Just Go With It: Development Programming in a BIM/IWMS World

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The fifth edition of *“Problem Seeking: An Architectural Programming Primer”* describes an expanded role of today’s facility programmer as both analyst and information manager, and enabled with new technology to meet client expectations for cost effective, sustainable and integrated design solutions.

Definition of Programming

Facility Programming: A systematic process of inquiry, leading to a statement of requirements to be met by an architectural solution. The first task, then, is to program the requirements of a project, and who knows more about those requirements than the people who use a facility? The client's decisions have their biggest impact early in design process, and less impact as the project goes into construction. On the other hand, client indecisions cost money. The longer a client postpones a decision, the higher the cost to the project. Programming is a 5-step analysis and decision-making process:

1. **GOALS** — Where do you want to go?
2. **FACTS** — Where are you now?
3. **CONCEPTS** — How do you want to get there?
4. **NEEDS** — How much do you want to spend getting there?
5. **PROBLEM** — What do you have to do to get there?

It's important that we deal comprehensively with the whole design problem. The client user may be interested only in function; the client manager may be interested in economy and time; the designer may be interested in form. We cannot be single-minded. We need to be comprehensive in our outlook.

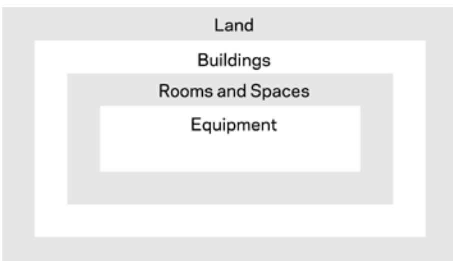
- **FUNCTION** People, Activities, Relationships
- **FORM** Site, Environment, Quality
- **ECONOMY** First Cost, Operating Cost, Life Cycle
- **TIME** Historical, Present, Future

The five steps and four considerations provide a framework for classifying project information. We organize and classify the information to establish order to the clients' vast world of information. The process analyzes volumes of information in the first three steps, and less in the fourth step since its space requirements and economic feasibility. And the fifth step is criteria for evaluating a design solution. This classification system produces an information index. We use this index to recall the knowledge developed on past projects. With today’s web technology, it is now possible to use links to sources of client and project type information, including building performance research and standards.

Data Management

Programming steps are alternately qualitative and quantitative. Goals, Concepts, and Problem Statement steps are qualitative. Facts and Needs steps are quantitative. Computer programs can help in the management and analysis of both quantitative and qualitative data. Using computer-based applications and building information modeling (BIM) is an integral part of today's programming process.

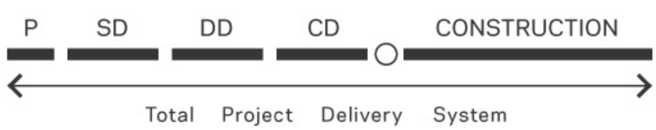
Building Information Life Cycle: The concept of a life cycle framework for facility management information was introduced by Douglas Sherman in the 1980's. Today, for the effective use of programmatic information, it is useful to consider the life cycle of building information and how that information is increasingly processed in a digital format. The programming process initiates the design and implementation phase of the life cycle.



Level of Detail: The building information requirements are fundamentally similar among individual organizations and vary principally in the level of detail. The major items of data common to all can be described in terms of entities. Entities address the level of detail found in the building information life cycle: Land parcels form sites that support facilities including buildings that house floors broken down into rooms and spaces, supported by fixed and moveable items of equipment.

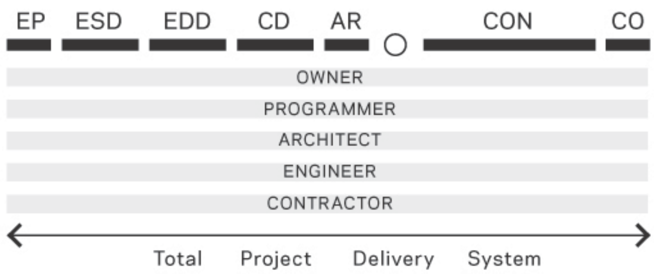
Project Delivery

Traditional Project Delivery System: A complete series of operations leading to the occupancy of a completed building: (1) programming (P), (2) schematic design (SD), (3) design development (DD), (4) construction documents (CD), (5) bidding, and (6) construction.



Integrated Project Delivery (IPD): A collaborative project delivery approach that integrates people, systems, business structures and practices into a process to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction. IPD principles are applicable to a variety of contractual arrangements. IPD teams are guided by principles of trust, transparent processes, effective collaboration, open information sharing, team success tied to project success, shared risk and reward, value-based decision making, and utilization of full technological capabilities and support.

IPD Phases: There are eight main sequential phases to the Integrated Project Delivery method: (1) conceptualization phase [expanded programming] EP, (2) criteria design phase [expanded schematic design] – ESD, (3) detailed design phase [expanded design development] – EDD, (4) implementation documents phase [construction documents] – CD, (5) agency review phase – AR, (6) buyout phase – O, (7)construction phase – CON, (8) closeout phase – CO.



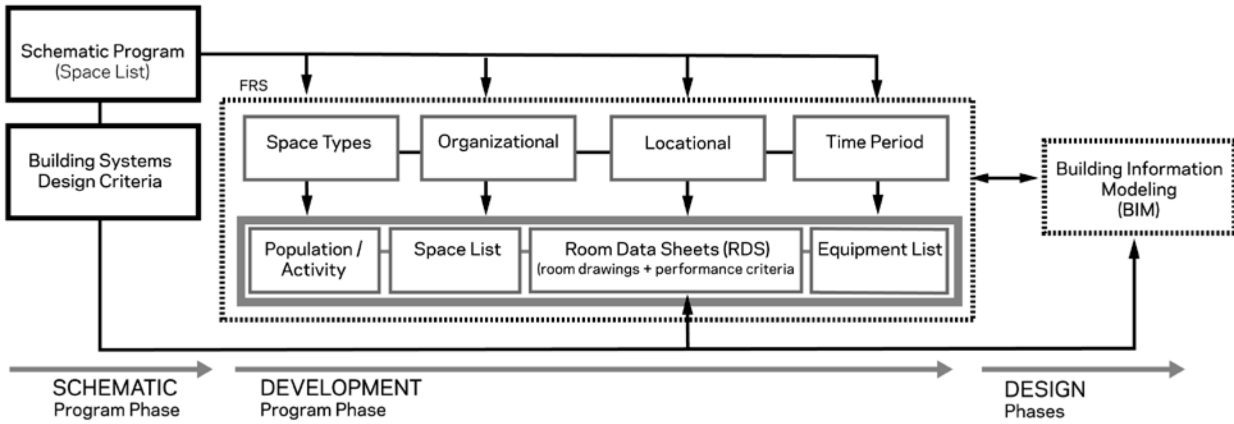
IPD Enabling Technologies: The IPD method leverages the early contributions of project participant's knowledge and expertise through utilization of information technologies. These allow team members to collaborate effectively while expanding the value they provide throughout the building information lifecycle. Most IPD projects are BIM based. The current trend is to integrate programmatic information into BIM models early in the design process. This enables designs to be audited against program requirements, giving clients an earlier voice in how a design progresses. The model now has room data attached to spaces and more detailed material and building system specifications. Starting with the programming information, completed models are now bringing forward the history of the building's design evolution that can be maintained through construction, commissioning and building operation.

Development Programming Database

The Facility Requirement System (FRS): A web-based relational database system used to collect, process, and manage design requirements. This application is primarily used for development programming and supports complex projects by allowing multi-office data entry, manipulation, and retrieval of building data and reporting that includes floor plan based room equipment configurations. The intent is for project participants to have access to up-to-date program related information for a given project. FRS accommodates needs for several user types, from programmer to designer, engineer and planner, third-party consultant, client, and contractors. Key for successful project execution is integrity of data. BIM integration increases planning and design accuracy. Standard report format is a key productivity feature for the general user of FRS, although the application also accommodates custom queries and reports. The following are features of FRS that apply to development programming:

Space Tool: Establishes space types organized into space categories and sub categories, allowing adjustment of characteristics from global to individual levels. Space types are compiled into space lists and assigned to locations (city / campus / building / floor), linked with organizational groups (enterprise / division / department).

Room Data Sheets (RDS): Are the means and method to define the "inside" of a space, addressing architectural material and engineering requirements, furniture layouts (uploading drawings), and relevant equipment. This feature establishes space standards and design criteria for all space types. Through its web based data structure and role based logins, in-house and third party consultants can enter data for each assigned room data sheet based on their discipline without duplicating work. RDSs link directly to space types and enable the design team to obtain global space characteristics for design consideration. This feature allows client review and sign-off on space characteristics earlier in the process.



The FRS Process

Equipment: A library of lab or medical equipment, including specifications, installation requirements, engineering, space requirements and unit costs. The FRS generates an inventory of equipment per room, based on the input of lab planners or researchers. This listing is linked to the construction documentation and becomes part of the laboratory design packages and enables lab equipment procurement packages.

FF&E: The Fixtures, Furniture and Equipment module provides a library of furniture items and related specifications. When linked with BIM the feature automatically counts instances of furniture items. This allows the application to produce accurate specification packages based on the furniture items selected by the design team and an exact count of items for use in procurement.

Data Reporting: This feature provides standard and customizable reports, depending on each project team's preferences. While the reports vary, the source data remains current.

Space Audit: For large and complex buildings, this feature compares the designed spaces to an initial program or baseline space list. As a project moves through the design and approval phases, the initial space list contained in the schematic program is amended. Through a BIM connection, the space audit feature compares the designed space list with the program space list. It produces a room by room audit, and generates Space Discrepancy Reports that are sorted in various ways, such as by department, floor or building. This enables the design team to provide documentation support for area changes and facilitates client approval of design revisions.

Building Information Modeling

Building Information Modeling (BIM) is a technology used by teams to create 3-dimensional designs of buildings. The BIM process integrates programmatic information with data supporting design decisions by architects, engineers, consultants and constructors during design and implementation of design in the construction, commissioning and occupancy process. It is conceivable that BIM can be used to manage a great deal of data during the design and construction portion of the building information lifecycle.

BIM Software: Digital, three-dimensional model of a building linked to a database of project information. Typically it uses three-dimensional, real-time, parametric modeling software to increase productivity in building design and construction. The process produces the building information model, which encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components.

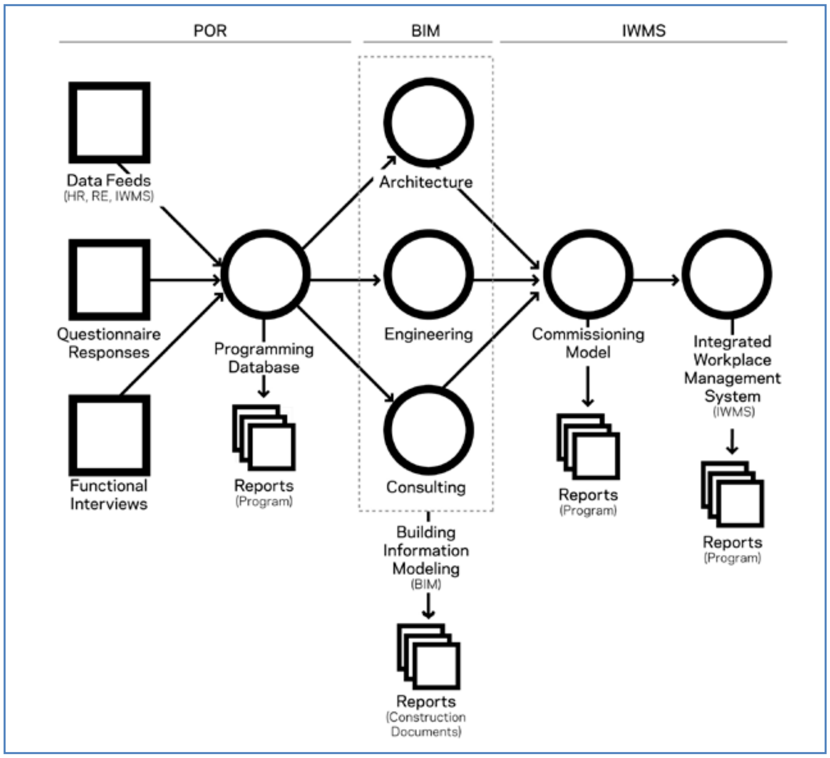
BIM Process: Begins with capturing the program of requirements for each phase of design. BIM is one of the most powerful tools supporting IPD because it can combine, among other things, the design, fabrication information, erection instructions, and project management logistics in one information system. It provides a platform for collaboration throughout the design, construction and commissioning process. Because the information model and database is useful for the life of a building, the owner may use BIM to manage the facility well beyond completion of construction for such purposes as space planning, furnishing, monitoring long term energy performance, maintenance, and remodeling.

The POR–BIM–IWMS Link

The building information life cycle begins with the program of requirements (POR) and the detailed information that supports it to feed the design process. To work effectively, this process must respect the information developed through the entire building design, construction, commissioning, and occupancy process, making for a fluid progression from step one of the building information life cycle. Building Information Modeling (BIM) is an object based application for designing built environments. Objects can be, among other things, walls, elements of roof systems, chairs, or fixed building assets. The objects are supported by data that not only define its three-dimensional shape, but also its characteristics. When assembled, the objects identify a built environment, supported by a database, which can then report out quantities of materials as well as contribute to assessing the behavior of assembled objects, such as lighting and energy studies, structural analysis, or even blast resistance.

As the program matures from schematic through development, data describing object characteristics matures by aggregating additional information, either within the program database or through linkage to other data sources. For example, a room, loosely described as a space in the schematic program space list, becomes a well-defined object with affinities to other room objects and “contains” data-driven objects. Data-driven objects, such as furniture, may be linked to a manufacturer’s database identifying materials, light reflectivity, and fire load values, and even a production schedule and address for delivery. The power of a building information model, when linked with a POR database, is realized by this level of data linkage or interconnectivity. Programming adds information richness to BIM functionality, particularly by adding capabilities/functionalities such as “Time” and “Phasing”, linking the client to a design in an auditable way.

In an idealized programming process, data to support a design phase is received from human resource (HR), accounting (AC), and integrated workplace management system (IWMS) databases. As noted above, the information would reside in tables that conform to the donor source by mapping live data feeds from the original source file to the file supporting the programming process. A ‘slice’ of information would be used to frame the program - departments identified to occupy the space, their interrelationships, space standards, buildings they currently occupy, or their cost of occupancy. By discovering what is known, the search for the unknown can begin. The programmer uses questionnaires that, when possible, are prepopulated from existing data, emailed and responded to by clients in a web environment that is tied to the programming database. The programmer uses the database to identify missing information, and set the basis for user interviews. The programmer uses the interview results to update the database.



The POR-BIM-IWMS Link

Once the programming application is populated, the project team can access reports that support identified roles—programmer verification, client approval, design input, and improved data integrity. The designers can manipulate the information to proceed through the building design process. A link between the BIM and programming database allows for auditing between the program and design to assure compliance. The project team can report changes to programming requirements—tracked by the database. This provides a tracking tool to document scope changes. As the schematic program progresses through development, the project team adds information to both the program and linked BIM so that one supports the other through design. As the constructor adds or changes building assets and modifies the BIM to capture changes made during construction, the model becomes the basis for building commissioning. From there, data is fed into an IWMS application to maintain and operate the building. The BIM is then linked to the IWMS for space analysis, systems analysis, and system/asset troubleshooting during operation.

Conclusion

The advancement of technology enables new techniques for project delivery, team communication and information management. These developments are extending the role of programmer and facility planner as a facilitator, analyst and documenter to an ongoing project function of information management, especially in regards to maintaining and refining client requirements; and ultimately incorporating that information into an integrated workplace management system for use over the life cycle of a facility.