Functional Programming

[Prepared by Justin Saly, MRAIC; Edited by Alberta Association of Architects]

The following information is supplemental to the information provided in section 2.3.4 in the Canadian Handbook of Practice for Architects.

What is Functional Programming

Functional programming can be described as the decision-making process that clearly defines the problem and scope of work for design. Functional Programs are also referred to as design briefs, facilities programs, architectural programs, space programs, space need analysis, owner's statement of requirements and output specifications in the case of P3 (Public, Private Partnerships).

A functional program, based on the Canadian Handbook of Practice for Architects, describes the requirements which a building must satisfy in order to support and enhance human activities. The programming process seeks to answer the following questions:

- What is the nature and scope of the problem?
- What information is required to develop a proper architectural solution to the problem?
- How much and what type of space is needed?
- What space will be needed in the future to continue to operate efficiently?

A functional program defines the character, services, scope, functions and space requirements in sufficient detail for subsequent design or approvals.

Why Prepare a Functional Program?

The purpose of a functional program is to provide the client and architectural design team with a clear understanding of the activities to be accommodated and the functional criteria to be achieved in the design of new facilities. In addition, functional programs are used by the client or owner to evaluate potential design solutions or alternatives during the design process.

Many approving and funding authorities require a functional program to provide them with a detailed description of the project and facility needs. The functional program can also be used to establish and evaluate capital, operating and project budgets prior to design stages.

How is a functional program prepared?

The Canadian Handbook of Practice for Architects identifies the following for the preparation of a functional program.

> The architect's main task is to examine the client's world in detail so as to define the client's need and objectives. These requirements will establish criteria for evaluating potential design solutions or other strategic alternatives. The architect must understand:
>
> - The impacts of a building occupants and processes in the built environment;
> - The social impacts of its program on the community;
> - The planning impacts of its functions on the local infrastructure.
>
> To prepare a functional program, architects should identify research and observe:
>
> - The users of the proposed building and their work activities, including:
> - Function-by-function, room-by-room, or department-by-department activity plans;
> - Staffing plans;

    - Equipment and storage requirements;
- The volume of activity planned for specific facility components, such as:
    - Throughput (amount of material put through a manufacturing process); flow patterns.

With this information, the architect can then develop approximate floor areas and technical requirements for the proposed facility, including:

- details of the space requirements to accommodate staff, equipment, and activities
- special furniture configurations;
- environmental criteria

Functional programs are future-oriented. A functional program specifies requirements for projected needs. As a result, projected space requirements may be based on the expected future levels of activities for the services.

A functional program is generally created through the following activities:

- describe the client's philosophy, vision and goals
- describe the services that are to be provided by the new facility
- identify how the services will be delivered and/or operational characteristics
- identify activities, workload, throughput and other measurements that may have an impact on space
- identify the number of people and/or staff required to provide the services and all other occupants
- identify major equipment used in the provision of services
- identify relationships between spaces or groups of spaces
- prepare detailed space requirements

In addition, a functional program may include the following activities:

- determine overall project implementation schedule
- prepare preliminary financial information and budgets
- identify project delivery method
- site evaluation and/or determination

Net and Gross Areas

Careful attention must be paid to identifying space requirements and understanding the space areas. Space is often identified as either net floor area and/or gross floor area.

Net floor area is defined as the space measured within the inside face of walls or enclosure of the space. For example, a 3m x 4m office would be the interior dimensions of the office from the interior face of the walls. In determining space requirements for specific functions, net floor area is used to describe the area required to accommodate the function or purpose. Net area may also be referred to as net square metres, net assignable square metres, or assignable square metres. In the prior example, the 3m x 4m office is 12 net square metres.

A space program may include a tabulated list of space requirements in net square metres. The sum total of the net area is the *total* net assignable area. This total net assignable area is not, however, the total gross area of the building. In determining net floor area requirements, spaces such as corridors, stairs, partitions, exterior walls, mechanical rooms, electrical and telecommunications rooms are not typically included within the tabulation of net areas.

Gross area is defined as the total area of the building. It includes all the net floor area, along with the floor area occupied by corridors, walls, columns, structure, exterior wall thickness, mechanical spaces, electrical and telecommunication rooms, stairs, vestibules, elevators, shafts and other service spaces, and all other areas of a building.

For a new building, in which design has not been undertaken, gross floor area is typically estimated as a multiplier applied to the net floor area. The multiplier is typically called a grossing factor. The grossing factor will vary depending on the building type and use, size, number of spaces, and various other factors. A one storey small warehouse building will have a very low grossing factor in the range of 1.1 to 1.25 depending on number and size of spaces and mechanical servicing. Schools and office buildings may range from approximately 1.4 to 1.6. Hospitals, laboratory building and other specialized facilities that typically have wider public corridors and intensive mechanical systems requiring larger service rooms may have net to building grossing factors over 1.8. Some clients will have prescribed targets for grossing factors. It is important to understand the assumptions in determining their prescribed grossing factors.

Some functional programs for complex facility types such as academic buildings, hospitals, and larger public buildings may be subdivided by departments or subgroupings of co-located spaces. These subgroupings are sometimes called components or functional units. These subgroupings can be assigned a departmental, or component, grossing factors. For example, the administrative department for a school clustered in one location, may be assigned a component grossing factor of 1.30. This factor includes all the floor area occupied by departmental corridors, the walls, interior structure, mechanical shafts within the administrative area, but excludes the main public corridors beyond the administrative area.

A component to building gross factor is applied to the sum of all component gross area to arrive at a building gross floor area.

The following table identifies component grossing factors for various departments within a hospital use by the Ministry of Alberta Health and Wellness. Inpatient units, for example, requiring wide corridors for movement of patients in beds and stretchers have a 1.50 component grossing factor in the Table 1.

Table 1: Component Grossing Factor Applied to Net Areas by Component (Department)
(source: Health Capital Planning Manual, 3rd Edition, Revised April 2005, Alberta Health and Wellness)

FUNCTIONAL COMPONENT	GROSSING FACTOR	FUNCTIONAL COMPONENT	GROSSING FACTOR
Ambulatory Care Areas	1.40	Administration Services	1.30
Cardiology Services	1.30	Ambulance Garage	1.25
Day Medicine	1.35	Auxiliary/Volunteers	1.25
Day Surgery	1.40	Education & Training	1.30
Diagnostic Imaging	1.50	Facilities Maintenance	1.20
Electrodiagnostic Services	1.30	Food Services	1.20
Emergency Department	1.50	Housekeeping	1.20
Gymnasium	1.15	Information Technology	1.20
Hemodialysis	1.40	Laundry & Linen Services	1.10
Inpatient Unit – Bedroom Areas	1.50	Materiel Management	1.15
Inpatient Unit – Support Areas	1.30	Pastoral Care	1.20
Intensive Care Units (Adult)	1.60	Pharmacy	1.25
Intensive Care Unit (Neonatal)	1.50	Recreation Therapy	1.30
Laboratory (Open Design)	1.30	Research - Lab	1.25
Laboratory (Compartmentalized)	1.40	Research - Support	1.30
Labour & Delivery Suite	1.50	Security	1.20
Pulmonary Function Lab	1.30	Social Services	1.25
Rehabilitation Medicine	1.30	Staff Facilities	1.15
Respiratory Therapy	1.30	Medical Records	1.30
Surgical Suite	1.45	Public Areas	1.15

(Special note to Table 1: The table above is provided as an example only. Grossing factors used in functional programming may vary between jurisdictions and agencies and it is important to understand the assumptions underlying the proposed grossing factors. Grossing factors may also be amended and updated by periodically based on factors that influencing building area (e.g. building code, accessibility, guidelines and standards prescribe by clients and agencies, new technologies, assessments from built projects, etc.))

Various organizations may have their own methods and definitions of space and area. The Building Owners and Managers Association (BOMA), Canadian Standards Association (CSA), Society of Industrial and Office Realtors (SOIR), and American National Standards Institute Inc. (ANSI) have developed standards for measurement of space in existing and new building. Special attention must be given to definitions of area by various organizations.

Evaluating a Functional Program

Prior to initiating design, an architect should be able to evaluate a functional program to determine its adequacy to commence design. A functional program may not always provide significant detail in all aspects of an owners need, but there are some key elements that can be reviewed prior to design. These include the following:

Does the functional program identify the client's philosophy, values, goals and services?

This provides the foundation for the purpose of the proposed facility.

Does the functional program identify the relationships between spaces?

The functional program should provide direction on how spaces need to relate to each other. This may include specific adjacencies between spaces, groupings of space, co-location or zoning. This may be provided in written descriptions, tables or diagrams.

Is there a reasonable correlation between the activity and/or occupancy of the proposed facility and the space identified in the functional program?

The functional program should clearly identify how the activities and/or occupancy of the facility is translated into the specific space requirements, or at minimum, provide the assumptions for the basis of the space requirements. Verification can include, for example, review of staffing of the proposed facility and corresponding space allocated to staff in the space list; workload indicators such as throughput or other metrics that can be used to translate into numbers and/or sizes of spaces.

Do capital budget estimates correspond with space requirements?

The capital budgets should be based on the *gross* floor area of the proposed facility, or at least provide explanations on the translation of net to gross floor areas within the costing, to ensure the capital budgets reflect the gross building costs.

Can the proposed facility be accommodated on a proposed site?

A functional program may be completed for a facility with a predetermined site. In other situations, a functional program may be prepared to determine the overall space requirements to assess potential sites for the required facility. In both cases, the functional program must fit on the site with all associated site requirements in order for the project to be feasible.

Principles of Sustainable Development within an Architectural Program

Sustainable development should be a goal throughout all phases of a project. The functional programming stage provides opportunities to identify sustainable development principles. These

principles may be initiatives of the owner, or they may be developed through the development of the functional program. Not all sustainable development principles will affect the architectural program. Some sustainable development considerations affect design, contract documents or construction phases. Sustainable development principles that affect the architectural program may be as follows:

Siting, building form and/or orientation of the building

Prescribed siting, building form, and/or orientation can potentially influence footprint and floor plate sizes, building grossing factors, volumetric characterizations, cost estimate and building services. In addition, site servicing and building impacts such as storm water management can also influence overall functional program development.

Energy Performance

Prescribed energy performance targets can influence mechanical, electrical and building envelop systems. As a result, gross floor area may be altered by mechanical space requirements and adjusted cost estimates.

Operational Systems

Operational systems in a functional program describe how program services will be provided. For example, decisions to pursue alternative forms of transportation, may have an impact on parking requirements, building storage or building occupant amenities (e.g. provision of shower and change facilities), and will affect an architectural program.

Space and Use Parameters

Assumptions such as flexible or adaptable interior environments, increasing utilization of space to accommodate more occupants, throughput and or activities may result in overall reductions in space requirements, or the ability to provide more services within a projected amount of space.

Some criteria to use to determine if a sustainable development principle influences the architectural program include:

- Will the sustainable development principle have a moderate to significant cost implication?
- Will the sustainable development principle impact space requirements?
- Will the sustainable development principle impact site requirements or site design?
- Will the sustainable development principle impact building geometry, configuration, footprint and/or orientation?