# Design Prophet®

## *Lean Design®*
## *and*
## *Quality Report Card®*
## *Methodologies*

### Design Prophet® Executive Overview:
### *Lean Design® & Quality Report Card® Methodologies*
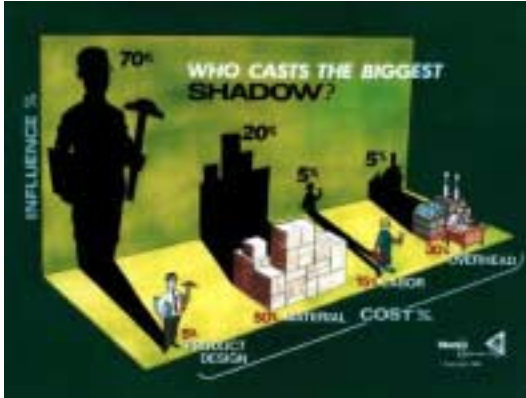


As the **Munro Shadow Chart** illustrates, product design is where most of a companies potential for productivity and profit lies. Munro & Associates developed the **Design Prophet®** suite of tools *Lean Design® & Quality Report Card®* to attack poor Quality and excessive cost at the root cause; *design*. Munro will address other forms of waste however the design will always be our prime focus because of the immense leverage attainable. Why wait to reduce waste cost and poor Quality after spending money and resources on tooling, floor space training etc when it can be eliminated up-front on the CAD tube?  Why expend resources to optimize the assembly of a part that should be eliminated in the design, along with all of its assembly time, material cost, fabrication time and tooling, Quality and logistics costs?  The true power of any manufacturing organization to drive profitability lies within the walls of the Engineering organization.

*Lean Design®* is Munro & Associates signature process. No one in the world has had attained more success or acclaim than Munro when it comes to refining products. Our processes consistently net higher profit and customer satisfaction than all other techniques combined.



*Lean Design®* identifies all the manufacturing inhibiters such as Poka Yoke problems & ergonomic issues before they become a problem on the floor.
*Lean Design®*, coupled with our internal software program **TechTransfer** will reduce costs from the concept through detail design phases.  A Key objective will be to integrate as many functions into the fewest parts as economically viable.  By combining, not eliminating, functionality and features and delight customers with less manpower, fewer parts and greatly reduced quality issues.

### Quality Report Card® (QRC®):

In our quest to capture and thereby influence all Profit drivers, Munro & Associates realized that no tool adequately quantified Quality with a meaningful metric – one which had a $ sign in front of it, allowing quality to be included in the business decision making process.  To fill this void, in 1994, Munro & Associates, Inc. created the predictive tool **Quality Report Card®** (**QRC®**)**.**

Dr. Ed Deming, the Quality Master who helped the Japanese achieve world class Quality, stated, *"Quality improves as variation decreases"* and Sandy Munro had often said *"all variation comes from the design"*.

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The QRC® provides a new tool for data-driven management methods that rely on the gathering and quantification of Quality data to develop new product designs, prioritize process improvement activity, and drive toward Best in Class 'First Time Right' rates.



**QRC®** is designed to be used at the design phase as well as on the factory floor.

Munro utilizes these two techniques on new product development, to establish its customers as World Class Quality Manufacturing companies. They set the standard for everyone else to try and follow.

**TechTransfer™** *"technology differentiation to ensure market domination"*

To assist in providing a wide variety of solutions to the problems identified in the *Lean Design® & Quality Report Card*® analyses*,* Munro has created a vast library of technical information and data from varied industries including aerospace, defense, medical, automotive, heavy industry, etc.

We are able to take this information and cross-pollinate our customers' products with new and innovative materials and process solutions for product improvement from other industries. For instance, by using a well-known aircraft technology, we helped the automobile industry reduce weight by 30% on an instrument panel; then reversed the process to bring automobile technology to the defense industry to reducing a missile price by 40%.

A selection of new manufacturing process, material, and application technologies are readily available for reviewed on any type of application. Munro & Associates maintains a Technology Transfer Center and a proprietary software package (TechTransfer™) to assist in the implementation of new design and manufacturing solutions. By utilizing cutting edge techniques from cross-industry sources our customers are able to leap frog all competitors stuck with old, costly, poor Quality techniques.

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Should you have questions, please contact:

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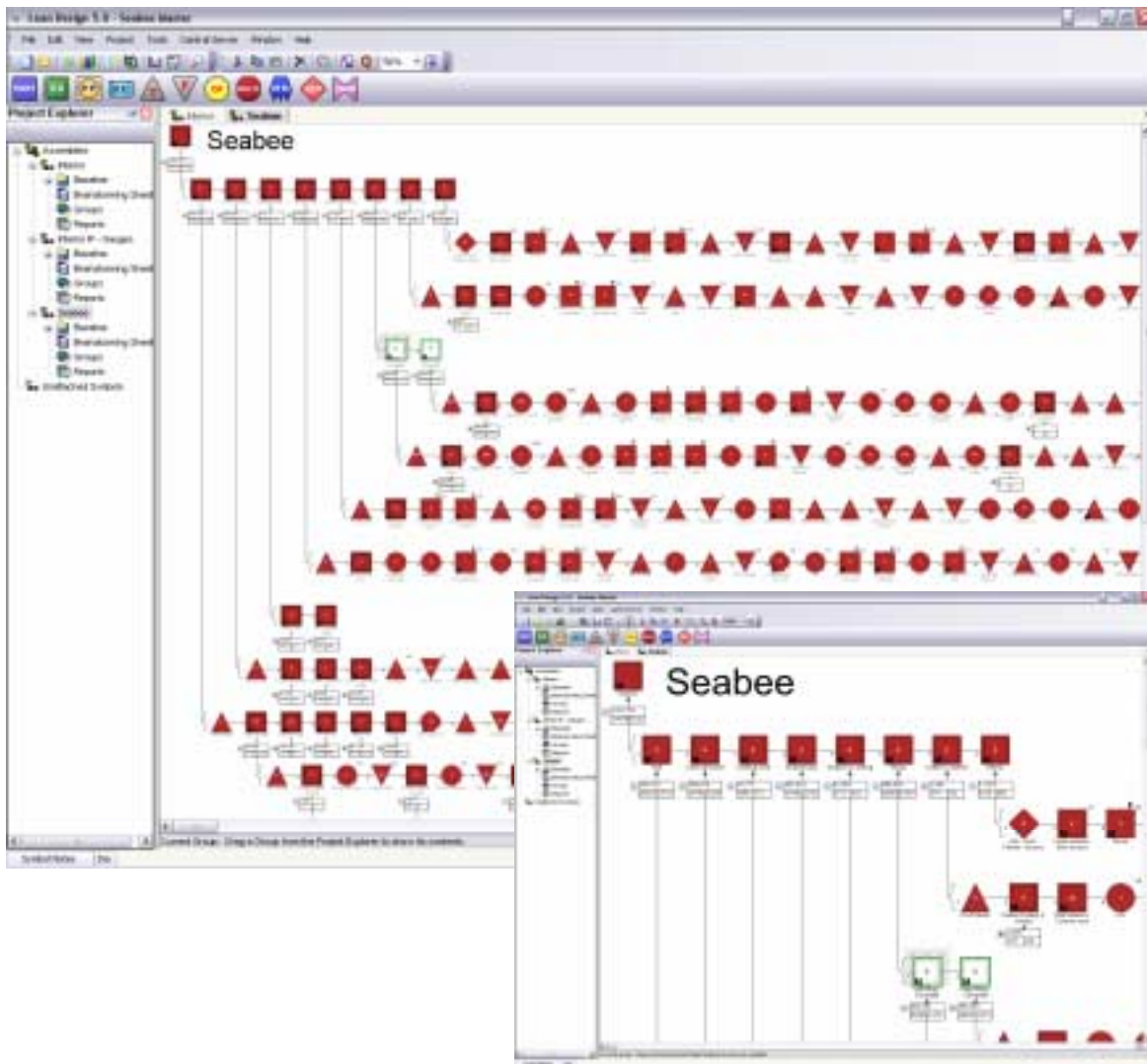Phone: (248) 269-0376
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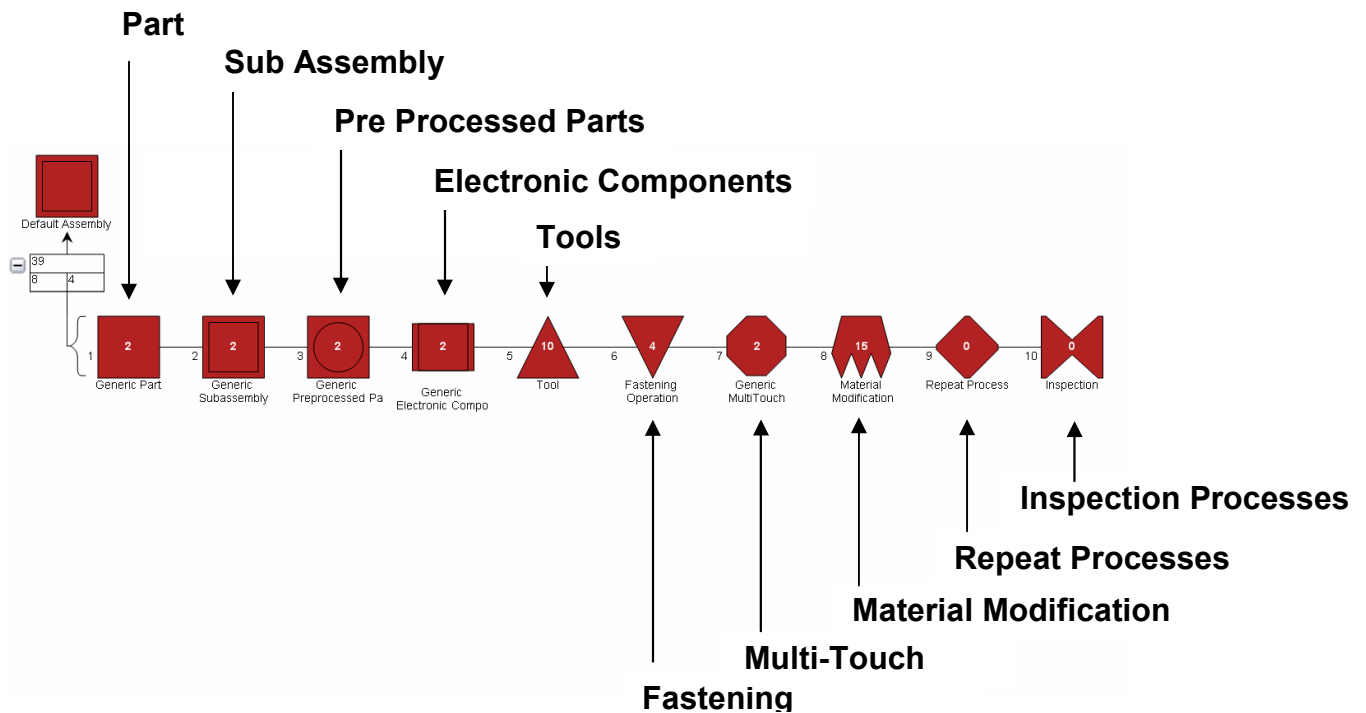
## Lean Design®

All of the information within *Lean Design*® is captured and mapped through the use of Symbols as the product or virtual design is dissected. These symbols represent all the components (subassemblies and parts) and operations (fastening, welding, gluing, etc.) required to build the product. The resulting symbol map can then be analyzed, modified, compared, and displayed.

*Lean Design*® uses enhanced Symbol diagramming functionality. Users will interact with the *Lean Design*® Symbol Diagrams in a Visio® like manner. Diagram symbols can be copied, pasted, dragged and dropped around the map.

Symbol diagrams are printer/plotter enabled so the complete symbol map or portions of the map can be displayed.

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The symbols available for modeling in *Lean Design*® are:

**Part**

**Sub Assembly**

**Pre Processed Parts**

**Electronic Components**

**Tools**

Default Assembly

| 39 |
| 8 | 4 |

1 | 2 Generic Part | 2 | 2 Generic Subassembly | 3 | 2 Generic Preprocessed Pa | 4 | 2 Generic Electronic Compo | 5 | 10 Tool | 6 | 4 Fastening Operation | 7 | 2 Generic MultiTouch | 8 | 15 Material Modification | 9 | 0 Repeat Process | 10 | 0 Inspection

**Inspection Processes**

**Repeat Processes**

**Material Modification**

**Multi-Touch**

**Fastening**

Entering symbols, other than parts and subassemblies, will generate a default penalty time which equates to seconds/ minutes/ hours of time needed to perform the task identified by that symbol. As shown below, the penalty times for parts/ subassemblies are generated by answering a set of methodical questions that allow the user to capture real-world part, handling and assembly characteristics. At any time a status check of the penalty time totals can be obtained by generating an Executive Summary and viewing the Standard Munro Score.

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This data allows the user to see the ramifications of design decisions and how changing designs will impact these important measures. Symbol properties can be categorized as Symbol Description Details, Costs, Quality, Categories, and Physical Details.

## Libraries

*Lean Design*® utilizes libraries for Tools, Standard Operations, Fastening Operations, Part and Subassembly Symbols and Repeat Operations. Libraries allow for:

- Administration of common Symbol properties by providing a single source of data entry
- Flexible reporting on information contained within *Lean Design*® by providing a reference between a Symbol type and its implementation within an Assembly
- A framework to share similar Symbols across projects, users, or organizations. Libraries can be copy, pasted, and saved for inclusion within separate projects.

## Symbol Groups

*Lean Design*® will allow for the selection, grouping and naming of a collection of Symbols. A group is created by selecting Symbols. Symbols added to a group need not be continuous. When a Symbol is added to a group, its contents are also included in the group. Symbols can be members of many groups. Once a group is created, all entity roll up values can be displayed for that group. A group can be compared against other *Lean Design*® collection entities on comparison reports.

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Creation of Symbol groups will:

- o Allow for automatic Symbol value roll-ups across the group, such as cost, weight and assembly score
- o Provide a means for attaching notes or mapping Brainstorming ideas to actual Symbol manipulations within the assembly
- o Annotate specific Symbols as special or eye catching
- o Create an entity of discontinuous Symbols that can be compared on reports against other assemblies, sub-assemblies, groups.  (An Executive Summary is a type of comparison report.)



Symbol Grouping
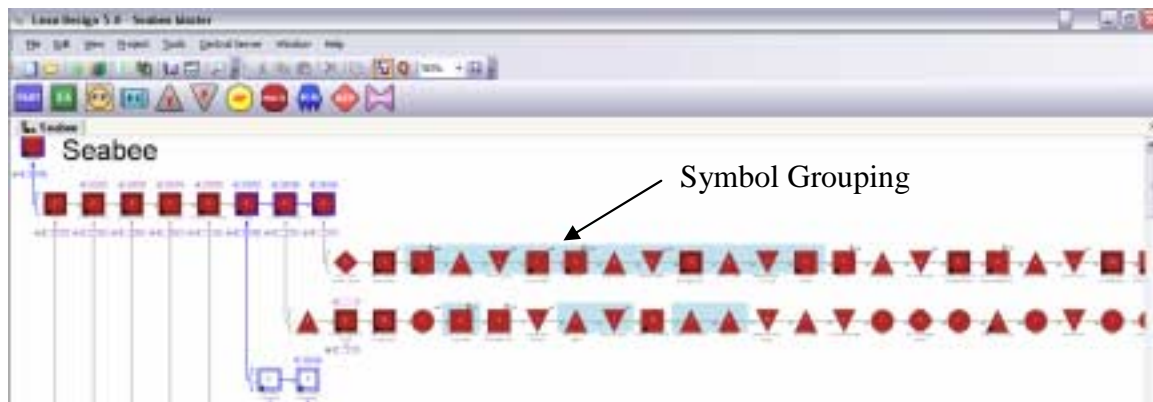
**Brainstorming Sheets**

Brainstorming sheets are used to capture redesign ideas within *Lean Design*®. Each redesign idea is associated to a group of symbols which can then be manipulated to reflect the design change.  The group is then mapped to the brainstorming sheet.  Ideas (groups) can be compared to the baseline or other ideas (groups) to view their impact using the Executive Summary Report.

Brainstorming Sheet Properties:
- Date
- Facilitator
- System
- Product

Brainstorming Idea Properties:
- Category Level 1
- Category Level 2
- Idea Number
- Idea Description
- Idea Generation Point
- Notes

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*Lean Design*® Actions that are assignable to a Brainstorming Idea:

- Symbol Group
- Redesign action

A *Lean Design*® project can contain an unlimited number of Brainstorming Sheets.  A Brainstorming Sheet can contain an unlimited number of ideas.

## Critical Path Determination

*Lean Design*® will analyze an Assembly or Subassembly for the critical path with respect to time.  By summing assembly times and dwell times, the longest duration path through an Assembly will be identified.  Critical path and throughput can be displayed on the Executive Summary.
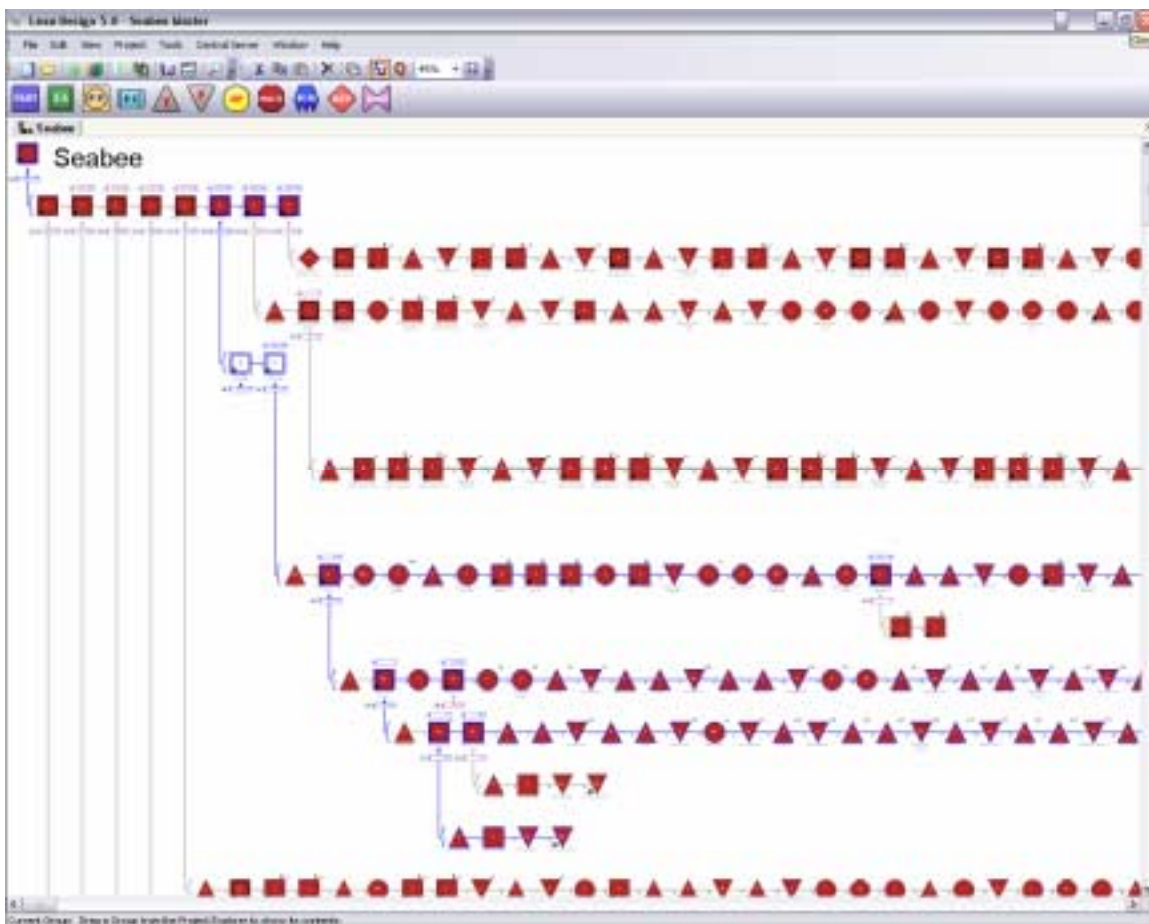


Subassemblies designated as purchased-in-assembly or pre-assembled parts do not roll up in a Standard Munro Score.  These Subassemblies are not a branch for critical path determinations.   Additionally,  any subassembly can be designated to *ignore critical path*.   These subassemblies will not be branches for a critical path determination.

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## Quality Report Card®

Symbol information pertaining to quality is captured within *Lean Design*®. Once captured, this information provides valuable reporting information for quality related costs and highlights Symbols with poor quality attributes.

For more detail on the Quality Report Card® refer to the Quality Report Card® section of this document.

### *Rework Map*

The actions required in rework can be mapped by creating a sequence of Symbols in a diagram. The rollup values from the rework map are used to derive the Incident Cost associated with the quality issue. They are not included in any other rollup. A user will be able to assign an actual rework time in lieu of creating a Symbol map. The Standard Munro Score will be generated for all Symbols contained in the Rework Map.

**Total rolled-up rework time and costs will be displayed on the Executive Summary**



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## Subassembly Rollups

## TOP (Time, Operations and Parts)

Subassemblies display the total time (Standard Score) of contained Symbols, the count of contained steps, and the count of parts (and subs that are unanalyzed or designated as a pre-assembled part). Subassemblies have properties that contribute to the Munro Score. These properties involve handling of the subassembly and are NOT rolled up into their own subassembly score. The Munro Scores that are associated with handling the subassembly is rolled into the assembly/subassembly in which that subassembly is contained in.
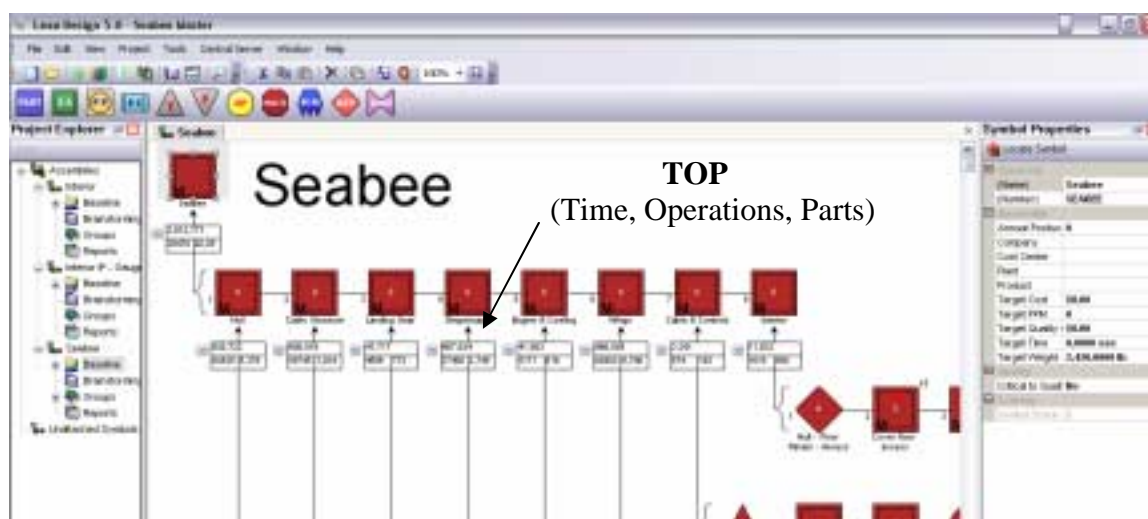


## Calculated Weight
All weights within the subassembly are quantity weighted and rolled-up as a subassembly calculated weight. A subassembly calculated weight is the total of all the component weights within that sub-assembly. If a subassembly does not have a calculated weight, then the actual weight, which is the weight of the complete fully assembled subassembly (known as a preassembled part), is used in the weight rollup.

## Calculated Material Cost
All material costs within the subassembly are quantity weighted and rolled up as a subassembly calculated cost. A subassembly calculated cost is the total of all the component costs within that sub-assembly. If a subassembly does not have a calculated cost, then the actual cost, which is the cost of the complete fully assembled subassembly (known as a preassembled part), is used in the cost rollup.

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### Cost Centers (Labor Rate)

Labor Rates are specified through creating a cost center. A cost center will provide the means for a user to itemize various costs that contribute to the labor rate of a specific subassembly.

### Preassembled Part (Purchased Assemblies or Parts in/of Assembly)

When a subassembly is designated as Preassembled, only the subassembly weight and material costs are totaled up from its contained Symbols. Subassemblies designated as Preassembled counted as only one part on comparison counts. The symbols which represent the assembly of the Preassembly Part to the parent are counted in the Standard Munro Score.

### Preprocessed Part

Preprocessed parts are parts where material modifications are necessary to create the part. A preprocessed part is visualized with its own symbol but behaves exactly like a subassembly within *Lean Design*®.

### Tools, Operations, Fastenings, Material Modifications

These Symbols represent categories of steps or actions that are taken in an assembly process. Each symbol represents a library of possible tasks that can be performed. These libraries can be expanded as new actions are identified.

### Inspect

When an inspection is required, the inspection symbol will be used and its properties defined.



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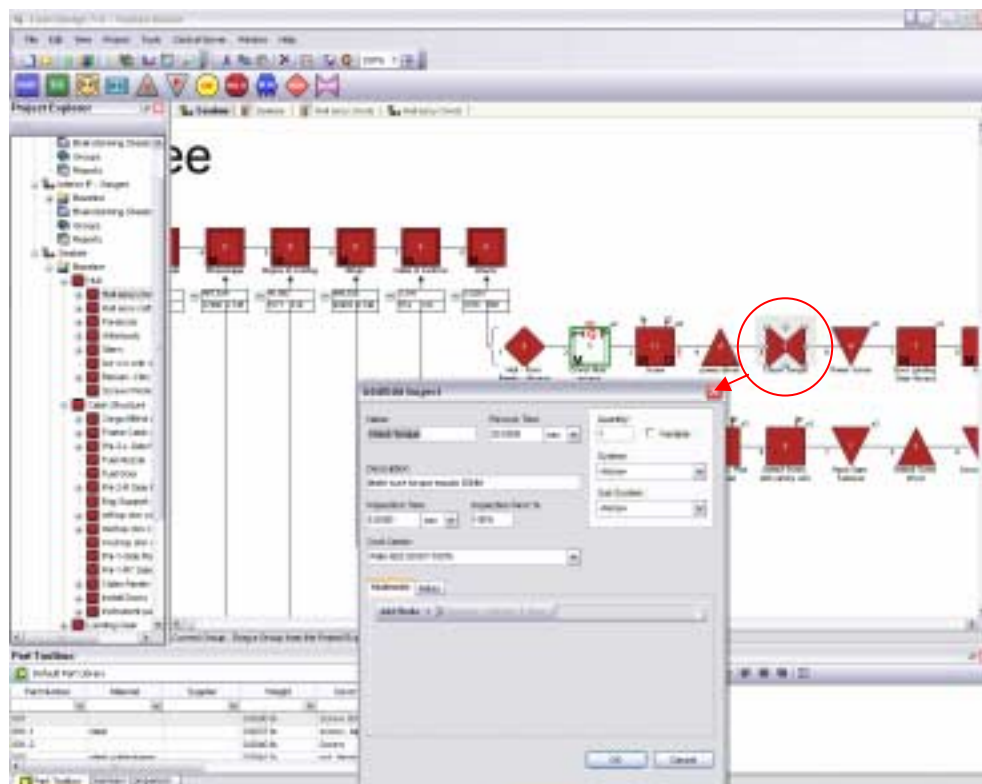
A failed inspection results in action to be taken.  In _Design Prophet_®, the action is _mapped_ by creating a sequence of Symbols in a diagram.  The roll-up values from the Inspection Map are used to derive the Quality Cost associated with the inspection.  A user can assign an actual rework time in lieu of creating a Symbol map.

_Inspection Map Rollup_
The Standard Munro Score, Operations Count and Parts Count will be determined for all Symbols contained in the Inspection Map.  A TOP will be adorned to the Inspect/Test Symbol when actions have been mapped.
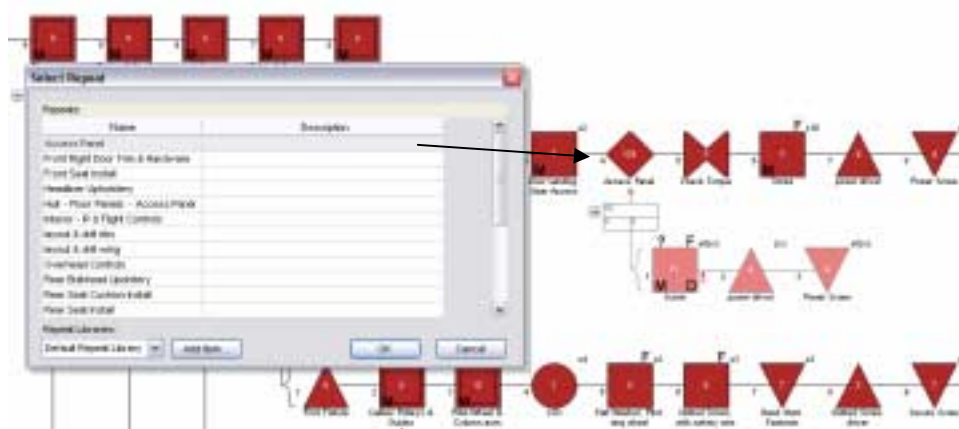
## Repeat
Repeats are a sequence of symbols that designate a series of tasks that recur throughout the mapping process.  Rather than duplicate the series, one symbol, called a repeat, can be used throughout the project.



Repeats are created by adding Symbols to a diagram, just as you would build a subassembly.  All Symbol types can be added to a repeat, including other repeats.

_Quantity Multipliers_
When Symbols are placed in a repeat, it can be designated for Quantity Multiplication.  For Symbols within the repeat that are designated for Quantity multiplication, the Symbol Quantity will be multiplied by the Repeat Quantity.  Non designated Symbols will use their Symbol quantity.

_Convert to Symbols_
Any instance of a repeat can be converted back to in-line symbols.  This one-way conversion will allow an instance of a repeat to become editable as individual Symbols.

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*Repeat Libraries*
Collections of Repeats can be added to *Lean Design*®.  These collections can be created as read only.    Read only repeats can still be converted back to fully editable Symbols.

## Custom Fields
A user can define eight custom fields on a project level.  Once defined, the custom fields will be assigned to all Symbols.

Four of the custom fields are text fields that will accept any data.  These fields are selectable for inclusion on Symbol based reports.

Four of the custom fields are numerical fields.  These fields can hold any numeric information.  Each custom numeric field will roll up through the hierarchy of Symbols.

## Adornments
Symbols displayed within *Lean Design*® can be adorned visually with graphical indications of their properties.  Some adornments are standard and can appear on any Symbol, while other adornments are specific to a type of Symbol.

- Critical to Quality.   When Quality Grade is F, a Critical to Quality adornment or "Q" is affixed to the Symbol
- Service.   When a Symbol has been marked as Service, a Service adornment ">-<" is affixed to the Symbol
- TOP.  A TOP display (Time, Operation Count, Parts Count) will be affixed to the Symbol
- Bad Part.  When a Symbol is designated as a bad part, The Symbol is displayed in Red
- Good Part.  When a Symbol is designates as a good part, the Symbol is displayed in Green
- Multimedia.   When media files are associated with a Symbol, a media adornment  "M"  is  affixed to the Symbol
- Ergo Danger.  When a Symbol has been defined as an Ergo Danger, a stick man figure is affixed to the Symbol.
- Poka Yoke.  When a Symbol has been defined as a Poka Yoke issue, a "?" is affixed to the Symbol.
- Eye Catching Feature.  When a Symbol has been identified as an Eye Catching feature, an eyeball adornment is affixed to the Symbol
- Fastener.  When a Symbol is designated as a Fastener, a "F" is affixed to the Symbol
- Quantity – The quantity assigned to the Symbol
- Munro Score – The calculated Standard Munro Score is adorned to the Symbol

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- Sequence Number – The step number in the sequence is adorned to the Symbol
- Thumb Image – A thumb image of the default Still image assigned to the Symbol is displayed under the Symbol
- Dwell – When a dwell is assigned, an adornment is displayed
- Pre-assembled Part – A Symbol is adorned when it has been designated a Pre-assembled Part.

## Libraries

*Symbol Libraries within Lean Design$^®$ are:*

- Tool Libraries
- Operation Libraries
- Fastening Libraries
- Repeat Libraries
- Part Libraries
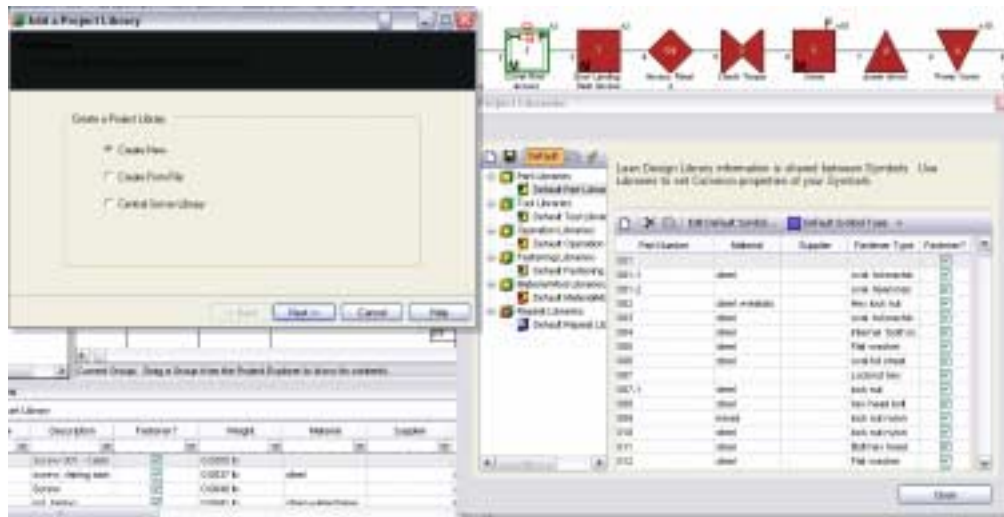
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Symbol Libraries provide the user the ability to make a collection of standard symbols (parts or operations) which may represent corporate components or standard build processes. Using libraries eliminates re-keying Symbol information and maintains a level of accuracy, consistency and continuity of Symbol data across a project. The Central Server holds global library templates that can be easily added to any project.

**Parts Import**

*Lean Design*® provides the ability to import a Bill of Materials (BOM) in the form of a comma or tabbed delimited file format. Once imported, a corresponding Parts Library will be created for use within a *Lean Design*® project.

**Multimedia**

All Symbols used within *Lean Design*® can have digital images and video files associated with them. The user can assign an unlimited number of multimedia files to a Symbol, with one file being designated as the default. When viewing a Symbol, a list of files names of each multimedia file will be presented for selection to view.

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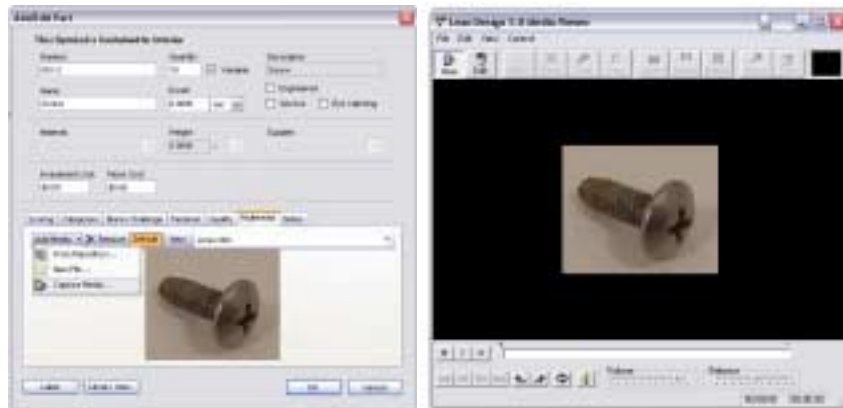
## Copy / Paste

Symbols are completely copy/paste and drag/drop enabled between diagrams and grids. Cross assembly and cross Project copy/paste functionality is supported. Copy/Paste functionality is integrated with the Windows® clipboard, including standard Windows® keyboard clipboard shortcuts, providing a common and familiar means to manipulate Symbol data.
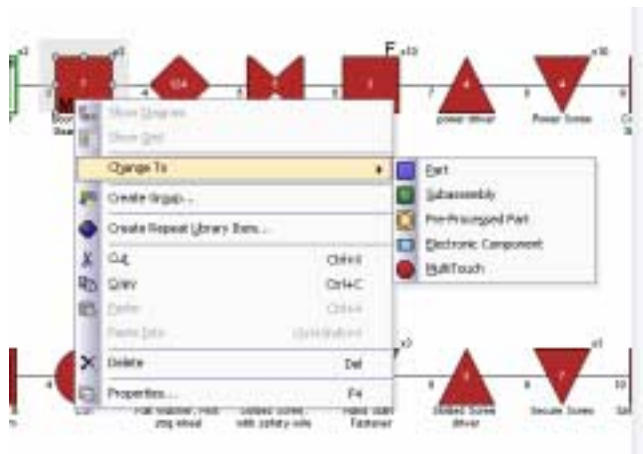


## Symbol Search

A powerful Search tool is used to find Symbols that match defined criteria. Searches based on Symbol fields as well as global text strings and Symbol modified date will be possible.

Search results are displayed in list format, with ability to easily modify the Symbol or navigate to the Symbols location within the model.

## Symbol Diagrams

Diagrams within *Lean Design®* are visual models of the hierarchal Symbol data. Diagrams can display an entire assembly, or individual *Lean Design®* container entities (Such as subassemblies, groups, repeats, etc). Users interact with *Lean Design®* Diagrams in a fashion similar to Visio®. Diagrams display all available visual Symbol information or can conceal specific information. User Symbol view options will include:

- Show/Hide Levels
- Show/Hide Repeat Symbol Contents
- Show/Hide Thumb Nail images
- Show/Hide Quality Symbol Maps
- Show Collections Only
- Show/Hide Symbols within Pre-assembled parts

Multiple Symbols can be selected on the diagram for grouping, copying and creating repeats. The working location on the diagram is visible to the user by a visual cursor.

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### Birds Eye View

A global view of the entire diagram, indicating to the user where the area of the diagram currently displayed on the screen exists with respect to the complete diagram. This view can also be used to navigate large diagrams as in a complete car or an airplane.
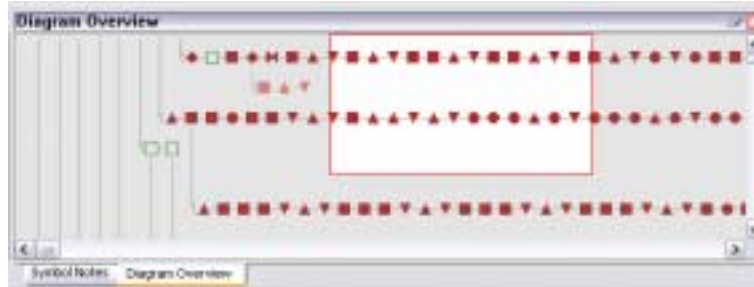


## *Edit Grids*

*Lean Design*® Edit grids allow for manipulating and editing Symbol data in an Excel® like fashion. Edit grids contain a single level of symbols allowing for easy drill down into the hierarchy. Edit grids support fill up and fill down as well as copy/paste functionality. Symbols can be copied and pasted across grids and diagrams.

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## Comparison Entities

*Lean Design*® consists of a collection of symbols.  An assembly, sub-assembly, group or preprocessed part are all groups of symbols.  *Lean Design*® will allow any Symbol collection entity to be compared with another and viewed on the Executive Summary.  Entities can be in the same project or across projects.

*Lean Design*® Symbol collections are:

- Assembly
- Subassembly
- Repeat
- Group
- Inspect Symbol Map
- Quality Symbol Map

Since Symbol collections can contain other Symbol collections, a Symbol hierarchy is created with each entity.  The top of a hierarchy is always an assembly.  Design information that is rolled up through the hierarchy is:

- Munro Standard Score (Assembly Time)
- Rework Time
- Throughput Time
- Weight
- Labor Cost
- Material Cost
- Investment Cost
- Quality Cost
- Part Count
- Unique Parts
- Step Count
- Good Part Count
- Fastener Count
- Unique Fasteners
- Tool Count
- Operation Count
- Ergo Danger Count
- Poka Yoke Count
- Poor Quality Cost (No QRC)
- 2nd Hand Touch Count

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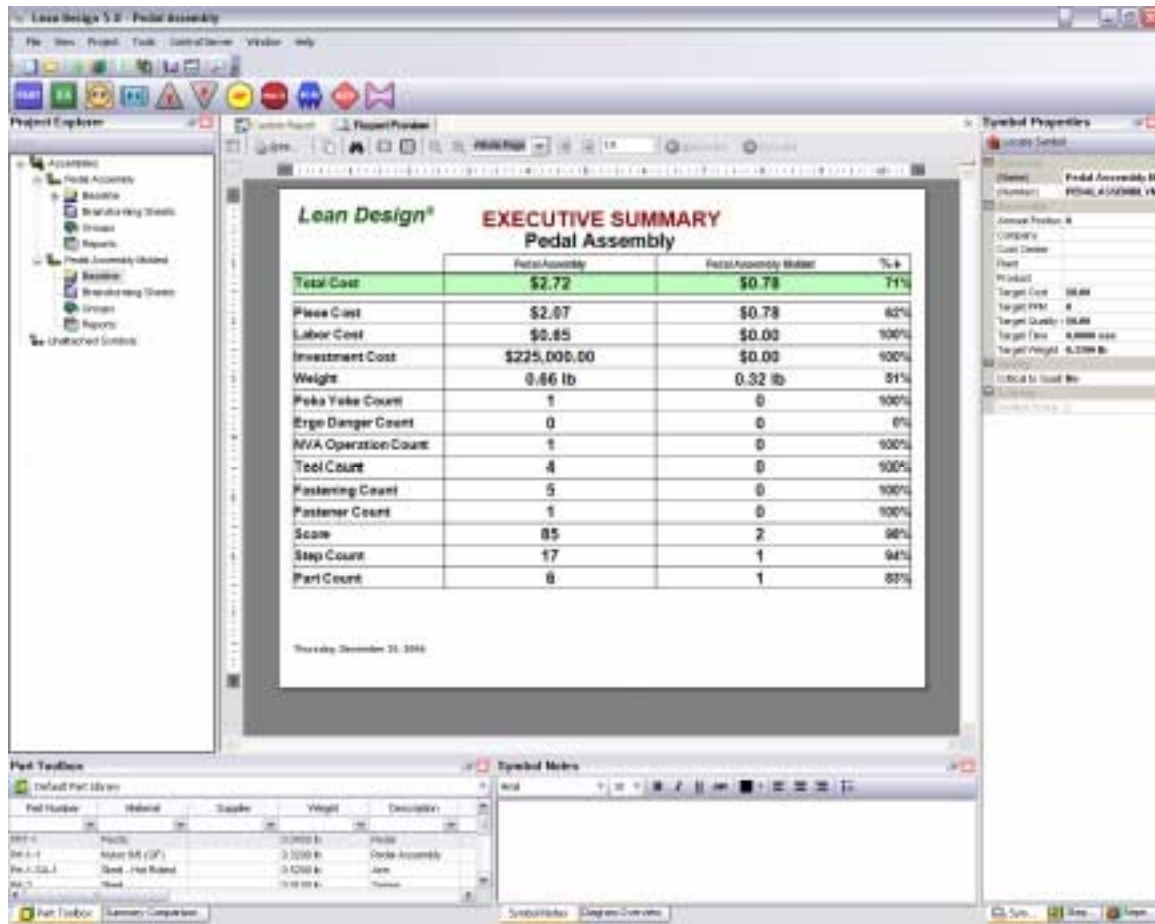
*Lean Design®* can generate summation values for any collection entity. Comparisons between any two (or more) collections can be determined. A *Lean Design®* user can easily determine the summation values at any level of the assembly.

### Reverse Sequence
The Symbol sequence in any collection can be reversed. Only Symbols on the current level are affected.

## Lean Design® *Assembly*
An Assembly is the top most level of a *Lean Design®* hierarchy. An assembly has properties that define the defaults for Symbols placed in the assembly.

### Assembly Properties:
- Assembly Name
- Number
- Company
- Product
- Weight
- Cost Center

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- Investment Cost
- Poor Quality Cost (Non QRC)
- Annual Production
- Target Weight
- Target Cost
- Plant



A *Lean Design*® project can contain an unlimited number of assemblies. Each Assembly is another *Lean Design*® Collection entity and can be compared with any other collection entity.

**Assembly Entities**

A *Lean Design*® assembly consists of a baseline design, multiple redesigns, groups and Reports.

**Baseline**

The assembly baseline is where a user maps the design using Symbols. The baseline is a view into the actual symbol data. Each assembly contains only one baseline.

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## Redesigns

A *Lean Design*® redesign is a series of changes made to the baseline. *Lean Design*® assemblies support unlimited redesigns. Symbols that are changed in a redesign are adorned as changed on a redesign diagram. Rollups on redesign entities reflect the redesign changes merged with the baseline information. Baseline changes are automatically reflected on all redesigns. Any redesign or entity within a redesign can be compared with any *Lean Design*® entity in any project. Redesign modifications can be associated with Brainstorming sheet ideas.

Redesign Properties
- Name
- Owner
- Brainstorming Idea

## *Lean Design*® Project

Everything a user does or creates is contained within a *Lean Design*® Project. Within a project, users create assemblies and model actual assembly processes. Within a project, users create redesigns, brainstorming sheets, reports, and documents. A project can also contain unassigned entities, which are Symbol hierarchies that are not a part of an assembly. Unassigned entities are always local and cannot be entered into the Central Server. *Lean Design*® will support running multiple instances of the application, allowing the user to open two projects simultaneously. A single project can only be opened in one instance on the same computer.

Project Properties
- Industry – Selecting an industry defines Quality defaults.
- Company / Client
- Owner – User who created the project

### *Industries*

The industry selection for a project will establish default PPM and Q Incident costs to be applied to Project entities. The A-F quality grade scale used to derive the Sigma and Grade values from PPM is assigned per the project industry selection. These default values are supplied by Munro Software Services and can only be modified by Munro Software Services.

*Lean Design*® Industries:
- Aerospace
- Aircraft
- Aircraft (GA)
- Aircraft Defense
- Appliance
- Automotive
- Building Construction
- Boats

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- Computers
- Defense
- Electro Mechanical
- Electronics
- Fuel Cells
- Furniture
- HVAC
- Jet & Turbine Engine
- Machine Tools
- Medical
- Motor Cycles
- Off Road
- Postal, Printing Automation
- Power train
- Ships
- Toys

## *Project Structure*

*Lean Design*® will accommodate a single user disconnected project work environment, as well as a multi-user centrally managed project work environment. To accomplish this, *Lean Design*® utilizes a Master / Local data structure. Projects will reside on a local machine data store, a *Central Server* data store or both, depending on the project collaboration requirements.

### *Check Out / In*

Project entities can be checked out at any level. In order for a Symbol to be editable, it must be checked out. Centrally managed project information must be checked out to be edited. While users are offline, project Symbols that are not checked out will not be editable. When a user checks out data, that data is transferred locally and will be available offline. Data not checked out and not made available offline will not be visible when disconnected from the central server.

### *Working Locally*

Projects can be created locally. When created locally, the project is automatically checked out, and will remain checked out until it is placed into a central server. Centrally managed projects can be modified locally by checking out the entities to be modified.

### *Add to Master*

When a project is created locally, the project can be shared with others by adding to a central server. Once a project is centrally managed, users must check-out the project entities they wish to modify.

### *Synchronization*

Centrally managed projects will require synchronization to maintain the local and central versions of the project. A user initiated refresh command will cause data on both local and central projects to be replicated to each other. Synchronization

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will post changes made locally to the central server, making user changes available to all users, while updating locally available information with changes made by all other users to the central server.

<u>Make Available Offline</u>
An entire project can be made available offline. A project that is made available offline will not always be checked out and therefore not always be editable. If not checked out, project data cannot be modified, but it can be viewed.

## Security

Users within *Lean Design*® are defined in a global User Directory. The User Directory contains users and user groups. A user or group can be assigned to one of four authority levels:

- Global Admin
- Project Admin
- Project User
- Project Reader

A *Global Admin* user has authority to interact with all of the Central Server entities. A Global Admin can open any project within the central server, add/remove/modify global libraries, and modify user accounts.

A *Project Admin* User can perform any action relating to that project. This will include granting other users permissions to the project, overriding checkouts by other users and any other restricted project functions. They can not modify the Global Libraries. When a user adds a local project to the Central server, that user will be designated as the Project Admin.

A *Project User* can interact only with the projects that they are assigned to. They will be able to checkout and modify project data, but will not be able to access any restricted project functions.

A *Project Reader* will be able to view and report on a project, but will not be able to checkout or modify any project data.

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## Central Server

To facilitate stand alone operation, the User Directory exists both locally and on the central server.  A client can only interact with one Central Server at a time.

Users and Groups from the User Directory can be assigned to Projects.  When browsing the Central Server project list, users will only see projects that they have rights to interact with.

*Lean Design*® can be configured to use your Windows® username to determine your identity.  In this case, the user will not require a logon prompt when accessing projects.  To facilitate the use of this feature, users must be entered into the *Lean Design*® User Directory with the same username as their Windows® account.  This feature can be optionally disabled, always requiring a logon.

**Central Server**

Projects
  Tools Libraries
  Operations Libraries
  Fastenings Libraries
  Parts Libraries
  Repeat Libraries
  Category Definitions
  Cost Centers

Global Libraries
  Tools
  Operations
  Fastenings
  Parts
  Repeats
  Category Definitions
  Cost Centers

User Directory

**User PC**

Projects
  Tools Libraries
  Operations Libraries
  Fastenings Libraries
  Parts Libraries
  Repeat Libraries
  Category Definitions
  Cost Centers

User Directory

Check Out / In Project Entities
Online / Offline Model

Templates
For
Projects

Auto Synchronizing

Design Prophet Client/Server Model

## Unassigned Files

*Lean Design*® Entities can be created within projects not checked out by placing them in an unassigned files section of the project.  Unassigned files are stored locally and provide a container in which Symbol data can be entered immediately and transferred later by a copy/paste function when the target destination can be checked-out.

## File portability

*Lean Design*® project entity information can be saved to a file for transferring via disk or email.  These files can be opened by *Lean Design*® and placed into the

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unassigned files section of the project.  Alternatively, if the originally saved entity is checked out, a user can replace the entity with the information contained within the *Lean Design*® file.

Complete *Lean Design*® projects can be saved to a file, transferred and opened by another user.

### *Backwards Compatibility*
All new releases of *Lean Design*® Software will support opening and manipulating older *Lean Design*® Projects without the need to update the project version.

## Reports
Information contained within *Lean Design*® are shared and distributed through reporting.  The *Lean Design*® application has been defined to ensure reporting data is captured by the user who is modeling an assembly process.

All customized *Lean Design*® Reports can be saved for easy retrieval.  Reports are run against a *Lean Design*® entity (Assembly, Subassembly, Repeat or Group).

## Lean Design® *Reports*

- Comparison Report (Executive Summary)
- Assembly Report
- Weight Report
- Indented Bill of Materials
- Fasteners
- Pareto Chart
- Brainstorming Sheets
- Distribution Pie Chart

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## *Comparison Report*

The *Lean Design*® Executive Summary compares any *Lean Design*® entity from any other Project. A baseline entity is assigned along with up to three comparison entities. Percentage change can be displayed. Time can be displayed in hours, minutes or seconds.

Fields for inclusion on Comparison Reports
- Parts
- Good Parts
- Steps
- Assembly Time
- Fasteners
- Fastenings
- Tools
- Operations
- Ergo Dangers
- Poka Yokes
- Weight
- Investment Cost
- Labor Cost
- Material Cost
- Total Cost
- Poor Quality Cost
- Unique Fasteners
- Unique Parts
- Annual Savings
- Simple Payback
- Target/Actual Cost comparison
- Target/Actual Weight comparison
- TDU
- Sigma
- Quality Cost
- Grade
- Rolled Yield
- Quality Opportunity Count
- Inspect/Test Costs
- Annual Quality Cost

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*Comparison Report*

## Lean Design™

### EXECUTIVE SUMMARY
### Pedal Assembly

| | Baseline | Comparison 1 | % |
|---|---|---|---|
| Number of Parts | 6 | 1 | 83% |
| Good Parts | 1 | 1 | 0% |
| Number of Steps | 15 | 1 | 93% |
| Munro Assembly Score | 85 | 2 | 98% |
| Loose Fasteners | 1 | 0 | 100% |
| Unique Parts | 7 | 1 | 86% |
| Unique Fasteners | 1 | 0 | 100% |
| Tools | 2 | 0 | 100% |
| NVA Operations | 1 | 0 | 100% |
| Poka Yoke Problems | 1 | 0 | 100% |
| Weight | 0.655 | 0.320 | 51% |
| Non-Recurring Cost(K) | $225 | $80 | 64% |
| Labor Cost | $1.52 | $0.03 | 98% |
| Material Cost | $2.07 | $0.78 | 62% |
| Total Cost | $3.59 | $0.81 | 77% |
| Annual Savings(K) | $0 | $2,774 | +100% |

January 8, 2004       Pedal Assembly       Munro & Associates, Inc.

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*Customizations*

A Comparison Report can be customized by selecting fields to display on the report and the order to be displayed. Percentages can also be displayed. Time fields can be displayed in seconds, minutes or hours. Comparison entities can be selected across projects.



*Charting*

The Comparison Report can be generated graphically using a bar chart. The baseline along with redesign bars will be shown side-by-side for each parameter displayed on the report.

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## *Assembly Report*

The Assembly Report makes available reporting for all symbols.  The category filter does not apply to an Assembly Report.

Fields available on the Assembly Report
**(Bold indicates Subtotals available)**

- Level 1 Category
- Level 2 Category
- Level 1 Category Description
- Level 2 Category Description
- Symbol Description
- **Quantity**
- Munro Standard Score
- **Munro Standard Score Total**
- Poor Quality Costs(No QRC)
- Labor Cost
- **Labor Cost Total**
- Investment Cost
- Labor Rate
- Plant Efficiency
- Parent Description
- Part Number
- Repeat Description
- Symbol Type
- Sequence
- UPG
- UPG Prefix

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## Assembly Report

### Pedal Assembly

| Engineer | Department | Qty | Total Labor | Est Seconds | Est Hrs | Labor Rate | UPG | Labor Cost |
|---|---|---|---|---|---|---|---|---|
| **Department** | **Dept-1** | | | | | | | |
| Eng-1 | Dept-1 | 1 | $0.10 | 6 | 0.002 | $58.00 | | $0.10 |
| Eng-1 | Dept-1 | 1 | $0.13 | 6 | 0.002 | $75.00 | | $0.13 |
| Eng-2 | Dept-1 | 2 | $0.21 | 5 | 0.001 | $75.00 | | $0.10 |
| Eng-2 | Dept-1 | 1 | $0.02 | 1 | 0.000 | $75.00 | | $0.02 |
| Eng-2 | Dept-1 | 1 | $0.03 | 2 | 0.001 | $58.00 | | $0.03 |
| Eng-2 | Dept-1 | 1 | $0.05 | 3 | 0.001 | $58.00 | | $0.05 |
| Eng-3 | Dept-1 | 1 | $0.02 | 1 | 0.000 | $58.00 | | $0.02 |
| **Totals for Department** | **Dept-1** | Qty 8 | Total Labor $0.55 | Count: 7 | | | | |
| **Department** | **Dept-2** | | | | | | | |
| Eng-4 | Dept-2 | 1 | $0.03 | 2 | 0.001 | $58.00 | Level 1 | $0.03 |
| Eng-4 | Dept-2 | 1 | $0.15 | 7 | 0.002 | $75.00 | Level 1 | $0.15 |
| Eng-5 | Dept-2 | 1 | $0.13 | 8 | 0.002 | $58.00 | Level 1 | $0.13 |
| Eng-5 | Dept-2 | 1 | $0.29 | 18 | 0.005 | $58.00 | Level 1 | $0.29 |
| **Totals for Department** | **Dept-2** | Qty 4 | Total Labor $0.60 | Count: 4 | | | | |
| **Department** | **Dept-3** | | | | | | | |
| Eng-6 | Dept-3 | 1 | $0.23 | 14 | 0.004 | $58.00 | Level 1 | $0.23 |
| Eng-6 | Dept-3 | 1 | $0.04 | 2 | 0.001 | $75.00 | Level 1 | $0.04 |
| Eng-6 | Dept-3 | 1 | $0.10 | 5 | 0.001 | $75.00 | Level 1 | $0.10 |
| **Totals for Department** | **Dept-3** | | | Count: 3 | | | | |

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## *Weight Report*

The *Lean Design*® Weight Report includes weight related information.  Only Symbols that contain weight values are included (Parts and Subassemblies).

Fields available on a Weight Report
**(Bold indicates Subtotals available)**
- UPG
- Symbol Description
- Weight Total
- Level 1 Category
- Level 2 Category
- Level 1 Description
- Level 2 Description
- Level
- Is Fastener
- Is Repeated
- Material
- Parent Description
- Part Number
- Repeat Description
- Sequence
- Supplier
- UPG Prefix
- Symbol Type
- Weight
- **Total Weight**
- **Quantity**

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## Weight Report

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### Weight Report

#### Pedal Assembly

| Department | Dept Name | Engineer | Lead Engineer | UPG | Description | Weight | Qty | Total Weight |
|---|---|---|---|---|---|---|---|---|
| **UPG** | **Level 1** | | | | | | | |
| Dept-2 | Tool & Die | Eng-4 | LdEng-2 | Level 1 | Pedal | 0.040 | 1 | 0.040 |
| Dept-2 | Tool & Die | Eng-5 | LdEng-2 | Level 1 | Spring | 0.010 | 1 | 0.010 |
| Dept-3 | Molding | Eng-6 | LdEng-3 | Level 1 | Arm | 0.520 | 1 | 0.520 |
| Dept-2 | Tool & Die | Eng-4 | LdEng-2 | Level 1 | Brg Support | 0.070 | 1 | 0.070 |
| Dept-3 | Molding | Eng-6 | LdEng-3 | Level 1 | Bearing | 0.005 | 1 | 0.005 |
| Dept-2 | Tool & Die | Eng-5 | LdEng-2 | Pin | | 0.010 | 1 | 0.010 |

| | | | | | | Qty | Total Weight |
|---|---|---|---|---|---|---|---|
| **Totals for UPG** | **Level 1** | | | Count: 6 | | 6 | 0.655 |

| **Report Totals** | | | Count: 6 | | Qty | Total Weight |
|---|---|---|---|---|---|---|
| | | | | | 6 | 0.655 |

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## *Fastener Report*

A *Lean Design*® Fastener Report includes fastener related information.  The report is automatically filtered to include only parts and subassemblies that are designated as fasteners.

Fields available on a Fastener Report
**(Bold indicates Sub-Totals available)**
- Sequence
- Head Type
- Diameter
- Length
- Head Size
- **Quantity**
- Material
- Hard Joint Count
- Notes
- Level 1 Category
- Level 2 Category
- Level 1 Description
- Level 2 Description
- Is Repeated
- Parent Description
- Part Number
- Repeat Description
- Supplier
- Symbol Description
- Symbol Type
- Threads
- Torque
- UPG
- UPG Prefix

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# MUNRO SOFTWARE SERVICES, INC.

## *Fastener Report*

Munro & Associates, Inc.

### Fastener Report

**Pedal Assembly**

| Part # | Description | Head Type | Comments | Driver Type | Diam. | Length | Clamp Diameter | Qty | Hard Joint Count |
|--------|-------------|-----------|----------|-------------|-------|--------|----------------|-----|------------------|
| PartNo | **Prt-3** | | | | | | | | |
| Prt-3 | Pin | Clevis Pin | Black Oxide | Rivet Head | 4 mm Knurled | 35 mm | 8 mm | 1 | 0 |
| **Totals for PartNo** | **Prt-3** | | **Count: 1** | | | | | **Qty** 1 | **Hard Joint Count** 0 |

**Report Totals**      **Count: 1**      **Qty** 1    **Hard Joint Count** 0

*Lean Design* ™

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## *Indented Bill of Materials (BOM)*

The indented Bill of Materials Report shows graphically the hierarchy of Symbols. No sorting or subtotals are included on the Indented BOM. The report displays the hierarchy and sequence of symbols.

Fields available on an Indented BOM Report
- Symbol description
- Part Number
- Quantity
- Supplier
- Cost
- Weight
- Weight Total
- Media (Link to Default Media file)
- Material
- Repeat Description
- Sequence
- Level 1 Category
- Level 2 Category
- Level 1 Description
- Level 2 Description
- UPG Prefix
- UPG
- Symbol Type
- Parent Description
- Quality Cost
- Quality Cost Total
- DPI
- Sigma

## Report Totals

The Indented BOM displays a Totals Section that includes:
Assembly Totals
- Analyzed Subs
- Unanalyzed Subs
- Parts
- Fasteners
- Parts + Unanalyzed Subs

Pre-assembled Totals
- Analyzed Subs
- Unanalyzed Subs
- Parts

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- Fasteners
- Parts + Unanalyzed Subs

Report
- Weight
- Cost
- Quality Cost
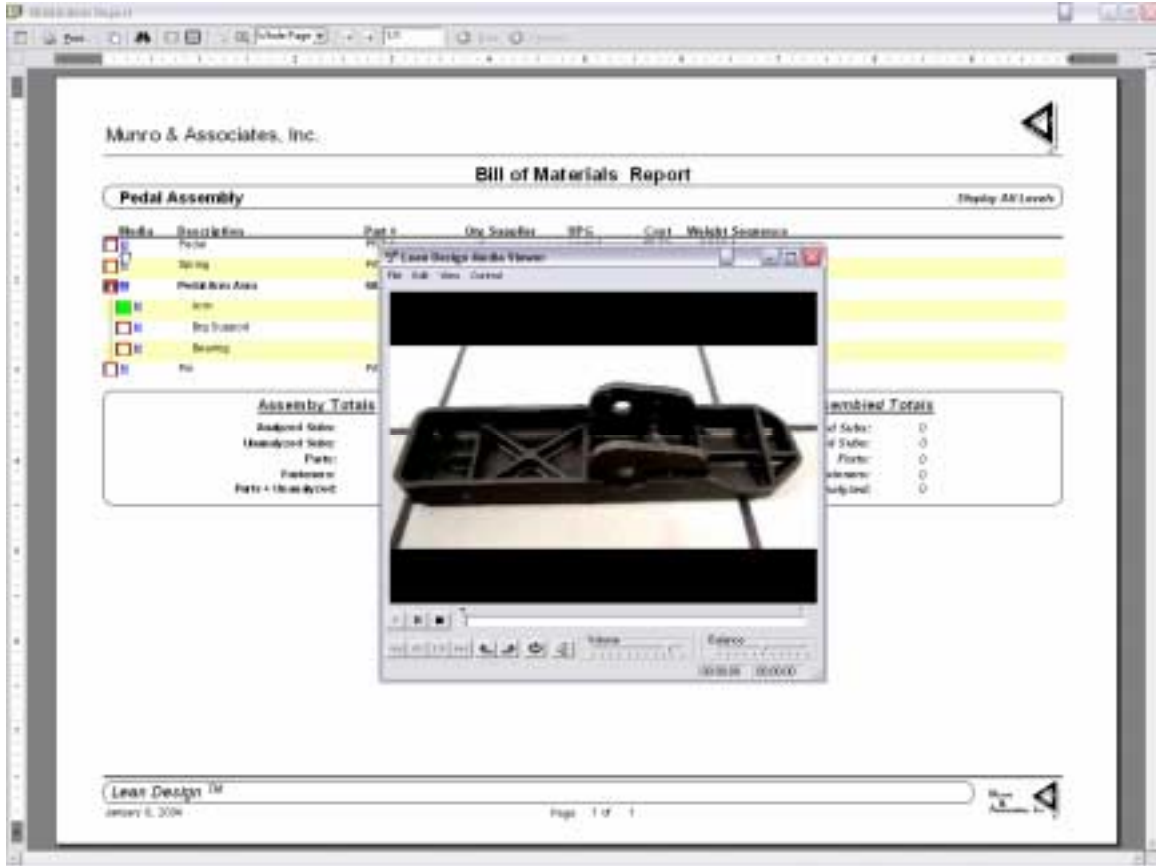
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*Part Labels*
Labels can be printed for a parts and subassemblies.  The label printer is from printers configured in Windows.  The printer must support 4 x 2.5" paper size.

The label will include the following elements:
- Assembly Name
- Product Name
- Part Description
- Part Number
- Quantity
- UPG
- Unit Weight
- Material
- Supplier
- Company Name
- Department

*Pareto Charts*

*T*he Pareto Chart identifies the Symbol with the heaviest influence on Cost and TDU.  The Pareto Chart can be selected to Sort on highest cost of highest TDU.  A Pareto chart can be generated for any *Lean Design*® Collection Entity.

*Labor/Material Cost*
A Pareto Chart similar to the Quality Pareto can be generated to compare Material and Labor Costs.

*Quality Report*
A *Lean Design*® Quality Report includes Quality related information.  This is intended to provide a comprehensive quality report including each quality issue assigned to Symbols in the report scope.

*Brainstorming Sheets*
Design Prophet Brainstorming sheets can be printed as a report.

*Distribution Chart*
This report identifies the % distribution of the selected parameter across Symbols assigned to a level.  The report is displayed in either a Pie Chart or Bar Chart format and can represent information from any *Lean Design*® Collection entity.  Bar Charts can display percentages or actual values scaled from the minimum value in the data set to the maximum value.

Parameters:
- Weight
- Material Cost

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- Labor Cost
- Investment Cost
- Quality Cost

## Report Output Types

*Lean Design*® Reports can be printed to any configured printer. In addition, reports can be exported in Excel, tab delimited, Rich Text, PDF, HTML, Text, and TIFF file formats.

## Diagram Printing

*Lean Design*® Diagrams will support printing/plotting functionality enabling a quality report output.

Diagrams, and all their adornments, can be printed or plotted. *Lean Design*® includes a Print Preview functionality showing page breaks.

When printing a diagram, the diagram will support scaling by a user defined percent.

Diagrams can be saved to JPG image files for inclusion in PowerPoint® and Word® documents.

Reports and Diagrams can be printed as PDF documents.

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Quality Report Card® (QRC®).

The Quality Report Card® provides a detailed and prioritized view of the cost of a product's quality and a prediction of the impact of planned changes. When a team has completed an analysis for a product, opportunities for quality improvement are highlighted for attention. As your quality improvement teams imagine ways to reduce or eliminate quality issues, the Quality Report Card® reveals how much monetary return can be expected.
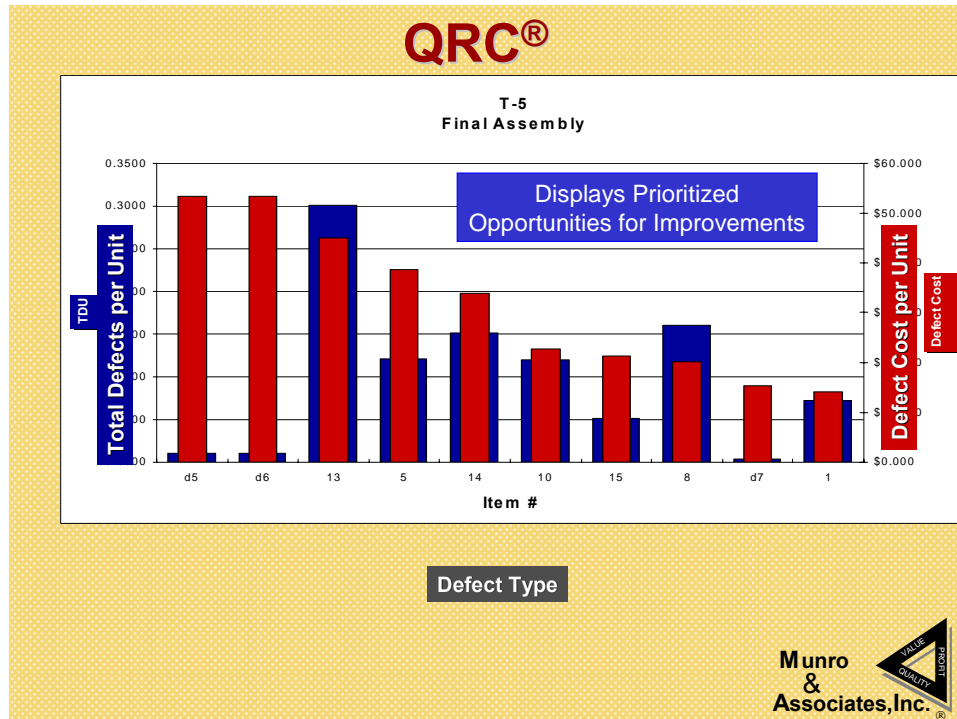


The Quality Report Card® provides a structure for collecting quality data and information to reveal summary measurements, which then prioritize opportunities for quality improvements that can be made by changes in manufacturing processes for existing products. However, the Quality Report Card® also provides a unique benefit of predicting quality for new product designs.

The *Lean Design*® symbol structure allows the User to go down to any level of detail that is appropriate to indicate root causes of defects and to determine which ones have the most influence on total quality and cost. The Quality Report Card® allows "pricing" of each defect type and includes algorithms to calculate the cost of quality for defects that are escaping from the lower levels up through the value chain. If a defect escapes from one level to another, the cost increases dramatically due to all of the "innocent" parts and assemblies that are affected, and the additional people and resources needed to deal with the defect. The Quality Report Card® also correctly calculates the burden that each good unit
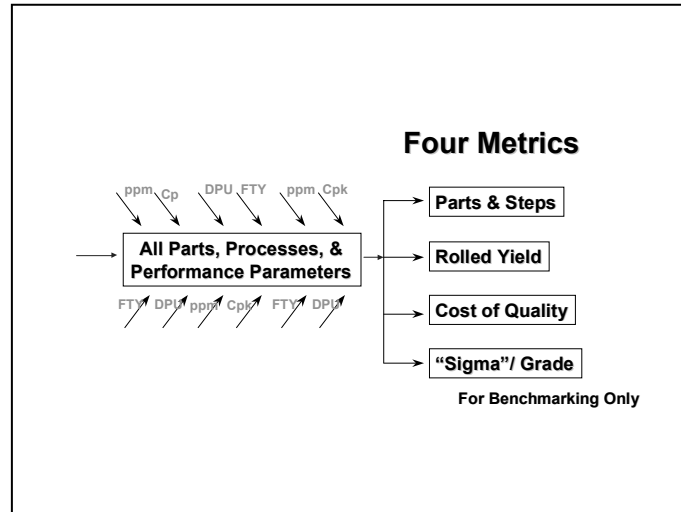
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must bear in order to pay for the scrap that is generated. As new data become available throughout the product improvement process, The Quality Report Card® can be updated to provide ever greater accuracy.

## What does the Quality Report Card® Measure?



The four metrics the Quality Report Card® uses to calculate a company's cost of quality.

**Total Parts & Steps** is a measure of the complexity of the product, comprising the total number of parts and process steps in the detail sheets, which represents the total opportunity count for this particular unit.

**Total Defects per Unit** is the average number of defects expected in each unit build.

**Rolled Yield** is the estimated percentage of production that would have zero defects without inspection, test, repair, and defect containment.

**Cost of Quality per Unit** is the calculated cost of all the quality activity (i.e., lost profit) per unit build.

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The results are charted on the Quality Report Card® and includes the:

**Total Annual Cost of Quality**, which is the total yearly cost of quality for the annual production volume, and the **Dpmo (defects per million opportunites), Sigma, and Grade**, which are automatically calculated from "TDU" and "Total Parts & Steps.

When a QRC™ analysis has been completed, an **Executive Summary** report is generated which looks like this:

## Munro Quality Report Card®

**Executive Summary**

| | |
|---|---|
| Assembly (Unit) | Company |
| Suppli | Product |
| | Date |
| | Prepared by |

**Four Metrics**

Annual volume

Total Parts & steps /Unit: **131**

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Total Defects /Unit:

Rolled Yield: **11.1%**

COQ per unit: **$700.59**

**Total Cost of Quality Annually:**

For "Six Sigma" Benchmarking Only --

Sigma: **3.63**

Quality Grade: **C-**
(considering complexity)

Supporting Details

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## User Interface

*Lean Design*® uses a Symbol diagramming interface making it easy for users to enter the Symbol information, and most importantly, use the visual Symbols to report and display the assembly process, and the impact recommended changes have on the assembly process

The *Lean Design*® User Interface uses dockable library windows, media windows, project and symbol trees, notes windows, and a Symbol property grid.

*Lean Design*® Interface toolbars are customizable. The user can select the buttons they want, in the order they want and are contained within the toolbar.

Standard Windows® Copy/Paste, Drag/Drop functionality integrated with the Windows clipboard, making Symbol manipulation easy.

A position marker is displayed on active diagrams, providing the user a visual indication of the location on the diagram an insert operation will affect.

A *Lean Design*® User manual is integrated with the application, extending standard Windows® help functionality such as pressing the F1 button to display help information screen items the user is currently interacting with.

*Lean Design*® employs selectable Symbol views, allowing all or part of the available Symbol information to be displayed on the active diagram.

Weight scale integration – *Lean Design*® will integrate with a single specified weight scale for one button weight capture. This will reduce the time involved with entering weight information from the scale.

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## Deployment

### *Server based and or client based*

Lean Design® is has a separate install for the server and the client. The client can be run standalone or share server based libraries and databases.

### *Initial Installation*

*Lean Design*® will be deployed by network or CD media. An initial installation will be required on any computer that is to run *Lean Design*®. This install will place all supporting components on the computer, including:

- Database Engine
- Net Framework
- Multimedia Components

### *Live Update*

*Lean Design*® will support Live Update functionality, allowing a user to update their *Lean Design*® software from a central server. This central server could be located on an intranet or the internet. The Live Update feature will not be automatic, but requires the user to explicitly select the option of updating the software. When *Lean Design*® is started, the software *will* automatically check the configured central server for software updates and prompt the user that updates to their software version is available.

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**Lean Design**® *is built with the following technologies:*

Windows XP
Net Framework 1.1
Windows Forms
Visual C#
ADO.Net
Net Remoting
Microsoft Data Access Components 2.7
COM+ / Component Services
SQL Server 2000
Internet Information Services (IIS)
Microsoft Data Engine (MSDE)
Visual Studio .Net 2003

*Minimum system requirements are as follows:*

*Client (*Processor and Memory requirements are dependent on size of analysis)
1 GHz Processor or better
256 MB Ram
500 MB free Disk Space or more (Multimedia files will require additional space)
1024 X 768 Screen resolution or better
Windows 2000, XP or later (NT Not Supported)
Internet Explorer 5.1 or later
MDAC 2.7 or later

*Server (*Processor and Memory requirements are dependent on size of analysis)
1 GHz Processor or better
256 MB Ram or better (
500 MB free Disk Space or more (Multimedia files will require additional space)
Windows 2000 - 2003 Server (NT Not Supported)
Internet Explorer 5.1 or later
MDAC 2.7 or later
SQL Server 2000
Internet Information Services (IIS)

*Licensing*
Node Locked License (Single computer)
Network License (Up to three simultaneous users)
Site License (Unlimited users, site is generally a single building, OEM Platform)
Corporate
Small Business (>50 people)
University

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