DESCRIPTION OF SPECIAL SYSTEMS

Structural

Architectural

Electrical

Mechanical

Telecommunications and Data Systems

LOADING CRITERIA AND HANGING POINTS

In general, live loading criteria shall be as required by the local building codes. In certain areas, live loads that exceed code minimums are required to meet the functional needs of the facility. Given this assumption, the table below is provided as supplemental information:

Floor Live Loads:		
Ballroom	150 psf	
Meeting Rooms	125 psf	
Concourse, Pre-Function	100 psf	
Exhibition Hall	350 psf	
Loading Dock, Warehouse	250 psf	
Equipment Rooms	40 psf	plus equipment weight, not less than 150 psf
Storage Rooms > 200 SF	200 psf	

Structural design for the elevated large gathering spaces such as exhibition halls, meeting rooms and ballroom shall address the potential for rhythmic motion such as dancing or aerobic exercise.

Heavy wheeled loads from forklifts caused a lot of unintentional damage to convention facilities, from backing into walls to crushing floor outlets. In general, the design criteria for these elements in high-traffic areas should anticipate a short-duration load from a hard rubber tired vehicle imparting a load of 32,000 pounds over a 1-inch by 16-inch contact area.

Larger storage rooms may provide for stacking racks of tables and chairs using mechanized material handling equipment.

Hanging Point Loading - Exhibition Hall

Overhead structure requires rigging support for signage, banners, projection screens, speaker clusters, light trusses and other production equipment. Hanging point load criteria is generally configured so that industry-standard 20-inch aluminum box trusses will fail if over loaded without impacting the building structure. Structural bays are assumed to be 30 feet on center for these loading purposes. The following criteria apply:

- Built-in fixed hanging points at maximum 15 feet on center each way over proposed head table or stage locations to support 2,500-pound point loads. Provide lateral bracing ability to allow rigging points to be used in tandem so that a 20,000-pound weight can be carried over a 30 foot-by-60 foot area.
- Built-in fixed hanging points at maximum 15 feet on center each way for the remaining portions of the overhead structure for the exhibition hall. Design to support 1,500-pound vertical point loads; brace for lateral loading assuming load reduction using a 1:2 vertical slope.

Hanging Point Loading - Ballroom

Overhead structure requires rigging support for banners, projection screens, speakers, light trusses and other production equipment. The following criteria apply:

- Built-in fixed hanging points at maximum 15 feet on center each way over proposed head table or stage locations to support 2,500-pound point loads; brace for lateral loading assuming load reduction using a 1:2 vertical slope.
- Built-in hanging points (where not required above) at 15 feet on center each way to support 1,500-pound point loads. Locations to start approximately 30 feet from near wall at entrance.
- Allow for short-term applied load of 20,000 pounds on any single girder spanning the depth (front-to-back) of the ballroom.

OPERABLE WALLS

There are a number of manufacturers that build high-quality operable wall panel and track systems. Each system is unique in its design, material selections, fabrication and assembly, which makes the comparison among these more challenging. The intent of this overview is to define critical functional and operational characteristics and to establish acoustical performance criteria for the installed system, and not to limit the Operator's options among available products.

Operation

Operable walls shall be top supported, manually operated, individually suspended rolling panels, each equipped with two trolleys. The wall panels shall be remote stacked, no floor track allowed.

Operating Force

The installed system shall not require more than 25 pounds of horizontal static force for the operation of each panel throughout the storage tracks and to and from the extended position. The force, applied approximately 48 inches above the floor, may be applied at one point, or a total of 25 pounds distributed between two points.

Track Configuration

Curves, switches, and diverters are all permitted; "X", "T" & "L" 90 degree corners are not allowed. Straight-line track configurations particularly relating to storage pockets are the most preferable. Manufacturer's standard heavy duty ball-bearing trolley system panel supports specifically designed for use with size and type of operable partition assembly indicated shall be used subject to above restrictions. Attach trolleys to panels with adjustable pendant bolts.

Stacking

Track and switch system shall provide the "free flow" method of panel travel through radius turns at every change in panel direction, through switch turns and stacking "Y"s. Track systems utilizing 90 degrees or other angular intersections without radii will not be permitted.

In all stacking areas trolleys shall be pre-programmed to direction and select the appropriate and separate stacking track automatically and without the use of mechanical switches, cam trip assemblies, or any other device.

Suspension System

Minimum 1/4" formed steel track (ASTM A500 Grade B) connected to the structural support by pairs of min. 1/2" threaded steel rods. Intersections shall be factory assembled and welded. Track systems utilizing 90 degrees or other angular intersections without radii will not be permitted. Track trim shall be of primed steel or anodized aluminum finish providing enclosure of plenum sound barrier on both sides of track for maximum sound control.

Panel Construction

Minimum un-backed 14-gauge steel face (preferred) or 20-gauge steel backed by 1/2" gypsum attached to minimum 16-gauge steel channel frame, factory fabricated panels. Top reinforcing as

required to support hanging from suspension components; internal insulation, internal gasket edged construction to achieve specified acoustical ratings. Faces and frames are to be constructed of continuous members.

Panels will be nominally 4" thick in manufacturer's standard widths, minimum thickness 3 5/8". Foot-bolts and stabilizers shall be internal and edge activated. Protruding foot-bolts attached to panel faces shall not be permitted. Each panel shall be supported by two 4-wheel type steel trolley assemblies with precision-ground radial bearings, double seated.

Final partition closure shall be by expandable panel. Expandable panel construction shall be the same as basic panels but will be provided with an expanding jamb operated by a removable handle. Expanding jamb shall compensate for minor out-of-plumb conditions or wall irregularities and provide positive pressure seal for maximum sound control. Face activated seals at closure panel shall be allowed.

Sound Seals

Extension/retraction of bottom seal is by built-in operating mechanism or by operating handle, either of which is operated from the panel edge at approximately waist height. Seals that operate by being forced against other panels or walls or which are activated via foot pedal are not acceptable. Minimum clearance between retracted seal and floor finish shall be one inch except at long-span conditions where four inches shall be the minimum clearance. No seals shall be allowed to rub against track trim or floor during movement of the panels.

Pass Doors

Pass doors in operable wall panels are not recommended, particularly in exhibition halls and ballrooms, because of security concerns and long-term maintenance concerns. However, if provided with Operator concurrence, pass doors must meet the following criteria:

Single Pass Doors

Nominal 3'0" x 7'0" door built into panel shall be of the same basic design, materials, thickness as panel construction, and equipped with sound gaskets around the entire perimeter of the door.

Clear Width

Doorways shall have a minimum clear opening of 32" with the door open 90 degrees, measured between the face of the door and the opposite stop.

Exit Signs

Provide one self-illuminated (ten year life span) flush mounted exit sign at each pass door.

Door Hardware

Provide hinges, with maximum exposure of 1/4", in finish to match other exposed hardware. All doors shall have concealed hydraulic closers. Pass doors shall operate with a push plate or bar to allow egress under panic situations. No thresholds at doors will be allowed. All hardware shall comply with the requirements of the Americans with Disabilities Act.

Safety Cable

Panels over 15' 0" in height shall be equipped with high strength emergency cable support capable of supporting the panel in the event of a panel trolley system failure. The cable shall be run through the center of the trolley bolt.

Plenum Closure

Plenum closure (not by operable wall installer): Factory supplied track and optional plenum trim is designed to permit enclosure and sound insulation of the plenum without interference by carrier assemblies. Design of plenum closure must permit lifting out of header panels to adjust track height. Plenum closure required for maximum sound control of partition.

Finishes

Exhibition Halls:	Wall carpet to top of panel.
Ballroom:	Vinyl wallcovering to top of panel.
Meeting Rooms:	Vinyl wallcovering to top of panel.

Field Testing for Acoustical Performance

Optimum acoustical performance from the operable wall systems is difficult to achieve because of the influence of a number of architectural features and constructability problems, from wall finishes at pressure seals to carpeted floors. Sound transfers through the adjacent building assemblies are difficult to diagnose and generally involve multiple trade contractors. Assuming the design and workmanship is such that the operable walls are not significantly flanked by sound through the surrounding building construction, noise reduction shall be described as NIC 42, or greater.

After the operable wall installations are complete, the walls shall be set up by the Manufacturer or his Representative and then field-tested by an independent professional experienced in the field of acoustical testing and analysis. Should the Operator perceive the acoustical separation to be less than satisfactory, the operable wall manufacturer and installer should be required to field inspect the installation, adjust or replace non-compliant components, and instruct the operating staff on the proper use and maintenance of the wall system. If the problem remains, the Operator shall have the option at its own cost to field-test, evaluate and work with affected tradesmen to resolve the performance issues between the operable wall system and flanking construction.

ACOUSTICS

Acoustical Performance

Exhibition Hall

To meet Program acoustical criteria, all Exhibition Hall overhead deck systems will be provided with sound absorbing material having a field NRC of 0.75 minimum. Acoustical metal deck, lapendaries and sprayed or panelized acoustical insulation are acceptable options; vertically suspended acoustical baffles are not recommended. If sprayed acoustical insulation is selected, provide with integral color, black or dark gray.

For any portion of the Exhibition Hall to be optimized for general assembly use, provide acoustical wall materials for any walls opposite temporary stage locations. Such acoustical materials shall be selected from acoustical foam board, curtains, wall baffles and other devices, having an NRC of 0.90 minimum.

Ballroom

The Ballroom shall be provided with a ceiling that acoustically is partially sound absorbing and partially reflecting. This approach anticipates an architectural design that typically includes a mix of absorptive and hard materials. The NRC of acoustical materials will be 0.75 minimum.

Portions of all wall areas shall be provided with acoustical materials having a minimum NRC of 0.90. At least 60% of the available wall surface above a height of 10 feet above finished floor will typically require such acoustical materials. The purpose of this acoustical material is to prevent discrete echo reflections that are set up by touring sound systems oriented towards the audience and these walls. The Ballroom floor shall be carpeted.

Meeting Rooms

All meeting rooms will have acoustical ceilings, NRC 0.70 minimum. Furred areas for ductwork and architectural patterns or soffits utilizing gypsum board or other hard materials are acoustically acceptable. At least 60% of the ceiling area shall be an acoustical surface having an NRC rating of 0.65 or higher.

The design of wall finishes for meeting rooms should meet the other requirements of the program. Meeting Rooms with ceiling heights below 16 feet do not require acoustical wall panels as long as the direction of amplified sound is from the ceilings. Any meeting rooms with ceiling heights 16 feet or greater shall be provided with acoustical wall material (NRC 0.90 minimum) above 9 feet. Floors will be carpeted.

Prefunction Areas

Some of these spaces occasionally are used for announcements to a standing audience before a Ballroom or Exhibition Hall event. Normally, carpeted floors are sufficient to provide acoustical control in these areas. Where carpeted floors are not provided some implementation of ceiling or

wall acoustical materials are recommended. Note that the taller the space, the greater the need for additional acoustical absorption to control reverberant sound and noise buildup.

Sound Transmission Between Spaces

Operable Wall Systems

Operable wall systems shall have an STC rating of 52 ±1dB.

Field acoustical performance of systems shall meet or exceed NIC-42, to be certified by field-testing after installation and before final approval. Where operable walls are scheduled for carpeted spaces, the NIC delivered in the field may be less due to sound leaks under the wall system through the carpeted finishes.

Plenum partitions will be required for spaces above operable wall tracks. These will carry STC rating of 52 to 55, which is represented by two layers of 5/8" gypsum board on one side and one layer of gypsum board on the other side of metal studs with resilient channels. Provide one layer of 3” sound attenuation blankets in the void.

Supply and return ductwork, transfer grilles or boots, and cable trays penetrating these plenum partitions – elements that can compromise the acoustical integrity and intent of the plenum partition – are **not recommended** to insure that operable wall NIC criteria will be maintained.

Demising Partitions Between Meeting Rooms

Demising partitions must extend full-height and be sealed airtight to the overhead deck, as well as at other perimeter joints and all penetrations. Avoid duct, transfer grille and cable tray penetrations through demising partitions; these should feed from service corridors.

To meet a criterion of STC-52 (NIC-45), wall type options include 8” standard-weight masonry with a furred, insulated layer of gypsum board on at least one side, or two layers 5/8" gypsum board on each side of metal studs, with one layer of 3" sound attenuation blankets in the void.

To meet a criterion of STC-58 (NIC-51) options for this wall type include two sets of studs with 1" clear space between channels, two layers 5/8" gypsum board each side of wall, and two layers 3" sound attenuation blankets or 8” standard-weight masonry with a furred, insulated layer of 5/8” gypsum board on Z-furring channels at least 2” in depth or 2-1/2” light gage studs not touching or braced from the block wall.

Installation requirements to meet acoustical performance shall specifically identify how to treat and seal openings for ducts, conduit, piping, supports or other materials. Dual support (or double track) wall systems shall not be braced to each other.

Demising Partitions Between Meeting Rooms and Support Rooms

Water closets or urinals should not be located adjacent to meeting rooms or assembly spaces. However, if water closets or urinals are located adjacent to meeting rooms, then the wall should be constructed as follows:

- 8" normal weight CMU with two coats block filler each side; architectural finish applied on the meeting room side per design and with a separated drywall plumbing chase on the toilet side, fully insulated between studs, with neither studs nor piping supports in contact with the CMU. There should be two layers of 5/8" drywall on the toilet room side of the studs. If desired, ceramic wall tile can substitute for the face layer of drywall where applied.

Structure-borne noise and vibration transmission must be evaluated on an individual case basis, with additional design considerations necessary where appropriate to minimize adverse effects. Potential noise sources include air handler and exhaust fan rooms, electrical substation and transformer rooms, loading docks and trash compactors.

Acoustic Isolation in Open Office Areas

Much of the administration office area will be comprised of open office / modular systems furniture. The designers shall evaluate white noise generators and other acoustic treatments, involving fixed equipment, architectural finishes and furniture specifications, to maintain appropriate levels of privacy between adjacent workspaces.

Architectural Control of Mechanical Noise Sources

Ballroom Fan Room

The wall system separating the Ballroom fan room from the Ballroom will require substantial noise reduction properties. Inasmuch as the STC rating system for walls de-emphasizes low-frequency noise which is the most important component of the airborne noise path from fans to the Ballroom, the STC rating system is of a minimal value here. Consideration should be given for one of the following wall systems:

- Minimal: 8" normal weight CMU with two coats block filler each side, 6" air space, metal studs, 3" sound attenuation blanket, 3 layers 5/8" gypsum board on Ballroom side.
- Preferred: same as above, but with two wythes CMU with 4" air space, and structural slab break in the floor system along the air space between the CMU elements.

The wall system must extend to the deck above, and be sealed acoustically at the deck. Direct penetration of this wall system with ductwork shall be avoided.

Provide 4" acoustical insulation on all inner wall surfaces of the fan room.

Other Fan Rooms

Fan rooms serving lobby and prefunction spaces typically share common wall systems to the Exhibition Hall. The wall construction may be single- or double-wythe normal-weight CMU, to the deck above. Block surfaces should be filled and painted.

Penetrations of these walls for ductwork and piping penetrations, if any, should be minimized and must be closely monitored during detailed design. Penetrating ducts and pipes must not directly touch or bear on mechanical room walls to avoid vibration transmission into the walls.

Provide additional acoustical insulation for inner fan room walls if double walled fan units are not provided.

Electrical Rooms

During detailed design, transformer locations will be identified. Where transformer rooms share common wall systems with sound-sensitive spaces, wall systems will be developed to meet normal office noise criteria (NC-30 to -35).

Mechanical Control of Mechanical Noise Sources

Noise Criteria for HVAC Systems are as follows:

- Exhibition Hall: NC-40
- Ballroom: NC-30
- Meeting Rooms: NC-35
- Boardrooms: NC-30
- Other Public Areas: NC-40
- Back of House Services: NC-50

Internal duct lining in supply and return ductwork is coming under scrutiny in today's building designs due to air quality concerns. Such lining or similar treatment has traditionally been used to help attenuate noise generated within ductwork. If this facility is to be provided with unlined (wrapped) ductwork, then air velocities will have to be significantly lower than one using lined ductwork. Low air velocity designs need larger ductwork than would otherwise be the case. Another consequence of no internal duct lining is that sound attenuators ("silencers') near air handlers may need to be longer to achieve the net sound attenuation needed to meet design NC criteria.

Low pressure drops in systems are desirable to reduce energy consumption. In the case of attenuators, this can involve increasing cross section area in order to have a low pressure drop across the attenuator. The net of these factors (no lining, improved energy efficiency, leading to bigger silencers) is increased duct system cost.

Standard Design Practices

Fan noise will be attenuated using commonly available sound attenuator packages (standard for lined systems, possibly pack-less for unlined systems). Volume dampers should be located at secondary branch takeoffs, not at diffusers. Avoid extractors at branch takeoffs; use "shoe" fittings.

SIGNAGE AND ENVIRONMENTAL GRAPHICS

Overview

Three basic types of messages are required to move large numbers of people through a convention center. The first group includes wayfinding signage that includes directories, building configuration maps, information regarding services available and directional signs to move attendees and service personnel through the facility. Identification signs include room numbers, door signs or other messages that mark functional destinations for building users. The third group includes public safety and code-mandated signage such as exit signs, emergency instructions, traffic control or other regulatory messaging.

The building design and configuration should provide visual clues to circulation patterns, orientation and decision points. Placement of special architectural features such as fountains, gardens, overlooks and other rest areas should adhere to basic wayfinding principles that signage should support.

A clear hierarchy of messaging should be followed in preparing the signage package. The decision-making approach to be used in directing users through the convention center is to provide advance notification of an upcoming decision point; establish clear and concise directions at the decision point; and to confirm the message from the decision point forward along the route to the final destination.

Building Configuration Issues

Certain signage problems arise from the nature of the project. Solutions to complex wayfinding issues will be required. There are independent circulation flows for building visitors, convention attendees and service personnel. This separation must also apply to each group for both pedestrians and vehicles, creating at least six distinct functional flows needing graphic solutions.

Directional signage must acknowledge multiple entrances that handle multiple events, both for attendees and service. Show decorators must have access to temporary signage locations in order to setup and break down event entrance and directional displays without disrupting other ongoing events.

A convention center serves as a backdrop for temporary, staged events. As such, basic directional and informational signage will compete with events for optimum locations. The graphic design must allow for placement of entrance features and other standards of the convention industry. Directional signage must have some redundancy, recognizing that event materials may cover some messages, particularly wall-mounted items in public concourses and registration lobbies. At destinations, provide showcard holders near (or incorporate them into) the room identification system.

Technical Issues

Feedback from meeting planners supports certain preferences on issues that will influence the signage package. These topics must be addressed in the final environmental graphics design:

- Messages must be concise, use simple language and be consistent throughout the facility. The order of messages should correspond to the sequence of destinations as they will be encountered. A second option is to list destinations in declining order by size or prominence.
- Room numbers are preferred for sequential spaces such as exhibition halls and meeting rooms. Both exhibition halls and meeting rooms in the existing facility are numerical. Subdivisions of meeting rooms should be given letter suffixes, e.g. “114A-B-C”.
- Room names are only appropriate for singular destinations such as the Ballroom and for staff-only functional spaces such as Break Room or Security Office.
- Font selection should enhance readability. Sizes of the text used and of the signs themselves are of equal importance to the placement and orientation to traffic flow. The signage system shall be integrated into the architecture wherever possible. It should complement the forms and color, not be an applied afterthought.
- Colors for text and background shall be selected to provide maximum contrast, recognizing the impact of surrounding lighting levels. Subtle color-coding to create implied associations with building levels or particular zones is not desirable.
- International symbols used alone or combined with text messages are appropriate for support functions such as restrooms, first aid and information. Symbols used as primary directional signs to assembly spaces such as exhibition halls, meeting rooms and the ballroom should be avoided.
- Convention centers typically are designed to move large numbers of attendees through the facility quickly. Typically directional messages are best conveyed overhead on flag, pendant and spanner sign forms. Kiosks and pylons are good for special locations and limited messages, but are not beneficial to informing large volumes of people.
- Computer-driven display panels located at entrances to exhibition halls, ballrooms and meeting rooms are replacing printed show cards on easels. Major event management software vendors are developing automated links to signage management software, which update periodically and use pre-designed graphic templates to control sign content. Large programmable directory panels should help define event activity zones within the facility.
- Allow for placement of large format LCD or plasma video monitors as message centers or directories located near the major entrances or registration lobbies. These may also be used to run video clips promoting local vendors, suppliers and event sponsors.
- Fixed graphic building directories with “You Are Here” indicators should be provided near main entrances. Coordinate graphics with the final placement of units so that “up” matches the straight-ahead direction of the viewer.

- Acceptable materials and finishes should be durable based on their locations. Typical materials include formed aluminum, cast metals, acrylic sheeting and letters, neon and fluorescent light sources. Highly polished finishes should be avoided, with satin finish acrylic polyurethane preferred for most base materials. Scratch resistant finishes should be used where signs are within reach of users.

Sign Types by Use

Internally Illuminated Signs

- Exterior Building Identification
- Map Directories

Changeable Message Boards

- Exterior LED Panels
- Electronic Message Center
- Room / Event Display Panels

Non-illuminated Signs

- Directional Signs
- Pin-mounted Cast or Formed Letters
- Directions, Free Standing and Wall Mounted
- Meeting Room Numbers
- Escalator/Stairway Signs

Wall Plaques

- Public Notices
- Room Name Plaques and Service Area Numbers
- General Notices in Back-of-House Areas
- Stair Landing Identification
- Elevator Signs (both informational and code required)

Miscellaneous Sign Types

- Dimensional Letters
- Silk-screened Signs
- Hand Painted Signs
- Vinyl Adhesives

MOVEMENT OF GOODS AND PEOPLE

The basic configuration of the convention center is driven by the functional flows of goods and people through it. Simplified, the people component is made up of three groups: attendees, show-related support, and building staff. Goods and materials can also be divided into three groups: event-related, general building support, and food service.

Each of these flows must be optimized for both vertical and horizontal movement to design an operationally efficient building. The basic operating rules must be established so that the designers can resolve potential conflicts between the different flows which least impact the users at an acceptable cost to the Operator.

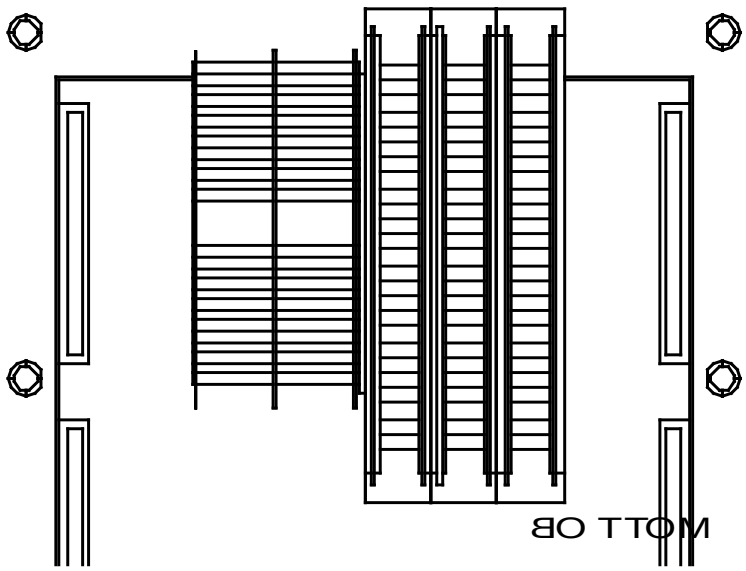
Each of the options will require its own technical approach and ultimate solution to the vertical transportation of people, goods and services. Because of the mid- to high-rise nature of these conceptual layouts, the approach generally looks at the need for moving between floors and is not cumulative.

Movement of People

The requirements for the horizontal flow of people have been documented in the sizing criteria for particular spaces such as registration, public lobbies and concourses. Moving walkways may be recommended for confined areas where extended travel distances may occur between internal destinations to reduce overall travel times.

The focus here is vertical movement of people. The use of escalators is the most efficient means of transporting large numbers between levels during peak periods.

The minimum configuration at any location is two reversible escalators with a stairway either integral to or within view of a typical vertical core. Operationally, both units run in the same direction during peak movement and the stair allows for counter-flow. In major vertical cores and at areas where peak flow may occur in both directions concurrently, three reversible escalators are recommended to reduce congestion.



The minimum escalator tread width shall be 40 inches. Using an average speed of 90 feet per minute, nominal capacity of a single escalator is estimated to be 6,000 people per hour. The concept plan provides approximately 270,000 square feet of exhibition space on a lower level, meeting distributed between intermediate and grade levels, and banquet space in the upper level of a renovated Public Auditorium. Total occupancy for the general assembly in the ballroom is approximately 2,700 people. Full capacity for a time period of 15 minutes is used to determine the equipment required to meet peak demand. The operational peak is assumed to occur in a 10- to 15-minute period, with stairs and elevators accounting for a portion of the vertical movement.

Using this approach, at least three escalators will be required per level to move all attendees from the assumed general assembly to another level during the peak period as shown by:

$$2{,}700 \div 6{,}000 \text{ per hour X } 60 \text{ minutes/hour} \div 15 \text{ minute interval} = 1.80 \cong 2 \text{ units}$$

This provides two escalators handling the peak flow in one direction and the third for attendees and service personnel moving in the opposite direction.

Elevators

The primary use for passenger elevators in public areas is for transporting the physically challenged and the elderly. Elevators should not be used as a major component of vertical circulation and should not be prominently located. They should not be featured as architectural elements, but should be visible from public concourses. All passenger elevators described herein shall be for the exclusive use of the convention center.

Minimum criteria for passenger elevators are 3,500 lb. capacity with a speed of 200 vertical feet per minute. Minimum platform size is 6'-6"W x 5'-6"D. Manufacturers' standard finishes for walls and ceilings are acceptable with marble, granite or terrazzo tile floors.

Vertical movement of service personnel is covered in the goods and materials portion of this section.

Movement of Goods and Materials

Similar to categorizing the different pedestrian flows, the flow of materials is separated into three groups. Display materials for the events typically arrive in semi-trailers at the dock or are driven to (and into) the convention center. Goods in general support of the building operation include janitorial supplies, office products; the converse of these is waste disposal that must be removed from the property. The last group of goods is food service supplies, including both consumable food and paper products and regular service deliveries such as linens. A separate topic is provided in review of food service items because the handling and routing of them differs substantially from the basic freight deliveries,

Show-related deliveries will typically arrive at a marshaling area first. From there drivers receive instructions to access the loading dock — which bay and when it will be available. Crates are removed from the vehicles and delivered to the floor using forklifts or pallet jacks, or trucks may

be driven directly onto the floor for unloading. The typical move-in period for this size exhibition or trade event is two to three days.

Significant effort is currently being made by building operators and event managers to reduce, reuse and recycle materials used for shipping and packaging. However, these sustainability practices are having an adverse effect on traditional material handling systems by increasing waiting times at service and freight elevators for loading both in- and out-bound goods simultaneously, as well as the need for larger vestibules for maneuvering between the two paths.

In some cases, mobile displays such as autos, boats or recreational vehicles may be driven to their display location elsewhere in the building. Typical placements include the ballroom and public concourses. Access to these areas must be provided, wherever possible via back-of-house service corridors. Use of oversize man-doors or sliding mall doors at public building entrances and overhead coiling doors into the exhibition halls and ballroom are common solutions to this problem.

Where service access is provided into highly finished spaces such as the ballroom, provide hinged wall panels, finished to match the surroundings, which can hide an overhead coiling door.

Building deliveries may also share dock space with event deliveries. Ideally, the dock and central receiving offices should be adjacent. A temporary parking zone will allow for short-term building deliveries to be handled without impacting the main dock operation. Staff will handle internal distribution of these materials.

Elevators

Two different types of elevators are required for service-related movement of materials through the convention center. The first, freight elevators, are for moving large or heavy items. These units typically have a large platform (10 ft. x 22 ft. minimum), painted steel bi-parting doors, and have 10 ft. minimum clear overhead both through the access and inside the cab. Freight elevators are slower than passenger units (50-60 feet per minute) with a 12,000-pound Class C1 load rating. Interior cab finishes are painted plywood or enameled steel walls (the concern here is for maintenance) and steel plate floors.

The freight elevator must be capable of transporting a full-size auto within the building. Additional consideration shall be given to personnel lifts, knuckle booms or other equipment necessary to clean and maintain walls, ceilings, lighting and access panels in tall spaces. Provide vestibule sizes adequate for maneuvering large items into and out of the elevators. If possible, the freight elevator shall be directly accessible from the loading dock.

The second type is the service elevator. These will be the primary path for moving both service personnel and goods throughout the building. The focus is to provide quick convenient service with moderate capacity for both volume and weight.

Physically, these are similar to passenger elevators, but are larger with more durable finishes. Minimum load ratings are 5,000 pounds and a speed of 125 feet per minute. Interior walls are

typically baked enamel finished steel or brushed stainless steel panels over plywood. Nominal platform size is 5'-6"W x 8'-6"D. A textured rubber tiled floor is standard.

There is a requirement for redundancy in service access to key parts of the building so that the regular maintenance or temporary malfunction of an elevator does not disrupt delivery of time-sensitive materials. See Food Service below for further explanation of this issue. Configurations may include having single service elevators in diverse parts of the building, but interconnected by back-of-house corridors; an alternative would be to provide paired elevators. Under this second scenario, the freight and service elevators would be considered to meet the redundancy criteria.

Movement of Food Service Goods, Materials and Personnel

The movement of food service-related products and personnel is typically independent of other building services. This group of employees will have their own separate entrance and support areas. Deliveries require a separate dock with a receiving office and commissary area for handling refrigerated and frozen foods, produce, and paper goods. Linen service will also be administered from the food service dock.

In a multiple-floor building configuration, priority is given to movement of near-finished food products. Because this level of service cannot be compromised, two basic tenets must be adhered to. First, locate the kitchen closest to the ballroom since the clients demand the highest quality level there for both product and service. Second, redundant routing must be available to final destinations for food deliveries. This does not mean dual service elevators are required throughout the building, but that an alternate route be available through service corridors to another service or freight elevator which can be used for vertical movement in an emergency. Elevators failing or out of service for maintenance are not acceptable reasons to disrupt meal service in the convention center.

From the loading dock materials will be moved with forklifts, pallet jacks, hand trucks or flat, wheeled carts. Vertical movement of raw materials which are not time critical can share use of building freight elevators if conveniently located and if dedicated food service elevators are provided to meet the redundancy requirement.

Meals will be distributed to the exhibition floor and meeting rooms using several methods. The largest and heaviest rolling carts are typically used for cold platters and beverage service to meeting rooms. Hot and cold boxes, linens, china, flatware and glasses will all be moved via the service elevator. Provide access to pantries distributed through the facility. All food service setup and product should be moved out of sight of attendees.

Portable point-of-sale carts for pastries, specialty coffees, ice cream and other convenience foods will be moved between concourses via the heavy freight elevator.

AUDIOVISUAL SYSTEMS

Audio System Overview

Provide a centralized audio control room with adjacent recording and storage areas. Provide patch bays, amplifiers, mixers, digital signal processor, and the ability to connect with broadcast, recording and playback equipment. The system must have these attributes:

- To provide common signals to and from any individual public area
- To record and broadcast audiovisual to the ballroom, meeting rooms and exhibition halls for individual or multiple events
- To record and rebroadcast from an event in the ballroom, meeting rooms or exhibition hall to other overflow attendees in any meeting room or concourse using dedicated equipment
- To interconnect with satellite up- and downlink equipment (furnished by others) to be located either temporarily on the loading dock apron or mounted permanently on the roof.

Individually zoned sound and paging systems are to be provided in the following areas: Exhibition Halls; Ballroom; Meeting Rooms; Public Concourses; Truck Dock and Administrative Offices. Building-wide paging to include back-of-house areas will be provided.

Provide a wireless assistive hearing system in the general assembly spaces to comply with the intent of the Americans with Disabilities Act. Built-in support for the system will be required in the Ballroom. Portable equipment furnished either by the audiovisual service contractor will be used elsewhere.

A separate intercom system can be supplied for the Truck Dock and associated offices.

Distributed Television System Overview

Distributed Television System (DTV) shall be provided for all of the areas listed for sound systems, and also registration areas, Show Manager Offices, Conference Rooms, Green/Dressing Rooms and other spaces as may be designated.

DTV systems will be capable of distributing cable TV, local or satellite video signals throughout the building. A satellite television dish location should be identified, possibly including a permanent roof mounting. Access to remote broadcast staging area (to be identified) will be required.

The DTV head-end equipment will be centrally located in the Audiovisual Control Room, rather than distributed, for economy. User requests for individual dedicated channel loops should be able to be accommodated.

Access to local cable television services will be provided with the ability to distribute signals over the DTV system or on a dedicated and restricted channel.

Work Not Included

- Portable sound equipment
- Portable audiovisual equipment
- Portable simultaneous translation equipment

Technical Requirements

Exhibition Hall sound system will accommodate presenters, background music or paging to a seated audience for General Assembly. Speakers to be scheduled are 12" coaxial units with integral HF horn. Power amplifiers will be sized for 60 watts per loudspeaker utilizing the 70.7-volt distribution system.

Ballroom sound system will accommodate the same functions as planned for Exhibition/General Assembly, with similar loudspeakers and power rating type. Because of the emphasis on live music performances, consideration should be given to permanent installation of a built-in performance-quality sound system during design.

Meeting Room sound systems will accommodate presenters, background music and paging, utilizing 6 to 8 inch coaxial loudspeakers at 15 watts each, as appropriate.

Audio systems will be divisible and combinable according to the operable wall division lines.

Audio Systems Performance

SPL capability (linear pink noise standard, no audible distortion:

- 100 dB, Exhibition Hall and Ballroom overhead systems
- 92 dB, Meeting Rooms
- 90 dB, General Paging/Background music

Acoustic Response

- 1.5 dB, 125 Hz to 8 kHz: Exhibition and Ballroom Overhead systems
- 2 dB, 160 Hz to 8 kHz: Meeting Rooms
- 3 dB, 200 Hz to 8 kHz: General Paging/Background music

Spatial Variation in SPL, 4 kHz octave band pink noise standard:

- 3 dB, All Assembly Areas
- 5 dB, General Paging, Background music

SECURITY SYSTEM

Systems Description

The security system design criteria shall allow the security operations personnel to monitor the status of all building entrances and restricted areas of the facility. Alarms will be provided to notify security personnel in the event of an emergency condition.

An operating practice often used at convention centers is to have all emergencies reported to the Security Office where it is then relayed to 911 services, with staff directing emergency responders to the specific location within the facility.

The system shall give security personnel the ability to view, via closed circuit television (CCTV) images, main entry doors, loading dock areas, and public and service corridors of the building. Fixed and pan/tilt/zoom cameras have been suggested for use in the exhibition halls, which can be programmed for blackout condition when requested by event managers.

The access control system shall allow authorized personnel to access restricted storage rooms, service corridors, electrical and telecommunications closets, show manager offices, general building access points and other restricted areas throughout the facility. The access control system shall allow selective entry to secured areas and provide a historical record of personnel accessing secured areas. The access control system shall allow for the immediate disabling of card keys that are lost or have expired, giving a higher level of security for restricted areas of the building.

Proximity cards with photo IDs shall be issued to all full-time staff for access to restricted areas of the facility. Temporary and service contractor personnel would be issued temporary throwaway access passes good only for the duration of their visit. These latter passes are inexpensive, but provide only a moderate level of security.

Provide a microprocessor-controlled intercom system to allow bi-directional communications between security personnel and visitors requesting entry at secured locations and assistance stations in the parking areas. This system shall be capable of call prioritization and identification. The intercom system shall be integrated with the access control, alarm monitoring and CCTV systems to facilitate camera call-ups and transaction history recording.

All alarm systems and card access-controlled doors will monitor alarms and card key usage, displaying information as it occurs. The computer-based monitoring system should be located at the Security Office. Digital recording of all cameras throughout the facility on a 24/7 basis is suggested, as digital recording allows for greater storage capability and simplifies historical video retrieval. All video signals should use the fiber optic backbone (see Telecommunications heading), not coaxial cable.

The integration of the access control, alarm monitoring, and CCTV systems allows full-facility monitoring and historical recording of activities in the Center. These systems will allow security personnel to view facility activity and coordinate the response of security, police or emergency personnel to an incident.

Security Zones

The Convention Center shall be conceptually divided into security zones to determine the type, number and location of security devices required. The zones and design approach shall be applied for each of these areas:

- All Facility Access Doors, Entrances and Building Exterior Areas
- Public Concourses, Elevators, Escalators and Stairways
- Meeting and Banquet Rooms
- Exhibition Hall
- Service Corridors
- Loading Dock and Associated Overhead Doors, Access Ramps and Driveways
- Parking Garages, Surface Lots and Access Walkways
- Critical Support Office/Operations Areas, including but not limited to:

Business Office	Ticket / Registration Offices
Food Service Money Room	Data Services Room
Telecommunications Closets	Electrical Distribution Closets
Show Managers' Offices	District Utility Services Room
Exhibitor Storage	Parking Operations Offices

The security system shall allow intrusion detection/door status monitoring of all building entrances and exits. This monitoring capability allows for the expedient response to any unauthorized entry to the Center or the response to visitors using unauthorized exits or who attempt to leave the facility with contraband.

In addition to all entrances being monitored for intrusion detection, all critical support office and operations areas will also be part of this system. Each entry door will have a recessed magnetic contact switch installed to notify the Alarm Monitoring System of intrusion or opening of access points to these critical areas. Security personnel can be dispatched via radio communications to investigate door-held-open conditions.

All entrances to the Exhibition Halls and Ballroom will have magnetic door contact switches installed to allow status monitoring of all doors at all times. This monitoring capability will be used to provide room security after regular business hours. The door alarms will be supplemented with full camera coverage that will allow immediate viewing and recording of any door opening or

activity in each Exhibition Hall division. Card access will be provided to grant authorized access to these areas as necessary. Provide full CCTV coverage in both the Exhibition Halls and the Ballroom.

Infrastructure (electrical power and data connections) shall be provided at main entrances and general assembly spaces to allow for future installation or temporary use of X-ray machines and magnetometers, which have become common practice for certain types of high-security events.

The entrances to truck ramps for loading dock access will be gated and controlled via call button and CCTV. Vehicle gates and personnel doors will have door contact switches at all locations.

The Loading Dock will have door contact switches installed on each overhead door and man-door leading to the Exhibition Hall. The Security Office shall have a lockout feature for all loading dock overhead doors that shunts electrical power to operate the doors when necessary. The Loading Dock will have exterior dedicated cameras providing full coverage for viewing and recording of the Loading Dock bays and entry areas. This level of security is required due to a high degree of exposure to losses associated with Loading Dock operations. Duplicate monitoring equipment shall be located in the dock office.

Critical Support Office and Operations Areas

The Ticket Offices and Food Service Money Room will have a recessed magnetic contact switch to provide intrusion detection notification to the access control system monitored in the Security Office. In addition, these spaces will have silent duress alarm switches to provide covert notification of robbery or emergency situations. CCTV coverage will also be implemented in this area.

Maintenance shop, electrical distribution closets, telecommunication closets, video communication offices, and entry door(s), will be card access controlled and have a recessed magnetic contact switch to provide intrusion detection notification to the access control system.

The Host Desks will each have a silent duress alarm switch to notify the Security Office in a covert manner of an emergency condition or disturbance.

The Show Manager Offices will be card access controlled with the entry doors having a magnetic contact switch to notify the Security Office of intrusion.

Exhibitor storage and meeting storage areas will be card access controlled with the entrance having a magnetic contact switch to notify the Security Office of intrusion.

Building exterior entrance areas and street traffic should be fully monitored by the CCTV system to aid in the response of intrusion detection, and to monitor crowd control functions and manage facility traffic flows.

An electronic Guard Tour System shall be utilized throughout the facility to track security personnel movement, providing historical reporting and incident tracking capabilities.

Local audible alarms shall be provided at designated perimeter doors to alert security personnel in the area of unauthorized use.

Code Compliance

All card reader installations requiring the use of electric strikes prohibit entry to an area and do not interfere with egress from any given space via the door hardware latch set. If desired, delayed exiting devices may be installed on fire exit doors. These devices allow for a fifteen second waiting period prior to door opening, but must allow for the delay function to be individually disabled at the computer console. All devices restricting egress shall be tied to the fire alarm system for automatic release upon fire system activation.

These devices allow security personnel and CCTV systems to monitor ongoing conditions in response to unauthorized use of fire exits or unauthorized access to the building or event.

LIGHTING SYSTEMS

Exterior Lighting

The goal of the lighting design is to create a sensitive blending of the facility with its adjacent planned landscape features and the urban streetscape. It must selectively reveal the building, landscape and art features for the enjoyment of all users, while creating an impression of security. To achieve a rich visual harmony of light for building facades, walkways, landscape and feature lighting, the design must adhere to the thoughtful and controlled selection and location of lighting equipment. Dark sky concepts are preferred. All lighting shall comply with lighting ordinances and LEED standards.

Relative Brightness Transition and Focus

The perception of the relative brightness of objects, buildings and landscape features is how we sense and experience the visual environment. With light, the importance of site elements easily identifiable during the day can be preserved at night, and selected features can be reinforced for dramatic effect. The design hierarchy for exterior building and site lighting must first determine specific elements to be featured, and then articulate key focal points.

At night, the objectives of the lighting change. Luminaire design is secondary to performance. Lighting effects will define the site, welcome and guide the visitor, enhance site features, and create a secure environment in which to circulate. Interior light will exude through entrances, skylights and other building fenestrations. The quantity of light for area lighting and feature lighting must be balanced and consistent with the architectural design objectives for the building.

Interior Lighting

As with the exterior lighting, the design approach and light levels for interior lighting will be established by determining the hierarchical progression through the Center. The public spaces will have non-uniform illumination with peripheral emphasis for an impression of spaciousness and pleasantness. A combination of integrated or indirect ambient lighting, decorative, and incandescent accent lighting will "paint" the public spaces - welcoming visitors at entry points and guiding them along concourses and circulation corridors to their destinations. Focal points will be registration spaces and meeting room, ballroom and exhibition hall prefunction areas. Every advantage shall be taken of natural light in the facility. Lighting shall have photoelectric control where natural light contributes effectively to the space and functional area.

To provide functional flexibility, ambient lighting in meeting rooms will use a combination of switched and dimmable fluorescent sources with decorative accent lighting. The general lighting will be uniform with primarily direct distribution. Incandescent lighting will be kept to a minimum to achieve compliance with LEED design standards, watt density allowances and operational efficiency goals.

The ballroom will feature a combination of ambient, decorative and accent lighting in order to provide functional and aesthetic flexibility. The general lighting will be uniform illumination,

overhead emphasis, for meeting and tabletop activities. Lighting controls will allow for a non-uniform setting with peripheral emphasis for such social activities as dining and dancing. Specialized lighting for head tables, portable stages and entrance displays shall be provided.

The exhibition hall will be provided with uniform illumination, overhead emphasis, with a minimum of two levels of light. A secondary stepped or dimmable system should be considered in selected areas for use during general assembly or multimedia presentations.

General Design Criteria

- Integrate light and architecture, using ceiling and wall surfaces as light sources. Consider having two variations on exterior lighting schemes to differentiate between active and inactive event times. Half-level lighting control shall be provided where required by code.
- Control direct glare with good visual shielding. Matte finishes will be used on all surfaces intended to receive and redirect light. Reflective surfaces shall be 85% minimum. Lenses and louvers shall be provided with matte silver, soft-glow, or low-iridescence reflectors and louvers.
- Allow interior light to exude through building fenestrations to provide a welcoming, warm ambiance throughout the site.
- All light sources shall be selected to truly render colors and complement natural and building materials, and the natural appearance of landscaping. "White" light sources will be selected based on their apparent color, color rendition properties, and energy-efficient characteristics. T5 and compact fluorescent, and metal halide lamps will be the primary sources; improved-color-rendition metal halide and tungsten-halogen lamps will be used in high ceiling areas; tungsten-halogen will be used as accent lighting.
- Designers should evaluate options available for new solid state lighting fixtures using light emitting diodes (LEDs), an evolving energy-saving technology.
- The base component of the fluorescent lighting system will be the T5 lamp and electronic ballast. Use electronic ballasts to power compact fluorescent lamps. T5 shall be used where high output is recommended and T8 shall be used at lower ceiling height locations where compliance to LEED certification will mandate lower wattage per square foot densities.
- Provide procedures, operating guidelines and location for recycling fluorescent bulbs.
- Limit the number of different lamps required to simplify the Operator’s inventory requirements.
- Photocells and time clocks will provide passive control for exterior light. A centralized lighting control system will be used. Occupancy sensors will be used in designated areas.
- General floodlighting of building facades shall be controlled and minimized. Pole mounted floodlights are discouraged.
- Minimize the use of in-ground fixtures and enclosures. Prior experience indicates temperature extremes significantly reduce the life cycles of these types of fixtures.

Lighting Control System

A centralized architectural lighting control system is a key labor-saving component of the convention center. Using a central processor unit, the electrical staff can offer the facility user any range of lighting services from simple switching and dimming to complex theatrical or audio-visual lighting solutions. The centralized computer, connected by communication cable to a series of dimmer/relay racks for both dim and non-dim circuits, will communicate with control stations in the Meeting Rooms, Ballroom and Exhibition Hall spaces and will control selected public concourses and specialty areas. The control extends to the exterior lighting, adjusting based on the exterior conditions. The lighting control system should interface with the Energy Management and Control System (EMCS) for centralized control of multiple systems.

Additional features include a one-year calendar with holiday, Daylight Savings Time, and leap-year settings; daylighting sensor interface; remote control programming and feature selection; and automatic building "sweeps" at a set time to turn off lights in unoccupied spaces.

Lighting control shall provide life safety code-required minimum illumination levels for egress areas. All lighting in the path of egress shall have battery back-up for 1 ½ hour life safety compliance in addition to standby power.

Remote control stations consist of push buttons with custom plate colors and silk-screened labeling. The control stations will be designed for the functions of the lighting in Meeting Rooms, Ballroom and Exhibition Hall and will range from simple 2 button ON-OFF stations at service corridor entries to stations with four to eight preset scenes. Operable wall interlock shall signal the microprocessor of each room's configuration and the system shall adjust to room changes automatically. Provide room jacks and hand-held infrared programmable controllers for staff, as well as infrared remote control devices for attendee use. Security Office override of local manual lighting control should be considered in selected areas where security will be a necessary factor.

ELECTRICAL POWER SYSTEMS

Electrical systems shall be designed to provide ample power distribution to all areas of the convention center. Multiple utility substations with automatic selectivity should be considered. A separate service will be required for the fire pump.

From the main service switchboards power will be distributed throughout the building as follows:

480/277-volt power

- to panel boards for 277-volt fluorescent and H.I.D. lighting

208/120-volt power via step-down transformers

- to switchboards and panel boards that serve exhibition hall floor boxes
- to company switches for supplemental show power
- to special receptacles in meeting rooms and registration areas
- to general use receptacle outlets and incandescent lighting

In addition to the normal services on-site, natural gas-fired or dual-fuel generators may be provided to service life safety and other critical loads in case of normal power failure. The emergency system will include complete fuel, cooling, exhaust and starting systems as well as automatic transfer switches, transformers and panel boards for distribution. Equipment and systems connected to the emergency power system will include the following:

- Portions of general lighting in public and mechanical spaces
- Fire pump
- Exit signs and egress lighting in corridors, stairwells and exit paths
- Sump and sewage pumps
- Building automation and life safety systems
- Telephone switch and data services equipment / rooms
- Partial elevator operation
- Required smoke exhaust system equipment as may be required for the atrium-lobby areas
- Fire alarm system
- Paging system
- Security system
- Door egress systems

FIRE/LIFE SAFETY SYSTEMS

The following life safety criteria recommendations are based on experience. The local authority having jurisdiction must approve the final conceptual approach and detailed design. The following devices and systems shall be utilized:

- Smoke detectors in return air paths
- Manual pull stations
- Monitoring of all sprinkler flow and supervision of sprinkler valves
- Voice/alarm signaling system, including audio speakers in all areas of the building, to permit fire alarm signals and emergency public address announcements
- A fireman's intercom system to permit two-way emergency communication between the fire command station and remote areas of the building
- Audiovisual alarm indicating appliances (strobes) per ADA requirements
- Automatic elevator recall system
- Interlock with door egress systems
- Passive HVAC and exhaust air shut down in the means of egress during fire alarm actuation. Coordinate with smoke evacuation design.

Life Safety Fire Command Center

- Fire alarm control panel
- Graphic annunciator panel
- Fan and damper control for smoke evacuation (firefighter's control panel)
- Emergency elevator controls
- Master fireman's intercom station
- Sprinkler flow and supervision alarm and annunciator panel
- Control and supervision station for the emergency generator
- Control and supervision station for the fire pump

Automatic External Defibrillators

Over the past few years, public buildings have increasingly provided access to portable, package defibrillators (AEDs) to provide immediate response to certain medical emergencies. These units are designed to be used by non-medical personnel using simple graphic instructions or assisted by 911 operators while trained responders are en route.

AEDs should be placed in cabinets along public concourses and selected back-of-house locations, with signage indicating purpose and operation. Generally, placement is such that cabinets are

within a two-minute response time to any location in the building. For planning purposes, spacing between AEDs should be approximately 300 feet in concourses and in exhibition halls, depending on specific building geometry and features. A common operating guideline for AED distribution is to have units within a two minute walking radius. The maximum response time for an emergency would allow two minutes travel time each way and two minutes for setup and activation within the recommended six minute treatment window.

HVAC SYSTEMS

Central Plant

The Convention Center will utilize steam and chilled water from a combined utility plant to provide heating and cooling via the HVAC system. The plant will also serve other buildings within the complex such as the Medical Mart and Arrivals Building.

The central plant will consist of multiple chillers, boilers, heat exchangers, supply and return pumps along with the necessary supporting equipment. Design capacity shall exceed peak design loads with the understanding that any portion of the distribution system could be non-operational due to breakdown or scheduled maintenance. Pumping stations with heat exchangers shall be designed to accommodate the facility's equipment hydronic pressure losses.

Hot and chilled water will be routed through the facility via a four pipe distribution system. Primary chilled water pumps and secondary chilled water pumps with variable speed drives will provide chilled water distribution throughout the building.

Multiple steam-to-hot-water heat exchangers are part of the central plant, but remote from the chilled water distribution. These heat exchangers will provide re-circulating hot water for space heating which will be distributed via dedicated pumps and piping. Condensate return pumps will be provided to return the steam condensate to the District Utility Plant. Similar to the chiller plant design, the heating system design shall ensure that any one heat exchanger or condensate return pump can be off-line for maintenance or repair.

Air Distribution

Air handling units will be installed within interstitial areas throughout the convention center facility. As an energy efficient measure, all air-handling units will be provided with variable speed drives. Constant temperature / variable volume units will serve the exhibition halls and ballroom while variable air volume air handling units with terminal boxes will serve the meeting rooms and prefunction areas – taking advantage of the operational diversities. The air-handling units will be coordinated with the building's architecture and will be functionally located for ease of servicing, replacement and accessing fresh air supply for the building. Systems shall be complete with supply and return ductwork, temperature controls and shall be zoned to accommodate partial use of the facility.

It is recommended that high-production event spaces – primarily exhibition halls and ballrooms – should not share VAV boxes with the adjacent prefunction areas because of past operational experience with pyrotechnics or theatrical smoke and fog effects. The potential negative impacts of these types of events on the monitoring of life safety systems, smoke detection, false alarms and building evacuations cannot be underestimated.

Other areas requiring a controlled environment on a 24-hour basis, such as A/V rooms, electrical rooms, elevator machine rooms, security, data and telecommunication rooms may be provided

with either dedicated chilled water fan-coil units or split system air conditioning units. Split systems will contain fans, compressors, remote condensers, evaporators and thermostat dedicated to the space served. Mixing boxes and automatic dampers may be a part of the system.

All equipment shall be suitably isolated to preclude noise transmission to adjacent occupied areas. Sound attenuators on supply and return ducts will be provided where required to reduce noise transmission to occupied areas. Smoke ionization detectors will be installed where applicable, and located in path of supply and return air as required.

Smoke Control

A smoke exhaust system will be provided for any atrium areas in accordance with the Building Code. Atrium smoke exhaust equipment will be provided with emergency power, and be controlled by the building Life Safety System. A firefighter's control panel will be provided to allow manual override for system operation. Smoke removal of the exhibition hall and ballroom may be accomplished via the air handling units or return air fans if utilized, however, unless required by the fire department, such units will not be on emergency power and will not be part of the Life Safety System.

ENERGY MANAGEMENT AND EFFICIENCY

Energy Management and Control System

The Energy Management and Control System (EMCS) shall employ direct digital control (DDC) and utilize a true, distributed-control architecture. The system shall utilize standard manufactured products and software of the selected system vendor to insure the ongoing availability of spare parts as well as that of trained technical support and service. A centrally located computer will be provided as a "front end" for the EMCS. The system will control, optimize and manage the Convention Center's equipment and energy consumption.

Energy Efficiency

To maximize energy efficiency, the following energy conserving features may be implemented:

- Demand control ventilation with use of CO2 air quality sensors.
- Light photocells for controlling light fixtures where daylighting occurs.
- Thermal energy storage.
- Load shedding and peak shaving of electrical power.
- Displacement ventilation.
- Air- and water-side economizers.
- Extensive implementation of variable speed drives for mechanical equipment.
- Water retention and reclamation.
- Onsite power generation can be used for peak shaving.

The above items will also serve to implement a more sustainable building design, as the County's stated goal is to achieve a LEED (Leadership in Energy and Environmental Design) Silver certified building.

PLUMBING SYSTEMS

Domestic Water

A single or multiple metered connections from the City's main water supply line will be provided. If the existing street water pressure is insufficient to meet the required flow rates and pressures at the upper floor fixtures, booster pump(s) will be required. The system will be designed to prevent water hammer conditions by providing shock absorbers or water hammer arrestors for quick closing valves and in the distribution piping. Pressure regulation will be provided as required to meet Code and the required system pressure. The maximum water pressure for the domestic water distribution piping will be 80 PSI per Code.

Isolation valves will be provided for each group of fixtures or for each restroom.

A connection will be provided at any exterior plazas for outdoor events if required.

Local electric storage type heaters will provide hot water to main public restrooms.

Hot water to food service areas will be provided by either steam-to-hot water heat exchangers or gas fired hot water heater with separate storage tank and circulation to maintain temperature in the system.

All water piping, subject to freezing, heat loss or sweating or condensation, will be provided with proper insulation and a fire retardant jacket.

Chilled drinking water will be provided by individual drinking fountains with remote coolers. These fountains will be located throughout the buildings.

Sanitary Drainage and Vent Systems

Plumbing fixtures above grade will be drained by gravity through soil stacks and house drains to connect to site sewer. Consideration shall be given to providing appropriate sizing criteria to meet peak occupancy conditions. Plumbing fixtures below grade will be drained by gravity to sump pits containing duplex sewage ejectors and be pumped to gravity house drain. Sump pits will have airtight covers.

A separate clear water waste system will be provided to accept drainage from the Exhibition Hall floor boxes. This system will discharge to a sump pit at the lower levels and from there will either be pumped or connect indirectly to the sanitary system, depending on the elevation difference of the installation.

Adequate gradients must be maintained to ensure a self-cleansing velocity. Cleanouts shall be provided per code.

Grease waste piping system and grease traps or interceptors will be provided for food service facilities.

Storm/Water Drainage System

Roofs and canopies shall be drained by gravity via roof drains through inside leaders and house drains to five (5) feet outside building. Separate overflow drains will be provided adjacent to each roof drain. Each overflow drain will be piped independently to grade.

All piping subject to "sweating" or condensation will be insulated. Drains will be provided to drain run-off from the truck dock areas. Appropriate sand/oil interceptors where required will be provided.

A separate system will be implemented for the distribution of harvested rain water for the landscaping. Proper equipment shall be installed to maintain the viability of the rain water for irrigation purposes.

Plumbing Fixtures

Fixtures will be provided with chromium-plated brass trim and individual stop valves. Water closets and urinals will be vitreous china wall hung, siphon jet pattern with water conserving flush valves with battery-operated infrared sensor activation. Lavatories shall also have battery-operated infrared sensor activation for water and soap dispensers.

Hose bibs will be provided throughout the building utility areas and recessed wall hydrants around the exterior of the building's perimeter. Non-freeze pattern units will be used for all external areas.

Appropriate "Barrier Free" fixtures will be provided for handicapped use. Public lavatories will be provided with single temperature hard-wired infrared sensor activation operating with flow restrictors.

Emergency showers and eye washers will be provided as required.

Natural Gas

A metered connection to the utility gas company main system for the facility shall be provided. From the meter location, branch lines will be routed to feed new gas-fired equipment as required.

Compressed Air

Compressed air will be provided to approximately 50 percent of the floor boxes in the exhibition hall. Duplex air compressors will be connected to a permanent building system complete with expansion tanks, air dryers, filters and a common receiver that will distribute throughout the hall.

FIRE PROTECTION SYSTEM

Sprinkler and Fire Standpipe System

The buildings shall be provided with metered connections from the City mains. Detector check valves or backflow preventers shall be provided for the fire protection connection. If the City pressure is not sufficient to provide the required fire flow and pressure, a fire pump and jockey pump shall be provided and shall be on emergency power. System pressure and flow shall be in accordance with NFPA 14, or as established by the fire department.

The facility shall have sprinklers in accordance with NFPA-13. Design densities and areas of application for the sprinkler system shall take into account the specific challenges of the high-ceiling exhibition hall areas. Branches to the individual sprinkler system shall be provided with monitored control valves and water flow switches as well as a system drain/test connection. All control valves and water flow switches shall be annunciated at the life safety control panel located within the fire command center.

Special consideration should be given to the fire protection design of rooms housing electronic equipment and electrical closets to minimize any damage that could be caused by leaks or false alarms that could trigger water flow. Double-interlocked pre-action fire protection system shall be provided for the Telecom, Data, and Electrical Rooms. The pre-action system shall be complete with smoke detectors, control panel, riser and trims per NFPA-13 Standards.

All isolating and sectionalizing valves on the fire protection system shall be provided with tamper switches, which shall be annunciated at the life safety control panel. 2-1/2” valves for fire department use shall be provided in required exit stairs of the building and horizontal coverage provided in hose valve cabinets. The exhibition areas shall have Class II hose racks in cabinets located along the sidewalls. Fire sprinkler zones shall be consistent with any necessary smoke exhaust systems.

Fire extinguishers shall be located throughout the building and around the perimeter of the Exhibition Hall areas. ABC dry powder type units of appropriate sizes shall be provided at the exhibition areas, meeting rooms and other general areas such as mechanical rooms, loading docks and kitchen areas.

Multiple fire department and fire pump test header connections shall be provided at the building’s exterior and shall be interconnected within the building. Fire pump test header shall be located on the building exterior per City of Cleveland Fire Marshall requirements.

PYROTECHNIC & THEATRICAL EFFECTS

The exhibition halls and grand ballroom must be designed and configured to accommodate ***Theatrical Mode*** allowing use of special effects such as fog, haze and minor pyrotechnic displays. Ballroom divisions and individual exhibition halls must have the capability to be utilized both independently and in any combination with one another. Adjoining function and support spaces must not be impacted, as these may otherwise be occupied and in use.

All building controls, including but not limited to the HVAC, fire and life safety systems, shall be designed to accommodate ***Theatrical Mode***, as should all building materials, products and equipment specified for use in these spaces. Notably, movable partitions and the demising structure above the partitions shall be able to maintain a relative room pressurization to accommodate pyrotechnic and theatrical effects.

HVAC System

To ensure that pyrotechnic and other theatrical effects may be incorporated into client programs, monitoring stations must not be shared between adjoining spaces such that system monitoring in ***Theatrical Mode*** in one space limits the functionality of the adjoining spaces.

Mechanical systems must be designed to monitor theatrical events in areas from the smallest room division through any combination of subdivisions, including when all partitions are retracted. All mechanical systems should be zoned so they can be effectively combined to maintain the same conditions in large areas as in the smaller rooms. Mechanical systems must also be able to maintain the prefunction and assembly spaces independently of one another.

Fire and Life Safety Systems

The fire and life safety systems must provide for ***Theatrical Mode,*** allowing theatrical effects and pyrotechnic operation for individual or grouped rooms.

TELECOMMUNICATIONS AND DATA SYSTEMS

Overview

It is desirable to provide a common communication infrastructure capable of distributing voice, video and data signals to all points within the facility in an easy "plug and play" fashion. By installing a broad range of media for voice, video and data communications, all current state-of-the-art signal transport needs can be supported.

Right sizing and location placement of conduit to meet initial needs with programming to the future use is desirable. Installation of a minimum of Category 6 unshielded twisted pair (UTP) copper, single- and multi-mode fiber and RG6 coaxial cable (as appropriate) is required to accomplish the goal of having a common communication infrastructure. Quantity and location of ports will be addressed later in this document.

It is important to differentiate between the physical media (cables) and services (voice, video, and data) that can be provided across them. The equipment for each service varies widely, but a well-engineered cable plant can accommodate almost any type of high tech signal with a minimum of effort.

Voice Service

Even though the widespread use of cell phones has changed the role of traditional service, dial tone service for voice, fax, modem and credit card authorization still accounts for a large percentage of work orders placed in convention centers. Analog phone service is the old-style workhorse of the telecommunications industry, but is well suited to public safety uses such as in elevators and parking garages because the units are powered by the signal line and do not require separate electrical service. Digital phones are common in corporate environments and provide access to many extra features, but compatibility is problematic with low-tech gear.

To meet the needs for dial tone service, the Center can purchase its own telephone switch or implement Voice Over IP (VoIP), a computer-based offshoot of the Internet. Either of these methods can be used to provide a dial tone, but each has its own limitations.

The first and most advisable approach is for the Center to purchase its own phone switch and provide local and long distance service via this device. This approach requires a substantial initial investment, but a reasonable ROI can be achieved in a relatively short period of time.

Most new digital telephone switches also provide Voice Over IP (VoIP) capabilities, which has proven to be a highly reliable solution. The challenge is that all circuits are digital and this system requires a fully operational data network. On the other hand, all voice and data signals are carried over the same cable system and the services are interchangeable. Convergence of telephony with a number of building automation and control systems can generate substantial first-cost savings while providing network redundancy.

Required Communication Infrastructure

There are two distinctive parts that make up a communication infrastructure, the backbone (vertical wiring) and the edge wiring (horizontal wiring). Together these separate sets of wire make up the complete system.

Backbone Communication Requirements

The backbone is used to connect the main distribution frame (MDF), sometimes called the central communication room, to the intermediate distribution frame (IDF) sometimes called satellite equipment rooms. All signals entering the facility are brought into the MDF. From the MDF these are patched into the UTP or fiber media that serves the location that will ultimately receive the signal.

UTP – Unshielded Twisted Pair wiring is used for all analog and digital voice circuits. It is also used to carry ISDN, DSL, T-1 and specialized voice/video signals. When used in the backbone, UTP is installed in 50, 100, 200 or larger pair-count bundled cables. Due to the distances between MDF and IDFs and because of the bundling of pairs, high-speed data signals (Ethernet) are not typically transmitted on this configuration of wire.

Single Mode Fiber – Single mode fiber is used for transmitting voice, video and data signals over long distances. All communication providers use single mode fiber as their backbone media of choice. Distance and bandwidth limitations of multi-mode fiber dictates that single mode fiber must be utilized as a component of the backbone. Providing single mode fiber to the "floor" or "desktop" will enable the delivery of high bandwidth circuits to the point where they will be used.

Multi-Mode Fiber – Multi-mode fiber is used for data networks up to 2 kilometers. When distributing Ethernet signals throughout a campus or event center, multi-mode fiber lends itself for the transport of these signals. Multi-mode is also used for short haul video. Use newer generation 50 μm fiber, which has better performance properties than the more common 62.5 μm fiber and can carry higher Ethernet speeds but at distances shorter than 2 kilometers.

Horizontal Communication Requirements

The second piece of the communication infrastructure is the edge wiring (horizontal wiring). This wiring sub system is used to transport the signal from the backbone to exhibition and meeting spaces where devices can plug into to and use the signal.

UTP - Unshielded Twisted Pair rated at Category 6. The major difference from the backbone UTP is that this type of wire only has 4 pair or eight wire conductors. This category of UTP is capable of carrying one billion bits of data a second (gigabit). With gigabit being the highest common denominator, all other signal types can easily run over this wire. UTP can also carry video signals instead of coax by using converters. UTP's biggest limitation is that cable length from IDF to workstation cannot exceed 90 meters.

Single Mode Fiber – Single mode fiber is typically used for transmitting voice, video and data signals over long distances. A small amount of horizontal single mode fiber is generally installed to production support areas to connect video or high-bandwidth signals onto the backbone.

Multi-Mode Fiber – Like with single mode fiber, moving signals from the backbone to the desktop requires similar media. However, media transceivers are used to convert signals from one media to another: migrating a signal from a multi-mode fiber to a Category 6 UTP cable or from a single mode fiber to a multi-mode fiber. Multi-mode fiber used to the desktop also gives greater bandwidth versus the highest grade UTP. Equipment used to transport signals over multi-mode fiber is less expensive than the same equipment used to transport signals over single mode fiber.

Special Communication Considerations

Backbone Cabling – Installation of the highest performance UTP, single and multi-mode fiber within budget is advisable. Utilizing MTRJ small-form-factor fiber optic tips such as the Panduit Optijack can save on rack space and patch panels. A minimum of 12 strands of single-mode and 24 strands of multi-mode fiber shall be used to link each IDF supporting function space to the MDF.

Cable Management Software – The installer will be required to use cable management software to provide the Center with system configuration data in electronic format.

Configuration of Ports – A standard communication faceplate should have as a minimum four Category 6 UTP outlets. Variations will include the addition of four strands of multi-mode fiber and/or two strands of single mode fiber optic cable, either separately by media type or in combinations.

Location of Ports – Registration areas, email stations, phone and information kiosks, public technology display cases, podiums, every fixed wall and every 30 feet, anywhere a possible communication device will be plug in should be the location of ports. Refer to the Spaces section for detailed placement instructions.

Redundant Power – Basic telephone and data services should be connected to a rack-mounted uninterruptible power supply (UPS) to prevent loss of service during short-term power outages. The UPS should further be connected to standby power to support building operations during longer power interruptions.

Roof Access/Wiring – There is a need to have access to communication ports on the roof of the building. The three different wireless signal types commonly used are microwave, RF and laser-based signals. Once a rooftop device receives the signals, they are routed to locations in the building using UTP, single-mode and multi-mode fiber for processing or distribution.

Southern Hemisphere Line-of-Sight – All commercial satellites orbit the earth and are found in the southern hemisphere. Having an unobstructed view of the southern sky for satellite down links and a path into the facility is desirable.

Local News Media – Local news media use mobile production trucks to capture live footage and relay those shots back to their respective stations for broadcast. Most local stations co-locate their repeaters on the same tower or group of towers. Mobile production trucks must have a line of site to those towers to facilitate live video feeds. Providing easy access for these groups makes for a user-friendly building. Either a dedicated cable tray/path should be installed from the general assembly room or dry line patches should be considered for installation.

Technical Space Requirements – Both the MDF and IDF(s) need to be in secure locations and have adequate electricity and environmental conditions. Overhead cable trays eliminate the need for a false floor and allow for greater equipment size.

External Signal Sources - The building is not an island. It has to be connected to outside signal providers, and whether it is AT&T, Cox, Comcast, Verizon or Sprint, there must be a path into and out of the facility. Installing at least two diversely routed conduit banks from the MDF to two different phone company communication vaults would enable access to all carrier signals while providing carrier service redundancy.

Technical Staff - An army of technicians is not required but there must be at least one person who has an understanding of voice, video and data communications and signal transport who can manage the services within the building.

Technical Services

The facility is intended to provide meeting planners with the connectivity to external services and voice, video and data networks linking it to the rest of the world. The challenge facing the technical staff will be not to provide all possible services, but to develop the working relationships with service providers, vendors and specialty contractors to be able to advise their clients in the best high tech manner to meet their demonstration goals.

However, a variety of services must be active on a daily basis just to meet the needs of the facility's operational and marketing staff. By extension, these services should be made available to meeting planners, with adequate capacity available to handle moderate voice, video and data needs on very short notice.

Data Services

The building's Technology Manager should also have responsibility for the internal data networks for facility staff and resident service contractors. Staff computers may be departmentalized for enhanced internal security – accounting, marketing, executive support and maintenance work groups. Rack-mounted servers can be located in the Main Telephone Room to centralize data operations or in a separate data room to allow the system operation to be subcontracted to a vendor.

The Technology Manager should be able to provide limited local area networking (LAN) during an event. Data services such as e-mail and common-user applications and data, from word processing to customized registration management, may be provided using servers controlled by

the Center. Show managers should have controlled access to IDF's under staff supervision for temporary placement of event-based private networking equipment.

Internet Access

Access to Internet services has rapidly become a requirement for not only technology and medical shows but for mainstream events. The Convention Center technical staff should provide Internet services for both the employees and clientele, maintain the Center's home page on the World Wide Web, and coordinate specialized data services for events.

Common practice is to provide wireless Internet (Wi-Fi) access in all public concourses. This is typically a speed-limited service that is free or at minimal cost to allow for checking e-mail or basic Web-based searches. Wireless services in public areas can be upgraded to higher bandwidth for added cost to accommodate audio, video and graphic file transfers or streaming. Wireless services to function spaces – exhibition halls, meeting rooms or the ballroom – are typically high-end data services at premium cost with temporary user identification required, which expires daily or at the end of a particular event.

Information Display – Message Center

Information displays can be either portable kiosks or fixed monitors. Signals can be generated using either proprietary systems or personal computers running Internet-based scripts looping continuously. Building management should control all message content.