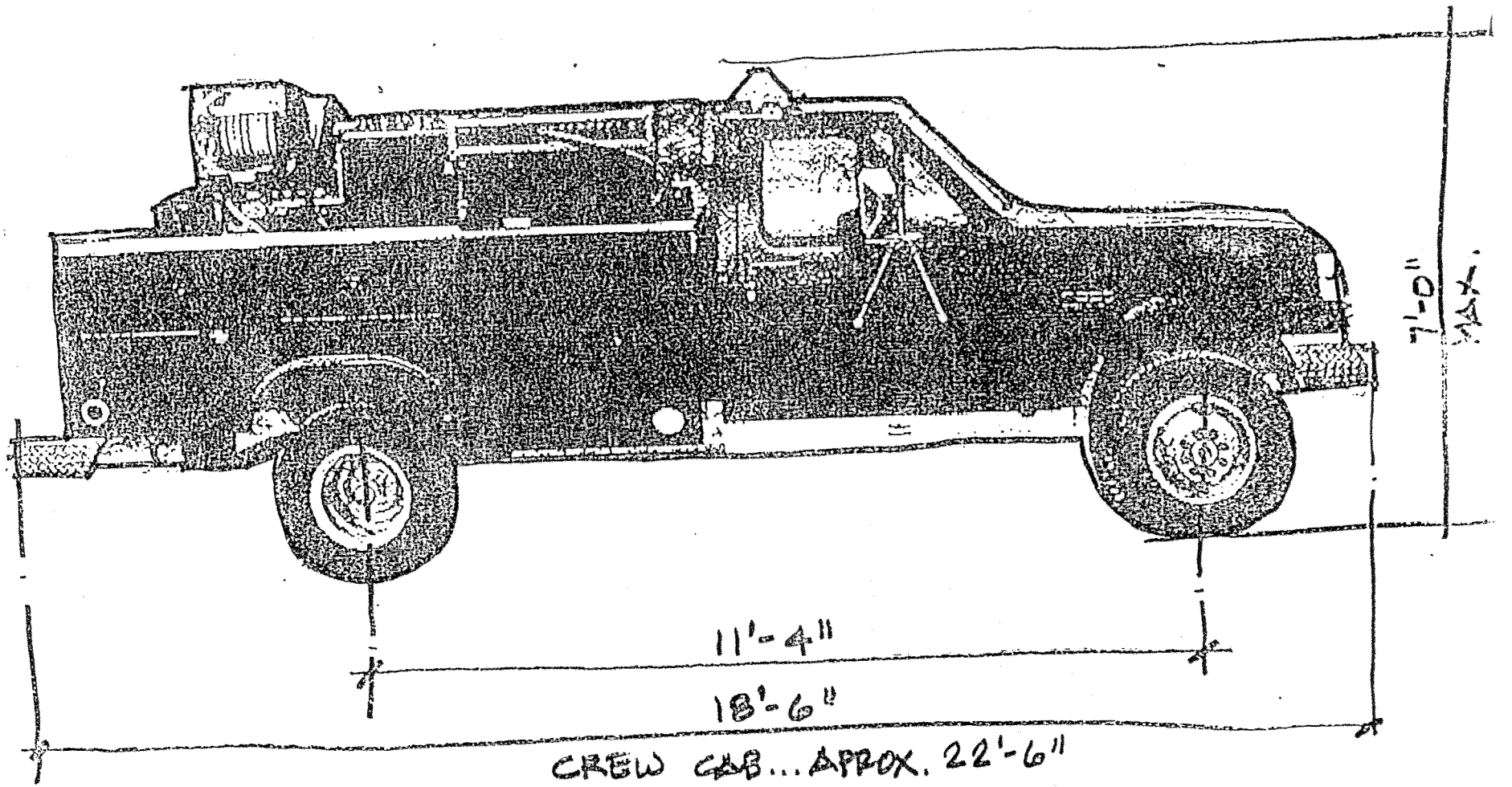
CAB/AXLE = 5'-4"
4x4

APPROX. SCALE.
1/2" = 1'-0".



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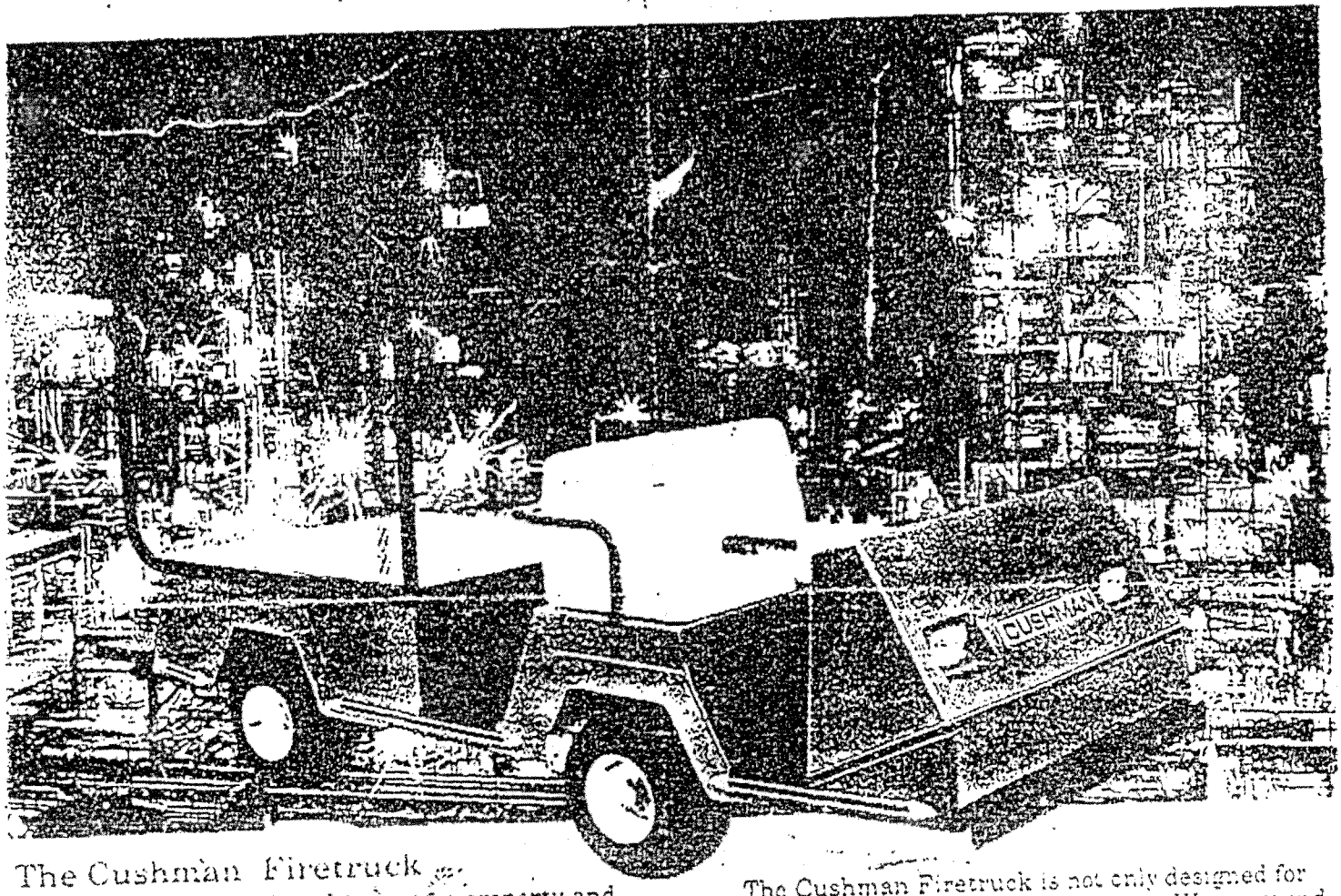

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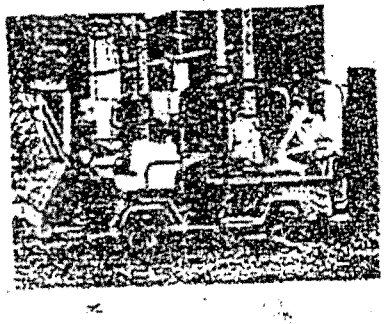
You'll be better equipped to protect property and personnel with the Cushman Firetruck standing at the ready. When an emergency strikes and only seconds separate you from disaster, the Cushman Firetruck responds with outstanding maneuverability. Its 22' outside clearance circle and 47" width brings quick assistance to hard-to-reach locations in tight, confined areas. The fire apparatus mounting structure allows you to rig the Firetruck with specialized materials and equipment appropriate for your plant. A warning siren and strobe light come as standard features.



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CUSHMAN

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PHONE (303) 573-5333

10" wide
192" Long (16')

Specifications

2 Vechiles Spec
Same Dimensions

Cushman® Firetruck
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898372-F2 gas Mod 867

BODY	Heavy-duty reinforced fiberglass with aluminum diamond plate deck
BRAKING	Hydraulic - rear Mechanical - parking
COLOR	Red
OVERALL HEIGHT	46" (1168 mm)
HEIGHT WITH TOP	78" (1981 mm)
OVERALL LENGTH	130" (3302 mm)
OVERALL WIDTH	47" (1194 mm)
OVERALL BED SIZE	44" x 65" (1118 mm x 1651 mm)
OUTSIDE CLEARANCE CIRCLE	22' (7 m)
WEIGHT	645 lbs. w/o batteries — electric 900 lbs. w/o battery — gas
WHEEL BASE	55" (1397 mm)
WHEEL TREAD	36" (914 mm)
SAFETY EQUIPMENT	2 headlights, 2 stop/taillights, electric horn
FRAME	All steel tubular frame for front & rear with side body protection
PAYLOAD	1900 lbs. (862 kg)
MPH MAX. STD.	12 mph. (19.3 km/h)
ENGINE	2 hp, 36-volt — electric 8 hp 4-cycle air-cooled — gas

CHARGER (For model #898371 only)	36 V, 25 AMP DC-115 V AC Built-in Lestronic II
DRIVE	Electric: Direct motor to differential — no belts or chains Gas: Forward and Reverse/ fully-automatic torque converter with helical gear type differential
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MODIFICATIONS & ACCESSORIES AVAILABLE FOR BOTH MODELS 371 F2 & 372 F2
4-wheel hydraulic brake, Seat belts, Special color, Hub caps, Hour meter, Turn signal with 4-way flashers

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Rolf Jensen Report / Alternatives

APPENDIX C

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DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
(303) 640-5522
(303) 640-2540

January 24, 1991

Mr. Brit Probst, Project Manager
C.W. Fentress J.H. Bradburn and Associates, P.C.
1800 Grant Street, Suite 600
Denver, Colorado 80203

RE: DENVER BUILDING INSPECTION DIVISION AND FIRE DEPARTMENT RESPONSE TO DECEMBER 28, 1990, CORRESPONDENCE AND DIA TERMINAL COMPLEX FIRE PROTECTION ALTERNATIVES

Dear Brit:

We concur with the approach of proceeding with the October 11, 1990, modified guidelines of the Rolf Jensen Fire and Life Safety Plan. However, some clarification of the items on page two is warranted and described below:

- Terminal Level 5 and 6 - Maintain special roadway access from the airside area east of the Central Plant as proposed be D.I.A.
- Parking Structure Access - Maintain access to east-west car rental and parking ramp access as proposed by D.I.A.
- Baggage Area/AGTS Tunnel - Access between Baggage Area and the Terminal Parking Structure at level 3 via low-profile vehicle.
- Fire Department Operations Center Terminal Complex - Relocate to level 3 of the Terminal on the east side of the complex.
- Low-Profile Fire Apparatus Parking Spaces - Adjacency to Fire Department Operations Center at level 3 is critical. This space should be in a secured and heated area, (non-terminal fire station) preferably in the Baggage Area.

- Electric Cart Fire Apparatus - Maintain freight elevator size for Fire Department use and provide open space adjacent to the Fire Department Operations Center and at level 5 or 6 adjacent to the freight elevator for electric cart storage.

Please contact Paul Spurgeon at (303) 640-5522, or Steve Rondinelli at (303) 270-1900, or Cliff Hennig at (303) 640-5843, if you should have questions.

Sincerely,

Paul D. Spurgeon, Division Chief
Fire Prevention and Investigation Divison

Cliff Hennig, Director
Building Inspection Divison, D.I.A.

PDS:rs/1-24.pds

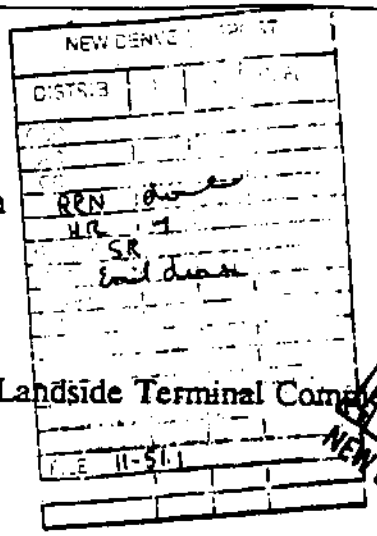
cc: Steve Rondinelli, R.A.
Emil Gadeken, Chief Code Coordinator

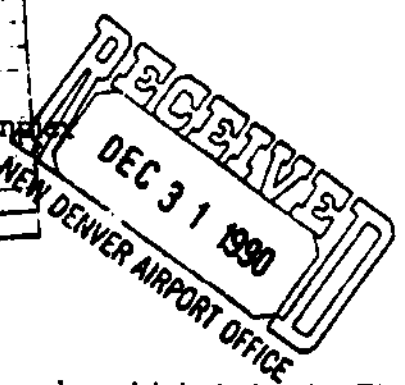
C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.
ARCHITECTURE, INTERIORS, PLANNING

December 28, 1990

E-121

Mr. Cliff Hennig
Director, Building Inspection Division
CITY AND COUNTY OF DENVER
200 West 14th Avenue
Denver, Colorado 80204





Re: Denver International Airport, Landside Terminal Complex
Fire Protection Alternatives
Project 8908.000 File 207.1
Serial #CWF.11615

Gentlemen:

This letter responds to the October 11, 1990 Memorandum, authored jointly by the Fire Prevention Bureau and the Building Inspection Division, which contained your responses to the Fire Protection and Life Safety Plan issued September 27, 1990.

The October 11, 1990 Memorandum indicated that the Building and Fire Departments supported many of the special conditions proposed by the Fire and Life Safety Plan, "contingent on the provision of firefighting personnel, special low-profile firefighting apparatus and a facility in the terminal complex." On October 15, 1990, the Department of Fire issued a letter outlining in greater detail the requirements for the Fire Department Operations Center. Basically, these requirements amounted to a fire station in the Terminal building, which was [redacted] previous discussions, nor was it acceptable to the New Denver Airport Office.

Since these memoranda were issued, it became clear to us that the New Denver Airport Office and the Department of Fire needed to reach an agreement on the location, staffing and funding of Fire Department facilities, both for the Terminal complex as well as for the entire airport. At various times, it appeared that a resolution would be forthcoming. However, to the best of our knowledge, resolution is no closer now than in October.

We have curtailed our contact with your department and the Department of Fire, pending a resolution on these larger issues so we could subsequently conclude the more detailed issues of the building design. [redacted] we can no longer proceed absent detailed interaction with the Building and Fire departments, and the project's schedule requires that we complete the documents by April, 1991. Therefore, we must proceed according to some concensus on how to deal with the unique aspects of this building, as identified in the original Fire and Life Safety Plan.

We believe it is appropriate to proceed in accordance with the conclusions stated in your October 11, 1990 Memorandum. These conclusions are sensible and defendable based strictly upon good engineering practice and upon the provision of enhanced life safety systems which would not normally be required. The question of the location and staffing

1600 GRANT STREET SUITE 600 DENVER, COLORADO 80203 FAX: 303-830-1033 303-830-1600

of Fire Department facilities needs to be resolved as soon as possible to the mutual satisfaction of all parties involved; however, it is beyond our aegis to deal with this issue. Our position is that the City and County of Denver has an irrefutable responsibility to make provisions for firefighting facilities with reasonable access to the Terminal Complex. Given that this must occur, we should be able to proceed with the design of the Terminal complex. Once there is greater clarity as to the final location of firefighting faciities, we will then re-evaluate detailed issues of access to each element in the complex.

We therefore request your endorsement of this approach: We will continue to develop the design in accordance with the guidelines developed in the Fire and Life Saftey Plan as modified by the October 11, 1990 Memorandum issued jointly by the Fire Prevention Bureau and the Building Inspection Division. The basic building design will continue to be developed in a manner which allows access between Level 3 of the Terminal and Garages, thereby maximizing firefighting access throughout the complex as well as into the tunnels. The Fire Department Operations Center will be as described in the report and will continue to be located at Level 3 of the Terminal on the west side of the complex. (Alternate locations may be acceptable, if so desired by the Fire Department). Adequate clearance for special low-profile firefighting apparatus will be maintained throughout the parking garages, and parking spaces adjacent to the Fire Operations Center can be made available. Also, in response to requests from the Fire Department, elevators at the north end of the Terminal have been increased in size so an electric cart apparatus could also be employed by firefighting or other emergency personnel at all levels of the Terminal.

We believe the above represents a reasonable solution which affords excellent life safety provisions for the complex. We request your response at your earliest convenience and would be happy to meet with you to discuss this further.

Respectfully,

C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.

Brit Probst

Brit Probst
Project Manager

BP:kjh
xc: Reggie Norman, Emil Gadeken/NDAO
Paul Spurgeon/DFD
Steve Rondinelli/DFD/DIA
Peter Bemelen/DBID
Dennis Reseutek/POUW
Thomas Walsh, John Salisbury/CFJBA

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CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
(303) 640-5522
(303) 640-2540

October 11, 1990

TO: Brian Olson, Fire Protection Engineer
Rolf Jensen & Assoc.

Brit Probst, Architect, C.W. Fentress
J.H. Bradburn and Assoc.

FROM: Paul Spurgeon, Division Chief Fire Prevention FDS
Cliff Hennig, Director Building Inspection Division

SUBJECT: **DIA TERMINAL FIRE PROTECTION ALTERNATIVES as presented in September 27, 1990. Fire Protection and Life Safety Plan by Rolf Jensen & Associates.**

The Fire Department and Building Inspection Division supports these recommendations contingent on the provision of firefighting personnel, special low-profile firefighting apparatus and a facility in the terminal complex. This facility shall have direct access to the baggage handling areas, AGTS Tunnels and parking structures.

1. EXITING - PROPOSED CONDITION

The maximum travel distance to an exit will be in compliance with section 3303 (d) except that in the Great Hall a maximum travel distance of 300 feet will be used.

Exterior exit doors will be provided that discharge to the upper open roadway and to the lower covered roadway. The roadways are open to the outside on both sides. Automatic sprinkler protection will not be provided for the roadways (see Code Considerations Roadways).

Horizontal exits may be used for exiting more than 50% of the occupants from the Bag make-up room and interior stairs. Horizontal exits in this location discharge into the Level 4 Arrivals Curbside.

Building and Fire Prevention Recommendations:

- **Add exit stairs to discharge level on north end of terminal from level 5 and 6. (as shown on submitted exit study).**
- **Permit increased travel distance at levels 5 and 6 of Great Hall only. (Maximum travel distance not to exceed 300 ft as suggested).**
- **Maintain automatic smoke control operation and sprinkler protection as discussed in items 2 and 4.**
- **Exiting concerns with AGTS platform and previous timed exit analysis.**

2. FIRE PROTECTION FOR "GREAT HALL" - PROPOSED CONDITION

The Landside Terminal Building will be fully sprinklered in accordance with the Denver Building Code. In the Great Hall Automatic Sprinkler protection will be provided by means of sidewall sprinklers to protect the level six areas open to the Great Hall. Sprinklers will not be provided over the level five portion of the Great Hall as permitted by code.

Building and Fire Prevention Recommendations:

- **Provide extended coverage side wall sprinkler protection for all side wall conditions adjacent to "Great Hall" from levels 5 and 6. (Note: Requires special architectural detail to create heat trap to activate sprinklers.)**
- **Verify standpipe placement will meet all 200 ft. travel distances. (maintain location at stairwells as shown.)**
- **Identify areas in the "Great Hall" where Kiosks would be permitted. Provide pre-plumbed fire protection stub-in from the floor level. Kiosks greater than 56 sq. ft. with roofs shall be provided with automatic sprinkler protection.**
- **Develop written administrative policy for Building Inspection Division, Fire Prevention Bureau and Airport approval regulating and prohibiting the use of all non-sprinklered "Great Hall" circulation areas including connecting bridges at level 6.**

3. SMOKE DETECTION - PROPOSED CONDITION

The requirement for smoke detectors in areas where the space is more than 25 feet high affects the Great Hall and Bag Make-Up Level 3, where ceiling heights greatly exceed 25 feet.

In lieu of placing area spot type smoke detectors below the fabric roof it is proposed that projected beam type smoke detectors be used, spanning the width of the Great Hall and spaced appropriately 50 feet apart. These detectors can be cross zoned.

Smoke detectors in addition to sprinklers should not be installed in the 300,000 sq. ft. Bag Make-Up Level 3.

Building and Fire Prevention Recommendations:

- **"Great Hall Condition"... Beam detection installed according to manufactures specifications (justify 50'- 0" referenced in report) must be cross-zoned for smoke exhaust operation.**
- **Bag Make-up . Level 3... smoke detection in this area with ceiling heights greater than 25'-o" may be deleted with use of "quick-response" sprinkler technology, duct-detection and pull stations.**

4. SMOKE CONTROL - PROPOSED CONDITION

A smoke control system will be provided in the terminal building. The system will be zoned consistent with horizontal and vertical barriers, automatic sprinkler system zones and fire detection and alarm zones. Each zone will have the capability to be exhausted (100% exhaust) or pressurized (100% fresh air supply).

The normal building HVAC system will be used for smoke control except that dedicated smoke exhaust fans will be provided at the top supports of the fabric roof structure and for pressurization fans at stairway and designated hoistways.

All smoke control functions will be initiated manually by fire fighting personnel from the Fire Department Operations Center, except for pressurization of stairwells and elevator hoistways.

A graphic control panel will be used to identify each zone and provide the controls so that each zone can be put into exhaust or supply on an individual zone basis.

Building and Fire Prevention Recommendations:

- **Exhaust conditions utilizing HVAC equipment or dedicated exhaust fans and pressurization of stairways and hoistways for smoke control will be automatic. Automatic exhausting will occur in the fire alarm, sprinkler and smoke control zone only. This automatic activation will occur with activation of either the fire alarm or fire protection system for that zone. Manual operation from the F.D. operation center will be permitted for additional exhausting capabilities and pressurization activities (including introducing 100% outside air through the HVAC system.)**
- **Provide access and maintenance information on smoke exhaust fan units located at the top of roof supports.**
- **Smoke control zones greater than corresponding sprinkler and fire alarm zones requires administrative approval.**

5. DRAFT STOPS - PROPOSED CONDITION

It is proposed that no draft stops be provided. In the Great Hall the fabric roof will provide a natural draft curtained area at each pole, forming collection points for smoke. At the top of each pole smoke exhaust fans will be provided. In all other areas of the building, smoke control systems and sprinkler systems will limit smoke spread in lieu of the draft stops.

Building and Fire Prevention recommendations:

- Agencies concur with deletion of draft stops in the "Great Hall" due to the design and arrangement of the "teflon-coated fiberglass steel supported structure".
- Draft stops in other areas as required by DBC5907 are still required.

6. ROADWAYS - PROPOSED CONDITION

It is proposed that the covered roadway not be provided with automatic sprinklers.

The sidewalks on the roadways lead to an at-grade dispersal area, although the width of the sidewalk is not full exit width of the Terminal. It should be noted that once the occupants have exited the Terminal onto the Public Way (i.e. the curbside) their exit path is accomplished. At the curbside, which is about 20 feet wide, the are at the point where emergency vehicles and personnel have ready access to them.

There is a 40 foot separation between the terminal and parking structure. In addition, there is no exposure hazard.

Building and Fire Prevention Recommendation:

- **Due to the life safety importance of this public way and dispersal area, the roadways must be protected with a dry pipe sprinkler system. Area of coverage requires further discussion.**
- **Provide stairs for firefighter access from level to level at roadway area.**

7. OPEN PARKING STRUCTURE - PROPOSED CONDITION

The open parking garage should not be provided with automatic sprinkler systems. Adequate openings will be provided to meet the code requirement that all areas of every tier be within 200 feet of the required openings.

Also, it is proposed that a special piece of Fire Department apparatus be provided that can negotiate the low ceiling heights and turning radius found in the garage.

The code requires the construction of the parking garage to be Type II-FR. The structure has been upgraded to Type I.

Building and Fire Prevention Recommendations:

- **Agencies concur with deletion of sprinkler protection in the open parking structures under the following conditions:**
  - **A. Class III standpipe system with water supply controlled by an electric valve and switch from each standpipe cabinet.**
  - **B. Maintain "open parking structure" per DBC definition.**
  - **C. Sprinkler adjacent roadway and public way as required in item #6.**
  - **D. No dispensing or storage of fuel as outlined in item #10.**
  - **E. Dry sprinklers required in parking structure area adjacent to terminal at levels 1, 2 and 3. (Coverage is from terminal too open canyons in parking structures.)**

8. SPECIAL FLOOR OPENINGS - PROPOSED CONDITION

In several areas of the floor slab which separates the AGT station from Level 5, glass block is desired so that natural light can enter. Glass block rated for 45 min opening protection will be used in addition to locating side wall sprinklers adjacent to the floor openings, t the AGT Level and in the level six floor adjacent to the Great Hall.

Building and Fire Prevention Recommendations:

NOT ACCEPTABLE...does not meet 2hr. horizontal separation requirement

- **Provide additional information regarding, structural capabilities and 45 min fire tests of glass blocks in horizontal installation. How is glass block protected by side wall sprinklers @level 6, approximately 50-75 feet away?**

9. UNPROTECTED STEEL ROOF SUPPORTS - PROPOSED CONDITION

It is proposed that the fabric roof system and the structural columns supporting the fabric roof be of unprotected steel construction, including the first 25 feet of column.

- **NOT ACCEPTABLE...** also concerned with conditions of unprotected steel at HVAC equipment levels.

10. FUEL DISPENSING IN PARKING STRUCTURES

- Although not proposed...the UBC and UFC does not permit fuel dispensing in any structure as suggested by previous submittals.

cc: Steve Rondinelli, R.A. Fire Protection Consultant, DFD/DIA
Pete Bemelen, P.E., DBID
Reginald Norman, Project Manager, NDAO
Emil Gadeken, Chief Code Coordinator, NDAO

100802
SR/p

APPENDIX C

D.I.A. Interpertation

C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.
ARCHITECTURE, INTERIORS, PLANNING

RECEIVED
MAY 14 1991
STAPLETON ENGINEERING

May 1, 1991

E-121

Mr. Reginald Norman
Assistant Project Manager
NEW DENVER AIRPORT OFFICE
Stapleton International Airport
Main Terminal, Fourth Floor
Denver, Colorado 80207

Re: DIA Landside Terminal Complex
Black & Veatch Fire Protection Letter (BLAK.00199)
Project 8908.000 File 101a
Serial #CWF.5708

Dear Reggie:

Attached please find one (1) copy of a Black & Veatch letter (BLAK.00199) regarding fire protection issues related to the Main Terminal Building. The issues are presented for clarification and/or further evaluation.

Please review these issues and respond with either your agreement or specific direction to the contrary.

Your quick attention to these matters is greatly appreciated.

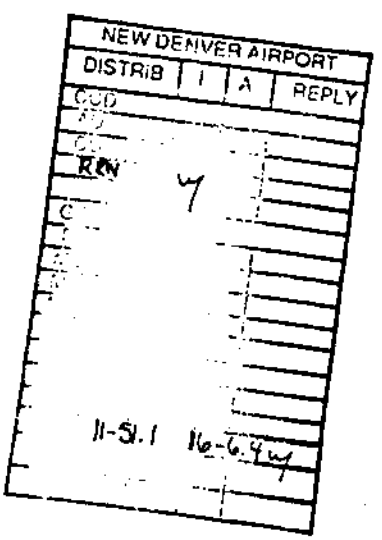
Respectfully,

C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.

Thomas J. Walsh

TJW:kjh

xc: Brit Probst/CFJBA



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BLACK & VEATCH
14400 South Power Street, Suite 200 Aurora, Colorado 80012, (303) 671-4200, Fax (303) 671-4285

C.W. Fentress J.H. Bradburn
New Denver Airport

B&V Project 16900
B&V File A19A/A08L
April 22, 1991
Serial No. BLAK.00199

C.W. Fentress J.H. Bradburn
and Associates, P.C.
1800 Grant Street, Suite 600
Denver, Colorado 80203

Subject: Fire Protection

Dear Thom:

The following is a list of items that we would like to present to the PMT for clarification and/or further evaluate.

1. We are presently not providing sprinkler protection under the bridges that span the Great Hall at Level 6.

   If the Great Hall were sprinklered, there would be a reason for sprinklers under the bridges--the overhead sprinkler discharge floor coverage would be obstructed by the bridge width. Since the Great Hall is not sprinklered, putting sprinklers under the bridges will serve no purpose and be of no protection value.

2. The second issue that requires clarification is the recommendation from CCD in their October 11, 1990 letter to use Early Suppression Fast Response (ESFR) heads in the Baggage Make-Up area in lieu of our smoke detection.

   Our present design utilizes regular sprinkler heads discharging 0.20 gallons per minute (gpm) per square-foot over a 3,000-square-foot area of operation. We recommend our design over the ESFR system based on the following discussion.

There have not been any fire tests conducted using ESFR heads in a high ceiling, uncompartmentalized, open area similar to the Baggage Make-Up area; NFPA Standard 13 mandates that ESFR heads may only be used to protect hazards and configurations where their use has been proven by tests.

If we use ESFR heads, we would only have to hydraulically calculate the most hydraulically remote 12 heads, based on NFPA Standard 13, Chapter 9. This means we would only have to calculate an area of operation of 1,200 square feet, since each head covers 100 square feet. In our professional opinion, if we use ESFR heads and only calculate 1,200 square feet, with this high ceiling we will be opening many ESFR heads beyond the area of operation. The ESFR heads will not, in our opinion, initiate early fire suppression of the combustion by fusing and discharging from that height. With the ceiling height, occupancy and uncompartmental conditions of the area in question, we are confident that the use of regular heads, and a calculated area of operation of 3,000 square feet, will best serve the protection of this area.

We therefore, request a reevaluation of using ESFR heads and propose to use regular heads using 0.20 gpm per square-foot over 3,000 square feet as presently designed.

3. We have reviewed the kiosk's areas of the Great Hall in more detail and the possibility of protecting them with self-contained sprinkler systems has been evaluated and have been found to be impractical. We understand that the minimum size of kiosk's with roofs requiring protection is 56 square feet. Even these small kiosk's would require two or three heads, and with each head discharging 28 to 32 gpm, we would be looking at a 900 to 1,000 gallon pressure tank for a 30 minute discharge. This is not practical.

   We are in agreement that the sprinkler supply piping for the kiosk's be run below the Level 5 floor and supplies stubbed up at each established potential kiosk's location. Each supply stub-up would have a control valve and a connection coupling. This would allow the connection of the kiosk's sprinkler system to be a closed supply pipe, which would not entail shutting down the floor below sprinkler system protection to make the connection. Each kiosk's control valve would be supervised to maintain valve position reliability. This concept will require your consideration in

C.W. Fentress J. H. Bradburn
New Denver Airport

B&V Project 16900
April 22, 1991

providing us preferred locations of the stub-up for any possible proposed kiosk layout. We will await your proposed layout before proceeding.

4. Another concern is the fire pump bypass. The fire pump bypass is required when the pump suction supply has adequate pressure and volume to offer some protection should the fire pump be out of service. A double-check valve backflow preventor is required on the suction side of the fire pump. This backflow preventor has a control valve on the upstream and downstream side to allow isolating the backflow preventor should it require removal, repair, or servicing. Good fire protection engineering and to be in compliance with NFPA Standard 20 would dictate that the bypass should take suction on the supply side of all control valves, and discharge into the pump discharge downstream of all pump control valves. To do this would require an additional backflow preventor in the bypass. We have been told that the fire department has directed that the bypass for the other fire pumps, in the NTSA area, be connected to the pump supply on the downstream side of the backflow preventor. This can present some major problems as indicated by the attached sketches. Please obtain direction from the PMT as to which bypass arrangement they will accept. We recommend Arrangement 1.

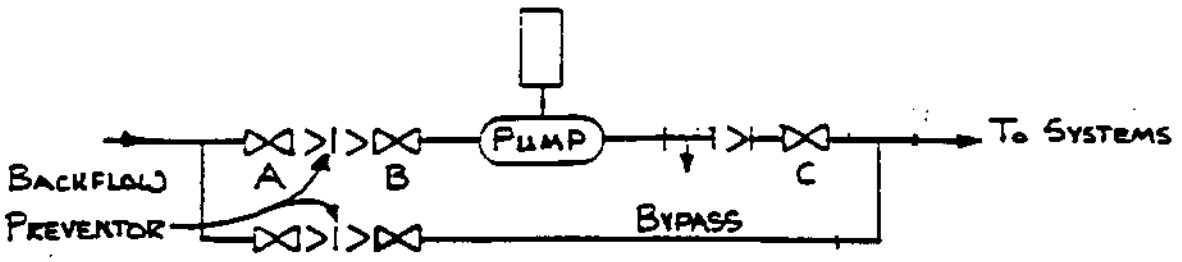
Very truly yours,

BLACK & VEATCH

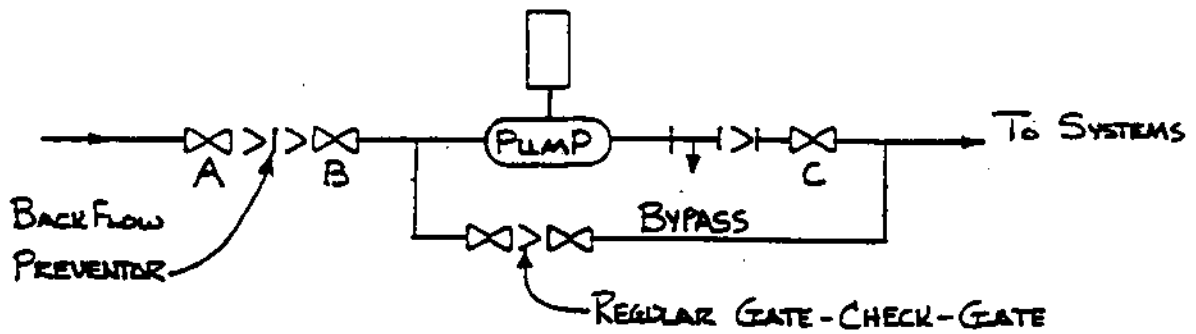
Scott J. Jack
Project Manager

alh
Enclosure

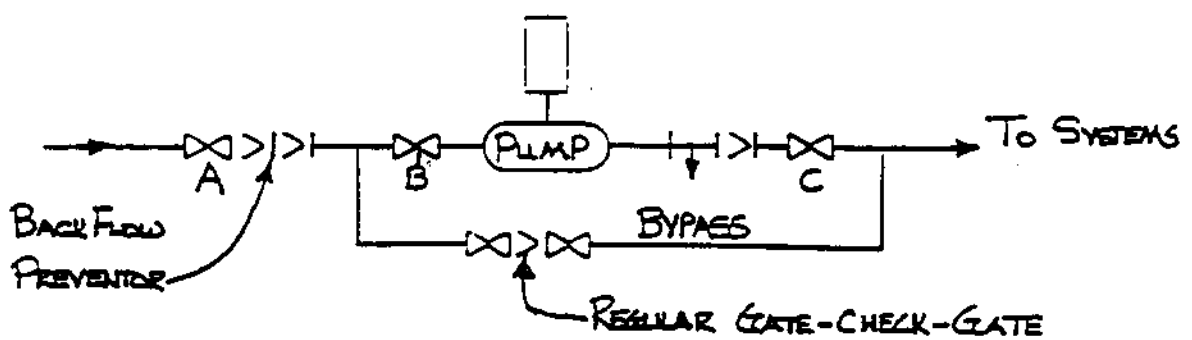
cc: Mr. Walt Coon, w/enclosure
Mr. Tim Heil, w/enclosure



BYPASS ARRANGEMENT 1. Connect bypass arrangement. Pump can be isolated by closing valves B and C. Backflow can be isolated by closing valves A and B. In both cases the bypass remains active.



BYPASS ARRANGEMENT 2. If valves A and B are closed to isolate backflow preventor, neither the bypass or pump are in-service. If valves B and C are closed to isolate fire pump the bypass is not in-service.



BYPASS ARRANGEMENT 3. Closing valves A and B to isolate backflow preventor the bypass and pump are out-of-service. Closing valves B and C will isolate the pump and the bypass is in-service.

FEDERICO PEÑA
Mayor

CITY AND COUNTY OF DENVER

DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
(303) 640-5522
(303) 640-2540

June 6, 1991

Mr. Thomas J. Walsh
C. W. Fentress J. H. Bradburn and Assoc. P.C.
1800 Grant Street, Suite 600
Denver, Colorado 80203

Dear Mr. Walsh:

RE: DENVER BUILDING INSPECTION DIVISION AND FIRE DEPARTMENT RESPONSE TO MAY 1, 1991, CORRESPONDENCE REGARDING CLARIFICATION OF DIA TERMINAL COMPLEX FIRE PROTECTION ALTERNATIVES

Provided below is our response to your attached inquiry. This correspondence amends the Rolf Jensen Report and Fire Protection Alternatives with respect to those sections referenced in this document only.

1. Concur that with the Great Hall area of the terminal building not being sprinklered the deletion of sprinkler protection under the bridges spanning the Great Hall at Level 6 is acceptable.

2. Design sprinkler system in Baggage Make-up area at Level 3 to .20 gpm/3,000 square feet instead of ESFR design as referenced previously. Sprinkler heads should be in the 165 - 212 degree temperature range.

3. Concur with your analysis, self-contained sprinkler systems are not acceptable to Building Inspection Division and the Fire Prevention Bureau. Suggest preplumbing for fire protection based on PMT recommendations for location of these kiosk units greater than 56 square feet.

4. Arrangement #3 most closely resembles the attached NFPA 20 diagram for the fire pump bypass and backflow arrangement required by the DFD. The Fire Department assumes that for routine maintenance of the fire pump and backflow preventor fire protection will be discontinued on a temporary basis. The Fire Department connection permits us to augment the fire protection should the system be shut down for any reason.

Please contact me at (303) 270-1900 or Paul Spurgeon at (303) 640-5522, or Cliff Hennig at (303 640-5843, if you have questions.

Sincerely,

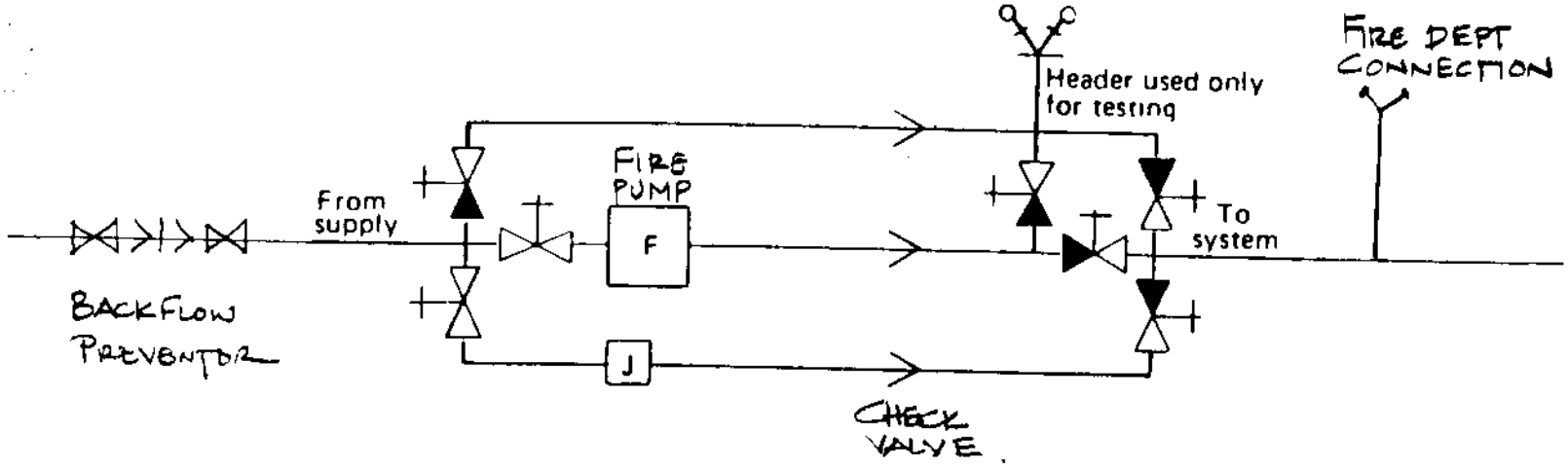
Steve Rondinelli, R.A.,
Senior Fire Protection Engineer
Fire Prevention Bureau

SR:rs/6-3.pds

cc: Emil Gadeken
R. Norman

Paul D. Spurgeon, Division Chief
Fire Prevention/Investigation

C. E. Hennig 6 June 91
Cliff Hennig, Director
Building Inspection Division


Header used only for testing
FIRE DEPT CONNECTION
FIRE PUMP
From supply
F
To system
BACKFLOW PREVENTOR
J
CHECK VALVE

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF PUBLIC WORKS

BUILDING INSPECTION DIVISION
200 W. 14th Avenue
Denver, Colorado 80204-2700

FIRE PROTECTION
ELEVATOR SHAFTS AND ELEVATOR MACHINERY ROOMS
IN FULLY SPRINKLERED BUILDINGS

Effective Date July 1, 1991
(This policy is not retroactive)

Sprinklers shall be installed throughout the premises, including elevator machinery rooms and at the top and bottom of elevator shafts in buildings that are required by the Denver Building Code or Fire Code to be fully sprinklered.

Locations and Coverage

Sprinklers shall be installed in elevator machinery rooms, at the top of elevator shafts, and at the bottom of elevator shafts. Sprinkler coverage shall be designed for Ordinary Hazard Group One. Sprinkler heads shall be high temperature classification (286°F).

System Design

The sprinkler heads in the elevator shaft and in the elevator machinery room shall be supplied from a separate, independent sprinkler branch line with a readily accessible indicating shut-off valve located outside of the shaft or machinery room. Valves shall carry identification signs.

In buildings over 4 stories in height, the sprinklers in the elevator shaft/machine room shall be supplied from a pre-action system to assure that elevator recall is complete before water is delivered to the sprinkler heads. In buildings of 4 stories or less, where elevator recall time is relatively short, a pre-action system is recommended, but is not required. A pre-action system prevents water damage should sprinkler piping or heads become physically damaged.

At least one smoke detector shall be located in the same area of each sprinkler head. Activation of any one of these detectors shall cause recall of the elevator(s) and also put the building into alarm.

In addition to the smoke detectors, at least one rate-or-rise thermal detector, with 135°F fixed temperature, shall be installed in the same area of each sprinkler head. The circuitry for the thermal detectors shall be separate from the circuitry for the smoke detectors. The thermal detector circuitry shall be interlocked with elevator control circuitry that can "verify" that elevator recall has been completed and that all cars are at a floor with the doors fully open. When any thermal detector is activated and all cars are at a floor with doors fully open, a shunt-trip circuit breaker shall automatically disconnect all electrical power to the elevator machinery room and the elevator machinery. When the sprinkler system is a pre-action system, the pre-action valve shall also be automatically opened at this time.

Sequence of Operation

Fire in the elevator machine room and/or the hoistway: A smoke detector would place the building in an alarm condition and cause recall of the elevator(s). Subsequently, a thermal detector would go into alarm and operate a shunt-trip circuit breaker to disconnect all electrical power to both the elevator machine room and within the hoistway. The shunt trip could operate only if the cars were at a floor with the doors fully open. At the same time, if the sprinkler system is a pre-action system, a valve would open and allow water to charge the sprinkler piping in the elevator machine room and/or hoistway. As the fire gains intensity, a sprinkler would fuse and extinguish the fire.

Specific Code References:

National Fire Protection Association Standard 13 4-4.7 Elevator Stairs and Floor Openings. Vertical Shafts. "One sprinkler shall be installed at the top of all shafts... When accessible shafts have noncombustible surfaces, one sprinkler shall be installed near the bottom."

The Uniform Building Code, Chapter 3804: "Sprinklers shall not be omitted from any room merely because it is damp or of fire resistive construction", approved future amendment "or contains electrical equipment."

Safety Code for Elevators and Escalators ASME/ANSI A17.1 Rule 102.2(c) "Standard sprinkler protection conforming to the requirements of ANSI/NFPA No. 13 may be installed in these spaces, subject to the following: .... (4) Means shall be provided to automatically disconnect the main line power supply to the affected elevator prior to the application of water. This means shall not be self-resetting... ."

C. E. Hennig 17 April 91

Clifford E. Hennig, Director
Building Inspection Division

Paul Spurgeon 4/18/91

Paul Spurgeon, Chief
Fire Prevention Bureau

CITY AND COUNTY OF DENVER

WELLINGTON E. WEBB
Mayor

DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
(303) 640-5522
(303) 640-2540

MEMORANDUM OF UNDERSTANDING AND INTERPRETATION
August 14, 1991

RE: **FIRE PROTECTION OF ELECTRICAL ROOMS IN FULLY SPRINKLERED BUILDINGS - POLICY EFFECTIVE SEPTEMBER 1, 1991**

This policy is being implemented by the City at a time when most basic design work and most construction contracts for the new airport complex have been completed. Because this policy becomes effective September 1, 1991, it would be applicable to only part of the airport complex. Recognizing that this policy is being implemented in the latter stages of this project's design program; and in an effort to achieve consistency throughout the new airport complex, it is agreed that all electrical rooms in the AGTS Tunnel and Baggage Structure, Terminal Complex/Parking Structures, Concourses A, B, C, and the Airport Office Building will not be sprinklered but will be provided with smoke/ionization detector(s) connected to the fire alarm system.

Sprinkler protection will be required in the electrical rooms of all other buildings at the airport complex. DIA agrees to reflect changes to the specifications regarding this policy and direct consultants accordingly of future facilities not covered by this interpretation and agreement.

C. E. Hennig 6 Sept 91
Cliff Hennig, P.E., Director, Building Inspection Division

Paul D. Spurgeon
Paul D. Spurgeon, Division Chief, Fire Prevention & Investigation

Ginger Evans Sept 9, 1991
Ginger Evans, Chief of Construction, DIA
SR:rs/8-14.sr

CITY AND COUNTY OF DENVER

WELLINGTON E. WEBB
Mayor

DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
(303) 640-5522
(303) 640-2540

August 8, 1991

MEMORANDUM OF INTERPRETATION AND ADMINISTRATIVE APPROVAL

RE: DIA/ARFF STATIONS - One-hour Fire Rated Corridor

The Denver Building Code Section 3309(d) requires a one-hour fire rated corridor connecting the stairs to the storage and observation levels and the exterior of the building. However, due to the limited area and occupancy of the ARFF/FAA observation level (less than 1500 square feet and fifteen occupants), a fully sprinklered facility and maintaining one-hour fire separation between the storage and mechanical/electrical rooms at Level 2, the rating of this corridor to the exterior is not required.

Paul D. Spurgeon, Division Chief
Fire Prevention and Investigation Division

C. E. Hennig 6 Aug 91
Cliff Hennig, Director
Building Inspection Division

Ginger Evans, Chief of Construction
Denver International Airport

SR:rs/7-31(2).sr

6/11/91

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF PUBLIC WORKS

BUILDING INSPECTION DIVISION
200 W. 14th Avenue
Denver, Colorado 80204-2700

FIRE PROTECTION OF ELECTRICAL ROOMS
IN FULLY SPRINKLERED BUILDINGS
Effective date September 1, 1991
(This policy is not retroactive)

In buildings that are required by the Denver Building or Fire Codes to be fully sprinklered, automatic sprinklers shall be installed throughout the building, including rooms having spaces dedicated to electrical switchboards, electrical panel boards, electrical distribution boards, and/or electrical control boards.

EXCEPTION:

Automatic sprinklers shall not be required in electrical rooms when all of the following conditions are met:

1. The room is separated from the rest of the building by not less than a one hour fire resistive occupancy separation.
2. The room contains electrical equipment operating above 600 volts.
3. The room is dedicated to electrical distribution equipment only.
4. The room is provided with smoke/ionization detector(s) connected to a fire alarm system monitored by a Central Station.

SYSTEM DESIGN

Sprinklers shall be installed to comply with National Fire Protection Association Standard 13 for the Installation of Sprinkler Systems. The occupancy classification is light hazard. Heads shall be flush type, or shall be protected from mechanical damage with listed guards. Heads shall be high temperature classification (250°to 300°F). Only the sprinkler branch lines necessary to protect the room may penetrate into the room.

CODE REFERENCES

.NFPA 13 Formal Interpretation 83-10, Reference 4-1.1.1
.NEC Section 384-4
.ICBO Formal Interpretation UBC Section 3804, UFC Section 10.308

C. E. Hennig
Cliff Hennig, Director
Building Inspection Division

Paul D. Spurgeon
Paul Spurgeon, Chief
Fire Prevention Bureau

11 June 91

Section 4306 (j)

Q: Please clarify the use of subducts in lieu of fire dampers at shaft openings.

A: Section 4306 (j) contains the requirements for protection of openings for ducts penetrating shafts. Item 3 of this subsection contains an exception which covers subducts as shown in Figure No. 3. The 22-inch vertical extension of the steel air subducts is permitted into the shaft enclosure without protection of the fire damper at the point of penetration.

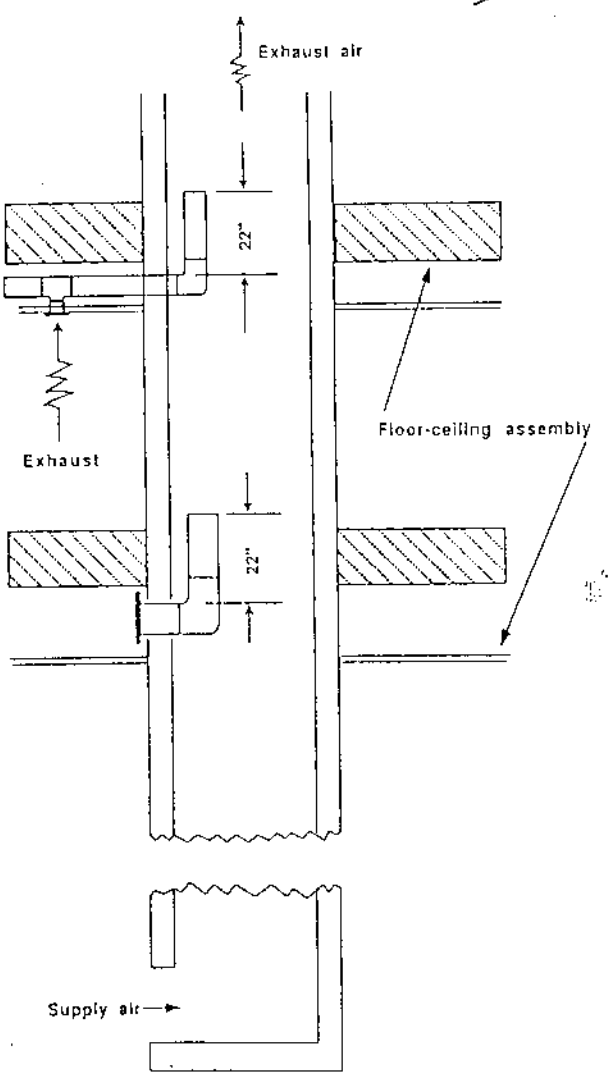


Figure No. 3

Section 10.308
U.B.C. Section 3804

Q: Does U.B.C. Section 3804 (U.F.C. Section 10.308), Item 1, allow the omission of sprinklers from rooms containing high-voltage electrical control equipment?

A: No. The intent of U.B.C. Section 3804 has been clarified with regard to electrical equipment in the 1990 Accumulative Supplement and this revision will appear in Article 10 of the 1991 Uniform Fire Code. The new text allows the omission of sprinklers as follows:

> When sprinklers are considered undesirable because of the nature of the contents or in rooms or areas which are of noncombustible construction with wholly noncombustible contents and which are not exposed by other areas. Sprinklers shall not be omitted from any room merely because it is damp, of fire-resistive construction or contains electrical equipment.

High-voltage electrical equipment can be expected to be de-energized by overcurrent protection devices immediately upon the application of sprinkler water, thereby eliminating the electrical hazard. If the concern relates to a potential accidental discharge or leakage, we suggest the use of an auxiliary pre-action valve which maintains system piping dry in the protected areas until a smoke-detection system senses smoke in the area. Water would then be released into the piping, but would not be discharged until adequate heat was present to fuse a sprinkler. Such a system is relatively fail safe with respect to accidental discharge and leakage and meets code requirements for automatic fire-extinguishing system protection.

Item 1 in U.B.C. Section 3804 is intended to give the building official and the chief some latitude in requiring sprinklers if a designer can demonstrate, based on testing or other satisfactory methods, that application of sprinkler water creates a significant problem which warrants omission.

Sections 45.206 and 79.804

Q: 1. Does the code provide any specifications for ventilating a spray room or is Section 45.206 (a) a performance standard?

A: 1. Section 45.206 (a) provides a ventilation performance standard. As stated, "all spraying areas shall be provided with mechanical ventilation adequate to prevent the dangerous accumulation of vapors." The Uniform Mechanical Code™ provides similar performance criteria for the design of product-conveying ventilation systems in Section 1105.

Section 45.206 (g) provides ventilation requirements applicable only to spray booths, not spray rooms. Note that this subsection was relocated from Section 45.204 (b) in the 1988 edition to clarify that the provisions apply to all spray booths, not just dry filter-type spray booths.

Additional discussion regarding performance-designed ventilation systems can be found in National Fire Protection Association Standard No. 33, Section A-5-2.

Formal Interpretation

NFPA 13

Installation of Sprinkler Systems

1989 Edition

Reference: 4-1.1.1
F.I. 83-10

Question: Is it the intent of 4-1.1.1 to require automatic sprinklers or equivalent automatic protection in rooms designated for the specific use of electrical equipment including buss ducts and circuit breaker panels?

Answer: Yes.

Issue Edition: 1983
Reference: 4-1.1.1
Date: August 1983

CITY AND COUNTY OF DENVER

FEDERICO PEÑA
Mayor

DEPARTMENT OF FIRE

FIRE PREVENTION BUREAU
745 WEST COLFAX
DENVER, COLORADO 80204
575-5522, 575-2540

July 02, 1990

Mr. Robert E. Solomon, P.E.
National Fire Protection Association
Batterymarch Park
Quincy, MA. 02269-9101

Dear Mr. Solomon,

Re: NFPA 13 Code Interpretations

Would you please provide us with your interpretation for permissible sprinkler omission locations for the following areas, based on an approved automatic sprinkler system being required throughout the building ?

Question 1. Is it the intent of Section 4-4.8.1 to require sprinkler protection at the top and bottom of all elevator shafts?

Question 2. Is it the intent of Section 4-1.1 to require sprinkler protection in the following locations?

Elevator electric motor machine rooms:
Elevator hydraulic machine rooms:
Dedicated electrical rooms:
Uninterruptable power supply rooms:
Areas containing electrical panelboards and switchboards:
Telephone equipment rooms:
HVAC mechanical rooms:
Boiler rooms:

Question 3. When sprinkler protection is provided, is it the intent of Section 13-4.4.14 to require hoods or shields to be installed to protect generator and transformer equipment or is it the intent to require shields to be noncombustible if installed?

Question 4. If the answer to #3 above is yes (ie: shields are required), are shields or hoods also required to protect electrical panelboards and switchboards?

Any information or code interpretations that you can provide to us pertaining to the above-mentioned questions would be greatly appreciated.

Sincerely yours,

James F. Madden, Senior Analyst

James F. Madden

mittee on
Automatic Sprinklers
of the NATIONAL FIRE PROTECTION ASSOCIATION
BATTERYMARCH PARK, P.O. BOX 9101, QUINCY, MASSACHUSETTS 02269-9101 · TELEPHONE (617) 770-3000 TELEX 200250
Fax: (617) 7700700

July 20, 1990

James F. Madden, Senior Analyst
City and Couty of Denver
Fire Prevention Bureau
745 West Colfax
Denver, CO 80204

Dear Mr. Madden:

This replies to your letter of July 2, 1990 requesting information on NFPA 13, Standard for the Installation of Sprinkler Systems. The NFPA cannot approve a particular design or arrangement but I can offer you my personal opinion of the Standard as it relates to your situation. My responses follow the same order as your 4 questions.

1. YES.

2. YES to all locations.

3. NFPA 13 (1989) Paragraph 4-4.13 mandates the construction of the shields. It is not the intent of this paragraph to require the installation of the shields.

4. N/A

I attach a previously issued Formal Interpretation on these subjects. My response does not represent a Formal Interpretation as noted below.

Sincerely,

7 20 90

Robert E. Solomon, P.E.
Senior Fire Protection Engineer

RES/pmm

Attachment

1990 NEC

the panelboard or one of the sections of the switchboard for connecting the grounded service conductor on its supply side to the switchboard or panelboard frame. All sections of a switchboard shall be bonded together using an equipment grounding conductor sized in accordance with Table 250-95.

Exception: As covered in Section 250-27 for high impedance grounded neutral system connections.

(d) Load Terminals. Load terminals in switchboards and panelboards shall be so located that it will be unnecessary to reach across or beyond an ungrounded line bus in order to make load connections.

(e) High-Leg Marking. On a switchboard or panelboard supplied from a 4-wire delta-connected system, where the midpoint of one phase is grounded, that phase busbar or conductor having the higher voltage to ground shall be durably and permanently marked by an outer finish that is orange in color, or by other effective means.

(f) Phase Arrangement. The phase arrangement on three-phase buses shall be A, B, C from front to back, top to bottom, or left to right, as viewed from the front of the switchboard or panelboard. The B phase shall be that phase having the higher voltage to ground on 3-phase, 4-wire delta-connected systems. Other busbar arrangements shall be permitted for additions to existing installations and shall be marked.

Exception: Equipment within the same single section or multisection switchboard or panelboard as the meter on 3-phase, 4-wire delta-connected systems shall be permitted to have the same phase configuration as the metering equipment.

(g) Minimum Wire Bending Space. The minimum wire bending space at terminals and minimum gutter space provided in panelboards and switchboards shall be as required in Section 373-6.

384-4. Installation. Equipment within the scope of Article 384 shall be located in rooms or spaces dedicated to such equipment. Such space shall include that space described in Section 110-16, and in addition shall include an exclusively dedicated space extending 25 feet (7.62 m) from floor or to the structural ceiling with a width and depth that of the equipment. No piping, ducts, or equipment foreign to the electrical equipment or architectural appurtenances shall be permitted to be installed in, enter or pass through such spaces or rooms.

(FPN No. 1): It is not the intent to mandate a dedicated room.

(FPN No. 2): This section is not intended to prohibit sprinkler protection for the electrical installation.

(FPN No. 3): For the purpose of this section dropped, suspended, and similar ceilings not intended to add strength to the building structure are not structural ceilings.

Exception No. 1: Control equipment which by its very nature or because of other rules of this Code must be adjacent to or within sight of its operating machinery.

Exception No. 2: Ventilating, heating, or cooling equipment that serves the electrical rooms or spaces.

Exception No. 3: Equipment located throughout industrial plants which is isolated from foreign equipment by height or physical enclosures or

911203.02

December 3, 1991

Mr. Cliff Hennig
City and County of Denver
Building Inspection Division
200 West 14 Avenue
Denver, Colorado 80204

RE: Denver International Airport, Contract F121B-Terminal Building, Contract F121E-Airport Office Building, Request for Waiver of Dual Fed Exit Signs

Dear Cliff:

Per your request, we are officially requesting a waiver of the requirement that:

> "Exit signs must comply with DBC 3314(d). This will required connecting one lamp to the building power and the other lamp to battery (UPS) power."

Both lamps in each exit in the terminal building and parking garage are connected to both normal and emergency sources via the dual source feed from the utility. Additionally, we have provided central inverter systems in lieu of generators to provide 90 minutes emergency egress illumination in the unlikely event of both sources failing.

A letter to Al Horne regarding this issue was written by Emil Gadeken on April 1, 1991, (see CCD-1597 attached). We have not received a copy of this letter with Al Horne's approval. We completed construction documents with the understanding that the Airport was in agreement with our position that this design met and exceeded the code requirements.

It is our understanding that the building department is in general agreement that we have adequately addressed the exit sign issue, but that they cannot approve the design because it is in conflict with their interpretation of the code. We have previously pursued resolution to this question, however, we now need to request a waiver of the building department interpretation requiring two conduits from two separate services hard wired into each exit sign.

Thank you for your consideration of this request.

Sincerely,

ROOS SZYNSKIE, INC.

Charlotte Szynskie

Charlotte Szynskie, P.E.

Acknowledged and Approved:

Ginger Evans

Ms. Ginger Evans
Denver International Airport

Acknowledged and Approved:

Paul Spurgeon

Mr. Paul Spurgeon
City and County of Denver
Fire Department

Acknowledged and Approved:

C. E. Hennig 20 March 92

Cliff Hennig, City and County of Denver
Building Inspection Division

Electrical Engineering & Lighting Design
Roos Szynskie, Inc.
Suite 225
3045 South Parker Road
Aurora, CO 80014
(303) 696-2602
FAX (303) 696-0812

Post-It™ brand fax transmittal memo 7671 | # of pages ▸

To TRICIA VAN DOP	From STEVE RONDINELLI
Co.	Co.
Dept.	Phone # 640-5526
Fax # 375-0576	Fax #

MEMORA

TO: Steve Rondinelli JC/P102A/IOC/0035

FROM: Jorge Cortes JC

DATE: July 2, 1993

RE: P102A, Static Signage/Fax Letter dated April 26, 1993

SUBJECT: Sprinkler head interference with signs in Terminal Building

Per our walk through of the Terminal Level 5 - NTA and Level 6 - passenger bridge on June 28, 1993 we showed you several conditions where sprinkler heads were in direct conflict with sign locations at ceiling soffits (see attached sketch, Condition A). We discussed two options for a solution 1) move sprinkler heads several inches to one side or 2) maintain the six inch clearance from sprinkler head to sign as per your agreement in the above referenced fax letter (see attached copy).

We have decided to go with option 2. However, per the agreement of the referenced fax letter, it states that the six inch clearance must be maintained for signs not to exceed 15 feet in length.

Our situation now is that the signs we surveyed are 27 feet long flushed to the ceiling but, per your field observation you indicated that this condition is acceptable , as long as, the six inch clearance is maintained.

Also, we showed you two conditions where the end of the signs were only 5-1/2 inches from the sprinkler head (see attached sketch, Condition B). Unfortunately, at these locations we have no other options to relocate the sign. Hence, you indicated that in this particular case this condition is acceptable.

In order to advice our contractor to proceed with the installation work, I would like your concurrence with this agreement.

S Rondinelli 7/14/93 Fire Prevention Bureau
Steve Rondinelli

Thank you for attention in this matter.

cc: Wally Boyd

7/12/93

MEMORANDUM

JAC/P102A/IOC/0030

July 6, 1993

To: Steve Rondinelli

From: Jorge Cortes

Re: P-102A, Static Signage and Fire Protection

Subject: Clarification on NFPA 13 vertical distance from sprinkler head to sign Denver International Airport

Per our walk through of the Terminal level 5 baggage claim on June 15, 1993, I presented to you a sprinkler head interference problem with our BIDS (Baggage Information Display System) casework by the baggage carrousels.
The BIDS are suspended from the soffit. The distance from the bottom of soffit, where the sprinkler head is located, to the top of the BIDS casework is 12 inches.

Per your information, 18-inches is required. However, the BIDS casework cannot be lower because it would violate the code clearance requirement of 7 feet minimum. For this reason and your field observation of adequate sprinkler protection adjacent to these areas I agreed that the 12 inches would be acceptable.

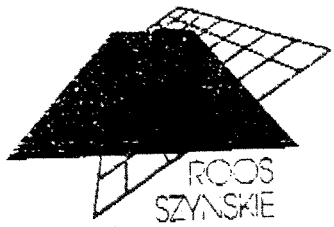
In order to advice our contractor to proceed with the work, I would like your concurrence with this agreement.

Paul D. Lofgren Fire Prevention Bureau
~~Steve Rondinelli~~ Division Chief

Thank you for your attention to this matter.

cc: Wally Boyd

November 30, 1993



Mr. Scott Jack
Black and Veatch
1400 South Potomac Street, Suite 200
Aurora, CO 80012

RE: DIA - Terminal Complex F-121B
(Roos Project #89124.00)
Serial No. ROOS.01295

Dear Scott:

This letter is being written per a request from John Salisbury for a written response to the attached Rolf Jensen letter.

We have reviewed the November 19, 1993 letter written by Rolf Jensen & Associates, Inc. in reference to the location of the beam type smoke detectors. We do not disagree with any of the statements made in their letter.

The basis for the original beam type smoke detector locations was from the manufacturer's recommendation. The recommendation was based upon the Simplex beam type smoke detector series number 2098.

If this product or one with similar performance characteristics is utilized, the spacing of the beam type detectors at 60 foot intervals, as originally indicated on the F-121B contract documents, should prove satisfactory.

Sincerely,

ROOS SZYNSKIE, INC.

Charlotte Szynskie

cc: John Salisbury, C.W. Fentress J. H. Bradburn

CAS:js

Enclosure

O:\F121B\F121BDA1\beam_det.DOC

Electrical Engineering
& Lighting Design

Roos Szynskie, Inc.
Suite 225
3045 South Parker Road
Aurora, CO 80014
(303) 696-2602
FAX (303) 696-0812

Simplex

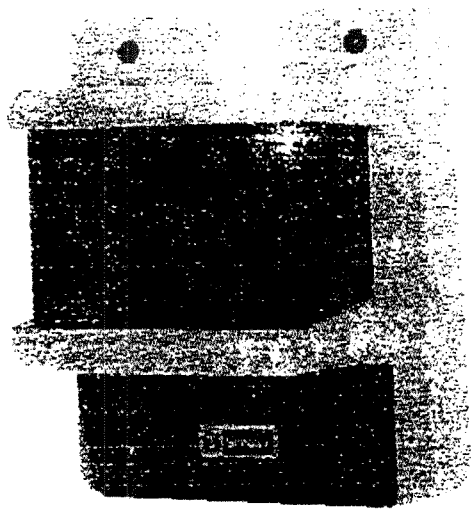
Multi-Application Peripherals and Accessories

Photoelectric Smoke Detectors 2098 Series (Projected Beam Type)

UL Listed
FM Approved

FEATURES:

- U.L. Listed to Standard 268
- Microprocessor Based
- Temperature Compensated
- Automatic Gain Control
- Up to 350 Foot Coverage
- Sensitivity Adjustment (6 Levels)
- Front Bore Sighting for Ease of Alignment
- Adjustable Optics
- Auxiliary Contacts
- Tamper Switch
- Normal Status Indicator (Flashing Green LED) at Transmitter and Receiver
- Alarm Indicator (Red LED)
- Trouble Indicator (Amber LED)



2098-9207
PROJECTED BEAM DETECTOR

SPECIFICATIONS:

- INPUT VOLTAGE: 16 to 32 VDC with a maximum allowable ripple of 4 Vp-p.
- STANDBY CURRENT @ 24 VDC: Receiver = 40 mA, Transmitter = 35 mA.
- RECEIVER ALARM CURRENT: Trouble = 40 mA, Smoke Detection = 70 mA.
- RANGE: 30 ft. to 350 ft. (10 m. to 110 m.) long 30 ft. to 45 ft. (10 m. to 13.7 m) wide.
- ADJUSTABLE OPTICS: ± 90° horizontal, and ± 10° vertical adjustment.
- SENSITIVITY: Field selectable for 20, 30, 40, 50, 60, or 70% beam obscuration.
- ALARM CONTACTS: Form "A" with contacts rated 1 amp, 60 VDC maximum for DC resistive loads. Do not use with capacitive or inductive loads.
- TROUBLE CONTACTS: Form "B" with contacts rated 1 amp, 60 VDC maximum for DC resistive loads. Do not use with capacitive or inductive loads.
- AUX. ALARM CONTACT: For "C" with contacts rated 1 amp, 60 VDC maximum for DC resistive loads. Do not use with capacitive or inductive loads.
- TAMPER: Access door tamper switch is in series with trouble contacts.
- SIGNAL DELAY: Fire = 30 ± 2 seconds; Trouble = 20 ± 2 seconds.
- TEMPERATURE: The storage and operating range is 32°F to +130°F (0°C to +54°C)
- MOUNTING: The units are designed to be mounted to 4" square or octagonal electrical boxes (not supplied by Simplex).

DESCRIPTION:

The Simplex 2098-9207 is a long-range photoelectric smoke detector consisting of a separate transmitter and receiver. It can be used to protect large areas such as gymnasiums, lecture halls, theaters, warehouses, atriums, etc.

The light source in the transmitter produces an infrared beam which is measured by the receiver to determine obscuration caused by smoke. When the beam intensity measured by the receiver falls below a preset threshold, an alarm output is generated.

If dust builds up to the point where the signal has been reduced by 50%, a trouble output is initiated. Intermittent beam blockage during cleaning is ignored, and complete beam blockage causes a trouble output, not an alarm.

Simplified installation requires only one-time access to each unit as the transmitter may be installed and aligned using internal bore sights before the receiver is in place. The receiver has micro-processor control allowing automatic calibration at the touch of a button. The crystal locked transmitter signature allows the receiver to distinguish the detection beam from all types of EMI, including fluorescent, mercury and sodium lighting.

The detector has an attractive beige case with black face plate.

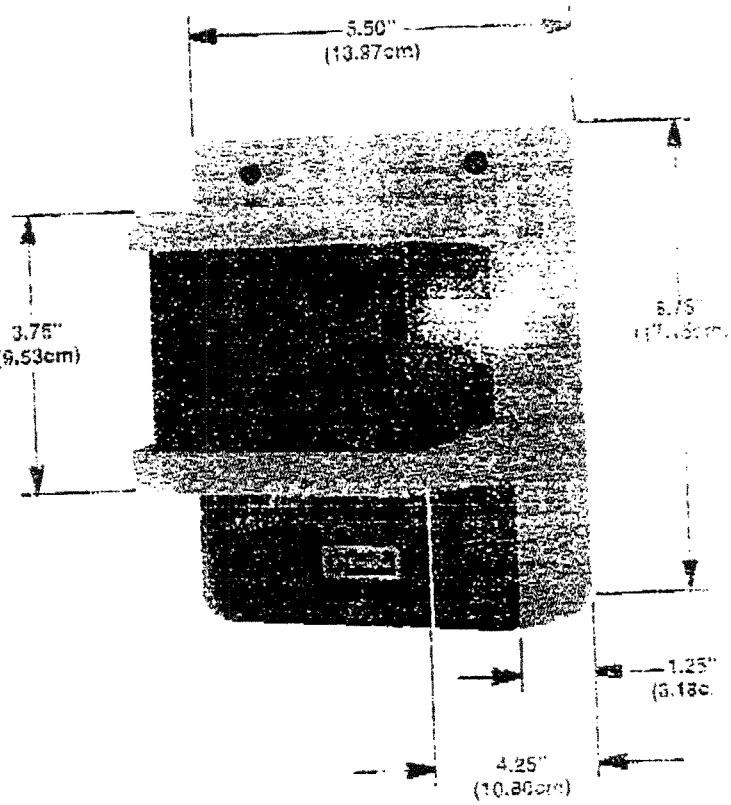
Publication S2098-0053-2 10-91

ONS:

LOCATION:

In all installations, good engineering judgement should prevail. Following are some general considerations:

- Do not use mirrors. The 2098-9207 should be installed with a clear line-of-sight path between the transmitter and receiver units.
- The intended beam path should also be clear of moving objects.
- Do not mount the receiver so that sunlight can shine directly down the beam path and into the unit.
- For smooth, flat ceilings, mount the units so that the beam paths are between 4" and 12" from the ceiling. For a sloped or peaked ceiling, the beam path should be located within three (3) feet of the peak of the ceiling.



- [illegible] more adjacent units are installed in the [illegible] alternating the transmitter and receiver [illegible] recommended. Reference Simplex [illegible] PER-21-016 (574-666).
- [illegible] air in a room may hinder smoke from [illegible] ceiling mounted detectors. Stratification [illegible] occurs because it is warmer than [illegible] reaches a level where it is the [illegible] surrounding air and does not [illegible] condition is considered a [illegible] detectors should be installed [illegible] located.
- [illegible] pass close to heating, ventilating [illegible] conditioning outlets where smoke might be circulated away from the beam. Avoid areas subject to normal smoke concentrations such as kitchens, and garages.
- Avoid areas subject to normal smoke concentrations such as kitchens, and garages.
- Do not install units where normal ambient temperature is below 32°F (0°C) or above 130°F (54°C).
- Reference NFPA 72E "Standard on Automatic Fire Detectors" for more detailed information on location and spacing of detectors.

ENGINEER GUIDE SPECIFICATIONS:

Furnish and install where indicated on the plans Simplex Photoelectric Projects Beam Detector, model 2098-9207. The detector shall be Underwriters' Laboratories (UL) Listed #268. The detector shall be microprocessor based, have automatic gain control and temperature compensation. The separate transmitter/receiver shall be capable of long-range coverage of up to 350 ft. (106M), and have six (6) sensitivity settings. The detector shall include a normal status indicator (Green Flashing LED), an alarm indicator (Red LED), and a trouble indicator (Amber LED). The detector shall obtain its operating power from a Simplex UL Listed fire alarm panel. The operating voltage shall be 24VDC (Nominal). The detector shall have front bore sighting for ease of installation.

REMOTE INDICATOR/TEST UNIT

The Simplex 2098-9816 is a Remote Indicator/Test Unit, to be used in conjunction with the 2098-9207 Beam Smoke Detector. This unit will indicate the status of the detector, (normal, alarm or trouble) provide test points to check the detector calibration voltage, and can be used to test (via the key switch) the alarm function of the detector.

The 2098-9816 is wired to the 2098-9207 Beam Smoke detector via color-coded wire leads. For set-up, alarm and trouble conditions, or calibration voltages, refer to Simplex publication PER-21-016-574-666).

Simplex Time Recorder Co.
Gardner, Massachusetts 01441-0001 U.S.A.
Time, Fire Alarm, Security, Sound and Nurse Call Systems
Offices and Representatives Throughout the World

DEC 08 '93 12:06PM

From 310 files

TRANSMITTAL

C.W. FENTRESS J.H. BRADBURN AND ASSOCIATES, P.C.
ARCHITECTURE, INTERIORS, PLANNING
[illegible] BROADWAY
DENVER, COLORADO 80203
FAX 303-722-5080
303-722-5000

DIA Distro
JKB 1 copy
Prof. file: This in Task 29
Prev. Agree.

93120800

TO DENVER BUILDING DEPARTMENT
200 WEST 14TH AVENUE
DENVER, COLORADO 80204

DATE 12-8-93
PROJECT NO 8908
ATTENTION PETE BEMELES / AL HORN
RE
-- ~~DIA LANDSIDE TERMINAL COMPLEX~~
CWF # 7258

[illegible] SENDING YOU
[illegible] SDS
[illegible] SPECIFICATIONS

SENT BY
☐ MAIL
☐ AIR MAIL
☐ REGISTERED MAIL
☐ SPECIAL DELIVERY
☐ MESSENGER
☐ EXPRESS

☐ RECEIVER
☐ BLUE PRINTER
☒ FAX 640-5623
FAX #
# of pages 3P + TRANS.
☐

COPIES	DATE	DESCRIPTION
1	11-30-93	LETTER FROM [redacted] REDS SENTSKE #01295 — BEAM DETECTORS AT GREAT HALL
		REPORT OF CONTACT
		Forwarded to Al Horne 12/8/93

THESE ARE SUBMITTED AS CHECKED BELOW
☐ FOR APPROVAL
☒ FOR YOUR USE
☒ AS REQUESTED
☐ FOR REVIEW AND COMMENT
☐ NO EXCEPTIONS TAKEN
☐ EXCEPTIONS AS NOTED
☐ REVISE AND RESUBMIT
☐ REJECTED
☐ SUBMIT SPECIFIED ITEM
☐ FOR DISTRIBUTION
☐ [illegible]

REMARKS PETE / AL, THIS LETTER IS CONFIRM THE DESIGN OF THE GREAT HALL BEAM DETECTORS IS IN CONFORMANCE WITH THE AGREED UPON ROLF JENSEN LIFE SAFETY - REPORT.

COPIES: FANNY LINDEMANN ☐ ☐ ☐ ☐

WITH ENCLOSURES

SIGNED

CWF FORM [illegible]

APPENDIX C

CITY AND COUNTY OF DENVER

WELLINGTON E. WEBB
Mayor

DEPARTMENT OF PUBLIC WORKS

NEW DENVER AIRPORT OFFICE
STAPLETON TERMINAL BUILDING
DENVER, COLORADO 80207
PHONE: (303) 270-1900

MEMORANDUM OF UNDERSTANDING

TERMINAL SMOKE CONTROL CLARIFICATION

January 3, 1994

To clarify the smoke control system in the terminal, the following information is provided.

1. The smoke control zones in the terminal will be modified to combine the "retail/office" zones with the adjacent ticketing (level 6) or baggage (level 5) zones. Activation of any one device (flow switch, detector or pull station), will alarm to a central station, activate hoistway fans, stair pressurization fans, smoke exhaust fans, and horns/strobes in the zone. Manual activation of other zones will be accomplished from the fire operations center (PCFC (graphics computer). adjacent or.

2. Draftstops will be required separating the (NTSA) North Terminal Support Area and Terminal. No draftstops will be required in the NTSA with the exception of those around escalators.

3. End switches for dampers in the open position will be provided and monitored as a zone, not individually. Damper end switches indicating the closed position will not be required. Exhaust fan status will be provided and monitored as a ~~group~~, zone not individually, and run status of the Exhaust Fans will be displayed on the Fire Alarm graphics at the PCFC.

4. Great Hall Exhaust fans shall operate by manual activation from the Terminal Fire Operation Center.

Ginger Evans — Date
Assistant Director of Aviation

C. E. Hennig — 18 Jan 94
Cliff Hennig — Date
Director Building Insp. Dept.

Paul D. Spurgeon — 14 Jan 94
Paul Spurgeon — Date
Chief of Fire Prevention

RIEGEL ASSOCIATES INC.
Building Systems/Analysis

June 10, 1994

Mr. Jeff Hilleary, P.E.
City and County of Denver
Building Inspection Division
200 West Fourteenth Street
Suite 101
Denver, Colorado 80204-2715

Mr. Steve Rondinelli, R.A.
Denver Fire Department
Fire Prevention Bureau
745 West Colfax Avenue
Denver, Colorado 80204

Re: Denver International Airport Main Terminal and North Terminal
Smoke Control Systems Fan Override Meeting Minutes

Mr. Hilleary and Mr. Rondinelli:

Enclosed is a copy of the Minutes of the Meeting held on June 1, 1994, with Denver Fire Prevention Bureau, PMT, AllWest Fire and Sound (AllWest), and Riegel Associates, Inc. (RAI). The purpose of this meeting was to define to the Denver Fire Prevention Bureau the installed overrides on the smoke control fan systems at the referenced project. Signature on these Meeting Minutes will signify concurrence with the smoke control fan system overrides, as defined herein.

Attendees: Steve Rondinelli / Fire Prevention Bureau
R.K. Foster / Fire Prevention Bureau
Jim Gaved / PMT
Harry Lindmark / PMT (part-time)
Ross Thenhaus / AllWest
Don Riegel / RAI
Brian Zimmerman / RAI

A. Main Terminal

1. Great Hall Exhaust Fans:

   a. HAND = Currently there is no manual override in the HAND position to shut the fans down.

   b. OFF = Off

   c. AUTO = Fans are initiated by the fire alarm system during smoke exhaust mode. Manual override provided to turn the fans off with hatches open.

5310 DTC Parkway Suite E
Englewood, Colorado 80111
(303) 796-7272 FAX (303) 796-9416

2. Stair and Hoistway Pressurization Fans:

   a. HAND = Fan currently will not run in the HAND mode unless the outside air damper panel is bypassed. However, if panel is bypassed and fans are running, currently there is no override to turn the fans off from this position.

   b. OFF = Currently, OFF is overridden by AllWest. AllWest intends to rewire the starters in order not to override this position. ***Done 06/04/94***

   c. AUTO = Fans are initiated by the fire alarm system simultaneously with the opening of the outside air dampers.

3. Level 7 Relief Air Fans:

   a. HAND = With the fans manually started in the HAND position, AllWest does not currently provide an override to turn the fans off from this position.

   b. OFF = AllWest does not override the OFF position at the starter.

   c. AUTO = The relief air fans are initiated for smoke exhaust by the fire alarm system. Manual override to turn the fans OFF is provided.

4. Level 3/4 Dedicated Smoke Exhaust Fans:

   a. HAND = With the fans manually started in the HAND position, AllWest does not currently provide an override to turn the fans off from this position.

   b. OFF = AllWest is not overriding the OFF position at the motor starter.

   c. AUTO = The dedicated smoke exhaust fans are initiated through the fire alarm system with manual override to turn the fans off.

5. Baggage Supply and Exhaust Air Handling Units

   a. HAND = AllWest is providing the override to turn the fans off and to pressurize/exhaust from the HAND position at the motor starter.

   b. OFF = AllWest is not overriding the OFF position at the motor starter.

c. AUTO = The supply and exhaust air handling units are initiated by the fire alarm system with manual override to turn the fans off or reset the fans back to the AUTO mode.

6. AGTS Platform Smoke Exhaust Fans:

a. HAND = With the fans manually started in the HAND position, AllWest does not currently provide an override to turn the fans off from this position.

b. OFF = AllWest does not override the OFF position at the motor starter.

c. AUTO = The dedicated smoke exhaust fans are initiated by the fire alarm system. Manual override to turn the fans off is provided.

B. North Terminal

1. Air Handling Systems and Relief Air Fans:

a. HAND = Presently, AllWest is providing manual override to turn the fans off for air handling units NAHU-3 through NAHU-8 and NRF-3 through NRF-8. NAHU-1 and NAHU-2, and NRF-1 and NRF-2 currently do not have this override provided, however, AllWest is installing the appropriate hardware to perform this function. ***Done for NAHU-1 and NAHU-2/NRF-1 and NRF-2 06/01/94***

b. OFF = AllWest does not override the OFF position at the motor starter.

c. AUTO = Pressurization sequence for the air handling systems and exhaust for the relief air fans is initiated by the fire alarm system. Manual override to reset the fans back to AUTO is provided. Override to turn the air handling units and relief fans off is provided for NAHU-3 through NAHU-8, and NRF-3 through NRF-8. AllWest will install the appropriate hardware to provide this function for NAHU-1 and NAHU-2, and NRF-1 and NRF-2. ***Done 06/01/94***

2. Dedicated Baggage Smoke Exhaust Fans

a. HAND = AllWest is not providing overrides with the motor starter in the HAND position.

b. OFF = AllWest is overriding the OFF position for these fans, however, AllWest is currently rewiring the starters to eliminate this override. ***Done 06/01/94***

c. AUTO = The dedicated smoke exhaust fans are initiated through the fire alarm system. Override to OFF or reset of the fans are provided.

3. Level 6 Passenger Walkway Smoke Exhaust Fans

a. HAND = We were unable to verify overrides for these fans systems. Presumably, overrides stated above will be provided as part of these fans.

b. OFF = AllWest does not override the OFF position at the motor starter.

c. AUTO = The dedicated smoke exhaust fans are initiated through the fire alarm system. Override to OFF or reset of the fans are provided.

C. Programming Changes

1. As part of the manual exhaust sequence for the Great Hall, it is our recommendation to disable all the supply air handling units serving the Great Hall during this smoke exhaust scenario. Currently, only half of the adjacent zones are disabled during this exhaust sequence, which during preliminary smoke control performance testing, has created problems with containing smoke in the zone in alarm. ***AllWest agrees to reprogram.***

2. It is our recommendation that a portion, if not all, of the North Terminal Level 6 rooftop air handling units NRTU-1 through NRTU-6, be put into pressurization as part of the manual exhaust mode for Great Hall MOD1, MOD2 and MOD3. Under previous preliminary performance testing, the smoke was not contained between the Great Hall MOD1 and the North Terminal Level 6 passenger walkway, with just the Great Hall MOD1 smoke exhaust fans in operation. However, a preliminary smoke control performance test did demonstrate that with NRTU-1 through NRTU-6 in pressurization, adequate smoke containment was achieved. ***AllWest agrees to reprogram.***

D. Summary

To the best of our knowledge and belief, the fan system overrides as defined hereinbefore meet or exceed the requirements of the Denver Building Code, in all cases, with corrective actions as noted.

If you have any questions, or which to discuss this matter in further detail, please don't hesitate to call.

Respectfully,
Riegel Associates, Inc.

Donald L. Riegel, P.E.

DLR/pgl

cc: all Attendees

Jeff Hilleary / Denver Building Department — Date 6/14/94

Steve Rondinelli / Denver Fire Prevention Bureau — Date 6/14/94

DFD FIRE PREVENTION BUREAU

TRANSMITTAL

DOCUMENT NAME SMOKE CONTROL FAN OVERRIDE

TRANSMITTAL ISSUED BY S. RONDINELLI

DATE RECEIVED _____ DATE OF ISSUE 6/16/94

ACTION: REVIEW/COMMENTS _____ INFO ONLY ✓

RETURN COMMENTS TO —

RESPONSE/COMMENTS DUE — PHONE 640-5522 FAX 640-3430

ACTION COPY
Denver Fire Department

ACTION	COPY	
		Div. Chief Juniel
		Asst. Chief Wyles
	X	Steve Rondinelli (Arch/Eng)
		Capt. Finken
		Capt. Gutierrez
		Lt. Sarconi, Arson
		Lt. Mehrens (Flammables)
		Lt. Spialek (Haz Mat)
		Lt. Ramos (Special Occup)
		Lt. Williams (Insp & Test)
		Lt. Wilson (Pub Ed)
		Lt. Jefferies (Institutions)
		Lt. Dwyer (Insp & Comp)
		Tom McManus (Engineer)
		Barney Mulligan (Engineer)
		JJ Smith (Clerical/Recep)
		Janice Orth (Data)
	X	DIA FILE

ACTION COPY
Building Inspection Division

ACTION	COPY	
		Ed Kocman (Act/Director)
		Pete Bemelen(Act/Ch StruArc)
		Jeff Hilleary (Chief Mech)
		Curt McMillan (Act/Ch Elec)
		Phil Marin (Inspections)

Other City Agencies

	X	HARRY LINDMARK @ DIA

COMMENTS

Mail to: DON RIEGEL @
RIEGEB ASSOCIATES INC
5310 DTC Parkway SUITE E
ENGLEWOOD CO. 80111

1/3 pp

CITY AND COUNTY OF DENVER

WELLINGTON E. WEBB
Mayor

DEPARTMENT OF AVIATION

Bruce Baumgartner
Manager of Aviation

Denver International Airport
Airport Office Building
8500 Peña Boulevard
Denver, Colorado 80249-6340
(303) 342-2200

November 9, 1998

#7BTO2CS1-TI29-PS.03.01.01.007

Mr. Peter Bemelen
City and County of Denver
Department of Public Works; Building Inspection Division
200 West 14th Avenue, Suite 101
Denver, CO 80204

1. During the construction of the airport a BID/FD policy changed by requiring the entire bldg to be sprinklered including the electrical rooms.
2. Electrical rooms were derated by BID since they didnot needto be rated per UBC and NEC. At that time DBC did not require sprinkling of electrical rooms

Reference: Denver International Airport
Terminal Level 5 & 6 Electrical & Communication Room
Wall & Door Construction Acceptance

Dear Mr. Bemelen;

This letter discusses existing wall and door construction of electrical and communication rooms at the DIA Terminal Levels 5 & 6, and requests approval of these walls and doors as they are built, provided that penetrations and top-of-wall joints are properly sealed.

As we have discussed, the following facts have been identified:

a. The DIA terminal building is a fully sprinkled Type I construction building.

(3) March 1, 1994 Memorandum allow rooms to remain as constructed.

b. The original issue of construction drawings, dated June 25, 1991, show many of these electrical rooms with 1-hour rated walls and doors.

c. An August 14, 1991 Memorandum of Understanding allowed sprinklers to be omitted in electrical rooms provided smoke / ionization detectors are installed.

d. A December 19, 1991 Change Request #44 by the architect (Fentress) removed the rating from many of these walls and doors.

(4) Rooms are probably within 95% one hour rated

e. A December 17, 1992 BID internal interpretation titled "Installation Requirements for Non-Required Full or Partial Fire Protection Systems" discusses a 1 hour separation between sprinkled and unsprinkled areas.

f. A March 1, 1994 Memorandum Of Understanding And Interpretation permits communication rooms of less than 600 square feet to be without sprinkler protection provided smoke detectors connected to the Fire Alarm System are provided.

PP 11/12/98

g. As-built record drawings dated January 30, 1995 show most electrical rooms and all communication rooms to have non-rated walls. Most electrical room doors are shown non-rated. The source for many of these changes has been traced to December 19, 1991Change Request #44.

2/3 PPD

h. Some of these walls are built as double walls of metal studs with 5/8" Type X gypsum board on the outer sides and an approx. 24" gap between the unsheathed interior sides. This space accommodates fireproofed steel columns and bracing.

i. While these existing concrete masonry walls and 5/8" Type X gypsum board walls are not noted on the drawings as rated, they are built similar to rated walls. They have most top edges and many penetrations sealed. DIA is now developing construction documents to have improved seals added where existing installations have been found to be lacking.

Additional details are contained in my October 26, 1998 letter to you. The attached 8 ½" by 11" contains two head details and one sill detail which represent this double walls construction.

As discussed during our October 29, 1998 site visit, a reasonable judgment can be made that the existing electrical room and communication room construction can be defined as essentially equal to one hour construction and as such can remain in place with no change other than miscellaneous improved seals outlined in item "i" above. Further it was agreed that any additional openings made in these walls in the future would be considered as requiring a 1 hour fire rating and would be so sealed.

Following your review, please sign the attached copy of this letter as confirmation of acceptance of these terminal level 5 and 6 electrical room and communication room walls and doors as installed, conditional upon completion of the work to seal penetrations and construction joints.

Sincerely;

Jon Feimen (for Jack Bartels)

Jack Bartels
Planning and Development

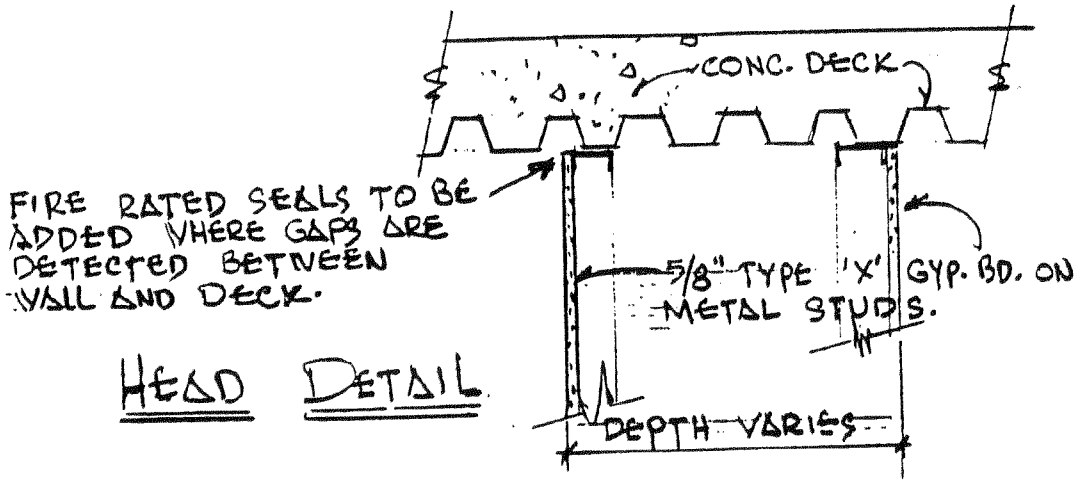
cc John Brann / Denver Building Inspection Division
Reggie Norman / DIA Planning and Development
Jon Feimen
Farren Elwood
Project File

DENVER BUILDING INSPECTION DIVISION
APPROVED AS NOTED

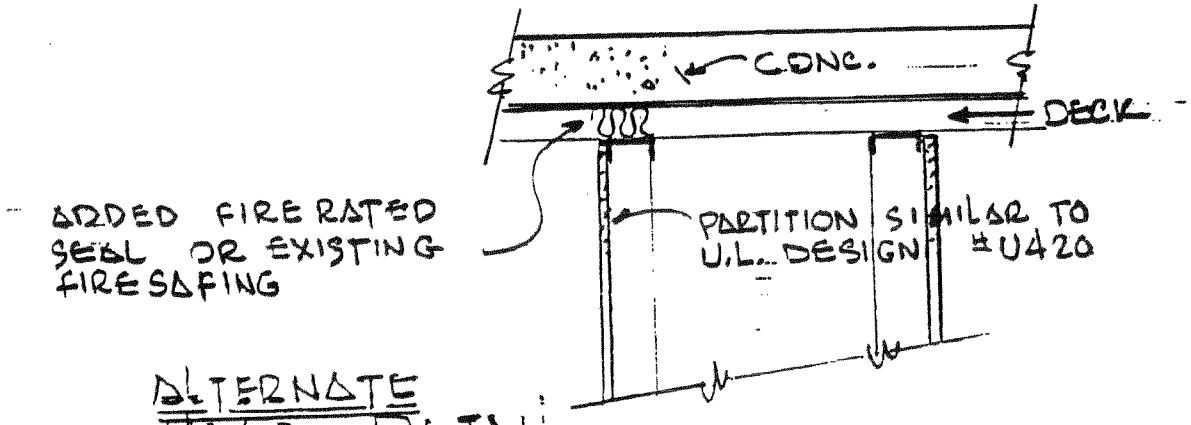
Peter Bemelen 11/12/98
ADMIN. AUTH. NO.

Peter Bemelen P.E.
Acting Director
The Denver Building Inspection Division accepts the above noted rooms as being code complying. PB

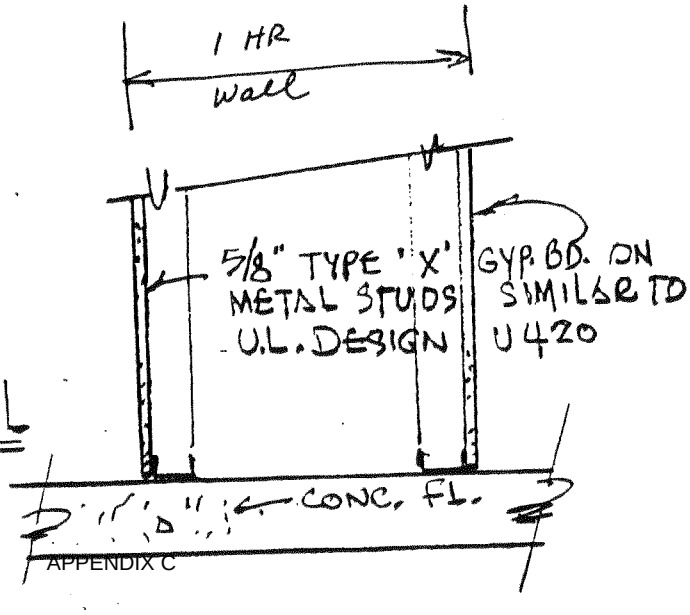
3/3 AB



HEAD DETAIL



ALTERNATE HEAD DETAIL



SILL DETAIL

1/3 PB

Meeting Minutes

Date: October 29, 1998

Place: Denver International Airport Office Building (AOB) and Terminal.

Attendees: Peter Bemelen / BID
Farren Elwood / DIA
Jon Feiman / DIA
Pat McCollum / DIA
Mark Kelley / DIA (For Item #1 Only)
Jack Bartels / DIA

Subject: DIA Terminal Certificate Of Occupancy Issues
#7BTO2CS1-TI29-PS.04.03.006

1. Inspected the Terminal Level 4 Pump Room 44A18. Pumps and controls are being installed for the new water feature. This pump room is located south of the south escalators from Level 5 to the outgoing train platform on Level 4.

a. Walls around this pump room and its entry door are to provide a 1 hour rated enclosure. The pump room contains a fire protection sprinkler system.

b. Fire rated expansion joints will be installed within the existing narrow vertical wall openings.

c. Wall extensions to the north, constructed of gypsum board on one face of metal studs, form 3 1/2 ft. wide unoccupied spaces with the side walls of the escalators. These areas are located to the west and the east of the south escalators. Due to complexity and size of plumbing routed into these spaces, it is impractical to build a rated separation wall at their end openings into the pump room. Determined that the walls of each of these two spaces can have the 5/8" Type X gypsum board extended and sealed to the concrete structure above. Determined that these measures would permit acceptance of these metal stud and gypsum board walls as 1 hour rated walls. Each space is to be cleaned of debris and have a barrier constructed at its south opening to prevent its use for storage.

Construction meets the intent of the DBC. approved PB

2. Discussed 3 types of terminal level 5 and 6 electrical rooms, all without sprinkler protection. OK PB

a. One type is located toward the interior of the terminal and is not accessed through a communication room. Inspected Electrical Room 6220 (#61A12 on drawing) located off the level 6 airlines ticket area as an example. This electrical room has a wall consisting of two back to back wall partitions, each with 5/8" Type X gypsum board on one face of metal studs. This is similar to Underwriter's Laboratory Inc. Design No. U420; however bracing is not installed and the distance between studs exceed 9 ½". Determined that this wall construction, located between a fire protection sprinkled area and a non-sprinkled area, will permit definition as a 1 hour rated wall. DIA is to provide a letter to Peter Bemelen outlining this existing wall construction for BID approval as a 1 hour rated wall. Existing wall openings to be sealed with fire rated materials. (This particular electrical room wall stops at the bottom of structural beams approx. 18" below the deck above. DIA will investigate construction at the top of this wall and determine if an improved rated termination is needed. BID advised that this improved rating could be provided by adding a layer of Thermofiber insulation over the top plate of the wall.)

The door of this electrical room is similar to others in that it does not contain a fire rated label nor a closer. Determined that non-rated electrical room doors and frames can remain in place. These doors will not require a closer because the doors are locked. Openings added to these walls in the future are to be closed with one hour rated constructions.

2/3 BD

b. The second type of electrical room is located toward the interior and entered from a communication room. Inspected Electrical Room 6350-1 (#68C15 on drawing) located on level 6. This electrical room also contains walls of back to back partitions of metal studs with gypsum board on one face. These existing walls are also addressed in DIA's letter to Peter Bemelen and requesting BID approval as 1 hour rated walls. Existing wall openings to be sealed with fire rated materials.

The door of this electrical room does not have a fire rating label or closer. The communication room door is labeled. Determined that the non-rated electrical room door and frame can remain in place. The door is locked & will not require a closer.

(See Item #3 for information relative to the communication room.)

c. The third type of electrical room is located toward the perimeter of the terminal. Inspected Electrical Room 6304 (#68C03 on drawing) located along the terminals west perimeter wall. The electrical room walls (which are identified on the record drawings as non-rated) are of non-combustible construction with sealed joints. The door is of non-rated spandrel glass construction. It was determined that this construction is acceptable as it is. The rooms are to have electrical covers installed, stored items removed and door locks secured.

3. Discussed communication rooms without sprinkler protection located adjacent to electrical rooms. Inspected Communication Room 6350 (#68C14 on drawing). Determined that this existing construction is similar to that of the adjacent electrical room and also permits acceptance as equivalent to one hour rated construction. Existing wall openings to be sealed with fire rated materials. OK PB

4. Inspected terminal level 4 Corridor 44C03 from Elevator Vestibule 44C04 and Stair W4N2 to the exterior door and parking area to the west. Discussed and viewed damage resulting from carts transporting parcels through this corridor resulting in destruction of exterior doors, frame and hardware, damaged concrete masonry walls, and doors forced to remain in the open position. Identified the following work components to be included within the CO contractor's package: OK PB

a. The double doors from Elevator Vestibule 44C04 into the corridor are to be provided with magnetic hold open devises, activated by the fire detection system.

b. Wall protection to be added to the south concrete masonry wall located southwest of the double door from elevator vestibule 44C04.

c. Replace 90 minute rated pair of exterior hollow metal doors, frame and hardware. Frame to not have a center mullion. Doors to be opened from the inside with panic hardware and/or automatic sensors. Doors to be opened from the outside with access card sensors and push buttons. Doors to remain in the open position when automatically opened from inside or outside for a long enough time frame for the parcel cart to be pushed through it. note: doors must latch when in closed position

5. Discussed termination of open utilities located in three difficult to reach areas identified in DIA's October 26, 1998 letter to BID and determined that these could remain as they are. OK PB

6. Discussed the Airport Office Building construction items needing to be changed as limited to the carpeting on the level 6 horizontal exit from western stair and a several roofing items.

a. Inspected the level 6 horizontal exit from the west side interior stairway which serves as an exit from levels 6 through 10. The horizontal exit is separated from the exit corridor serving the rest of the AOB level 6 by two doors, one of which is held open by a magnetic hold-open activated by the fire detection system and closed by automatic closer. The floor has been carpeted with surplus carpet of unknown specification. BID is to investigate the new building code and determine if this use of carpet is approved. Replace carpet w/ floor covering material complying w/ DOC FF-1 "pill test" (CFR 16 CFR, Part 1630) (per IBC 2000 FINAL DRAFT) see note PB

2/3 PB

OK PB

b. Identified one door at office 6843 & one break room door, both to the corridor and being inappropriately held in the open position. These two doors are to have a magnetic hold open activated by the fire detection system added. A closer is to be added to the door to Office 6843.

Please advise Jack Bartels ASAP if any of the above is not a correct record of the meeting discussions and conclusions.

Jack Bartels Phone 342-2200 x4490; Fax 342-2635

Distribution All attendees
Reggie Norman
Mike Steffens
Frank Odland
George Snead
Ken Borrousch
Dave Anderson
Project File

bcc Note to Mark Kelley: Regarding Item #1; our CO Package is to include the construction of the gypsum board up to the deck above. The water feature package is the to include the rated expansion joints, cleaning of the area between wall segments and the construction of barriers to limit use as storage.

Jon Teeman (for Jack Bartels)

DENVER BUILDING INSPECTION DIVISION
APPROVED AS NOTED

11/12/98

ADMIN. AUTH. NO.

Peter Bemelen P.E.
Acting Director

(7 pages total)

DENVER INTERNATIONAL AIRPORT

PLANNING & DEVELOPMENT DIVISION
8500 Peña Boulevard
Denver, CO 80249
Phone: (303) 342-2200
Fax: (303) 342-2635

FACSIMILE TRANSMITTAL SHEET

TO:	Peter Bemelen	FROM:	Jack Bartels	
COMPANY:	City and County of Denver	DATE:	November 10, 1998	
FAX NO.	(303)640-5623	FAX NO.	(303) 342-2635	
PHONE NO.		PHONE NO.	(303) 342-2200	
SUBJECT:	DIA Terminal Construction	NO. OF PAGES INCLUDING COVER:		7

COMMENTS:

TO: Jack Bartels
342-2635

11/18/98
DIA Distribution of info. from BID as received by mail. (The BID note on the first page of our Nov. 9 letter was not on the info. received by fax.)

Reggie Norman	copy
Jon Feiman	copy
Farren Elwood	copy
Dave Anderson	copy
George Sneed	copy
Jack Bartels	copy
Project file	This
John Brann BID	copy

cake in fr folder

BRUCE BAUMGARTNER
Manager of Aviation

February 6, 2002

MEMORANDUM

TO: David Clark, P.E.
Chief Fire Protection Engineer
Denver Fire Prevention and Investigation

FROM: Robert Busch RB
Design Manager
Life Safety Team

SUBJECT: Terminal Building Level 5 Customs Area

RE: Modification to Fire Alarm, Fire Protection and Smoke Zones

Terminal Level 5 Customs area is presently served by two zones for each of the systems; Fire Alarm, Fire Protection and Smoke Zones. The demarcation of the zones are not consistent with the other respective zones.

The customs area is bounded on the north by the zone for the Passenger Bridge, and the south by the zone for the Terminal "Great Hall".

DIA plans to modify the Fire Alarm Control Panel Programming to allow the entire area (approximately 69,000 S.F.) to report as one zone for incidents. This will allow proper activation of smoke control systems. The smoke control system to the south of the area in the main terminal shall remain "manual". Reference Exhibit A attached.

This modification shall not be submitted for permit in that sequencing changes will be modified by DIA authorized technicians.

Your approval of this modification is requested.

Approved _____ 2/7/02
David Clark, P.E. Date
Chief Fire Protection Engineer
Denver Fire Prevention and Investigation

DENVER INTERNATIONAL AIRPORT

Department of Aviation
Airport Office Building
8500 Peña Boulevard
Denver, Colorado 80249
Phone: (303) 342-2200

City and County of Denver

WELLINGTON E. WEBB
Mayor

BRUCE BAUMGARTNER
Manager of Aviation

February 6, 2002

MEMORANDUM

TO: David Clark, P.E.
Chief Fire Protection Engineer
Denver Fire Prevention and Investigation

FROM: Robert Busch RB
Design Manager
Life Safety Team

SUBJECT: Terminal Building Level 5 Customs Area

RE: Modification to Fire Alarm, Fire Protection and Smoke Zones

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The customs area is bounded on the north by the zone for the Passenger Bridge, and the south by the zone for the Terminal "Great Hall".

DIA plans to modify the Fire Alarm Control Panel Programming to allow the entire area (approximately 69,000 S.F.) to report as one zone for incidents. This will allow proper activation of smoke control systems. The smoke control system to the south of the area in the main terminal shall remain "manual". Reference Exhibit A attached.

This modification shall not be submitted for permit in that sequencing changes will be modified by DIA authorized technicians.

Your approval of this modification is requested.

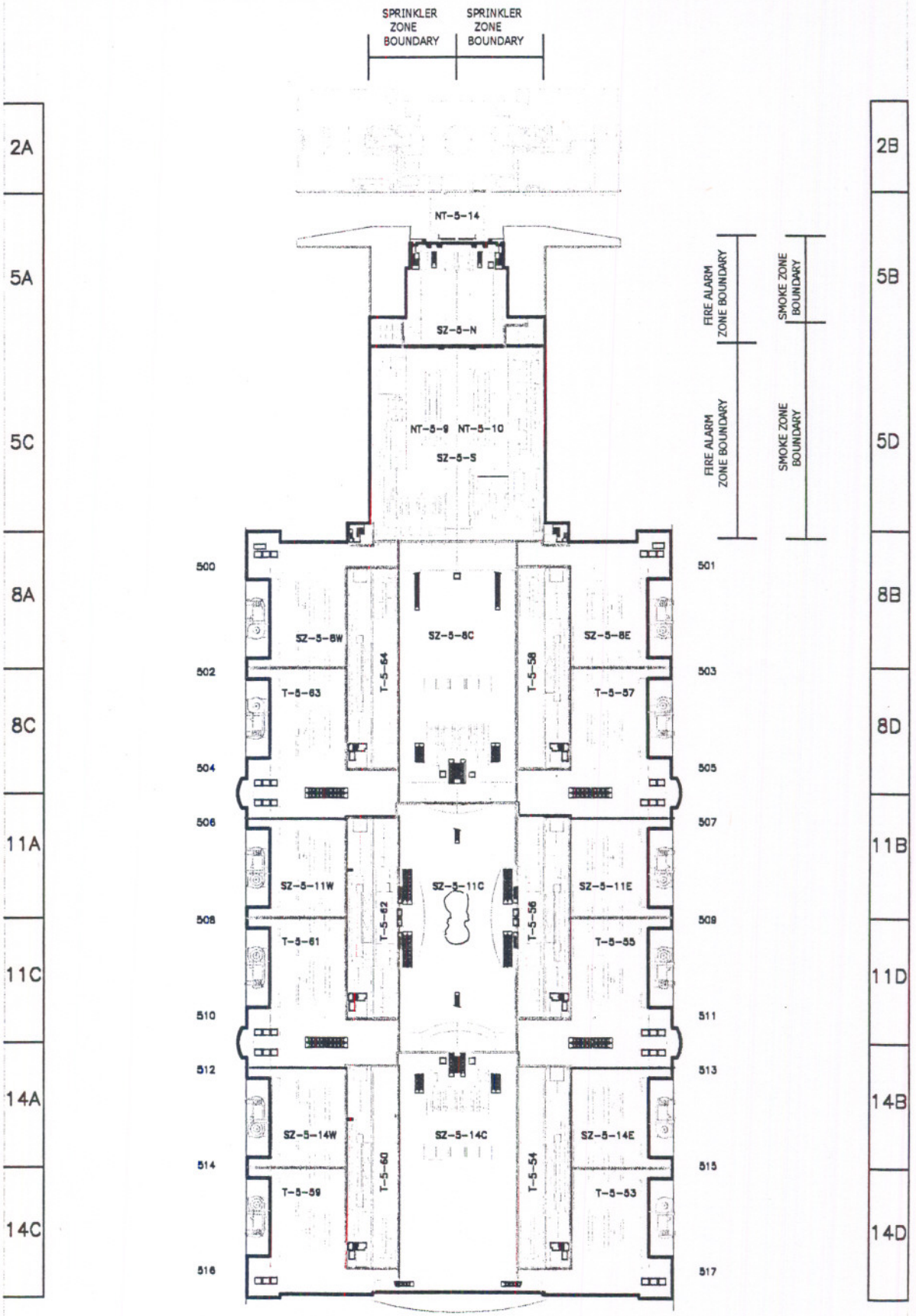
Approved _____ 2/7/02
David Clark, P.E. Date
Chief Fire Protection Engineer
Denver Fire Prevention and Investigation

DENVER INTERNATIONAL AIRPORT

Department of Aviation
Airport Office Building
8500 Peña Boulevard
Denver, Colorado 80249
Phone: (303) 342-2200

City and County of Denver

WELLINGTON E. WEBB
Mayor



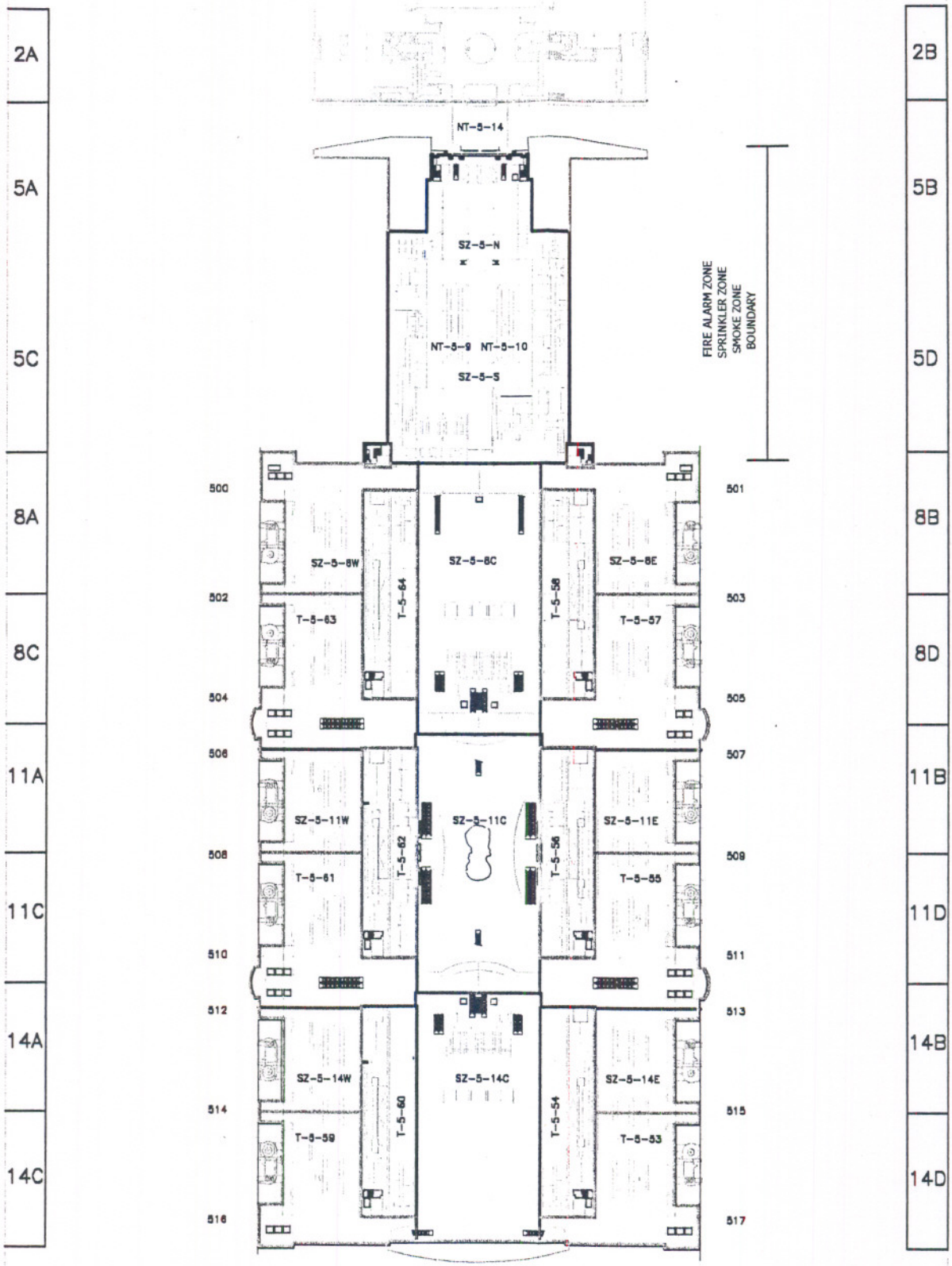
LEVEL 5 TERMINAL

FIRE ALARM ZONES

SMOKE ZONES

SPRINKLER ZONES

EXHIBIT A - EXISTING



LEVEL 5 TERMINAL

FIRE ALARM ZONES

SMOKE ZONES

SPRINKLER ZONES

EXHIBIT B - MODIFIED

02/06/02

EXHIBIT A - NORTH TERMINAL LEVEL 5

DENVER
THE MILE HIGH CITY

June 7, 2011

Chief Joseph Gonzales
Chief of Fire Prevention and Investigation
Denver Department of Fire
745 W. Colfax Avenue
Denver, Colorado 80204

RE – Administrative Modification Request #8
Denver International Airport – Fire Alarm Replacement Project; Project CE-50136
Permission to Utilize Presignal Feature

Chief Gonzales,

This Administrative Modification request is submitted by Denver International Airport (DIA), in consultation with Hughes Associates, Inc. (HAI), to request permission to utilize the Presignal Feature as permitted by the 2009 International Fire Code (IFC) Section 907.6.1 and installed in accordance with Section 23.8.1.2 of the 2010 edition of the *National Fire Alarm and Signaling Code®* (NFPA 72). A fire alarm presignal feature is permitted when approved by the fire code official. As such, this Administrative Modification request does not involve a variance from the proposed 2010 Denver Amendments to the 2009 International Fire Code (IFC) or any other applicable codes. Instead, this Administrative Modification requests permission to utilize a code recognized alarm initiation sequence of operation. This request is specific to the Airport Terminal Buildings (i.e., Terminal and Concourses A, B, and C). Other buildings including the Airport Office Building (AOB), AGTS Maintenance Facility, and Central Utility Plant are not included in this request and will have automatically initiated alarm activation.

NFPA 72 Section 23.8.1.2 for Presignal Feature states the following:

23.8.1.2.1 Systems that have a presignal feature complying with 23.8.1.2 shall be permitted if approved by the authority having jurisdiction.

23.8.1.2.2 A presignal feature shall meet the following conditions:

(1) The initial fire alarm signals sound only in department offices, control rooms, fire brigade stations, or other constantly attended central locations.
(2) Where there is a connection to a remote location, the transmission of the fire alarm signal to the supervising station activates upon the initial alarm signal.
(3) Subsequent system operation is by either of the following means:
(a) Human action that activates the general fire alarm
(b) A feature that allows the control equipment to delay the general alarm by more than 1 minute after the start of the alarm processing

Means of compliance with these requirements are as follows:

1. Any alarm condition will cause visual and audible notification to occur in the Airport Operations Center on the 10th Floor of the AOB, which is a constantly attended location. Alarm indication will also occur in all Fire Command Centers and in the Life Safety Maintenance Office. Initial fire alarm signals will not activate in other areas including public spaces.
2. The fire alarm system will be monitored directly by the DFD Line Shop via AES Transceivers. All alarm conditions will immediately be transmitted to DFD through this system for fire department response.

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3. Section 23.8.1.2.2, Item 3 provides options for alarm initiation. This Administrative Modification is requesting that Option (a), human action, be utilized to initiate alarm notification in the Airport Terminal Buildings.

This request is based on discussions to date with project stakeholders. Specifically, ongoing meetings with DIA, DFD, and HAI personnel have demonstrated concurrence that an alarm initiation approach consistent with Presignal Feature is the best approach for public areas of DIA. This approach provides a number of operational benefits:

- Prevention of nuisance alarms initiating evacuation or causing occupant misinformation
- Unnecessary exiting into the path of aircraft operations
- Misdirected exiting into areas of higher hazard
- Undue interruption of airport operations

This Request is intended to obtain permission for the Presignal Feature and not to identify or determine specifics of the message wording, message delivery (i.e., live or prerecorded), zoning, or sequence of operation of the notification. These specific emergency response issues will be determined through continued coordination between DFD, DIA, and HAI.

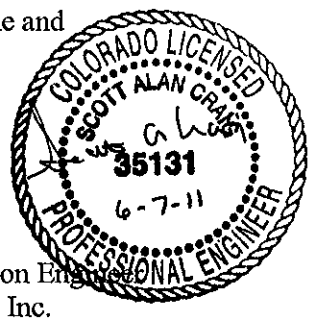
Based on the information contained herein, DIA requests DFD approve the use of Presignal Feature in all Airport Terminal Buildings with the option to utilize human action to initiate notification (i.e., specific sequence of operation). We feel that this approach will provide clear and unambiguous occupant direction based on the emergency event while minimizing the potential for confusion in an emergency situation.

Please contact us if you have questions or comments. Thank you for your time and attention to this matter.

Sincerely,

David I. Rhodes, P.E.
Deputy Manager of Aviation
Denver International Airport

Prepared by,



Scott A. Craig, P.E.
Senior Fire Protection Engineer
Hughes Associates, Inc.

Reviewed by,

P.P. W.D. MOOR

Wayne D. Moore
Principal
Hughes Associates, Inc.

Technical Review by:

George Morkovin, P.E., Fire Protection Engineer — 6/16/2011 Date

Approved by:

Chief Joseph Gonzales, Chief of Fire Prevention and Investigation — 6/16/2011 Date

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August 20, 2013

Chief Joseph Gonzales
Denver Fire Department
Fire Prevention Division
745 W. Colfax Avenue
Denver, Colorado 80204

RE – Administrative Modification Request #19
Denver International Airport – Public Safety Notification Upgrade Project
Project CE-05021
Visual Notification Design Approach

Chief Gonzales,

This Administrative Modification request is submitted by Denver International Airport (DIA), in consultation with Hughes Associates, Inc. (HAI), to document the design approach for visual notification for the Public Safety Notification Upgrade (PSNU) Project at DIA. This request is a code clarification of the design intent for visual notification as addressed by the 2011 Denver Fire Code (DFC) Amendments to the 2009 International Fire Code (IFC), specifically Section 907.6.2.3. This request is specific to the Airport Terminal Buildings (i.e., Terminal and Concourses A, B, and C). Other buildings including the Airport Office Building (AOB), AGTS Maintenance Facility, and Central Utility Plant have already been modified in compliance with applicable codes for visual notification.

PSNU Administrative Modification #6, for Private Notification Areas, and #7, for Public Notification Areas, are also applicable to the project and are to be considered within the application of visual notification.

Applicable DFC requirements for visual notification are as follows:

> **Section 907.6.2.3 Visual Alarms**. In all occupancies, visible notification shall be provided in toilet rooms accessible to the disabled, in corridors, public and common areas and in areas of assembly. Visible alarms shall be installed in accordance with NFPA 72.
>
> **(IFC) 907.6.2.3.1 Public and common areas.** Visible alarm notification appliances shall be provided in public areas and common areas.
>
> **(IFC) 907.6.2.3.2 Employee work areas**. Where employee work areas have audible alarm coverage, the notification appliance circuits serving the employee work areas shall be initially designed with a minimum of 20-percent spare capacity to account for the potential of adding visible notification appliances in the future to accommodate hearing impaired employee(s).

It is acknowledged that IFC and DFC both require compliance with the National Fire Alarm and Signaling Code (NFPA 72) for the spacing, candela rating, and installation of the visual notification appliances.

This Administrative Modification clarifies the overall notification approach and provides for system consistency when modification is anticipated in the near future.

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This Administrative Modification addresses notification for the following three types of areas.

1. Public Areas

All areas accessible to the public, including sterile and non-sterile areas, that are not tenant spaces shall comply with NFPA 72 except as previously modified by PSNU Administrative Modification 7.

2. Tenant Spaces Accessible to the Public

At the time of fire alarm system migration, existing tenant spaces utilized by the public will be provided with a one-for-one replacement of visual notification. The next time the tenant space is renovated or upon lease renewal (i.e., maximum of five years based on current contracts), the visual notification shall be upgraded to provide prescriptive visual coverage in the space. Based on this approach, all tenant spaces that serve the public will be code compliant within five years.

3. Non-Public Areas

In general, existing visual notification appliances in non-public spaces will be replaced with new visual appliances at existing locations (i.e., one-for-one replacement). The new visual appliance shall be provided with a candela rating sufficient for the space to provide the best possible prescriptive coverage and shall be synchronized with other devices within the notification zone.

Additionally, visual notification shall be relocated or added as necessary in specific rooms/spaces to meet the following design criteria:

- Restrooms/Toilet Rooms: Provide prescriptive coverage in accordance with NFPA 72.
- Elevator Lobbies: Provide prescriptive coverage in accordance with NFPA 72.
- Break Rooms / Lunch Rooms: Provide prescriptive coverage in accordance with NFPA 72.
- Conference Rooms / Training Rooms: Provide prescriptive coverage in accordance with NFPA 72.
- AGTS Train Stations: Provide 110cd strobes throughout the AGTS Train Platform with spacing of devices not to exceed 100 feet apart.
- Corridors: All corridors that are greater than 50 feet in length shall be provided with at least one strobe. Candela rating of existing devices and placement of new devices shall comply with prescriptive coverage wherever possible.
- Mechanical Rooms: Due to high ambient noise levels, install at least one 110cd strobe near the entry point of the room. Complete prescriptive coverage of the room will typically not be provided. Larger mechanical rooms (i.e., greater than 100 feet in either direction) will have multiple notification appliances.
- Electrical Rooms: Electrical rooms are not required to have visual notification so visual appliances will not be provided.
- Existing locations: For locations other than addressed above, existing notification will be replaced with new devices and candela ratings will be set to provide compliance for the space when possible without adding additional devices.

In addition to the criteria above, new or relocated visual appliances will be provided where determined by the Engineer of Record or DFD to be in the best interests of public safety and within the intent of the code. Nothing within this Administrative Modification is intended to limit the DFD Fire Protection Engineer responsible for permit document review from requesting additional visual notification during the Permit review process.

For all areas of the Complex, the system replacement design will include a minimum of 20-percent spare capacity to account for the potential of adding visible notification appliances in the future.

Please confirm that this design approach for visual notification is acceptable for the DIA Complex, specific to the Terminal and Concourses A, B, and C.

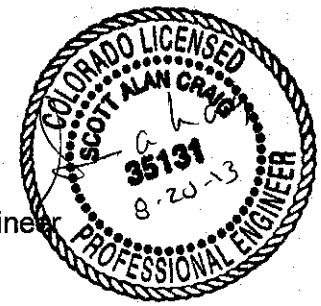
Please contact us if you have questions or comments. Thank you for your time and attention to this matter.

Sincerely,

Dave LaPorte
Deputy Manager of Aviation
Airport Infrastructure Management (AIM)
Denver International Airport

Prepared by,

Scott A. Craig, P.E.
Senior Fire Protection Engineer
Director, Denver Office
Hughes Associates, Inc.



Technical Review by:

George Morkovin, P.E., Fire Protection Engineer — 8/30/13 Date

Approved by:

Chief Joseph L. Gonzales, DFD/Fire Prevention Division — 9/3/13 Date

DENVER
THE MILE HIGH CITY

October 24, 2013

Chief Joseph Gonzales
Denver Fire Department
Fire Prevention Division
745 W. Colfax Avenue
Denver, Colorado 80204

RE – Administrative Modification Request #21
Denver International Airport – Public Safety Notification Upgrade Project
Project CE-05021
Smoke Control System – Basis of Design Modification

Chief Gonzales,

This Administrative Modification request is submitted by Denver International Airport (DIA), in consultation with Hughes Associates, Inc. (HAI), to modify the existing design approach for the smoke control system at the DIA Complex. Specifically, we request that the requirements within the 2011 Denver Building Code amendments be allowed to be applied instead of the original design requirements of the 1990 Denver Amendments. This Administrative Modification request does not involve a variance from the 2011 Denver Fire Code (DFC) Amendments to the 2009 International Fire Code (IFC) or any other applicable codes. Instead, this Administrative Modification requests permission modify the existing design to utilize the current code approach to smoke control design. This request is specific to the Airport Terminal Buildings (i.e., Terminal and Concourses A, B, and C). The Airport Office Building (AOB) has a smoke control design based on the high-rise requirements and will remain unmodified.

The original DIA smoke control design was consistent with the 1990 Denver Building Code (DBC) Chapter 59 for Airports as follows:

> **Section 5907(F)3** "A Detector in a smoke control zone shall actuate all the adjacent zone smoke control equipment to pressurize those adjacent zones with 100% outside air while the affected smoke control zone goes into exhaust. All other smoke control zones shall remain in normal operation."

This language was moved to Appendix N for Airports but remained unchanged through the 2008 Denver Amendments. However, the 2011 Denver Building Code amendments modified this language as follows:

> **Appendix N Section 4.6.1** - "If multiple smoke control zones for the airport terminal building are provided either by the zone area requirements of this Section or by system design, only the smoke exhaust system for the zone in alarm shall be activated. Smoke exhaust systems for adjacent airport terminal building zones shall not operate."

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Based on the new 2011 language, the requirement for pressurizing adjacent zones was removed. The wording in Appendix N is consistent with the DFC Sections 909.21.5.2(2) and 909.21.6.3.1 for "General building smoke exhaust for large spaces" and "Smoke control systems for covered mall areas" respectively.

Therefore, this Administrative Modification requests that the requirement for pressurizing surrounding zones be eliminated for DIA smoke zones.

The proposed modification is based on the following overall approach:

1. The new design approach will maintain the air change design basis from the original installation (i.e., 4 air changes per hour) consistent with the original Denver requirements of 1990 Denver Building Code Chapter 59, which was later changed to Appendix N and remains unchanged in the 2011 edition. Exhaust is typically not modified from the original sequence unless it is determined to be inadequate to obtain 4 air changes per hour.
2. In general, smoke control zone boundaries are not being modified unless addressed by administrative modification as a separate document (i.e., the basement levels of the Concourses are to be modified based on Administrative Modification #4 to the project) or are determined to be inconsistent with existing sprinkler zones.
3. Where multiple smoke zones have the exact same sequence of operation, these zones are combined into a single zone to simplify the documentation of the system.
4. Adjacent zones will not be pressurized unless make-up air is determined to be necessary to prevent excessive negative pressures within the building. Specifically, make-up/supply air fans are modified for each smoke zone to attempt to create a slightly negative condition (i.e., more exhaust than make-up air). This approach is an attempt to contain the smoke to the original zone and to avoid the smoke being pushed into other building areas or even other buildings. Maintaining a slightly negative condition credits the large volume of the building to allow make-up from other areas and through normal building leakage.
5. Identification of fans that are not required to be utilized in the smoke control sequence with the intent to remove them from the active smoke control sequence to reduce replacement costs.

A separate report will be provided for each building that details the existing documented and the proposed sequence of operation for each zone. This documentation will allow specifics of each building and smoke zone to be approved by DIA Engineering and DFD Fire Prevention. This new approach to smoke control as requested herein will be applied to all existing DIA Airport Terminal Buildings (i.e., Terminal and Concourses A, B, and C) and will also be consistent with the South Terminal Redevelopment Program, which is being designed to the 2011 DBC.

Please confirm that this smoke control design modification approach is acceptable for the DIA Complex.

Please contact us if you have questions or comments. Thank you for your time and attention to this matter.

Sincerely,

Dave LaPorte
Deputy Manager of Aviation
Airport Infrastructure Management (AIM)
Denver International Airport

Prepared by,

Scott A. Craig, P.E.
Senior Fire Protection Engineer
Director, Denver Office
Hughes Associates, Inc.

Technical Review by:

George Morkovin, P.E., Fire Protection Engineer — Date 10/29/13

Approved by:

Chief Joseph L. Gonzales, DFD/Fire Prevention Division — Date 10/29/13

DENVER
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July 7, 2014

Chief Joseph Gonzales
Denver Fire Department
Fire Prevention Division
745 W. Colfax Avenue
Denver, Colorado 80204

RE – Administrative Modification Request #24
Denver International Airport – Public Safety Notification Upgrade Project
Project CE-05021
Modification of Evacuation Pre-Message Tone

Chief Gonzales,

This Administrative Modification request is submitted by Denver International Airport (DIA), in consultation with Hughes Associates, Inc. (HAI), to request an alternate evacuation pre-message tone for the DIA Complex. This Administrative Modification requests a variance from the 2011 Denver Fire Code (DFC) to the 2009 International Fire Code (IFC) as the code of record, and to the 2010 *National Fire Alarm and Signaling Code*® (NFPA 72) as the governing system design standard. Specifically, this document requests the use of a slow-whoop tone instead of the three-pulse temporal pattern required by NFPA 72.

NFPA 72 Section 24.4.1.2.1 states that evacuation messages shall be preceded and followed by a minimum of two cycles of the emergency evacuation signal specified in Section 18.4.2. NFPA 72 Section 18.4.2 states that alarm audible signal patterns used to notify building occupants of the need to evacuate shall be the standard alarm evacuation signal consisting of a three-pulse temporal pattern.

The current Transportation Security Administration (TSA) security breach alarm message utilizes a pre-message tone pattern that is very similar to the three-pulse temporal pattern required by NFPA 72. Airport staff is trained to react to the pre-message tone instead of the message.

Because of the similarity between the NFPA 72 required three-pulse temporal pattern and the existing security breach alarm pre-message tone, DIA requests a variance to NFPA 72 Section 18.4.2. Specifically, DIA requests the use of a slow-whoop tone as this tone has been one of many tones historically used for evacuation and because it does not conflict with any other existing DIA pre-message tone. This pre-evacuation tone will be used throughout all airport terminal buildings including the Terminal and all Concourses. The slow whoop tone will not be used in the hotel areas of the Hotel and Transit Center (HTC) so that these areas can utilize a low-frequency pre-evacuation tone in compliance with NFPA 72 Section 18.4.5.3.

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Please contact us if you have questions or comments. Thank you for your time and attention to this matter.

Sincerely,

ON BEHALF OF

Dave LaPorte
Deputy Manager of Aviation
Airport Infrastructure Management (AIM)
Denver International Airport

Prepared by,

Scott A. Craig, P.E.
Senior Fire Protection Engineer
Director, Western Region
Hughes Associates, Inc.

COLORADO LICENSED
SCOTT ALAN CRAIG
35131
7-7-14
PROFESSIONAL ENGINEER

Technical Review by:

George Morkovin, P.E., Fire Protection Engineer — 7/7/14 — Date

#3A PERMIT REQUIRED

Approved by:

Chief Joseph L. Gonzales, DFD/Fire Prevention Division — 7/7/14 — Date

DENVER
THE MILE HIGH CITY

April 6, 2015

DENVER BUILDING PERMITTING
& INSPECTION SERVICES
ADMINISTRATIVE MODIFICATION 2015Am0038
PAGE 1 OF 18

Chief Joseph Gonzales
Denver Fire Department
Fire Prevention Division
745 W. Colfax Avenue
Denver, Colorado 80204

RE – Administrative Modification Request 26
Denver International Airport – Public Safety Notification Upgrade Project
Continued Use of Fire and Smoke Dampers with Multiple Temperature Sensors

Chief Gonzales,

This Administrative Modification request is submitted by Denver International Airport (DIA), in consultation with Jensen Hughes, to document the proposed approach to address fire and smoke dampers with multiple temperature sensors in the Terminal Building. This request does not involve a variance or wavier to applicable code as these devices are existing and UL Listed. Instead, it is provided to identify the type of damper utilized in the Terminal and obtain concurrence regarding the method of control for specialized dampers.

The Terminal Building utilizes a fire and smoke damper that have been configured with a Ruskin TS150 Firestat controller that allows the damper to be "reopenable"; see Attachment A for product data.

The TS150 has two resettable temperature sensors, which have been confirmed to be 165°F and 350°F for the accessible dampers in the Terminal and believed to be consistent throughout. The TS150 allows the fire and smoke damper to be reopened after the lower temperature sensor operates to close the damper at the 165°F setting. The general intent of this device is to allow the option of smoke control operations to occur when temperatures exceed 165°F. The wiring diagram on the second page of Attachment B illustrates the configuration. Specifically, the contact noted as "R1-3" can be closed to bypass the 165°F sensor and prevent closing of the damper at that setting. If temperatures within the duct reach the setting of the higher sensor (i.e., 350°F), the damper will close and the sensor must be manually reset to reopen the damper.

The existing configurations vary by location of these fire and smoke dampers, use of the dampers, and configuration of control and monitoring by the fire alarm system; see Attachment C for examples of different existing configurations. For a number of these configurations, an existing EST control module with a normally open contact is provided as the bypass around the 165°F sensor. These control modules are labeled as "Thermal Override" in the EST system. The concern with these control points is that they complicate the smoke control sequence of operation, provide additional failure points, and their functionality cannot be tested unless the damper's controller is heated to 165°F.

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A number of these existing dampers are not accessible for testing or maintenance due to location and duct configuration. However, Jensen Hughes personnel inspected five of these dampers. The tested damper was found to close when the lower temperature sensor reached approximately 165°F, was able to be reopened utilizing the thermal override bypass, and then closed again when the second sensor reached approximately 350°F. Dampers reopened when the sensors were manually reset.

While there are multiple existing configurations, there are only three relevant situations that are required to be addressed:

1. The damper is involved with smoke control exhaust; regardless of whether the damper is at a fire resistive rated assembly or not,
2. The damper is involved with smoke control supply or make-up air; regardless of whether the damper is at a fire resistive rated assembly or not,
3. The damper is not required for smoke control but is part of a fire resistive rated assembly, or

Note that no location has been identified where a fire and smoke damper with this dual heat sensor is provided where it is not associated with smoke control or a fire resistive rated assembly. However, this scenario is addressed herein to address all potential situations.

Damper for Smoke Control Exhaust

The 2009 International Building Code (IBC) provides exceptions for not providing fire dampers in fire resistive rated assemblies including Section 716.5.2 Exception 2 and Section 716.5.3 Exception 1.3. These exceptions are provided because closing fire dampers would interfere with the operation of the smoke control system. Closing of these dampers at 165°F would make the smoke control system ineffectual as it can be assumed that the exhausted smoke will reach temperatures of 165°F. However, we believe that it is acceptable to allow the damper to close at 350°F. Most fans provided for smoke control exhaust are rated for 250°F. Therefore, it can be assumed that at 350°F, the fans will be adversely affected and are likely to fail. Therefore, allowing these fire and smoke dampers to close at 350°F should not further diminish the system performance because it is expected that other components will also be failing at these temperatures.

Therefore, the desired configuration is to always maintain the damper in the open position to allow for smoke exhaust until the internal temperature reaches 350°F, when it would close. This configuration can be accomplished by utilizing the Thermal Override function of the damper controller. The existing EST system utilizes a normally open contact on a control module for this functionality.

The same performance can be obtained by permanently wiring across this bypass. Instead of connecting the wires associated with this bypass to the open contact, and then closing the contact in a fire condition, the two wires can be permanently connected together so the bypass is always present. This wiring approach eliminates the need for the control module and provides a more reliable method of ensuring that the bypass around the 165°F sensor performs.

For dual sensor dampers associated with smoke control exhaust, it is proposed that the wires associated with the bypass be connected using a crimp-type butt splice, and the associated box labeled indicating the purpose of the interconnection. Dampers will be controlled as necessary to support the smoke control sequence of operation. Monitoring will be provided for all dampers currently provided with end switches.

Dampers for Smoke Control Supply

Based on current Denver Amendments and as documented in Administrative Modification #21 for this project, pressurization of surrounding smoke zones is in general not required to be provided. However, there are exceptions to this approach where smoke control make-up air or pressurization is provided.

Contrary to current code requirements, the Terminal has stair and hoistway pressurization ducts that have fire and smoke dampers as they pass through fire resistive rated assemblies. For these configurations, we believe that the dampers should be closed if the internal temperature reaches 165°F. Specifically, it would be inappropriate to discharge elevated temperature air into either a stair or hoistway. Additionally, this same restriction would be true for general make-up air supplies.

Therefore, it is proposed that all dampers in supply ductwork for smoke control close upon activation of the 165°F sensor. To accomplish this sequence, it is proposed that the wires associated with the Thermal Override be isolated from each other and covered with electrical tape to ensure that they do not connect. Dampers will be controlled as necessary to support the smoke control sequence of operation. Monitoring will be provided for all dampers currently provided with end switches.

Dampers for Passive Protection in Fire Resistive Rated Assemblies

A number of these dual sensor fire and smoke dampers are used at fire resistive rated assemblies to provide compliance with opening protection of IBC Section 716. For these locations, the damper needs to close at predetermined acceptable temperature settings. The 165°F sensor is above the minimum recommended temperature setting of 160°F for fire dampers per IBC Section 716.3.3.1(2). Therefore, we recommend that these fire dampers be allowed to close upon 165°F sensor activation.

Typical of dampers in smoke control supply, it is proposed that the wires associated with the Thermal Override be isolated from each other and either provided with a wire nut and/or electrical tape to ensure that they do not connect to bypass the 165°F sensor closure of the damper. Fire alarm control will be maintained for the smoke damper functionality where provided. However, no monitoring of these dampers will be provided as this is not required for passive dampers.

Summary

The dual sensor fire and smoke dampers addressed herein are non-typical based on applicable codes. However, the dampers are UL Listed and limited testing has shown that the control operation works as designed. Therefore, we request your concurrence with the proposed approach addressed above for each general configuration for the dual sensor fire and smoke dampers in the Terminal.

The specific location of all identified dampers along with the modification proposed herein will be detailed on the pending Terminal Building fire alarm replacement permit drawings. Additionally, a complete sequence of operation for all dampers will be included in the permit drawings. Maintenance and testing procedures provided by the manufacturer will be provided to the DIA Maintenance Department.

Please contact us if you have questions or comments. Thank you for your time and attention to this matter.

Sincerely,

Dave LaPorte
Deputy Manager of Aviation
Airport Infrastructure Management (AIM)
Denver International Airport

Prepared by,

Scott A. Craig, P.E.
Senior Fire Protection Engineer
Vice President, Western Region
Jensen Hughes, Inc.

Appendix A: Ruskin TS150 Firestat for "Reopenable" Fire and Smoke Dampers datasheet
Appendix B: Ruskin Wiring Diagram for Modulating Actuators
Appendix C: Examples of Existing Configurations of the Dual Sensor Fire and Smoke Dampers

Technical Review by:

George Morkovin, P.E., Fire Protection Engineer — Date 4/22/2015

Approved by:

Chief Joseph L. Gonzales, DFD Fire Prevention Division — Date 4/22/2015

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& INSPECTION SERVICES
APPROVED AS NOTED
5/4/15
Mechanical Engineering Supervisor
DANNY BOWLES

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PAGE 9 OF 18

Appendix A

Ruskin TS150 Firestat for "Reopenable" Fire and Smoke Dampers datasheet

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TS150 FIRESTAT FOR "REOPENABLE" FIRE AND SMOKE DAMPERS

OPERATION INSTRUCTIONS SUPPLEMENT

APPLICATION

The TS150 is a UL Classified heat responsive device which is used in conjunction with Ruskin fire/smoke dampers. The TS150 is an **optional** device which can be ordered with electric actuators or pneumatic actuators and EP (electro/pneumatic) switches. The TS150 allows the dampers to be reopened after the initial closure for dynamic smoke control. **The TS150 must be installed at the factory and cannot be added in the field. Replacement TS150's may be field installed with the approval of the local authority.**

SMOKE DETECTION/TEST/POWER FAILURE OPERATION

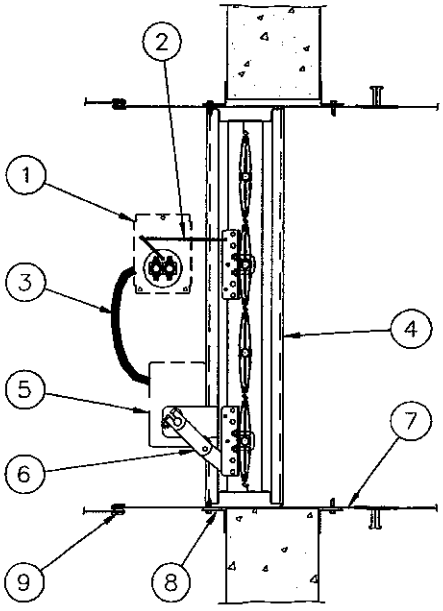
If smoke is detected, or during testing, or if power failure occurs, the damper will close and lock. When the smoke signal ceases (or smoke detector resets) , the test is complete or power is restored the SYSTEM will automatically REMOTE RESET the damper to the open position. The damper automatically resets if nuisance alarms occur and the SYSTEM is reset. The damper may be closed at any time by placing the MCP1 (optional) or other control switch (by others) in the CLOSED position.

FIRE OPERATION

When the switch of a control panel (MCP) is in the NORMAL position and temperatures in excess of 165°F/74°C (212°F/100°C optional) are detected, the damper will close and lock and the damper CLOSED indicator light on the control panel will light.

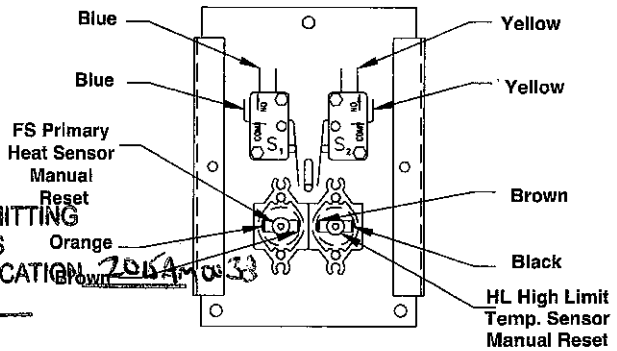
The damper remains closed until the override signal for smoke management from a remote command station is present and the duct temperature has not exceeded the high limit. The high limit temperature sensor prevents the damper from reopening when duct temperature is above the damper's UL555S degradation test temperature of 250°F/121°C or 350°F/177°C. Upon cessation of the fire condition, the damper can be reopened by pressing the RESET button on the TS150 assembly. At no time will the damper disengage from the actuator. The integral SP100 will positively communicate to the fire commander via the control panel the position of the damper for smoke management purposes.

Refer to the appropriate damper installation instructions for details on damper installation. All electrical wiring and connections to the Fire-Stat must be in accordance with the standards of the authorities having jurisdiction.



ITEM	ITEM
1. TS-150 Fire Stat	6. Over-Center Lock
2. Adjustable Connecting Rod	7. Damper Sleeve
3. Flex Conduit	8. FAST, PFMA or conventional mounting angles
4. Damper Frame	9. Sleeve to Duct Connection (by others)
5. Actuator or EP Switch	

S1 and S2 Switch AMP Ratings: 15 AMPS, @ 24, 125 or 250 VAC 1/2 AMP, @ 125 VDC, 1/4 AMP, @ 250 VDC



CLASSIFIED c UL us SEE COMPLETE MARKING ON PRODUCT

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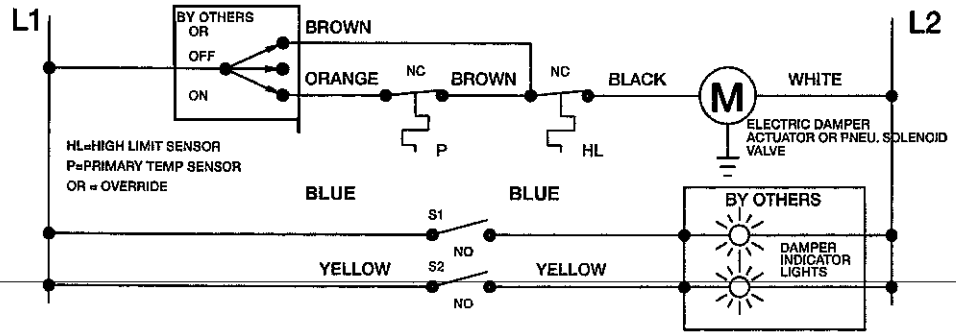
PAGE 6 OF 18



ALL STATED SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE OR OBLIGATION.

Appendix B:

Ruskin Wiring Diagram for Modulating Actuators

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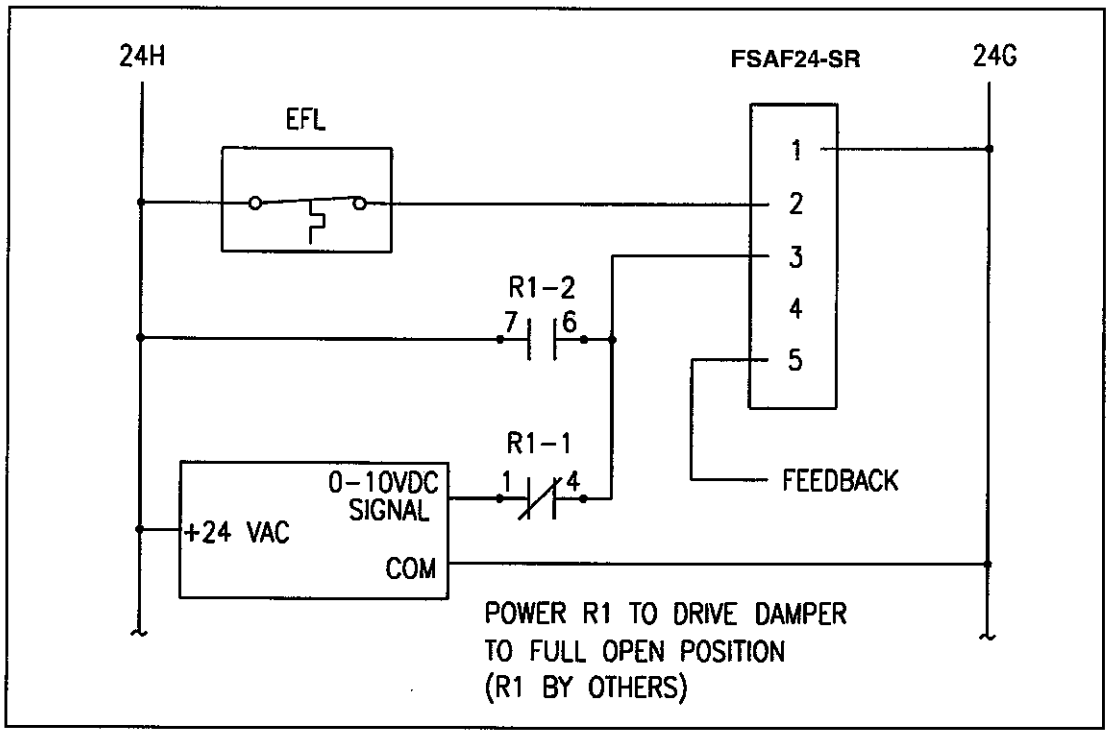
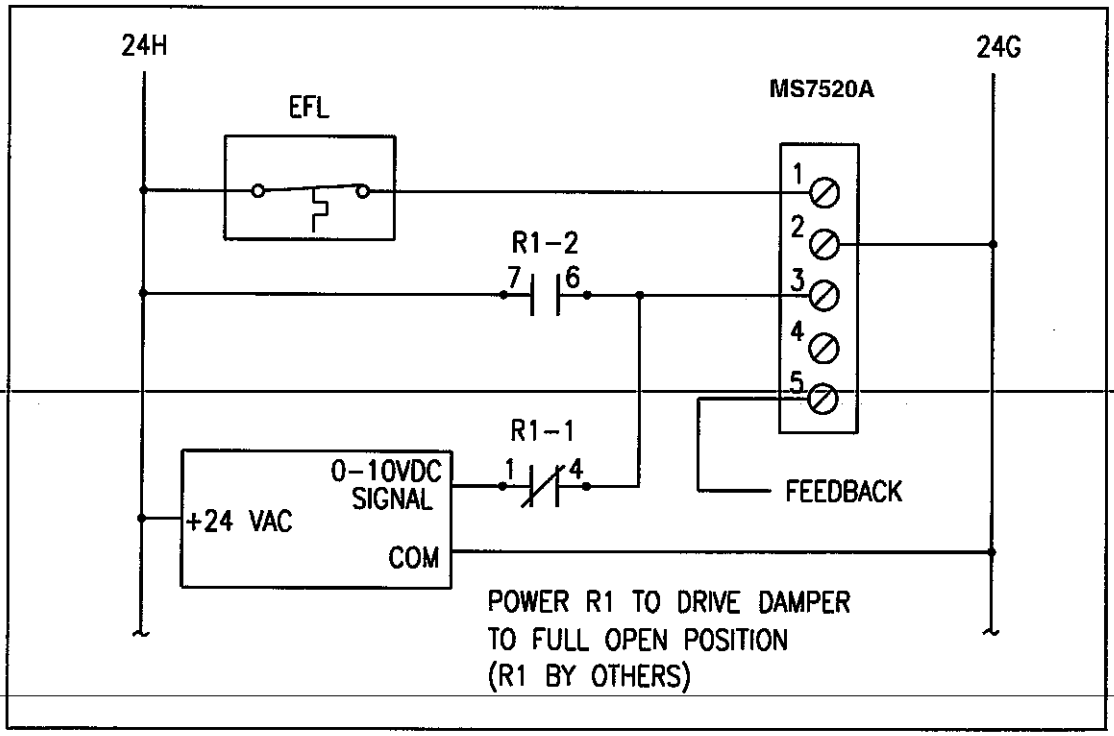
EFL WIRING DIAGRAMS FOR MODULATING ACTUATORS

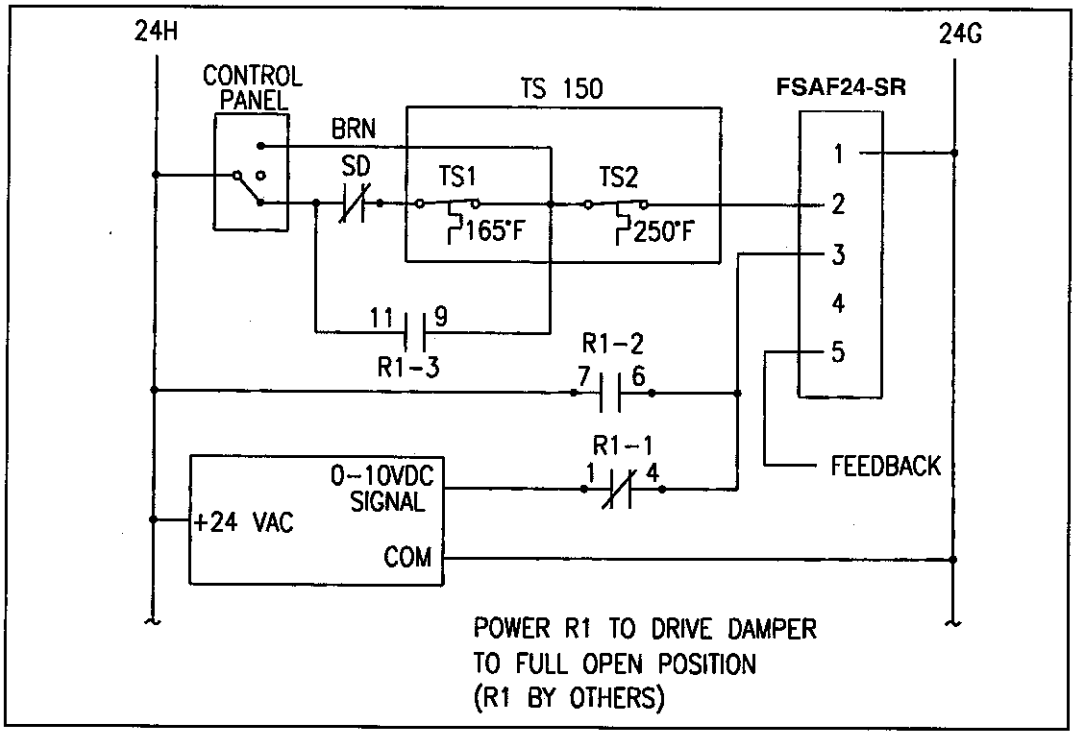
The wiring diagrams below are for the FSAF24-SR and the MS7520A modulating actuators. The wiring diagrams show how the control signal is field wired to the actuator through the EFL (heat release device). Also shown in the diagrams is a field supplied relay which when wired as shown will allow the actuator to drive the damper full open for smoke control purposes. The relay and single point control wiring connection is available from Ruskin as an option.

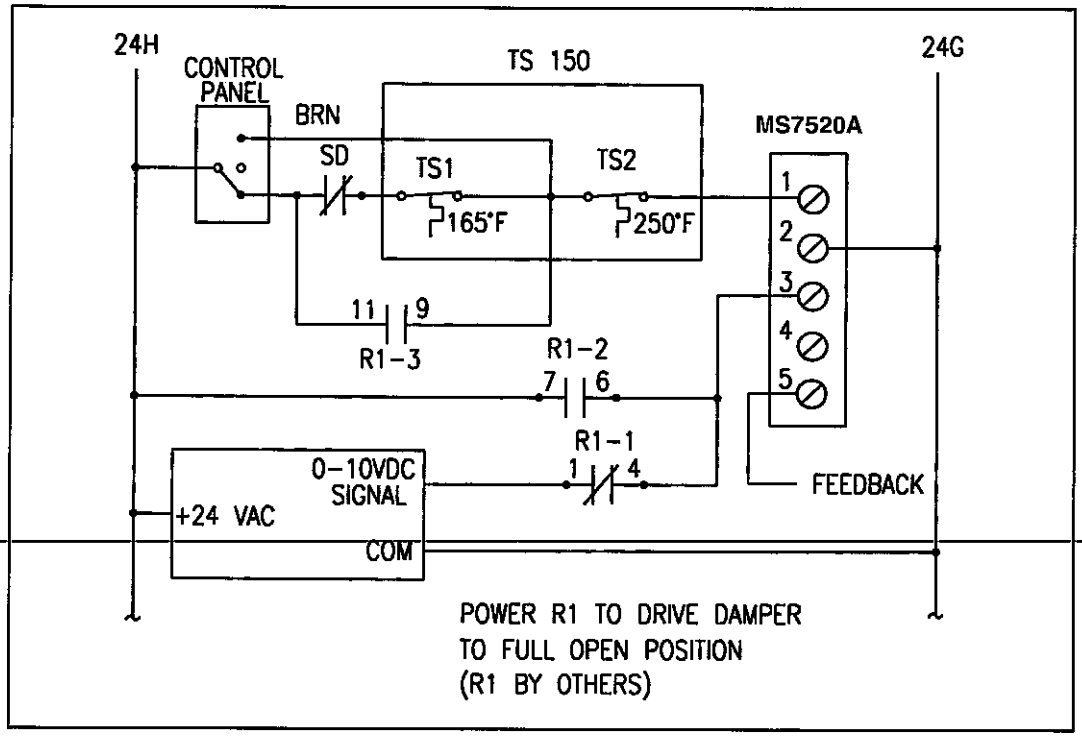




TS150 WIRING DIAGRAMS FOR MODULATING ACTUATORS

The wiring diagrams below are for the FSAF24-SR and the MS7520A modulating actuators. The wiring diagrams show how the control signal is field wired to the actuator through the TS150 (heat release device). Also shown in the diagrams is a field supplied relay which when wired as shown will allow the actuator to drive the damper full open for smoke control purposes. The relay and single point control wiring connection is available from Ruskin as an option.





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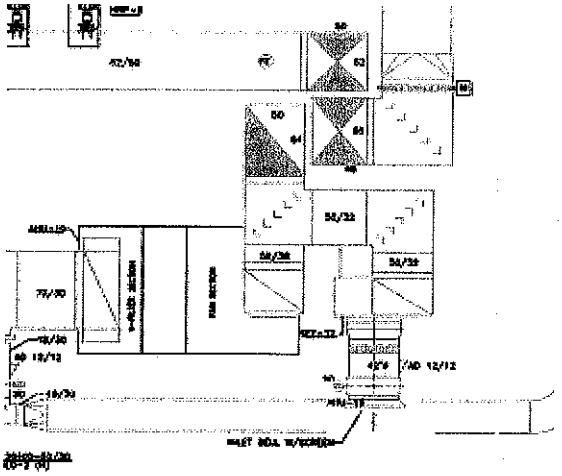
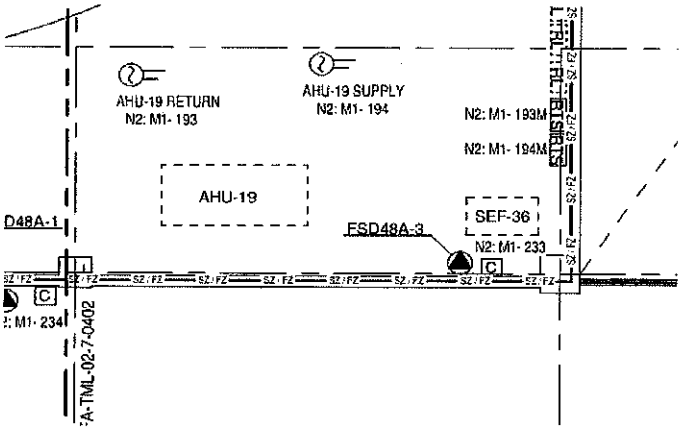
Appendix C:

Examples of Existing Configurations of the Dual Sensor Fire and Smoke Dampers

DIA Terminal - Thermal Override Issue
Scenario A

Smoke Exhaust Fan (dedicated exhaust)
Fire/Smoke Damper in wall of Mechanical Room
Damper opens when fan turns on
Damper contains Ruskin TS150 Firestat
EST Control Module listed as "Thermal Override"
Estimated number of occurances: 14





Example: Level 4 Mod 1 West

Current Sequence of Operations:
When fan is activated, thermal override control module was activated.

Proposed Sequence of Operations:
Replace EST module with Simplex module.
When fan is activated, thermal override control module was activated.

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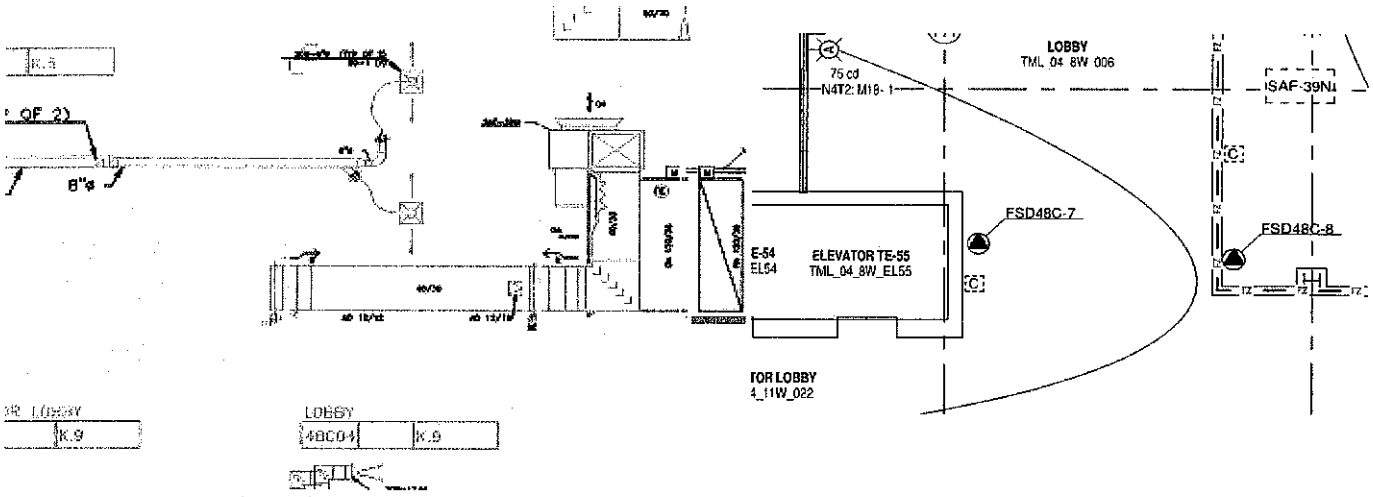
ADMINISTRATIVE MODIFICATION 2016Amod38
PAGE 14 OF 18

DIA Terminal - Thermal Override Issue
Scenario B

Supply Air Fan (dedicated - elevator shaft pressurization)
Fire/Smoke Damper in wall of Mechanical Room and/or in wall of elevator shaft
Damper opens when fan turns on
Damper contains Ruskin TS150 Firestat
EST Control Module listed as "Thermal Override", one module per damper
Estimated number of occurances: 28



Example: Level 4 Mod 1 West (SAF-39N)

Current Sequence of Operations:
When fan is activated, thermal override control module was activated.

Proposed Sequence of Operations:
Demo EST module.
Decommission thermal override by placing tag on damper.
Damper will close at 165 degrees, operating as a normal fire damper.

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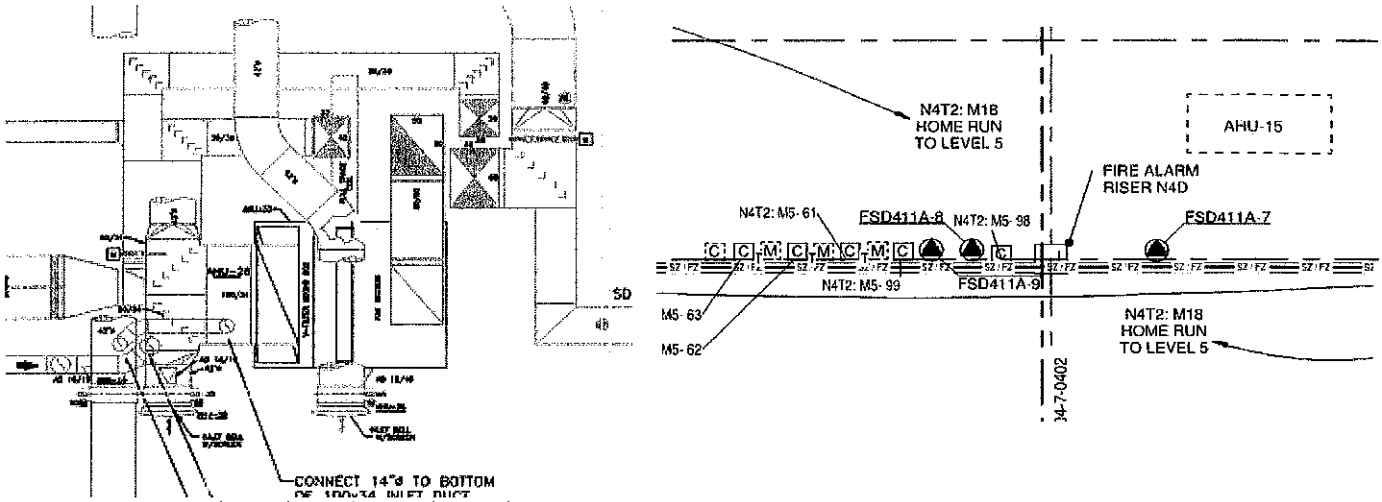
ADMINISTRATIVE MODIFICATION 2016Am0038
PAGE 11 OF 18

DIA Terminal - Thermal Override Issue
Scenario C

AHU used as normal exhaust from Level 3/4.
Fire/Smoke Damper in wall of Mechanical Room
Damper opens when fan is on
Damper contains Ruskin TS150 Firestat
EST Control Module listed as "Thermal Override", one module per damper
EST Control Module listed as "Damper Control", one module per damper
EST Monitor Module listed as "Damper Status", one module per damper
Estimated number of occurances: 12



Example: Level 4 Mod 2 West (AHU-15)

Current Sequence of Operations:
When smoke control is activated, thermal override control module was activated.
For exhaust AHU's serving separate smoke zones, the damper control module is used to close the damper to only exhaust from the proper smoke zone.

Proposed Sequence of Operations:
Replace EST modules with Simplex modules
Maintain existing sequence

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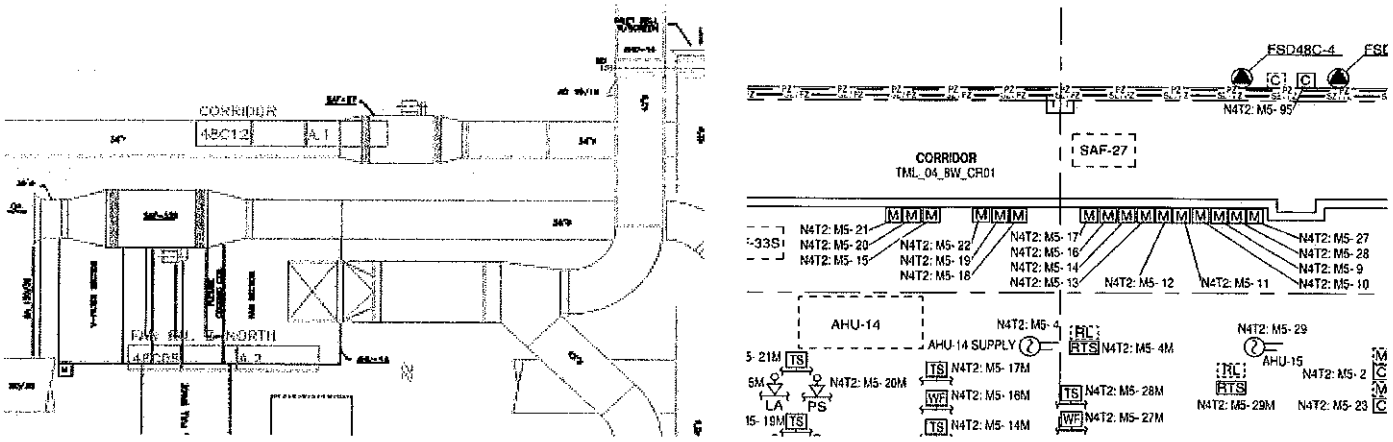
ADMINISTRATIVE MODIFICATION 2015Am0038
PAGE 12 OF 18

DIA Terminal - Thermal Override Issue
Scenario D

AHU used as normal supply to Level 3/4.
Fire/Smoke Damper in wall of Mechanical Room
Damper opens when fan is on
Damper contains Ruskin TS150 Firestat
EST Control Module listed as "Thermal Override", one module per damper
EST Control Module listed as "Damper Control", one module per damper
EST Monitor Module listed as "Damper Status", one module per damper
Estimated number of occurances: 8 (plus 4 dampers that have Thermal Override control modules only)



Example: Level 4 Mod 1 West (AHU-14)

Current Sequence of Operations:
When smoke control is activated, thermal override control module was activated.
For supply AHU's serving separate smoke zones, the damper control module is used to close the damper to only supply to the adjacent smoke zone.

Proposed Sequence of Operations:
Demo monitor and control modules. Damper operates as fire damper only

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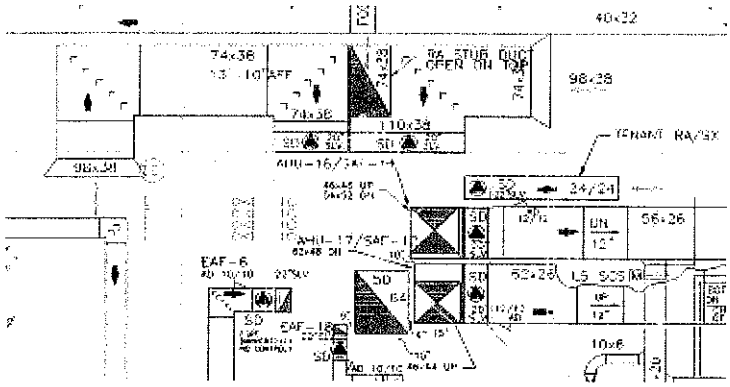
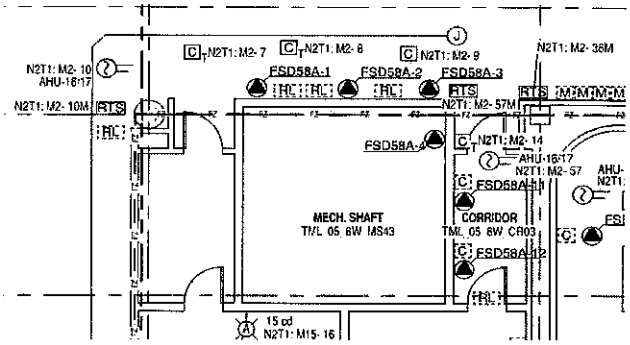
ADMINISTRATIVE MODIFICATION 2016AMOD38
PAGE 14 OF 19

DIA Terminal - Thermal Override Issue
Scenario E

Ductwork is normal return air to shaft for Levels 5/6.
Fire/Smoke Damper in wall of Shaft
Damper is normally open
We believe the Dampers contains Ruskin TS150 Firestat although not controllea
EST Control Module listed as "Damper Control", one module per damper
EST Monitor Module listed as "Damper Status", one module per damper
Estimated number of occurances: 72





Example: Level 5 Mod 1 West

Current Sequence of Operations:
When smoke control is activated, thermal override control module was activated.

When adjacent smoke zones are activated, the control module closes the damper to pressurize the area.
Roof-mounted dedicated smoke exhaust fans activate to pull smoke out of the building.
Proposed Sequence of Operations:
Replace EST modules with Simplex modules
Maintain existing sequence

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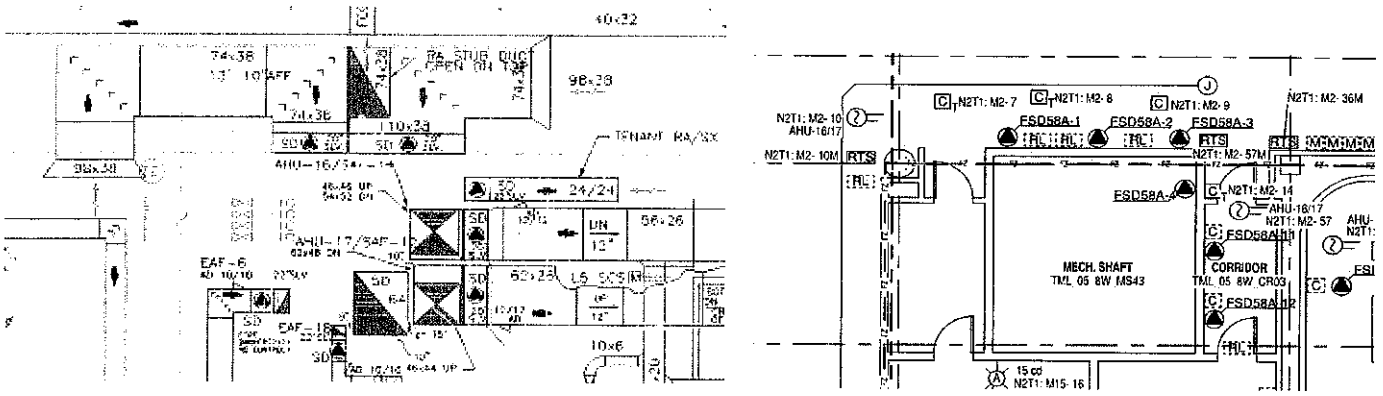
ADMINISTRATIVE MODIFICATION 2015AM00038
PAGE 14 OF 18

DIA Terminal - Thermal Override Issue
Scenario F

Ductwork is normal supply air for Levels 5/6.
Fire/Smoke Damper in wall of Shaft
Damper is normally open
Damper contains Ruskin TS150 Firestat
EST Control Module listed as "Thermal Override", one module per damper
Estimated number of occurances: 54 (plus 94 downstream dampers that have control/monitor modules)



Example: Level 5 Mod 1 West

Current Sequence of Operations:
When smoke control is activated, thermal override control module was activated.
Downstream control modules on downstream dampers open or close to supply make-up air to adjacent smoke zones.

Proposed Sequence of Operations:
Demo EST module.
Decommission thermal override by placing tag on damper.
Damper will close at 165 degrees, operating as a normal fire damper.
Demo all downstream damper control and status monitor modules.

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ADMINISTRATIVE MODIFICATION 2015am00338
PAGE 16 OF 18

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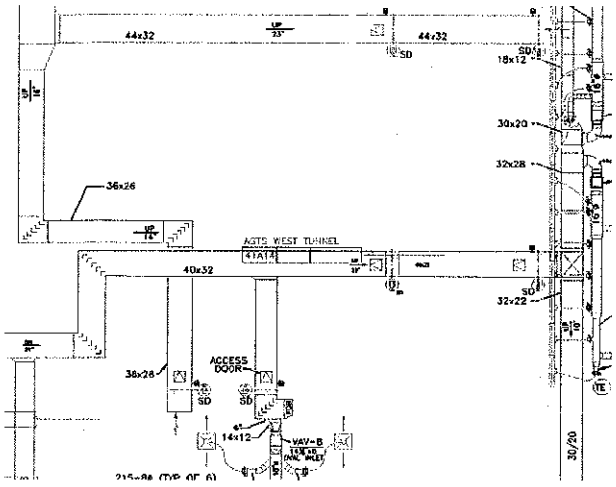
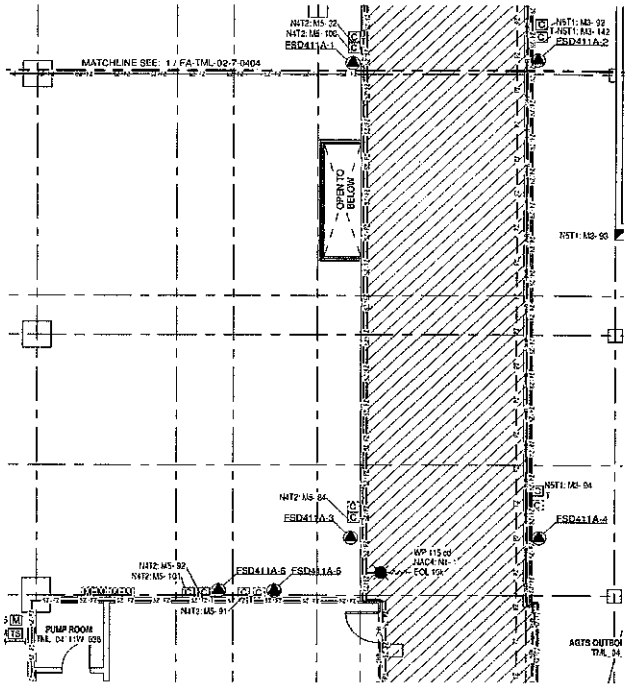
DIA Terminal - Thermal Override Issue
Scenario G

Issue specific to AGTS Platforms (both inboard and outboard)
Ductwork is normal supply air and return/exhaust air for Level 4 train platforms.
Fire/Smoke Damper in wall of platform or wall of train tunnel.
Damper is normally open
Damper contains Ruskin TS150 Firestat
EST Control Module listed as "Thermal Override", one module per damper
EST Control Module listed as "Damper Control", one module per damper
EST Monitor Module listed as "Damper Status", one module per damper
Estimated number of occurances: 18 (12 are supply and 6 are exhaust)





Example: Level 4 Mod 2 West

Current Sequence of Operations:
When smoke control is activated, thermal override control module was activated on exhaust duct.
Smoke control exhaust duct dampers go open and supply duct dampers go closed. Adjacent zone dampers pressurize and close exhaust.

Proposed Sequence of Operations:
Demo EST module on supply duct work.
Decommission thermal override by placing tag on damper.
Damper will close at 165 degrees, operating as a normal fire damper.
Replace EST modules with Simplex modules on exhaust duct work.
Maintain existing sequence

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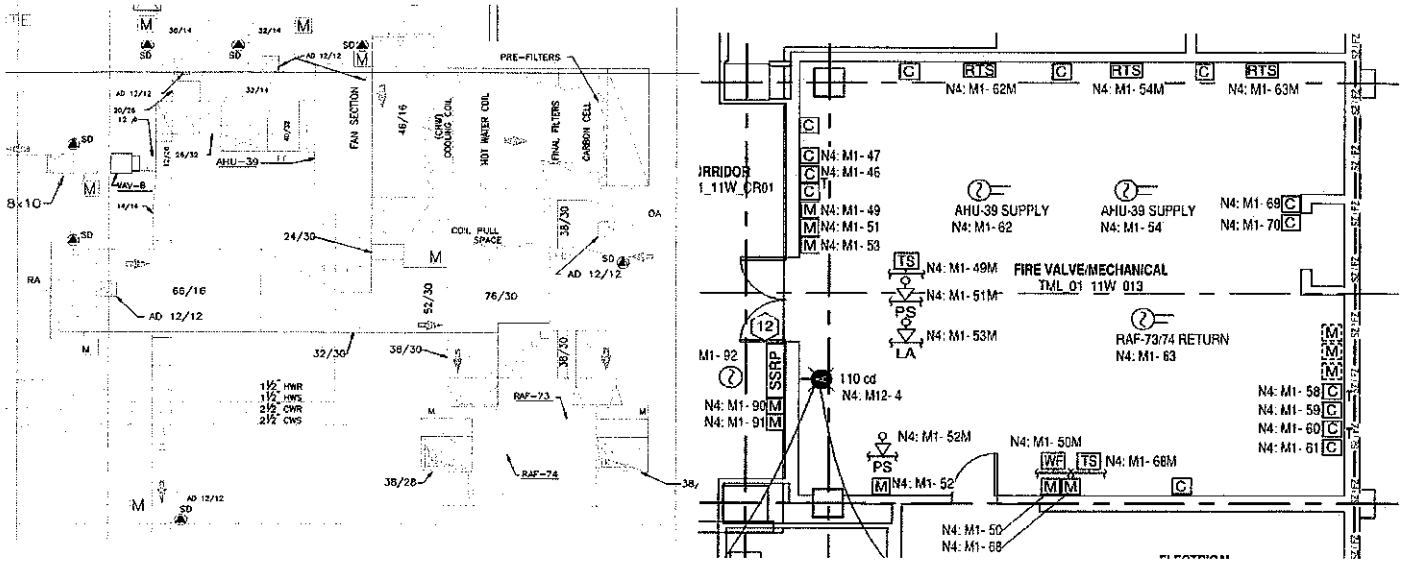
ADMINISTRATIVE MODIFICATION 2015AM00038
PAGE 4 OF 18

DIA Terminal - Thermal Override Issue
Scenario H

Level 1 normal AHU with two Return Air Fan used for Smoke Control
Fire/Smoke Damper in wall of Mechanical Room (4 Supply, 2 Return/Exhaust)
Damper is normally open
Damper contains Ruskin TS150 Firestat
EST Control Module listed as "Thermal Override"
Estimated number of occurances: 12 (8 Supply, 4 Return/Exhaust)



Example: Level 1 Mod 2 West

Current Sequence of Operations:
When fan is activated for smoke control, thermal override control module was activated.

Proposed Sequence of Operations:
Demo EST module.
Decommission thermal override by placing tag on damper.
Damper will close at 165 degrees, operating as a normal fire damper.

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ADMINISTRATIVE MODIFICATION 2015Amod39
PAGE 18 OF 18

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2016-ADMIMOD-0000023
ADMINISTRATIVE MODIFICATION #
PAGE 1 OF 8

February 26, 2016

Chief Joseph Gonzales
Denver Fire Department
Fire Prevention Division
745 W. Colfax Avenue
Denver, Colorado 80204

RE – Administrative Modification Request #28
Denver International Airport – Public Safety Notification Upgrade Program
Terminal Smoke Zones

Chief Gonzales,

This Administrative Modification request is submitted by Denver International Airport (DEN), in consultation with Jensen Hughes, to request a modification of the smoke zones in the Jeppesen Terminal Building. Specifically, this request is to combine smoke control zones on Levels 5 and 6 in the Terminal to improve functionality and performance of the system. This Administrative Modification request does not involve a variance from the 2011 Denver Amendments (DBC) to the 2009 International Building Code (IBC) or International Fire Code (IFC), or any other applicable codes. Instead, this Administrative Modification seeks to clarify the design intent for these smoke zones and document the new zone configurations.

Existing Conditions

On Levels 5 and 6, the Terminal building is divided into nine smoke zones as indicated by the attachments to this letter. On each of these two Levels, the east and west sides of the Terminal are divided into 3 smoke zones. Additionally, the Great Hall, which is really a single zone encompassing both Level 5 and Level 6, has historically been shown as three separate smoke zones.

Separations between open smoke zones are required to have draft curtains per DBC Section 909.21.7.1 Exception 1. Additionally, smoke zones are to be configured consistent with the fire sprinkler zones in the area.

The east and west smoke zones boundaries are not consistent with respect to the mechanical systems, the sprinkler system boundaries, or the draft curtains. Additionally, the lack of clear delineation of the smoke zone boundaries makes it very difficult to prevent smoke from migrating north and south within these zones.

The Great Hall does not have any smoke curtains to separate it into north to south smoke zones. This area is essentially a single atrium space and smoke would migrate through this high ceiling area primarily as a result of stratification.

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Proposed Configuration

The proposed configuration of smoke zones is to combine the three north-south zones for the east, center (Great Hall), and west areas; see Attachment B for details.

The east and west zones would operate automatically by level with multiple exhaust fans operating throughout the active zone. This configuration will reduce concerns of incorrect zone activation between the north-south zones and should improve the ability to hold smoke within the activated zone.

The Great Hall is a manually only activated zone. Exhaust fan activation is set up by groups of fans, so operators can limit the number of fans that are activated. Addressing this as a single zone more closely represents the actual configuration of the space.

Draft curtains will be provided/maintained between the east/west zones and the Great Hall zone.

Please contact us if you have questions or comments. Thank you for your time and attention to this matter.

Sincerely,

Somer Shindler
Acting Senior Vice President
Airport Infrastructure Management (AIM)
Denver International Airport

Prepared by,

Scott A. Craig, PE
Senior Fire Protection Engineer
Vice President, Western Region
Jensen Hughes, Inc.

COLORADO LICENSED PROFESSIONAL ENGINEER SCOTT ALAN CRAIG 35131 2-26-16

Attachments:

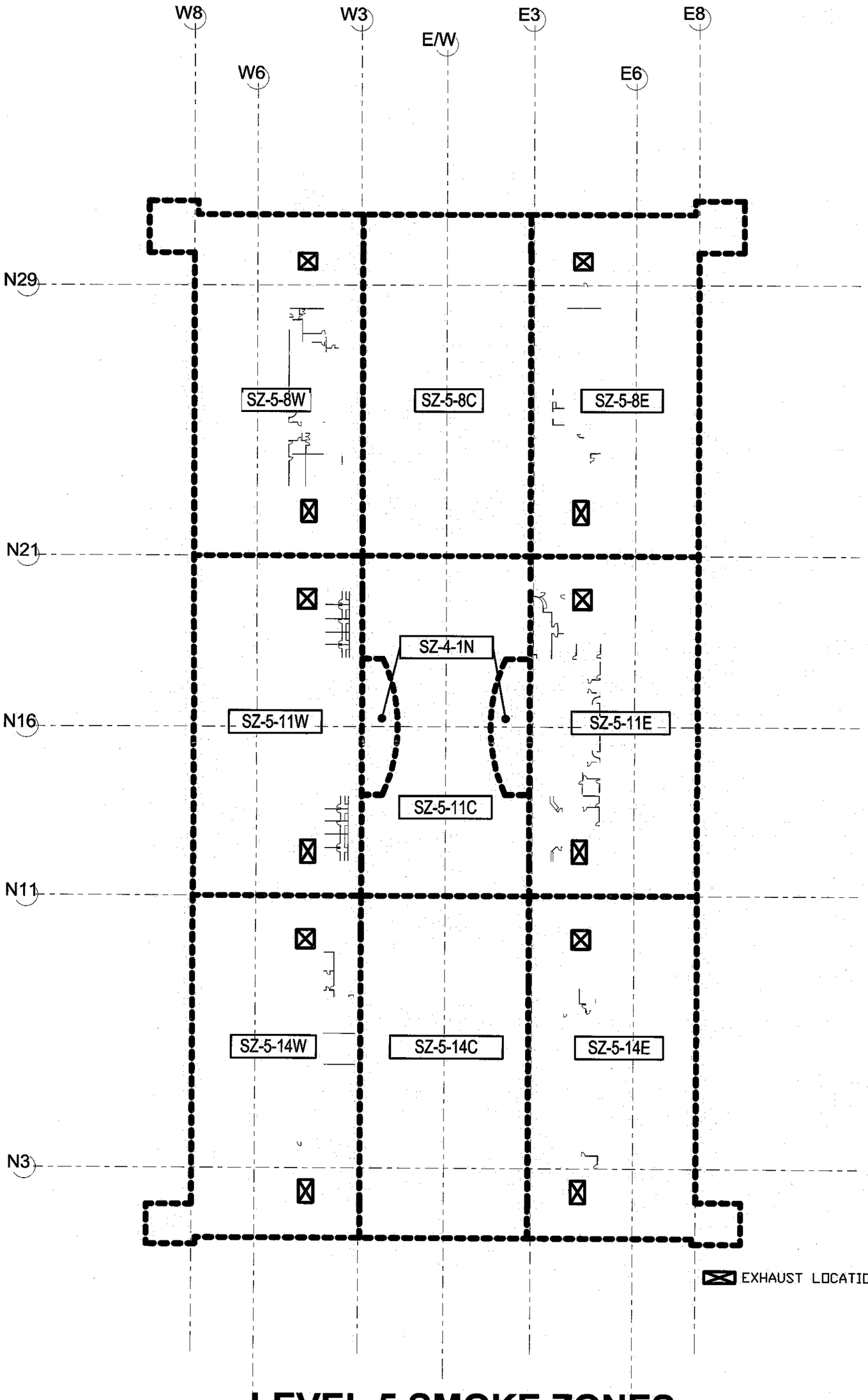
- Level 5 Fire Zones
- Level 5 Existing Smoke Zones
- Level 5 Proposed Smoke Zones
- Level 6 Fire Zones
- Level 6 Existing Smoke Zones
- Level 6 Proposed Smoke Zones

Technical Review by: Recommend Approval:

George Morkovin, P.E., Fire Protection Engineer — 4/15/16 Date

Approved by:

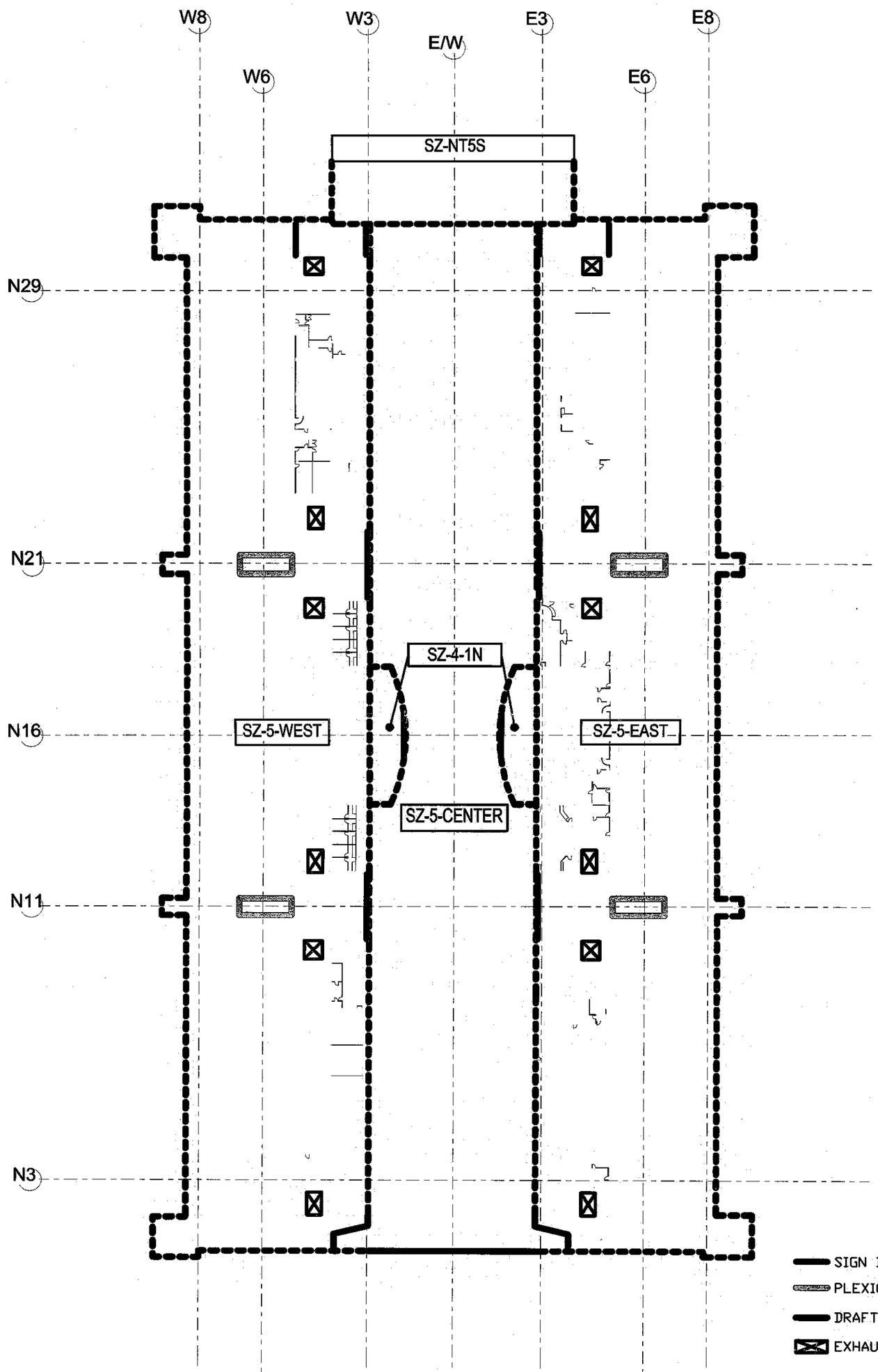
Chief Joseph L. Gonzales, DFD/Fire Prevention Division — 15 APRIL 16 Date



LEVEL 5 SMOKE ZONES
EXISTING

APPENDIX C

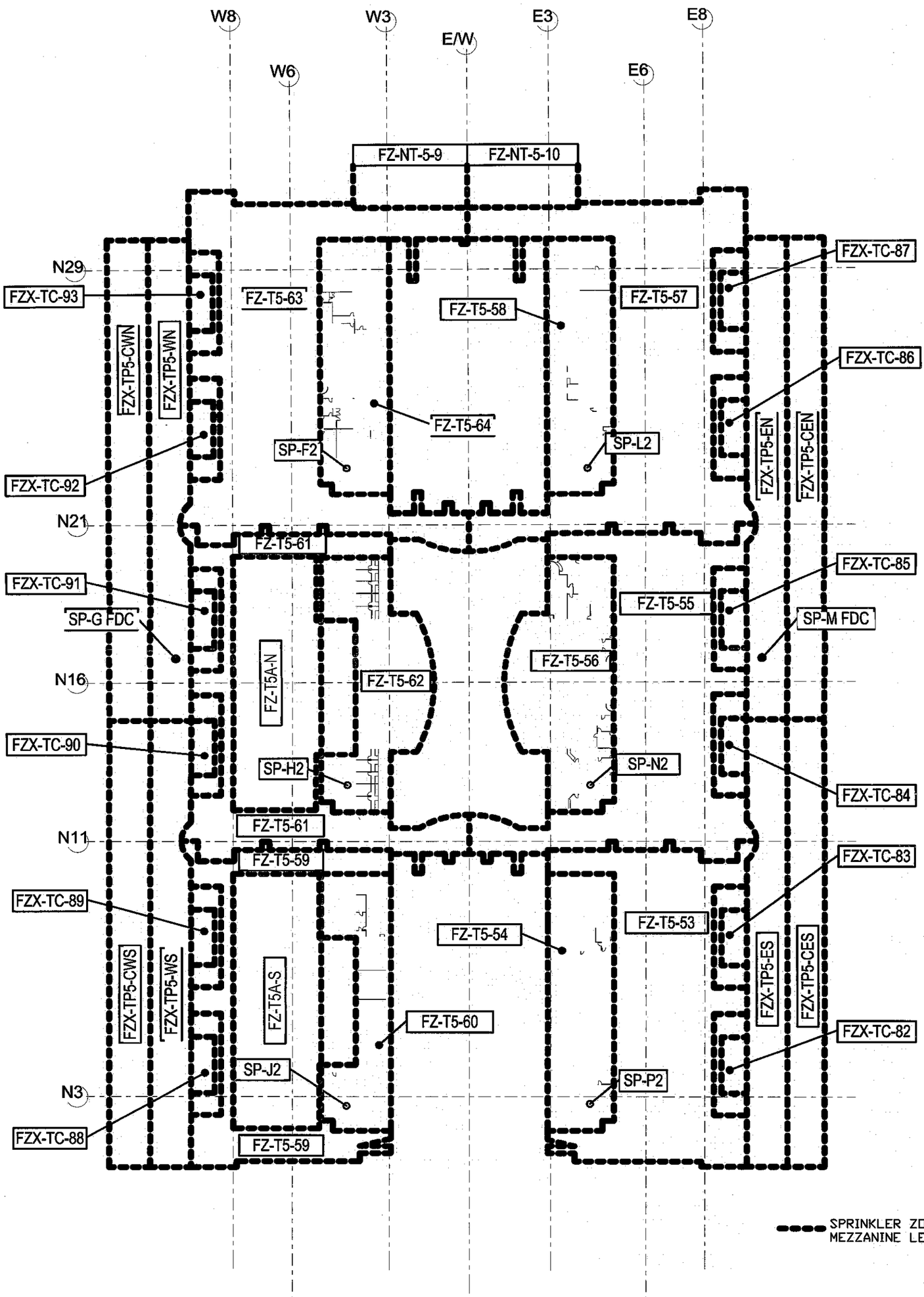
ADMINISTRATIVE MODIFICATION # 2016-Admin-00023
PAGE 3 OF 8



LEVEL 5 SMOKE ZONES
PROPOSED

APPENDIX C

ADMINISTRATIVE MODIFICATION # 2016-ADMIN-MOD-00023
PAGE 4 OF 8

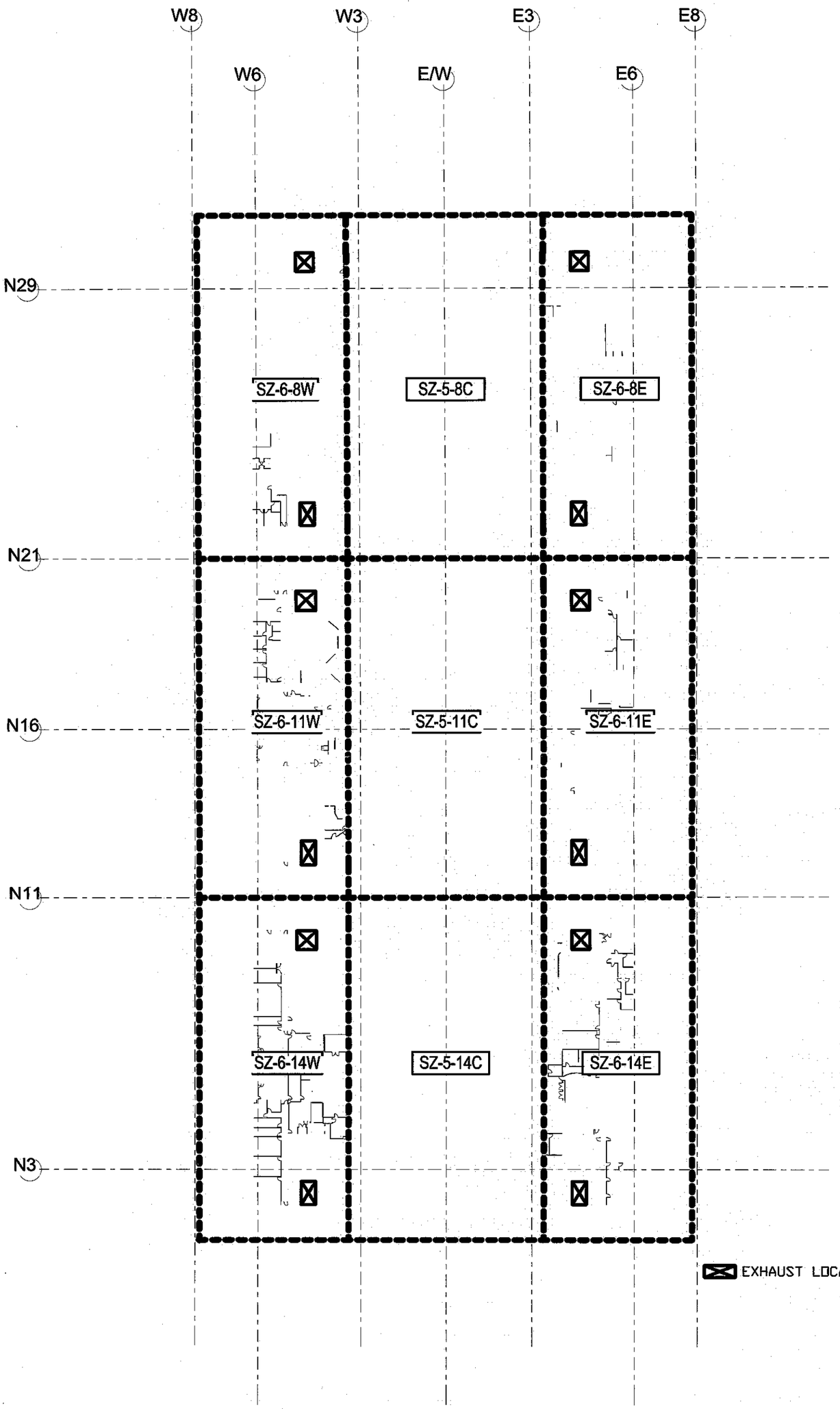


LEVEL 5 FIRE ZONES

APPENDIX C

ADMINISTRATIVE MODIFICATION # 2016-ADMIN-MOD - 00002023

PAGE 5 OF 8



LEVEL 6 SMOKE ZONES
EXISTING

APPENDIX C

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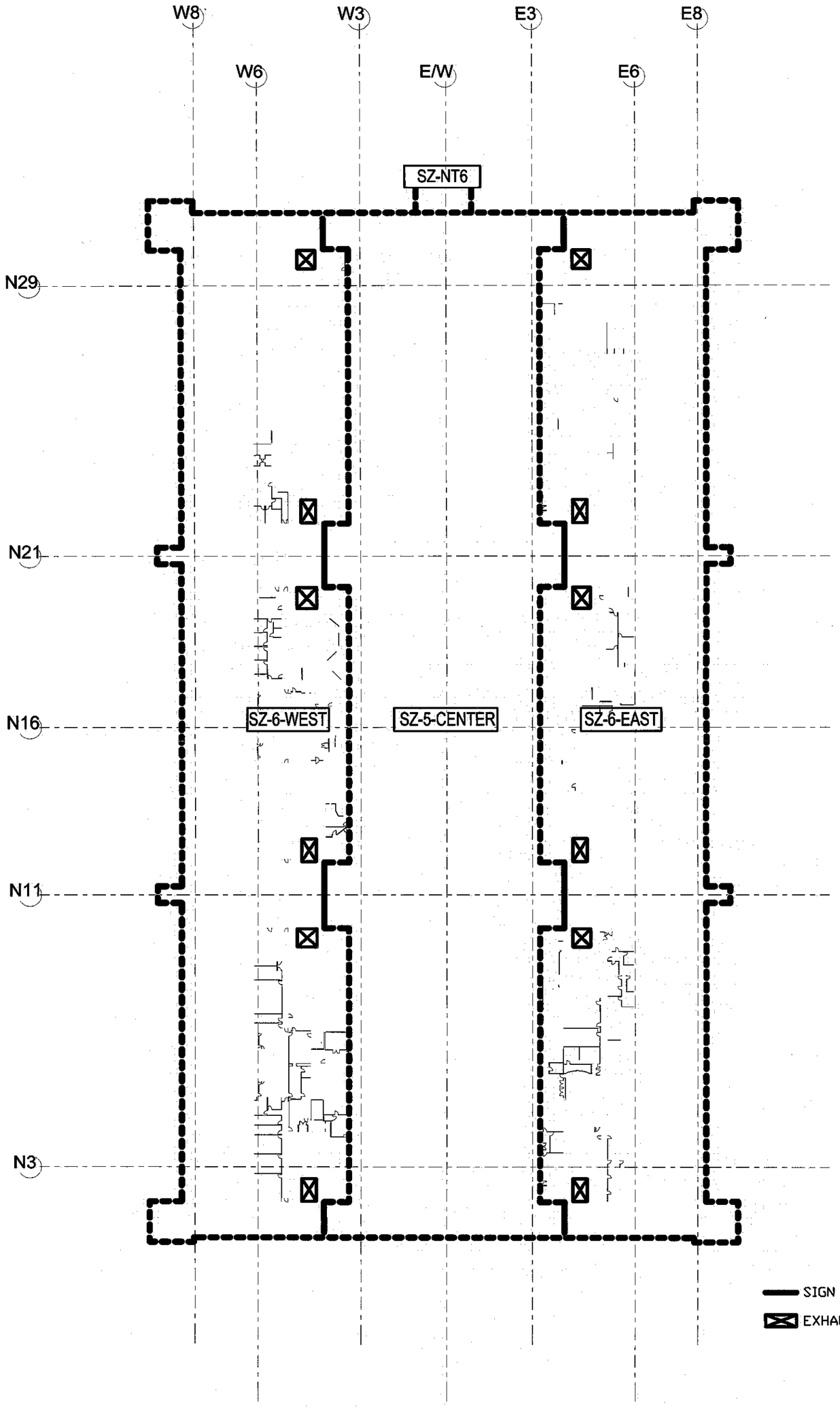
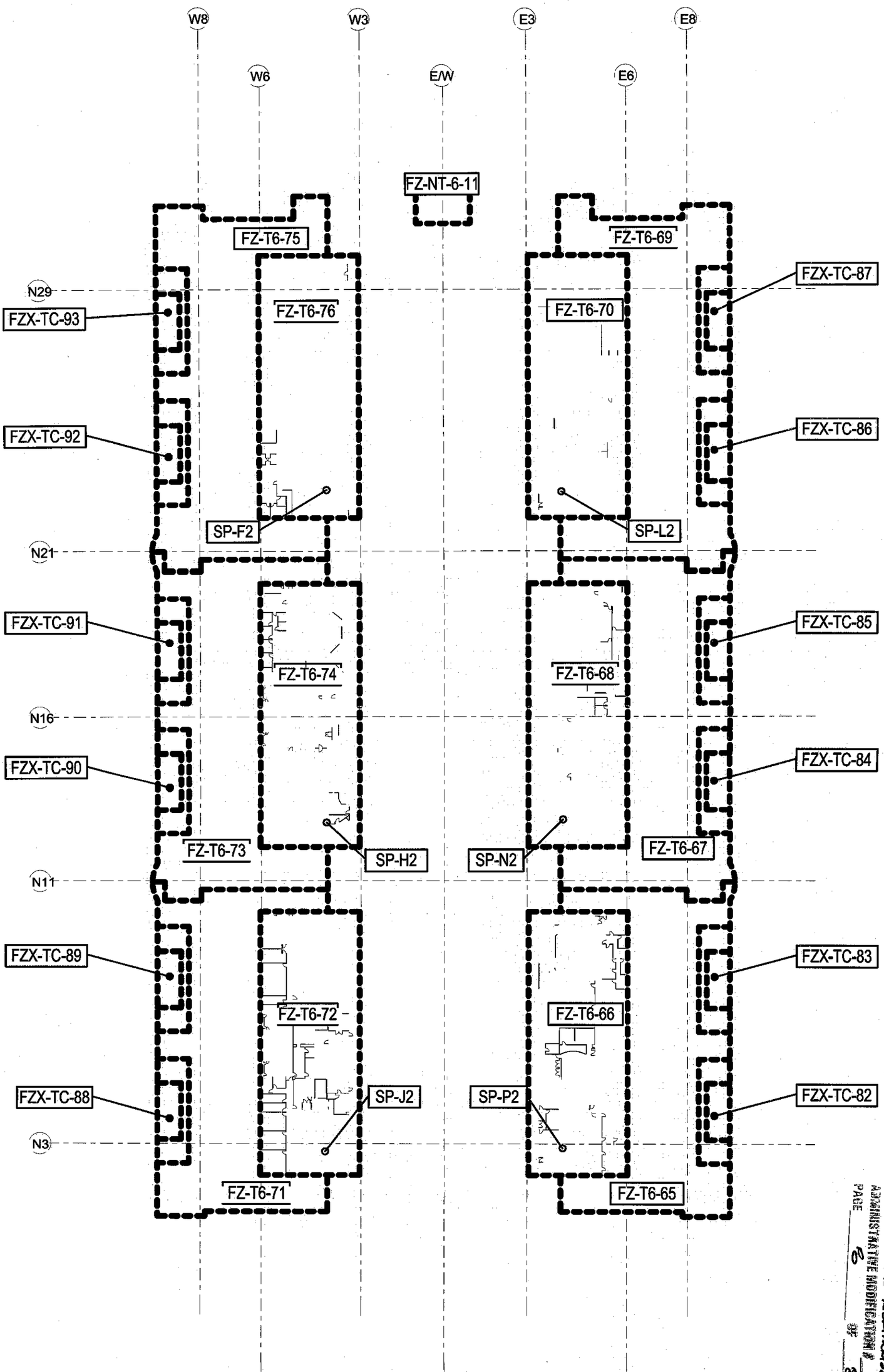
PAGE 6 OF 8



LEVEL 6 SMOKE ZONES
PROPOSED

APPENDIX C

ADMINISTRATIVE MODIFICATION # 2023
PAGE 7 OF 8



LEVEL 6 FIRE ZONES

APPENDIX C

ADMINISTRATIVE MODIFICATION #
PAGE 8 OF 8
2016-ADMIN-0003.23