

Quick C/O Principles

<https://www.allaboutlean.com/smed-theory/>

eVSM – Creating a Quick C/O Model

Opening the Changeover wizard

In the "Open" dialog box to open the Changeover application (in is in the Lean Design Tools category).

Time Units

Drag and drop the "time units" shape from the WizCO stencil onto the page. This registers it as a Changeover design page. Select the appropriate length and cost units

Import Floor plan

Use "Insert Picture" command in Visio to bring in a copy of the floor plan. Fade the picture by making it transparent so that its easier to see the data that you will create on top of it. Scale it so its fairly large and you can draw motion paths without too much congestion. Optionally you can "lock down" the image by putting on a Visio layer and locking the layer.

Establish the Scale

Drag and drop the "scale" shape from the WizCO stencil onto the page. Move the arrow ends to a known dimensional value on the floor plan. Enter in the corresponding actual dimension in the "scaled distance" variable. Right click the circular orange interaction shape and select "update scale". This must be done every time the scale value is changed or the scale arrow is adjusted

Add changeover activities to the floor plan

You can drop activities directly onto the page from the Wiz CO stencil. Optionally there is a means to import these from Excel

Identify the resources working on the changeover

Drop one or more resource shapes from the WizCO stencil onto the page and name each resource using the Blue text gadget. Enter speed and cost values for each. Position each resource somewhere near the first activity that the resource is involved in

Connect each resource to its activity sequence to create a resource chain

Select the resource and then shift-select the activities in sequence that the resource is executing. Use the "Sequence Arrow" button in the toolbar to connect the resource to the activities. Note that there CANNOT be two resources on the same activity. If more than one resource is needed than duplicate the activity and have a resource connect to each one.

Intermediate routing points

Note that the length of the sequence arrow is used to estimate walk times. For any complex walk patterns between activities use intermediate "routing centers" that the sequence arrows can be connected to.

Connect each resource to its activity sequence to create a resource chain

You can link the activities later with a "same start" constraint and via leader lines from each activity.

Handling sequential activities without related walk times

There is a "Trail Time Override" variable on the arrow that you can set to a small (but non-zero) value like 0.1s

Over-riding the walk time because of alternate time taking motion

There is a "Trail Time Override" variable on the arrow you can set to the override value

Adding a description to an activity

Select the activity and use the "List Variables" button to add a description. Use a text gadget to make the description visible

Identify each activity and trail (arrow) as internal or external.

Internal implies that the activity or travel happens while the station is stopped. Right-click on an activity or arrow and select "internal" or "external" as appropriate

Apply scheduling constraints BETWEEN the resource chains

Use the "Pipe" button in the toolbar to create pipes between activities on two chain. A pipe implies an End-Begin constraint. Drop the "Start Linker" shape on the page and connect activities on different paths to it via their yellow flying connector. This implies that all the shapes have the same start time

Add a summary shape for the changeover

Drop the summary shape from the WizCO stencil on the page. Connect all the resources to it via their yellow flying connectors

Check and Solve

Autopath, AutoTag, Check and Solve the Model

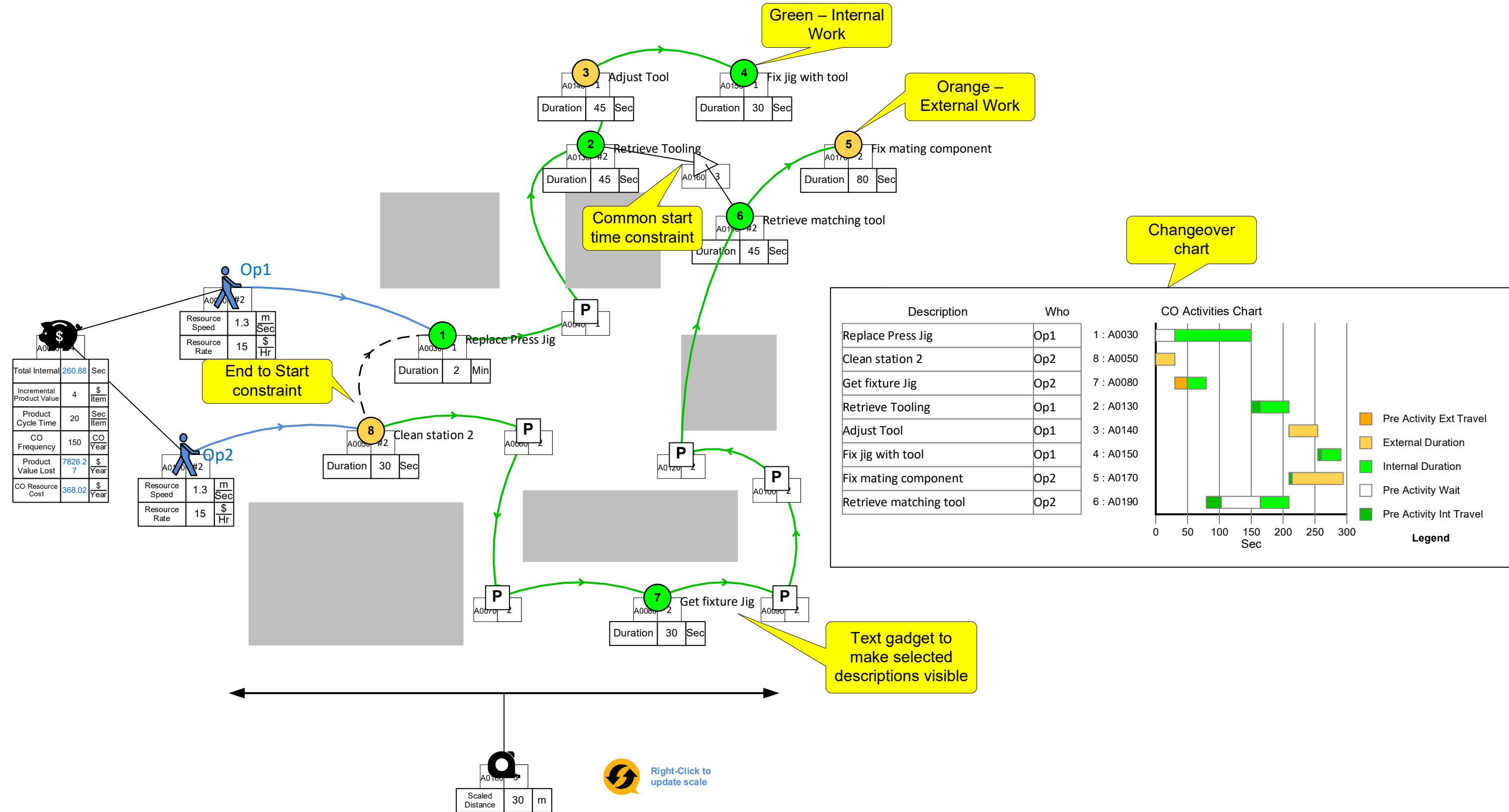
Create the CO chart

Drop the CO chart on the page and use the RMB plot option

Create the Timing Chart

This is a simpler form of the CO chart. Drop it on the page and use the RMB plot option. Select the path number to the right of any of the horizontal path bars and select the option to animate. This will animate the path that a single resource goes through

eVSM – Quick C/O Example



Variables

CO Frequency : Number of changeovers per period

CO Resource Cost : The cost of the resources involved in accomplishing these changeovers on a per period basis

Description : Description of this activity. This appears in the CO Chart

Duration : The duration of this activity

Effective Start : System variable used to create a value for the CO plot and allowing the travel time, wait time and activity time to be shown on a single bar for more compact tabulation

External Duration : The external time component of an activity duration

External Trail Time : The external time component of travel time for a path segment

Incremental Product Value : What's the value we get from being able to make one more product

Internal Duration : The internal time component of an activity duration

Internal Trail Time : If the trail is traveled while the station is stopped than this is the travel time. It is zero otherwise.

Pre Activity Ext Travel : The external travel time immediately ahead of an activity

Pre Activity Int Travel : The internal travel time immediately ahead of an activity

Pre Activity Wait : This is an enforced wait time for an activity because of a dependency from another path

Product Cycle Time : The time to produce a product at this station. Used to estimate production loss during changeover period

Product Value Lost : The value lost per period at this station due to reduced production because of changeovers

Resource Rate : Cost per period for this resource

Resource Speed : The average speed of movement of this resource

Scaled Distance : User input value of actual distance corresponding to a length on the page between the arrowheads

Total Internal : The total internal time for the changeover activity. This is the stoppage time for the station.

Who : System variable. Allows propagation of a resource name to all the activities they are working upon