HTNG New Builds Design Guide

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About HTNG

Hotel Technology Next Generation (HTNG) is a non-profit association with a mission to foster, through collaboration and partnership, the development of next-generation systems and solutions that will enable hoteliers and their technology vendors to do business globally in the 21st century. HTNG is recognized as the leading voice of the global hotel community, articulating the technology requirements of hotel companies of all sizes to the vendor community. HTNG facilitate the development of technology models for hospitality that will foster innovation, improve the guest experience, increase the effectiveness and efficiency of hotels, and create a healthy ecosystem of technology suppliers.

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1 Document Information

1.1 Document History

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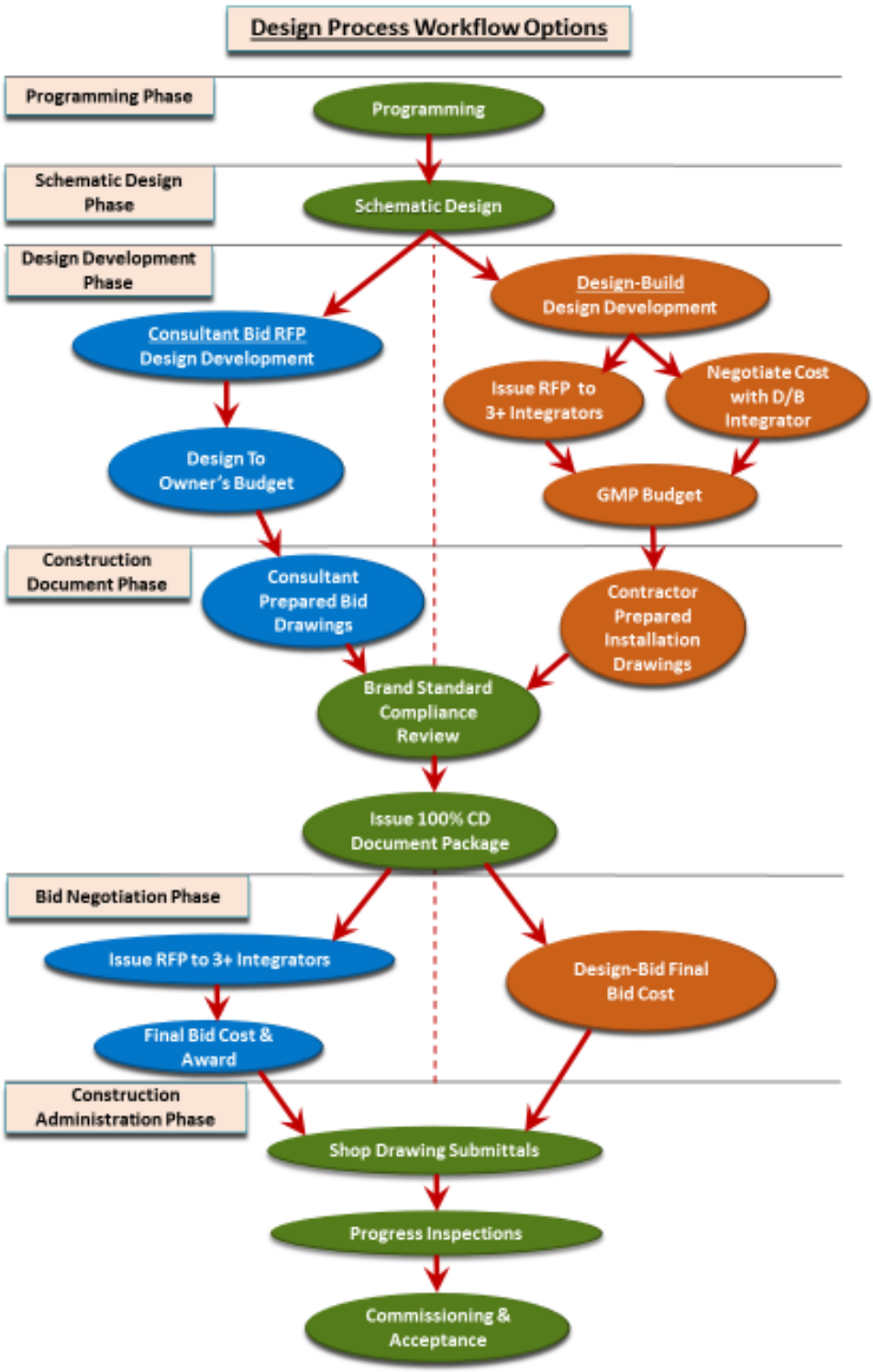
2 Design Documents



2.1 Design Build

This briefing describes activities, phases, and tasks necessary in developing the IT/ELV/AV systems for hotel projects.

We describe options including conventional design-bid-build and two versions of design-build, or Integrated Project Delivery (IPD).

2.2 Process Descriptions

2.2.1 Design-Bid-Build

This is the traditional process of developing design document packages for construction projects. As the descriptive title indicates, there are three distinct phases.

The first phase, Design, involves the architect and all consultants, engineers, and design professionals. Through collaboration, they detail a complete representation of the project with drawings and specifications. This document package is called Construction Documents, and eventually becomes a part of the Contract Documents.

The second phase is the Bid/Negotiate Phase. The Construction Documents are sent to several (typically three to seven) general contractors who prepare construction proposals. A general contractor sub-divides the work to other contractors specializing in the relevant trades such as concrete, steel, flooring, roofing, and of course, IT and AV technologies. Developers sometimes engage a construction manager or act as their own general contractor, choosing to bid the trade packages directly. Upon receiving all proposals, the team evaluates, reconciles, levels, and decides to award the work to a particular contractor or team of contractors.

In the third phase, Construction, the selected general contractor and sub-contractors execute the work. The Design team provides quality control services throughout the process by answering questions, inspecting the site, reviewing submittals, and commissioning the completed work.

2.2.2 IPD (Partnering)

Integrated Project Delivery (formerly referred to as “Partnering”) involves selecting the critical design team members and an experienced design-build contractor who brings their own preferred sub-contractor specialists. A master collaboration agreement, developed at the end of the Programming phase (see Section 2.3.1 Programming), outlines: the critical goals and constraints of the project, and the roles and responsibilities for each of the participants on the design and construction team (referred to as the Team).

The Team then works through the same phases as conventional design-bid-build; however, since the contractors are involved from the beginning, they have the opportunity to influence the design and contribute to its development.

2.2.3 Consultant-Led Design-Build

This approach is very similar to IPD, except that the project leads off with designers and consultants performing the programming and scope definitions of the project before engaging a contractor. This approach relies on a small, specialized team to define the project goals.

2.2.4 Fast-Tracking

Combining IPD and Consultant-Led Design-Build overlaps the design and construction processes to simultaneously complete both, rather than proceeding sequentially. For example, as the civil work and foundations are designed, construction work can start while the architect and design team are still designing the insides of the building and systems. This fast tracks project completion.

There are many advantages and disadvantages to Fast-Tracking a project, and all participants should be very experienced to minimize the premium costs and mistakes. Estimates indicate that Fast-Tracking costs 10% to 15% more in contracts, but can save 25% to 35% of the time between ground breaking and opening.

2.3 Process Phases

The following are the industry-standard project development phases that are used by architects.

2.3.1 Programming

This phase defines the nature and scope of the project, setting goals and pro-forma to be accomplished. It also identifies constraints and limitations that must be respected, whether defined by local building codes, brand standards, or owner's prerogative.

One of the outcomes from this phase, the Programming Report, defines the hotel project in detail with respect to size, height, number and mix of guestrooms, amenity features, types and sizes of event spaces, recreation facilities, special features, etc. The architect follows this formula in developing the hotel's design. Additionally, the Programming Report contains the technical specifications sent to contractors in requesting bid proposals.

The Programming phase also identifies the strategic approach taken by the IT/ELV/AV designers with respect to the systems, such as whether the hotel is state-of-the-art high-tech, or utility oriented.

2.3.2 Schematic Design

This phase develops and analyzes various options for IT/ELV/AV systems for each of the specific areas of the hotel. Options are considered with respect to cost-effectiveness, practicality, future accommodation, maintenance, and related attributes.

Recommendations for each space in the hotel are described in the IT/ELV/AV Programming Reports. These reports are prepared in plain English with the intent to communicate system features and functionality to all readers. This report also includes a rough order-of-magnitude estimated budget for the technologies recommended.

2.3.3 Design Development

This phase reflects the efforts of the Design team to integrate their individual Schematic Design efforts into the project. Plan drawings for floors and ceilings show the systems roughly coordinated with interior design and other design disciplines, taking into account infrastructure requirements and main equipment rooms.

Infrastructure and riser diagrams communicate sufficient information for electrical contractor and related trades to prepare estimated pricing for the empty conduit systems required for each system.

2.3.3.1 *Design-Bid-Build*

The Design team and the technology consultants develop estimated budgets for their respective technologies. These are considered "design-to" budgets with the intention to be fairly accurate place-holders that will reflect the contract values for the installed systems.

Note: This is different from the Design-Build Guaranteed Maximum Price (GMP) Budgets, which are developed with the Design-Build integrator. So, essentially, the GMP budget is the preliminary proposal from the Design-Build contractor.

2.3.3.2 *Design-Build*

Negotiate with D-B Integrator(s)

The Programming Report includes distinct information for every area of the project, room-by-room, including the equipment rooms. The advanced part includes technical specifications that define the features, functions, and performance of the IT/ELV/AV technology systems for the project as well.

Issue RFP to D-B Integrator(s)

Solicit proposals from Design-Build contractors/integrators using the Programming Report. The roles and responsibilities are described in the Request for Proposal (RFP) package prepared by the consultant so that the bidders have a clear and well-defined scope of work to propose against.

When the Design-Build proposals are received, they are evaluated, reconciled, levelled, and decisions are made to award the work to a particular contractor or systems integrator, or team of contractors.

GMP Budget

The successful proposal is adopted for the project as a GMP budget. Unless the scope of the project changes, the final price for the respective systems should not exceed this.

2.3.4 Construction Documents

The Construction Documents are comprised of detailed design drawings and specifications for all elements of the project. This includes site work, architecture, MEP trades, interior design, and of course, IT/ELV/AV systems and technologies.

2.3.4.1 *Drawings & Specifications*

Design-Bid-Build

The drawings developed by technology consultants working with Design-Bid-Build projects are Design Intent documents. These detail the features, functions, and performance of the systems while showing one expression of the design for these systems.

The contractors/integrators do not build from Design Intent documents, but use them as the basis of their proposals. They will subsequently generate a separate set of design drawings called Shop Drawings, which contain sufficient detail for construction.

There are two parts to this set of documents: the Infrastructure Package and the Technical Package.

Infrastructure Design Drawings & Specifications

This set of drawings includes floor plans showing locations of all IT/ELV/AV devices such as jacks, control panels, input/output panels, visual projection and displays (digital signage), speakers, kiosks, etc.

This set of drawings also includes riser diagrams and details of infrastructure, power, cable-tray, and other raceway of "containment" requirements.

Specifications for the infrastructure elements are included in this package.

Technical System Drawings & Specifications

This set of drawings includes signal-flow drawings (sometimes called: "one-line" drawings), rack elevations, device coordination details, plate and panel layouts, patchbay layouts, programming parameters, etc. These drawings reflect all of the equipment.

Specifications for the technical elements are included in this package.

Design-Build

The same documents required in the Design-Bid-Build path are also required in the Design-Build path, but are prepared differently. In the Design-Bid-Build path, the technology consultant prepares the Infrastructure Design package, while the contractor/integrator prepares the Technical Package.

More time and detailed coordination is undertaken earlier in the project in Design-Build compared to conventional Design-Bid-Build. This saves time and resources during the Construction Phase where changes are incremental rather than going through the whole shop drawing submittal activities during construction.

Infrastructure Design Drawings & Specifications

The technology design consultant uses the design disciplines to generate the infrastructure design package.

Coordination between the technology design consultant and the interior designer, MEP engineers, structural engineers, and acoustical consultant ensure all system elements integrate into the project.

The technology design consultant also coordinates with the technology contractor/integrator to ensure inclusion of every infrastructure package element in the technical package.

Technical System Drawings & Specifications

Since the technology contractors/integrators are already on the Design-Build team, they prepare detailed design or shop drawings in this phase.

This time spent earlier in the project saves a corresponding amount of time in the Construction Phase.

2.3.4.2 *Issue 100% Construction Documents Package*

In both paths, the completed and coordinated Construction Documents are assembled and represent the project elements. These documents are used by all relevant construction trades to construct the project.

2.3.5 Bid/Negotiate

This phase is intended to provide the Owner/Developer with a firm, fixed cost for the project.

2.3.5.1 *Design-Bid-Build*

In a Design-Bid-Build project, a general contractor bids all trades based on a complete request for proposal package.

Issue Request for Proposal (RFP)

The Construction Documents combine with other elements to complete an RFP package. These include: invitation letter with instructions; substitution forms; exception and qualifications forms; project milestone schedule (summary); general, supplemental, and special conditions documents related to this project; bid forms; and a list of submission requirements.

Two-Envelope RFP Process

Some RFP packages require the bidders to respond with one package reflecting their qualifications and experience for this particular project, and a separate package containing their “commercial offer” or pricing for the work.

In this process, the qualifications packages are opened first, scored, and ranked according to most qualified contractors. Then, the corresponding commercial offer is opened, and if it is within the project budget, contractor negotiations begin. If the commercial offer is more than 10% above the project budget, then the next most qualified contractor’s commercial offer is opened and processed as above.

The goal is to optimize the value to the Owner by awarding the work to the most qualified contractor whose pricing fits into the project budget; not to award only on which contractor is lowest in cost.

Reconciling and Leveling of Proposals

All contracts require reconciling and leveling by the consultant.

First, in reconciling, the consultant compares each proposal to the RFP requirements, accounting for all of the systems and work elements outlined in the Construction Documents. This process also provides a cursory math check to detect if the bidder may have made a math

error in calculating their pricing. If math errors were made, in accordance with law, the consultant returns the bid to the contractor to re-figure the pricing. These math errors may change the relative positioning of the bidders, so due diligence is critical.

Leveling is the process of reviewing the proposals to ensure no exceptions, qualification statements, carve-outs, assumptions, or mistakes exclude work in one or more proposals that others reflect. This enables proper "apples-to-apples" analysis and fair comparisons for both the contractors and the Owner.

Final Bid Cost

The result of the RFP process applied in a competitive procurement environment provides the Owner with a contract for the relevant work that reflects the best and highest value for the work specified.

2.3.5.2 *Design-Build*

In the Design-Build process, establishing the GMP informs the design. In the step, compare the complete design to the original scope to determine deviations.

Final Bid Cost

The Design-Build contractor/integrator reviews the design in detail and finalizes the furnish-and-install phase of their Design-Build proposal.

Due to synergistic efficiencies expressed throughout the design process, Consultant-Led Design-Build projects often deliver a Final Bid Cost below the original GMP estimate.

2.3.6 Contract Administration and Construction

In this phase, the contractors work together to build the project.

2.3.6.1 *Design-Bid-Build Shop Drawing Submittals*

The Contract Documents require the contractor prepare and submit detailed shop drawings shortly after contract award. These provide more extensive details than the Consultant's Design Intent drawings included in the Contract Documents, such as:

- show point-to-point wiring for all systems indicating detailed terminations and connections,
- reflect all components of the systems,
- show exactly how the contractor/integrator intends to interpret and satisfy the requirements of the Contract Documents, and
- provide specific and detailed instructions for the contractor's technicians to assemble, fabricate, and install the systems and equipment.

In Consultant-Led Design-Build, the shop drawings are prepared in the Construction Documents phase.

Final shop drawings reflecting all modifications due to field conditions, requests, etc. become the As-Built Drawings maintained by the Owner to facilitate servicing the completed systems.

2.3.6.2 *Progress Inspections*

The consultant periodically performs observation visits to review the progress of work and ensure quality. The consultant and contractor work together to anticipate any impediments to progress and resolve before they become problems.

The consultant visits the project site to inspect the installation of the raceway/containment, device rough-ins, cabling, power, and equipment room accommodations. The consultant also visits the contractor/integrator's fabrication shop and inspects the fabrication and assembly of the equipment racks, internal rack wiring, plate/panel fabrication, etc. to ensure quality and intent.

2.3.7 Commissioning & Acceptance

There are four steps of project close-out:

1. Pre-Commissioning Documents Submission
2. Final Inspection
3. Completed Systems Commissioning
4. User Training

These steps are interdependent and must be completed sequentially. When projects are well executed and completed on time, these activities can be accomplished during one single visit, typically lasting two or three days. If there are significant issues discovered with incomplete or incorrect precedential elements, however, the subsequent work element (Commissioning or User Training) cannot be performed until the issues are resolved.

2.3.7.1 *Final Inspection/Punch List*

The Pre-Commissioning Documents include preliminary as-built drawings, Operations & Maintenance Manuals, Performance Testing and Adjustments Report, an un-compiled copy of the control system and DSP programming code, and a letter certifying that the systems are complete and ready for Final Inspection and Commissioning. Upon satisfactory review of the submittals, the Final Inspection is arranged.

The Final Inspection will involve visual and electrical inspection of all system devices. These will be matched to the As-Built drawings, a draft copy of which will be required to be provided by the installing contractor before the Final Inspection. We will also need the contractor to provide testing instrumentation, O&M Manuals, Performance Testing & Adjustments Reports, and a soft copy of the programming code. The result of this inspection will be a punch list that reflects (hopefully minor) corrections to the installation that are required to bring the work into compliance with the contract requirements.

2.3.7.2 *Commissioning*

The Commissioning of the systems involves fine tuning and balancing of levels and equalization of the systems. Commissioning also involves detailed testing of each and every function of each and every control panel and equipment component in the system. Therefore, the installer's programmer will need to be present to make adjustments to the control system and DSP system

programming on the spot. The documentation prepared by the Contractor must be updated to reflect the adjustments to the systems made during the Commissioning.

2.3.7.3 *User Training*

After successful Commissioning of the completed AV systems User Training may be arranged. Copies of the Operations & Maintenance Manuals are required to be provide to the Users for reference during this training. Typically, two training sessions of three (3) to four (4) hours each are scheduled.

2.4 Close-out Documentation

As part of the overall project close-out document phase, the installer shall be responsible for providing the following record documentation for all technology systems.

2.4.1 Record Drawings

The technology contractors shall be responsible for submitting a complete set of record documents at the completion of the project. Record drawings shall be submitted in hardcopy and electronic formats. Submittal shall include all floor plans revised as per actual installation. The electronic format shall be submitted via on-line share-file or via email in Visio (.vsd) and/or (.dwg) AutoCAD version 2014 or most current version. The drawings shall identify:

- Low Voltage Outlet Devices, Active Equipment Hardware and Cabling locations including their location specific naming conventions
- IT/AV/Security Equipment Room Locations and Detailed plans of each Equipment Room
- Low voltage cable pathways, tray/conduit sizes and routes and vertical riser sleeve locations.

2.4.2 Operation and Maintenance Manuals and Warrantees

Upon substantial completion of the project, the contractor shall provide a minimum of one (1) digital via on-line share-file or via email and one (1) hard copy of all equipment operations manuals. These materials must include a listing of all major components, hardware and software with a master Bill of materials or equipment list and an index for this equipment. All manuals shall be combined into a single master O&M book for the owner. This section of the submittal shall also include copies of all training and quick reference guides prepared for this project.

2.4.3 Cabling Certification Warranty

The low voltage data/voice/video cabling fiber and copper infrastructure must be 100% tested to meet the appropriate TIA cabling standards. All test results and the associated cable manufacturer's warranty certification shall be included in this submittal.

2.4.4 Ownership of Un-Compiled Source Code:

The systems integrator will be required to turn over all programming source code to the client upon completion of the project. This code must be in the uncompiled state, in the original control system software format, for the owner's use with future programming changes. The owner shall be provided the rights to perpetual use of the programming code for on-going modifications that do not require the involvement of the integration company.

2.4.5 Active Network Documentation:

The network integration company that installs and configures the network shall provide a complete network configuration record document package that includes the following:

1. Core router, firewall and edge switch configurations in file and text format
2. Provide spare patch fiber cable, GBIC and at least 1 typical edge switch for replacement use
3. Network one-line diagram that includes all WAN/LAN/WLAN network equipment with the formal naming conventions.
4. List of public IP address ranges and assignments to internal devices
5. Emergency Support contact directory (call tree)
6. Sub-Systems Vendor contact directory (other vendors that utilize converged network)
7. VLAN list of all vendor assignments
8. Master list of all Network Equipment listed with IP and MAC address
9. Master List of all User equipment by make and model with IP and MAC address
10. Warranty and support agreements in place with renewal dates clearly defined
11. Top 5 issues - review troubleshooting procedures (loss of internet, loss of connectivity to a floor, power, bad fiber, replacement of switch)

2.5 Versioning, Storage, Sharing of Documents

2.5.1 Document Management

A good document management tool is critical to the success of any project by enhancing collaboration between Architect, Owner, Consultants, Operator and others associated with the project. It should allow users to store, locate, and retrieve documents easily. A document management tool should not become so cumbersome that the tool gets in the way of storing and retrieving documents, but should be a mechanism for assisting in helping you manage your documents. It should allow for local as well as remote users working the project as well as the occasional guest user to access the system to store and locate the documents they are searching for. The system should provide an audit trail or log of activities identifying the action/transaction and time of day the action/transaction took place by user. Some document managements systems will also provide a work flow process so that as one action is completed it kicks off another event or series of events to take place. The success of any good document management tool is based on a solid implementation plan identifying the different types of documents, who needs access to these documents, and policies and procedures around its usage. This document will attempt to highlight critical components that should be considered when selecting a document management tool.

2.5.2 Storage/Filing

Different systems use different methods of filing documents. Some systems utilize Metadata that creates tags or key words that get associated with a particular file/document when stored, while other methods utilize a traditional folder structure where the file ends up residing. Both methods are good however when initially setting up the system no matter which approach is chosen, it is recommended that a thoughtful logical lay out of your structure is defined. You do not want to over complicate a metadata approach with a high number of metadata tags that the end user has to choose from every time they go to file a document. Likewise you do not want to create an overly complicated folder structure either. The system should also be flexible enough to easily expand storage capabilities.

2.5.3 Versioning

The system should easily allow the user to apply a version to a particular file or document. When a newer version of the document is saved on the system the older version should be retained however when doing an initial search, only the latest version should appear. Previous versions should be available to view but only when selecting to see older versions with the most recent version appearing first followed by the older versions of the document.

2.5.4 Notification

When new documents are loaded/stored on the system there should be an option that can automatic notify all appropriate project participants of this latest document posting. In order to minimize e-mail traffic and e-mail storage the notification should not transmit the document but should provide a message with a link to the document where the recipient would have the option to open or down load/ store the document at that time.

2.5.5 Transporting/Moving Documents

In order to minimize impact on an organizations network or e-mail system, documents should never automatically be transmitted or sent from the system. The process should always utilize a pull approach in that the recipients request the documents, controls when and where they will be downloaded onto their system. This allows control over when and how the documents come down. It also allows the recipient to confirm that they have received the document after pulling it down.

2.5.6 File Lock-Out/checkout

The tool should allow for documents that are being revised or updated to be “checked out” or “locked out” during that period, allowing others to view the document but preventing them from making changes to it while the document is checked out. The system should provide a method of identifying what individual currently has the documents checked out. If a document has not been checked back in within a pre-determined period, then a notification should be sent automatically reminding the person of the document they currently have checked out.

2.5.7 Viewer

The tool should allow for the documents to be viewed from within the application without having to download them onto a local work station and run them from applications on that work station

2.5.8 File Format

The tool should allow for the storage and retrieval of any and all document types and file formats. It should be able to handle documents that utilize Unicode, Double Byte Characters, or proprietary/unique file extensions.

2.5.9 BIM Tool

Other recommended tools for the generation and management of the design process include the commonly used tools/processes Building Information Modeling (BIM). The BIM method of construction provides the potential for a virtual information model to be handed from the Design Team (architects, consulting engineers, and others) to the Contractor and Subcontractors and then to the Owner. This collaboration can assist with more accurate project estimates and schedules.

Each team is responsible to add their own additional discipline-specific knowledge and to track changes to the single model. The result greatly reduces the information loss that occurs when a new team takes "ownership" of the project as well as in delivering information to the owners. It also prevents errors made by design team members as well as the construction team (Contractors and Subcontractors) prior to a phase starting by allowing the use of conflict detection software.

This software, in conjunction with the submitted models from each discipline, informs team members about parts of the building in conflict or clashing through detailed computer visualization of each part in relation to the total building. As computers and software become more capable of handling more building information, this will become even more pronounced than it is in current design and construction projects.

This error reduction is a great part of cost savings realized by all members of a project. The method has proven to cause a reduction in the time required to complete construction as well as a decreased amount of change orders.

3 Brand Design Standards

3.1 Main Purpose: Consistency and Quality

The main purpose of developing and using Brand Design Standards is to ensure a consistent level of facility and systems quality among all hotel facilities flying the brand flag. This supports the brand's staff training and their operating procedures to deliver a consistent level of quality of guest service. This combination of quality facilities and quality staff services result in the Brand's Reputation for guest experiences.

The Brand Design Standard provides developers and ownership group asset managers with a clear set of requirements that the hotel they are developing must meet. These requirements are best expressed in terms of functional and performance parameters for the various elements of the hotels, from architectural and interior design, materials, equipment and systems, installation practices, warranties, etc.

By consistency, it is sometimes meant to identically replicate the design of the facility exactly so that there is no distinction between any properties anywhere. This interpretation is typically more applicable to select service hotels. For upper tier hotel brands, consistency applies to the level of quality towards a consistent guest experience of quality, and is intended to be open to interpretation for differing styles, materials, character, designs, etc.

The Brand Design Standards are one ingredient in a recipe of a Consistent quality guest experience. In addition to the Brand Design Standards, the hotel brand should provide: (1) a programming or scoping document that specifically applies the Brand Design Standards to a particular development project, (2) a Best Practices document that provides cost-effective solutions to meeting the requirements, and (3) an Operating Standards document that supports the hotel's use of the project's features and maintains the quality and functions of these features. It may also be helpful to provide a "Master Specification" supplement, although these typically become outdated very quickly.

Where?, How?, (& Why?) The questions Brand Standards are expected to answer are: **What** (systems, quality, features, functions, performance, etc.) do we (the Developer) need to do? **Where** do we need to do that? **How** should we do it?

The question so often missing from Brand Design Standards is: **Why**? Where each requirement is expressed, it is helpful to the reader to have a brief explanation, or justification, to understand why this requirement is being expressed. This way, alternative solutions proposed by the design team or by vendors can be intelligently evaluated relative to the expressed functional requirement, the "why" of the standard. Without expressing the "why", the functional requirement is left to assumptions, postulations, and creative interpretation.

The question: How? is crucial to provide sufficient information for the Developers' design teams to design the buildings and systems to provide the minimum required performance. However, providing too much specific detail crosses into defining "means and methods". This may contradict the performance requirements specified elsewhere, and therefore relieve the

developers' design teams from responsibility of meeting the intended and required performance.

An example is specifying the wall construction by calling for STC (Sound Transmission Class) rated walls, rather than the performance ratings of NIC (Noise Isolation Class) or ASTC (Apparent Sound Transmission Class). The latter requires the Design team to design to specified performance.

Too often, Brand Standards include specific products, and frequently these describe proprietary products. This may be done for convenience, or where only one proprietary product will provide the combination of features, functions, and performance the Brand wants. But sometimes these proprietary products appear in Brand Standards as a result of the product manufacturer's sales team "helping" to write the standards.

If the Brand wants to specify particular products, that is best provided in the form of a supplement to the Brand Design Standards, either using the Master Specification format, or Best Practices format. The "how" may be expressed through narrative, example, or illustrations… but should always be expressed as a current best practice, and not the sole solution.

3.2 Design Standards vs: Design Guides

Brand Design Standards are intended to be "mandatory minimum" requirements. If the Standards are written too broadly, or if they include optional elements that are not clearly identified as optional, then the Standards "soften" and are subsequently interpreted by both Brand representatives as well as developers as "guidelines" rather than mandatory minimums.

When Design Standards are prepared that include both minimum requirements, and possibly optional enhancements, the entire Design Standard is considered to be recommendations, or suggestions or a guide, and thus loses its definitive strength as a minimum "Standard" that it was meant to be. It takes a strict discipline to test each specification in the standard to be sure it reflects a minimum requirement and that anything that is not a minimum, be clearly indicated as such.

3.3 Design Standards vs: Best Practices

While the Brand Design Standards are defining the "What" and "Why" of the minimum requirements, the next question that follows is "How." The answer to the "How" question is best expressed in a Best Practices supplemental document. The experience may vary widely among the many different designers and consultants involved in a new hotel development. It may be desirable to provide examples of successful designs and interpretations of requirements to the design team.

A separate Best Practices supplement ensures that the users do not confuse the best practice as the one-and-only way to satisfy the Minimum Standard requirement. Sometimes, several examples of solutions to the requirements may be given for a particular requirement. A Best Practices supplement also can serve as a living document, leaving the Brand Standard as a fixed distinction and not subject to fluidity or evolution.

Best Practices may take the form of narrative, illustration, or even a mention of one or several specific products that exemplify cost-effective or high-performance ways of meeting the requirements. When product specifications are provided, they are offered as "basis of design" and examples.

3.4 Design Standards vs. Master Specifications

The Brand Design Standards should focus on functional and performance parameters and avoid referencing specific products or brands to the extent possible. There may be instances where the clearest way to define a standard is by specifying a particular product when it is the one-and-only that satisfies the requirement. But, where more than one product, design, or material can be used, it is best to not identify a specific product.

When specific brands, model numbers, or specifications are included in the Design Standards, the document is frozen in time. Manufacturers often improve products and change specifications, thus rendering these references outdated.

As described above, the Best Practices document can be designed to be a living document and reference. It may include a listing of acceptable products and that list can be revised and updated as new products are introduced, model numbers change, etc. It is best for the Brand Design Standards to be more static to protect its authority power.

While Master Design Standards do not provide specific model numbers of products, materials, etc., Master Specifications do. These documents are sometimes offered as a complementary supplement to the Brand Design Standards to reflect an example of products that meet the Brand Design Standard requirements.

The need to establish consistency in Brand Standards may lead the Standards to provide the names of several specific manufacturers as "standards of quality". However, Brand Standards avoid specifying model numbers of products, as model numbers change frequently when products are improved, which would make the Standards outdated.

Master Specifications will follow the structure and format of the construction industry standards, such as CSI or MasterSpec and may include an exemplary Bill of Quantities or Bill of Materials, without indicating quantities.

3.5 Proprietary vs. "Generic" Specifications

Often, manufacturers "help" to write the Design Standards. And, in doing so, they will endeavor to "write in" their products, typically emphasizing their products' unique attributes. When brand management insists that the Design Standard NOT have any particular manufacturer's name or product specifically called out, the product representative offers what appears on the surface to be generic.

These "proprietary-generic" specifications stand out clearly to anyone in the respective industry who is familiar with products and materials typically used. The fingerprint of the authoring manufacturer is as clear as if the product were specifically named. This tends to discredit the

veracity of the Brand Design Standard as a whole, both in the eyes of the designers and developers.

3.6 Anticipating and Accommodating Innovation

When Brand Design Standards are written with an eye toward the future, they are clear about the minimum requirements for features, functions, and performance of equipment and systems while not limiting the upward development of same. This invites and accommodates design approaches and equipment that exceed the minimum requirements and allows for innovation.

Innovative approaches are typically called out by the design team as variances to the Master Design Standards for review and consideration by the Brand Representative.

The emphasis on defining the features, functions, and performance as minimum parameters along with the "why" descriptions will provide an opening for new and innovative products, processes and strategies to meet clearly expressed requirements.

3.7 Regional Variations

Where Brand Design Standards are too definitive or too strictly limited to specific products or solutions, the standards may not be considered applicable to other regions or countries. This becomes quite challenging to Development when the Brand Design Standards run counter to or even "insults" the local ways of doing things.

Regional offices have been known to disregard the Brand Design Standards entirely when arranging a project, especially when they have confidence that the Developer will provide a first-class product in that particular market. This is one more reason to keep the Brand Design Standards focused on functional and performance parameters, and ensure they reflect the minimum requirements.

One way to address this challenge is to offer sections in the Best Practices supplement that address regional perspectives on meeting the Brand Design Standards. Often, other regions see solutions that will work outside of the originating region, and that just adds to the overall Best Practice knowledge base.

3.8 Complementary Operating Standards

It is critical that Operations be involved in the development of the Brand Design Standards, and that there be a parallel set of Standard Operating Procedures (SOPs) to ensure delivery of the intended guest experience. The Design Standards are the vehicle, and the hotel staff is the driver. It takes both to ensure consistency in service delivery.

The operating standards must include service and preventative maintenance plans to ensure the functions and quality performance defined in the Brand Standards and Best Practices is maintained.

3.9 Using Design Standards for New Builds

This is the most typical application of Brand Design Standards. When a developer approaches a hotel brand to consider engaging them for facility management, the hotel brand provides their standards document as a developer contract requirement.

Developers typically hand the Brand Design Standards document over to their design team and asks them how much it will cost to meet these requirements in their design.

If the Brand Design Standards are too broad in nature, and include all requirements for every possible type of space in any hotel, the design team may interpret this as an invitation to over-design the project, and inappropriately drive the developer's costs up.

The best way to support the Development and Design team to understand exactly what is needed for the specific project is to provide a Programming Document or Scoping Report that defines, space-by-space, what elements of the Brand Design Standard apply to each space and as required for this project. This may be in the form of a checklist, a schedule, or a dynamic online resource that culls and parses the Design Standard in response to queries. Ideally, this Programming Document is developed by the hotel Brand Management first, then negotiated with the Developer.

3.10 Using Brand Design Standards for Renovations

Since the purpose of Brand Design Standard is to provide consistency in guest experience, it is appropriate to apply the standards to any hotel undergoing a renovation. However, many times hotel renovations are undertaken on an existing property that, for any of many reasons, are less than ideal and cannot cost-effectively meet the specific requirements of the current Brand Design Standards. This is another reason why the Brand Design Standards reflect features, functions, and performance requirements along with the "Why" or rationale behind such requirements, allowing the project management and design team to develop solutions that fit with existing facility constraints.

Where a hotel has been acquired with intrinsic shortcomings and it is not economically feasible to reconstruct deficient elements to meet the Brand Standards, it then falls to Operations to develop unique service and operating procedures to work around the deficiency. This also applies to the outside vendors who are serving the hotel guests as well, such as the AV Operating Company.

A variation of the Programming Document may be used in developing Project Improvement Plans (PIPs) or CapEx plans as well. This could take the form of a checklist that corresponds to the Brand Design Standard and to the Best Practices document.

Major renovations would likely have the same requirements as new builds, and the Brand Design Standard can serve well as the guiding document for these projects.

The Best Practices document should also have a separate "Renovations" section to build a knowledge base that describe solution options for renovations. As a living document, this can expand to reflect the unique situations and challenges that each renovation may present, along with solutions.

3.11 Using Brand Design Standards for Acquisitions

Growing a hotel management company often includes re-flagging existing properties that were developed for other hotel management groups. Sometimes, properties are re-purposed buildings that were never originally intended to serve as hotels.

The Brand Design Standards can be very useful in analyzing re-flagging and re- purposing opportunities. The checklists may be used to help budget the CapEx and renovation costs to bring the property up to current Brand Standards.

3.11.1 Brand Design Standards, CapEx, OpEx, and Operational Constraints

The purpose of Brand Design Standards is to provide facilities and systems that enable the hotel management staff to provide consistent quality guest experiences.

When a facility does not meet Brand Standards, (either initially due to budget constraints, negligent design, or through lack of maintenance) increased burdens are placed on the hotel management staff to meet guest expectations. This may take the form of additional staff requirements, using more outside vendor-supplied supplemental resources, reducing availability of event spaces to avoid locating concurrent meetings adjacent to each other, higher repair or maintenance costs, etc. In fact, all of these compensations increase the cost of operating the hotel if Brand Standards are not met.

So, whether considering new builds or renovations, failing to provide Brand Standard facilities shifts first cost or CapEx costs to Operating Expenses or OpEx, which reduce profit. The alternative is to deliver a lower quality guest experience, which carries its own costs in the long run.

3.12 Brand Design Standards Compliance Review Processes

Enforcing the Law: The Brand Design Standards represent the minimum requirements of the hotel management company. These are the parameters that the Developers are required, under contract, to deliver.

The Brand owes it to itself to have a specific and consistent Design Standards Compliance Review program in place to ensure that the designs will meet the requirements. This process should establish expectations early on in the design process, and be rigorous in the Schematic Design and Design Development phases to ensure the projects start out properly. If deviations are discovered later in the project design development, it may be too late to correct in a cost-effective manner.

It is important that the Brand Representative performing the Design Standards Compliance Review is objective and independent of the Development and Design team. The key is to avoid a conflict of interest situation or “fox guarding the henhouse.” The Architect or his consultant may not hold interests that align with that of the Hotel Brand.

The Design Standards Compliance Review process uses a checklist that is derived from and extends the original Programming Report to this specific project, on a space-by-space and system-by-system basis. Each space is defined with respect to the critical Design Standard

requirements in the form of a checklist that facilitates quick and objective evaluation of the design documents.

The Design Standards Compliance Review process should continue all the way through the Construction Documents Phase, and the Construction Phase, reviewing significant contractor submittals and any proposed value engineering actions.

3.13 Commissioning Processes

The Commissioning Process is a logical extension of the Design Standards Compliance Review process. Ideally, the Commissioning Process uses the same checklists developed for the design reviews, and confirms that the requirements have been met in the completed hotel construction. It also confirms that all features and functions are present, that the systems work and perform to the required levels, and that the documentation and training have been completed.

The Brand Representative performing the commissioning should be the same as that performing the Design Standards Compliance Review to ensure consistent interpretation of requirements and to extend the knowledge of the peculiarities and minor compromises that each project inevitably includes.

The commissioning process must be fully documented and retained for posterity. The system performance, configuration, and close-out and as-built documentation is crucial for maintenance purposes, and to provide future renovation teams with accurate information relating original conditions. Copies of the entire close-out and as-built documentation package should be maintained on the property as well as digitally archived at a repository at Brand Headquarters.

One critical element of the close-out documentation is archival copies of all programming for all systems including security, energy management, audiovisual, etc. control systems and signal processing systems. The hotel must own unrestricted rights to and copies of “un-compiled source code” as well as the authoring software used to create the source code in order to maintain the systems. This software and source code should be provided as archival copies, in two different formats.

3.14 Brand Design Summary

A Brand is distinguished by the quality of the unique guest experience it consistently delivers. This guest experience is a product of both the facility and the services delivered by the staff. Brand Design Standards define the critical and unique qualities of the facility, infrastructure, and systems that the staff needs to create the guest experience. Only through sensitive development and consistent application can a Brand Design Standard be effective.

4 Use of Design Standards

The Brand Design Standards provide developers and ownership group asset managers with a clear set of requirements that the hotel they are developing must meet. These requirements are best expressed in terms of functional and performance parameters for the various elements of the hotels, from architectural and interior design, materials, equipment and systems, installation practices, warranties, etc.

4.1 Interpretation Processes

Hotel Brand Design Standards are by definition comprehensive both in scope and scale. Design Standards typically aspire to define requirements and quality for all significant aspects of the hotel development, including: massing, stacking, space planning, adjacencies, systems, materials, etc. This level of detail is required to ensure consistent quality, leading to consistent guest experiences.

Brand Design Standards are written to be applied consistently to hotels of varying capacities as well, from smaller properties to larger hotels. They are written to apply to hotels in temperate zones and those in colder climates. Downtown hotels and seaside resorts may both be addressed in the same Design Standard.

These expansive Design Standards must be interpreted on a hotel-by-hotel basis. This interpretation process begins during the Programming Phase of development. However, if the entire comprehensive Design Standard is provided to the Developer's Design Team without narrowing scope, the less experienced members of the design team typically over-interpret the requirements and drive the cost and complexity of the project higher than the Brand intended. This is particularly true when the project is being developed using the design-build process, where many of the "designers" are paid commissions on the systems and equipment they can include in the project.

The best practice for interpreting Design Standards on a project-by-project basis is to have an experienced, bona-fide independent consultant interpret the Brand Design Standards for that particular project. This can be arranged easily using standardized checklists and programming templates to indicate which elements of the Design Standard apply to the specific project being developed.

4.2 Design Standards Compliance Review and Commissioning Processes

As a hotel design works its way through design document development, there are quality control reviews scheduled where the Brand Representative is provided with progressive designs to ensure that the Brand Design Quality standards are being complied with. During these reviews, the Brand Representative usually sends each of the sections by discipline to their in-house or retained subject matter experts who review the documents and report variances to the Brand Design Standards.

The checklists described above for Design Standard interpretation provide an excellent and consistent format for performing the Standards Compliance reviews.

Commissioning is a step-by-step process whereby the individual spaces and completed systems and equipment are evaluated to determine how well they meet the feature, function, and performance requirements described in the Brand Design Standards. Using the same templates as developed for programming and interpretation will ensure that all critical elements are addressed and included during the Commissioning Process.

5 Summary

5.1 Owner Preferred Design Criteria

5.1.1 Owner/Developer Criteria

On all hotel build and renovation projects, the hotel owner and operators technology vision needs to be reviewed, confirmed and then applied to the design very early in the project. All aspects of the hotel technology requirements and ultimate hotel technology operations must be pre-planned. The Project technology Criteria development will follow this general process:

1. Investigation Phase – An assessment of all available and emerging hotel technologies. Commonly, a "Technology matrix document is used to present and record the criteria decisions.

2. Preliminary Visioning and acceptance proposed solutions

3. Schematic design and Budgeting for the proposed solutions

4. Formal Acceptance of the technology decision matrix and budget

5. Final Design and Request for Proposal or Design-Build vendor pricing submittal

5.1.2 Technology Matrix

For reference, below is a sample draft of the technology planning matrix. This document would need to be tailored to each property's needs and technology vision.

General Questions for the Property Goals and Operational Vision

- Room Count and Floor layout: is there a set key count? Standard rooms, suites, Premium suites?
- Location: Will the property be in a Metropolitan area, multi-acre ranch/mountain or Caribbean Villa style location?
- Will the property be a 4 to 5-star major Brand or a Boutique style?
- Is this property flagged with one of the major chains, and if so, are we to be held to any of their technology design standards (we need a copy of that document)?
- Has a list of Property Back-Of-House Applications been established that required to interface into the Guest Room Control System: PMS, POS, Spa/Restaurant Reservations, etc.
- Has an operator company been established yet – and if so, do they have any pre-set mandatory technology requirements and/or mandatory 3rd party providers that must be designed for?
- Will there be any mixed use occupancy at this facility; Hotel Only, Partial Residential, Residential component to be rentable to the hotel?
- What is the plan for Retail and restaurants? Will there be any branded restaurants?
- Is the target Market youth, seasons business travelers, unknown?
- Does the property plan to target a LEED status?

The following matrix is provided as an in-progress understanding of the technology solutions planned for the property. The information shown is a potential record of conversations and

generally are proposed technology solutions for review and confirmation by the hotel owner and operator. Brand standards should be consulted in all technology decisions.

Note: The RFP process will be for non-specified systems will be Multi-Vendor in order to be competitive.

Technology Description	*Technology Solution Features*	*Comments & Discussion Points*	*Final Decision*
Guest Room Phone	*Analog or VoIP, Cordless or Corded*		
Guest Room Locks	*Magnetic Stripe, NFC, RFID, Mobile Key, Online/Offline, Audio tone*	*Online systems need communications (Wfi, Zigbee, etc)*	
Guest Room HVAC Controls (Energy Management System)	*Local / stand alone thermostat, online HVAC with centralized control to EMS*	*Online systems need communications (Wfi, Zigbee, etc), Utility rebates may be available*	
Guest Room Controls	*Local light switches, Master on/off, Room Scene selections, Guest device control, Hotel owned tablet, Motorized shades*		
PBX Options	*Administration, Analog, VoIP, etc.*	*On-property vs. above property*	
High Speed Internet Access (wired, wireless)	*Wired ports (1 or more), in-room AP, Property-wide wireless*	*Bandwidth needs, authentication requirements, network seperation*	
TV Entertainment	*IPTV, RFTV, LCD Screen, Screen Size, Remote control, HD vs. 4K, DVD/Blu-ray player, Set-top-boxes, Jack pack*	*Audio system, external sound bar, bathroom TV*	
DND, Room Service	*Paper hanger, phone*	*Rapid guest response*	

Technology Description	*Technology Solution Features*	*Comments & Discussion Points*	*Final Decision*
Guest Room Doorbell	*Electronic door bell, integration to DND system, tray detection*		
Guest Room Safe	*Electronic Integration with PMS, reset/unlock features*		
Bedside Clock & Charging System	*USB, iPhone, iPad, Wireless Charging, Radio (FM/AM)*		
Staff Communications	*RF Radio, Wi-Fi, Cellular*	*Infrastructure requirements, Rapid Response Systems,*	
In-Building Cellular	*DAS, Wi-Fi, Small Cells*	*Infrastructure Requirements, Local mobile network operator needs*	
Security	*Door locks (guest room and back of house), CCTV*		
Guest Room Cabling	*IDF Homerun, in-room media termination box, in-room switch, STB/phone integrated switch*		

Abbreviations Reference

DAS – Distributed Antenna System for In-Building Cellular Enhancement

DND – Do Not Disturb

EMS – Energy Management System

FTG – Free to Guest Entertainment channels HSIA – High Speed Internet Access

HD – High Definition referencing TV Display Resolution

IDF – IT Closet (Intermediate Distribution Frame)

IP – Internet Protocol

MDF – Main IT Room (Main Distribution Frame)

MUR – Make Up Room

PBX – Phone System

PMS – Property Management System

POS – Point of Sale

USB – Universal Serial Port

VOD – Video on Demand Entertainment Channels

VoIP – Voice over Internet Protocol

WAP – Wireless Access Point or Antenna

5.1.3 Submittals

5.1.3.1 *Conduit Pathway Shop Drawing*

The technology contractors submit a complete set of floor plans and details. These drawings shall include all required cable pathways with conduit size and routing, cable quantities, type and size. All conduit pathways sizes shall be calculated based on a conduit fill chart provided in the shop drawings. If the technology systems installation will require power outlets/connections, this information must also be included in the shop drawing submittal. The shop drawings shall be coordinated with other ceiling trades. All required low voltage conduit shall be provided and installed by EC.

5.1.4 As-Builts

As part of the project deliverable, all constructed conditions must be documented in a record drawing format.

6 Planning IT Space and Infrastructure

6.1 Wi-Fi

The content of this document is primarily intended for use in new build hotels and should be used to communicate the standards to architects, contractors and vendors as well as to act as a guideline document for internal I.T. staff involved in the project.

6.1.1 Wireless Distribution

The provisioning of Wireless High Speed Internet (Wi-Fi) services will require the installation of UTP cable, Category 6, from Main Computer Room or Intermediate Data Cabinets to locations throughout the hotel (see Areas of Coverage) for the mounting, installation and servicing of Wireless Access Points (WAPs). All previous reference to conduit, cable placement and termination requirements for Category 6 cabling in this document must be adhered to for installation of this Wi-Fi cabling. The scope of this definition relates only to the design and installation of the Cabling system for this Wi-Fi network. Reference to WAPs in this document is only intended to give a point of reference for design of the Cabling system.

6.1.2 Areas of Coverage

Common areas, to include all lobby areas, lounges (to include towers or executive level lobby and lounge areas), bars, restaurants, pool and patio (interior or exterior), fitness centre, meeting and function areas, to include all Meeting Rooms, Conference (to include Towers or Executive level conference facilities), Ballrooms and Pre-function areas. Care must be taken to ensure the installation of enough infrastructure in these areas such that their subsequent division by mechanical or other partitions does not deteriorate signal reception in any one partitioned area. Guest Rooms, to include all space within all guest rooms, suites, parlors. Also these should include coverage for all Fractional Ownership or Condominium units as may reside within the Property.

6.1.3 Installation Parameters

The installed infrastructure defined here should provide for the installation of WAPs such that the following criteria are met: WAPs should be concealed from public view, or mounted in a subdued and aesthetic manor as well as secured from tampering if in an accessible area. WAPs will be permanently accessible after installation, to facilitate repair or replacement. WAPs will not require access to electrical power near their installation, but may utilize it if available terminated cables for the Wi-Fi network must be emplaced throughout the Areas of Coverage in sufficient density and proximity to each other to provide the following minimum Receive Sensitivity:

Common Areas: 88dBm (example)

Meeting and Function Areas: 72dBm (example)

Guest Rooms: 89dBm (example)

Cable runs for the Wi-Fi network should be terminated in 8pin RJ45 female jacks at the access point location. Jacks will be installed in wall plates if the WAP is to be mounted aesthetically in a

visible location, and interconnected with the shortest possible patch cord to maintain a neat and tidy look and also to minimize tampering. Signal coverage between WAPs should never fall below 15% overlap at the specified dB levels Regardless of the signal level requirements being met; WAPs must never be required to provide signaling beyond a 300' circumference from any one WAP.

6.2 Cellular Service

6.2.1 In-Building Cellular Enhancement

6.2.1.1 *Hospitality Design Considerations for a DAS Deployment*

There are many factors to consider when implementing a neutral host distributed antenna system (DAS) to support the mobile needs of guests, meeting attendees and staff. Once the decision is made to progress with the installation a DAS, several guiding principles should be established. These principles will be used to assist in making critical decisions and keeping the project on track to completion.

These foundation decisions will be used as the cornerstone for a robust system deployment.

- Any system to be installed should be designed to support the four (4) major U.S. Wireless Service Providers who are AT&T Mobility, Sprint, T-Mobile and Verizon Wireless. For venues that have a large International clientele, AT&T Mobility and T-Mobile are desirable since international phones generally roam on these networks. T-Mobile service is especially desirable since they have a much larger international presence than the other major U.S. WSPs.
- Any system installed today should be designed to support the four (4) primary frequency bands shared among the major and minor WSPs. This spectrum is commonly referred to as the Commercial 700MHz, Cellular, PCS and, AWS. Recently the FCC has just completed their auction of additional AWS spectrum. Additional frequencies to be considered in a neutral host design would also include 800Mhz SMR and 2.6Ghz Band utilized by Sprint.
- The system should be designed for maximum capacity. This means the in-building antenna placements should be spaced to provide proper coverage with all the WSPs providing the maximum coverage their licensed spectrum will allow. If the system is not designed to accommodate maximum capacity, then when the WSPs increase their capacity, the facility will develop areas of weak signal or no coverage. This same problem will occur if the system is designed for 1, 2, or 3 WSPs and then others are added after the installation has been completed.

With the rapid advancements in mobile devices and especially smart phones, in-building deployments have undergone many changes as well. A few years ago it was common for a WSP to deploy an in-building DAS for their larger customers. However, with many organizations moving away from supplying cell phones to employees and moving to a bring your own device (BYOD) philosophy, WSPs have moved away from the single WSP DAS model. In certain situations, a WSP will deploy a neutral host DAS supporting multiple WSPs. However, there is no

guarantee the other WSPs will meet the financial requirements imposed to connect to this "neutral host" DAS. Many times these systems remain as a single WSPs system which benefits the deploying WSP but not necessarily the venue owner. Since the WSP deployed the DAS, the property owner does not have ability to modify, upgrade, or control which WSPs can connect to the system.

Another possible option for a venue is to contract with a 3rd party neutral host provider. With this scenario, the 3rd party provider pre-negotiates with the WSPs to determine their interest in providing funding for the project. If this 3rd party supplier is able to secure the proper amount of funding the project moves forward. If the required funding support is not obtained, the 3rd party provider will not install the "free" DAS for the venue. This process can take over a year to be determined with no guarantee the DAS will be built. Since the DAS is owned and operated by a 3rd party, the property owner does not have ability to modify, upgrade or have any control of which WSPs can connect to the system.

The 3rd option is for the property owner to build the DAS and work with the WSPs for partial funding. This partial funding will most likely be in the form of the WSP providing the signal source, such as a base transceiver station (BTS) or small cell which is the radio frequency (RF) source for the DAS and the demarcation point between the DAS and the WSP. In this type of deployment, all stakeholders regarding the facility have ownership and motivation to maintain the DAS in optimum working condition. An important decision for the property owner is determining a trusted vender/integrator/partner who can help guide them through the various processes of a DAS deployment. The selected vendor should conduct a survey to establish a baseline of the ambient RF environment which will assist with developing a preliminary RF design. This vendor will also need to work on the property owners behalf in talking with the WSPs to gauge their interest and financial support in regards to providing their RF signal sources. In some cases, (such as repeater-based RF signal sources) WSP funding ay not be available but they will allow the DAS owner to fund the RF signal sources. During the process to gauge the interest and intent of the WSP, the property owner can either start the DAS installation process or wait until the RF signal source issues with one or more of the WSPs is finalized. Unfortunately some property owners have built the DAS without the proper WSP coordination resulting in none of the WSPs participating on the DAS or if the DAS is not designed or installed properly, they will refuse to participate.

The WSP RF signal source are typically a bi-directional amplifier (BDA) or repeater, a base transceiver station (BTS) or a small version of a BTS referred to as a small cell. The BDA/BTS/small cell is the interface that connects the DAS to the WSPs' macro network.

In a one (1) sector solution, there is one signal source per frequency band (per WSP). In a two (2) or more sector design there will be two (2) or more signal sources per frequency band (per WSP). Whether one or more sectors are needed per WSP is based on several factors including number of users and coverage area of the DAS.

An overview of the various signal source types is as follows:

- A repeater, also known as a BDA, or bi-directional amplifier, connects into the WSP's network through a roof mounted donor antenna, which receives signals from the WSP's macro (or area-wide) network. This unit amplifies signals in both directions (to and from the DAS and users' mobile devices)
- A BTS, or base transceiver station, is usually connected to the WSP's network via a direct fiber-based Ethernet connection. From this connection the BTS generates the radio frequencies (RF) that create the WSP's wireless services. Part of the BTS system is the external signal conditioning, or DAS tray, that matches the RF output of the BTS to the RF input requirements of the DAS head-end. Typical requirements for a BTS per WSP system include:
    - 220VAC
    - Two (2) equipment racks. Additional rack space may be required depending on size of venue and carrier requirements.
    - Grounding
    - Battery backup (part of the BTS system and installs in one of the equipment racks)
    - GPS antenna outside with coax connection to the BTS.
- A small cell operates similar to the BTS, but supports fewer simultaneous connections. The small cell will connect to the WSP's network directly through a fiber-based connection or through a commercial grade Internet Service Provider and the Internet. The Internet connection will either be WSP or customer provided. Small cells have limited capacity, meaning it supports fewer simultaneous users and is typically not used in larger capacity environments. Small cells are currently WSP frequency specific and would require a set of small cells deployed per WSP.

The decision to determine which RF signal source sub-system will be approved and used is ultimately made by the individual WSPs. It is during the design and approval process with the WSPs when this decision is typically made.

Another DAS design consideration, especially for high-end venues, is aesthetics. Most high-end property owners prefer the DAS in-building coverage antennas be hidden from view and installed above the ceiling. While not being able to see the antenna has advantages, it has one big drawback. If the antenna is installed above the ceiling and out of site, it will provide less coverage in the surrounding area. The result is more antennas will be needed which means more cabling to be installed and more DAS equipment to be purchased, installed and configured. To help alleviate this concern, there are now models of antennas that are low profile, meaning they are smaller and less noticeable. It is also possible to paint the antennas to have them match the surrounding area, making them less noticeable. These two solutions, while possibly not ideal for the property owner, are much less costly than placing the antennas above the ceiling.

6.3 First Responder Radio

6.3.1 Public Safety

In many cities across the US, new construction, major renovations larger than 3 stories or buildings with underground facilities may require the need to pass a public safety communications test. The local building department or local Fire Marshall Office may hold the occupancy permit until this requirement is resolved. It is recommended to contact the local building department and the local Fire Marshall to confirm the new building requirements for first responders. A Public Safety DAS is often a common solution for this requirement.

Like a Cellular DAS, the public safety solution consists of 3 major components: A. RF Source (typically a BDA). B. DAS Headend which receives the RF signal. C. Distributed antennas which includes cable infrastructure (fiber and coax in the vertical and horizontal) and may also include remote radios to boost the signal throughout the facility.

National Fire Protection Association (NFPA 72) and International Fire Code standards do apply to public safety DAS. These codes are set to protect the system that is installed to allow communications to stay up for first responders while responding to an emergency inside the building. Some of these requirements include:

- Fully waterproof installation using NEMA 4X enclosures (typically painted red), including conduit for cabling.
- Battery or generator backup.
- Monitoring points on active components
- Coverage focused on stairwells and elevator shafts to keep open communications for first responders.

While it is possible to design PS frequencies over the same system as a Cellular DAS, these requirements may increase the overall cost of a Cellular DAS. Cellular DAS do not carry the same requirements. If conduit is required for all DAS cabling, adding PS over the same solution as the Cellular DAS could actually be a cost savings.

Before moving forward with a Public Safety DAS, it is good practice to identify the local building codes for Public Safety and the specific frequencies utilized by the local first responders for both County and City systems. In some cases there are different systems utilized. The typical frequencies for Public Safety are 700Mhz and 800Mhz but other frequencies utilized can be 150Mhz and 450Mhz. Once the frequencies have been identified along with the # of channels utilized per frequency, the Public Safety DAS system can be designed to meet the specifications for the given building.

The good news about Public Safety Frequencies is that these frequencies are low and they propagate well through many building equipment. That typically equates to the need of less antennas to meet the typical -95dB RSSI requirement over 95% of the property which is captured by spectrum analyzer equipment.

It is recommended to utilize a RF design firm that can perform site surveys, gather data as need from a site survey, and provide a propagation heat map (for example, via IBWave) based on a proposed design for the specific frequencies required.

6.4 Wiring Standards (Data, Voice)

Although this section will not define the specific quantities of cables required as this can only be determined by looking at the specific requirements of the project, however we will provide guidelines around the types of cabling and recommended minimum quantities should be considered when installing cabling. It is recommended that all cabling be installed with a 20-year warranty.

6.4.1 Cabling

6.4.1.1 *Riser Cabling*

The riser cabling plant is the cable that typically runs between floors and inter connects the MDF room and each of the IDF rooms. This cabling is typically performed in a star configuration where a core set of riser cable runs from the MDF to each IDF in a point to point configuration. This cable should never run from the MDF to the first IDF then terminate and patch into cabling that runs to the second IDF and so on. It should always be run as a continuous cable with no spliced or patched in between the MDF and each IDF closet.

We recommend that a combination of fiber and copper riser be installed as this provides the most flexibility to support current and future requirements.

At minimum we recommend a 12 core of multi-mode armored riser rated fiber cable along with a 12 core of single-mode armored riser rated fiber cable. In addition, we recommend a 50 pair Cat 3 UTP cable. Again these quantities many need to be increased based on the specific data/voice requirements within the project.

The two different fiber types should terminate in separate fiber patch panels that utilizes type LC connectors. The copper cable should terminate into a 48 port patch panel.

Each of these cables should be tested (100%) to ensure they meet the manufacturer's specifications in performance after being installed. Testing should take place from jack to jack.

6.4.1.2 *Optional Riser Cable*

Multiple media types are used today, and if the service provider has not been selected, you should plan for spacing and service needs for CAT cable, fiber optics, and coax.

Depending on the type of TV system being installed a coax RG11 or .500 Hardline coax riser infrastructure may be required. Although at this point we do not recommend using Coax for your TV solution and recommend delivery be done over a CAT 6 cable.

6.4.1.3 *Horizontal Cabling*

Horizontal cabling is the cable that runs between the IDF and the end point device. We recommend this cable be specified as a 4 pair UTP Category 6. These cables cannot exceed 90 Meters (297 Ft) in length from jack to jack (100M including the patch cords at each end) and should be wired in a star configuration from the IDF to each end point. It should always be run

as a continuous cable with no spliced or patched in between the IDF and the end point termination.

Termination of this cable in the MDF should be on a 24 or 48 port RJ45 patch panel while termination at the end point should be an RJ45 jack. These can be wired as either a 568A or 568B configurations, so long as the entire building is wired in the same format.

6.4.1.4 *Horizontal Cable Containment*

All horizontal copper cabling should be installed within or upon dedicated cable trays, cable basket, within conduits or multiple compartment trunks.

The Voice & Data cables must not be installed within the same containment as any other and the minimum segregation spacing should be maintained.

6.4.1.5 *Guestroom Cabling*

It is recommended for the guestroom that 2 X 4 pair Cat 6 cables be installed from the IDF to each guestroom. Within each guestroom one of the cables should terminate and provide connectivity to an in room wireless access point with build in multiple Ethernet ports. The termination port should be powered by PoE and at least one of the Ethernet switch ports should provide PoE. The second cable can be provided as a spare to the wireless access point or can be used as a direct feed to the back of the TV for IPTV services.

Depending on placement of the wireless access point and it's integrated Ethernet switch all other cabling in the guestroom for wired HISA, VoIP telephony, and IPTV (if not utilizing the second cable) can be done with CAT 6 patch cables or fixed CAT 6 cabling that connects to the switch with CAT 6 patch cables.

6.4.1.6 *Staff Office Cabling*

It is recommended that 2 X 4 pair Cat 6 cables be installed from the IDF to each office/work station for PC and telephony connectivity.

6.4.1.7 *Select Areas*

Select areas such as the front desk may require additional cabling to support the check in process with credit card procession, guestroom key encoding, telephone, PC/laptop, and printer. We recommend a minimum of 6 X 4 pair Cat 6 cables be pulled to each user work station.

6.4.1.8 *Patch Leads*

Should be 24 AWG (UTP), 26 AWG (STP) stranded, with low flammability sheath to standard IEC 60332-1.

Connectors should be RJ45 style IEC 60603-7-2/3.

Electrical performance to be enhanced Category 6

6.4.1.9 *Installation recommendations*

It is strongly recommended that the cabling system be procured from one manufacturer and installed according to the manufacturer's instructions.

6.4.1.10 *Testing*

It is recommended that cables be tested to IEC 61935 with a Level III (or higher) cable tester set to Class D Permanent Link referencing the Permanent Link performance standards detailed in ISO 11801:2002, or Class D detailed in BS EN 50173-1:2002, or Cat 6 detailed in ANSI/TIA/EIA-568-B.

The results should be stored in an electronic database compatible with the tester manufacturer's cable management program

The structured cabling system shall comply with cable balance and EMC requirements of BS

EN 50288-3-1:2003 and ISO 11801:2002 and will not degrade the EMC performance of any electrical device connected to it. The manufacturer shall guarantee this facility.

6.4.1.11 *Fiber Optic Patch Panels*

It is recommended that Fiber Optic Patch Panels be capable of housing no fewer than 12 x LC connectors. All fiber optic cores should be fusion spliced using pigtails onto LC connectors. Each fiber patch panel should use 1U of cabinet space and be located above the Active Components within the same cabinet or Patch panels within the Local Communications Rooms

6.4.1.12 *Installation Quality*

The complete structured cabling system will be installed in accordance with the quality standards as applicable and in accordance with the manufacturer’s guidelines.

The structured cabling contractor must ensure that all installation staff has a complete understanding of the quality requirements.

6.4.1.13 *Testing*

Testing of fiber optic cables will be carried out using an OTDR, and must be carried out at both 850 and 1300nm from each end of the cable. Each trace shall be recorded along with the test engineers name and signature.

Should the testing identify a failure, this must be immediately rectified and noted with the hand-over documentation under test failure. Where rectification is not possible then the cable and associated components must be replaced and removed from site.

The Cabling contractor must undertake to provide the Hotel IT with advance knowledge of all testing activities and allow witness to the testing as required.

All cabling should be terminated and tested.

6.4.1.14 *Manuals and Documentation*

The structured cabling contractor shall provide the following items as hand-over documentation to the properties nominated representatives at the conclusion of the project.

Two (2) paper copies and a CD-ROM of all fitted drawings showing the cabling schematics, connectivity drawings, cabinet and frame schematics, all clearly showing label designations. All drawings shall be produced using the latest version of AutoCAD for windows and saved in DWG or .DXF file format.

7 Technology Design Categories

7.1 Digital Signage

Digital signage is used for many purposes in hotels. One is for design or decorative purposes. Some interior designers are including video displays, ribbons, video walls, and projection as part of their designs. These displays may be used for social media during events, silent radio news feeds, ticker tape feeds, etc. for entertainment purposes.

Digital signage is also used to promote hotel amenities or local events. Displays may be located in the elevator lobbies, elevator cabs, lobbies, assembly and pre-function areas, etc. They are frequently included adjacent to way-finding displays as well.

There are several types of way finding displays. Following the guests' journey from the guestrooms, from the main lobby, and from any convention or conference entrance, a Primary Directional Display is located at each decision point. This allows a guest to find their way to the meeting space without back-tracking or getting lost. These primary directional displays are sometimes referred to as MIDS or Meeting Information Display Systems, so named after the airport FIDS or Flight Information Displays Systems.

Adjacent to each Primary Directional Display should be a "You Are Here" graphic floor plan to help the guest to know which way to travel to get to their event. These floor plans are static and may be back-lit graphics rather than digital displays.

Another type of way-finding display is the door-side display. These are small (15") displays that are located adjacent to the event space guest entry door and announce the event that is currently in session in that room. These displays are frequently integrated into the fixed room naming signage plaque as well.

There may be Interactive Displays included for some hotels. These are helpful for one user at a time, but not for groups of guests. They may be used as directories or to promote hotel amenities. They do not replace the need for Primary Directional Displays.

Glossy versus Anti-Glare: In all cases of public displays, always specify only video displays that feature non-glossy, anti-glare viewing surfaces. Glossy surfaces cause distraction and reduce the legibility of the displayed content. Do not specify glossy displays.

7.2 Telephony

Today when looking at a telephone system for the hotel you have several options to consider.

- Do you deploy Voice over IP (VoIP) technology or do you deliver this service via a traditional analogue/TDM signal.
- Do you deploy VoIP to the guestrooms as well as the BOH areas or do you limit this to only your BOH areas?
- Will incoming services from your service provider be delivering those circuits via SIP (Session Initiation Protocol) or will they come in through traditional T1/E1 services?
- Do you consider going all wireless and implement a BYOD solution?

- Do you consider utilizing a hosted solution or do you provide an on premise based solution?

Below we will attempt to provide you some points to consider when trying to make your decision.

7.2.1.1 *Deploying VoIP in Guestrooms*

This provides several benefits but also some challenges that need to be considered. By deploying VoIP into the guestroom you will reduce your copper riser cabling requirements. Although when reducing this cabling you should still having some copper riser remain for miscellaneous applications or for emergency back-up. You can also possibly reduce some of your horizontal cabling as well by utilizing IP phones that offer an Ethernet port built into the phone. This port could provide connectivity for guest wired, wireless High Speed Internet, or other applications. Before planning on using this port you should verify with the manufacturers of the PABX/Handset as well as your application provider and the operator to ensure that they will support this configuration. In addition, security for both applications needs to be considered when using the Ethernet port built into the phone.

Before eliminating a horizontal run it is also recommended that you keep in mind any potential future requirements that may need to utilize this cable in that area and again verify with the vendors and the operator before eliminating.

Things to consider when bringing VoIP into the guestroom include the additional Ethernet port(s) that will be required to support the phone(s). Note the additional port may be offset if you are able to utilize a built in port on the phone to support other applications. Other items to consider include up time during a power outage. With a traditional analogue system the handset gets all the necessary power to operate from the PABX system which typically is on the generator and a UPS electrical system. In VoIP solutions the handsets would either get their power from a PoE Ethernet port located in the wiring closet or through an external electrical outlet near the phone. The preferred method is to source that power from the IDF where a single UPS feed can be managed and supported vs individual devices in the guestroom. In addition there is a potential the phone could become unplugged from the electrical outlet rendering it inoperable. In either case, extension of the generator and or UPS solution into the IDF closet or at the electrical outlet near the phone would need to be considered. Without this, during a power outage the phone would not operate and could be a serious issue in the event of an emergency.

Additional items to considerations include if any increase in cooling requirements for the IDF closet will be required due to the increase in PoE ports on the Ethernet switches along with any additional floor space requirements in the IDF.

7.2.1.2 *Deploying VoIP in the Administrative Spaces Only*

In this configuration it is more commonly found to use the Ethernet port build into the phone to support the PC on the user's desk. These phones typically can offer additional benefits by

syncing up with your desktop to help manage messages and calls. Other options include the use of soft phones which run a VoIP client on your desktop and allows your desktop to become the telephone. This can free up space on the desk by providing all tools from one device, and reduce cost. Consideration needs to be made around compatibility and interoperability with the other applications, security of the application, along with electrical power/UPS.

It is recommended that if you utilize the port on the phone to support the PC or if you use the soft client approach, you should still maintain a minimum of 2 cable drops to each work station. Please consult with each of the vendors along with the operator before making any decision to remove any cables.

Implementing VoIP into the administrative spaces only, while maintaining traditional analogue/TDM into the guestrooms is typically a less costly approach, however it is recommended you evaluate the cost for both approaches.

Note: depending on the vendors selected for certain items emergency phones in elevator lifts, or fire panels have typically been slow to adopt VoIP and may still need to connect via analogue. In those cases analogue ports out of the PABX will still need to be provided or a VoIP gateway that converts the signal from IP to Analogue and vice versa will be required.

7.2.1.3 *Incoming Services*

With a VoIP solution you now have the option of having your incoming services brought in via SIP Trunks from your service provider. This typically can result in carrier savings. It also gives you more flexibility of being able to easily route your calls to other locations outside of business hours or based on special needs.

7.2.1.4 *Wireless and BYOD (Bring Your Own Device)*

BYOD via wireless will without any doubts be the next generation of in room guest facilities and should be fully integrated within the guest room. Substantial savings can be achieved, depending on the chosen configuration. Sales and Marketing are the driving force, when it comes to the look and feel of the APP used on any smart device. Just think about potential revenue you may be able to generate.

7.2.1.5 *Hosted vs On Premises*

A hosted solution allows you to have your PABX system located off property while still having a similar experience and functionality as if the system was on property. This approach typically reduces CapEx expenditures but does increase OpEx expense as it defers the cost of the system over the duration of the contract.

By moving the system off premise items such as maintenance and support are typically handled by the service provider although you can continue to manage and maintain some items such as adds and changes if preferred.

One item to consider when looking at Hosted solutions is the quality and reliability of your internet services as this can play a critical role in the systems performance and up time if those services are not reliable.

A hosted solution can provide you with other benefits besides Capex cost and support reduction. It can offer more secured data provided the right service provider is selected as typically they offer other hosted services and have a quality security team on staff. Bottom line know your provider. In the event of an on property disaster, in a hosted solution, connectivity to the end points (user) can be rerouted in a relatively short period of time as oppose to having a new system/components delivered and set up.

When looking at hosted VoIP solution, it is important to understand how the vendor preforms their numbering plans, PMS interface, Call billing, and DID assignments. Because this is a hosted system shared with multiple originations there can be some unique situations in which numbering plans, DID assignments or other services may not be as flexible as a dedicated on premise solution.

Before choosing to go with a hosted VoIP solution or to stay with a traditional Analogue/TDM solution the ROI needs to be evaluated closely as hosted impacts the bottom line and typically over the term is more costly but allows the cost to be distributed over the term of the agreement.

8 Planning IT Space and Technology Rooms

The designing and development of the Technology Rooms (TR) represents the requirements for the planning of Information Technology (IT) Space provided within a Hotel property to distribute services intricate to the operation of the Active Technology Systems. These operating systems typically support the interior structure of the Hotel/Resort, but can also support the exteriors of the property as well as satellite structures. These rooms also provide both Structured Cable System (SCS) connectivity and active equipment functionality to support all of the applications associated with maintaining the property at an acceptable level to the owner, operator and/ or guest. The Administrative & Guest Networks, MATV, Telephone, Audio Visual, DAS, IRAS, CCCTV and Access Controls equipment are some examples of the the systems supported within these IT spaces.

Preparing the design requirements for these Technology Rooms is an intricate part in successfully maintaining and managing these primary and secondary Information Technology distribution centers once the property is operating. Each Technology Room should be designed with the needs and requirements associated with the physical room/ space, electrical requirements, HVAC, fire suppression, access control, and distributed cable pathways for the necessary bulk and horizontal cabling to be integrated. The structured cable infrastucture, active equipment, and operating requirements associated with these design elements should be considered for not only the inception of the hotel development, but for the potential growth and expansion the property may require. All elements associated with the above should be considered when designing and developing the Technology Room Space(s).

8.1 Physical Room and Space Requirements

The physical room and space requirements are dependent on factors associated with the type and purpose that the Technology Room is being designed to support. Technology Rooms (TR's) associated with IT Server/ Core switches, Main Distribution Feed (MDF), and Intermediate Distribution Feed (IDF's) Rooms are typical and most commonly used spaces defined and provided to distribute the necessary information technology infrastructure and active equipment for the property. The overall property square footage will mandate the amout of Technology Room(s) and associated space necessary. The Technology Rooms should be "sole purposed" for the use of the Technolgy Systems and Structured Cable System (SCS) Infrastructure. The TR spaces should not be designed for multi purposing with other electrical or mechanical equipment and systems. In addition, TR's can be designed for specific System Applications, purposes and equipment to be supported. Some examples of single purpose TR's typically include Carrier Services- Point of Entry (POE), Distributed Antenae Systems (DAS), Audio Visual (AV), PBX and Security Systems. Overall, the square footage of all defined TR's should be calculated and designed to meet not only the anticipated requirements upon the property openning, but capable of sustaining an increase of a minimum twenty percent (20%) more development for infrastructure and active equipment. This formula will assist not only with the expansion of the current active systems and potential added infrastructure, but also

allow for placement of additional equipment and infrastructure associated with any potential new technologies developed in the future.

There are typical design standards to be maintained in the industry in support of the core and shell of each Technology Room. These general design elements should be provisioned during the pre construction and development phases of the project and implemented during the construction phases. First, The TR's should be located within the Interior of the Building and not adjacent to any Mechanical Pump Rooms or Electrical Closets. Also, the typical core of the TR's should be constructed to include ¾" Fire Rated Plywwod Walls; antistatic Vinyl Covered Tile or Sealed Concrete; adequate overhead fluorescent lighting with removable ceiling tiles. The drop ceiling and lights should be a minimum of 10'-00" from Finished floor to allow for overhead cable pathways and access within the room and over the installed Racking/ Cabinet Equipment.

The room should have no windows to the external walls of the building or onto a public area. It is recommended that there be no structural columns, pillars or other forms of intrusions within the room that prevent full access to internal walls for mounting telecom voice frames or similar.

There must be no wet services that pass through this room.

8.1.1 Dimensions

The room should be as square as possible with no single wall less than 4m (13' 2") wide.

8.1.2 Medium Size Hotels

The Computer Room for a hotel up to 600 bedrooms should not be less than 25m2 (269ft2). More precise dimensions must be planned in conjunction with the known specifications/ dimensions for all IT and PABX equipment to be located in the room. Larger Hotels will require a separate review of these dimensions.

8.1.3 Smaller Size Hotels

The Computer Room for a hotel up to 300 bedrooms should not be less than 16m2 (172ft2). More precise dimensions must be planned in conjunction with the known specifications/ dimensions for all IT and PABX equipment to be located in the room.

8.1.4 Larger Size Hotels

Please consult with the operator to determine size.

Also note that depending on the operator's requirements for security the computer rooms may need to be sized larger in order to support the number of cameras required by the operator.

There should be no signs, directions or public facing windows indicating or revealing the location of the Computer Room.

8.1.5 Electrical

The electrical requirements for all Technology Rooms should be based on the Active Equipment calculated loads and the requirements associated with the Uninterupted Power Supply (UPS), Generator Support (GENSET), and Power Distribution Units (PDU) to provide the proper line/load necessary to support the properties equipment housed within each dedicated Technology

Room. Typically this information is provided to the design team by the owner/ operator and will be codified by the electrical engineer with the assistance of the low voltage designer and/ or active equipment vendor associated with the project.

8.1.5.1 *Uninterrupted Power Supply (UPS)*

Provide UPS in order to protect equipment and data from voltage and current surges. In addition to the computer room each IDF closet should be protected by UPS and Generator system as well. It is recommended that a minimum of 1 hour UPS be provided for protection of the computer room and each of the IDF closets.

It is recommended that UPS protected and isolated outlets be identified with a different color outlet so that they can easily be identified and help to minimize devices being connected that could potentially create surges on the electrical line.

The UPS is required to protect equipment and data from voltage and current surges. In the event of a complete power outage the emergency generator or dual power source should primarily be used for emergency lighting and to ensure guest and employee safety and often takes some seconds to 'kick-in' during which time data files and computer equipment can be damaged in the loss of power and the subsequent surge. Therefore a UPS that connects the Computer Room and other equipment to the emergency generator is required. Note that in many cases the warranty of hardware is affected if it is not connected to the UPS, e.g. Point of Sales Systems, PABX.

The capacity of the UPS must be sufficient to allow hotel staff sufficient time to conduct an orderly shutdown of the computer systems in such a way as to minimize guest inconvenience and to protect the revenue of the hotel. This may vary from area to area, as some do not have a dedicated IT manager 'on-site'. In those cases:

Larger Hotels

A dedicated modular UPS system connected to the Standby Generator must provide not less than 1 hour's autonomy for computer systems to be attached.

Where no emergency generator exists, the UPS must provide not less than 4 hour's autonomy.

All UPS circuits will be fed via a dedicated distribution board within the computer room, each circuit protected by a correctly rated circuit breaker and clearly identified at both ends.

The UPS may be located in the Computer Room itself in order to place it in an area with air conditioning (preserving battery life), and sufficient load bearing floors. If floor design permits, this location may be partitioned from the main Computer Room.

Qualified electricians observing all electrical and environmental requirements applicable in the country must install a UPS. UPS batteries must be kept at a constant temperature of 20oC (68oF) or less, to preserve battery life.

The UPS will have an external bypass switch to aid maintenance and an external audible alarm to indicate faults.

8.1.6 HVAC

The HVAC requirement for the various Technology Rooms (TR) is dependent upon the type of purpose the TR is being designed. Typically the calculation of the British Thermal Units (BTU) for all active equipment and the relative acceptable humiduty standard derive the calculation for the amount of circulated and/ or refreshed air that will meet the minimal requirements specified by the project MEP during the development and design of the property. Overall, the design intent should be to maintain a maximum temperature of 75 degrees Farenheit and 60% R.H./ N.C. BTU's for each TR. The HVAC requirements should be derived and projected to the current system requirements while maintaing the ability to increase with expansion of the active equipment. Typically, when deciding on the type of HVAC equipment to be installed, it is important to provide the adequate interior/ exterior space for equipment installation. Only the necessary equipment responsible for the temperature and air flow should be installed within the Technology Room. All other HVAC support equipment should be housed outside of the Technology Rooms.

The Computer Room should have a backup separate split DX system connected to the emergency power system so that in case the main HVAC system fails, then a backup system is able to provide sufficient cooling to maintain the computer room within a safe operating level until such time the main HVAC system can be repaired.

The sizing of the Air Conditioning unit must also take into consideration the heat output from any other equipment placed in room such as UPS and lighting.

A malfunction alarm for the air-conditioning unit or a high temperature alarm for the Computer Room should have its indicator located in an area that is monitored by staff such as the security office or engineering department.

Note: where fan-coil systems are installed, they should not be located inside the Computer Room, but should service the room via air ducts. If installation in the Computer Room is unavoidable it must not be positioned above any computer equipment

8.1.7 Pathways

The main pathways required in support of the typical Technology Room are comprised of electrical, HVAC, mechanical, low voltage infrastructure, and fire suppresion. Each element of these systems require designated space coordinated during the design so these elements do not inhibit the ability of the core equipment to be housed within the TR's while in operation. Essentially, these systems support the equipment and infrastructure defined to be installed within the Technology Room(s). In addition, elements associated with supply or return pipes, condensation, and/ or drain pipes must be eliminated from transversing within or adjacent to the proposed spaces developed for the TR's. All potential "fluid" hazards to the Technology Room(s) and the equipment they contain should be coordinated and eliminated with the development team prior to any construction.

The necessary pathways for the Bulk feed and Horizontal Cabling should be achieved within the TR by appropriatly sized Overhead Cableways. These Overhead Cableways should be designed to support all Bulk Feed and Horizontal Cable requirements as well as any necessary Patch Cords to be provided for inter connectivity of racks and cabinets. Further, the Overhead Cable System (OCS) should support any conduit and/ or sleeves entering or exiting the room that is part of the SCS. When applicable and accepted by ownership, raised floor systems can be utilized to support additional cable pathways within the TR.

8.1.8 Security

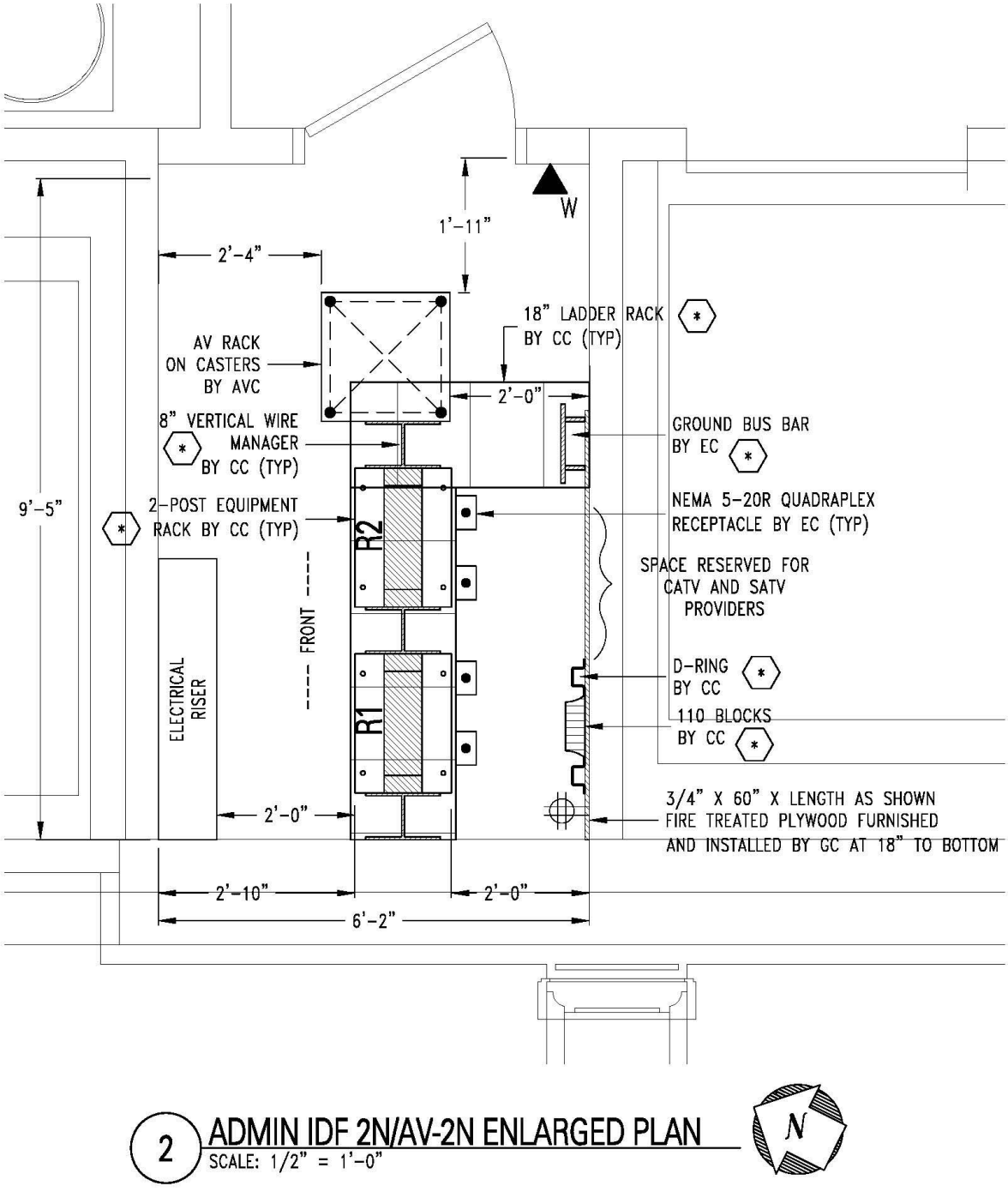
Security of the Technology Rooms should be provided to ensure that those without proper authorization are not allowed access to these spaces. The standard requirements for all Technolgy Rooms should be to utilize an acccess control system on all entry/ exit doors and recordable security cameras at the exterior entrance and wihin view of the operation active equipment racks and/ or cabinets. If an Access Control system or Security Survielance System is not provisioned for the project, a mechanical locking cylinder for the door hardware at the entry door of each Technology Room must be utilized. The “Hard Key” should not be duplicatable and the property must provide a secure “Key Control” plan so only the property personnel that are authorizized can gain access. However, it is recommended that all TR doors be part of the property’s Access Control System. This would allow digitally documented files of the Access Control System to monitor all personnel entering these rooms. Further, it is recommended that CCCTV cameras be placed with in the TR’s to provide visual recordings of all personnel obtaining access to the TR’s where any active systems are operational. When vendor(s) require access, hotel security may issue tempory controlled access or provide an authorized escort and supervision while the vendors are supporting the carrier or active system equipment. Further, all vendor supported system equipment at the TR’s should be housed in independent lockable cabinets so only the authorized vendors can access the necessary equipment associated with their applications.

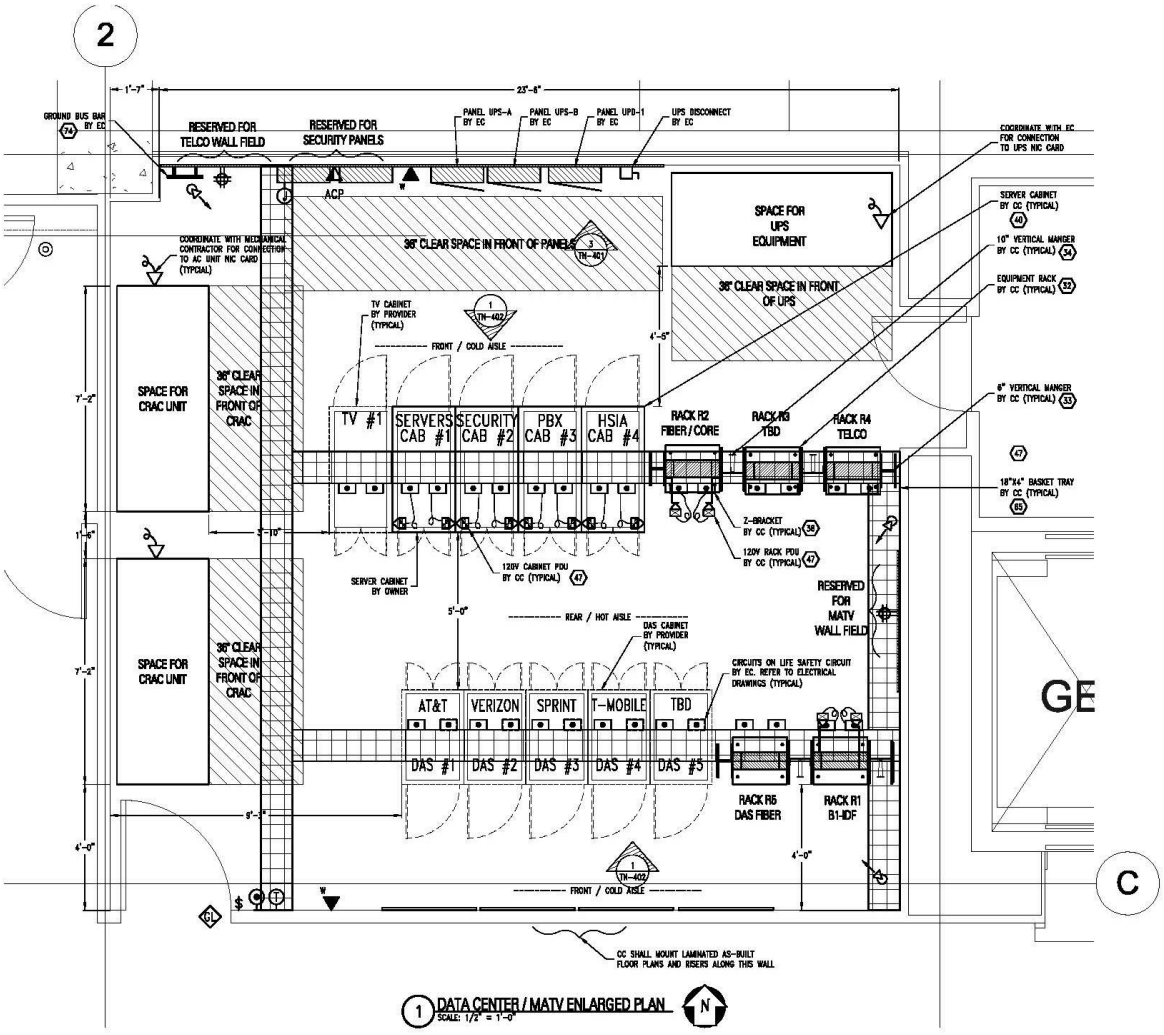
8.2 Types of Technology Rooms

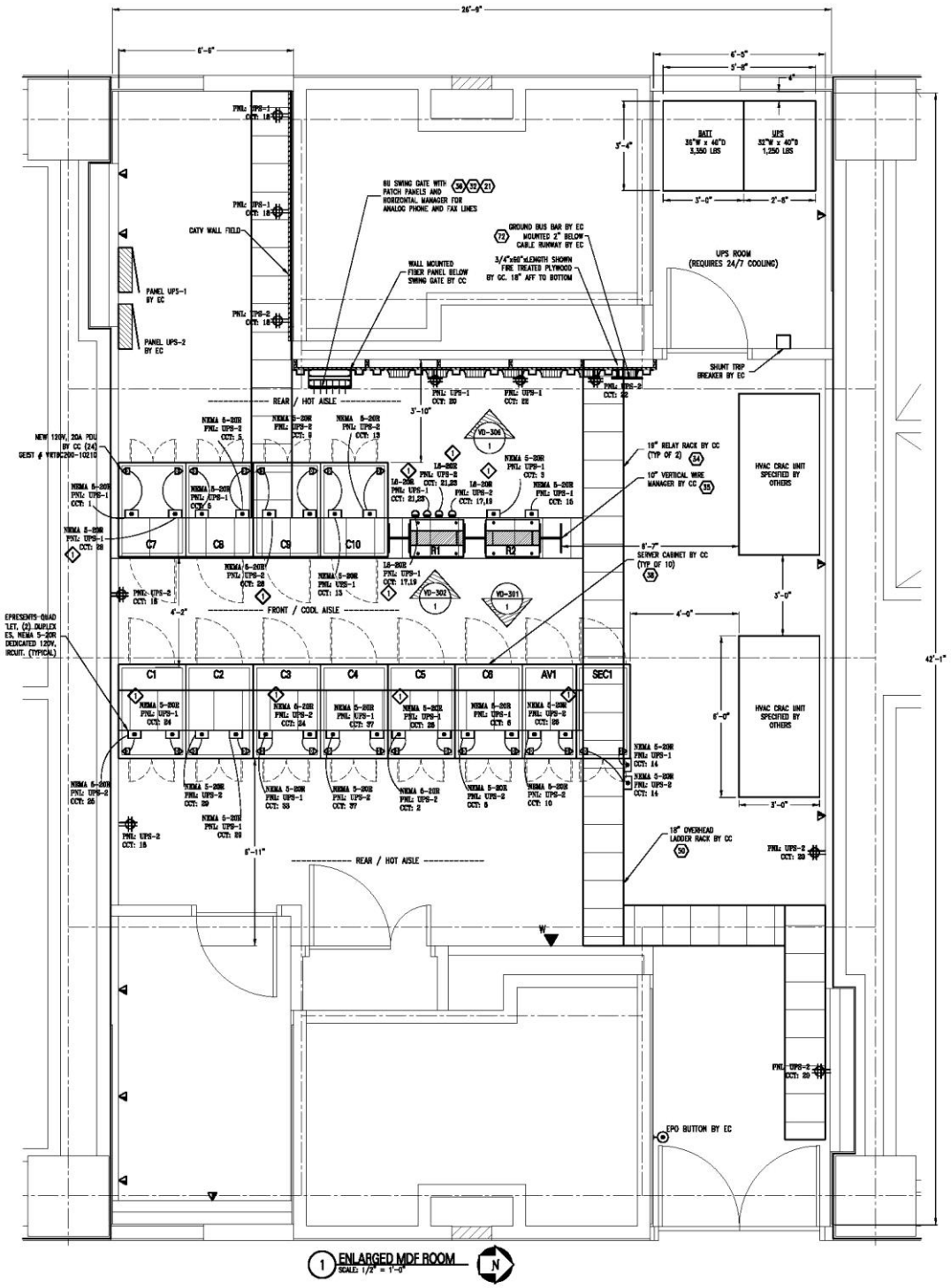
There are many types of Technology Rooms neccesary to support the Hotel’s Services, Active Equipment, and Applications. The quantity and type of each TR is dependant upon the size and functional requirements necessary to comply with the hotel program. These Technology Rooms should be defined and specified to meet the requirements stated during the Schematic Design and Design Devolopment phases of the hotel project. Once these Technology Rooms are defined and located within the property, the development team should decide what specific purposes these rooms will be designated. These designations will assist with providing all the criteria necessary to plan, develop, and build the Technology Rooms to utilize and support the defined active systems and services. Specific disciplines that require IT space provisions that should be accounted for include Carrier Services, Audio Visual, Security, Property Management Systems, PBX, and DAS. Although areas of some Technology Rooms can provide general space to be utilized for support of these services and systems, it is recommended that Technology Rooms be defined with the primary intent of space provisioned for the specific system purpose

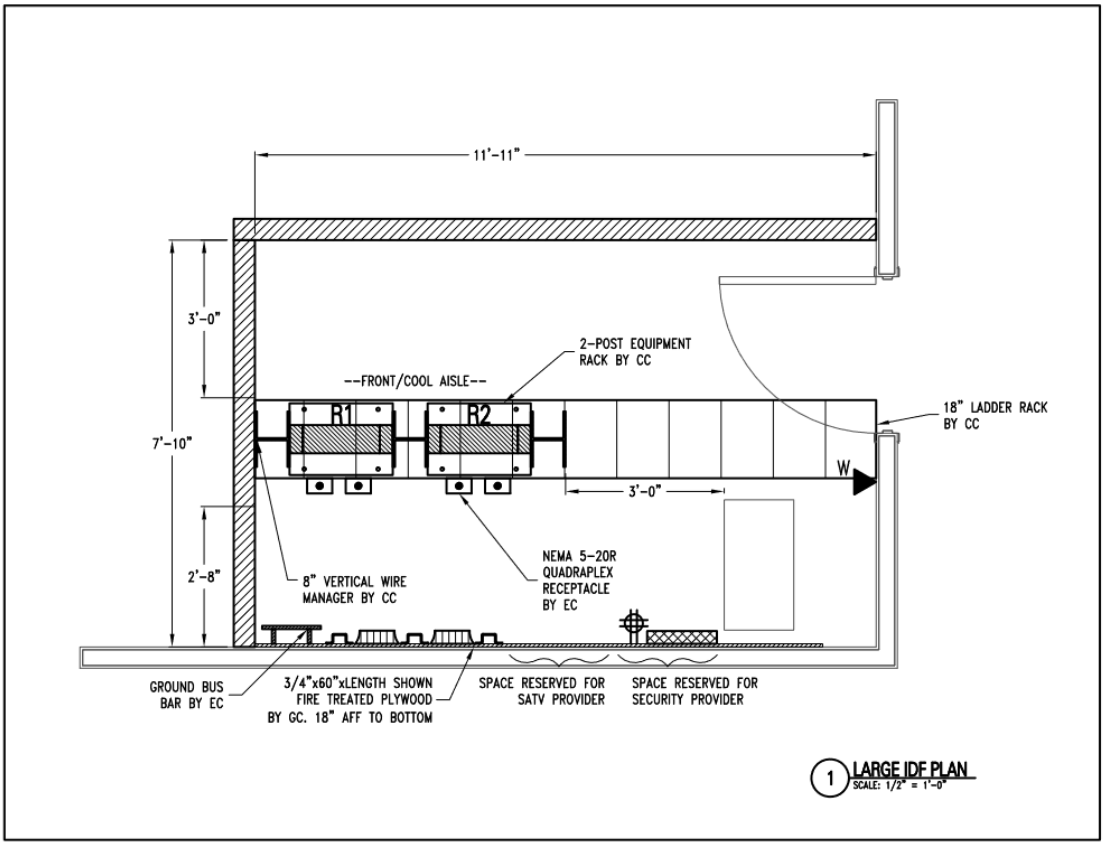
and service to be supported. Specific Vendor and/or Carrier requirements can also be addressed, designed, budgeted, and implemented as required for the specific room purposing. The specific Technolgy Room designations will also assist the property during daily operations with the associated access control and security requirements.

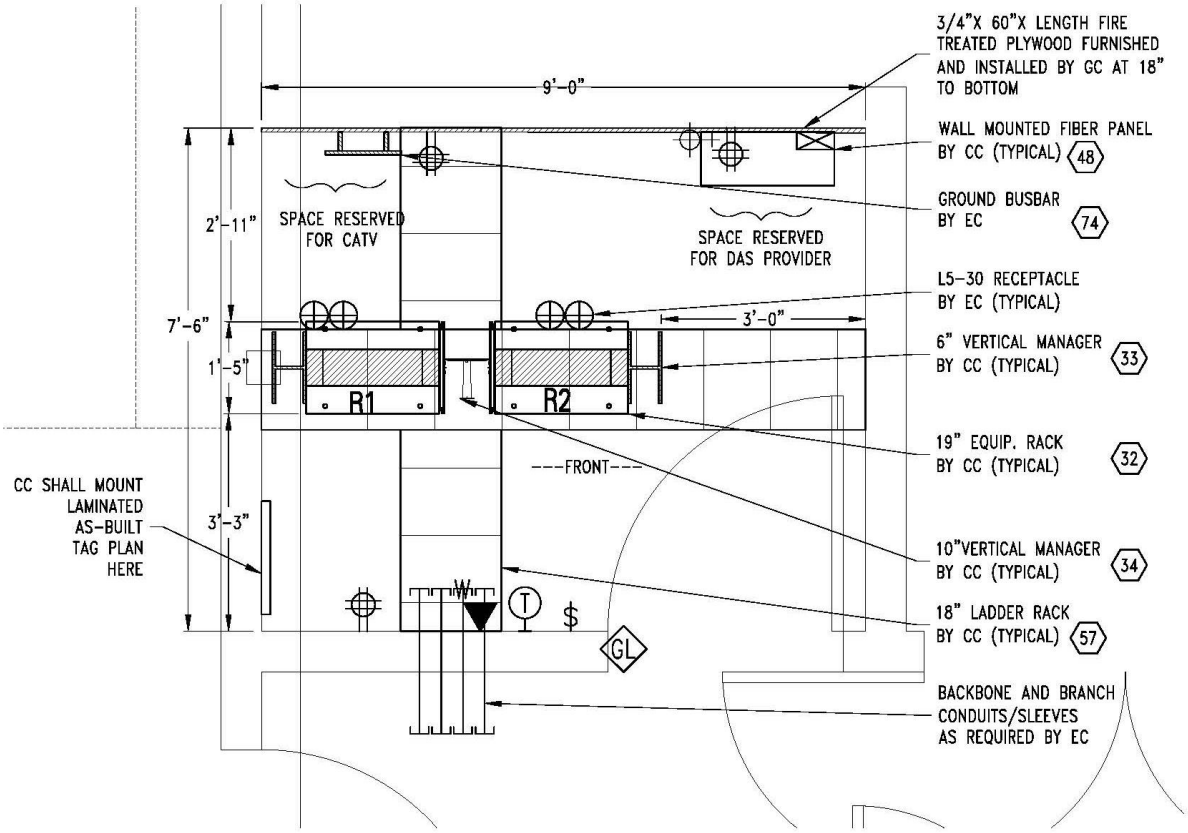
8.2.1 Floor Plan Samples




2
RESERVED FOR TELCO WALL FIELD
RESERVED FOR SECURITY PANELS
ACP
36" CLEAR SPACE IN FRONT OF PANELS
SPACE FOR UPS EQUIPMENT
36" CLEAR SPACE IN FRONT OF UPS
SPACE FOR CRAC UNIT
36" CLEAR SPACE IN FRONT OF CRAC
TV #1
SERVERS CAB #1
SECURITY CAB #2
PBX CAB #3
HSIA CAB #4
RACK R2 FIBER / CORE
RACK R3 TBD
RACK R4 TELCO
FRONT / COLD AISLE
REAR / HOT AISLE
RESERVED FOR MATV WALL FIELD
AT&T
VERIZON
SPRINT
T-MOBILE
TBD
DAS #1
DAS #2
DAS #3
DAS #4
DAS #5
RACK R5 DAS FIBER
RACK R1 B1-IDF
CC SHALL MOUNT LAMINATED AS-BUILT FLOOR PLANS AND RISERS ALONG THIS WALL
1 DATA CENTER / MATV ENLARGED PLAN
SCALE: 1/2" = 1'-0"
C


26'-9"
6'-6"
6'-0"
5'-6"
4"
3'-4"
BATT
35"W x 46"D
3,350 LBS
UPS
32"W x 40"D
1,250 LBS
3'-0"
2'-8"
8U SWING GATE WITH PATCH PANELS AND HORIZONTAL MANAGER FOR ANALOG PHONE AND FAX LINES
CATV WALL FIELD
GROUND BUS BAR BY EC MOUNTED 2" BELOW CABLE RUNWAY BY EC
3/4"x66"xLENGTH SHOWN FIRE TREATED PLYWOOD BY GC. 18" AFF TO BOTTOM
WALL MOUNTED FIBER PANEL BELOW SWING GATE BY CC
UPS ROOM (REQUIRES 24/7 COOLING)
PANEL UPS-1 BY EC
PANEL UPS-2 BY EC
SHUNT TRIP BREAKER BY EC
REAR / HOT AISLE
3'-10"
NEW 120V, 20A PDU BY CC (24) GEIST # YRTDC200-10210
19" RELAY RACK BY CC (TYP OF 2)
10" VERTICAL WIRE MANAGER BY CC
HVAC CRAC UNIT SPECIFIED BY OTHERS
C7
C8
C9
C10
R1
R2
6'-7"
SERVER CABINET BY CC (TYP OF 10)
3'-0"
4'-2"
FRONT / COOL AISLE
4'-0"
EPRESENTS QUAD LET, (2) DUPLEX ES, NEMA 5-20R DEDICATED 120V, RCUIT. (TYPICAL)
C1
C2
C3
C4
C5
C8
AV1
SEC1
42'-1"
6'-0"
HVAC CRAC UNIT SPECIFIED BY OTHERS
3'-0"
6'-11"
REAR / HOT AISLE
19" OVERHEAD LADDER RACK BY CC
EPO BUTTON BY EC
1 ENLARGED MDF ROOM
SCALE: 1/2" = 1'-0"
N


11'-11"
3'-0"
7'-10"
2'-8"
--FRONT/COOL AISLE--
2-POST EQUIPMENT RACK BY CC
R1
R2
18" LADDER RACK BY CC
W
3'-0"
8" VERTICAL WIRE MANAGER BY CC
NEMA 5-20R QUADRAPLEX RECEPTACLE BY EC
GROUND BUS BAR BY EC
3/4"x60"xLENGTH SHOWN FIRE TREATED PLYWOOD BY GC. 18" AFF TO BOTTOM
SPACE RESERVED FOR SATV PROVIDER
SPACE RESERVED FOR SECURITY PROVIDER
1 LARGE IDF PLAN
SCALE: 1/2" = 1'-0"



4 TR-04 ENLARGED PLAN
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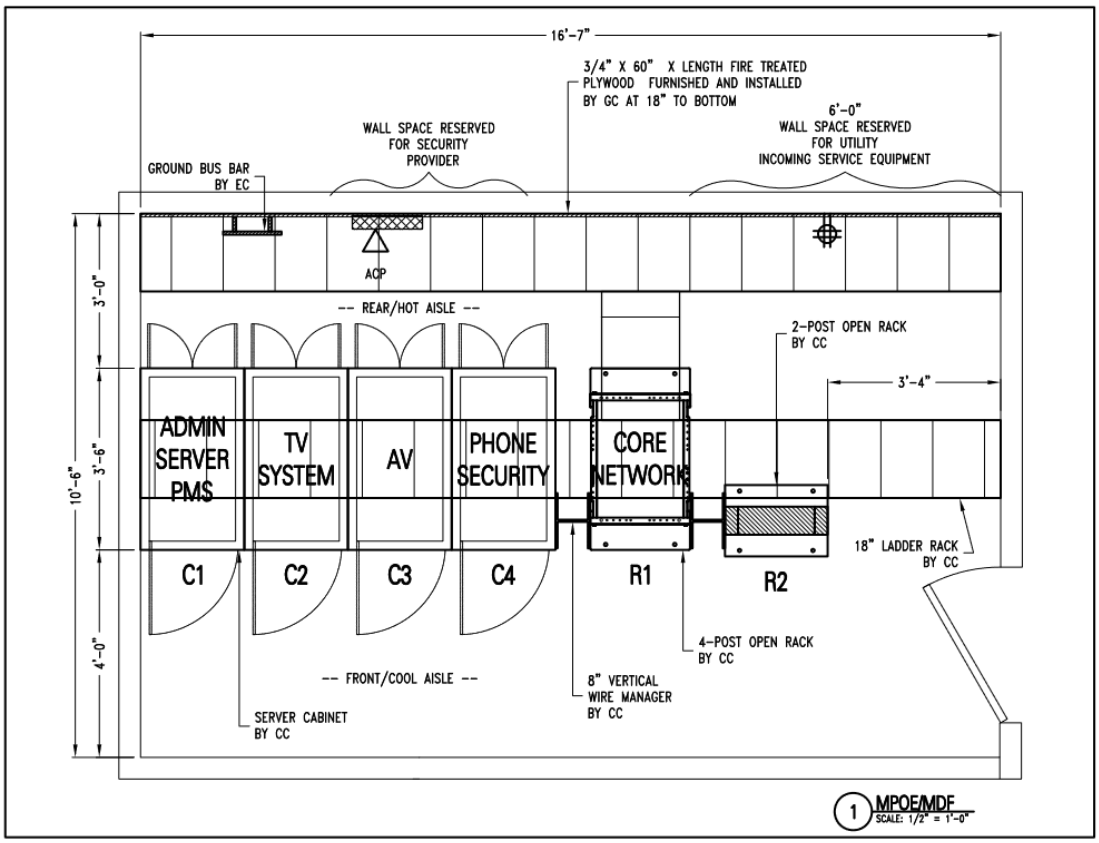
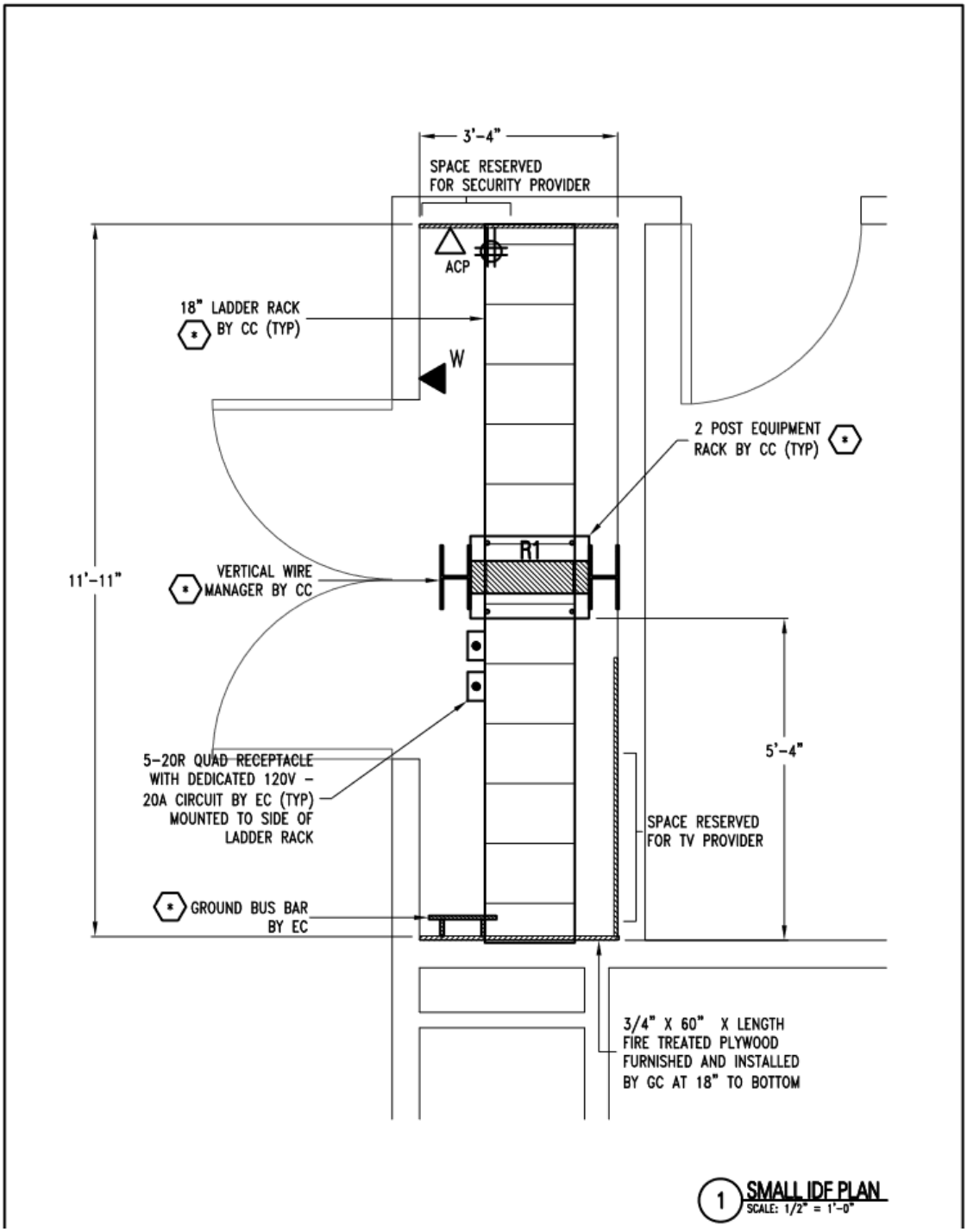
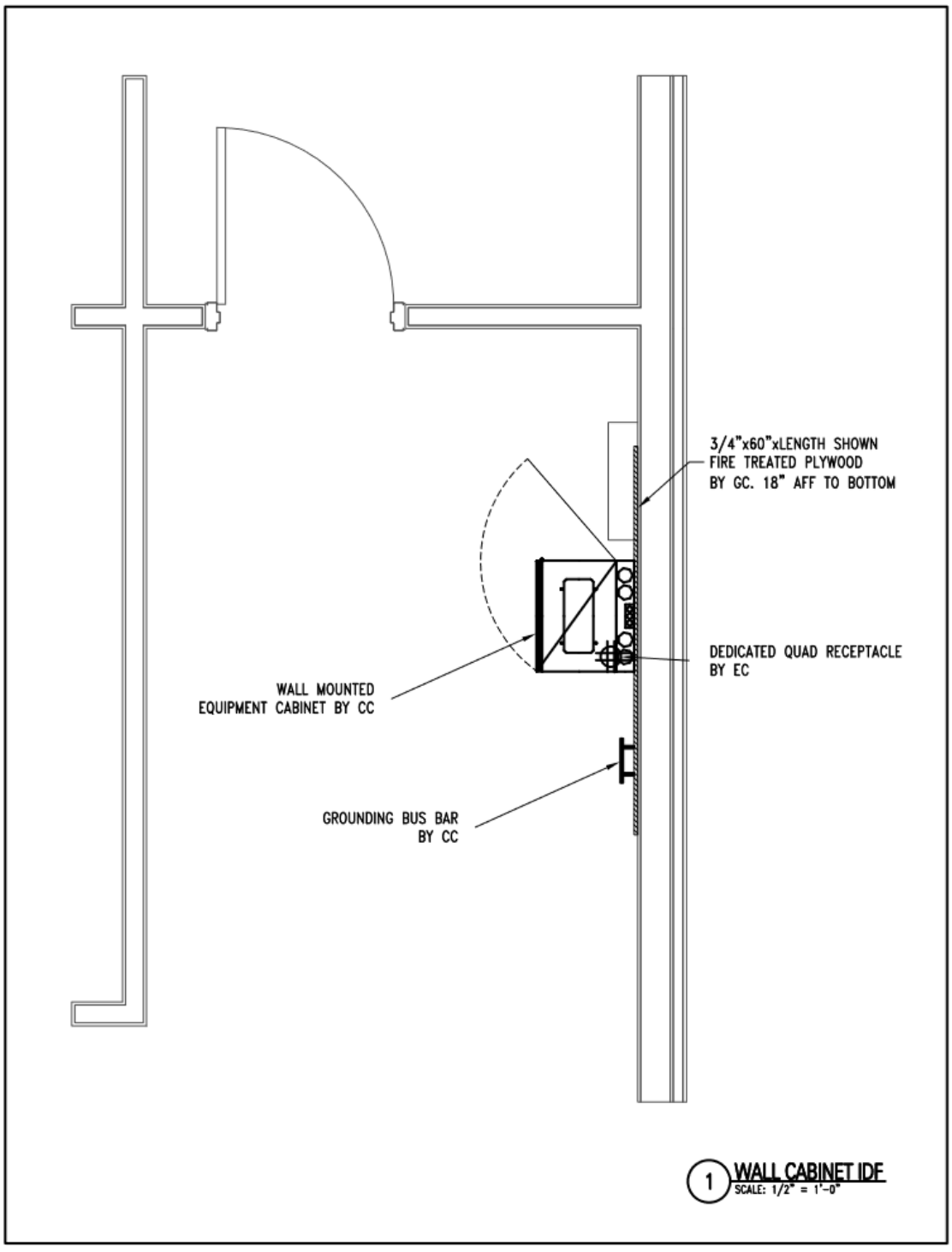

16'-7"
3/4" X 60" X LENGTH FIRE TREATED PLYWOOD FURNISHED AND INSTALLED BY GC AT 18" TO BOTTOM
6'-0" WALL SPACE RESERVED FOR UTILITY INCOMING SERVICE EQUIPMENT
WALL SPACE RESERVED FOR SECURITY PROVIDER
GROUND BUS BAR BY EC
ACP
-- REAR/HOT AISLE --
2-POST OPEN RACK BY CC
3'-4"
10'-6"
3'-0"
3'-6"
4'-0"
ADMIN SERVER PMS
TV SYSTEM
AV
PHONE SECURITY
CORE NETWORK
C1
C2
C3
C4
R1
R2
18" LADDER RACK BY CC
4-POST OPEN RACK BY CC
-- FRONT/COOL AISLE --
8" VERTICAL WIRE MANAGER BY CC
SERVER CABINET BY CC
1 MPOE/MDF
SCALE: 1/2" = 1'-0"


3'-4"
SPACE RESERVED
FOR SECURITY PROVIDER
ACP
18" LADDER RACK
BY CC (TYP)
W
2 POST EQUIPMENT
RACK BY CC (TYP)
R1
11'-11"
VERTICAL WIRE
MANAGER BY CC
5'-4"
5-20R QUAD RECEPTACLE
WITH DEDICATED 120V -
20A CIRCUIT BY EC (TYP)
MOUNTED TO SIDE OF
LADDER RACK
SPACE RESERVED
FOR TV PROVIDER
GROUND BUS BAR
BY EC
3/4" X 60" X LENGTH
FIRE TREATED PLYWOOD
FURNISHED AND INSTALLED
BY GC AT 18" TO BOTTOM
1 SMALL IDF PLAN
SCALE: 1/2" = 1'-0"


3/4"x60"xLENGTH SHOWN
FIRE TREATED PLYWOOD
BY GC. 18" AFF TO BOTTOM
DEDICATED QUAD RECEPTACLE
BY EC
WALL MOUNTED
EQUIPMENT CABINET BY CC
GROUNDING BUS BAR
BY CC
1
WALL CABINET IDF
SCALE: 1/2" = 1'-0"

TR-DAS

8.3 Fire Protection and Suppression

8.3.1 Computer Room Recommendations

The Computer Room should be on a different, isolated fire sector than the rest of the surrounding areas.

Walls, floors, ceilings and doorways should have a one-hour minimum fire resistance rating carried to the underside of the construction. All materials used in the construction of the Computer Room including walls, floors, ceilings, floors, partitions etc. should have flame-spread ratio of 25 or less. Doors should have a minimum 30-minute fire proof rating.

The Computer Room should be fitted with suitable smoke detection system, fire alarm audibility and appropriate portable fire extinguishing equipment.

Although there are multiple types of fire suppression options available it is recommended that at a minimum a water based fire suppression be provided. However please check with your operator and local code as each may have a different requirement for the computer room.

8.3.2 Cabinets

All cabinets must have lockable doors and should be installed with suitable cable management. In locations that are susceptible to earthquakes, the server cabinets must be capable of protecting the servers.

8.3.3 Grounding

Electrical communications grounds and all other conductive pathways in the building infrastructure should be bonded. If multiple bonds are necessary, a copper ground bar must be emplaced. All equipment and cable shields must be properly grounded as set forth in NEC, Article 250, ANSI/NFP 70 and BS EN 50310:2000, in addition according to Manufacturer or Country minimum regulations.

All racks within the Computer Room must be grounded.

8.3.4 Fire Suppression

8.3.4.1 *New Builds Server Room & IT Space Fire Suppression Considerations*

We recommend to use a dry chemical solution due to the electrical requirements for IT rooms, but if unavailable, pre-action may be used. However, many local codes also may requirements on wet systems (or prevent or not allow certain systems). Local codes should be adhered to in all circumstances.

The design of the core IT infrastructure space will require an evaluation and design for a code compliant fire suppression system. The traditional wet sprinkler system is compliant, however, intrudes risk to substantial damage and extended outage time related to potential water damage from the wet sprinkler system.

The National Fire Protection Agency is the governing body over fire and life safety. NFPA 72 is the code section governing Fire Alarm and Life Safety Systems.

Generally, a life safety system is installed for protection of life, property and mission. In order for a life safety system to be useful, it must be able to perform these functions:

- Detect the presence of smoke or fire.
- Notify the occupants
- Notify the fire department (usually through a central station connection)
- Operate other fire safety functions, e.g., release magnetically held open smoke doors or activate an automatic sprinkler system.

There are four basic types of automatic sprinkler systems that a life safety system may be connected to.

8.3.4.1.1 Wet Pipe:

The most common is a wet pipe system that is fully pressurized with water and only requires one alarm point (heat or smoke detector, pull station or broken sprinkler head) to set off that sprinkler zone and release the water.

8.3.4.1.2 Dry-Pipe:

In a dry pipe system water is not present in the piping until the system operates. The piping is filled with air below the water supply pressure. When one or more of the automatic sprinklers is exposed, for a sufficient time, to a temperature at or above the temperature rating, it opens, allowing the air in the piping to vent from that sprinkler. Each sprinkler operates individually. As the air pressure in the piping drops, water enters the piping system. Water flow from sprinklers, needed to control the fire, is delayed until the air is vented from the sprinklers.

8.3.4.1.3 Pre-Action:

Pre-action sprinkler systems are specialized for use in locations where accidental activation is undesired, such as Data Centers, for protection of computer equipment from accidental water discharge. Pre-action systems are hybrids of wet, dry, and deluge systems. There are two main sub-types of pre-action systems: single interlock, and double interlock.

The operation of double interlock systems are similar to deluge systems except that automatic sprinklers are used. These systems require that both a “preceding” fire detection event, typically the activation of a heat or smoke detector, and an automatic sprinkler operation take place prior to the “action” of water introduction into the system’s piping. Activation of either the fire detectors alone, or sprinklers alone, without the concurrent operation of the other, will not allow water to enter the piping. Because water does not enter the piping until a sprinkler operates, double interlock systems are considered as dry systems in terms of water delivery times, and similarly require a larger design area.

8.3.4.1.4 Deluge:

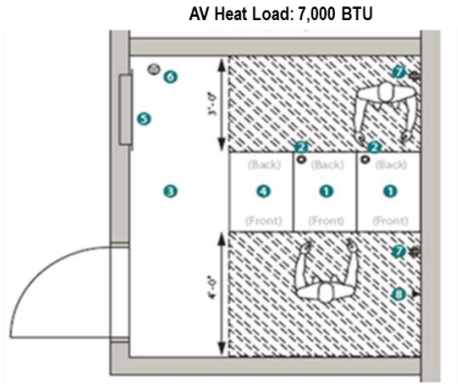
Deluge systems are systems in which all sprinklers connected to the water piping system are open. These systems are used for special hazards where rapid fire spread is a concern, as they provide a simultaneous application of water over the entire hazard. They are sometimes installed in personnel egress paths or building openings to slow travel of fire (e.g., openings in

a fire-rated wall). Water is not present in the piping until the system operates. Once the life safety system has signaled the deluge valve to open water flows unhindered.

9 Audiovisual and Event Space Considerations

9.1 Audiovisual Fixed Equipment Rooms

9.1.1 Design



Example of AV System Equipment Room Layout

The event space sound equipment is located in a dedicated Sound System Equipment Room on the same level as the event space and has its main door opening to the service corridor associated with that space.

The equipment layout in the AV Equipment rack(s) should be designed and constructed following the InfoComm best practices as taught in CTS-D and CTS-I training classes.

9.1.2 Security

Should the equipment room serve both A/V and telecommunications equipment, the equipment is separated with a locked fence and door between them so that the A/V equipment remains accessible, and the telecommunications equipment is protected.

9.1.3 Environment

The Audiovisual Equipment Room is environmentally conditioned to maintain a temperature between 10˚ to 27˚ C with 30% to 75% relative humidity, non-condensing. There is no equipment in the ceiling space above this room that requires maintenance, adjustment or service that can leak or produce condensation.

The Sound System Equipment Room is not intended to provide storage of portable A/V equipment. It may, however, serve as the A/V Department offices.

Where event spaces are remote from the equipment room, provide a large touch screen control panel in a rugged enclosure in the service corridor associated with these rooms.

9.1.4 Control Room for Ballroom

As noted above, control room must be readily accessible for technical staff and accommodate loading in/out of production mixing consoles, lighting control consoles, spot lights, and other production equipment.

9.1.5 Audiovisual Portable Equipment Storage Rooms

Provide storage rooms for the portable AV equipment needed to support AV operations. The total gross size of these storage rooms is approximately 2% to 3% of the gross floor area of the event space in the hotel. Storage room should be located adjacent to the service corridors serving the respective clusters of event spaces.

Layout of the storage room will vary greatly on a project by project basis, based on the available back-of-house space layouts. The room should be equipped with a single doorway to control the access to the equipment. Shelving, storage bins and various organizational systems will be required around the periphery of the room to store equipment while not in use. Adequate floor

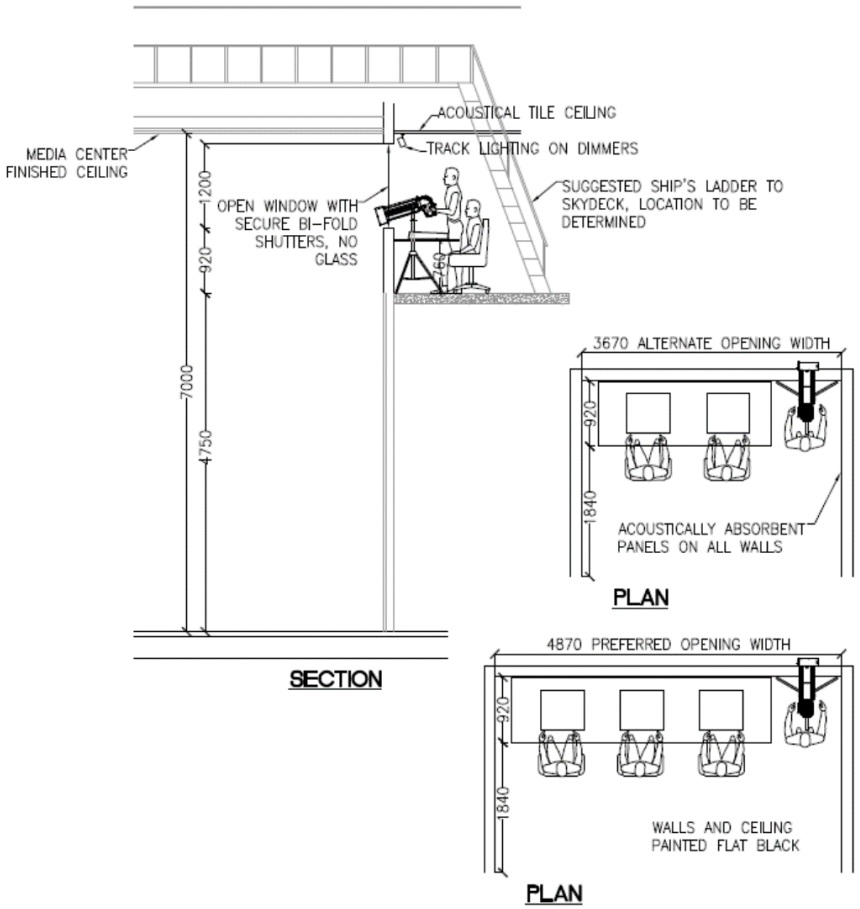
space for the staging of equipment that is coming from or going to the meeting space should be available. At least one desk or work area is provided for the person responsible for the equipment, with a phone and computer. It is appropriate to use this room as the AV Office as well.

9.1.5.1 *Control Rooms*

Where possible, provide a control booth that permits locating the technicians serving an event to occupy this booth space instead of taking up floor space in the room itself.

The floor of the control booth must be elevated above the floor of the event space enough so that a seated technician can see over the heads of the standing audience to the stage or platform.

The control booth needs an opening into the event space. This should be clear and not equipped with a window, unless the window can be completely opened. The technicians must be able to see and hear clearly. Usually, this opening has hinged or sliding panels to conceal the opening when the control booth is not in use. A chase for cabling must be provided from the floor level into the control booth to accommodate the cable trunking the production companies will need for these events.



9.2 AV Equipment

9.2.1 AV Specific Glossary

Built-in voice sound systems (ceiling array): refers to an array of ceiling speakers that reinforce the sound from microphones and talkers in the meeting room. Distributed ceiling array sound systems provide the highest intelligibility in typical conference spaces.

DSP sound systems: refers to digitally processed sound systems that can be easily controlled by digital control systems.

Telephone Hybrid: Refers to a device that uses the meeting rooms ceiling speakers and microphones to connect with a telephone conference; essentially a very large speaker phone.

Sound system point source speakers built-in at main display/screen: refers to speakers (usually stereo) that are installed in or on the wall flanking the main projection screen. These play the audio portion of the visual program.

Surround sound for program: refers to more sophisticated program audio playback. Requires careful attention to creating a good acoustical environment.

Cluster voice sound system: refers to a sound system that places an engineered speaker above the talkers head and aims the sound energy into the audience from above. Provides most natural sounding voice reinforcement. Only practical in relatively high-ceiling spaces with exceptional acoustics.

Built in ceiling microphone(s) for room monitoring & recording: refers to placing microphones in the ceiling so that the technicians in the control room can hear and record proceedings. In properly designed rooms, provides good recording of audience interaction. Typically used with cameras as well.

Built-in or removable microphones in audience with microphone management system: refers to installation of microphones in fixed seating venues where significant audience interaction is anticipated. Allows for everyone to hear audience questions, for recording, distance learning, etc. May include audience response or voting features.

Simultaneous interpretation, multiple language (IR or RF): refers to a system that accommodates live interpretation during events. Each accommodated language requires a sound proof booth for two interpreters. Audience participants use headphones and receivers to hear the interpretations.

Hot room or mix-minus sound system: refers to a sophisticated array of microphones and speakers in a meeting room ceiling where each microphone's signal is sent to all speakers except for those speakers which are adjacent to the microphone. Thus, the talker's voice is reinforced at a distance from the talker. This requires extremely careful system engineering and attention to room acoustics.

Manual or electric drop down projection screen: refers to projection screens that retract into a housing either in the ceiling or mounted on the wall. The dimensions of the screen vary according to (1) the size of the room, and (2) the aspect ratio of the image (either 3:4 or 9:16). The vertical dimension of the image height is usually one sixth of the distance from the projection screen to the furthest viewer.

Ceiling mounted projector w/remote inputs: Refers to permanently installing a projector either tight to the ceiling or suspended from the ceiling on a pole or other mount structure. The projector can be positioned no higher than the top of the image on the screen when in use.

Retractable projector lift for social functions: refers to a mechanism that can retract the projector into the ceiling so that social functions may be held without the distraction of seeing the projector on the ceiling. The mechanism can lower the projector to the proper position for projection when needed.

Built-in flat-panel LCD display w/remote input: refers to installing a current technology flat panel display on the object wall of the event space. These may be visible in more utilitarian rooms, or concealable in higher-finish rooms. Practical for small to medium sized rooms, due to current size limitations.

High definition projection built-in: refers to the larger 9:16 aspect ratio format for visual displays, both projection and flat-panel. All future built-in display technologies should anticipate this format.

Interactive computer display w/internet access built-in: refers to technologies which use touch-screen computer displays of various sizes to allow the presenter to interact with the computer during presentations.

Rear Projection: refers to display technologies that locate a projector behind a translucent projection screen material. This is used in more high-end venues because it minimizes distraction from having a projector hung above the audience, it does not shine light into the presenters' eyes, and allows for a more natural interaction between the presenters and the program material. It does require space behind the display. Self-contained rear-projection display cubes may be 24" to 48" deep, while single projector rear projection displays may require 10' to 15' of depth behind the display.

Robotic video cameras built-in for image magnification, recording, and webcast/VTC/distance learning: refers to video cameras in the meeting space that are operated by a technician who is not in the meeting space. The cameras can be made to pan, tilt, zoom, focus, etc. remotely, making their use less intrusive or distracting compared to having camera operators in the meeting room.

Web camera, built-in monitoring from central control room: refers to smaller, lower quality cameras that are used by the conference center staff to monitor activities in a meeting room from any staff computer. May also be used for basic webcasting or archival recording of an event.

Dimmers for lighting, plus zone control (to avoid washout): refers to the ability to adjust light levels in a meeting room. Also, to turn off the lights individually which are located where they would wash out the most commonly used projection screen locations. Built-in projection screens may have their up/down controls automatically turn off these light fixtures.

Programmable lighting control w/in-room control panel: refers to digitally controlled dimmer systems which have multiple circuits of control and multiple pre-set scenes. For example, there may be one circuit for the downlights, one for wall washers, one for the chandeliers, one for eh sconces, and one for the track lights. Changing from one scene to another is one button touch.

Flexible feature lighting: refers to the means of highlighting the lectern, podium, exhibit, display, panel, or platform or any other feature independently from the main room lights. This function may be provided using recessed "eyeball" fixtures, commercial track lights, light pipes, or retractable lighting fixtures.

Retractable feature lighting fixtures w/tech power and tie lines (Litelab BussPort): refers to a means of supporting and powering lighting fixtures. This mechanism retracts into the ceiling when not in use and is lowered manually when needed, and equipped with light fixtures. When lowered, connectors are accessible for dimmed lighting circuits, technical power, and network circuits for control, audio, and video signals. It can also be used to support projectors, monitors, powered speakers, and is load-rated (500# live load; 800# dead hang) allowing it to be used as a rigging point for trussing and other production elements.

Acoustical treatment to reduce reverberation & echoes on both fixed walls and operable partitions: refers to the means of controlling unwanted reverberation and echo sound energy by absorbing it within the room. This is most practically provided by using fabric-wrapped, acoustically absorptive panels on the wall surfaces, from approximately the chair rail up at least eight feet.

Low levels of background noise (NC25): refers to controlling the loudness of background noises generated by HVAC systems, sound from service corridors, sound from outside through the walls and roof, and sound from adjacent spaces.

Acoustical isolation w/operable partitions (NIC 50 minimum): refers to the quality of sound isolation afforded by the operable partitions. This involves not only the quality of the partition itself, but also the surrounding construction including sealing the partition track to the structure above, providing adequate blocking at the end walls to prevent sound from flanking the partition, proper adjustment and maintenance of top and bottom partition seals, etc.

Glossary: Production

Accommodates Portable AV Technologies: refers to the effort to ensure that the interior architecture and design elements, power and signal infrastructure, and arrangement of the room is developed to support the use of all types of portable audiovisual presentation and event technologies.

Tie Lines to central control (data/digital video grade): refers to providing multiple circuits from various locations within the event spaces run to patch panels leading to the central control room, or at least to the nearest MDF or IDF. Tie lines may be copper Ethernet cabling (shielded Category 6 is best), single and multi-mode fiber optic, audio, or video. These circuits may be used to interconnect any combination of spaces with each other; to route tele-data services to any space; to provide control, monitoring, or recording; or to simply avoid using cables taped across the floor within the space itself.

Multiple AV input/output connections around room: refers to locating analog and digital inputs and analog outputs on panels around the periphery of the room to accommodate a wide variety of room arrangements.

Digital, programmable control system w/in-room control panel; optional portable control panel (wired & wireless): refers to systems that interconnect between all of the built-in analog and digital audio and visual systems and equipment to provide synchronized, intuitive user access and control for all anticipated functions. These systems may also connect with and control environmental elements such as window drapes or shades, programmable lighting control systems, etc.

Video teleconferencing (portable or built-in): refers to the provision of equipment to accommodate interconnection with other locations for teleconferences. Both IP based and switched-network services should be accommodated.

Webcast, simulcast, digital events: refers to production services that include distance learning, video and audio teleconferencing, webcasting, broadcasting, on-demand online services, etc.

Interactive lectern: describes a lectern that is equipped with a control panel and usually an interactive computer interface as described above.

9.2.2 Venue Types & Factors

9.2.2.1 *Star-Level Differences*

While there are many “basics” that are required to be included across all spaces intended to accommodate group presentations and events, there are increasing infrastructure requirements as the facilities become higher in star ranking. These increasing requirements reflect increasing expectations by meeting planners and attendees of these facilities.

The basic requirements that are shared by all venues include logistical access, egress, lighting, convenience and heavier duty power.

Select service hotels may have little or no built-in technologies, relying on all technologies for background music, voice reinforcement, and program reproduction to be provided using portable equipment. These venues typically have limited small event spaces and hosting events is not a significant source of revenue for the property.

Mid-level (two- and three-star) hotels may have basic background music built-in with limited voice capabilities… just for announcements. Hotels that have significant event space will

typically have an outside AV vendor providing AV services for its guests, and they use all use potable AV equipment.

Higher star-level venues will include requirements for more built-in technologies. The voice reinforcement systems using an array of overhead speakers are capable of good intelligibility so they can serve entire meetings without requiring portable speakers.

The highest five-star hotels and conference centers include built-in high-level sound systems, projectors, and projection screens. They may also have separate AV control rooms overlooking the main event space. This "clean room" approach maximizes the occupancy of the space and minimizes the clutter and distraction from portable equipment and AV technicians working from tech tables in the room.

9.2.2.2 *Market Differences*

While the Brand Design Standards define the minimum functional and performance requirements for various systems and elements, local markets may dictate that variations and upgrades to the Brand Standards be made for particular properties. For example, business hotels in high-tech markets (e.g., software, pharmaceuticals, etc.) may need more advanced displays or internet connectivity than proscribed in the Design Standard.

Similarly, the local competitive set may have evolved to offer more advanced features or technologies that the project may need to consider implementing simply to enter the market on a competitive footing.

9.2.2.3 *Small, Mid-Size, Large, and Convention-Class Hotels*

In addition to star levels, hotels may be generally classified relative to the size of the facilities. This can be independent of the brand, service, and star level. For example, some brands have the same star-level quality and have properties in their portfolio that range from small boutique-like properties to large business hotels.

In general however, the higher the star level, the smaller the property tends to be. Likewise, the larger and convention class hotels tend to be in the three and a half star range.

The larger the hotel with respect to event space, the greater the need and the greater the challenges for providing appropriate infrastructure such as power, structure/rigging, HVAC, WiFi, etc.

9.2.2.4 *Hotels vs. Conference Centers*

There is a unique category of facility that is referred to as an IACC Conference Center. IACC is the International Association of Conference Centers, and they have their own set of Brand Design and Operations Standards. IACC Conference Centers may also fly a hotel brand flag as well or may be "soft branded" and/or operated by facility management companies.

This type of venue originated in the early 1970's as purpose-built, high-tech, small group training centers for pharmaceutical companies and financial management firms. As management for these facilities were contracted to out-sourced management companies, they grew to offer meeting spaces to the public.

The IACC Technology Standards are referred to as: "Design for Great Technology" and reflect the higher level of built-in infrastructure and unique architectural elements that distinguish IACC Conference Centers from typical hotels. This document serves as a defacto conference center industry standard for event technologies, infrastructure, and event space environmental criteria.

9.2.2.5 *Boutique Hotel Designs*

A growing segment of the lodging market is a category referred to as Boutique Hotels. Most major hotel brands have one or more lodging products positioned in this segment; many independent hotels fit into this category as well.

Boutique Hotels may be in the smaller to larger size class. The infrastructure requirements for the complement of event space will be defined by the management's Brand Design Standards, or may be undefined and left to the design team to determine.

9.2.2.6 *AV Services*

The AV infrastructure requirements are to some extent determined by the AV Services business model the hotels intends to operate with. There are three approaches to providing event AV services. One is "drop-off" services, where the hotel has a working relationship with a local AV equipment company, and orders the AV equipment on an as-needed basis. The rental company may set up the equipment, or just drop it off to be setup by the hotel staff. This approach is typical for smaller hotels with limited event space.

Another approach to providing AV services is to out-source to an AV services company who furnish an inventory of portable AV equipment along with full time staff at the hotel. This service acts as an in-house AV services provider, and shares the rental revenue with the host hotel. This approach is taken by most mid-size business hotels all the way through convention class properties.

Another approach is for the hotel itself to own portable AV equipment and use dedicated hotel staff to set up and operate the AV equipment to serve the guests. This model is typical for Conference Centers and "high-tech, high-touch" properties.

Finally, there is a "hybrid" approach where the hotel has a limited inventory of built-in and portable AV equipment that is operated by the hotel AV staff, and supplements these services through a working relationship with a local AV rental and production company.

Where the hotel will be primarily offering services through an out-sourced vendor, the amount of built-in technology will be limited. Where the hotel will be providing AV technical services using its own staff and/or when the hotel has a higher star level, more of the AV technologies will be built-into the facility.

An increasingly common request for smaller meetings is where the meeting planner, presenter, and/or guests bring their own AV equipment for use in their meetings. This self-provisioned practice requires similar infrastructure as described above.

In all cases, the infrastructure must be designed to accommodate the use of portable AV event technologies, since many events will be using their own out-sourced AV production vendor to provide the needs of the meetings. The critical infrastructure elements that must be considered include: acoustics, show power, structure and rigging, lighting and control, raceways, and show flow.

9.2.2.7 *Event Space Sizes*

The level of built-in AV technology varies according to the size of the event space. Smaller meeting rooms used for huddle or breakout sessions are typically less than 1,000 ft², and according to current best practice are usually only equipped with power and connectivity.

Larger meeting rooms (>1,000 ft² to 2,000 ft²) generally require built-in ceiling speakers for background music and to reinforce the spoken word.

Flexible function spaces are typically larger than 2,000 ft² and are provided with movable temporary operable partitions to sub divide the space. These rooms typically have higher ceilings and are provided with structural rigging and hang points for trusses, lighting, etc. They also have higher power sound systems built into the ceilings.

9.3 Service Access & Show Flow

"Show Flow" refers to the study of how materials and equipment move into and out of a venue before, during, and after an event. This includes staging and production equipment, scenery, actors and talent, service staff, F&B services, etc. The flow should be analyzed from the hotel's loading dock all the way into the event space, ideally without passing through any front-of-house areas. The largest element typically planned for is a dolly of standard 10' trusses, which measures 3' wide, 3' high, and of course, 10 feet long.

Show Flow also plans the arrival journey of the attendees, event space orientation, and locations of production elements and technologies. In special cases, it is appropriate to anticipate VIP guest attendees and presenters. Green rooms and secure suites may be appropriate.

Generally speaking, the guests arrive and enter an event space at the rear of the space. Therefore, the object walls or areas opposite of the main guest entry doors is considered the primary stage location. The infrastructure must anticipate this preferred orientation and provide appropriate connectivity and zoning of infrastructure elements accordingly.

9.4 Acoustics

The acoustical characteristics of an event space are critical to the comfort and experience of the guest and ultimately to the effectiveness of the technologies and events held in these spaces. There are three critical acoustical qualities that must be considered: Noise, Reverberation, and Isolation.

9.4.1 Background Noise

The level of background noise in event spaces must meet hotel brand and industry standards. High levels of background noise (above NC35 to NC40) will reduce guest comfort, reduce

intelligibility of the spoken word (both natural and amplified) and reduce the effectiveness and quality of the sound systems and recordings.

Smaller spaces such as meeting rooms should have even lower levels of noise, and rooms intended for audio or video teleconferences or recording of meetings should be closer to NC25 to NC30.

The primary source of background noise in hotel event spaces is the HVAC systems. There are many ways to make noise and to control noise when designing the HVAC systems. The acoustical consultant should be involved to prevent problems that are discovered when the HVAC systems is first turned on. Noisy HVAC systems are VERY expensive to correct.

9.4.2 Reverberation & Echoes

Reverberation describes the persistence of sound energy in a space, once the sound is introduced. Reverberation is measured in units of time and frequency. Larger flexible event spaces with long reverberation times (above 1.2 to 1.5 seconds @ 500Hz) will sound hollow, boxy, loud and uncomfortable during events. Event spaces that have good, short reverberation times sound personal, intimate, safe, and comfortable. Smaller spaces such as meeting rooms should have reverberation times well below one second.

Echoes are exact copies of the sound wave energy that are reflected back to the listener. Both reverberation and echoes are considered to be Noise when considering acoustic quality of event spaces.

Noise: besides the background noise from the HVAC systems, there are many other sources of sound energy in hotel event spaces. The guests themselves can be noisy when talking and during dining and social events. Hard floor surfaces make noise from footfalls and chair movements.

Bands, DJs, and the built-in and portable sound systems generate sound energy. Sound coming from adjacent spaces such as service corridors, pre-function areas, or through the operable partitions are noise sources as well. All of these sound energies excite the reverberant space in a hotel event room. If the room has a relatively long reverberation time, the sound energy builds on itself and the noise becomes overwhelming.

Note: The distinction between Signal and Noise is this: Signal is sound energy that we want and need; Noise is sound energy that we do not want or need. The quality of the guests' experience and quality of intelligibility and verbal understanding is a direct function of the Signal to Noise Ratio. The higher level the noise, the lower the quality of the guests' experience.

Many events including both Corporate and Social, will include stacks of speakers on stage, or portable speakers on stands; these all project their sound energy sideways. So, only a small part of the sound energy reaches the audience directly; this part is the Signal. All of the rest of the sound energy that reflects off of the ceilings and walls is Noise.

Acoustically absorptive and diffusive surface treatments are used to control reverberation. All surfaces, especially the walls, must include some absorption and or diffusion. The Acoustical Consultant will work with the Interior Designer to find the right combination of materials, quantity, location, and appearance to ensure the reverberation characteristics are appropriate.

9.4.3 Isolation from Adjacent Spaces

One of the primary complaints of meeting planners and guests relates to the quality of acoustic isolation of their event space from adjacent spaces. As noted above, sounds coming from service corridors, pre-function areas, and from the meeting next door are considered noise, and are distracting to the guests and presenters.

There are many ways of minimizing noise from the service corridors including space planning and operating practices. One of the most important relates to the quality of the pass-doors separating the spaces. Providing an entry vestibule (one for IN, one for OUT) can create a sort of "sound lock" and reduce the transfer of noises into the event spaces.

Where hotels are planned near airports, train stations, or other noisy exterior environments, the building envelope must be carefully considered. Vertical isolation should also be considered, such as hotel Ballrooms that are above loading docks or garages. Or meeting rooms under the fitness room where free weights may be dropped. The entire envelope of the event space should be considered by the Acoustical Consultant when planning a hotel.

Possibly the most crucial decisions a design team must make relates to the specification of the operable partitions in the flexible event spaces. Operable partitions have an effective 30 year life expectancy, and are very expensive. While service doors and guest entry doors may be fitted with better seals later, there are no effective options to improve the isolation quality of a poorly specified operable partition, once installed.

In addition to the isolation quality of the operable partition itself, sound can find its way around the partitions. This is called "flanking" path sound. The Acoustical Consultant will inform the HVAC systems design, demising partitions above the partition track, partition storage pockets, any pass-doors, etc. during design.

A word about using STC ratings for acoustic specifications: BEWARE. Do not assume that STC ratings can be effectively compared between different products. STC ratings ONLY measure isolation between the frequencies of 125 Hz, and 4 kHz, and do not consider any of the bass energy in program content, music, etc. below 125 Hz. Further, even two constructions that both are lab rated the same can have a 2:1 difference in effectiveness at lower or higher frequencies.

9.5 Outdoor Event Spaces

9.5.1 Staging

Many projects include outdoor event spaces for both corporate and social events. These may be as basic as a wedding gazebo all the way to an amphitheater.

When considering the location of the main stage or object area, consider guest journey, show flow, sun lighting (and setting), and environmental sound factors. Be aware that the sound

energy from the stage will travel well beyond the audience area and if it encounters a hard, flat wall, will be reflected right (right) back (back) as (as) an (an) echo (echo). Try to avoid this; position the stage differently.

Depending on the scale of the space, the requirements for staging, tents, power, etc. will differ. But there will always be the need for power at the stage location. Smaller areas may only need some convenience outlets. Larger outdoor event spaces will need regular show power for the entertainment and production equipment.

Part way back or at the rear of the outdoor event space, anticipate the need for a “tech table” where the AV technicians will sit or stand to control the show. This location will require power and communications links between the table and the stage, and to/from the main AV equipment room for signals.

Ideally, the path from the stage and tech table locations will allow for easy load in and strike of the event to/from the parking lot or loading dock without disturbing guests.

9.5.2 Lighting

Outdoor events frequently are staged at sunset or dusk, and require lighting for safety and ambience. Ambient lighting may be provided by fixtures designed into the landscaping or hardscaping or plantings or trees. Alternately, they may be portable.

In addition to the ambient lighting, consider the locations for feature lighting to illuminate and feature the stage or platform. These lights are frequently located at several places along the sides of the audience area, and are supported on portable “light trees.” These lights may be part of the hotel’s design, and are typically also brought in by outside production companies. Provide power and lighting control circuits to these locations to minimize cables run around the audience areas.

9.5.3 Connectivity

The stage area and tech table locations require connectivity between each other and to the main hotel’s AV equipment room for music, telco, and internet signals.

As it is increasingly appropriate, provide wireless internet access for both guests and production staff.

9.5.4 Sound

Most hotel projects today will require outdoor background music for the public circulation, assembly, and activity areas including the outdoor event spaces. In the outdoor areas, these are most commonly provided by using planter speakers, mushroom speakers, or rock speakers in the landscaped areas surrounding the activity areas. Alternately, speakers may be built into architectural elements or sometimes into lighting bollards, or attached higher up to trees.

If there is a permanent structure such as gazebo, platform, PR stage, it is preferable to build in an engineered sound system into the structure. This way, the sound can be controlled to provide sound energy just to the lawn area and not “overshot” and disturb other areas.

Alternately, the hotel AV Technicians and outside production companies will use portable sound systems and speakers; these will require additional power to accommodate.

9.5.5 In Closing

The quality of the event space environment and infrastructure is MORE important to event success and quality guest experience than the event technologies themselves. Technology can and will change, and portable equipment will be used at least half of the time. But the quality of the room acoustics, power, lighting, and infrastructure is fixed and difficult to compensate for if deficient or inappropriate for intended events. A poor room cannot be "fixed" by adding more technology. It is critical to start with a good room. This guide describes these requirements.

9.6 AV Accommodations

9.6.1 AV Offices

In cases where the hotel will use an outside AV services vendor, an office will be required. This office should accommodate at least two desks, file cabinets, and some storage for high-value AV equipment. It should be located to provide direct access to the pre-function or service area associated with the largest event space in the facility.

9.6.2 AV Storage

For all but the smallest hotels, there will be the need to store portable AV equipment on site. This equipment may be owned by the hotel/conference center, or may be the property of the outsourced services vendor. The storage requirements for the basic complement of portable AV equipment is typically around 3% of the total of all function and event spaces being served. Therefore, if a hotel has 10,000 ft^2 of meeting and ballroom space, the AV storage room should be at least 300 ft^2.

The AV equipment storage room must be air conditioned to protect the equipment. It should be located to provide direct access to the service corridor associated with the largest event space in the facility and may be combined with the AV Offices where convenient.

9.6.3 AV Equipment Rack Room

Where AV systems (background music, voice and program reinforcement, etc.) are included in the hotel, there will be one to several floor-standing racks for the built-in AV equipment. This room also must be air conditioned and located to be convenient for AV staff to access. The typical floor space required for these rooms will range from 60 to 300 ft^2 and may be combined with the AV storage room.

The AV equipment has cooling fans that may be somewhat noisy; this would interfere with the AV Office activities.

In some properties, it may be possible to combine the AV equipment racks with the nearest IDF/MDF space. However, care must be taken to protect the security requirements for PCI compliance. Keep in mind that the AV equipment racks serving the event and function spaces may require frequent access and adjustment by the AV staff, so any security must be provided "beyond" the AV racks.

9.6.4 AV Control Room & "Clean Room" Approach

Some of the high-tech, high-touch properties want to provide a "clean room" approach for their main event spaces. This refers to being able to provide basic AV services including presenters' voice reinforcement, program audio reproduction, and large screen visual display without requiring the use of obvious portable equipment.

While projection screens can be set up against a wall, projectors hung from the ceiling, and wireless microphones used, the control table for the technicians somehow must be accommodated without taking floor space.

This "clean room" approach calls for an overlooking control room with an opening into the event space. Facility panels with interconnectivity run from this control room to the AV Equipment Room, to the object wall of the event space, to the projector location, and to various locations around the periphery of the space.

The room accommodates two to three technicians seated at a work table for their AV mixers and lighting control consoled. The room is acoustically quiet and dark to minimize distraction. The opening port is three feet high by six to eight feet wide and positioned at an elevation to allow the seated technicians to see the stage area over the heads of a standing audience. Sightline studies should be performed with particular attention paid to potential interference from chandeliers.

Ideally, the Control Room is positioned to provide useful sightlines to several of the main stage or object wall locations in the flexible function space. Since this Control Room will be used by outside production companies, access to the Control Room must anticipate the need to move large sound mixing consoles, video production equipment, and lighting consoles into and out of the Control Room for each event.

It is important to note that the floor space saved by re-locating the tech tables to the control room will accommodate two or three more banquet rounds, improving the capacity of the event space, and improving the guest experience as well.

9.6.5 Facility Panels and Connectivity

Connectivity for AV technologies and events is provided through the use of facility panels. These include provision of services (internet, telephone, network) and interconnectivity with the built-in systems.

The facility panels must be located to provide connectivity and services to and for stage and object wall locations without requiring laying cables across or over any guest or service doorway. Since flexible function spaces invite creativity on the part of the meeting planner, it should be anticipated that these utilities will be required anywhere along the fixed walls of any event space.

The facility panels are typically located at standard electrical outlet height. Since the facility panels are populated with a range of labeled connectors (XLR audio jacks, RJ45 network jacks, fiber network jacks, etc.) the appearance is generally considered unacceptable, especially by

interior designers. Concealment of these panels may be provided by standard metal wall boxes or custom millwork pockets with hinged doors.

It is critical that a convenience power outlet be provided adjacent to each facility panel, since whatever plugs into the facility panel will also require power to operate.

In some venues, it is appropriate to provide floor boxes to provide the connectivity to the center of larger spaces. In these cases, convenience power is also typically provided in the floor box as well.

9.6.6 Sound Systems

The event spaces and associated public areas are provided with sound systems. These sound systems provide low-level background music in public circulation and activity areas and may provide higher-level background and foreground music for social functions.

Some areas may require the capability of making announcements; these are sometimes referred to as “public address” or PA systems. It is important to note the difference between Public Address and voice evacuation systems. The latter are part of the emergency, life safety, fire and security systems and as such are highly secure and supervised. The AV technicians need to access, control, and re-configure the background music and public address systems for different events. These activities would violate the integrity of the emergency life safety systems if they were combined. Combining the emergency systems with the background music systems is thus not recommended.

More advanced sound systems may provide high-intelligibility “voice reinforcement” for meetings and program reproduction to supplement visual presentations. In some cases, the built-in music systems are capable of reinforcing live entertainment from musicians.

A particular note: program audio from content being displayed on built-in projection screens should come from the same direction as the image. In other words, there should be speakers provided flanking the image. These may be portable speakers on stands, or may be built into the wall details when the projection screens are built in. See “clean room” above.

9.6.7 Video Display, Flexible Function Spaces

Spaces intended for business meetings and for huddle or breakout purposes are typically equipped to accommodate viewing visual content from the presenters’ laptops or other sources.

Mid-level hotels and large conference and convention class hotels typically use all portable equipment for visual displays. This decision is driven by many factors including reduced first cost, high degree of flexibility, accommodating (or anticipating) the out-sourcing of AV services, and having large enough spaces to not be too concerned about maximizing occupancy.

Higher end hotels with flexible function spaces large enough to require visual displays larger than can be provided by direct-view displays are provided with built-in retractable projection screens and projectors on lifts to retract into the ceiling.

Video walls are tiled arrays of individual flat-panel displays; their primary use is for digital signage. While video walls are sometimes considered for event image display, there are specific limitations that must be considered. Most notably is the mullion that occurs between the tiled displays. This mullion creates a subtractive gap in the content that can be quite distracting and disturbing if the content is not expressly developed for video wall display.

9.6.8 Video Display, Meeting & Conference Rooms

Smaller rooms may be equipped with wall mounted flat panel displays while larger meeting rooms may be equipped to accommodate projection displays.

It is the distance from the display to the furthest viewer that determines the size of the display. The industry standard calls for the display image height (vertical dimension of the image) to be one sixth of the distance between the display and the furthest viewer.

Also, the closest viewer should be seated no closer than two times the image height. These metrics apply to all types of visual displays, since they are determined by the average visual acuity of the human beings, and not by the display technology being used.

High-tech, high-touch hotels, five-star properties, and IACC Conference Centers typically take the “Clean Room” approach described above, and build the displays into the rooms’ interior designs. This would typically be direct-view displays for the smaller rooms, possibly concealed behind hinged pocket doors or panels.

9.6.9 Direct-View Flat-Panel

It should be noted that direct-view flat-panel displays are always preferred over projection technology since they are not affected by ambient light (washes out projected images) and can be interacted with by the presenter without “painting” a projected image onto the presenter.

9.7 Infrastructure for AV

The infrastructure requirements to properly accommodate the AV systems include power, connectivity, rigging/hang points, and cable routing.

9.7.1 Power Needs

Almost everything associated with AV systems requires power of some sort. When production services are also considered, the power requirements increase substantially.

9.7.1.1 *Convenience Outlets*

These are standard electrical power connections that are used not only by the hotel staff, but also by guests to power or charge personal devices. While applicable electrical codes typically dictate the number of outlets required, spacing, and location, we note that there should always be a convenience outlet located immediately adjacent to any AV facility panel.

9.7.1.2 *Technical Power*

The AV equipment racks contain very sensitive analog and digital components. Because the job of the system is to convert tiny electrical signals (from microphones, video sources, etc.) to very high levels, the quality of the power and grounding provided to the AV equipment is crucial. The consequences and effects of improper power to the AV racks includes intermittent

operation, spurious noises in the sound systems (hums, clicks, whistles, buzzes), visual noise and interference in the visual displays, etc.

Ideally, there will be a dedicated power panel located in the main AV equipment room. This should be a single-phase panel with an isolation transformer and isolated, dedicated ground. This ground should not be used by any other equipment (other computers, telephone, etc.). The power required will vary per the design but the described quality level should be maintained.

9.7.1.3 *Show Power*

This term refers to the heavy duty power that is required by AV production companies to serve their sound and lighting systems. The equipment that requires this power will typically be located adjacent to or behind the main stage or platform, so that's where the Show Power should be provided.

The connectors for the Show power should be coordinated with local event production companies. There are several "standards" so it may be useful to have adapters available to avoid field splicing.

9.7.1.4 *Exhibition Power*

Exhibit Halls have unique power requirements that range from simple to very sophisticated. At the minimum, each exhibitors' booth must be served with a single convenience power level circuit. Where industrial exhibits are anticipated, the power requirements will be quite substantial.

9.7.2 Connectivity

The guests using the event spaces need to be connected. The technical staff operating the AV systems also need a means for sending signals from room-to-room and for bringing in signals and services from outside the hotel into meeting rooms from time to time.

Both wired and wireless internet services must be provided. While this topic is covered elsewhere in this guide, it is important to note that wired internet is a requirement for successful events and spaces. There are several reasons behind this recommendation.

Many government agencies, government contractors, and private-sector corporations do not permit their company computers to operate on wireless services, as it is considered to be a security risk. Also, wired connections are always more reliable and provide higher speeds and more bandwidth than wireless connections. All event spaces must have wired internet connections available, at least for the presenters' use.

Each event space and salon in flexible function rooms needs to have a facility panel with connectivity to patchbays in the central AV equipment room. This arrangement permits the AV technicians to quickly send signals anywhere they need to without stringing cables through service or public areas.

The patchbays in the AV equipment room also are provided with telecommunications and internet services, including circuits provisioned with POTS, ISDN, T1, and internet as well as fiber and copper tie lines to the nearest MDF or IDF.

9.7.3 Rigging and Hang Points

Event audiovisual productions frequently need to suspend technologies from overhead; from the ceiling. These production elements may include trussing with feature and effects lighting, speakers, video projection, scenery, curtains, etc. These requirements call for several different types of rigging/hang points.

Fixed, load-rated hang points are designed into the structure of the hotel by the structural engineer. These are designed to support between 500 pounds to 2,000 pounds, depending on the size of the ballroom and anticipated production needs. These load ratings are net, or placarded ratings, and provide a safety factor of at least five times rated load.

Trussing hung from these hang points are fitted with fixtures and cabling run across the ceiling to dimmer packs located behind or adjacent to the stage. These are what are connected to the show power, described elsewhere.

Another type of hang point is a demountable, retractable, or recessed multi-purpose point that not only provides structural support, but is also equipped with dimmed lighting circuits and technical power and signal tie lines to the patchbays described above. These devices are concealed when not in use, but can support production lighting instruments, speakers, video projectors, etc. without requiring trusses. This type of rigging/hang point is often used in high-finish ballrooms where the visibility of the production technology wants to be as discrete as possible. See: “clean room” above.

The locations of these points must be determined through a staging/production study of object walls and platform locations, sizes, heights, etc.

Another type of rigging element that may be included in the design is “banner track”. This is lightweight structural channel that is recessed into the ceiling (or otherwise concealed in a reveal) around the periphery of the Ballroom salons. These tracks are rated to support approximately 100 pounds per foot of length and are spaced approximately 6” to one foot away from the walls. These banner tracks are used to support banners, drapes, cables, scenery, etc. that might otherwise be stapled, nailed, or taped to the wall surfaces or millwork.

If rigging/hang points are not provided during design, the in-house technicians and outside production companies will find ways of hanging from the structural elements above. This creative access is often accomplished by removing parts of the ceiling, and/or removing downlights and attaching cables or slings to the structure above. Providing rigging/hang points reduces or eliminates this damage to the building.

9.7.4 Cable Ways

It is helpful to anticipate where production companies will need to run their cables around and through event spaces. While the AV tie lines described above are intended to minimize the need to run cables around the spaces, outside production companies will frequently insist on using their own cables, preferring them to the unknown (to them) quality of the hotel’s built-in cables.

The path most often required involves running a bundle of cables from the stage, head table, or platform area, to a “tech table” located on the side wall or back wall of the event space. This means that the cables will most certainly cross service and possibly guest entrance doorways.

One way to accommodate these cables is to build out the architraves and door frames to allow the cables to be discretely run up the side of the door frame, draped over the top of the transom of the frame, and down the other side.

There is often a requirement for hotels of all sizes and levels to accommodate Outside Broadcast Vans (OBVs) when the events in the Ballrooms are to be broadcast via television or satellite. It is helpful to anticipate where the broadcast van will park and how to run cabling form the event spaces and the AV equipment room to that location. This must be accomplished without blocking open fire or egress doors. Frequently, fire-rated access hatches and “J” hooks along the service corridors are included in the design for this purpose. It is also important to provide a convenient building ground connection for the broadcast truck to connect to, for safety purposes.

10 Life Safety

The National Fire Protection Agency is the governing body over fire and life safety. NFPA 72 is the code section governing Fire Alarm and Life Safety Systems.

Generally, a life safety system is installed for protection of life, property and mission. In order for a life safety system to be useful, it must be able to perform these functions:

1. Detect the presence of smoke or fire.
2. Notify the occupants
3. Notify the fire department (usually through a central station connection)
4. Operate other fire safety functions, e.g., release magnetically held open smoke doors or activate an automatic sprinkler system.

Heat and smoke detectors are the most commonly used fire detection devices. Heat detectors are designed to detect a fixed amount of heat present at the detector or a rapid increase of heat in the area of the detector. Smoke detectors can detect the presence of smoke in an area (when it reaches the ceiling where the detector is normally located.)

There are two common types of smoke detectors, ionization and photoelectric.

Ionization-type smoke alarms have a small amount of radioactive material between two electrically charged plates, which ionizes the air and causes current to flow between the plates. When smoke enters the chamber, it disrupts the flow of ions, thus reducing the flow of current and activating the alarm.

Photoelectric-type alarms aim a light source into a sensing chamber at an angle away from the sensor. Smoke enters the chamber, reflecting light onto the light sensor; triggering the alarm.

Manual fire alarm boxes are usually placed (as a minimum) at all exits on each floor in a building. An automatic sprinkler system requires water flow devices to be used to indicate the systems operation.

There are four basic types of automatic sprinkler systems that a life safety system may be connected to (see Section 8.3.4.1 for details on each system):

1. Wet Pipe
2. Dry Pipe
3. Pre-Action
4. Deluge

The most common is a wet pipe system that is fully pressurized with water and only requires one alarm point (heat or smoke detector, pull station or broken sprinkler head) to set off that sprinkler zone and release the water.

In a dry pipe system water is not present in the piping until the system operates. The piping is filled with air below the water supply pressure. When one or more of the automatic sprinklers is exposed, for a sufficient time, to a temperature at or above the temperature rating, it opens, allowing the air in the piping to vent from that sprinkler. Each sprinkler operates individually.

As the air pressure in the piping drops, water enters the piping system. Water flow from sprinklers, needed to control the fire, is delayed until the air is vented from the sprinklers.

Some property owners and building occupants may view dry pipe sprinklers as advantageous for protection of water sensitive areas, such as a data center. This perceived benefit is due to a fear that wet system piping may slowly leak water without attracting notice, while dry pipe systems may not fail in this manner.

Pre-action sprinkler systems are specialized for use in locations where accidental activation is undesired, such as Data Centers, for protection of computer equipment from accidental water discharge.

Pre-action systems are hybrids of wet, dry, and deluge systems. There are two main sub-types of pre-action systems: single interlock, and double interlock.

The operation of single interlock systems are similar to dry systems except that these systems require that a “preceding” fire detection event, typically the activation of a heat or smoke detector, takes place prior to the “action” of water introduction into the system’s piping by opening the pre-action valve. In this way, the system is essentially converted from a dry system into a wet system. The intent is to reduce the undesirable time delay of water delivery to sprinklers that is inherent in dry systems. Prior to fire detection, if the sprinkler operates, or the piping system develops a leak, loss of air pressure in the piping will activate a trouble alarm. In this case, the pre-action valve will not open due to loss of supervisory pressure, and water will not enter the piping.

The operation of double interlock systems are similar to deluge systems except that automatic sprinklers are used. These systems require that both a “preceding” fire detection event, typically the activation of a heat or smoke detector, and an automatic sprinkler operation take place prior to the “action” of water introduction into the system’s piping. Activation of either the fire detectors alone, or sprinklers alone, without the concurrent operation of the other, will not allow water to enter the piping. Because water does not enter the piping until a sprinkler operates, double interlock systems are considered as dry systems in terms of water delivery times, and similarly require a larger design area.

Deluge systems are systems in which all sprinklers connected to the water piping system are open. These systems are used for special hazards where rapid fire spread is a concern, as they provide a simultaneous application of water over the entire hazard. They are sometimes installed in personnel egress paths or building openings to slow travel of fire (e.g., openings in a fire-rated wall). Water is not present in the piping until the system operates. Once the life safety system has signaled the deluge valve to open water flows unhindered.

Voice Evacuation Systems are designed to provide notification and instruction in case of an emergency event, most commonly fire. Voice evacuation systems are required to reproduce audio signals both live and recorded with intelligibility. The audio shall be no less than 15 dB

above the ambient noise of the space or at least 75 dB whichever is greater. Ideally the frequency response should be 150Hz to 11kHz but UL only requires 400Hz to 4kHz.

Firefighting phone jacks are generally place in each stairwell and at a location near the fire control center and fire alarm panel so firefighting personnel can connect their microphones and provide instruction to people within the building.

Voice evacuation systems can be used as both the BGM system and the emergency evacuation system provide the equipment is listed under UL 1483 and meets the hour rating required for the space. Typically, these systems are separate because in general voice evacuation system components do not meet the high fidelity requirements of BGM systems and it is very expensive to meet the requirements of UL 1483.

11 Guest Room

11.1 Guestroom Technology Planning

Guestroom technology planning consists of identifying the services to be enabled by an operator, the supporting technologies, electronics, power plan, and low voltage infrastructure required to enable those services. A complete understanding of the guestroom technology is necessary to budget, design, and implement an effective low voltage systems package. Additionally, the hotel operator may have special brand positioning or marketing considerations which may drive specific guestroom technology requirements.

11.1.1 Guestroom Data Distribution Types

11.1.1.1 *IDF Distribution*

IDF Distribution consists of running all supporting guestroom cabling to a central technology room (TR) located on the guestroom floors. Advantages for this model include the ability to centralize and secure critical equipment, power and cooling. Disadvantages include cost and space for horizontal cabling.

11.1.1.2 *In-Room Distribution*

In-Room distribution consists of running a single data connection to each guest room and using electronics to further split that connection to provide data for all Ethernet services to be used. In this model, each guestroom becomes an IDF. Advantages include reducing the length of cabling, and potentially cost for enabling guest technologies. In-Room distribution can be enabled via a variety of cabling mediums including Fiber, Category Cabling, or COAX. Disadvantages include power considerations for services requiring emergency or uninterruptible power and security, cooling and service of electronics in a decentralized model.

11.1.1.3 *Multi-Room*

Multi-Room distribution is much the same as in-room distribution but where two or more rooms are serviced from a single guestroom. The advantages and disadvantages of this model are similar to in-room distribution with the additional benefit of the potential for less electronics and supporting infrastructure by centralizing more than one room. The additional shortcomings include a more challenging environment to maintain over time.

11.1.2 Guestroom Technology

11.1.2.1 *WiFi Network*

Wireless access points can be deployed in guestrooms to provide wireless data services for guest internet, back office support systems, and other in-room technologies. Wireless Access Points are typically powered via PoE connections from the data source. Some services may require the WiFi network to remain powered in the event of an emergency. This should be considered when selecting the data and power source.

11.1.2.2 *Wired Network Port(s)*

Wired Ethernet ports can be deployed in guestrooms to provide data services for guest internet and other in-room technologies. Depending on the services supported, power may be required in the event of an emergency.

11.1.2.3 *Mobile Device Connectivity*

Mobile devices may include VoWLAN services for back office communications or other critical staff communication technologies. Those technologies often require uninterruptible service in the event of an emergency. It is critical to understand the mobile device services to be used by the operator when designing the supporting infrastructure.

11.1.2.4 *Telephony*

In-room telephone systems can vary widely depending on the type of technology deployed such as IP, analog, wired, wireless DECT, etc.. The number and location of handsets will affect the design as well. Guestroom telephones may require uninterruptible power in the event of an emergency. Source power should be considered in the design.

11.1.2.5 *TV Entertainment*

TV Entertainment systems will vary for each type of hotel and according to any required Brand Standards. However, signal and content distribution will be provided via RF (Coax Cable) and/or Internet Protocol (Category Cable). It is important to determine all of the potential content requirements prior to defining the necessary media. TV Entertainment will typically include Free To Guest (FTG) channel line ups and may also include Video On Demand (VOD), Media Splash Page Content and/ or Personnel Device Streaming. Depending on the Active System provider this content can be distributed to the TV multiple ways. It is important to prepare the most accurate Basis of Design prior to defining the necessary infrastructure.

11.1.3 Guestroom Considerations

11.1.3.1 *Door Locks*

Door Locks can be provisioned in multiple ways. However, it is recommended that stand alone Electronic Access Control Devices be utilized for the guest rooms. These devices can then be interrogated and managed more efficiently by the hotel operator. In addition, the guests and support staff can be provided cards, key fobs and/ or bracelets for ease of use. If desired, door access devices can also be provisioned to include Blue Tooth Enablement for use with the guest's smart phone. Further, the electronic door locks can be bridged with the guest room energy management system to allow predefined setbacks to assist ownership with energy consumption costs.

11.1.3.2 *Minibar/Dry Goods*

Minibars and Dry Goods offered in the guest room should be provisioned to allow the operator and owner to manage the sale of goods via the hotel network while allowing the guest the ease and comfort of purchasing drinks and snacks without leaving the room. Typically these devices can be monitored and sales transactions completed via a hard wired network connection (CAT6) to the device or over the wireless guest network. It is important to define the system type to be integrated prior to the design of the guest room infrastructure.

11.1.3.3 *Energy Management System (EMS)*

The Energy Management System is intended to assist the owner and operator with cost efficient methods to best manage the guest's energy consumption. The energy management system should provide predefined setbacks when the guest room is vacant or unsold and automatically

allow the guest to regulate the temperature within a predefined range when occupied or present. This should be accomplished by utilizing room occupancy sensors, door lock integration, and interfaces with the hotels Property Management System.

11.1.3.4 *In Room Automated Systems (IRAS)*

There are multiple variations of IRAS. Overall the owner and operator should predetermine the extent of these systems prior to the design of the guest rooms. These systems can be of a standalone nature or subset to an existing system such as the EMS. These systems can include the Lighting, Music, Make Up Room (MUR) and Do Not Disturb (DND). Depending upon the overall solution defined for the project, these ancillary systems can be provisioned without the requirement for additional network infrastructure.

11.1.3.5 *Guest-Room Technology vs. Infrastructure Matrix*

Guestroom Technology Consideration Matrix						
Category	Data Connection Type	Data Connection Quantity	Equipment Location	Power Required	Kind of Power	Critical Power Solution
	Coax			Yes	None	UPS
In-Room Controls	Cat-5E/Cat-6			No	Remote POE/DC	Generator
TV Entertainment	Fiber				Local AC	Both
Energy Management	Wifi				Battery	
Telephony	Zigbee					
Wifi HSIA	Infrared					
Wired HSIA	Z-Wave					
Mobile Device Connectivity						
Door Locks						
Minibar						
Lighting/shades/drapes						
DND/MUR						
Experience Shower						
Bathroom TV						
In-Room Music						

12 Back of House and Staff Areas

12.1 Infrastructure

Although a lot of effort to ensure the latest technology and infrastructure is in place to support the Front of House and Public spaces it is also very critical that a focus is placed on the BOH infrastructure. It is critical that communications does not break down as it enters the BOH spaces. This section will touch on the infrastructure requirements for those BOH spaces.

Wireless WiFi and Cellular coverage is critical to the operations in the BOH space and should be provided in these areas. Full WiFi and Cellular coverage should be present in all of the BOH including all offices, F&B prep and storage areas, parking garages, MEP plants, as well as general storage rooms. With today's expectation of immediate accessibility and uninterrupted communications, staff that enter these areas are expected to and expecting to remain connected and in communications. As more and more critical materials relating to the operations of the hotel are being stored on line, access to this information wirelessly in all areas of the hotel is crucial.

In addition to the extension of cellular and WiFi connectivity in these areas, there should be a strong RF radio system (push to talk) extended into the BOH and Administrative work areas. These are quite often used by staff that need an inexpensive method of communications but don't need the full capabilities of a cellular or wireless VoIP phone or the data of a portable tablet. These two systems should however be interconnected so that users on an RF radio are able to communicate with users on a cell phone or wireless VoIP device (and vice versa) in a one on one setting or a group broadcast setting.

12.1.1 Cabling and Power

Even if Voice over IP is implemented in the hotel or only in the administrative sections of the hotel, It is still recommended that a minimum of 2 cable drops be placed at each BOH work station supporting both voice and data connectivity. A duplex electrical power outlet should also be provided to support the PC/Laptop and its monitor. Additional convenience outlets may also be considered for a desk lamp as well as a point to charge your phone or tablet device. If using Voice over IP, an option of back hauling the data connection by using the Ethernet port build into some VoIP handsets is possible. If this option is taken then the second cable should still be installed as a spare for any future requirements or in the event of the first cable fails. It is recommended that locations such as storage rooms and MEP rooms have at a minimum 1 cable drop in order to support a phone or to allow for future use or expansion of that areas function. All BOH kitchens and food prep areas should be designed with a voice and data point located within these areas for kitchen printers. For every data point it is recommended that a duplex power outlet is also provided to support the equipment connecting to the data point.

12.1.2 Security

Security cameras should be located at key locations within the BOH spaces such as all building exit doors, hotel safe, computer room, employee cafeteria. Other areas such as laundry room and entrance to employee locker rooms should be considered. Critical areas such as storage

rooms, meeting rooms, ballrooms, executive office areas, should be secured using the same key technology used at the guestroom allowing for ease of performing audit trails and monitoring. This also allows staff to utilize one key for access into FOH and BOH areas. If IP cameras are used they typically will receive their power from a PoE Ethernet port, however if a non IP camera solution is deployed then electrical power will be required that should be on emergency generator at a minimum.

12.1.3 Digital Signage

In house information boards should be located in key areas within the BOH space such as near human resources and employee dining providing staff with updated company information. Electronic versions offer easier methods of managing content and updated material. A data drop and a duplex electrical outlet should be provided.

Back of house phones should be located through major corridors and especially near the BOH corridors leading into meeting rooms and ballroom spaces. These should be located in such a place so as to prevent noise from entering the meeting facility when being used.

12.1.4 Key FOH Areas

12.1.4.1 *Front Desk/Concierge*

It is recommended that sufficient data and power be placed at each work station location for the Front Desk/ Concierge area. Often items such as electronic key encoders, or the new Chip and Pin credit processor, or in some countries electronic passport scanning or special fiscal printers, require network connectivity. We recommend a minimum of 6 cables and 6 electrical outlets per user station. It is recommended that these locations be on UPS and generator power so as to have minimal impact on the guest during a power outage. It is recommended that the Concierge be outfitted with the same cabling and power as a traditional front desk station as these areas often are used to assist in the check-in process during peak or extremely busy periods of time.

Security cameras monitoring the front desk/concierge area and a panic buttons should be considered for these locations as well.

12.1.4.2 *Entrance/Lobby*

Cabling and power provisions should be placed strategically around the lobby and entrance/vestibule of the hotel along with the pre function areas of the meeting rooms and ballroom areas. There may be times a welcome/registration table for an event may need to be set up or additional security measures may need to be implemented for short or extended period of time. It is recommended that data and power also be placed close to the main entrance door for potential future security requirements,

Full wireless coverage should be in place at the front desk along with all public spaces. Not only can this offer guest internet connectivity but can be valuable for the staff communications, depending on the appropriate communication device/tool they carry with them.

12.1.4.3 *Bell Station*

Cabling and power provisions should be placed at the Bellman's station. Typically a phone is sufficient but occasionally there may be a need for a computer as well. A data and voice cable along with a duplex power outlet should be provided.

12.2 Vendor Access

Vendor access into the BOH areas of a hotel are typically restricted or limited. They should always check in and out with the security department and should be escorted by an IT staff member or someone qualified in IT to understand if they are doing inappropriate activities when they are working on IT/Communications related systems. It is recommended that they never be left alone especially in the computer room or any one of the IDF closets as company and guest private information could be compromised and expose the hotel operator and owner to unnecessary risk.

Computer rooms should be designed so that if external vendors are required to frequently work in this area their equipment should be physically separated in their own cabinets from the hotels systems and preferably in a separate room with its own entrance and security access control. If, however, this is not possible then it is critical that all the hotel equipment racks be lockable and that strict policies to ensure the racks are locked is adhered, too.

13 Engineering, Building Management and Building Automation

Building Automation Systems (BAS)/Building Management System (BMS) are designed to efficiently manage the performance and operations of your Mechanical and Electrical systems in the building. Its goal is to achieve a comfortable environment for the occupants, to efficiently operate the systems it controls, and to reduce energy usage and operating cost.

It utilizes a series of controls, sensors, valves, relays, and other components along with a sophisticated software program to manage and control the end devices. These devices are turned on/off, load shared, load shed, reduced or dimmed based on time of day or external influence such as demands, performance, or physical presence in the area. From this point on we will refer to the system as (BMS).

It is recommended that the BMS system at minimum manages your "high cost to operate components" within the hotel such as your building chillers, fan coils, boilers, and lighting. Since these are typically your higher cost to operate items, managing them to ensure they are operating at their most efficient levels or turned off when not required, ultimately helps reduce their operating cost and helps to maintain their life cycle.

The BMS System should support the following functionality:

- System must utilize an open architecture design.
- A color graphical floor plan and schematic display utilizing a touch screen, indicating the systems they are monitoring and their current status. This gives a quick overview of the performance of each system and how it's operating at that moment.
- All alarm conditions should be sent to wireless staff devices as well as maintaining a stored copy of the event including date and time on a secured electronic media.
- Support multi-tiered alarm notification. Based on severity different rules are followed.
- All reporting and management of system should be accessible thru web services.
- System should interface with critical systems such as:
    - Security System
    - Fire Alarm System (to the extent permitted by code). During an alarm condition the fire alarm system interfaced into the BMS system should trigger the BMS system to shut down air handlers and fresh air intake in the affected area, thus reducing the potential for helping to fan or spread the fire.
    - Hotels PMS System for adjusting systems predictive load.
    - Kitchen Refrigeration Systems
    - Interface to metering systems such as Gas and Electricity.

- If the hotel has a CMMS (computerized Maintenance Management System)

- Energy management features such as:
  - Non-essential load shedding during peak periods.
  - Time setting of lighting and fans
  - Set points and Set back points for all hotel areas.
  - Individualized area sub metering by department.
- Items that should be monitored and managed by the BMS system.
  - Indoor Air Quality to ensure a minimum standard is being maintained.
  - Hot Water Systems
    - Steam Boilers
    - Pumps
    - Water Softening Plant
    - Heat Exchangers
  - Fans
    - Supply Fans
    - Exhaust Fans
  - Water Tanks & Fire Storage Levels
  - Main Pressurization Booster Pumps
  - Lifts/Elevators
  - Chilled Water Systems and Chillers
  - Fuel, Storage & Transfer tanks
  - Sump Pump
  - Gas/Electric Sub Meters to each department
  - Air Handling units with return fan, fresh air, and economizer.
  - Main Sub Station
    - Total Power
    - Main Circuit Breakers Position (Open, Closed)
    - Transformer (Voltage and Output)
  - Emergency Generator (Status Battery Level, Fuel Level, Off/Running).
  - Reactive Power Monitoring of Power Factor.
- Recommended Sub Metering Locations for Gas, Water, and or Electric
  - Building Service Entry (Total Consumption)
  - Laundry and Valet Laundry
  - Generator
  - Swimming Pool
  - Hot Water Boilers
  - Steam Boilers
  - Cooling Tower

- Chiller
- Each Restaurant/Kitchen
- Banquet Kitchens/ Banquet Areas
- Each Retail/Tenant Space
- Apartments or other housing associated with hotel.

- Data collection for reporting is recommended to be set to 15 minute intervals.
- Reporting should include:
  - Morning report that automatically runs displaying any overnight events.
  - Daily report to include average usage and trends.
  - Weekly report to include average usage and trends.
  - Monthly reports to include average usage and trends.
  - Annual reports.

14 Appendices

14.1 Glossary of Terms

For the purpose of this document the following terms have been defined as follows:

Term	Definition
Acceptance Testing	Testing provided to determine if the requirements of an installation have been met, including performance testing.
Access Points	Wireless communication devices that operate over radio waves.
Adapter – Optical Fiber Duplex	An adapter that has a fiber for both transmission and reception.
Aerial Plant	Telecommunications cables that are attached to poles in the air. Fiber optic cables, specifically, may use cables containing a suspension strand.
AFEXT	Alien far-end cross talk - interference on a fiber optic cable caused by bundled cables measured at the opposite end from the transmitter.
America Wire Gauge(AWG)	A measurement of the diameter of round, solid, nonferrous conductive wire.
ANEXT	Alien near-end cross talk - interference on a fiber optic cable caused by bundled cables measured at the same end as the transmitter.
ANSI/TIA/EIA	American National Standards Institute \ Telecommunications Industry Association \ Electronic Industries Alliance
Applications Specific Cabling	Communications or protocols specifically assigned to a PIN typical of a copper cable
Armoring	Metal clad cable which provides its own ground.
Array Connection	Fiber bundle/strand connectors typically designed to shield and isolate electromagnetic interference.
As-Built	A snapshot (post-deployment) immediately after the installation was finished. A virtual profile of the infrastructure. A listing of every powered and passive cabling element, complete with location, IP addressing, port assignment installed/deployed during a project. Updated after any change is made to the infrastructure to reflect the current environment.
As-Built Drawings	Drawings depicting an installation "as-is" or how the installation occurred in the real world, rather than planning phase drawings or designs.
Attenuation (or Fade)	Transmission loss due to the reduction in intensity of the signal as relative to distance.
Backboard	Typically made of plywood, a color coded (based on what the cables are used for) base for telecommunications wiring termination.
Backbone Cabling	A system of cabling that connects the entrance facilities, equipment and telecommunications rooms.

Backscatter	A reflection of light waves/signals back to origin of the wave/signal.
Balanced Cable	A type of cable that effectively reduces cumulative dispersion to zero (fiber). Or two wires kept close together generally by twisting with a consistent distance between cables.
Banner track, lightweight hang track	refers to the provision of structural steel channel on the ceiling around the periphery of each event space. This is used to suspend banners, curtains, posters, scenery elements, etc. without requiring attachment to millwork or other interior surface treatment. Examples are UniStrut, SuperStrut, and Kindorf.
Baseboard Pathway	An enclosed sheathing system typically run along a wall at the point of connection to the floor for cable routing.
Bend Radius	As measured by the inside curvature of the bend, the minimum radius at which a fiber optic cable can be bent or turned safely without damaging the cable, generally not less than 15 times the diameter of the cable.
BFOC	Bayonet Fiber Optic Connector - a type of fiber optic connector.
BIC	Backplane Interface Connector, typically used to connect wiring to switch infrastructure.
Blackout capabilities for windows	refers to providing a means of eliminating all light through any windows into a meeting space. This is to accommodate typical visual projection display technologies as well as minimizing light fluctuations during video teleconferences.
Boring	Drilling a pathway for cabling through non-porous substances.
Break-Out Cable	Fiber optic cable containing several fibers, each with its own jacket, surrounded by a common jacket.
Buffer Coating (Tight)	A protective layer (PVC) applied over fiber cladding.
Building Entrance Terminal	A point of cross connect between outside fibers and internal wiring.
Bundled Cable	An assembly of multiple cables into a single, generally non-flexible group.
Cabinet	Electronics infrastructure storage, typically secure and fire rated.
Cable	Metal and/or glass wire that transmits electrical current or light waves.
Cable Assembly	Cables and/or wires that are bound together in some way, including cable ties, conduit and other means.
Cable Rack	Cable sorting in the IDF/MDF that supports and cleanly separates cables for easier access and identification.

Cable Sheath	Protective coating made of various materials shielding fiber and/or copper cables from the elements and, in some cases, electromagnetic interference.
Cable Tray	Cable support for safe routing through an installation.
Campus Backbone	Fiber connections between campus buildings which define a single pathway for communication.
Campus Environment	Physically separate yet geographically close buildings typically on a contiguous plot of land.
Category 3,5,5e,6,6a,7	Types of twisted pair cabling generally categorized by speed and cable construction. Higher categories are faster speed rated. (add throughout specific information, in MHZ, and mb/gb, including IEC spex, using the word CLASS).
Ceiling Distribution System	Structured Cable pathways in the ceiling.
Centralized Fiber Cabling	A network design from which all data electronics and passive optical splitters are housed in a single location and optical fiber cables provide direct connections to every workstation outlet in the network.
Change Order	A process whereby changes in the Scope of Work agreed to by the Owner, Contractor and Architect are implemented.
Chase Nipple	Used on the end of a conduit to protect the cable during installation. It reduces the pull tension on the cable.
Cladding	A covering or coating on a structure or material.
Code	A systematically arranged and comprehensive collection of laws.
Communications Riser Cable	Cable used in vertical tray applications such as cable runs between floors through cable risers or in elevator shafts. These spaces cannot be used for environmental air. These cables must self extinguish and must also prevent the flame from traveling up the cable in a vertical burn test.
Conduit	A tube or trough for protecting electric wiring.
Condulets	It is a special corner fitting for joining two pieces of conduit while providing access for pulling wires around the corner.
Connecting Hardware	A device, used to terminate an optical fiber cable with connectors and adapters that provides an administration point for cross-connecting between cabling segments or interconnecting to electronic equipment.
Connector	A mechanical device used to align and join two fibers together to provide a means for attaching to and decoupling from a transmitter, receiver or another fiber (patch panel).
Convergence	The combination of multiple functions on the same physical infrastructure. Constitutes the reduction of the cable infrastructure as IP Phones, IPTV etc are transmitted on the same infrastructure. VOIP, IPTV, High Speed Internet, MiniBars, Back-of-House Applications, Front-of-House Applications, Security Cameras, Digital Signage; all on the same network.

Converter (Media)	A component used in Ethernet, although it is not part of the IEEE standard. The IEEE standard states that all segments must be linked with repeaters. Media converters were developed as a simpler, cheaper alternative to repeaters.
Core (Fiber)	The central region of an optical fiber through which light is transmitted.
Coupler	An optical device that combines or splits power from optical fibers.
CPE	Customer Premises Equipment: Terminal, associated equipment and inside wiring located at a subscriber's premises and connected with a carrier's communication channel(s) at the demarcation point (demarc), a point established in a building or complex to separate customer equipment from telephone company equipment.
Cross-Connect	Connections between terminal blocks on the two sides of a distribution frame or between terminals on a terminal block (also called straps). Also called cross-connection or jumper.
Demarcation Point	The point at which the public network ends and connects with the customer's on-premises wiring.
Direct-Buried Cable	Direct-buried cable is a kind of communications or transmissions cable which is especially designed to be buried under the ground.
Directional Coupler	A coupling device for separately sampling (through a known coupling loss) either the forward (incident) or the backward (reflected) wave in a transmission line.
Dispersion	The cause of bandwidth limitations in a fiber. Dispersion causes a broadening of input pulses along the length of the fiber. Three major types are (1) modal dispersion caused by differential optical path lengths in a multimode fiber; (2) chromatic dispersion caused by a differential delay of various wavelengths of light in a waveguide material and (3) waveguide dispersion caused by light traveling in both the core and cladding materials in single mode fibers.
Distributed Fiber Cabling	A network design from which all data electronics and passive optical splitters are housed and distributed through the property.
Distribution Patch Panel	A wiring board that patches fiber and/or copper terminations end-to-end and is typically housed in rack space in the IDF/MDF.
Duct	A flexible enclosed pathway for cables to be routed.
Electronic Auditable Lock on Door	refers to provision of locks which can be programmed to each guests' access requirements and which will record the time and key number each time it is used, for tracking purposes.
EPON	Ethernet based Passive Optical Network (PON). Another term sometimes used to refer to a BPON.

Ethernet	A system for connecting a number of computer systems to form a local area network, with protocols to control the passing of information. Ethernet is a standard for using various transmission media, such as coaxial cables, unshielded twisted pairs and optical fibers.
Fading	A fiber optic's light source that gradually grows faint and disappears.
False Ceiling	A dropped ceiling is a secondary ceiling, hung below the main (structural) ceiling.
FC Connector	A threaded optical connector that uses a special curved polish and angled tip on the connector for very low back-reflection. Used with single-mode or fiber only.
FDDI	Abbreviation for Fiber Distributed Data Interface. 1) A dual counter-rotating ring local area network. 2) A connector used in a dual counter-rotating ring local area network.
Fiber Optics	Light transmission through optical fibers for communication signaling.
Fill Ratios	The fill ratio formulas are used in estimating the number of fiber optic cables that can be installed in ductwork. Key element used in the design of a network.
Firestop System	A specific construction consisting of a fire-rated wall or floor assembly.
Floor access for power and data tie lines	refers to the provision of floor access jacks ("poke-throughs"), and floor boxes or pockets equipped with convenience power outlets and network connectors.
Floor Plan	A scale diagram of the arrangement of rooms in one story of a building.
FOTP	Standards developed and published by the Electronic Industries Association (EIA) under the EIA-RS-455 series of standards.
FOTS	Fiber-Optic Transmission System: a communication system using fiber optic cables.
FSAN-B	Full Service Access Networking working group, founded by major telecom providers and system vendors, instrumental in the provisioning of the original fiber to the home protocols, now a major industry proponent of GPON technology
Fusion Splice	A permanent joint produced by the application of localized heat sufficient to fuse or melt the ends of the optical fiber, forming a continuous single fiber.
Gigabit Ethernet	A network technology that transmits Ethernet frames at a rate of a gigabit per second (1,000,000,000 bits per second), as defined by the IEEE 802.3-2008 standard.
Graded Index Fiber	An optical fiber whose core is designed to accept several rays of light, at different angles, and have all rays arrive at the same time.

Grommet	Grommets are flared or collared rings inserted into a hole in material. Grommets are often installed in desks and tables to allow the passing of electrical and communication cables.
Guy	A steel cable used to stabilize utility poles. Guys attach to the ground to oppose the tension from cable weight and keep the pole upright.
Hand-hole	An in-ground enclosure in which cable can be pulled. Hand-holes are similar to maintenance holes, but are not large enough for a person to fully enter.
Header Duct	Sometimes called a trench duct or feeder duct, a header duct is rectangular cable raceway, installed within a floor to bring cable from a service closet to distribution ducts.
Home Run	A pathway or cable between two locations that does not contain a splice, consolidation point or transition point.
Horizontal Cable	The telecommunications cabling infrastructure that connects a telecommunications outlet to the IDF (Intermediate Distribution Frame) or telecommunications room on that floor.
Horizontal Cross-Connect	Also known as a floor distributer; horizontal cross-connects are a group of connectors, such as patch panels or punch-down blocks. A horizontal cross-connect allows equipment and backbone cabling to be cross-connected with jumpers or equipment cords.
Hybrid Cable	A cable assembly which contains two or more different types of cables. All cables are enclosed in one sheath or jacket.
Hybrid Coupler	A component used to combine two communications signals or equally split a signal amongst its ports.
IDF	Intermediate Distribution Frame. Also known as telecommunications room, an IDF is a space housing telecommunications equipment, cross-connect cabling and cable terminations for a building floor or section.
Infrastructure	A collection of telecommunications components, excluding equipment, which enables the transmission of voice, data and video throughout a building or campus environment.
Innerduct	Located within a conduit or sheath, innerduct is a flexible, non-metallic raceway used to route, separate and protect cabling.
International Electro-technical Commission	A global standardization organization that publishes standards and conformity assessments for electric and electronic products, systems and services.
J-Hook	A rigid metallic support, shaped like the letter "J." J-Hooks are mounted to some building structures to support horizontal cables.
Ladder Rack/Ladder Cable Tray	A rigid metallic structure, resembling a ladder, used to support and route cables within a building.

Laser	A device that produces highly amplified and coherent light radiation on one or more frequencies.
LC Connection	A small form factor, fiber optic cable connector, used with both single-mode and multimode fiber.
Loose Tube	A type of fiber optic cable, where fibers are laid loosely in a protective sheath, often filled with gel.
Maintenance Hole	An underground vault used to install, terminate and maintain cables. Maintenance holes are large enough that a person is able to fully enter and perform work.
MDF	A Main Distribution Frame (MDF) is a space used to interconnect and manage telecommunication wiring between itself and any number of intermediate distribution frames, in addition to the cabling from the network it supports.
Mechanical Splicing	A method of joining two fiber optic cables, through mechanical means.
Media Converter	A hardware device that converts the signal from one type of cable to another; for example, from twisted pair to optical fiber.
Modular Jack	A female telecommunications connector, used to connect equipment with the use of patch cords.
MT-RJ Connector	A small form factor fiber optic connector that contains two to twelve fiber strands.
Multimode Fiber/Single-Mode Fiber	The two major types of fiber optic cable. Single-mode fiber carries a signal on a single path for long distances. Multimode fiber is able to carry numerous signals over one strand, by injecting light at different angles, for shorter distances.
Nanometer	The most commonly used unit of measurement, for measuring fiber optic wavelength. 1 nm (nanometer) is equal to 1 billionth of a meter (0.000000001 m).
National Electric Code	A safety standard that regulates the use of electrical wire, cable, electrical and optical communications cable installed in buildings.
Near-End Crosstalk	The undesirable signal interference between pairs of a twisted pair copper cable, closest to the point of transmission.
Noise	Undesirable signal on a cable that interferes with the quality of the expected communication signal.
Nonzero Dispersion	A type of fiber optic cable, constructed to allow a small amount of signal loss without having the light cross the zero point in its wavelength.
Numerical Aperture	In a fiber optics, numerical aperture is a number that characterizes the angular spread of light from the central axis of the strand.
OF	Optical Fiber is a communications medium that transmits information as light pulses along a glass or plastic wire.

OFC	Optical Fiber Conductive cable – Optical fiber cable that has a metallic sheath for protection.
OFCG	Optical Fiber Conductive General purpose cable – General purpose optical fiber cable that has a protective metallic sheath; designed for installation in non-air handling spaces.
OFCP	Optical fiber Conductive Plenum cable – Optical fiber cable that has a metallic sheath for protection and an outer jacket designed for installation in air handling spaces.
OFCR	Optical Fiber Conductive Riser cable – Optical fiber cable that has a protective metallic sheath; designed for installation in non-air handling spaces.
OFNR	Optical Fiber Nonconductive Riser cable - Optical fiber cable that contains no conductive material and an outer jacket designed for installation in non-air handling spaces.
OM1 to OM4	The four categories of multimode optical fiber cable. Each category has distinct design and performance characteristics.
ONT	Optical Network Terminal - A media converter that converts fiber optic light signals to electric signals, which can be transmitted over copper cabling.
ONU	A generic term for a fiber optic termination panel. Optical Network Units are wall or rack mounted enclosures, housing and protecting fiber optic terminations.
Optical Fiber Ferrule	A mechanical fixture, generally a ceramic tube, used to protect and align a fiber in a connector. Generally associated with fiber optic connectors.
Optical Receiver	A receiver that converts an optical signal into an electrical signal.
OTDR	Optical Time Domain Reflector – An optical cable measuring instrument that can estimate overall cable length, measure attenuation and provide testing results on the integrity of the fiber run or strand.
Overhead	Planned over-capacity design to ensure future proofing of raceways and conduits.
PageFormat	Designed by the Construction Specifications Institute, PageFormat is a model describing the recommended arrangement of text, articles, paragraphs and subparagraphs for design and construction documentation.
Passive Optical Lan (POL)	Evolving technology that can potentially revolutionize the way networks are built. It can reduce direct deployment costs, cabling costs, and ongoing costs of ownership significantly vs traditional copper based networks.
Patch Cord	Often called a patch cable or equipment cable, a patch cord is an electrical or optical cable with male ends on each side, used to connect one device to another, routing signals.

Pedestal	A protective above-ground outdoor enclosure, used to splice cables or for administrative terminal location.
Performance Bond	A written financial bond from a third party guarantor, ensuring the contractor will abide by the design specifications. Performance bonds ensure payment of a stipulated sum of money in the event the contractor fails in the full performance of the contract.
Physical Topology	The physical layout of cabling and equipment on a network.
Plastic Optical Fiber	Fiber optic cabling that is manufactured using plastic, versus glass.
Poke-Thru	Penetrations through the floor of a structure, allowing the installation of telecommunications, audio/visual and/or power cabling.
Power over Ethernet (PoE)	Describes a system to pass electrical power safely, along with data, on Ethernet cabling. IEEE 802.3af-2003[2] PoE standard provides up to 15.4 W of DC power, IEEE 802.3at-2009[7]. PoE standard, also known as PoE+ or PoE plus, provides up to 25.5 W of power.
Project Management	The discipline of planning, organizing, securing, managing, leading and controlling resources to achieve a specific goal, typically within a specific time frame and within a budgeted/contracted cost.
Pull Cord	A cord, string, wire or fish tape that when connected to cable, will pull the cable through a pathway or conduit.
Pull Point	An opening or break in the pathway that allows connection to a pull cord.
Pull Tension	The amount of tension that can be applied to a cable while pulling it through a pathway.
Raceway	Any open or enclosed channel, pipe, conduit or tray for holding cabling.
Reflection (Fresnel)	Optical light reflection at a discrete interface with refractive discontinuity. Also known as Fresnel Reflection or Fresnel Loss.
Refraction	The change in direction of an optical beam produced at the interface between two dissimilar media.
Rigging Points, Fixed, 1,000# live load	refers to load-rated hardware that is attached to the building structure such that it is designed to support theatrical and production stagecraft elements such as loaded trusses.
SC Connector	Subscriber Connector - A common optical fiber connector used to connect fiber terminations.
Schematic Design	Done typically after preliminary planning and scope development, a planning phase for a project that typically includes a Schematic diagram, which is a projected illustration of the low voltage cable plan.
SCS	Structured Cabling System.

SFF Connector	A generic term representing "Small Form Factor" connectors. SFF connectors are the trend in deployments as they allow more low voltage connections in a smaller space.
Show Power	refers to the provision of heavy three-phase electrical power service to run theatrical lighting systems for larger staged events and productions.
Sleeve	As It relates to structured HVAC, a sleeve is: (1) An opening that allows for the passage of cables or (2) A larger-circumference tube or pipe that slides over existing conduit to hide or cover an opening ("Slip Sleeve").
SMF	Single-Mode Fiber - In fiber-optic communication, a single-mode optical fiber (SMF) (also known as mono-mode optical fiber, single-mode optical waveguide or unimode fiber) is an optical fiber designed to carry only a single ray of light (mode).
Splice	Weaving the strands of cabling together. Optical splicing includes fusion splicing and mechanical splicing.
Splice Case	Enclosure used in optical splicing to cover and protect the splice.
Splice tray	A fiber splice tray houses and protects a fusion or mechanical optical splice.
Splitter	Low voltage copper (or fiber) device that provides multiple outputs to a group of devices.
Star Coupler	In fiber optics, and especially in telecommunications, a star coupler is a passive optical device used in network applications. An optical signal introduced into any input port is distributed to all output ports. Because of the way a passive star coupler is constructed, the number of ports is usually a power of 2; i.e. two input ports and two output ports (a "two-port" coupler, customarily called a directional coupler, or splitter); four input ports and four output ports (a "four-port" coupler); eight input ports and eight output ports (an "eight-port" coupler), etc.
Step-Index Fiber	For an optical fiber, a step-index profile is a refractive index profile characterized by a uniform refractive index within the core and a sharp decrease in refractive index at the core-cladding interface so that the cladding is of a lower refractive index. The step-index profile corresponds to a power-law index profile with the profile parameter approaching infinity. The step-index profile is used in most single-mode fibers and some multimode fibers.
Straight Splice	Two pieces of cabling connecting in-line from opposite directions.
Strand	A single unit of wire that, when bundled together, create a cable.
Telecom Closet	An enclosed (typically secured) space that is purposed to house telecommunications equipment, cable terminations, server racks, points of entry, etc.

Tie Cable	The Tie Cable is used in a backbone cabling environment and is the interface between the inter-building (campus) or intra-building cable connections in the equipment rooms/telecommunications closets, AND the distribution (horizontal) connections.
Tight Buffered Optical Cable	Type of fiber cabling that has increased coating and protection, and allows for more workability, bending, etc.
Transition Point	A transition connection between a round cable and a flat rug cable.
Trench Duct	Sometimes called a header duct or feeder duct, a trench duct is rectangular cable raceway, installed within a floor to bring cable from a service closet to distribution ducts.
Trunk Cable	This is usually a telephone company term. It refers to the main bundle of cable(s) coming out of a central office or other centralized telephone switch (computer). It is based on the way a tree grows: there is the trunk, then the branches.
Uplink	In computer networking, an uplink is a connection from a device or smaller local network to a larger network.
Value Engineering	Value engineering (VE) is a systematic method to improve the "value" of goods or products and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost. It is a primary tenet of value engineering that basic functions be preserved and not be reduced as a consequence of pursuing value improvements.
WDM	Wavelength Division Multiplexing - In fiber-optic communications, wavelength division multiplexing (WDM) is a technology that multiplexes a number of optical carrier signals onto a single optical fiber by using different wavelengths (i.e. colors) of laser light. This technique enables bidirectional communications over one strand of fiber, as well as multiplication of capacity.