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Requirements Composer

User's Manual

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October 2004

Facility Composer Suite

Requirements Composer

on target for
building excellence

Suite of Criteria/Requirements-Based Design Tools

ERDC / CERL <http://bc.cecer.army.mil/>

Requirements Composer: User's Manual

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Final Report

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ABSTRACT: Facility Composer is a suite of tools for use by facility planners, designers, and engineers during the initial phases of facility planning and design. In Facility Composer, customer-specific and computable criteria are associated with a growing facility model that continues throughout the life cycle of the facility. Facility Composer's ability to maintain a linkage between criteria and project elements (site, building, story, etc.) is beneficial in that it: (1) helps in defining criteria and recording their rationale; (2) helps ensure that critical criteria are followed, and that desired characteristics are recorded and addressed; (3) helps organize criteria and makes them available at their point of use; and (4) simplifies creation, maintenance, and distribution of new criteria. This work has developed user documentation for the Requirements Composer application, to help users develop corporate and building specific criteria libraries.

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Conversion Factors

Non-SI* units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
acres	4,046.873	square meters
cubic feet	0.02831685	cubic meters
cubic inches	0.00001638706	cubic meters
degrees (angle)	0.01745329	radians
degrees Fahrenheit	$(5/9) \times (^\circ\text{F} - 32)$	degrees Celsius
degrees Fahrenheit	$(5/9) \times (^\circ\text{F} - 32) + 273.15$	kelvins
feet	0.3048	meters
gallons (U.S. liquid)	0.003785412	cubic meters
horsepower (550 ft-lb force per second)	745.6999	watts
inches	0.0254	meters
kips per square foot	47.88026	kilopascals
kips per square inch	6.894757	megapascals
miles (U.S. statute)	1.609347	kilometers
pounds (force)	4.448222	newtons
pounds (force) per square inch	0.006894757	megapascals
pounds (mass)	0.4535924	kilograms
square feet	0.09290304	square meters
square miles	2,589,998	square meters
tons (force)	8,896.443	newtons
tons (2,000 pounds, mass)	907.1847	kilograms
yards	0.9144	meters

* *Système International d'Unités* ("International System of Measurement"), commonly known as the "metric system."

Preface

This study was conducted for Headquarters, U.S. Army Corps of Engineers (HQUSACE) under project 622784AT41, “Military Facilities Engineering Technologies (6.2 Exploratory Development),” Work Unit LK6K75-N, “Fort Future Facilities.” The technical monitors were Paul A. Howdyshell, CEERD-CF-M and Michael P. Case, CEERD-CF-N, Special Projects Officer for Fort Future.

The work was performed by the Engineering Processes Branch (CF-N) of the Facilities Division (CF), Construction Engineering Research Laboratory (CERL). The CERL Project Manager was Beth A. Brucker. Recognition is due to Jeff Heckel, Wayne Smith, Russ Northrup, William Zwicky, and Van Woods for their contribution to the development of the Facility Composer Suite of Tools. Also special recognition is due to Matthew R. Geaman and Ronnie B. Pride, Research Assistants from the University of Illinois, for contribution to this document. The technical editor was William J. Wolfe, Information Technology Laboratory. Donald K. Hicks is Chief, CEERD-CF-N, and L. Michael Golish is Chief, CEERD-CF. The associated Technical Director was Paul A. Howdyshell, CEERD-CF-M. The Director of CERL is Dr. Alan W. Moore.

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1 Introduction

Background

Description of Facility Composer

Facility Composer is a suite of tools for use by facility planners, designers, and engineers during the initial phases of facility planning and design. While originally developed to support the design of government facilities, *Facility Composer* is based on the general concepts of: (1) providing a method to effectively and creatively create and use criteria libraries, (2) providing support for architectural programming and project specific criteria specification during interactive design charrettes or at the designer's desktop, and (3) supporting the creative and analytical aspects of architectural conceptual design involving the creation of one or many solutions from the specified criteria in an intuitive design environment.

Although *Facility Composer* does not enforce any particular design process, the program is designed to support the process flow shown in Figure 1.

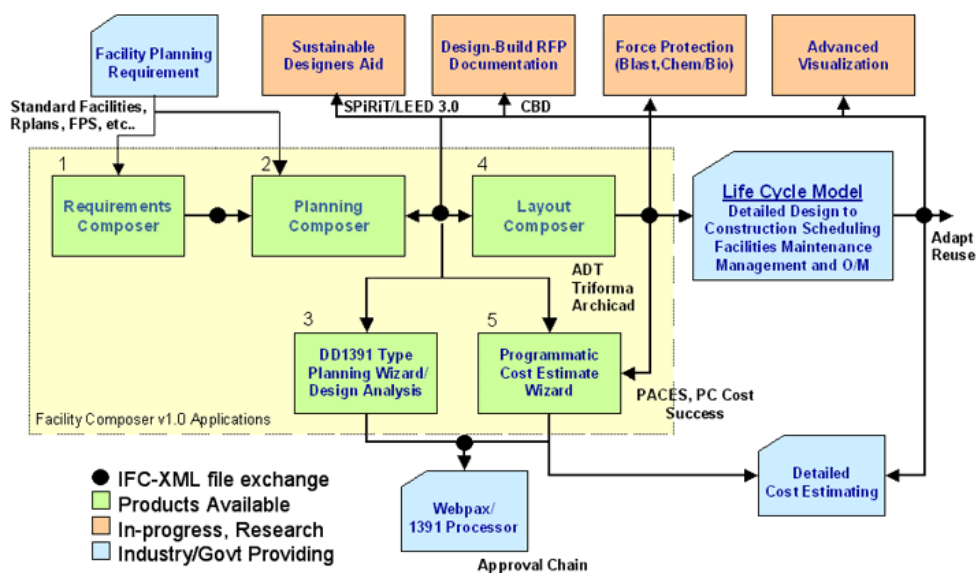


Figure 1. Facility Composer data flow.

The most important concept of *Facility Composer* is that **customer-specific and computable criteria are** associated with a growing facility model that continues throughout the life cycle of the facility. While many volumes of government design criteria exist in the form of design guides, regulations, technical manuals, and web pages, few, if any, of these are expressed in a computable format. In addition, current design systems do not provide a way to directly interact with these criteria, nor do they provide an efficient way to extend the functionality of an application to directly support criteria usage. With the evolution of facility modeling standards, these restrictions will be overcome by emerging design systems.

In *Facility Composer*, criteria can be associated with different project elements based on the appropriate level of detail, from the **project** to the **site**, the **building**, **story**, **function**, and down to the individual **space**. For example, *Facility Composer* allows one to specify that a target schedule and cost be associated with a project, that masonry exterior walls and a steel structure be used on a building, that 32-Watt T-8 florescent lights be used in corridors and 50 foot-candles be maintained in the offices, and that a particular room will have VCT flooring. *Facility Composer's* ability to maintain a linkage between criteria and project elements (site, building, story, etc.) provides many benefits:

- It helps in defining criteria and can help in recording their rationale.
- It helps ensure that critical criteria are followed, and that desired characteristics are recorded and addressed.
- It helps organize criteria and makes them available at its point of use.
- It simplifies creation, maintenance, and distribution of new criteria. For example, as requirements that better implement sustainable design principles are developed, these are added to an organization's standard library for use in subsequent projects. These libraries are typically organized around facility type, but are not required to be.

Facility Composer helps support rapid conceptual and detailed design & analysis (cost, structural, HVAC, energy, electrical, O&M, etc.) either directly or through standards, such as the [International Alliance for Interoperability's Industry Foundation Classes \(IAI-IFC\)](#) and [Building Lifecycle Interoperable Software \(BLIS\)](#).

Owners with numerous facility holdings, in particular, reap benefits from this approach as it helps ensure the initial design satisfies their corporate criteria, shortening the review process and avoiding "design by review." All of these benefits result in cost and time savings by reducing user changes late in the design process or during construction. Design quality is also enhanced, as many alternatives can be explored rapidly.

Facility Composer Tools

The primary tools in the *Facility Composer* application suite include:

- ***Requirements Composer***, a web-based application that helps in the development of corporate and building specific criteria libraries
- ***Planning Composer***, which helps users create an architectural program and to set values for project specific criteria
- ***Layout Composer***, which provides an environment for the designer/user to rapidly create 2D and 3D conceptual facility designs solutions
- ***Wizards*** that provide support for various discipline specific issues and assist in the completion of individual design tasks and calculations.

Objective

The overall objective of this project is to develop and field the *Facility Composer* software suite. The objective of this specific part of the project was to develop user documentation for the *Requirements Composer* application, to help users develop corporate and building specific criteria libraries.

Approach

Researchers investigated how criteria can be associated with different project elements based on the appropriate level of detail, from the project to the site, the building, story, function, and down to the individual space. *Requirements Composer* was programmed to enable customers to create and customize libraries of architectural functions and criteria from which the architectural program is developed. Steps were outlined to familiarize users with the automated process of adding new architectural functions, updating criteria, and notifying interested parties so that the *Requirements Composer* can then export the criteria library in an XML-based format for use by Planning Composer and Layout Composer.

Mode of Technology Transfer

This report will be made accessible through the World Wide Web (WWW), as a laboratory publication through the CERL website, at URL:

<http://www.cecer.army.mil>

and directly to users through the *Facility Composer* website, at URL:

<https://ff.cecer.army.mil/fc>

2 Requirements Composer

Facility Composer relies on a customer-specific library of architectural functions and criteria from which the architectural program is developed. Each customer will be able to create and customize these libraries using the web-enabled *Requirements Composer* application. Those authorized use this tool to add new architectural functions, update their criteria, and notify interested parties. *Requirements Composer* will then export the criteria library in an XML-based format for use by Planning Composer and Layout Composer.

Creating a New Library

This chapter presents a few practice exercises designed to demonstrate key features of *Requirements Composer* and also to demonstrate how *Requirements Composer* can be used at the beginning stages of the planning process.

In an open web browser, type <https://ff.cecer.army.mil/fc/rc.jsp> in the address bar.

Result: The *Requirements Composer* Home page loads (Figure 2).

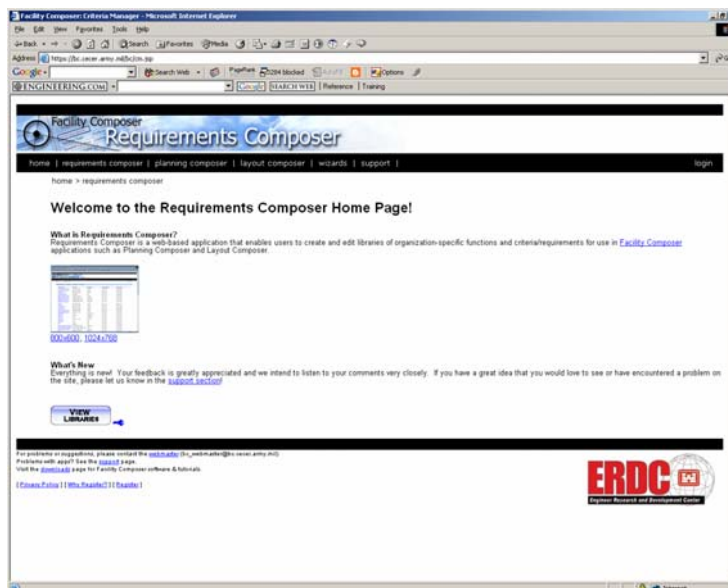



Figure 2. *Requirements Composer* home page.

Click the  button on the *Requirements Composer* Home Page.

Once the Login page loads (Figure 3), input your Username and Password then click the  button

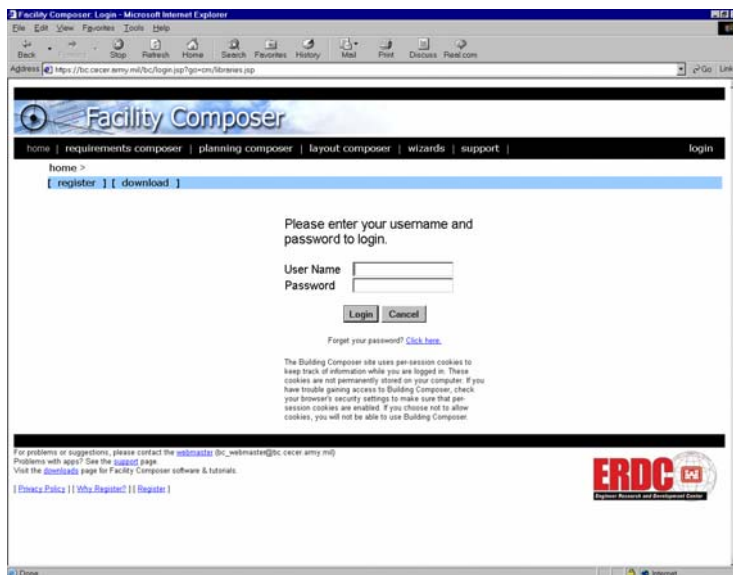


Figure 3. *Requirements Composer* login page.

Result: The *Requirements Composer* Library list page loads (Figure 4).

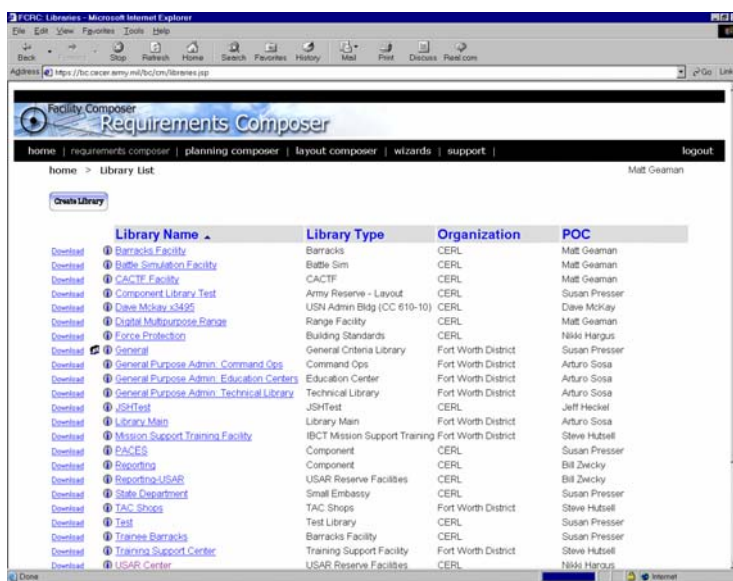

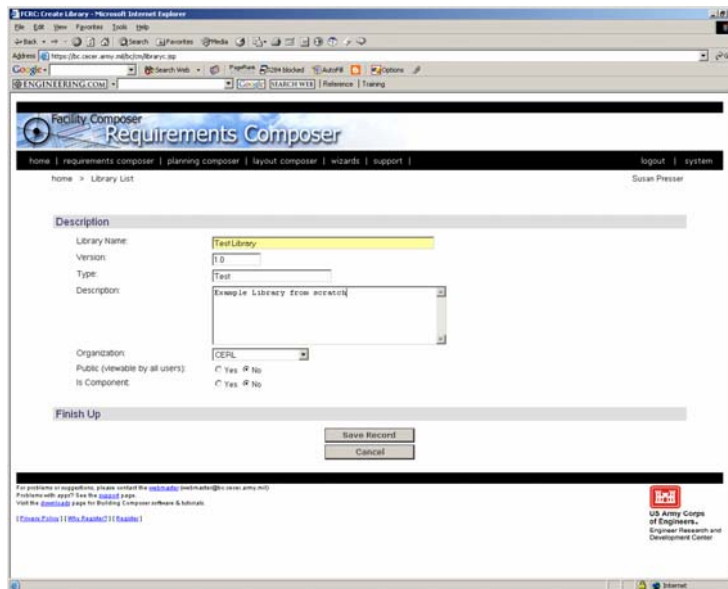


Figure 4. *Requirements Composer* library list.

Creating a New Library

To create a new library containing no information click on the  button

Result: Create library page loads (Figure 5).




The screenshot shows a web browser window titled "FCRC: Create Library - Microsoft Internet Explorer". The address bar shows "http://csrc.army.mil/requirements". The page header includes "Facility Composer Requirements Composer" and navigation links like "home", "requirements composer", "planning composer", "layout composer", " wizards", and "support". The main content area is titled "Library List" and contains a form for creating a new library. The form fields are: "Library Name" (with "TestLibrary" entered and highlighted in yellow), "Version" (with "1.0" entered), "Type" (with "Test" entered), "Description" (with "Example Library from creation" entered), "Organization" (a dropdown menu with "CERL" selected), "Public (viewable by all users)" (with "No" selected), and "Is Component" (with "No" selected). At the bottom of the form are "Save Record" and "Cancel" buttons. A footer section contains contact information for the US Army Corps of Engineers, Engineer Research and Development Center.

Figure 5. “Create Library” page.


Enter a unique name for the library, the version number, the type of library and a description. Under the **Organization** pull-down, select which organization that this library will be associated with.

If the “No” radio button next to **Public** attribute is selected, this library may only be viewed by the creating organization. If the library needs to be viewed by all, select the “Yes” radio button.

Note: Currently the “**Is Component**” functionality is not fully implemented. Once the implementation is complete, a description of this will be included in a subsequent User’s Manual.

Once all information is entered select the  button at the bottom of the page.

Creating a Library from an Existing Library

Find the **General Library** in the Library Name list and click the  button next to it.

Result: The General Library Description page loads (Figure 6).

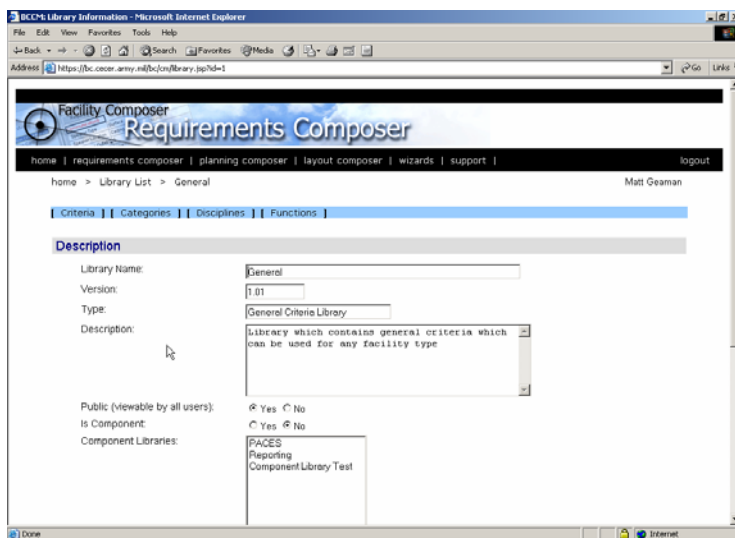


Figure 6. “General Library” description page.

In the **Library Name** box, input a new name for your library. (This example uses “Test Library” as the library name.”


Scroll down to the bottom of the General Library Description page and click on the **Save As New** button. This will save contents of the General Library to a new library titled “Test Library.” This allows you to customize the existing criteria in the General Library for this project without affecting the contents of the original library.

At the top of the page click on **Library List** to return to the Library List page. On the Library List page click on the newly created **Test Library**. You will notice that Test Library contains all of the Criteria, Categories, Disciplines, and Functions that were included in the General Library.

Criteria

Adding Criteria to a Library

On the Library List page, click on **Test Library** that you just created.

A blue rectangular button with rounded corners and a slight 3D effect, containing the text "Create Criteria" in a white, sans-serif font.

At the top of the page, click on **Create Criterion button**.

The following steps will create a new Criterion for the various general illumination fixture types desired in the building.

In the name box for the new criterion, input “General Illumination Fixture Type.” Also, enter a description of the criterion in the Description input box to give a more detailed explanation of the criterion.

At this point, you must associate the new Criterion with a specific Discipline and Category.

The Discipline and Category headings are used to further classify each individual Criterion. The Discipline heading is used to define different specialty trades such as: architecture, electrical, mechanical, etc. The Categories are used to break each Discipline into more detailed sub-sets. Each Category is associated with a certain Discipline on its creation. Both the Discipline and Category are fully customizable and can be broken down to any level of detail, depending on the requirements of the user. Creating and Deleting Disciplines and Categories will be discussed later in this manual.

Lighting fixture types fall under the Electrical Discipline and the Lighting Category. Under **Grouping**, choose **Electrical** from the pull-down menu for the Discipline, then choose **Lighting** from the pull down menu for Category.

At this point, we must also specify a Datatype for the different values for General Illumination Fixture Types that we wish to input. The data type choices include: (1) **Text** for textual data such as “Incandescent,” (2) **Decimal** for numerical values that will include decimal places such as “0.00056,” (3) **Integer** for numerical values without decimal places such as “100” or “-50” and (4) **Yes/No** where the only allowed values are either “Yes” or “No.”

Since the different fixture types will be expressed in text format, it is appropriate to choose **Text** for the Datatype under the Value heading.

At this time you can also make this particular piece of criteria as “Read-Only.” If this is activated, the criteria will not be able to be modified when the library is used in Planning Composer or Layout Composer.

The next step in the creation of the Criterion is to assign Values and which Level (Project, Site, Building, Storey, Function) the criteria/requirement will be associated

with. Before we can do this we must save the changes completed thus far by clicking on the **Save Record** button at the bottom of the page.

Result: The page re-loads with notification that changes have been saved (Figure 7).

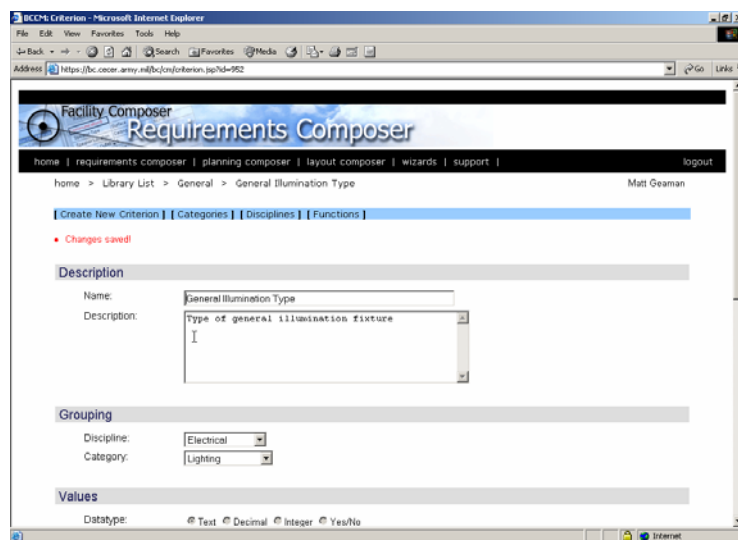


Figure 7. "New Criterion Changes" saved dialogue.

Next, under the heading **Level**, click on the **Assign** button.

You now have the option to assign the criterion to any level of the project. Under the "Assign to Objects" heading, you may choose to assign the criterion to the Project, Site, Building, Story, All Functions, or a subset of the Functions. We will assign the General Illumination Fixture Type criterion to the Building Level.

Under the Assign to Functions heading, you have the option to assign the Criterion to all functions or to specific functions. Since it is likely that all of the building Functions will have some type of general illumination fixture, assign the Criterion to all functions by clicking the check box next to **All Functions**

Once you have assigned the Level for the Criterion, click the **Save Record** button at the bottom of the page to save changes.

Under the Values heading click the **Add/Modify** button. In the subsequent menu that loads, you will define the values that make up the General Illumination Fixture Type criterion (Figure 8).

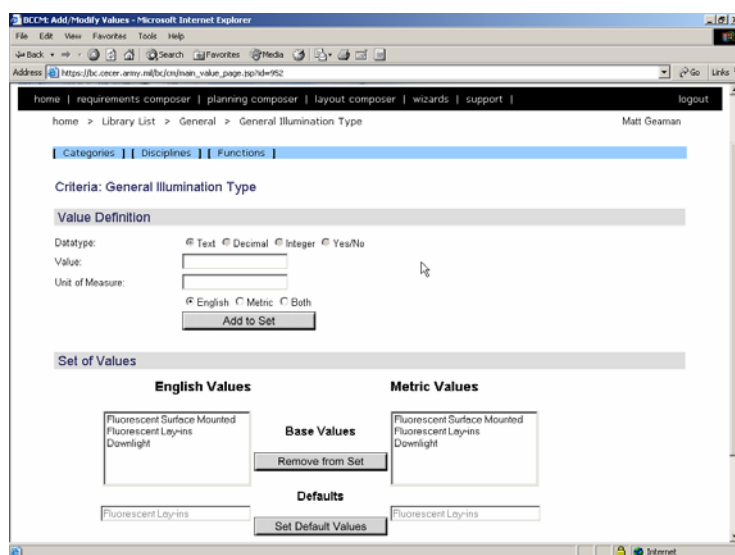


Figure 8. “Assigning values” dialogue.

Two sets of values exist for Criteria. Separate categories have been created for English units and Metric Units. For non-specific unit values, such as those that contain only text, choose Both under the Unit of Measure and the same value will be input to both categories. If you wish to input different English and Metric values, select the appropriate button, input the Value and Unit of Measure. Repeat the process for all desired values.

Under the set of values heading, notice that there are “Base” values and “Default” values. Base values are all possible values associated with the criterion. The default value is the value that will automatically be associated with a given criteria/requirement when the library is used in Planning Composer or Layout Composer. The default value can be changed by selecting a value from both the English and Metric value columns, then clicking the **Set Default Values** button. Base values can be removed by selecting values in either column and clicking the **Remove from Set** button.

Deleting Criteria From a Library

Click on **Test Library** at the top of the page to load the Criteria List.

Click on **Domestic Water Supply Size**, or any criterion you wish to delete, to view that criterion’s detail page.

At the bottom of the page click on the **Delete Record** button. At the prompt (Figure 9), click the **OK** button to permanently remove the criterion from the library.

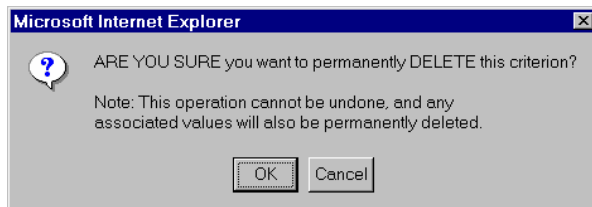


Figure 9. "Delete criterion" prompt.

Disciplines

The Discipline category is used to define different specialty trades such as: architecture, electrical, mechanical, etc. These will be displayed as the Tabs in the Project Requirement panel (Refer to Planning Composer User's Guide) within Planning Composer and Layout Composer.

Creating a New Discipline

In the blue bar at the top of the page, click on **Disciplines** (Figure 10). Once the Disciplines List loads, click on **Create Discipline** at the top of the page.

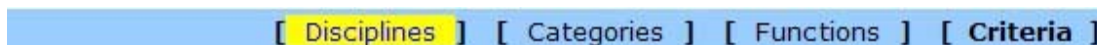


Figure 10. Creating a new discipline.

Input a **Discipline Name** and **Description** for the new Discipline, then click the **Save Record** button. Return to the **Discipline** list page. The new Discipline should now appear in the Discipline List.

These Disciplines will be accessed while creating criteria/requirements under the **Grouping** pull-down menu.

Deleting a Discipline

To remove a Discipline from the Library, click on the Discipline you wish to remove in the Discipline List.

Once the Discipline Description page loads, click on the **Delete Record** button at the bottom of the page. At the prompt (Figure 11) click the **OK** button to permanently remove the Discipline from the library.

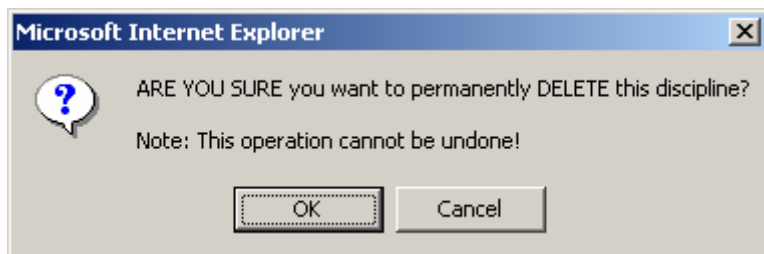


Figure 11. “Delete discipline” prompt.

Categories

Categories are used to break each discipline into more detailed sub-sets. Each Category is associated with a certain Discipline on its creation. Categories can also be associated with Multiple Disciplines as well. These will be displayed as red text in Planning Composer and Layout Composer within the criteria/requirements grid on the Discipline tabs.

Creating a Category

In the blue bar at the top of the page click on **Categories** (Figure 12). Once the Categories List loads click on **Create Category** at the top of the page.

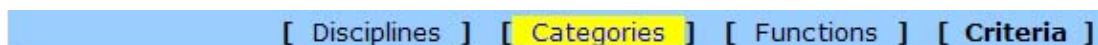


Figure 12. Creating categories.

Input a **Category Name** and **Description** for the new Category (Figure 13). An Associated Discipline must also be selected for each new Category. Choose the appropriate Discipline for the new Category from the pull-down menu. To associate the category to more than one discipline simply select each Discipline while holding the <CTRL> key. Then click the **Save Record** button to save the Category. The new Category should now appear in the Category List.

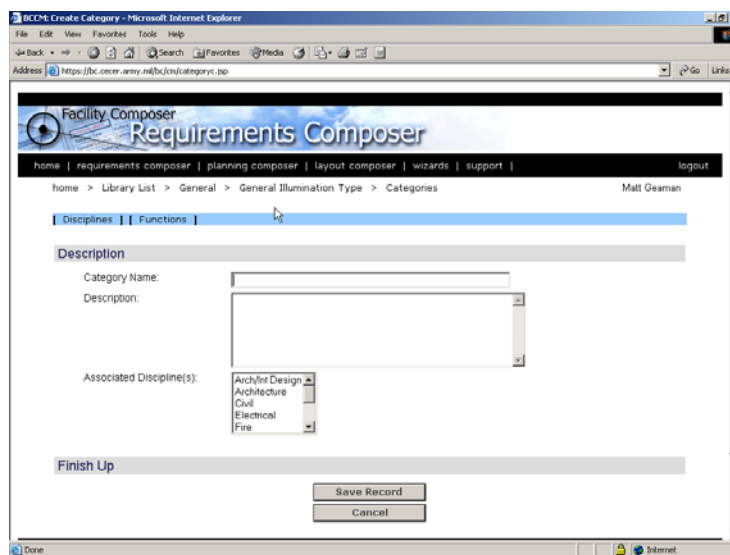


Figure 13. Category description page.

Deleting a Category

To remove a Category from the Library, click on the Category you wish to remove in the Category List.

Once the Category Description page loads, click on the **Delete Record** button at the bottom of the page. At the prompt (Figure 14), click the **OK** button to permanently remove the Category from the library.

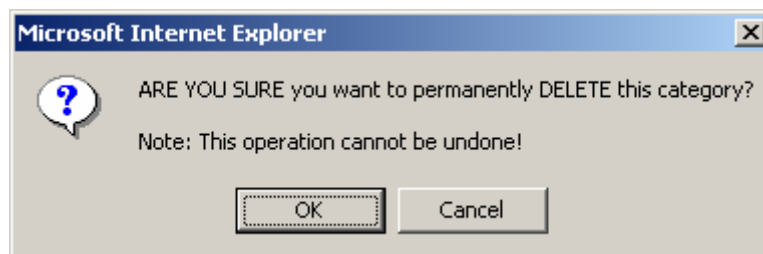


Figure 14. "Delete category" prompt.

Functions

Functions are the templates that represent Functional Areas or Zones such as Administration Space, circulation, etc. They can also represent individual spaces as well.

Creating a New Function

Click on **Test Library** at the top of the page to load the Criteria List.

In the blue bar at the top of the page click on **Functions** (Figure 15). Once the Functions List loads click on **Create Function** at the top of the page.

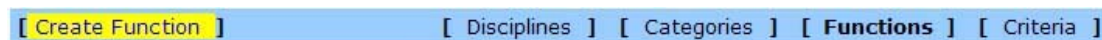



Figure 15. Creating functions.



Input a Function ID, Function Name, and Description for the new function.

Specify whether the function is a Site Function or a Building Function by choosing the appropriate check box at the bottom of the page.

Click the  button at the bottom of the page to save the new function.

Deleting a Function

To remove a function from the Library, click on the Function you wish to remove.

Once the Function Description page loads, click on the  button at the bottom of the page. At the prompt (Figure 16), click the  button to permanently remove the function from the library.

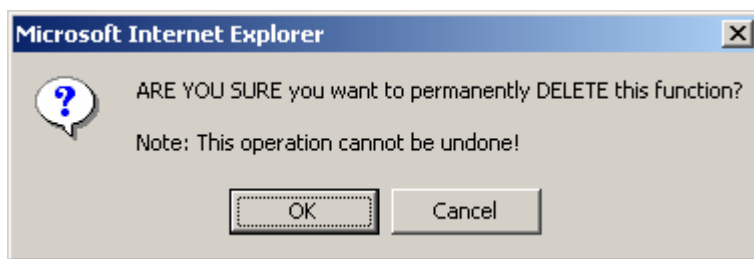


Figure 16. "Delete function" prompt.

3 Conclusion

The most important concept of *Facility Composer* is that customer-specific and computable criteria are associated with a growing facility model that continues throughout the life cycle of the facility. *Facility Composer's* ability to maintain a linkage between criteria and project elements (site, building, story, etc.) provides many benefits:

- It helps in defining criteria and can help in recording their rationale.
- It helps ensure that critical criteria are followed, and that desired characteristics are recorded and addressed.
- It helps organize criteria and makes them available at their point of use.
- It simplifies creation, maintenance, and distribution of new criteria. For example, as requirements that better implement sustainable design principles are developed, these are added to an organization's standard library for use in subsequent projects. These libraries are typically organized around facility type, but are not required to be.

This work has developed user documentation for the Requirements Composer application, to help users develop corporate and building specific criteria libraries.

Glossary

Term	Definition
Actual Area (Placing View)	(Compare to Planned Area) The area of the selected object as determined by Facility Composer; it calculates this value by totaling the areas of all spaces placed at this object level.
Allocated Area (Planning View)	The total area that has been allocated (assigned) to a function for a particular level of project hierarchy. For example, the total area allocated to a particular function might be different for the story level, building level, and project level.
Assigned Function	(See Function) A function that was explicitly added to a program by the user.
Attribute	(Compare to Requirement) Physical characteristics of an object; for example, the name, height, and elevation of a story.
Building	An object in the Project Composition hierarchy. A building object contains information related to a single freestanding physical structure and can be further broken down by stories, functions, and spaces.
Function	A function can be related to other functions through three different means: <ol style="list-style-type: none"> 1. A specialization relationship can exist where one function is the parent function and the other function is the child function, for example, the relationship between an office and private office. A private office is a specialization of the office. The office is the parent function and the private office is the child function. 2. A spatial containment relationship can exist where one function physically contains another function, for example, the relationship between a lobby and the reception area. The lobby is the super-function and the reception area is the sub-function. 3. The final relationship is that of assigned and unassigned functions. This type of relationship supports the "roll-up" capability through item programs.
Function Template	A Function definition from a library. Templates are the parents of specific <i>function instance</i> objects added to project elements (site, story, etc.)
Function Instance	Function objects created from function templates and assigned to project elements. All function instances created from the same function template aggregate their areas for project planning purposes.
Object	An element (or node) in the Project Composition structure. Since there is a hierarchical relationship between all objects in this structure the structure is often referred to as a "tree." The PROJECT object occupies the highest level of the hierarchy. From highest level to lowest level, the other objects include: BUILDING (and SITE), STORY, FUNCTION, and SPACE.
Planned Area	The total area for the selected project element, or for a specific function at a particular level in the project hierarchy (project, building, etc.) as determined and entered by the user. This value expresses the estimated and desired area for this object. In later stages of project development when spaces have been placed, the Actual Area value will be compared to the Planned Area value to determine how closely the project layout is meeting the initial plan.

Term	Definition
Program	A group of function templates added to a Project, Site, Building or Story project element for planning purposes. Planned areas are typically assigned during program development.
Project	A set of information pertaining to a building/construction project. In Facility Composer, the project object occupies the highest level of the Project Composition tree. All information for a Facility Composer project is stored in a PRJ file and directory that the user names on project creation. In Facility Composer, only one project may be opened at a time.

