

IMPACT Scenarios

IMPACT Scenario Overview

IMPACT is a simulation tool that uses BUILDER's databases and coded processes to project maintenance, repair, and replacement (MR&R) work requirements for up to ten years into the future. The purpose of this overview is to explain how IMPACT does this and how you can benefit from using its projections to improve your facility management practices.

The data required to construct a BUILDER database and its embedded knowledge and methods regarding condition assessment, component life expectancy, and costs combine to provide a complete model of your facilities and business processes includes:

- Where your facilities are and the effect of location on costs
- Records of each building's use, age, size, construction type, etc.
- Decomposition of each building into its component-sections, specified as to type, material, quantity, age, etc.
- History of past condition assessments of each component-section, with a dated condition index rating for each
- History of MR&R work performed
- Cost estimating capability for various work activities related to building components
- Expected service life and paint life of each component by material category and type
- Models for projecting condition and remaining service life on the basis of past condition assessment results
- Standards, policies and policy sequences for determining when work is required
- Prioritization schemes for ranking a given set of work items by their importance to you
- Funding sources with their future expected levels of funding, their restrictions, and their order of allocation.

IMPACT uses all of this information as the basis for predicting how your inventory will change over time. BUILDER shows you the past and present for your inventory. IMPACT shows you the future. It is able to show you the future in very much the same way that BUILDER is able to show you the past and present. That is, IMPACT shows you the future by adding and changing records in your database at each step in simulated time the same way that you add or change records with the passing of real time. The difference is that, for example, when you add a new condition assessment record, it is based on a physical observation, whereas when IMPACT adds a new condition assessment, it has calculated the expected condition based on prior condition, deterioration rates, and work activity records. As another example, a work item in BUILDER may be subject to a good deal of off-line planning and debate before it is finally funded and complete, while in IMPACT the prioritization scheme and funding algorithms methodically calculate whether or not a particular work item can be completed.

Outline of IMPACT Scenario

Here is a brief description of how IMPACT simulates changes in your inventory over a 10-year period, starting at the date the scenario is run:

1. With the current inventory, update all time-sensitive data elements (CI, RSL, Cost) for every component-section as of the current date.
2. Use the selected [policy sequence](#) to determine the appropriate standard for each component-section.
3. Cycle through all of the component-sections in the inventory and use each component-section's standard to identify and generate necessary work items.
4. [Prioritize the work items](#) for the current year using the selected [prioritization scheme](#).
5. Allocate [funding sources](#) to the work items in [rank order](#) following the funding amounts, precedence rules, and restrictions established for each funding source.
6. Schedule completion of funded work items for later in the current year.
7. Set current date to the date scheduled for work item completion and register the effect of the work. That is, create a condition assessment for the current date with appropriate findings, change component-section record if replaced or painted, and mark work item as completed.
8. Set current date to the end of the current year and calculate CI's for all component-sections, taking into account the appropriate prior CI, deterioration rate, and any work completed.
9. The previous 8 steps have completed one year; advance current date to the start of next year and go back to 1 until 10 years have been simulated.

This very simple outline of what IMPACT does shows that you will have to specify several key elements of the process before it is able to move through these steps. They include the policy sequence, the prioritization scheme, and the funding levels. You will do this when [managing a scenario](#). The particular policy sequence you choose will affect what work is identified. The particular prioritization scheme you choose will affect which work items rank highest in a year's work plan. The particular funding levels you choose will affect the amount of work that can be accomplished in any given year. As you might imagine, scenarios in which different policy sequences, prioritization schemes, and/or funding levels are used will yield very different outcomes and can be [compared and analyzed](#) to determine the optimal work plan for your inventory.

Advantages of Using an IMPACT Scenario

The ability to run the simulation with different scenario settings makes IMPACT a valuable tool in creating a credible long-term MR&R budget. For a manager of a large number of buildings, establishing and defending a budget for the next 5 to 10 years is a very difficult problem. Often, managers use industry-standard planning factors to prepare a budget. Figures such as 2% - 4% of building replacement cost per year are often used. The DOD Facility Cost Handbook publishes a cost per square foot for MR&R by building use (category code), a planning tool similar to several commercial tools which also use a per-square-foot factor for building sustainment. One problem with these methods of forecasting costs is that they are each based on the assumption of a continuing investment that allows the manager to repair what needs to be repaired when it needs to be repaired, which assumes no backlog of MR&R. Very few managers have ever had sufficient funds to meet that assumption. Another problem with these methods is that they are averages that could miss the mark in

any given year for any given building by a factor of 2, 3, or much more. The manager of a thousand buildings could be faced with a very large shortfall. Still another problem, budgets prepared with planning factors are difficult to defend. If cuts are to be made, the manager is hard pressed to identify what will suffer. Without the ability to identify consequences, erosion of funds is inevitable.

IMPACT gives you the opportunity to prepare a long-term MR&R budget based on your actual inventory in its current condition. When IMPACT has finished a scenario run, it has produced records that tell the story about what is forecasted to happen under the scenario parameters. Each component-section in the inventory is tracked during the simulation. Dated condition assessments track expected deterioration. Dated work items show when work was done and how much it costs. When grouped by year, the work items provide an annual work plan constrained by expected funding levels. Annual work plans can be summarized by cost of completed and incomplete work, allowing you know what the backlog was each year and you know which work went unfunded. With roll-up CI values, you can determine how well buildings or even locations did over the simulated period.

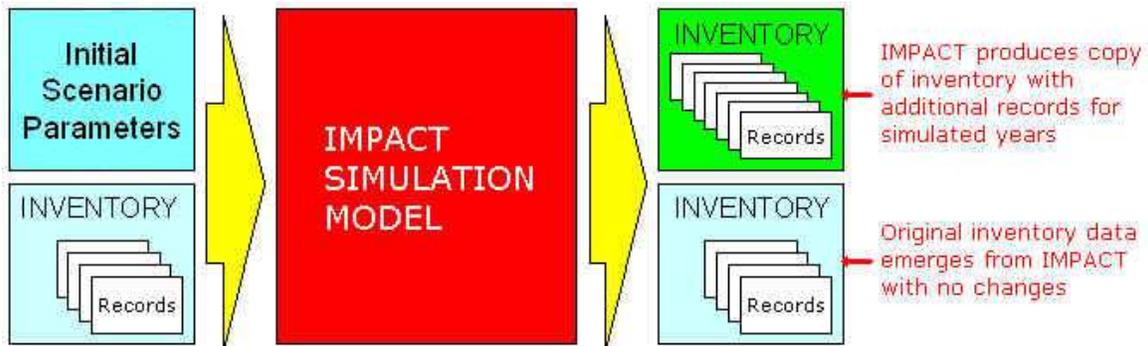
IMPACT allows you to run a scenario either constrained or unconstrained by budget. With an unconstrained budget, all work items are completed when they are first recognized. Analysis of this type of scenario will provide estimates of your total annual requirement. With a constrained budget, work items are funded in rank order until funds are exhausted. Work items not completed in one year will be generated the following year at a higher cost due to inflation and, for repair work types, to the cost for additional deterioration. Analysis of a constrained scenario will give you insight into what parts of your inventory will suffer at a given funding level.

Integration of IMPACT into the BUILDER 3.0

New to BUILDER 3.0 is the integration of the IMPACT application into the BUILDER application. That is, an IMPACT scenario can be run directly from the BUILDER user interface. The inclusion of IMPACT with the BUILDER application improves ease of use and increases efficiency in exploring long range work plans.

Scenario Management

A simplified outline of the IMPACT simulation steps was described in the [IMPACT Overview](#). You should review that topic before proceeding. Shown below is a conceptual illustration of the process:

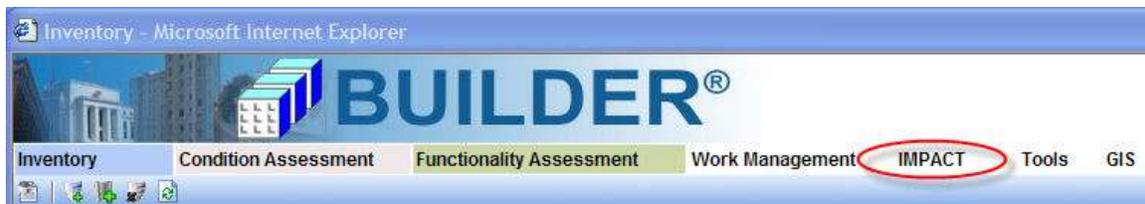


In IMPACT, a scenario is a set of data to be presented to the IMPACT simulation model consisting of particular inventory data and a set of initial parameters. The result of running the scenario is expressed as a copy of inventory records in which the "current date" is sometime in the future, typically 5 to 10 years, and in which the time-stamped records beyond the run date are generated by the IMPACT Simulation Model.

The first step in using IMPACT is to create a scenario and establish the set of initial parameters. The initial parameters are a set of values for key elements of the simulation decision process, such as the length of time to simulate, the [policy sequence](#) to use for generating work, the [prioritization scheme](#) to use for prioritizing work, and the [funding levels](#) to use for determining whether or not work can be completed. Additional parameters include specifications for future [building status](#) changes, the addition of new inventory, and the addition of new functionality assessments for buildings and functional areas. After the initial parameters are set, you are ready to run the simulation.

Creating a Scenario and Setting Initial Parameters

To create or edit an IMPACT scenario, select *IMPACT* from the navigation menu.



The Scenario Analysis window will appear.



After navigating the tree on the left of the screen, the scenarios for that site will be listed in the grid on the right. Also shown in the grid is the total run time and owner, or the creator, of each scenario.

Toolbar

- **CLOSE.** Use this button to close the Scenario Management window.
- **NEW.** Use this button to create a new scenario.
- **DELETE.** Use this button to delete the selected scenario.
- **COMPARE.** Use this button to compare different scenario results. See [Scenario Analysis](#) for a description of this tool.
- **HELP.** Use this button to launch the help topic associated with scenarios.

Creating or Editing a Scenario

A new scenario can be created by clicking the NEW button in the toolbar or an existing scenario can be edited by clicking its name in the grid. In either case, the Create Scenario window will appear.

At the top of this screen, you can enter or edit the scenario name and also enter a description of the scenario. Additional information for the scenario is input in the six different tabs, which are described below.

Scope Tab

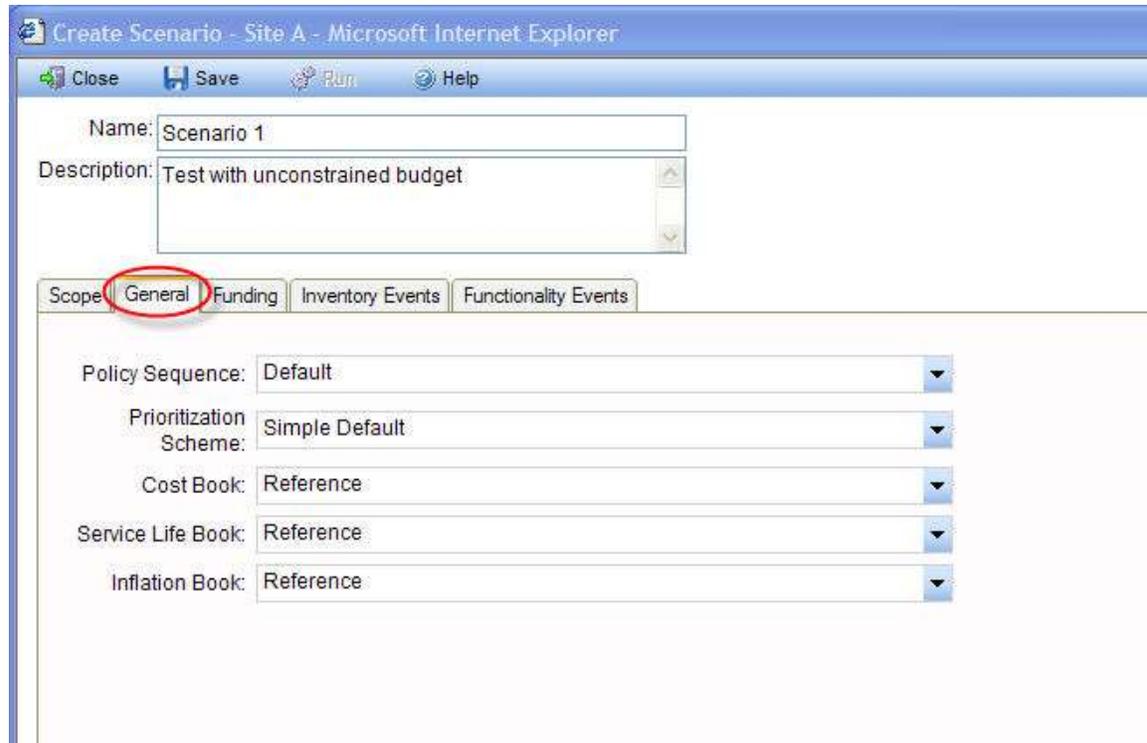
The Scope tab, which is shown above, specifies the planning horizon and the specific buildings to be included in the simulation. The data entered on this tab includes:

- **Number of Years to Simulate.** Select the number of years the simulation will run (1-10) from the dropdown list.
- **Organizations.** Select the organizations that are to be included in the simulation. The Available Groups list contains all of the groups, sites, and complexes currently in the inventory. Use the arrow keys between the two lists to create a list of inventory that is to be included in the simulation. The scenario will only include buildings that are in at least one of the Selected Groups. It is OK if the selected inventory overlap, i.e. if the same building is in more than one of the groups in the Selected Groups list.

- **Selected Systems.** Select the systems that are to be included in the simulation for the selected buildings. This is especially useful if you are simply developing a long-term repair and replacement plan for a single building system.

General Tab

The general tab allows you to set the policy sequence, prioritization scheme, cost book, and service life book to use for the scenario. Each option is described in greater detail below.



The screenshot shows a web application window titled "Create Scenario - Site A - Microsoft Internet Explorer". The window has a menu bar with "Close", "Save", "Run", and "Help". Below the menu bar, there are two text input fields: "Name: Scenario 1" and "Description: Test with unconstrained budget". Below the description field, there are five tabs: "Scope", "General", "Funding", "Inventory Events", and "Functionality Events". The "General" tab is selected and circled in red. Below the tabs, there are five dropdown menus, each with a label and a value: "Policy Sequence: Default", "Prioritization Scheme: Simple Default", "Cost Book: Reference", "Service Life Book: Reference", and "Inflation Book: Reference".

- **Policy Sequence.** Choose the policy sequence you wish to use for the scenario from the dropdown list. A policy sequence is defined so that when it is applied to the inventory it will determine a standard for every component-section by using its default standard and then by successively applying the applicable policies. See [Standards, Policies, and Policy Sequence Overview](#) for general information or [Adding and Editing Policy Sequences](#) for information on how to add and edit policy sequences.
- **Prioritization Sequence.** Choose the prioritization you wish to use for the scenario from the dropdown list. A prioritization scheme is defined so that a priority score can be calculated for each section-level work item based on the measures, point values, and weights you have assigned. See [Creating a Work Prioritization Scheme](#) for more information. The Prioritization Scheme will be used only when funding is constrained, but you must select a scheme here even if the funding is unconstrained.
- **Cost Book.** Choose the cost book you wish to use for the scenario from the dropdown list. A cost book is defined so the cost of each work item can be computed. See [Viewing and Editing Cost Data](#) for more information.

- **Service Life Cost Book.** Choose the service life cost book you wish to use from the dropdown list. A service life book is defined so that the service life of all component-section in the inventory can be estimated.

Funding Tab

On the Funding tab, which is shown below, the funding levels for the different funding sources defined in BUILDER are set and the option of running the simulation with no funding constraints is provided. Each is described in greater detail below.

The screenshot shows a web application window titled 'Create Scenario - Site A - Microsoft Internet Explorer'. It has a menu bar with 'Close', 'Save', 'Run', and 'Help'. Below the menu, there are two text input fields: 'Name: Scenario 1' and 'Description: Test with unconstrained budget'. Below these are four tabs: 'Scope', 'General', 'Funding', 'Inventory Events', and 'Functionality Events'. The 'Funding' tab is selected and circled in red. Under the 'Funding' tab, there are two radio buttons: 'Unconstrained' (which is unselected) and 'Constrained' (which is selected). Below the radio buttons is a table with the following data:

	Fund	2007	2008	2009	2010
O&M		\$ 750,000	\$ 700,000	\$ 650,000	\$ 600,000

- **Unconstrained/Constrained Option.** Choose whether the scenario is to be constrained by funding or unconstrained by funding. If unconstrained, all simulated work items will be completed in the year they are generated. If constrained, you must specify the annual funding levels for all funding sources previously identified in BUILDER. In a constrained scenario, work items and projects are ranked by priority and funded for completion in order of rank until funds are exhausted. Work items and projects that are not funded cannot be completed. Projects and user-created work items that are not completed as planned will be carried over to the next year.
- **Funding Sources and Amounts Grid.** If you have chosen the Constrained option, the grid with funding sources and amounts will appear. Initially, the funding sources and amounts are set to data entered in the [Anticipated Funding Levels](#). You may not delete funding sources here, but you may set their amounts to \$0. Remember that if you change an amount, you must move to another cell or strike the Enter key for the grid to recognize that a change has been made.

Inventory Events Tab

On the Inventory Events tab, which is shown below, a future "whole building" events can be triggered at particular points in the simulation and completely new buildings

can be dynamically added to the inventory during the simulation. Each is described in greater detail below.

The screenshot shows the 'Create Scenario' interface in Microsoft Internet Explorer. The 'Inventory Events' tab is highlighted with a red circle. Below the tabs, there are two sections: 'Status Changes' and 'New Inventory'.

Status Changes

List future building status changes for this scenario. Identify each building, its new status, the year the status will change, and, for "To be" statuses, the effective year. Use the buttons on the right to add, edit, or delete a status change.

Building	New Status
1397 - Community Building	Demolished

New Inventory

Add new buildings during the simulation by specifying building number, name, location, template to be used in creating the new building, and the year the building will enter the inventory automatically be included in the scope of the simulation.

Building Number	Building Name	Organization
1011	Admin	Main Post Complex

- **Status Changes.** Buildings in the BUILDER inventory that have a "To be" type of status will have the implied effects of those status changes represented during the scenario. For example, if a building has a status of "To be demolished" in year X, the IMPACT simulation will include the occurrence of the demolition in year X. In addition, you can schedule building status changes in the scenario parameters. This capability allows you to do the following:
 - Add new buildings to the inventory dynamically as the scenario progresses. To do this, add the buildings to the BUILDER inventory with status "To be built" or "To be acquired," with an effective year equal to the year the status is to change to "Active." When the scenario time reaches that year, the status will be changed. At that point, the building will be considered in the automated processes of condition assessment and work planning. If you wish to override the effective year of the status change in BUILDER, you can enter a status change for the building in the scenario for the new year.
 - Plan to demolish or transfer a building as the simulation progresses. You may do this in several ways:
 - Enter a building status of "To be demolished"/"To be transferred" in the BUILDER inventory, with an effective year set to the year the building is to be removed.
 - Enter a scenario status change to "Demolished"/"Transferred" in the appropriate change year.

- Enter a scenario status change to "To be demolished"/"To be transferred" in a chosen year. Note that this allows you to model the progression of an active building to one that is to be demolished (with perhaps reduced maintenance standards) to a demolished building that is removed from work planning considerations.

To initiate a status change in the simulation, click the new button in the Status Change portion of the screen and enter the following data elements:

- **Building.** Select the building for which the change in status applies.
- **New Status.** Select the new status of the building using the dropdown list.
- **Change Year.** Enter the year in which the building's status is to change to the new status.
- **Effective Year.** Enter the effective year of the new status.
- **New Inventory.** BUILDER allows to add completely new buildings during a scenario, by clicking the NEW button in the New Inventory portion of the screen and entering the following data:
 - **Building Number.** Enter the number identifier for the new building.
 - **Building Name.** Enter the name identifier for the new building.
 - **Organization.** Select the organization to add the new building to.
 - **Template.** Select the [template](#) to use to estimate the new building's inventory.
 - **Effective Year.** Enter the year the new building will be added to the inventory.

Functionality Events Tab

On the Functionality Events tab, which is shown below, a future building and/or functional area functionality assessments can be triggered at particular points in the simulation. Further description of this process is provided below.



- Building Functional Assessments.** Any building-level functionality assessments with the status of "To Take Effect" that have been entered for the inventory included in the scenario will be shown in this grid. If you wish to include a future assessment in the scenario, mark the checkbox in the USE column next to it in the grid. For all assessments that area included, the data from the future assessment will replace the active assessment data and be used to compute the BFI for the building in the effective year shown in the grid.
- Functional Area Assessments.** Any functional area-level functionality assessments with the status of "To Take Effect" that have been entered for the inventory included in the scenario will be shown in this grid. If you wish to include a future assessment in the scenario, mark the checkbox in the USE column next to it in the grid. For all assessments that area included, the data from the future assessment will replace the active assessment and be used to compute the FAFI for the functional area in the effective year shown in the grid.

Running the Simulation

After all of the initial scenario parameters are set, the simulation can be run by clicking the RUN button in toolbar.



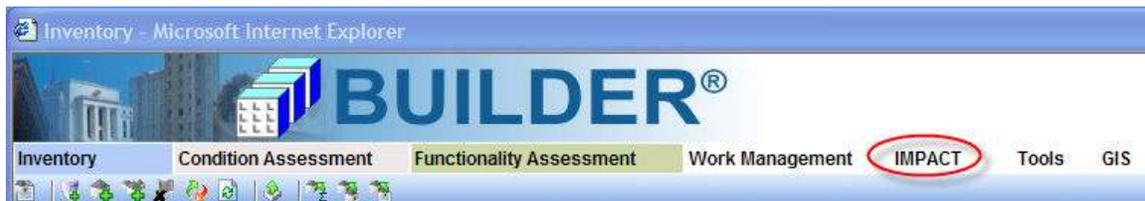
A progress report will scroll along the bottom of the window, entering a new line each time a new activity begins. Each line of the progress report begins with the system time on your computer so that you may judge how long each step takes. After the initial setup, the activity stream will repeat from year to year for the number of years in the simulation. By calculating how long it takes to simulate one year you can estimate how long the simulation will be running.

The simulation is a computationally intensive process, and many new records will have to be created in a single run. The simulation run time is very dependent on your computer system's speed and the size of the inventory in the simulation. The simulation could take from a few minutes up to several hours to finish. It does not allow for any interaction after you have clicked the RUN button, other than allowing you to CANCEL the run at any time. If you click the CANCEL button, the simulation will probably not stop immediately; it will complete the activity currently in progress before stopping.

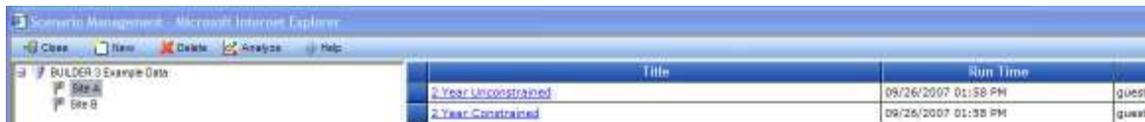
When the scenario run is finished, the results can be [compared with the results of other scenarios](#) or used to [create a work plan for BUILDER](#).

Scenario Analysis

After a [scenario has been run](#), the results of the scenario can be analyzed and compared with the results of other scenarios. To analyze and compare the results of scenarios select *IMPACT* from the navigation menu.



The Scenario Analysis window will appear.



After navigating the tree on the left of the screen, the scenarios for that site will be list in the grid on the right. Also shown in the grid is the total run time and owner, or the creator, of each scenario.

To view the results of a scenario, or to compare the results of multiple scenarios, click the *Analyze* button.



The scenario analysis window comes up. The user can choose to view or compare scenarios for an entire site, or drill down to a lower level to see analysis results. For example, if the user wanted to see how an individual component section would perform under two different scenarios, the user could select that component section from the tree, then select the scenarios to compare from the drop down boxes. The user then chooses from a number of reports to run to display scenario results.



These results include the following report options:

- **CI Performance.** Displays the year by year trend of the Condition index for each scenario.
- **FCI Performance.** Displays the year by year trend of the Facility Condition Index for each scenario. Only available at the building level or above.
- **FI Performance.** Displays the year by year trend of the Functionality index for each scenario. Only available at the building level or above.
- **Location Budget - Expensed and Backlog Cumulative.** Displays the cumulative amount of work expensed, and the total backlog at the end of each scenario horizon.
- **Location Budget - Expensed and Backlog Yearly.** Displays the yearly amount of work expensed and backlogged for each scenario in a given year.
- **PI Performance.** Displays the year by year trend of the Performance index for each scenario. Only available at the building level or above.
- **Work Plan Completions.** Displays a graph of work completed funds accomplished for each scenario in a given year.
- **Work Plan Detail By Years.** Displays the details of a work plan, including all work items for each year. Note that results for only one scenario can be viewed at a time for this report.
- **Work Plan for Export to MS Excel.** Generates the details of a work plan that can be exported to MS Excel. Note that results for only one scenario can be viewed at a time for this report.

After choosing these settings, the user clicks the *View Report* button on the toolbar and the resultant information is displayed.

Copying a Work Plan from a Scenario

After a [scenario has been run](#), the expected work items for all of the years in the scenario can be copied into BUILDER as the annual work plans. If the scenario was constrained by funding levels, then only the future work items with "Completed" status will form annual work plans constrained by budget. To create a work plan using the results of a scenario, click the COPY SCENARIO button on the Work Items screen.

Select the scenario to copy the work items from, and the following steps will be taken by BUILDER:

- If your work plan contained work items for the years prior to the scope of the scenario, those work items receive preferential treatment so that no conflicting work efforts will be generated during the scenario and the original work items will move along in the process with the simulated work items. The original work items will have to compete for resources if the scenario has funding constraints, so that original work items may not be "Completed" and therefore not re-imported back into your production database during the Copy Scenario process. One way to insure that the manually created future work items already in your production database do not get lost in the IMPACT scenario is to mark them as "Must Complete as Planned." This will essentially require that they be completed as planned in the IMPACT scenario.
- All current year and future work items for buildings in the scope of your scenario will be deleted.
- All "Completed" current year and future work items in the selected scenario will be imported into annual work plans with a status of "Awaiting Funds," a rank of "1/1", and a score of "0.000."

These steps are rather drastic in their manipulation of work item records, and it is possible for work items to be deleted and/or lost in the shuffle. It would be wise to make a copy of the database and work with the copy to ensure nothing is lost.

By using the IMPACT scenario tool, you can refine a work plan. If you start with no future work plan, then running an IMPACT scenario should give you a first cut at constructing future work plans. Use the Copy Scenario button to import the budget-constrained, completed work items from the scenario into your production database. You can then refine the work items from the [Work Plan screen](#), moving work items from year to year, changing work item properties, perhaps marking those that will definitely be completed as planned so that the next run of the scenario will insure that each one is completed. You may even re-inspect sections identified as needing work, especially if they have not been inspected for some time. Improvements in the accuracy of your data will improve simulation results as well.

You can then run another IMPACT scenario with your new data and the same scenario parameters and use the Copy Scenario button to import the work plan from the new scenario database. Each cycle should improve the work plan generated and the overall scenario results. This is important because the work plan generated will begin to represent your future work plans more realistically, and the scenario results will give you a more realistic view of the next 5 to 10 years and improve your insights into the consequences of a given funding level.