Section 2

VAHBS Overview

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History of VAHBS

The VA Hospital Building System (VAHBS) is an approach to the design and construction of large, multi-story hospital buildings based on the principles of systems integration. Key features of the VAHBS are modular design with integrated service zones for permanent and adaptable building subsystems.

Jerry L. Pettis Memorial VA Medical Center
Loma Linda, CA, 1977

Faced with rising costs, lengthy periods between programming and occupancy, accelerating obsolescence and inadequate building performance, VA decided to study the application of systems integration to a prototype design for new hospitals. The result of the work by VA Research staff and the consultant, Stone, Marraccini and Patterson with Building Systems Development, was the Development Study--VA Hospital Building System Research Study Report (Red Book) first published in January 1972. The Red Book report was last revised in August 1977.

The VAHBS has been used successfully on many VA projects. Over the last three decades certain elements of this system have evolved in response to field experience, emerging health care models, and technical and regulatory changes. As a supplement to the Red Book, this Paper is intended to aid designers of new VA hospital buildings in the application of VAHBS concepts to today's conditions and construction practices.

VAHBS Concepts

Systems Integration

The Red Book presented a prototype design system for new hospital buildings. In the prototype system, building systems and subsystems and their interrelationships are defined and examined as integrated or coordinated components of the building as a whole from the very beginning of the design process. The primary objectives for systems integration are cost control, improved performance, adaptability, time (schedule) reduction, and the provision of a basis for the long-term development and modification of the hospital building.

Readers must keep in mind that the prototype design system was not intended to be used as a standardized scheme. The prototype design system was to be used as a model for the generalized decision process for the design and construction of new facilities. The prototype space modules were based on functional criteria appropriate to the health care delivery model of the time. Changes in these criteria have made many of the dimensions and space modules proposed in the Red Book obsolete. However, the basic concepts of integrating building services and using a systems approach for problem definition and solution in design and construction still remain valid.

Planning Modules

The conventional design process tends to concentrate on spatial and functional relationships with minimal consideration for structure and mechanical and electrical systems during preliminary and schematic design. This approach tends to result in specialized and unique designs for the service systems in each part of the building. The results are increased complexity in detailing and construction, and compromises in maintenance, future adaptability, and expansion.

To use the VAHBS, a designer needs to understand the following concepts:

- Service Modules
- Fire Compartments (Sections)
- Building Subsystems
  - Shell Systems
  - Service Systems and Subzones.

Service Modules

The Red Book proposes a systematic or modular approach to the design of new hospital buildings where building systems are integrated into the planning modules from the start of design. The basic building block is the service module. Service modules were defined as one story units of building volume with a footprint of approximately 10,000 square feet. More recent designs have used service modules in the range of 20,000 square feet. Each Service module is comprised of

- structural bays,
- a service zone, and
- functional zones or space modules (the occupied areas).

Each service module is completely contained, alone or with one or more other modules, in a fire compartment.

The building block concept can offer advantages in design, construction, operation and maintenance. Once established, the service module provides a means of manipulating overall building configuration with the assurance of subsystem capability and integrity.

Structural Bay: The structural bay is the basic unit of which all other modules are comprised. The dimensions of the structural bay are influenced by the functional layout (space planning), service zone clearances, and type of structural system selected. Refer to Section 3 Issues, Section 4 Application to New Projects and Appendix A for further discussion and examples of typical bay sizes.

A special variation of a structural bay is the service bay. This special bay contains the mechanical, electrical and telecommunications rooms that support a service module; and service shafts and risers (and may include exit stairs) necessary for vertical distribution of services. It is a part of the service zone [see below]. Major equipment items and all pumps and motors are contained in the service bay. In section, the service bay extends from structural floor to structural floor. The walk-on platform (interstitial deck) does not extend into or through the service bay.

Service Zone: A service zone includes a full height service bay (with independent mechanical, electrical, and telecommunications rooms) and an independent service distribution network that includes the interstitial zone above the functional zone.

Functional Zones and Space Modules: The functional zone is the occupied floor area within a service module. The Red Book defines space modules as variations of the service module designed for inpatient bed units. Space modules may be the same size or smaller than a service module, but in no case may be larger than a service module.

Fire Compartments (Sections)

When the term “fire section” is used in the Red Book, it should be replaced with “fire compartment” to be consistent with current Code terminology. A fire compartment is a unit of area enclosed by two-hour fire resistance rated construction on all sides from which there are at least two different exits. The size and number of fire compartments shall be as determined by current codes, VA criteria, and the overall fire protection strategy for the building.

A fire compartment may contain one or more service modules. The boundaries of the service module(s) should coincide with the boundaries of the fire compartment.

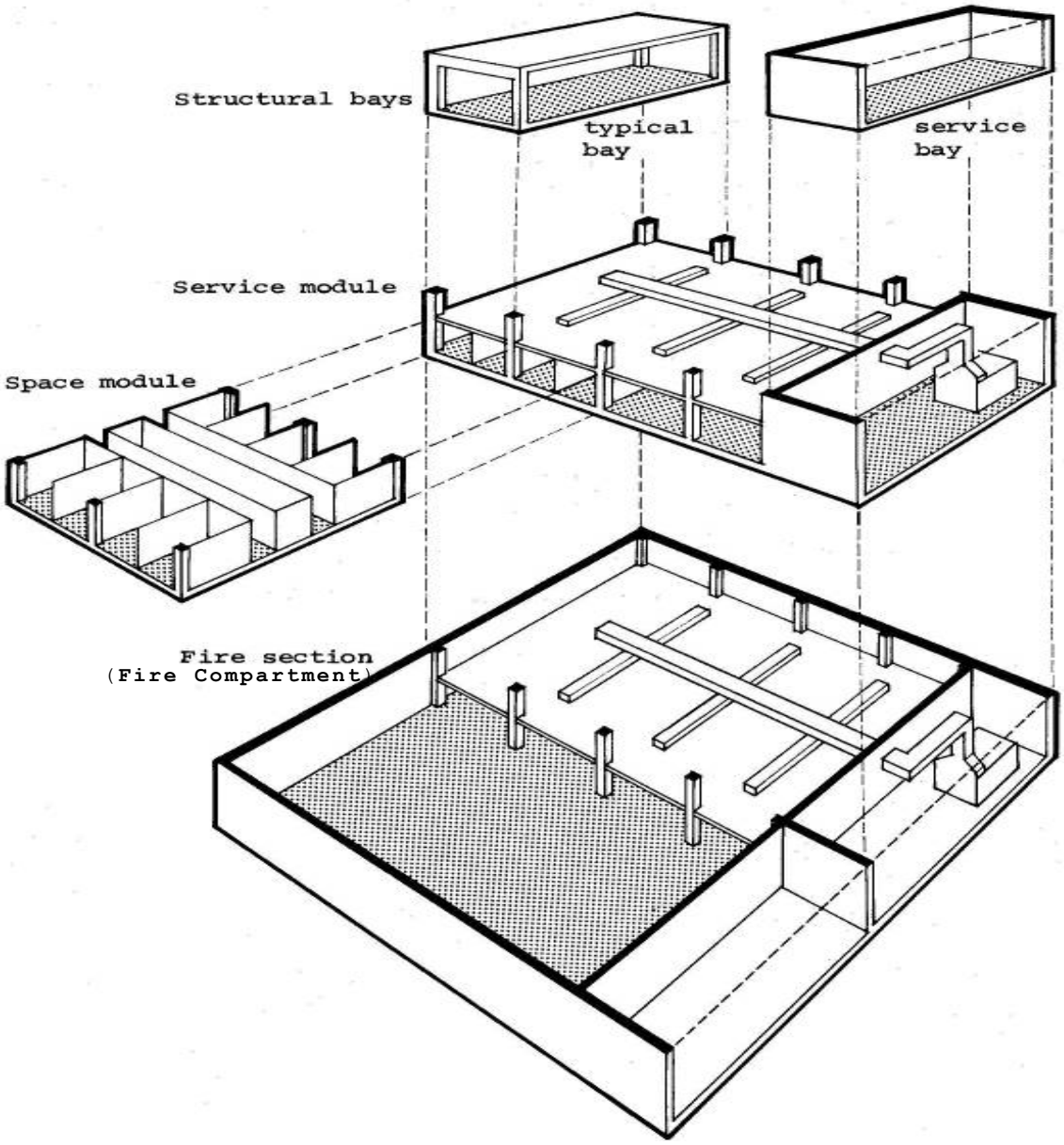


Figure 2-1 Service Module Concepts

Building Subsystems

The prototype system design includes six specific building subsystems that are referred to as integrated subsystems: structure, partitions, and walk-on platform (interstitial deck) are “shell” subsystems; HVAC, plumbing and electrical are “service” subsystems. Other subsystems such as foundations, exterior closure, roof, and conveying systems have been excluded and are referred to as non-integrated subsystems. Communications systems were originally considered non-integrated systems. The increases in the numbers and complexity of telephone/data and other “low-voltage” sub-systems warrant considering them as integrated service subsystems.

Shell Systems

Structural: The structural system may be steel frame or reinforced concrete frame. Selection would be based on engineering and economic analysis.

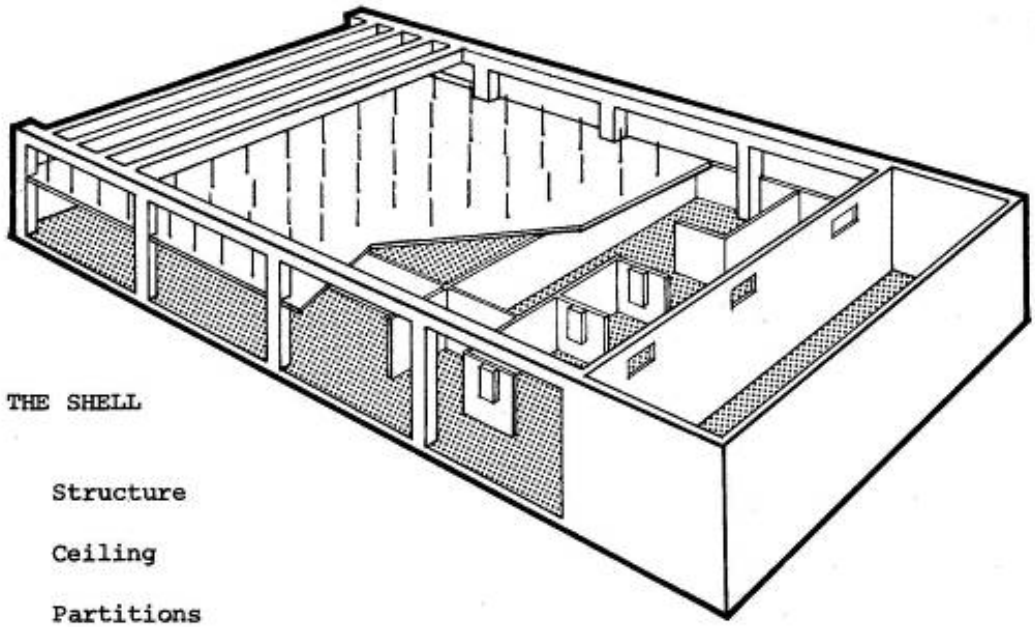
Partition: Partition subsystem is the generic term used in the Red Book for non-load bearing, vertical, interior construction used to subdivide or enclose portions of the building volume. Components must provide a wide range of performance in terms of impact resistance, finishes, fire and/or smoke resistance, acoustics, x-ray shielding, etc. In current practice, “partitions” with fire or smoke resistance ratings are called “fire barrier walls” or “smoke barriers” as defined in NFPA 101. Except as required for code compliance, construction will typically terminate underside of the platform. The Red Book envisioned that the final service runs in the functional zone would be installed outside, or on the surface of, the partitions. In current practice, vertical service drops to a room or area are to be concealed within the partitions. Horizontal distribution of services is to remain in the defined service zones.

Platform: The walk-on platform/ceiling subsystem has also evolved from the system originally described in the Red Book. The Red Book defined subzone S-6 as the ceiling: a combined walk-on platform or interstitial deck with surface applied finishes and fixtures on the underside (exposed to the functional zone). Current practice uses two subzones, S-6 and S-7. The S-6 subzone is the platform. The S-7 subzone includes the space below the platform and the suspended finish ceiling. Light fixtures are typically recessed in the finish ceiling. Refer to Section 4 Application to New Projects and Appendix C for examples of walk-on platform and ceiling construction.

Service Systems and Subzones

The service subsystems for each service module are located within the service zone, i.e., within the service bay and/or the horizontal portion of the service zone (interstitial space) above the functional zone. To many A/E’s the platform/ceiling subsystem and the interstitial space it creates are the most prominent features of the VAHBS. The platform allows for better organization of service distribution, improved access for maintenance or modification of services with reduced impacts to functional zones. The integration and coordination of building services are much more important to the successful application of the VAHBS.

The service zone is highly organized into reserved subzones for the various mechanical, plumbing, fire protection, electrical and tele/data services. The purposes of this “pre-coordination” are to provide clear channels for access and passage for all trades, to minimize crossovers and other conflicts, to assure reasonable space for future extensions and additions, and to permit positive location of all components. All services, except gravity drains, downfeed into the functional zone below.

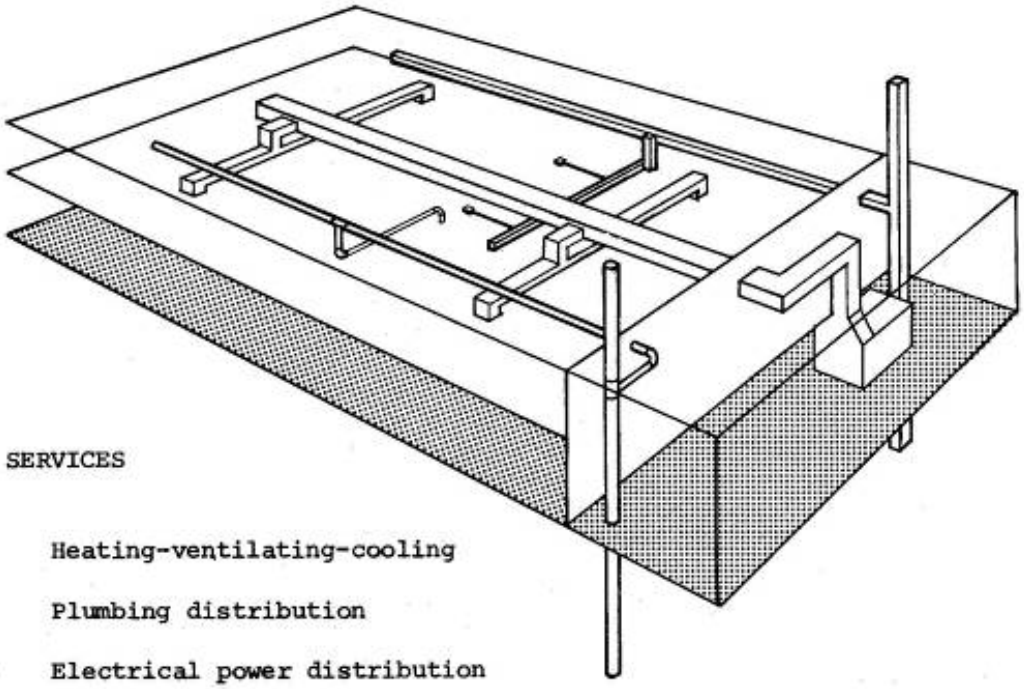


THE SHELL

Structure

Ceiling

Partitions



SERVICES

Heating-ventilating-cooling

Plumbing distribution

Electrical power distribution

Tele/data distribution

Fire Protection

(Sprinklers and Standpipes)

Figure 2-2 Building Subsystems

Service Zone: The service zone is organized into subzones and channels that define and organize the service runs. [Refer to details in Appendix C. Refer to Appendix A for examples in existing VAHBS hospitals.] Subzones are horizontal layers within the service zone. Main service distribution runs from the service bay are all parallel, each connecting to branches at right angles to the mains, and branches connecting, where required, to laterals at right angles to the branches within the defined subzones. Channels are plan divisions of the subzones and define reserved locations for particular services.

In order to preserve the rights-of-way for initial and future installation of service runs, no shortcut or point-to-point routing of services is permitted. This is extremely important.

S-1 Subzone—Floor Slab
This subzone equals the depth of the floor finish, topping slab and structural slab.

S-2 Subzone—Branch Distribution
This subzone contains the structural beams, pressure piping and gravity drainage and vents.

S-3 Subzone—Main Distribution
This is the major subzone and is reserved for main distribution of services through the length of the service zone. It is divided by service into channels. The depth will be governed by HVAC supply and return/exhaust ducts. Note that crossovers of main ducts are to occur in the Service Bay.

S-4 Subzone—Branch Distribution
This subzone contains mechanical and electrical branches and vents. It is divided by service into channels. Depth will be governed by HVAC branches.

S-5 Subzone—Lateral Distribution
This subzone takes the final service run to the location of the service drop into the functional zone below. Any projections from the walk-on platform construction will be parallel to the services at this level. Formal channels are usually not defined in this subzone.

S-6 Subzone—Platform
This subzone equals the overall depth of the walk-on platform (interstitial deck) construction.

S-7 Subzone—Ceiling
This subzone extends from the underside of the walk-on platform to the bottom of the suspended, finish ceiling. Limited lateral distribution may occur in this subzone such as offsets in service drops from the penetration through the walk-on deck to fixture or partition; fixtures and devices recessed in the finished ceiling; switch legs and whips for lighting fixtures; fire sprinkler; and non-integrated telecommunications conduit and cabling for public address, nurse call, CATV/MATV systems and fire alarm system.

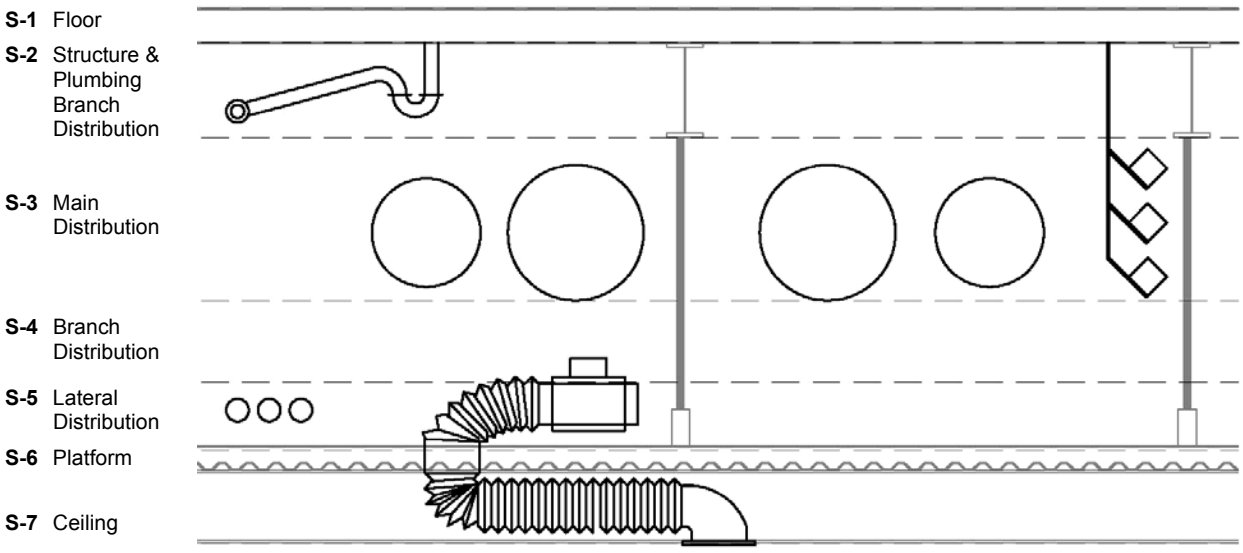


Figure 2-3 Typical Subzones

Hospitals Built Using VAHBS

The VAHBS has been used in new and replacement hospital projects in all areas of the country.

Example Medical Centers

Three representative Medical Centers were selected for review and inclusion as examples of the application of the VAHBS in this Supplement. They are identified as Medical Centers A, B, and C in the Appendix. The main hospital building at each medical center is a single structure of 929,000 to 1.5 million square feet. The number of stories, building geometries, structural bays and materials of construction vary in each building.

Project data for each of these hospital buildings, including typical plans and service zone strategies, are presented in Appendix A. Also included in Appendix A are summaries and analysis of interviews of the Facilities or Engineering Officers and Resident Engineers (if available) for the example medical centers regarding the effects of the VAHBS on the construction, maintenance, operation, remodeling and new construction for the buildings.

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