Workplace Planner Help

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1 Proplanner Work Place Planner

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2 Introduction

Workplace Planner allows you to:

Determine cycle times in a workplace (operator walking and stationary or moving parts)

Compute processing times from predetermined time systems

Perform Lean value-added and Ergonomics assessments

Generate animations for the workplace, which allows for validation of the analysis and can enhance communication

You will not be able to operate Workplace Planner fully without a licence file; you will be restricted to evaluation mode and unable to use more than one routing file. Please see the next section for licensing instructions.

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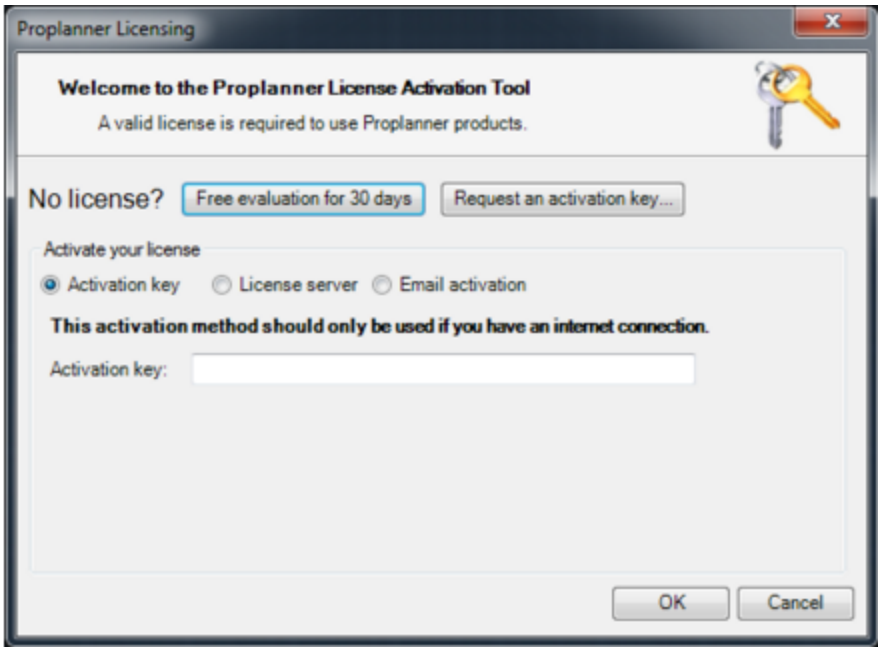
3 Licensing

You will see a screen similar to the one below when you open the application.



License Activation Tool - Activation Key

- Free evaluation for 30 days

If you would like to try the application, select this option to begin a 30-day trial period for full-feature evaluation. This will automatically retrieve a trial license.

- Activation Key

If you have purchased a stand-alone version of the application, please use the 'Request an activation key...' button to send Proplanner an email containing the necessary information. We will then return an activation key that can be copy and pasted into the Activation Key input box.

- License Server

Use this feature if you are utilizing a central licensing server. This is typically used for university lab computers and at corporations which have purchased floating/network licenses. Please contact your IT for support.

- Email Activation

If you do not have access to the internet, but you are able to send emails, please use the Email Activation button.

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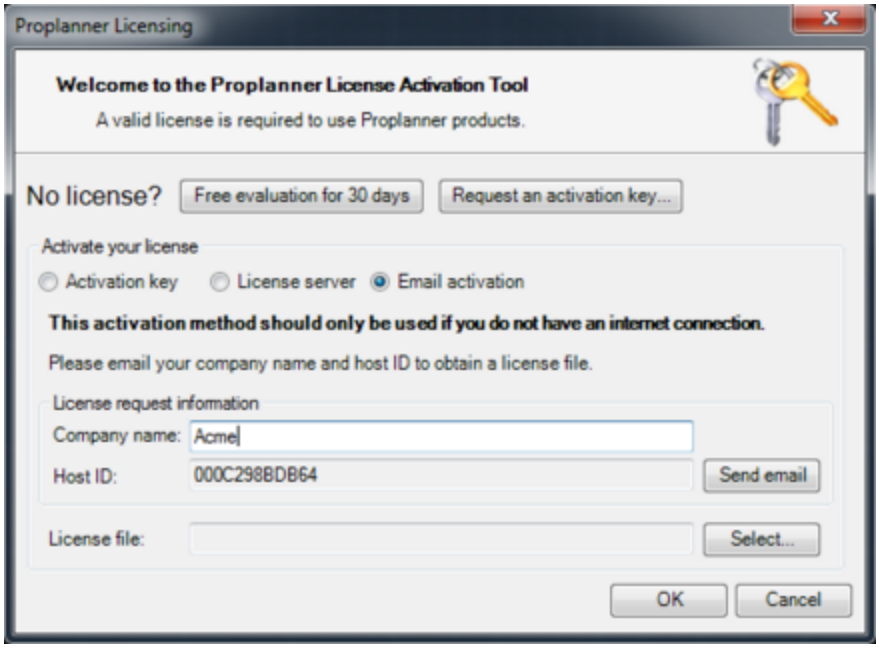

License Activation Tool - Email Activation

If you have any issues or questions in regards to obtaining a license for the application, please contact licensing@proplanner.com.

4 Getting Started

4.1 Preparing and Loading the Drawing

WPP can work in either Engineering (Foot-Inch) or Decimal (Metric) units. By default, the application will assume that if your drawing is set to Engineering units (Done with the Units command in AutoCAD) that your base unit is 1 inch in size. If your drawing is set to Decimal units, then Proplanner will assume that your base drawing unit is 1 millimeter. Once the WPP is running, you can reset your default base units (to Inches, Millimeters or Meters) in the Licensing/ Settings tab if the selected default is incorrect.

AutoCAD Note: Remember that if you use the AutoCAD UNITS command to change your drawing units, you will likely need to set your drawing limits (size) by using the AutoCAD LIMITS command. You will then need to follow the limits command with the ZOOM ALL command in order to ensure that you are viewing the entire work area.

Since WPP reads the distance from your drawing, it is important that the drawing is created in actual size. This means that if the distance between a table and a box is 3'6" in the real world then the drawing needs to be created such that the table is 42 base units from the box (in foot-inch units of course).

The drawing does not need to be highly detailed for WPP to work. Essentially, the drawing needs to contain enough detail so that the WPP user can determine where locations specified in the operator routing would be located within the workplace.

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4.2 Preparing the Routing

The workplace routings can be defined in another application (such as MS Excel) and imported into WPP, or the routings can be defined within the WPP application. If you wish to create your routing file in MS Excel, it is best to first import the stationary or moving.csv files into Excel and modify them in an effort to ensure that the file format is correct. Documentation on the format of each field in this file can be found in the appendix of this manual.

You may define a workplace routing within WPP by adding and Inserting lines within the routing editor. Make certain to use unique element numbers for each row, and to use the proper element code for a row (W for walking routes and P or M for process times, etc). Also do not forget to specify a location in the From field for all processing rows in order to tell WPP where the processing is to occur.

4.3 Conducting the Analysis

Now that your drawing is drawn to actual scale and your routing has been created, you are ready to select the Calculate command on the main routings window. Calculate will create your operators for you and will also ensure that all locations (From and To) specified in the routings are actually located within your drawing. If any routing locations are missing, WPP will prompt you to locate those within the drawing. Once all locations have been specified, WPP will update the walk times and distances in the routing editor and will compute the summary distance, time and lean information in the results window and on the LEAN and Ergonomics Charts.

Selecting the “Save As” button will save your results out to a file. The input routing data and output results data are stored in the same file. This file is a simple comma-delimited text file that is easy to import into a word processor or spreadsheet.

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5 Reference Section

Routings Tab
Locations Tab
Paths Tab
Stations Tab
Operators Tab
Parts Tab
Animate Tab
Lean Tab
Ergonomics Tab
Reports Tab
Sequencing Tab
Licensing/Settings Tab

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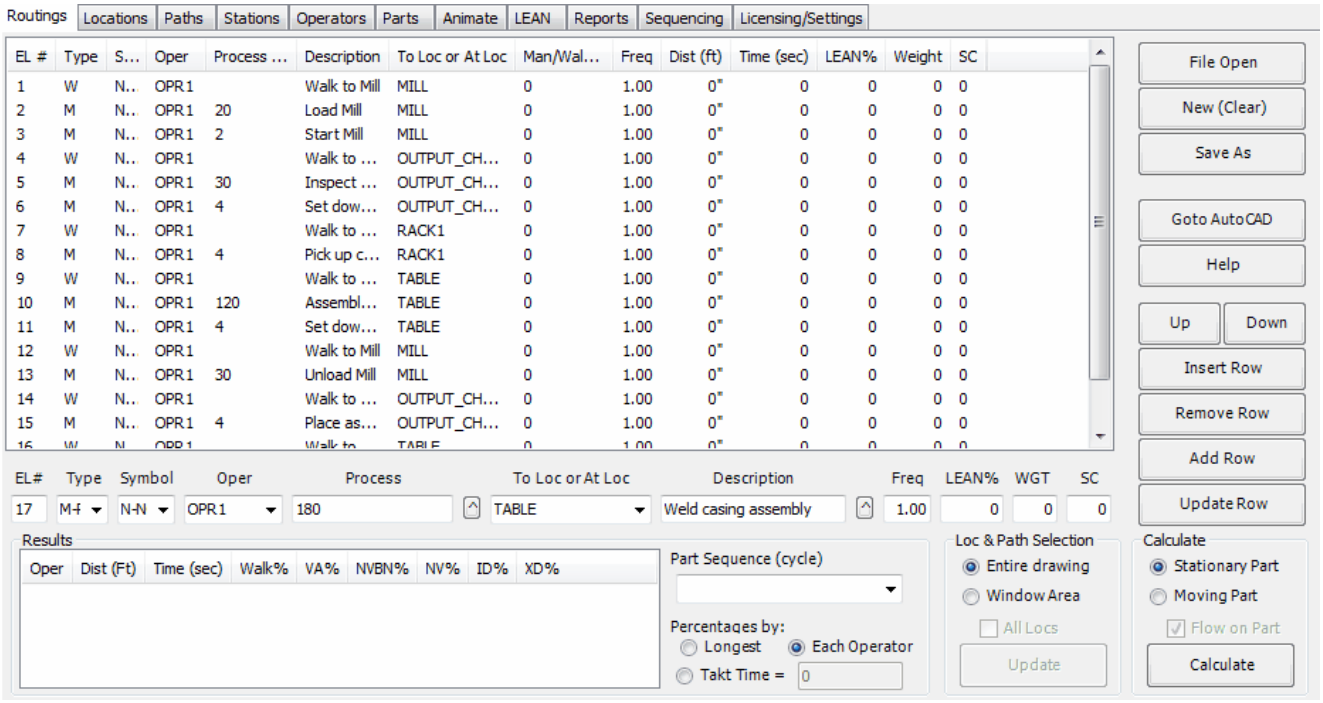
5.1 Routings Tab



Routings Tab

The routings tab is the main window of the WPP interface. In this window, you can Import, Save, and Calculate your studies, as well as enter and edit part routings and processes. Each route (also referred to as an element) identifies a move or process activity for an operator. These routes need to be defined in the order in which they occur for each operator. There is no required order for routes between operators. For example, it would not matter if you alternated the routes for Operator1 and Operator2 versus first specifying all Operator1 routes and then Operator2 routes (the only exception occurring with Synchronized operators, discussed in the following paragraphs).

Special Note: Your analysis summary will appear in the lower left corner of the routings screen. You may right-click in this window to copy these results to the clipboard. In fact, you can right-click and copy all WPP display list window information for subsequent pasting into other windows applications, such as MS Word or MS Excel.

Main Controls
Route Format
Parsing Options for User-P (MOST) and MODAPTS
Parsing Options for user-defined User-K1 and User-K2
Synchronized Operators
Moving Part Cycles
Workplace Planner with Proplanner

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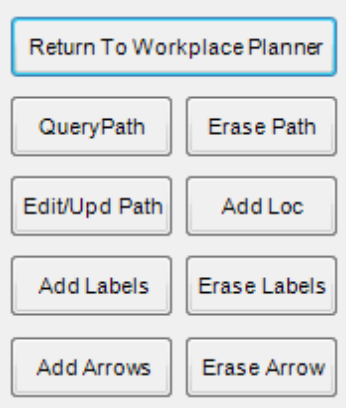
5.1.1 Main Controls

File Open: Loads the routing file into the routing editor. The import control will also set the Calc Stationary/Moving Part option, and read the drawing for location text, walk paths, and part paths and fill their associated displays.

New (Clear): Clears the current routings list, so that new routings may be entered.

Save As: Saves the routings in the editor to a file, along with the units of the study and any results in the lower-left results window.

Goto AutoCAD: Hides the WPP Modal window and displays a smaller Modeless editing window. This command is used when you need to work in the AutoCAD editor environment but wish to return to the WPP application and retain your information. The Modeless window (shown below) will appear in the far upper-left corner of the AutoCAD window. The controls included within this modeless window are discussed in their respective sections (i.e. Locations, Paths, etc.)



Modeless Window Displayed After Clicking Goto AutoCAD

Calculate: The calculate button performs the distance and time calculations and generates and updates the flow paths.

Calculate first looks in the drawing to see that all of the referenced locations exist. If some locations that appear in the *routing*, do not appear in the *drawing*, then WPP will prompt the user to enter each location. In this case, the user will be prompted to select the calculate button again to resume the calculate procedure once all of the input locations have been specified.

Calculate also computes the trace information needed for the Animation, and thus calculate must be run prior to viewing the Animation.

> **Stationary Part or Moving Part:** Determines which calculate method to use. For example, if a file containing relative part locations (i.e. @L5) would be calculated with Stationary Part option, then WPP will prompt the user for the location @L5 which will be referred to thereafter as a fixed location. Likewise, calculating a Stationary routing file with the Moving Part option will actually work the same as if it were calculated with the

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Stationary option.

Flow on Part: This checkbox is available for selection when the Moving Part option is chosen. By default, this option is selected on, which means that WPP will add flow distances for the operator when they are working on the moving part (and thus moving with the part). Checking this option off will tell WPP to ignore reporting walk distances for the worker when traveling with the part (i.e. riding the conveyor). Obviously, the total operator times will be reported identically in either situation.

Part Sequence (cycle): This button selects which single cycle or all to show results and lean values for.

Percentage: Chooses the value by which to calculate the walk, lean, and delay percentages.

Each Operator – Uses the actual cycle time computed for each operator.

Longest – Takes the longest cycle time of the operators in the results window and sets this as the cycle time for each operator. Internal delay time is then added for the operators with the shorter cycle times.

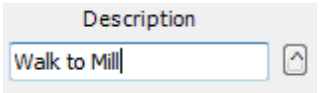
TAKT Time – Allows the user to specify a line TAKT time and then sets this as each operator's individual cycle time. Note that the TAKT time needs to be larger than any of the operator cycle times.

Loc&Path Selection: Determines if flow paths, part paths, locations, labels and arrows are to be evaluated and modified for the entire drawing (in the case of one workplace per drawing) or for a selected window area within the drawing.

All Locs Option: the All Locs option allows WPP to use reference locations outside of the windows selection area (only applicable if window-area is selected).

Routing Editor Controls

Insert Row: Inserts a row above the selected row and copies the information from the input boxes below the routing display into this new row as a default starting point.
Remove Row: Removes the selected row.
Add Row: Takes the data in the input boxes below the routing display and adds them to the end of the routing file.
Update Row: Takes the data in the input boxes below the routing display and updates them to the selected routing in that display.
Up or Down : Moves the selected row, up or down one row.
Description (shown below): Is where the general description and those for the left and right hand processes are stored.



General Description

The up arrow to the right of the text field can be clicked to open a new description window. In the case of some time standards, such as MTM-B, MTM-UAS or MOST, and non-predetermined time, it is optional to put the process description in the description field if it involves more than

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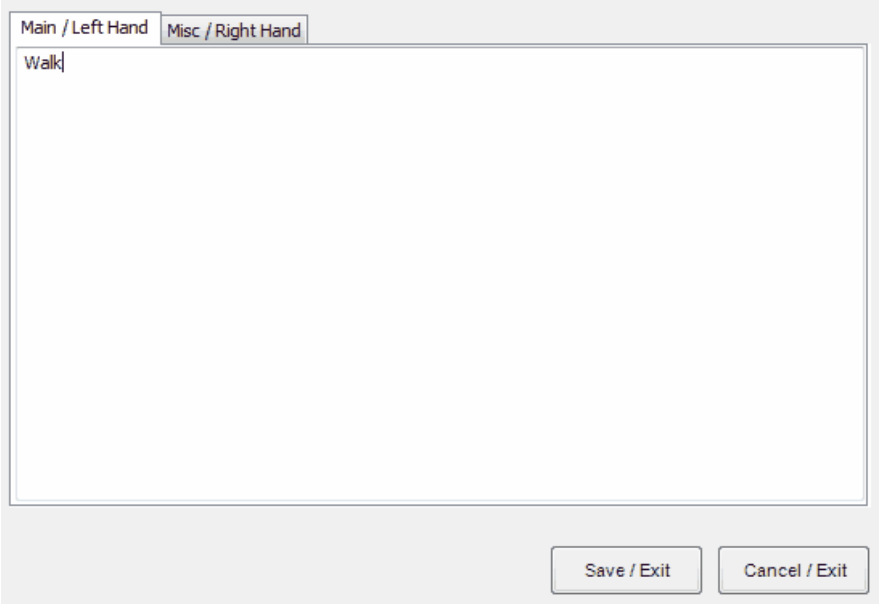
one statement. In this situation(MTM), it is necessary to put the word DESC, /DESC or DESC/ DESC in the Process field of the routing to direct the parser to look for codes in the left hand, right hand or left and right hand description fields respectively.



Process Description Field

Upon selecting the carrot next to the description field, the user can input both right and left hand descriptions as seen below.

Results Window in lower left of Routings tab

Oper: Operator for which the results are shown.
Dist: Distance being traveled for entire process.
Time: Total time of operations or time of each cycle.
Walk%: Percent of total time spent walking.
VA%: Value-added percent.
NVABN%: Non-value-added but necessary.
NV%: Non-value-added percent
ID%: Internal Delay is time spent waiting on a machine or synchronized operator.
XD%: External Delay is time spent waiting on a part to reach the station.

Results

Oper	Dist (Ft)	Time (sec)	Walk%	VA%	NVBN%	NV%	ID%	XD%
OR1	120'-2"	58.74	41	44	0	11	0	4
OL1	119'-4"	54.28	36	64	0	0	0	0

Routings Tab - Results Window

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5.1.2 Route Format

EL# - Element Number, used to synchronize specific element routings (rows) in WPP with other applications – such as Proplanner. If you are having the WPP compute distances for Walk and Hand oriented processes which you wish to re-import back to Proplanner, or other applications, it is recommended that you not modify these numbers for existing routings. Proplanner will automatically insert an asterisk "*" for all new routings.

Type – Element Type
NOTE: When defining your process elements, your entire routing file must use EITHER "P/M/W-type" or "I-type" elements. Do not combine a routing file with both types of elements.

EITHER

- **P or M or T or X –** Manual or Automated process element. The WPP will attempt to parse the text in the Process field upon Calc if a parser type has been selected. The P, M and T types are for different processes (machine dependent, operator dependent, etc) as specified by MTM standards. The X element tells the program to ignore the parsing of the process code for that element line.

- **W –** Walk move, tells WPP to compute the walk distance in Feet or Meters. The WPP will also parse this element and attempt to use the computed distance in the computation of time for that element code upon Calc if a parser type has been selected and if text is entered into the Process Field. [A walk type code is optional for W type elements]

OR

- **I –** Integrated Walk to, and Process at, element, tells WPP to compute the walk distance in Feet or Meters (from the operator's previous location to this new location specified in the From field) and then apply the process time (at this location) as specified in the process field. With the Integrated element type, you do not specify the process time in the Time field (as you do with the M,P,T or X element type). Instead, you specify your time in the Process field, according to the rules for specifying time in this field (discussed in the process section below).

- **A** - Activity Header (Not Fully Implemented). This provides for the future opportunity to define elements within an activity and have the individual element times be automatically aggregated into the Activity time. The WPP application will only evaluate the Element rows, and then update the Activity row with the aggregated time values.

- **H –** Hand move, tells WPP to compute the distance in inches (if output Feet) or millimeters (if output Meters) and replace for distance in hand move code (such as Reach or Move in MTM-1). The WPP will attempt to parse the text in the Process field upon Calc if a parser type has been selected. **This feature is not yet implemented**.

- **S-** Synchronized Move indicates that this task (Walk or Process) cannot begin until all of the operators who are being synchronized have completed their last task prior to the

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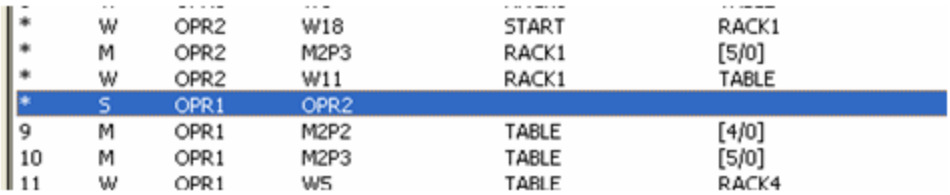
Synchronized element. To use synchronized moves, you must select a row in the routing file that is after all routes and processes that must be performed **prior** to the synchronized activity **for all operators being synchronized**. You then create a row with the element type "S" for synchronous and put the names of the operators that you are synchronizing in the following fields (Operator, Process, From and To). As such, there is a maximum possible of 4 operators that can be synchronized. For more information, please reference the "Synchronized Operators" section of this document.



*	W	OPR2	W18	START	RACK1
*	M	OPR2	M2P3	RACK1	[5/0]
*	W	OPR2	W11	RACK1	TABLE
*	S	OPR1	OPR2		
9	M	OPR1	M2P2	TABLE	[4/0]
10	M	OPR1	M2P3	TABLE	[5/0]
11	W	OPR1	W5	TABLE	RACK4

Synchronized Move

- **C –** New Cycle, is used only for moving part studies in order to set the arrival of the next part. After this line, all relative locations are referenced from this new part and thus the prior part is ignored from this line forward. Cycles can optionally have names (i.e. 2CAR shown below) and start times. Start times can be specified in absolute time with a time entry such as 40 (for 40 seconds from the beginning of the first part entering the WPP session) or in relative time @40 (for 40 seconds from the beginning of the prior part entering the WPP session). For more information, please reference the "Moving Part Cycles" section of this document.

56	P	OPERR-2	PROC	@RW<D		1.0	10'	15	75
57	W	OPERR-2		@RW<D	STARTR-2	1.0	3'-6"	0.7	0
58	C		2CAR			1.0	0"	@40	0
1	W	OPERL-1		STARTL-1	@L	1.0	11'-6"	2.3	0
2	P	OPERL-1	PROC	@L		1.0	9'-4"	14	100

New Cycle

Symbol – Operation process symbols used to add another degree of detail and recognizability to route data in the reporting outputs.

Oper - Operator Name. Unique operator names will appear in the *Operator* tab. You can add new operators by simply typing in a new operator name in the routings editor. This new operator will immediate appear as a valid operator within the Operator's tab.

Process – Process Code to be parsed (if parsing method selected). Otherwise, this text is just a notation for the user as to the activity being performed, and is not required to be specified. (reference exception for "I" element types discussed below) The text in this field will be passed to other programs that may parse the time code, provided that parsing is not selected within the WPP. Putting the text **DESC** in this field (upper or lower case) will tell the parser to look in that element's Left Hand Description field for the codes to parse. A **DESC/DESC** could be specified to tell the parser to look in the Left and Right hand description fields for both the left and right hand codes respectively. Finally, a **DESC/**

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M2P2 would also be valid to tell the parser to look in the left hand description field for the left hand code and to use the codes specified in the process field for the right hand (i.e. **M2P2** which is a MODAPTS code for this example). For additional information on parsing options refer to the "Parsing Options" section of this document

If the element type "I", for Integrated, is selected, then the WPP will parse this field to get the process time, even if no parsing method is selected. In this situation, you need to enter a time for the processing activity. This time can be specified as a number (in decimal minutes or seconds as selected in the Options tab). Optionally, you may also specify a walk time component and a machining time component, but the walk time component will be ignored. The walk time will be calculated as a W process would be. The syntax for specifying process times in this field is shown below (shown with time unit set to seconds)

Manual time/[walk time]/[machine time]	*(general form)*
3.4	*(specifies manual 3.4 seconds)*
3.4/2.5	*(specifies manual 3.4 sec and walk of 2.5*)*
3.5/2.5/4.2	*(specifies manual 3.4 sec, walk of 2.5*, machine of 4.2)*
3.5//4.2	*(specifies manual 3.4 sec, machine of 4.2)*
//4.2	*(specifies machine time of 4.2 seconds)*

*This value will be ignored and a walk time will be calculated by WPP.

To or at Loc – To Location for walkpath analysis and continuity evaluation

Man/walk/machine Time – Shows the breakdown of times into their manual, walking, and machine usage times.

Freq – Frequency is the number of times that the process or walk activity is performed per cycle.

Dist – Move Distance from drawing for Hands (H) or walking (W).

Time – Time in seconds to move or process. Times can also be specified in the hours:minutes:seconds format as shown in the example below, or in Decimal Minutes according to the settings in the Options tab.

2:42:12.5 would be 2 hours, 42 minutes and 12.5 seconds

Only times associated with element type W moves are computed if no parser is selected. In this situation, times are expected to be entered by the user, or contained within the imported file.

LEAN % – Defines the value added content for the element. For example, walking is considered to be totally non-value added, while Operating or Assembling is 100% value-added. Other Processing tasks such as reach, grasp, move, etc, may be partially value-added, or may include Non Value Added but Necessary content.

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LEAN values are whole numbers (integers) specified from 0 to 100 (inclusive), and may optionally include a second part to represent Non Value Added but Necessary content. The first part (before a slash) represents the Value Added content, and the second part (after a slash) represents the Non Value Added but Necessary content. The slash is optional if there is no Non Value Added but Necessary content. The following examples represent valid syntax for LEAN values.

100 is 100% Value Added
100/0 is 100% Value Added (*slash and zero at end is optional*)
50/20 is 50% Value Added and 20% Non Value Added but Necessary
/40 is 40% Non Value Added but Necessary
0/40 is 40% Non Value Added but Necessary (*0 before slash is optional)*

For I-type elements, the LEAN value percentage only applies to the process time component of the integrated element, as the walk time for the I-type element is always assumed by the WPP to be non-value added. For example, if an I-type element had a process time of 12 seconds and a walk time of 5 seconds and if the LEAN percentage was specified as 50 (i.e. 50%) then the WPP would consider the entire element to have 6 seconds of Value Added work content and 11 seconds of Non-Value added work content.

Weight – Currently a weight is entered into this field for use by the Ergonomics Evaluator. Weight can be entered as an integer number for walking (Type W) to be used in the Carry Assessment and also with a posture and integer weight value for Lifting in a process element. For example, a lift from the floor to the waist for a 10 lb object would be represented as F10. In addition, a combo-approach can be used if lifting between two or three zones as shown in the following examples. (FK10 is a lift from the Floor to the Shoulder for a 10lb object) (FH10 is a lift from the Floor to above the Head for a 10 lb object)

- **F** – Lift from Floor to Knuckle height when standing
- **K** - Lift from Knuckle height (just below waist) to shoulder height)
- **H -** Lift over Head from shoulder to above

SC – Special Codes field used for process time parsing. Some time estimation languages, such as MTM-1 and 4M require the addition of Special Codes that are used to define attributes of the element such as field of vision, In-Motion and Simultaneous Activities. Currently the MODAPTS and User-P (Most) parsers will assume simultaneous Left and Right hand motion unless an “L” (must be capital) is put in the SC field, in which the program will add both the left and right hand times.

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5.1.3 Parsing Options for Used-P (MOST) and MODAPTS

The MOST and MODAPTS predetermined work measurement systems are parameter based systems in which the parameter values (numbers) following the parameter codes (letters) are simply added together in order to determine the appropriate number of TMUs or MODs that define a particular activity. These TMUs, or MODs, are then multiplied by a fractional seconds value (shown below) in order to determine time in seconds (or Decimal minutes as specified in the Options tab).

MODAPTS Conversion: 1 MOD = 0.129 Seconds
MTM/MOST (User-P) Conversion: 1 TMU = 0.036 Seconds

For example, a Move and Place task would be defined in MODAPTS as an M2P2 which would evaluate to 4 MODS and thus 0.516 Seconds. For more information on the MODAPTS and MOST language syntax, please contact the user manuals produced by their appropriate organizations.

The WPP application includes special capabilities for parsing these parameter based codes. These capabilities are described below.

Left and Right Hand tasks with High or Low skill level

Left and right hand codes can be specified by simply separating the codes by a slash character **/** . The parser will use the longest processing time of the left or right and thus assumes a High skill level by default. You may also optionally place a capital **H** in the SC field to signify High skill level. If the task is of low skill level and thus the left and right hand codes should be added together (thus these tasks are performed sequentially) then a capital **L** should be placed in the SC field to signify Low skill level.

Partial Code Repetition

Part of the code syntax can be repeated by placing the codes to be repeated in parentheses that are prefixed by a multiplication factor. For example, in MODAPTS an **M2P2 5(W5)** would cause the parser to compute 29 MODs where the W5 parameter number would be multiplied by 5. Likewise, in MODAPTS, a **3(M2P2)** would evaluate to 12.

Simultaneous Motions

Part of the code syntax can be ignored by placing the codes to be ignored in angle brackets (i.e. **<>**). In some situations you may wish to document a set of simultaneously occurring tasks, but have the parser ignore some of these tasks which can be performed concurrently. For example, if the operator was doing a Move and Place task while walking and the walking should be ignored, then the code should be specified as **M2P2 <W5>.**

Direct Time Specification for "I" type elements

As mentioned in the discussion for I-type elements, the process time must be specified in the process field. This can be done by specifying a parse method and including the codes for that particular method in this field, or it can be accomplished by specifying the time directly as a direct value as per the format shown below. This format for specifying the process time can be used if no parse method is selected, or if any parse method is selected – even though the

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following format is not valid for that parse method.

Manual time/[walk time]/[machine time]	*(general form)*
3.4	*(specifies manual 3.4 seconds)*
3.4/2.5	*(specifies manual 3.4 sec and walk of 2.5)*
3.5/2.5/4.2	*(specifies manual 3.4 sec, walk of 2.4, machine of 4.2)*
3.5//4.2	*(specifies manual 3.4 sec, machine of 4.2)*
//4.2	*(specifies machine time of 4.2 seconds)*

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5.1.4 Parsing Options for user-defined User-K1 and User-K2

The WPP application allows you to define your own user-defined keyword-based parsing method. To define your own time standard file, simply create a comma delimited text file (CSV) of the format shown below - following the time code definitions. The first line of this file must contain the 3-letter code for the units of the times specified in the following file. Unit types and their 3-letter codes are shown below.

MIN *(decimal minutes)*
SEC *(decimal seconds)*
TMU *(MTM Association TMU's which equal 0.036 seconds)*

MUS *(MTM Association MU's which equal 0.0036 seconds)*
MOD *(MODAPTS Association MOD's which equal 0.129 seconds)*

The sample code file has it's fields separated by commas (not shown below).

1. The first field contains the code name (any string – cannot include tabs, spaces or commas
2. The second field contains description of the task represented by the code. This field is for user-use only as the program does not parse this field.
3. The third field contains the time for the code, in the units specified in the time code field at the beginning of the file.
4. The fourth field contains the description of the task frequency (i.e. Each, Per Foot, etc.) This field is for user-use only as the program does not parse this field.
5. The fifth field contains a number 0, 1 or 2. The 0 number means that the time is a manual operator time, the 1 code means that the time is a machine processing time, and the 2 code means that the time is for walking.
6. The sixth field contains the percentage of value added work content in this process. The percentage is represented by an integer number from 0 to 100 (inclusive).

MIN						
A01	LWR SHIELD POS. ELECTRODE & STRIKE ARC	0.05	EA	E	0	100
A02	RAISE SHIELD & REMOVE ELECTRODE	0.05	EA	E	0	100
A03	REPOS SHRT. GRPS OF WELDS NO RAISE SHLD	0.02	EA	E	0	100
A04	REPOS LONG	0.04	EA	E	0	100

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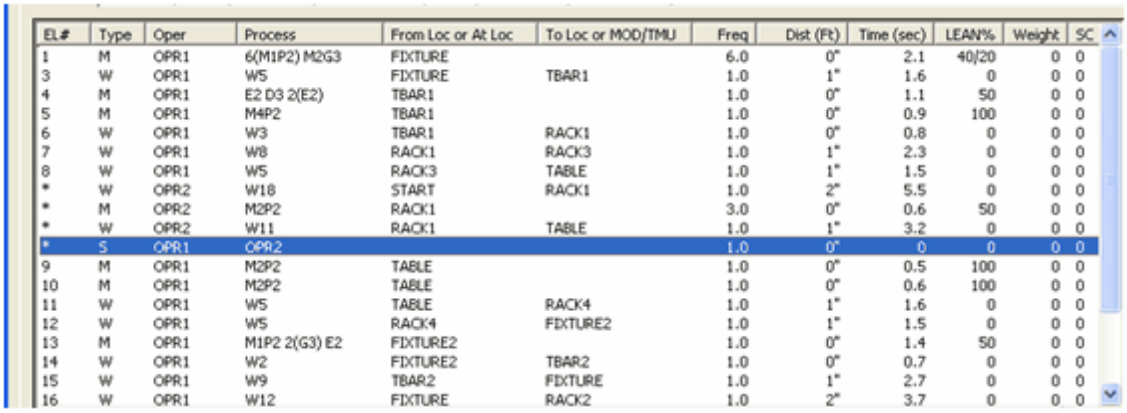
5.1.5 Synchronized Operators

The WPP application will allow you to synchronize up to 4 concurrent operators within a workplace. This feature is most often used when you have tasks that must be performed by more than one operator concurrently, or when an operator cannot begin a particular task until another operator has completed a prior task.

Operators can be synchronized in stationary and moving part studies. An operator will wait for another operator at the last specified location that he/she is routed to prior to the task after the synchronization element. In moving part studies it is possible that an operator might be waiting on a moving part for another operator and thus this situation should be taken into consideration when viewing the animation of synchronized operators in moving part studies.

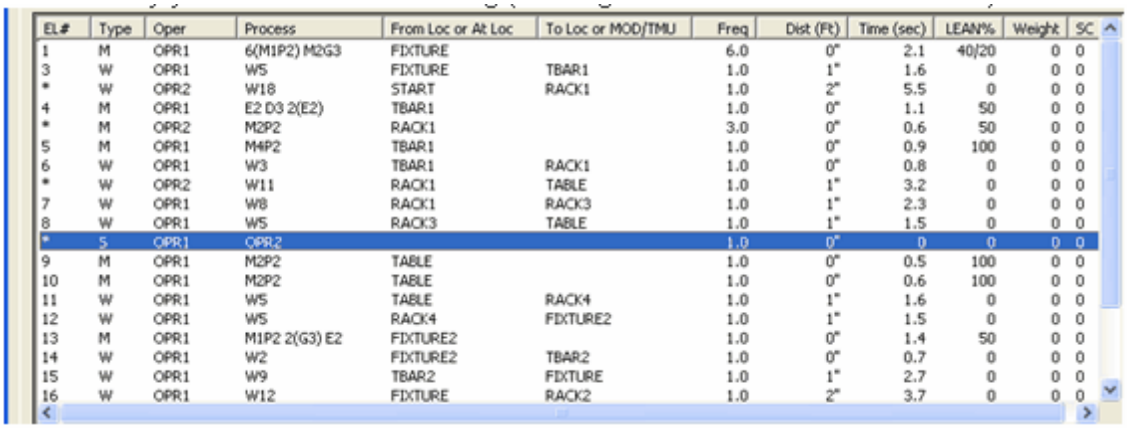
All routes (elements) for synchronized operators must be completed prior to the synchronization element before the WPP application will continue on to those tasks listed after the synchronization element. The order of the tasks specified between operators prior to the synchronization element can be listed alternately or sequentially as shown in the two examples below.



EL#	Type	Oper	Process	From Loc or At Loc	To Loc or MOD/TMU	Freq	Dist (Ft)	Time (sec)	LEAN%	Weight	SC
1	M	OPR1	6(M1P2) M2G3	FIXTURE		6.0	0"	2.1	40/20	0	0
3	W	OPR1	W5	FIXTURE	TBAR1	1.0	1"	1.6	0	0	0
4	M	OPR1	E2 D3 2(E2)	TBAR1		1.0	0"	1.1	50	0	0
5	M	OPR1	M4P2	TBAR1		1.0	0"	0.9	100	0	0
6	W	OPR1	W3	TBAR1	RACK1	1.0	0"	0.8	0	0	0
7	W	OPR1	W8	RACK1	RACK3	1.0	1"	2.3	0	0	0
8	W	OPR1	W5	RACK3	TABLE	1.0	1"	1.5	0	0	0
*	W	OPR2	W18	START	RACK1	1.0	2"	5.5	0	0	0
*	M	OPR2	M2P2	RACK1		3.0	0"	0.6	50	0	0
*	W	OPR2	W11	RACK1	TABLE	1.0	1"	3.2	0	0	0
*	S	OPR1	OPR2			1.0	0"	0	0	0	0
9	M	OPR1	M2P2	TABLE		1.0	0"	0.5	100	0	0
10	M	OPR1	M2P2	TABLE		1.0	0"	0.6	100	0	0
11	W	OPR1	W5	TABLE	RACK4	1.0	1"	1.6	0	0	0
12	W	OPR1	W5	RACK4	FIXTURE2	1.0	1"	1.5	0	0	0
13	M	OPR1	M1P2 2(G3) E2	FIXTURE2		1.0	0"	1.4	50	0	0
14	W	OPR1	W2	FIXTURE2	TBAR2	1.0	0"	0.7	0	0	0
15	W	OPR1	W9	TBAR2	FIXTURE	1.0	1"	2.7	0	0	0
16	W	OPR1	W12	FIXTURE	RACK2	1.0	2"	3.7	0	0	0

Sequentially Specified Tasks

Alternatively you could to the following (although this is more difficult to read)



EL#	Type	Oper	Process	From Loc or At Loc	To Loc or MOD/TMU	Freq	Dist (Ft)	Time (sec)	LEAN%	Weight	SC
1	M	OPR1	6(M1P2) M2G3	FIXTURE		6.0	0"	2.1	40/20	0	0
3	W	OPR1	W5	FIXTURE	TBAR1	1.0	1"	1.6	0	0	0
*	W	OPR2	W18	START	RACK1	1.0	2"	5.5	0	0	0
4	M	OPR1	E2 D3 2(E2)	TBAR1		1.0	0"	1.1	50	0	0
*	M	OPR2	M2P2	RACK1		3.0	0"	0.6	50	0	0
5	M	OPR1	M4P2	TBAR1		1.0	0"	0.9	100	0	0
6	W	OPR1	W3	TBAR1	RACK1	1.0	0"	0.8	0	0	0
*	W	OPR2	W11	RACK1	TABLE	1.0	1"	3.2	0	0	0
7	W	OPR1	W8	RACK1	RACK3	1.0	1"	2.3	0	0	0
8	W	OPR1	W5	RACK3	TABLE	1.0	1"	1.5	0	0	0
*	S	OPR1	OPR2			1.0	0"	0	0	0	0
9	M	OPR1	M2P2	TABLE		1.0	0"	0.5	100	0	0
10	M	OPR1	M2P2	TABLE		1.0	0"	0.6	100	0	0
11	W	OPR1	W5	TABLE	RACK4	1.0	1"	1.6	0	0	0
12	W	OPR1	W5	RACK4	FIXTURE2	1.0	1"	1.5	0	0	0
13	M	OPR1	M1P2 2(G3) E2	FIXTURE2		1.0	0"	1.4	50	0	0
14	W	OPR1	W2	FIXTURE2	TBAR2	1.0	0"	0.7	0	0	0
15	W	OPR1	W9	TBAR2	FIXTURE	1.0	1"	2.7	0	0	0
16	W	OPR1	W12	FIXTURE	RACK2	1.0	2"	3.7	0	0	0

Alternatively Specified Tasks

In both situations, OPR1, and OPR2 will both wait at location TABLE (although they could just as easily be waiting at two different locations) until both operators are available. When they are both available, OPR1 will process at the TABLE and OPR2 will also perform its activity (not

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shown in the current display).

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5.1.6 Moving Part Cycles

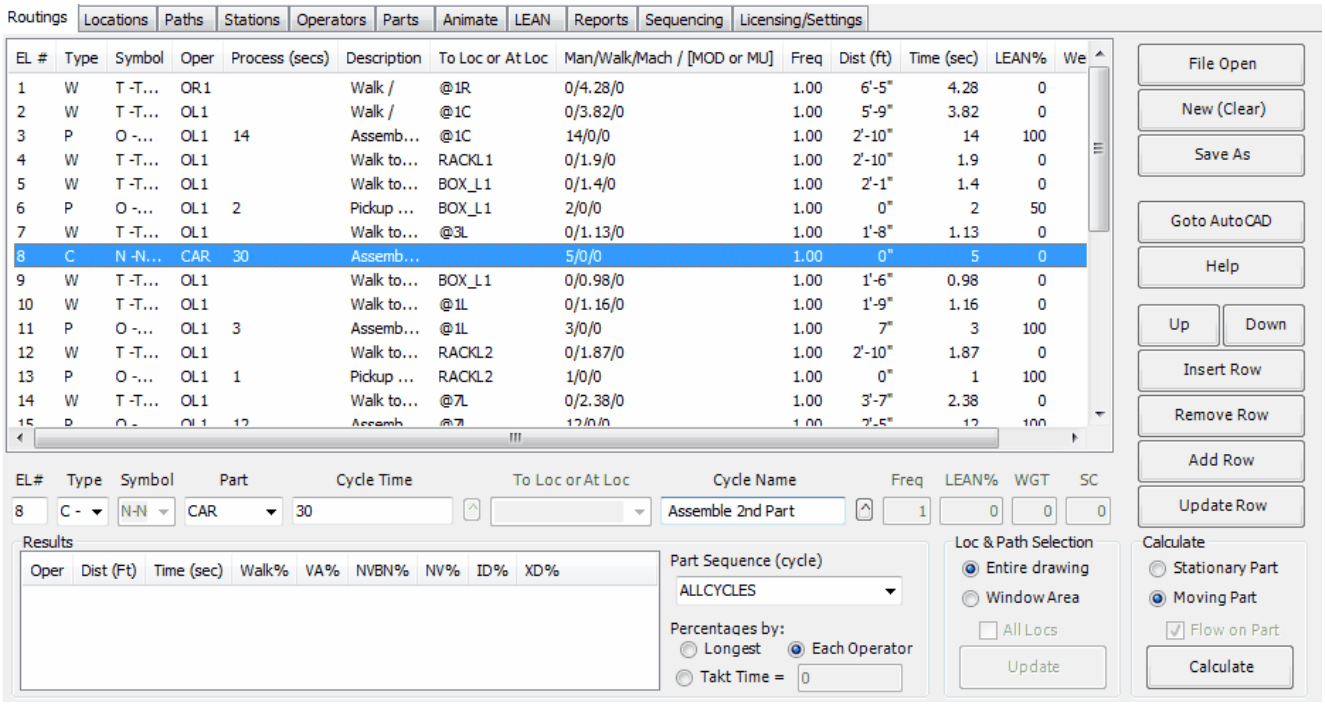
The WPP application will allow you to define the entry of multiple sequential parts for moving part calculations (moving part option only). Up to 25 sequential parts can be specified within the standard WPP application.

A new part entry cycle is specified with the "C" element type and each cycle may be given a unique name and reference a unique part, defined on the ***Parts*** tab to help identify the unique work content contained within that cycle. If you do not define a cycle as the first element in your routing, then the WPP application will assume a part cycle with no name that starts at time 0.

The routing lines that follow the start of a part cycle are directed to that part for all locations on that part. This referencing continues to either the start of the next part cycle or to the end of the routing file (whichever comes first). Obviously, the routing lines (elements) for each part cycle can be different. In this way, you could model a part with no options in the first cycle, followed by a part with many options in the second and third cycles and then back to a no-option part in the fourth and final cycle.

Operators will begin work on a following cycle after they complete work from a previous cycle. Thus, an operator that is running over the cycle time on a prior part will begin work late on the next part, after it may have entered quite a way into the operator's workstation.

A new part will enter 30 seconds from the beginning of the analysis shown below.



Moving Part Cycle

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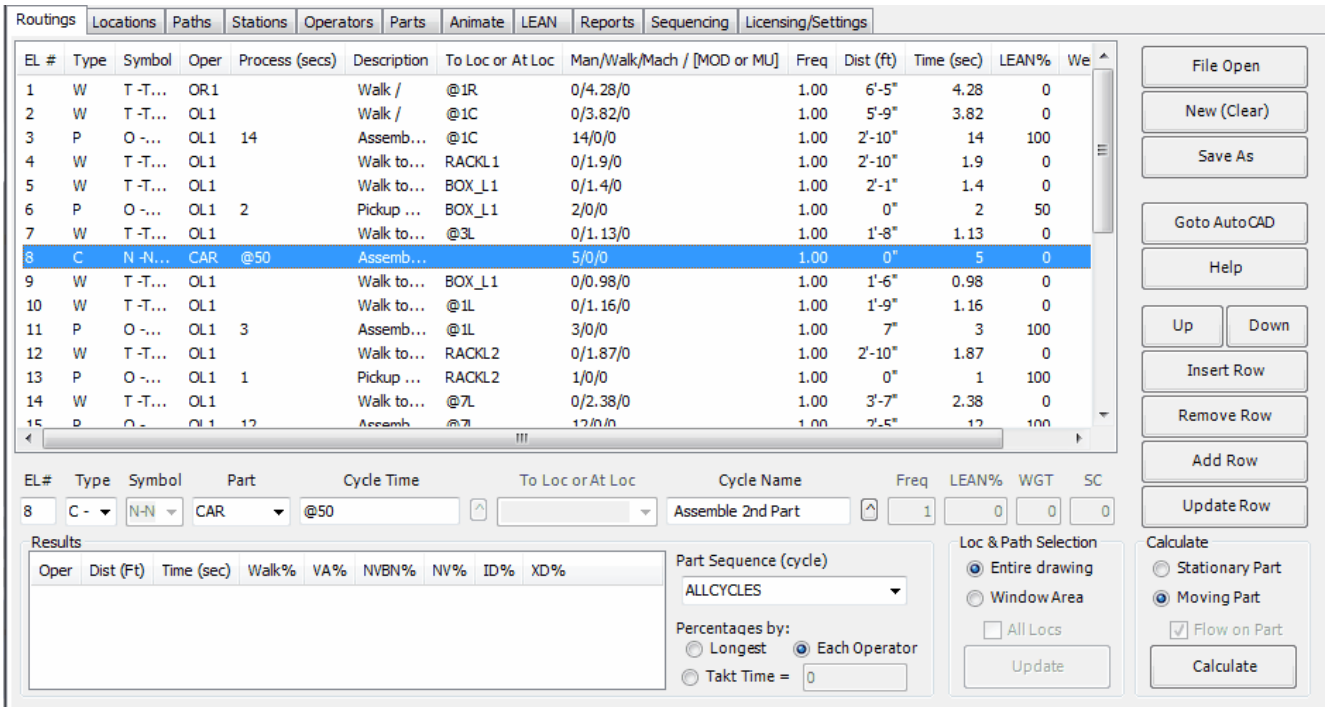
Alternatively, you can specify a part's entry time as 50 seconds relative to a previous part's entry such as shown in the example below, by simply prefixing the time with the @ character.



50 Second Time Prefixed With @

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5.1.7 Workplace Planner with Proplanner

The Proplanner application can export the Elements of an Activity by using the Export option in the Activity-Time-Calculated tab. These Elements will be exported to a CSV file of the format required by the WPP application. Likewise, you may import a WPP routing CSV file into the element list of a Proplanner activity.

In the 2.0 Version of Proplanner (and above) WPP CSV files can be exported from, and also imported to, Operations within Proplanner. In this situation, each routing line in the WPP application will correspond to an Activity time and thus only Walking time tasks will actually be imported back into Proplanner from the WPP application.

For more information on Using the Workplace Planner with Proplanner please consult the Proplanner User Manual.

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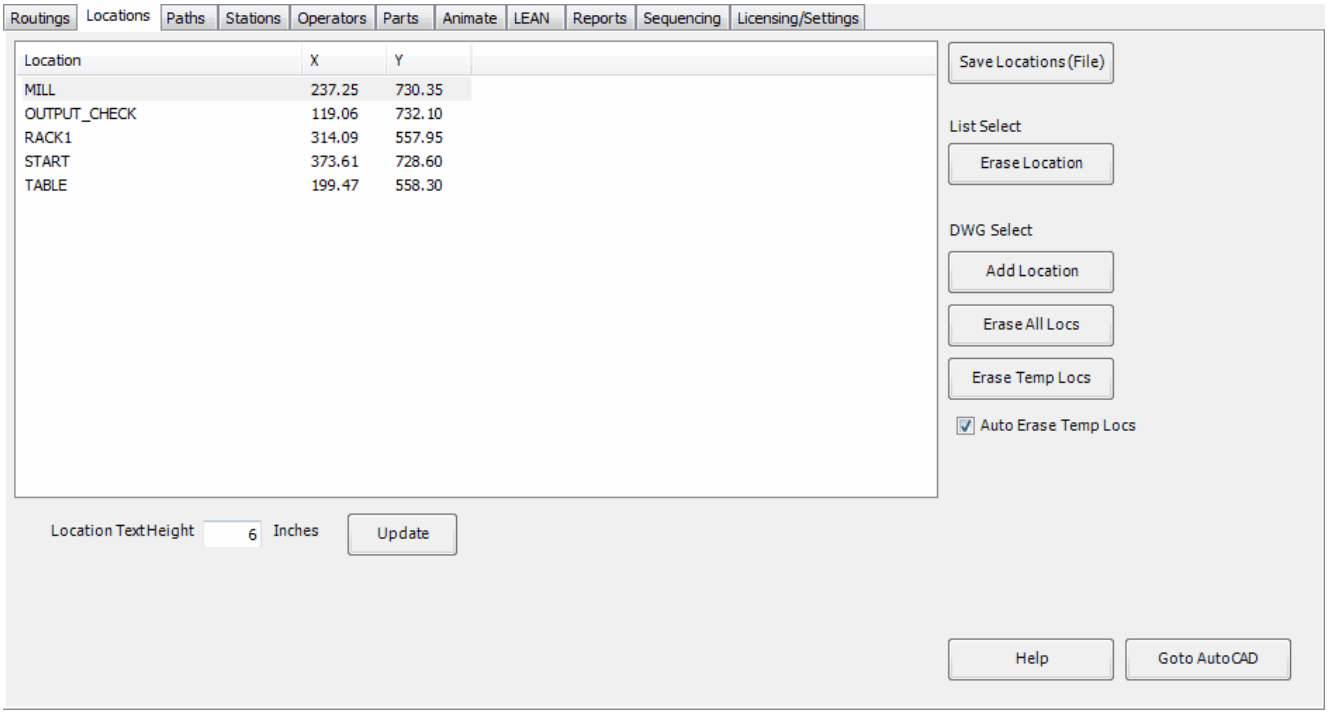
5.2 Locations Tab



Locations Tab

Locations referenced by the WPP are simple text located on a layer called PP_LOCATIONS within the drawing. Text positions are referenced via their insertion points, which WPP sets at Bottom-Center when using the Add Location controls. Users adding text to this layer manually will want to specify the text insertion points accordingly.

Special Feature – Selecting the Location column heading in the display will sort the locations alphabetically or by X or Y value correspondingly.

Add Location: Will prompt the user to enter a location name and position within the AutoCAD drawing environment and also adds it to the location display list.

Erase Location: Erases the selected location from the list and in the drawing. If you wish to erase locations from the drawing, you can select the ***Goto AutoCAD*** control on the Routings tab and use the AutoCAD erase command.

Erase All Locs: Erases all of the locations from the list and in the drawing. If the window option is selected on the routings tab, then only the locations within that window will be erased.

Erase Temp Locs: Erases all of the temporary locations from the list and in the drawing. Temporary locations are those automatically created by the WPP application within a moving part study to mark operator positions at the part along the assembly line. These locations are automatically erased and regenerated upon every selection of the Calculation command.

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Save Locations (File): Saves the location display to a comma-delimited CSV file in the same format as shown in the display. Used for exportation of locations to other applications. The WPP application does not read these files.

Location Text Height/Update: Specifying a new location text height and selecting ***Update***, will change the size of all text on the PP_LOCATIONS layer.

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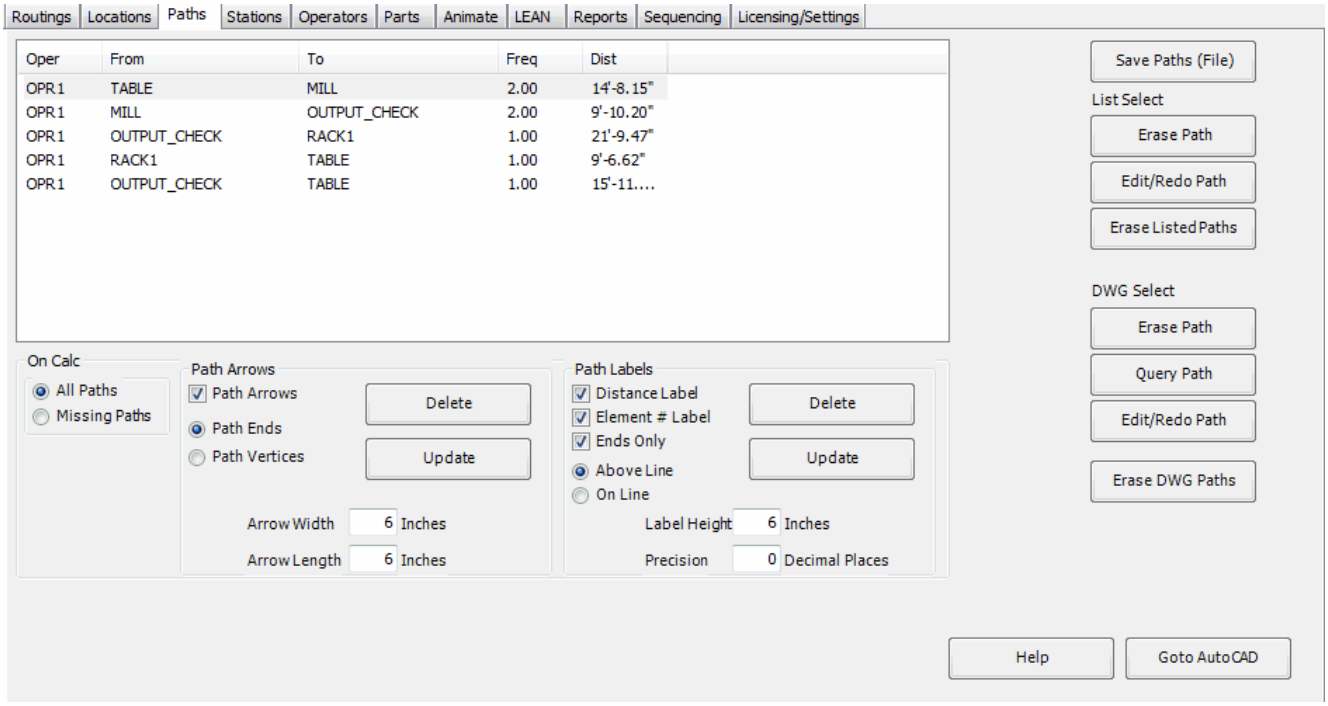
5.3 Paths Tab



Paths Tab

The Paths tab is the main control for path editing and annotation.

List Select

Erase Path: Selects (in the drawing) the currently selected path from the path display list, and then deletes it from the drawing and the path display list. The path will be regenerated automatically by WPP on the next Calc.

Edit/Redo Path: Selects (in the drawing) the currently selected path from the path display list, which WPP will automatically delete and then prompt the user to select vertices (up to 11 vertices to create a maximum of 10 segments) for a new path to replace it. User-defined paths are replaced by Euclidean paths when WPP creates new paths, such as is done in ALL Moving part studies or when the “All Paths” option is selected on this path window during stationary part studies.

Erase Listed Paths: Will erase all the walk flow paths shown in the current list, which are paths in the Drawing referenced by this routing file.

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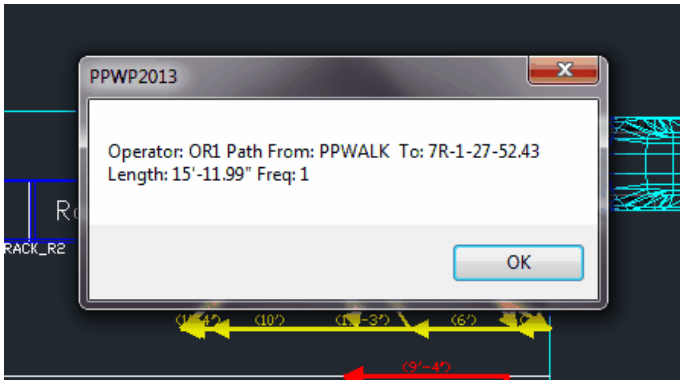
Drawing Select

Erase Path: Allows the user to select a path in the drawing and then deletes it from the drawing and the path display list. The path will be regenerated automatically by WPP on the next Calc.

Query Path: Allows the user to select a path in the drawing and display its properties as shown in the example below.



Query Path Properties

Edit/Redo Path: Allows the user to select a path in the drawing, which WPP will automatically delete and then prompt the user to select vertices (up to 11 vertices to create a maximum of 10 segments) for a new path to replace it. User-defined paths are replaced by Euclidean paths when WPP creates new paths, such as is done in ALL Moving part studies or when the "All Paths" option is selected on this path window during stationary part studies.

Erase DWG Paths: Will erase all of the walk flow paths in the current drawing regardless of if they are referenced by this routing file or not.

Path Arrows

Delete: Deletes all arrows.

Update: Any change to the arrow size or placement option will only occur on the next calc or when this Update button is selected.

Path Arrows checkbox: Determines if paths should have arrows.

Path Ends/Path Vertices: Determines if arrows are to be placed at path ends only, or also at each path vertex.

Arrow Width/Arrow Length: Specifies the size of the arrow for a zero width path. As the path is scaled larger by the Path Thickness value and the Path Frequency, the arrows for those specific paths will be factored accordingly.

Path Labels

Delete: Deletes all labels.

Update: Any change to the label size or placement option will only occur on the next calc or

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when this Update button is selected.

Path Labels checkbox: Determines if paths should have labels.

Ends Only: Places labels in the middle of the last segment of the path specifying the total distance of that path. If checked off, then labels are placed at every segment also to show the length of that segment. In this case, the last segment has two distance labels. The one in parenthesis is the total path length, and the alternate one is the segment distance.

Above Line/On Line: Determines if labels are placed center on the line or positioned slightly above the line (i.e. text insertion point Center or Bottom-Center) to the center of the line segment.

Label Height: Specifies the height of the label.

Precision: Determines how many decimal places to show in the path distance labels.

On-Calc Options

All Paths/Missing Paths: When *All Paths* is selected, WPP will first erase all existing paths in the drawing (including manually generated ones) and replace them with new Euclidean (point-to-point) paths. Selecting only *Missing Paths* (default) will result in WPP only generating paths not yet existing.

Other

Save Paths (File): Saves the location display to a comma-delimited CSV file in the same format as shown in the display. Used for exportation of flow path distances to other applications. The WPP application does not read these files.

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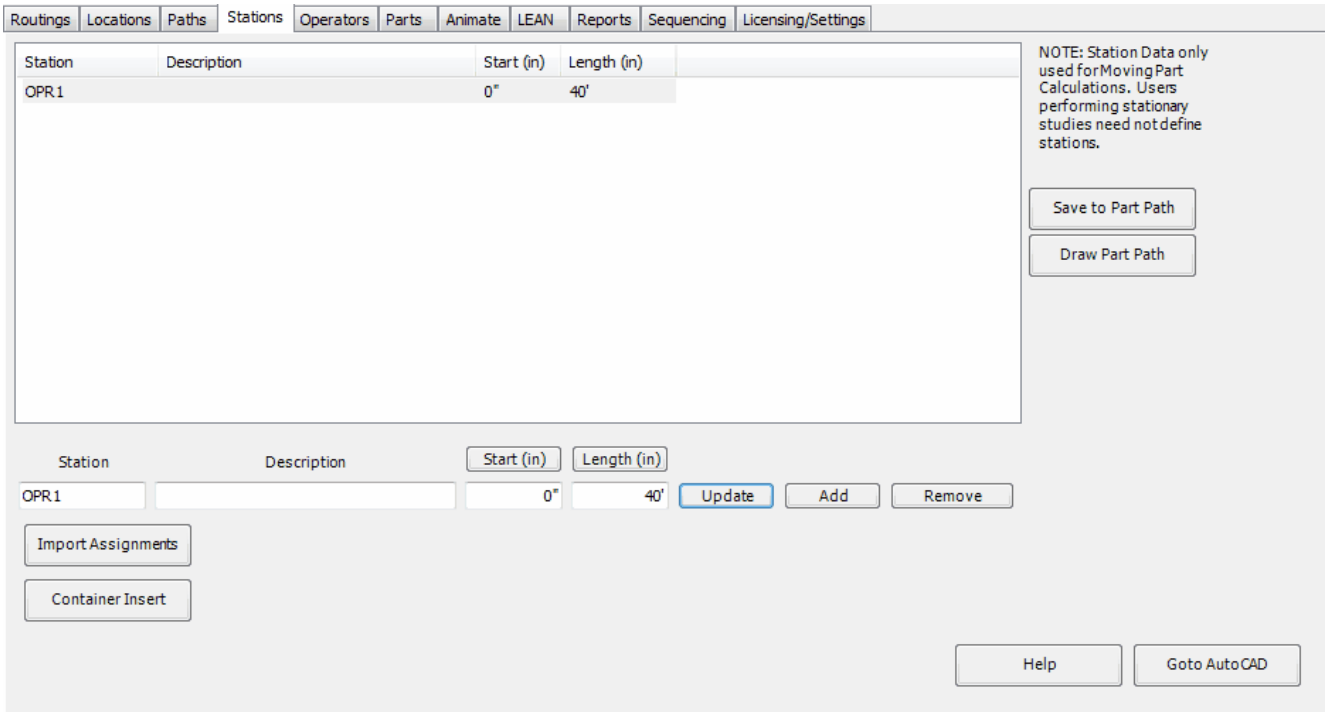
5.4 Stations Tab



Stations Tab

The Stations Window is where all the part path information for the individual stations is accessed within the WPP. The data itself is stored within the part path poly line within the drawing. **NOTE: The information within the "Stations" tab is only used when performing Moving-Part studies. Users who are performing "Stationary" studies need not enter any information into this tab.**

Station: This input box is where the station names are assigned.
Description: Allows the user to describe the station for future reference.
Start: This is the distance from the beginning of the Part Path line where the station begins.
Length: This is the length of the station, starting at the start distance.
Update: Updates the station list with the new information.
Add: This button adds the station created to the list.
Remove: Removes the selected station from the list of available stations.
Save to Part Path: Saves the station data into the Part Path line on the AutoCAD drawing.
Draw Part Path: Allows the user to draw the path on which the parts will travel. The first point is considered the start or zero distance. This would be set as 0 if a station was being defined as starting here.
Import Assignments: Allows for station assignments to be imported as a .csv file.
Container Insert: Can be used to create containers for stations.

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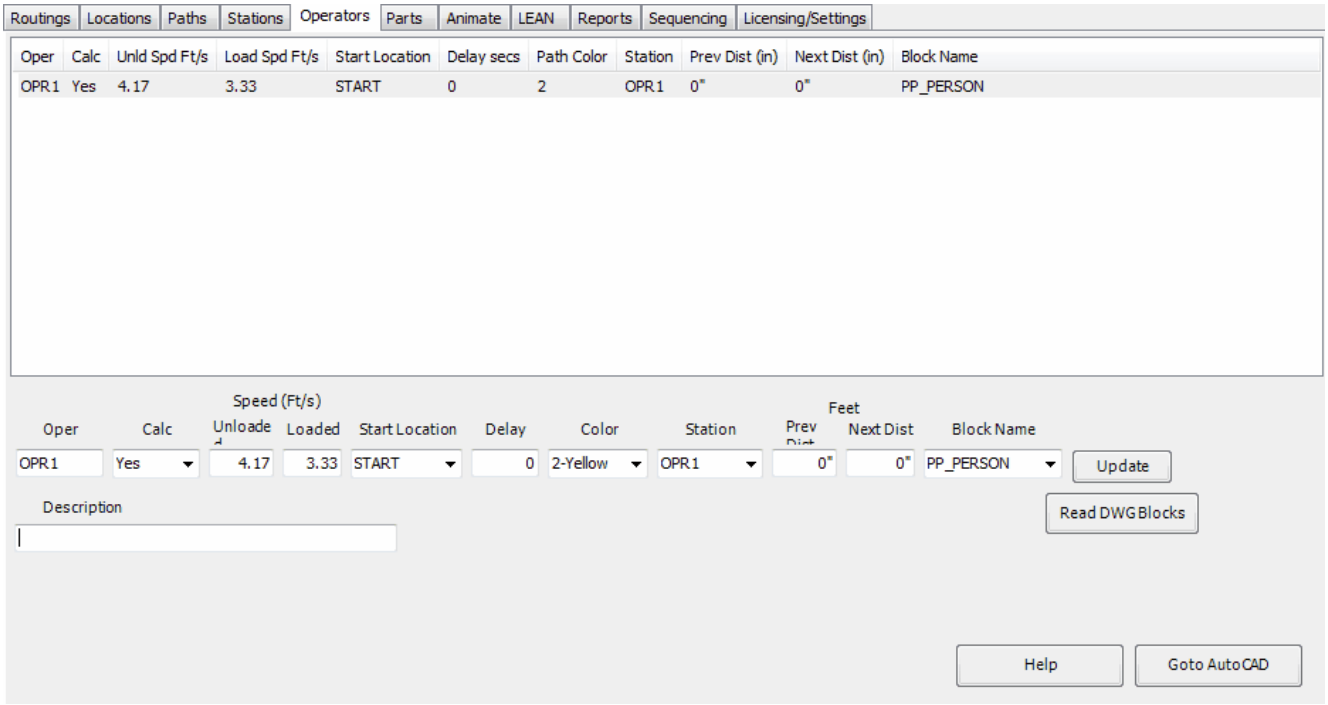
5.5 Operators Tab



Operators Tab

Operators are automatically listed in the Operators display when they are uniquely specified in the routings file. The WPP will automatically generate their respective flow path layers (as each operator's flow is generated on a unique layer PP_FLOW-*opname*) in which all of the operator information is stored on the drawing. In addition, the WPP will generate a default Loaded and Unloaded walk speed from the settings on the Options tab (Default: 4.17 feet/second). The user is allowed to specify a unique layer color for each operator.

Calc: Allows the user to turn off the calculation of all walkpath flows for the specified operator. With this option set to off, the walkpaths will not be updated or included in the total walkpath distance and time calculations, and the operator will not animate.

Delay: The delay time is set to 0 by default. This time allows the user to delay the availability of the operator within the workplace. A time in seconds may be entered into this field. The distance option is allowed for moving part analyses so that workers in downstream stations can begin work when the part travels the specified distance from the beginning of the line to their station.

Start Location: Determines if, and where, WPP should begin the operator's movement prior to assuming the first position specified for that operator in the routing file. A value of NONE (default) tells the WPP to ignore that operator's initial location.

Station: Assigns the operator to a station to prevent the operator from trying to reach locations within other work stations.

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Previous Distance/Next Distance: Sets the distance which an operator is allowed to move into the previous and next station in order to intercept the part. This calculation does not take into account the length of the part. if the part is long and at the beginning of the walkpath while the operator goes to the end of the part, the operator may still walk further into the previous workstation. This is easily overcome by subtracting the part length from the value entered into this field or adding an operator delay.

Block Name: Allows the user to represent the operators with any individual blocks inserted in the drawing before the WPP was opened.

Special Feature – Changing the name of the operator and selecting the update button will automatically search and replace all occurrences of that operator name in the routings file.

Special Note: Operator names cannot contain any special characters other than dashes and underscores. (!@#$%^&*) and other non-letter characters are not allowed.

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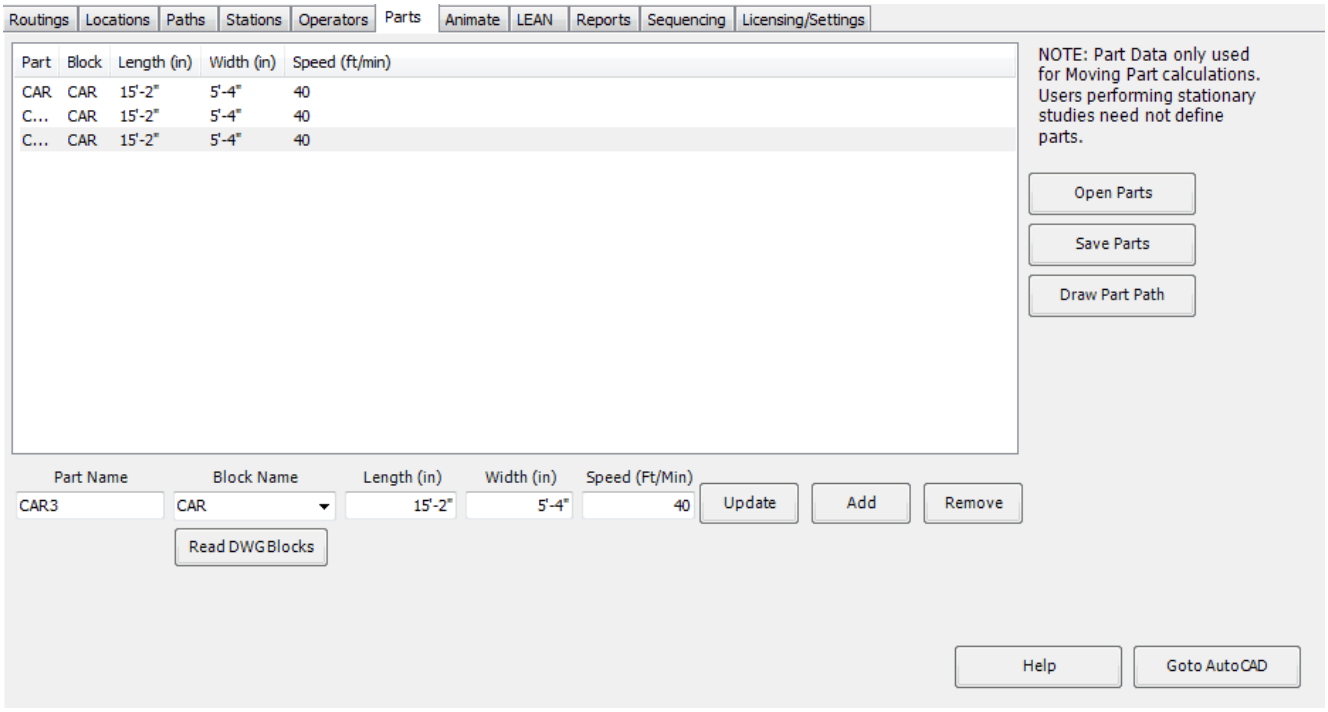
5.6 Parts Tab



Parts Tab

The Parts tab controls the part and path properties for the Moving Part Calculation. This is where the part blocks are assigned to the part names referenced in the routings. The part information is stored in the parts.prt file in the AutoCAD Programs folder with the rest of the Workplace Planner files. This file name can be changed on the Licensing/Settings tab. **NOTE: The information within the "Parts" tab is only used when performing Moving-Part studies. Users who are performing "Stationary" studies need not enter any information into this tab.**

Part Info

Open/Save Parts: Allows the user to store or open pre-made part information for different scenarios.

Part Name: Generic part name linked to the routings and each cycle that uses that part.

Block Name: Name of block which has been assigned to represent the given part name when the animation is run.

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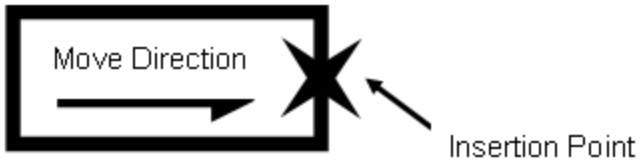
Blocks are loaded upon startup of the WPP so if the user adds a new block to the drawing, WPP will need to be restarted before it will read the block in this drawing. Only valid blocks currently available within the drawing are shown in the pull-down list. Blocks must be defined with their default direction and insertion point as shown below.



Correct Block Image Of Direction & Insertion Point

SPECIAL NOTE: Backup and Metric or Standard versions of the default blocks can be found on the installation CD in the folder called SAMPLE FILES.

Length: Determines the part length for the A, B, C and D longitudinal offset parameters in the relative part location syntax. (i.e. @L<B references a location in the center of the part 1/3 of the way back from the front.

Width: Determines the part width for the **W** offset parameter in the relative part location syntax. (i.e. @LW references the beginning of the part at the width offset (1/2 width) from the center of the part's flow path.

Speed: Determines the speed of the vehicle for animation and Moving Part positional calculation. Remember that part speed must be less than operator speed (preferably by at least a factor of 2) or the operators will not be able to "catch" the part.

Draw Part Path: Prompts the user for points that make up a polyline path on the PP_PART-PATH layer. A maximum of 5 segments are allowed for a part path within a workstation. A part path must be specified before a Moving Part calculation can be performed.

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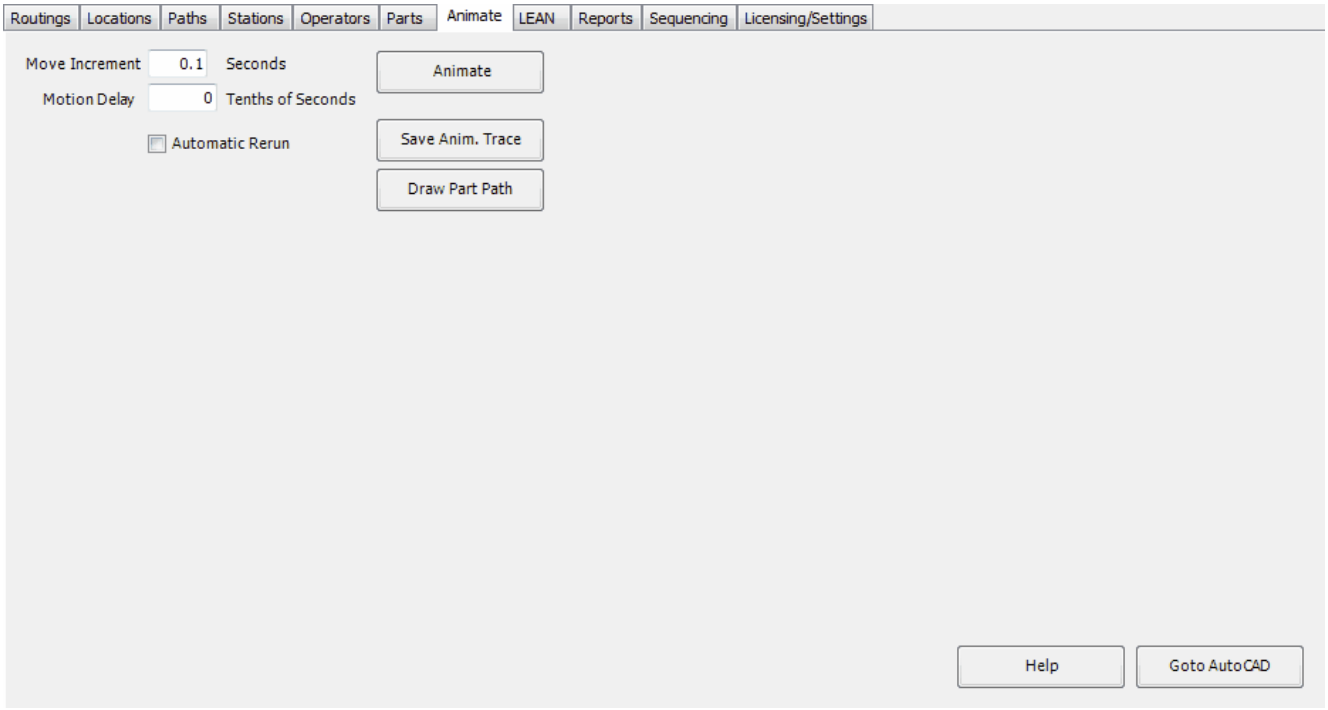
5.7 Animate Tab



Animate Tab

The animate window sets up the animation speed, precision, and repetitions. This tab also allows the user to save a trace file that can be used to create an animation in other programs.

Move Increment: Determines the resolution of the animation. Smaller values (minimum of 0.05) will make the animation run more accurately and more slowly and smoothly. Larger values will provide the opposite effect. As such, the final workstation animation time could be different than the calculated workstation cycle time - as displayed in the operator results display on the Routings tab. In this situation, the values in the routings tab are ALWAYS more accurate.

Motion Delay: Allows the operator to slow down the animation by inserting a delay between each animation move. This delay value will often be needed when viewing animations in 2D with simple (i.e. default) operator and part blocks.

Save Animation Trace: The Calculation process generates an animation trace events list which is used by the animation engine to present the results of the calculation to the user. This trace list can be optionally saved to a file for use in evaluating the animation events textually or possibly for use by other external animation applications. If other applications are to use this trace file then it is likely that those applications will also need the location and path coordinate information stored in the Locations (LOC) and Paths (PTH) files respectively. Together, the LOC, PTH and TRC files provide all of the information required by any external animation application to replay the events generated by the WPP application.

The WPP application does not read or use a saved trace file, as this information is automatically

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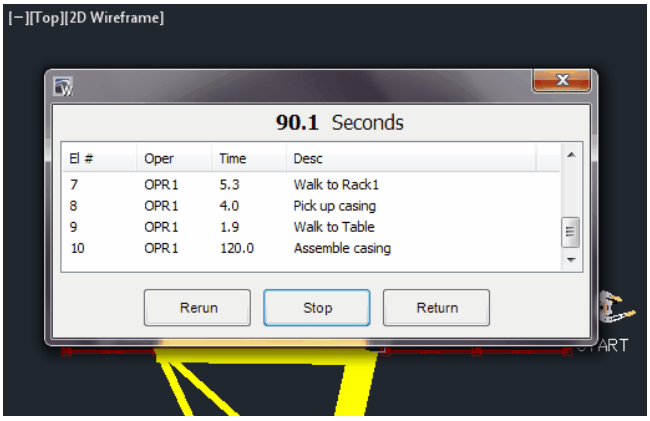
created by the WPP application when the Calculate option is selected from the main routings tab.

Automatic Rerun: Causes the animation to automatically rerun until stopped by the user. This setting is ideal for presentation and demonstration purposes where it is desired for the animation to run continuously in an unattended mode.

Animate: Selecting this button will switch control to the AutoCAD window and begin the animation while displaying the animation counter in the Modeless WPP control window. Once complete, the user will have the option to ***Return to Walkpath*** or ***ReRun the Animation***. The animation can be stopped and started with the ***Alt*** key.



Animation Window

Draw Part Path: draw the moving part path. It is used for Moving Part study.

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5.8 Lean Tab

LEAN Tab

The LEAN tab charts the percentage of walking, value-added processing, non-value-added processing, non-value-added-but-necessary processing and internal delay for each operator in the workplace.

Part Sequence (Cycle): The dropdown window here again lets the user chose which cycle or all cycles for which to show the lean percentages.

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5.9 Ergonomics Tab

Ergonomics Tab

The Ergonomics tab charts the operator safety for the Lift and Carry tasks involving weight and posture defined within the routings. The WPP uses the "SNOOK" tables developed by Liberty Mutual Insurance in 1991 and approved by OSHA. The WPP allows the user to compute results for both 75% Females and 75% Males.

SHIFT LENGTH – The SNOOK tables require a number of cycles (or repetitions) of the routing performed over a given period of time. The Shift length determines the total duration of time during which the routing is performed. Together with the Task Focus (defined below), and the routing cycle time, the WPP is able to determine the number of repetitions per day over the shift length time to determine the safety of the task.

TASK FOCUS – The task focus defines the percentage of time during the shift that the operator is performing the activities defined in the routing. For example, if the operator is working an 8 hour shift (as defined in the shift length), but only performs the routing cycle ½ of the time during this shift, then the Task Focus value would be 50 to represent 50%.

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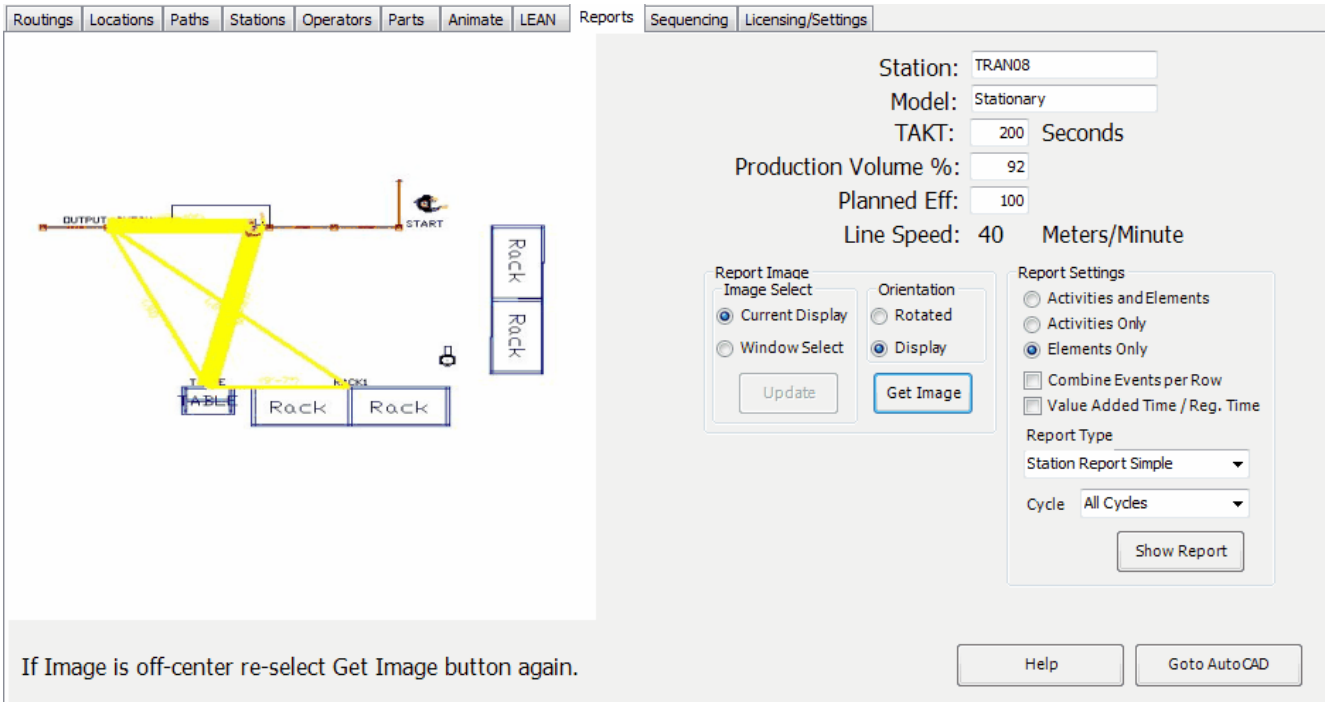
5.10 Reports Tab



Reports Tab

The Reports tab is where you generate your workstation report. The workstation report includes an image of your workstation, along with workstation header information that you can enter in the top right of the screen.

Select the Get Image button to get the current view of your workplace. You may need to select the Goto AutoCAD button in order to adjust your display such that the workstation view looks correct. If using a window select, selecting get image a second time may zoom in more precisely on the section selected.

Once your view is acceptable; select the Station Report button to generate your report. Using the Value Added Time/Reg. Time option will create the same station report with VA/NVA percentages and times. Another option is the Man/Machine report to demonstrate the difference in manual versus machine work times in the same format as the original station report (note this report is available upon request). Once the report is generated, simply select the File Save option in the browser window to save your report.

These reports can be set to show both Activities and Elements or either choice separately. This will help the user gauge how much information is needed to be displayed.

(Note the total time calculated on the Station Report does not include the external delay added by waiting for the next part, only the actual time spent working on this part.)

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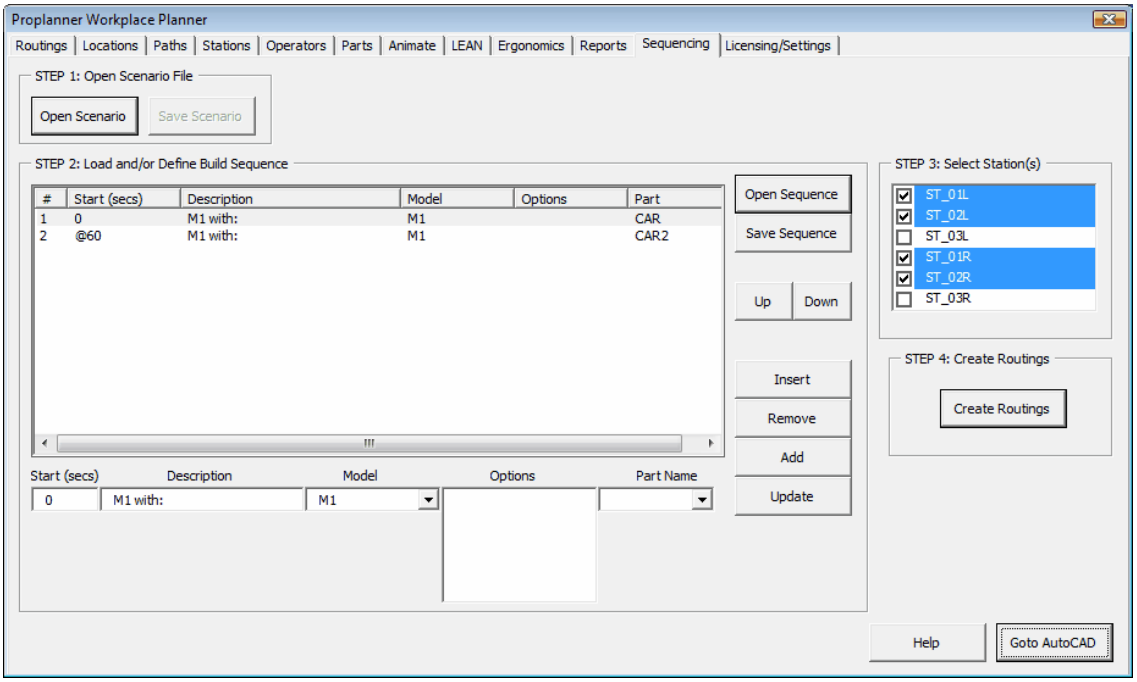
5.11 Sequencing Tab



Sequencing Tab

The Sequencing tab provides functions for importing a ProBalance study of tasks and generating a Workplace Planner process routing. Once a line balancing xml file is saved from the Proplanner Line Balance tool, it can be imported into the Workplace Planner on this tab. This tab then selects the model and options to be simulated within a work station and creates a routing that can be analyzed, edited, or animated. **NOTE: The information within the "Sequencing" tab is only used when performing Moving-Part studies, where the processing steps are imported from ProBalance. Users who are performing "Stationary" studies need not enter any information into this tab.**

Open Scenario: Selects the Line Balancing xml file to open for simulation.

Save Scenario: Saves the scenario and any changes made to LB routing data in the WPP. This option is available only when one model/option mix has been selected.

Open Sequence: Opens a pre-made sequence file that contains numerous model/option mixes in a given sequence. This can be used to create the routings file once Line Balancing information has been loaded and a station selected.

Save Sequence: When model/option mixes are added and put into the desired sequence, it can be saved to a file which can be loaded in the future to avoid recreating the operation sequence.

Up/Down: Moves selected build up or down in the Build Sequence window.

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Insert: Insert's a row similar to the selected option/model mix above this row. Will use information provided in the Sequence Start and Description field instead of the attributes of the selected build if they are different.

Remove: Erases the option/model mix selected from the Build Sequence window.

Add: Adds Line Balancing data for the selected station and model/option mix to the sequence that can later be used to create a routing file to run a WPP simulation.

Update: Updates the selected build with the Sequence Start and Description information in the input fields to the left of this button.

Station: Selects which work station to simulate from the Line Balancing file that will contain all stations within the plant.

Model: Defines the specific model for which this routings will be made. You can choose different mixes and add them to the sequence.

Options: Sets the options for which the simulation will be created. You can choose different mixes and add them to the sequence.

Create Routings: Uses the selected station, model, and options to create the routings file for activities and operations done within that work station in that scenario. In other words, this generates the actual simulation routing file.

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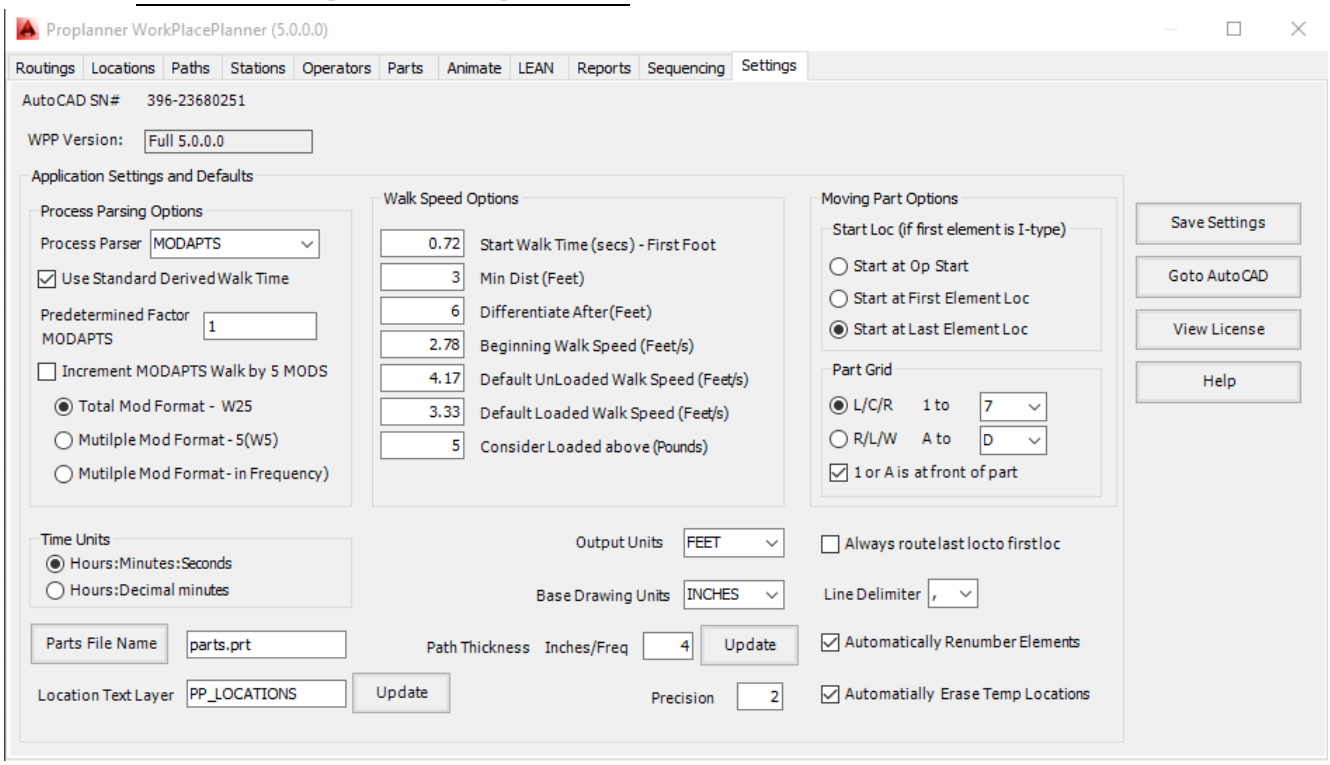
5.12 Licensing/Settings Tab



Settings Tab

The Licensing/Settings tab is where the licensing codes and expiration dates are set, as well as, the special options available within the application. The Help button will access the on-line help document, which is also available as a PDF file (located in the program directory) for easier print-out. All entries in this tab window are saved between user sessions.

5.12.1 Process Parsing Options

Process Parsing: Determines if the WPP should attempt to evaluate the Process code column for the routings and compute the appropriate process times. MTM-B, MODAPTS, User-P (MOST), and User-K1 or User-K2 (user defined keyword parser) are available in the application by default. Users may request the MTM-1, MTM-2, MTM-4M and MTM-UAS standards from the MTM Association, or a Proplanner representative. Remember that Proplanner's Time estimation module will also parse these Process codes and can Import and Export files from/to the WPP. Proplanner can import/export a Workplace Planner study as ELEMENTS of an ACTIVITY, or as ACTIVITIES of an OPERATION, whereby the walk tasks are assigned as delays to the ACTIVITY links within the OPERATION. For additional information on parsing options refer to the "Parsing Options" section of this document. Also, for additional information on the interface between Proplanner and the Workplace Planner, refer to the "Workplace Planner with Proplanner" section of this document.

When any of the Keyword-based parse methods (MTM-B, MTM-UAS, MTM-2, User-K1 or User-K2) is chosen, you may select the button just to the right of the Process field **(as shown below)** to pull-up the process list. This process list is a view of your process standards file and it lets you select a particular standard, so that you do not need to type it in.

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- The standard times in the list will be in the units of the list (i.e. Minutes, Seconds, TMU's, MU's, MOD's) and will be automatically converted into the current WPP session units (Minutes or Seconds) upon selection.
- If you want to override the process time as specified in your standards file, you can do so by selecting the Process Type "X". This will tell the parser to ignore parsing the process code in that element.

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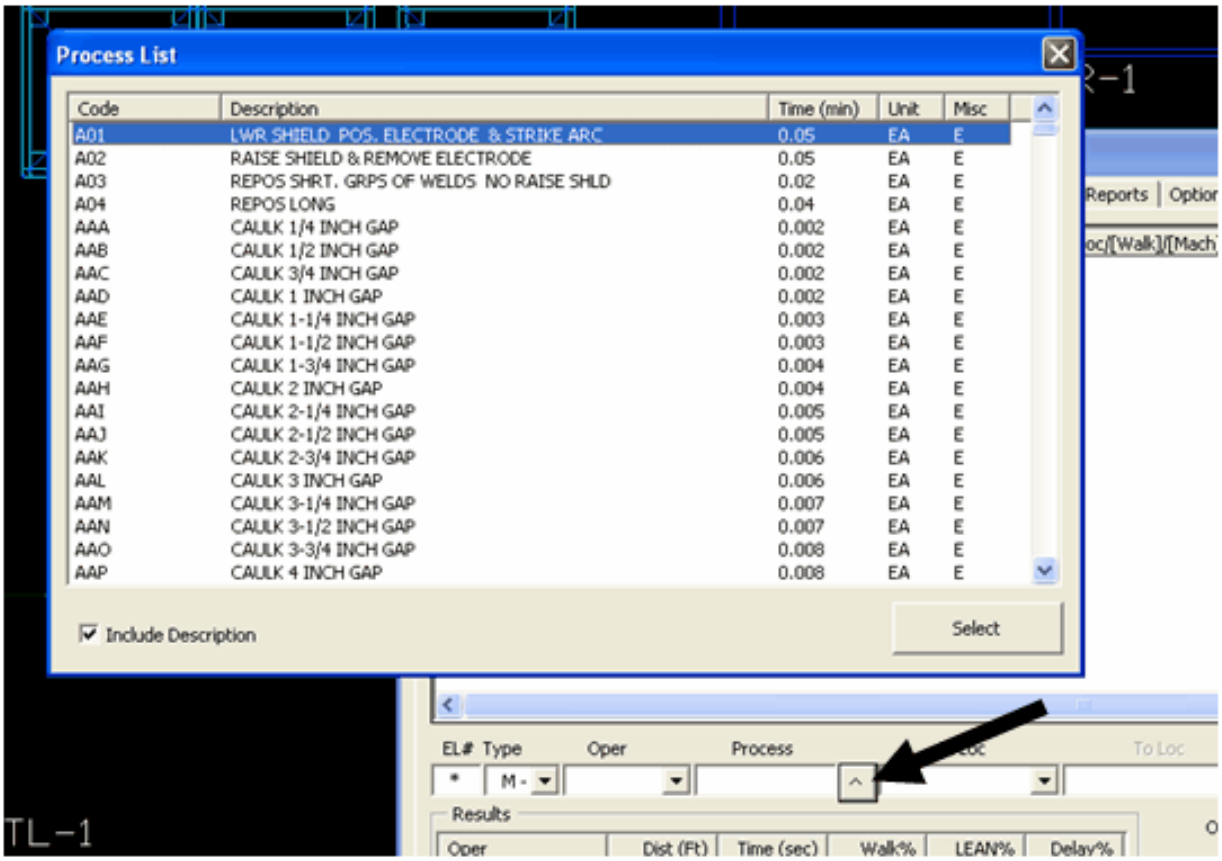
For those standards that are specified in distance, or per-item, you can use the frequency field to factor the number of occurrences of the process type within your element line.

Selecting the option to Include Description will copy the standard's description into the element description field within the routing editor.



Process List

Use Standard Derived Walk Time: If this option is selected, then the operator speed (specified in the Operators tab) is ignored and the distance is used to compute the walk time by using the user-selected predetermined time system (MODAPTS or USER-P).

Increment MODAPTS walk by 5 MODS: If the MODAPTS time parsing is selected, then the application will automatically round up walk distances in increments of 5 MODS. Even if this option is not checked, the application will never report a walk time of less than 5 MODS.

Example:

	Increment by 5 MODS	
Actual	**ON**	**OFF**
2.5	5	5
7	10	7

5.12.2 Time Units

Hours:Minutes:Seconds: Allows for the entry (by the user) and output (by the application) for time in an Hours:Minutes:Seconds format. As such, a time of 91.6 will be automatically interpreted as 1:31.6 (one minute, thirty one point six seconds).

Hours:Decimal Minutes: Allows for the entry (by the user) and output (by the application) for time in an Hours:Minutes format. As such, a time of 91.6 will be automatically interpreted as 1:31.6 (one hour, thirty one point six minutes).

5.12.3 Walk Speed Options

The WPP walk speed options give you extensive flexibility in specifying workplace walk time estimates. Note: these time calculations are bypassed if the user selects the USER STANDARD DERIVED WALK TIME option AND if the parser is set to the MODAPTS or USER-P.

Start Walk Time (secs): The time for the first foot or 1/3 meter of walk distance. If this value is zero, then the WPP will use the operator's Loaded/Unloaded speed for this initial distance.

Min Dist: The minimum distance for any move. If this value is zero, then the WPP will use a minimum distance of 1 Inch or 1 millimeter.

Differentiate After: The distance (after the first foot or 1/3 meter) for the WPP to use for the BEGINNING WALK SPEED, after which the WPP will use either the Loaded or Unloaded speed. If this value is zero, then the WPP will use the operator's Loaded/Unloaded speed for the distance after the first foot or 1/3 meter.

Beginning Walk Speed: The speed used by the WPP for the distance up to and including the distance specified in the DIFFERENTIATE AFTER FIELD. A value of zero in this field will cause the WPP to use the operator's Loaded/Unloaded speed for this initial distance.

Default UnLoaded Walk Speed: The default speed that the WPP will use for walking without a load when new operators are added by the WPP.

Default Loaded Walk Speed: The default speed that the WPP will use for walking with a load

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when new operators are added by the WPP.

Consider Loaded Above: If the routing element's weight is GREATER THAN this value, then the WPP will use the Loaded Speed for that operator, otherwise the WPP will use the Unloaded speed.

Times in Feet/Second		
Example	Default	
0.72	0	Start Walk Time
3	0	Min Dist
6	0	Differentiate After
2.78	0	Beginning Walk Speed
4.17	5	Default UnLoaded Walk Speed
3.33	4	Default Loaded Walk Speed
5	5	Consider Loaded above

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5.12.4 Moving Part Options

5.12.4.1 Start Position if First Loc on Part

Determines the FROM location when the To/At location for the First element is a relative location on the part, and/or when the first element's type is Integrated.

Start at Op Start Location: The WPP will start the operator at that Operator's START location as specified in the Operator's tab.

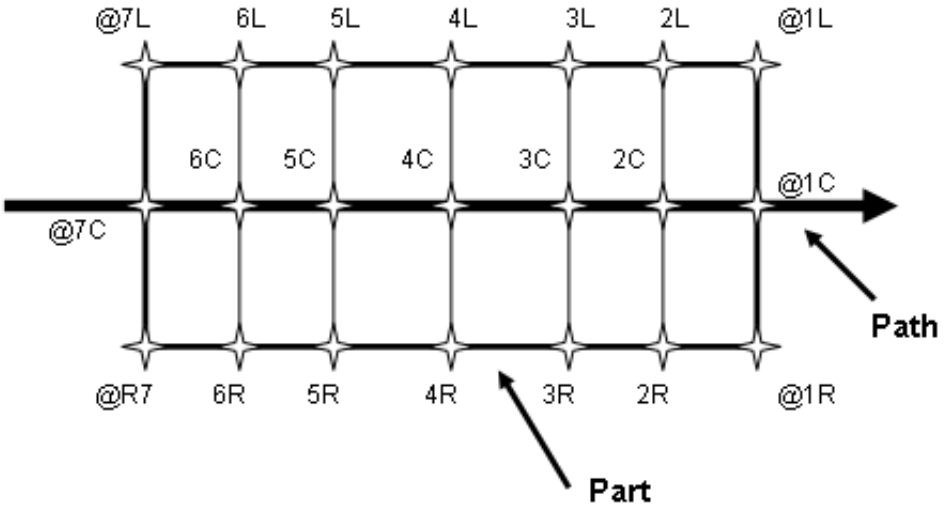
Start at last Element Location: If the location of the last element is not a relative location on the part, then the WPP will start the operator at this location and then move to the location specified in the first element. If the last element's location is on the part, then the WPP will default to using the Operator's Start location as the from location for the first element.

5.12.4.2 Part Grid

1 to ? L/C/R: A number from 1 to N (where n is from 1 to 25) that specifies how many zones are longitudinally spaced along the part followed by the letter L for Left, R for Right, or C for Center. A number 7 is the default amount of longitudinal divisions. The first and last zones are directly at the front and the back of the part respectively.

- @2L (specifies a location on the left side at the width and 2/7 back)
- @1R (specifies a location on the right side at the front)

@3C (specifies a location at the center and 3/7 back)



Part Grid Zones

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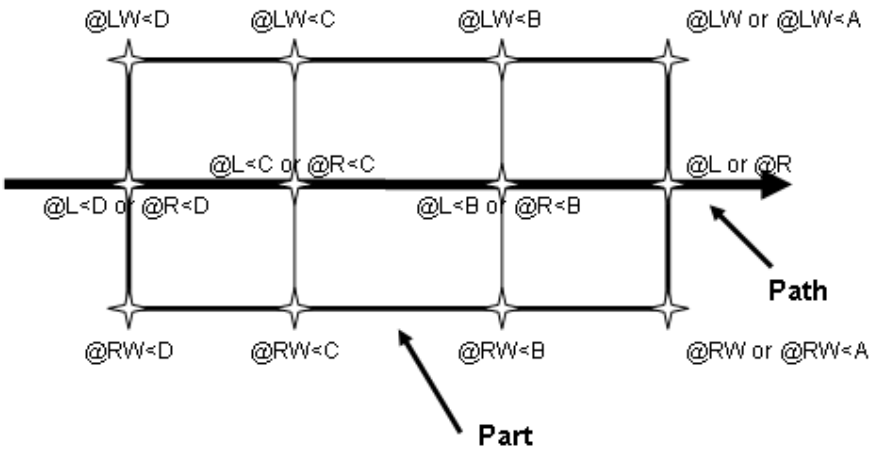
R/L/W A to ?: The method to specify a location on a Moving part. L-Left, R-Right, W-Width and then a letter from A to Z that specifies how many zones are longitudinally spaced along the part. The letter D is the default. The first and last zones are directly at the front and the back of the part respectively. You must always place an 'At' symbol (@) at the beginning of this location name. You may optionally replace the letter 'W' with a distance from the center of the part out to the side (Feet or Meters). You may also optionally replace the longitudinal letters (i.e. A to D) with a distance from the front of the part to the back. The examples below assume the default of **A to D** and units of **Feet**

- @LW<B (specifies a location on the left side at the width and 1/3 back)
- @R (specifies a location on the right side at the front)
- @RW<2.5 (specifies a location on the right side at the width and 2.5 feet back)

@R1.2<C (specifies a location on the right side 1.2 feet from the center and 2/3 of the way back)



Zones On A Moving Part

5.12.5 Other Settings

Output Units: Sets the default distance units for output information from the program.

Base Drawing Units: Sets the default distance units to read distances from the drawing.

Location Text Layer: The layer that the WPP will look to find location text. Default is PP_LOCATIONS.

Path Thickness: Determines how thick a path should be for each unit of travel frequency specified in the flow path routing. A value of zero will generate dimensionless thick flow lines. Path thicknesses are generated during a Calc command.

Automatically Renumber Elements: If this is set, then the program will constantly renumber your elements sequentially. (NOTE: some applications that you interface with, my require the element numbers not to be changed in the WPP application.)

Always route last loc to first loc: Automatically route the last location in the element list to the first location.

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Line Delimiter: This setting allows the user to select either the comma or semi-colon for the delimiter it uses to separate information in the input files. The default comma separated files are not always standard for foreign numeric notations that use commas instead of periods.

Automatically Erase Temp Locations: Automatically erase the temporary locations generated in the drawing.

Parts File Name: The default directory and file for the parts file used in WPP.

Save Settings: Saves the values specified in the Application Settings and Defaults frame so that they will be default for all subsequent sessions.

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6 Tutorial

There are three tutorials to help you become familiar with Proplanner's Workplace Planner: These tutorials (both Metric and FootInch versions) are located in subdirectories within the HELP subdirectory located in the directory where the program was installed (typically c:\program files \proplanner\autocad programs).

The Metric tutorials (base unit is millimeter) are available in two forms (comma and semi-colon delimited). The comma delimited metric tutorials are for those countries who use the same number format as the United States (i.e. 1,200.52), and the semi-colon tutorials are for those countries (Germany, Italy, France, Sweden, etc.) who reverse the comma and decimal point (i.e. 1.200,52).

Stationary Part Analysis

Moving Part Analysis

Sequencing from Line Balance data

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6.1 Stationary Part Analysis

STEP 1: To get started, make sure all other drawings in AutoCAD are closed. If you have already been working in Workplace Planner, click the New (Clear) button in the ***Routings*** tab. Then ***Open*** the file "WALKPATH-2D.DWG". You should be able to see the Proplanner Applications menu on your screen. If not, you will need to load this menu using the Menu Installation Guide included in the Install.pdf.

STEP 2: Select the "W" icon button in the Proplanner ribbon.

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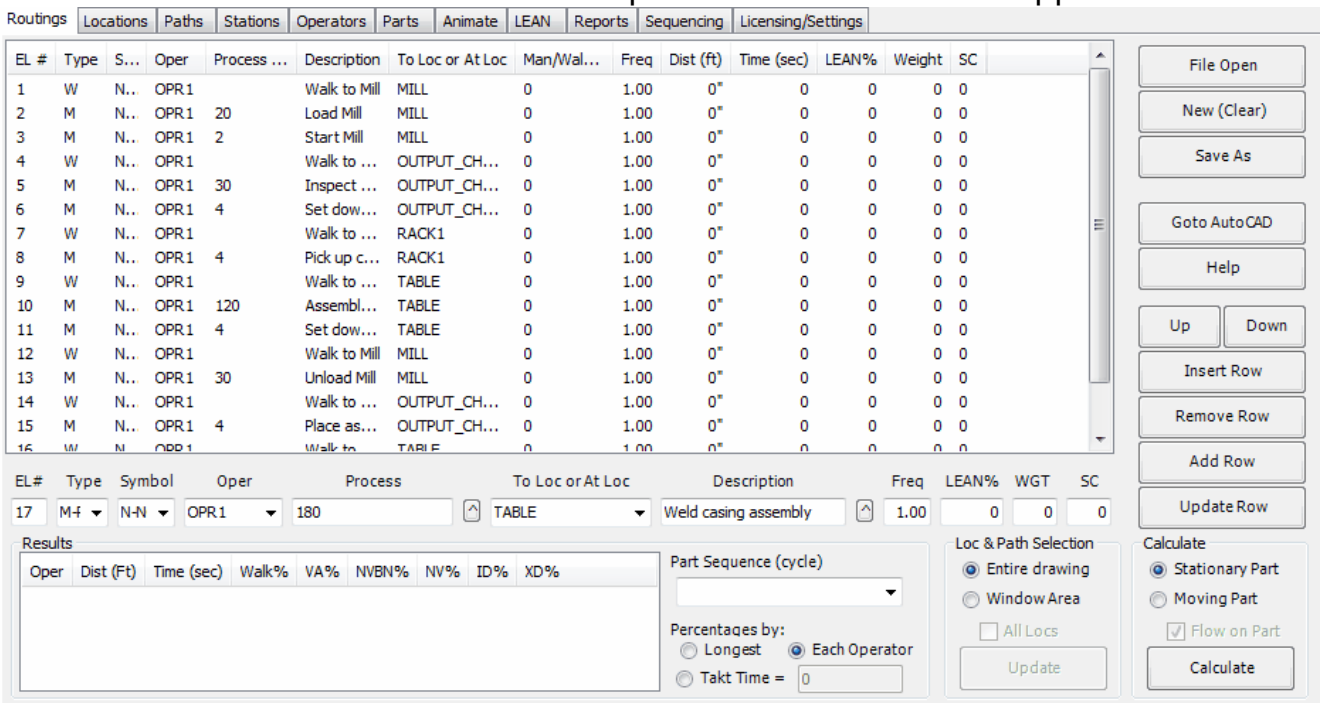
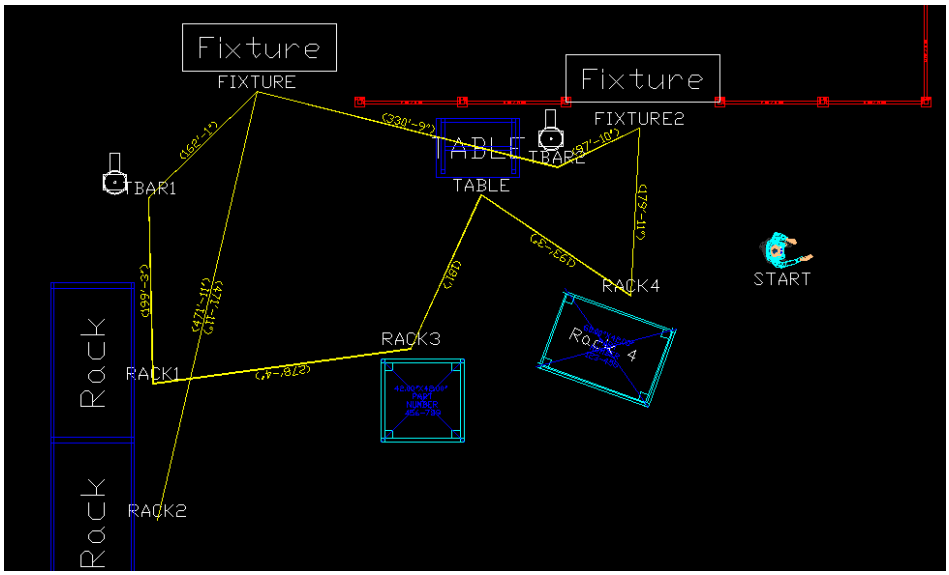
STEP 3: To import an existing workplace routing file, select the ***File Open*** button from the top right corner of the ***Routings*** tab screen as shown below. Then select the STATIONARY.CSV file provided with the WPP application.



Importing A Routing File

STEP 4: You should now be able to select the ***Calculate*** button in the bottom right of the screen to analyze the initial workplace layout. If it prompts that not all locations are present, add them by clicking on a location on the drawing. If an error states that a station has no length, go to the stations tab and update the length to 40'. The results of this Calculate can be seen in the Distance and Time columns in the right side of the routings window and in the Results Area in the bottom left corner. In addition, the flow lines should have been drawn in your layout as shown below. Depending on your version of AutoCAD and the specific tutorial files that were loaded, the drawing and routings may vary.



Drawing

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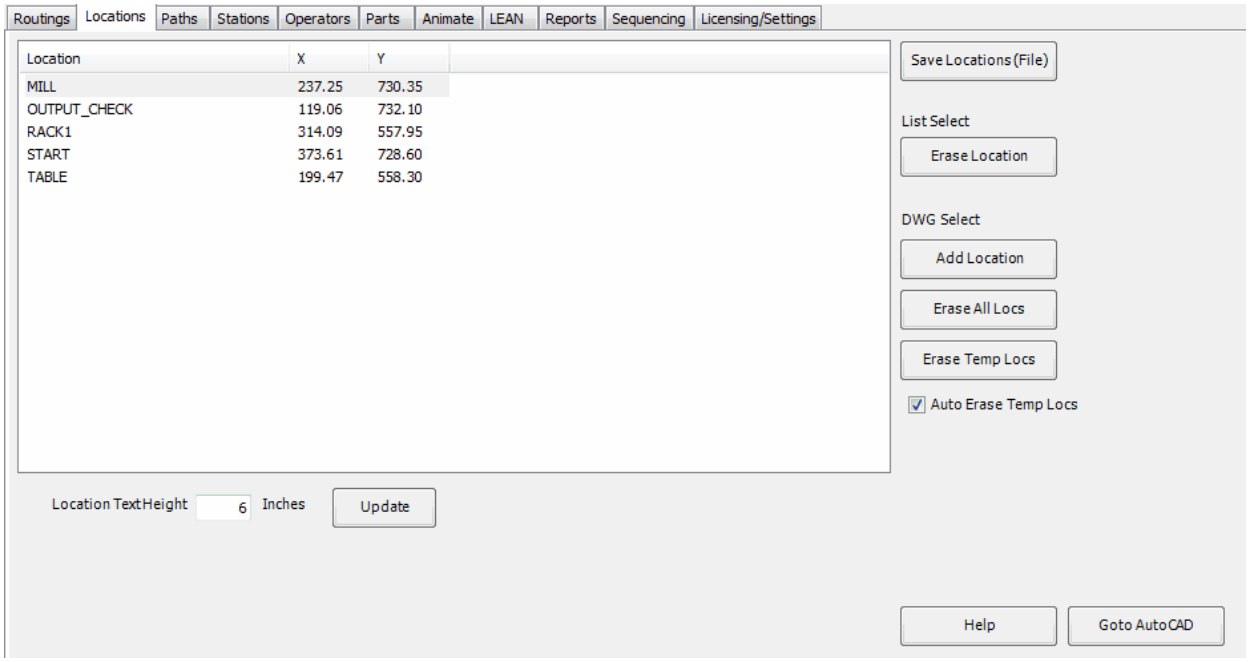
STEP 5: You can now select the ***Locations*** tab to see the location text that Proplanner found on the PP_LOCATIONS layer within the drawing. This text has already been added for you, however you could add additional location(s) by selecting the ***Add Location*** button in the middle right of this screen, under DWG Select, or by going into AutoCAD and simply placing text manually on this layer.



Locations Tab - Adding Location

STEP 6: You can now select the ***GotoAutoCAD*** to see the walk paths that were drawn by Proplanner in the workplace between the locations. Proplanner automatically generates flow paths using Euclidean (point-to-point) lines.

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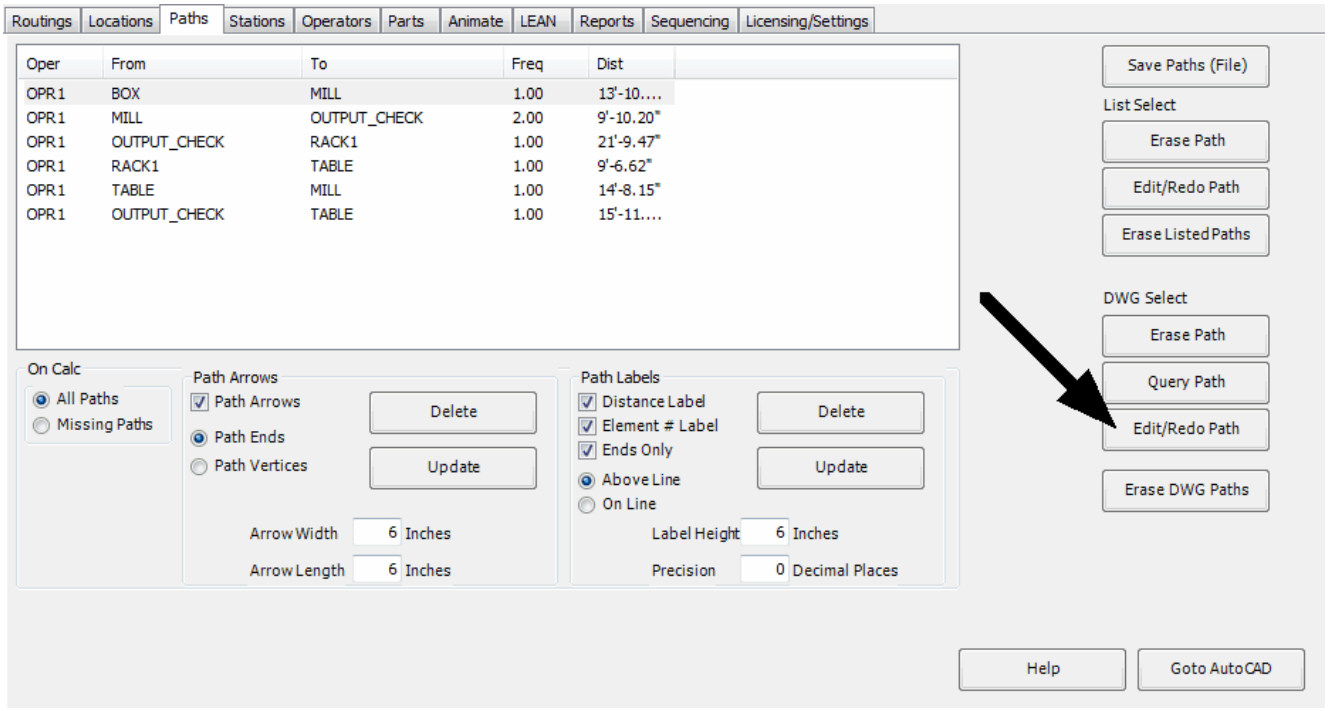
STEP 7: Flow paths may be set to move through other objects. In this example, one of the flow paths currently moves through a table. To replace this straight line flow path with one that moves around the table select the ***Edit/Redo Path*** button in the ***DWG Select*** section of the **Paths Tab** as shown below.



Edit/Redo Path

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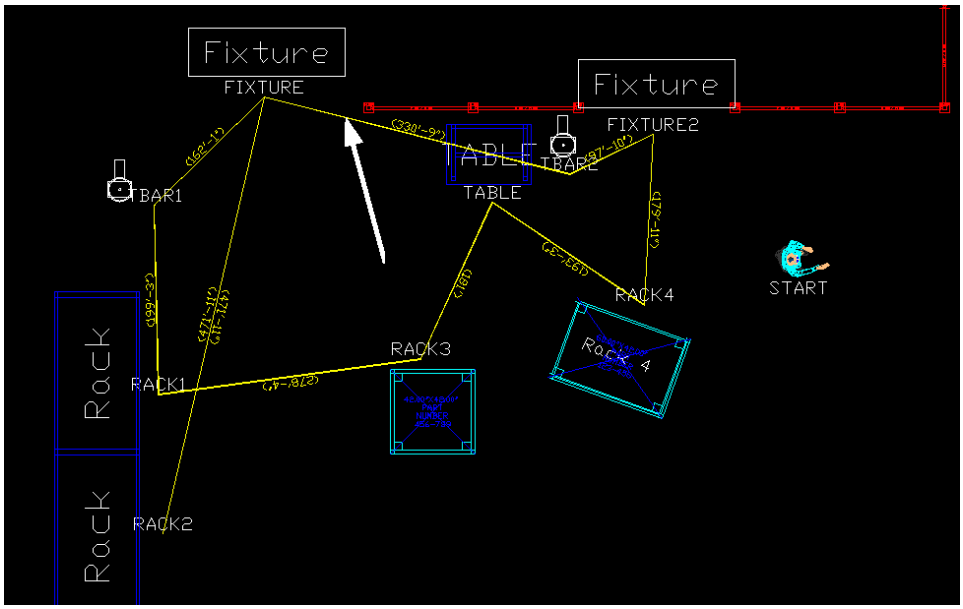
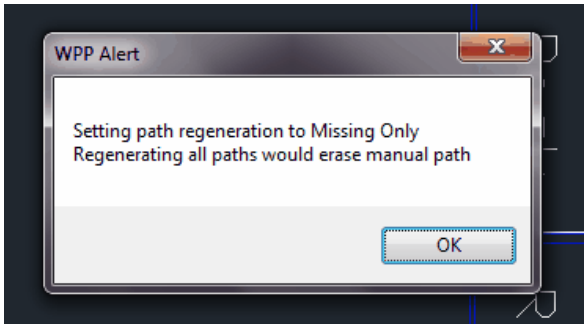
STEP 8: The WPP window will now disappear and you will be in the AutoCAD application window. AutoCAD is prompting you to select a path to replace with a new manually drawn one. Select the path to be moved as indicated by the white arrow below.



Moving A Path

STEP 9: The original path will now disappear and you will be prompted to enter a path from START to FIXTURE. Simply pick points starting from where the path originated around the table and then finally to the FIXTURE as shown below. When you pick your last point at the fixture you can press ***Enter*** on the keyboard, or your Right mouse button. A WPP Alert window will show up. Click "OK". You will then be returned to the Paths tab in the WPP application.



WPP Alert

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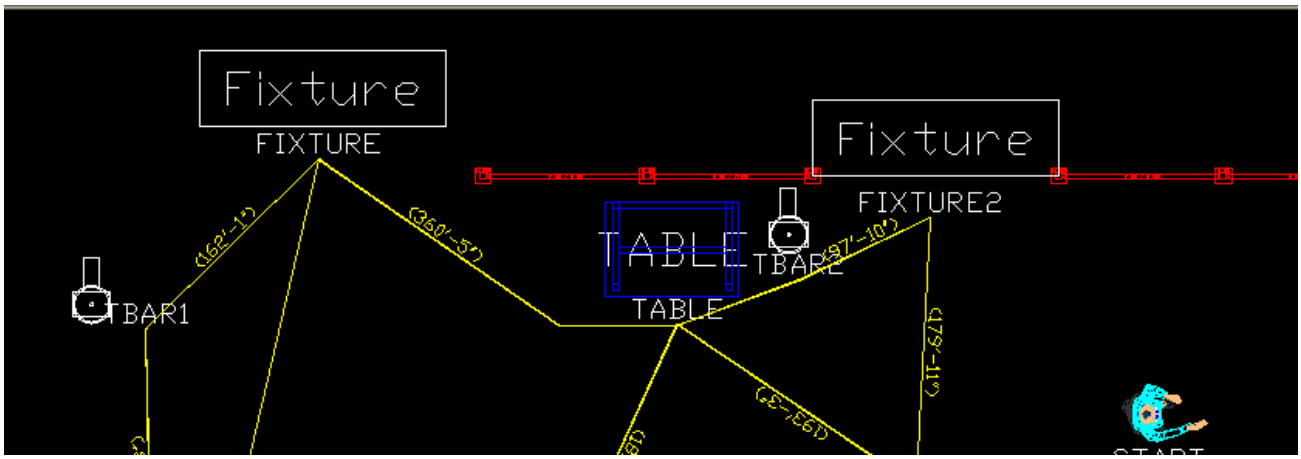
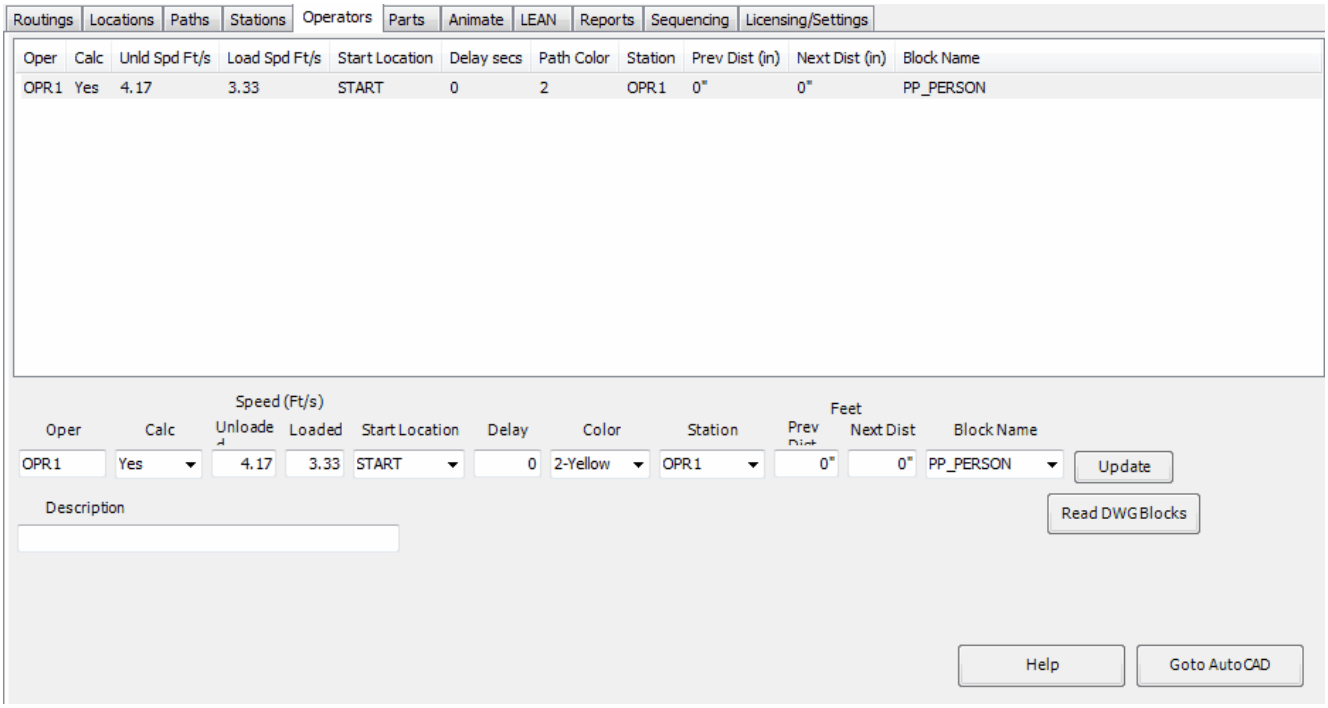
STEP 10: To evaluate the impact of this change. Simply select the ***Routings*** tab at the top and re-select the ***Calculate*** button. Make sure that the study is set to stationary part Calculate in the bottom right of the routings tab. Your new total walk distance and time will be updated, and your paths will look like those shown below. If the distances cannot be seen, within the paths tab there are options to increase arrow width and height, as well as path labels. Clicking update will change the labels (lengths) automatically to the new height.



Calculate

STEP 11: Now select the ***Operators*** tab to see the operator in your study. This window is filled when you load, or define, your routings. Every time that you use a unique operator name, it will appear in this window. From this window, you can set the walking speed of your operators and the color of their flow paths. An ability to set the maximum distance traveled into the previous workstation to work on a moving part has also been included here.



Operators Tab

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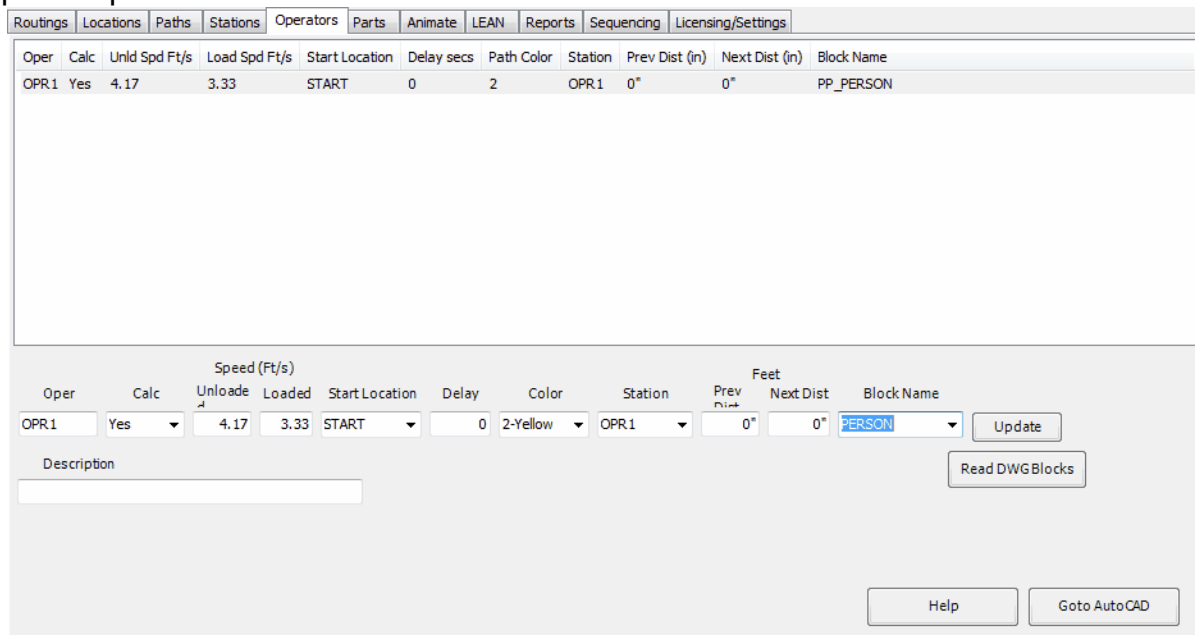
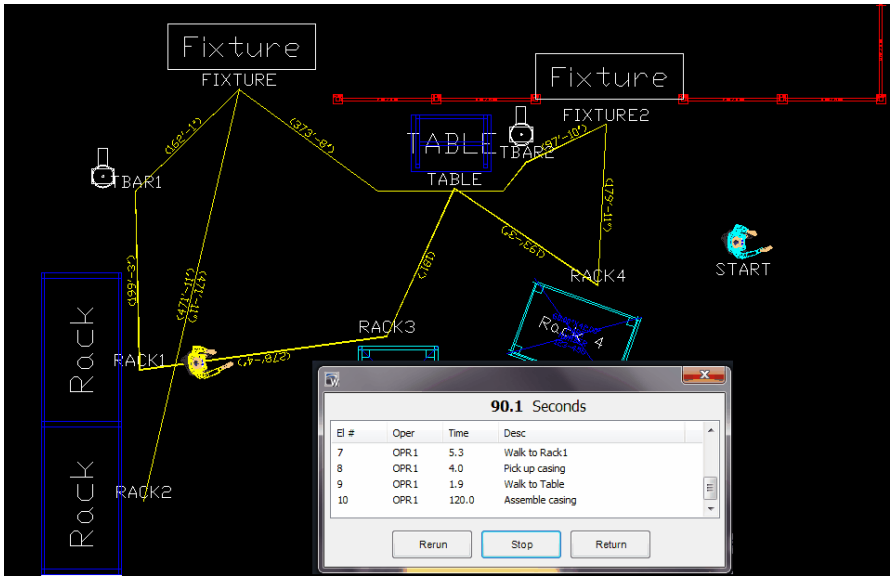
STEP 12: Select the ***Operators*** tab and select the Person Block name of “PERSON” or "PP_PERSON" in the pull-down box shown highlighted below. Next, select the ***Animate*** tab to see the animation options. Finally, select the ***Animate*** button at the top of the screen to watch the operator perform the work in 2D.

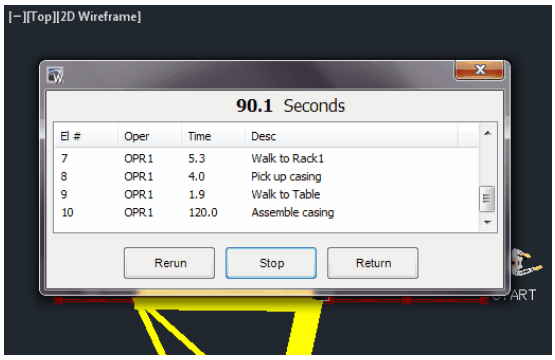


Person Block Name



Animation

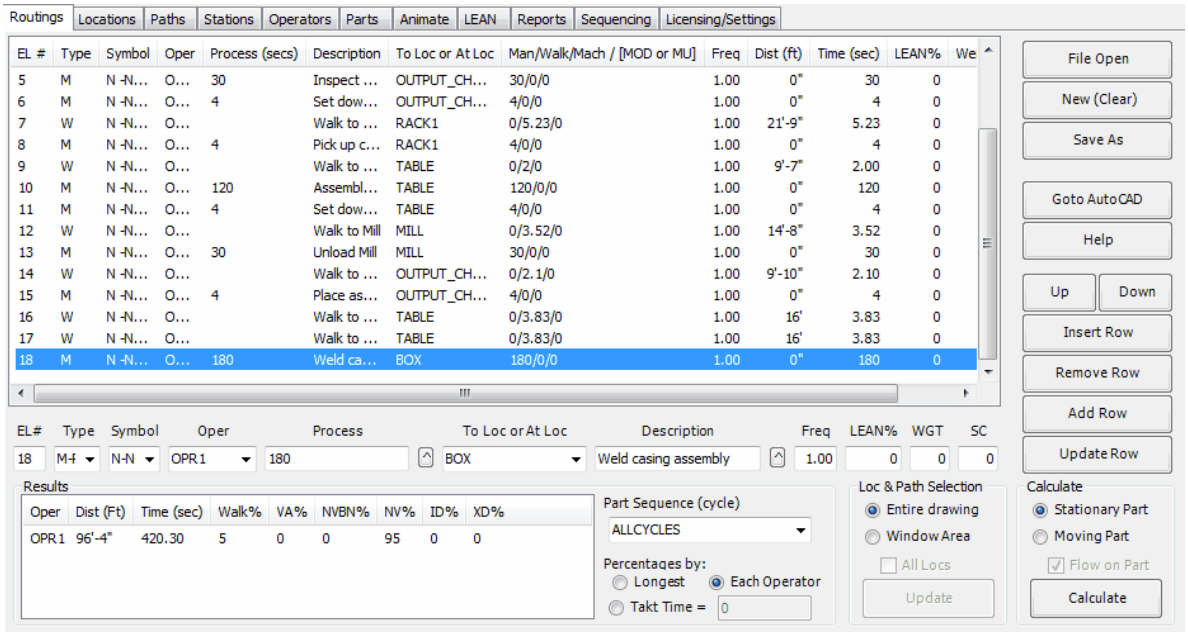
As the animation runs, you will see the screen shown below with the animation time displayed (Note: this time is dependent on your simulation ***Move Increment*** value specified in the ***Animate*** tab window and thus may not agree exactly with the final results). Decreasing the move increment will increase the accuracy of your results and will slow down your animation. You can also slow down the animation by entering a delay factor in the ***Motion Delay*** input box.



Animation Time Displayed

STEP 13: Now you are going to add a new route just before the end of our existing routing. To do this, select the last row in the routing window and press the **Insert *Row*** button. Now select this new row and enter the location name BOX in the **To Loc** column and then press the ***Update Row*** button.

You have just changed the routing from RACK2 to the FIXTURE to instead go from RACK2 to the BOX and then to the FIXTURE. At this point you could go to the Locations tab and add the location BOX, however we are instead just going to let the WPP prompt us for this location when we select the Calculate button. Your final result should look like that below.



Final Result - Changed Routing

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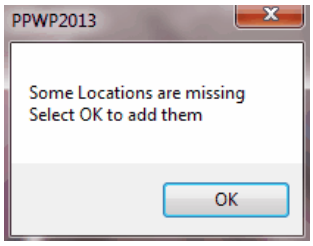
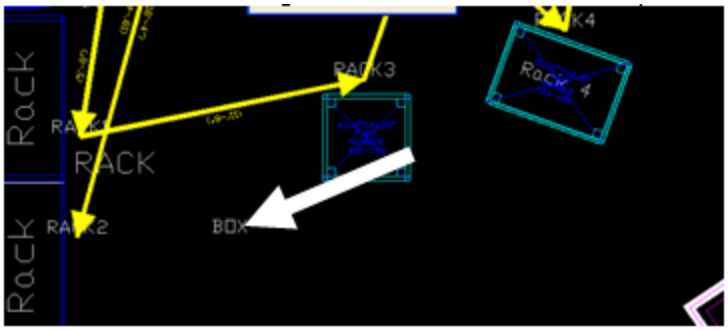
STEP 14: Select the ***Calculate*** button to re-Calculate the workstation cycle time and paths. Since you added a new location that has not yet been placed in the drawing, the WPP will display the following window alerting you to this fact. Selecting ***OK*** on this window will take you into the AutoCAD window and allow you to select the position for the missing location.



WPP Alert

Now select a position in the drawing for our new BOX in the place shown below.



New BOX

Moving Locations

To move locations select the ***Goto AutoCAD*** button and either use the AutoCAD ***Stretch*** command (crossing window option) or the ***Move*** command to relocate the Location text. Using the Stretch option will also move the end points for the flow paths, whereby the Move option will not. The user may also just grab the location text and drag it to the new location.

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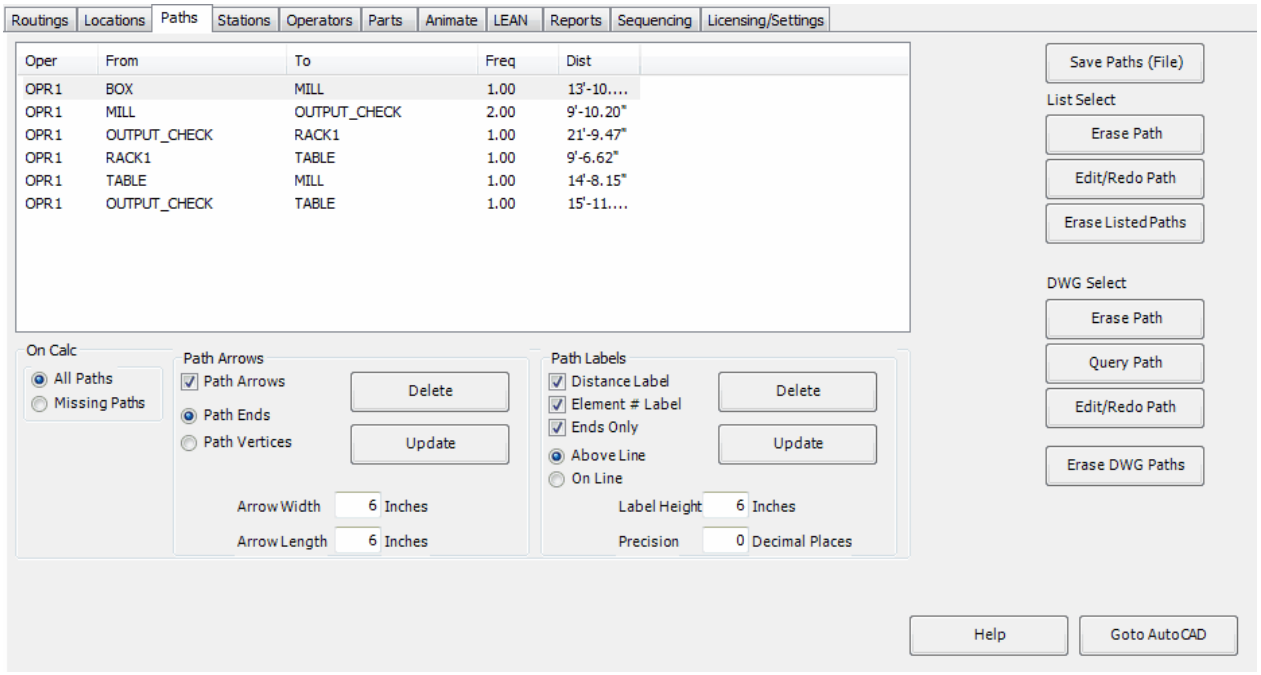
Upon returning to the WPP and selecting ***Calculate***, the flow paths that were stretched will report their new distances correctly, however the program will not automatically regenerate new flow paths for the relocated Location text, so those paths will report the same distances that they had in the prior Calculate. As such, you need to either go to the ***Paths Tab*** and delete the paths that would be affected by the relocated Location text labels, or you need to select the ***All Paths*** *on Calc* option in this menu and then select the ***Calculate*** button (as shown in the example screen below). Selecting ***All Paths*** will tell the WPP to first delete all of the flow paths and then regenerate them to their current Location text positions. Selecting ***All Paths*** is recommended in situations whereby you do not have many manual paths specified, as those manual paths will also be deleted by the ***All Paths*** option thus requiring the user to re-specify them.



All Paths Selection

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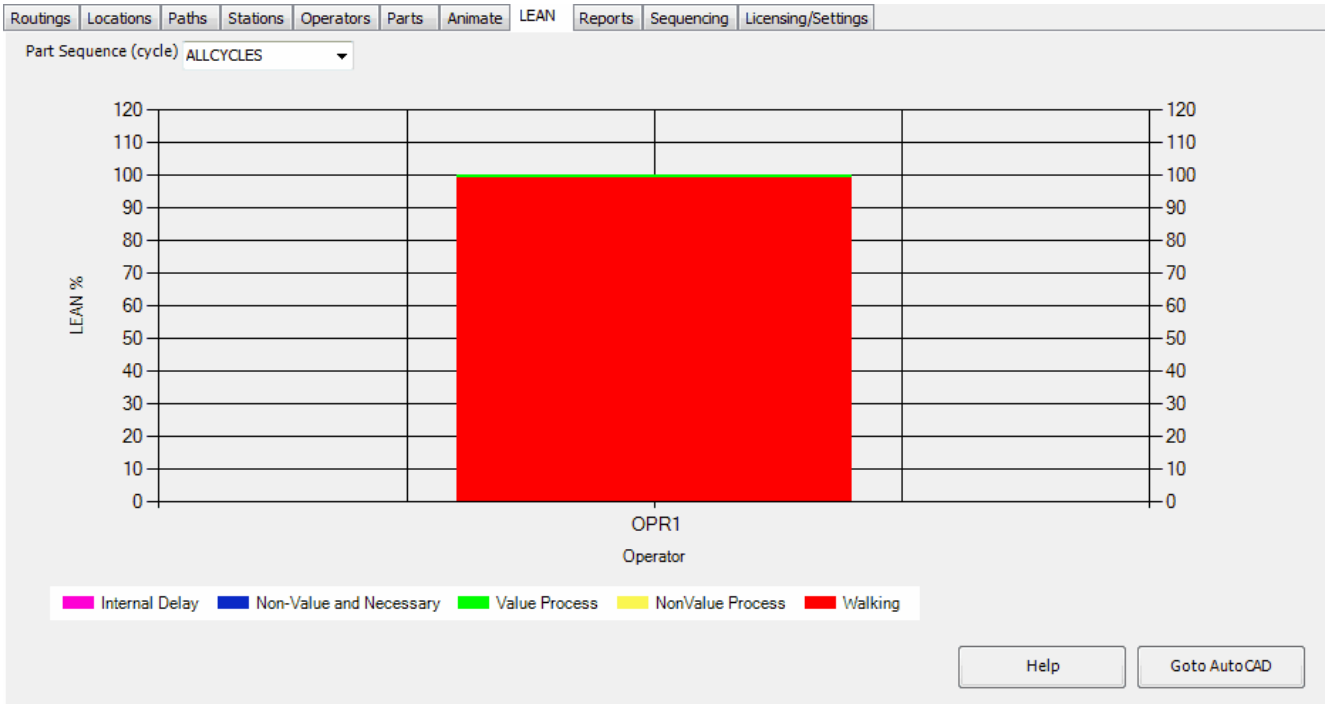
Step 15: The output abilities of the WPP can be seen in the summary results window in the bottom left side of the routings window, the Lean chart on the LEAN tab, and the reports created on the Reports tab.

The Lean chart is automatically created for the stationary example and will have different amounts of Value and Walking depending on the speeds and distances that are set.



LEAN Chart Summary Results

The Station Report can be created on the Reports tab by selecting get image, setting your stations takt time, and clicking Generate Report. The Station Report output can be exported directly to Excel, saved, or printed.

Congratulations!! You have now completed the first tutorial on using the Proplanner Workplace Planner for stationary parts. You may now continue on to the next tutorial on using the WPP for moving parts, or you may wish to continue on to the WPP Manual.pdf for more detailed information on the WPP options.

Special Note: Your analysis summary will appear in the lower left corner of the routings screen. You may right-click in this window to copy these results to the clipboard. In fact, you can right-click and copy all WPP display list window information for subsequent pasting into other windows applications, such as MS Word or MS Excel.

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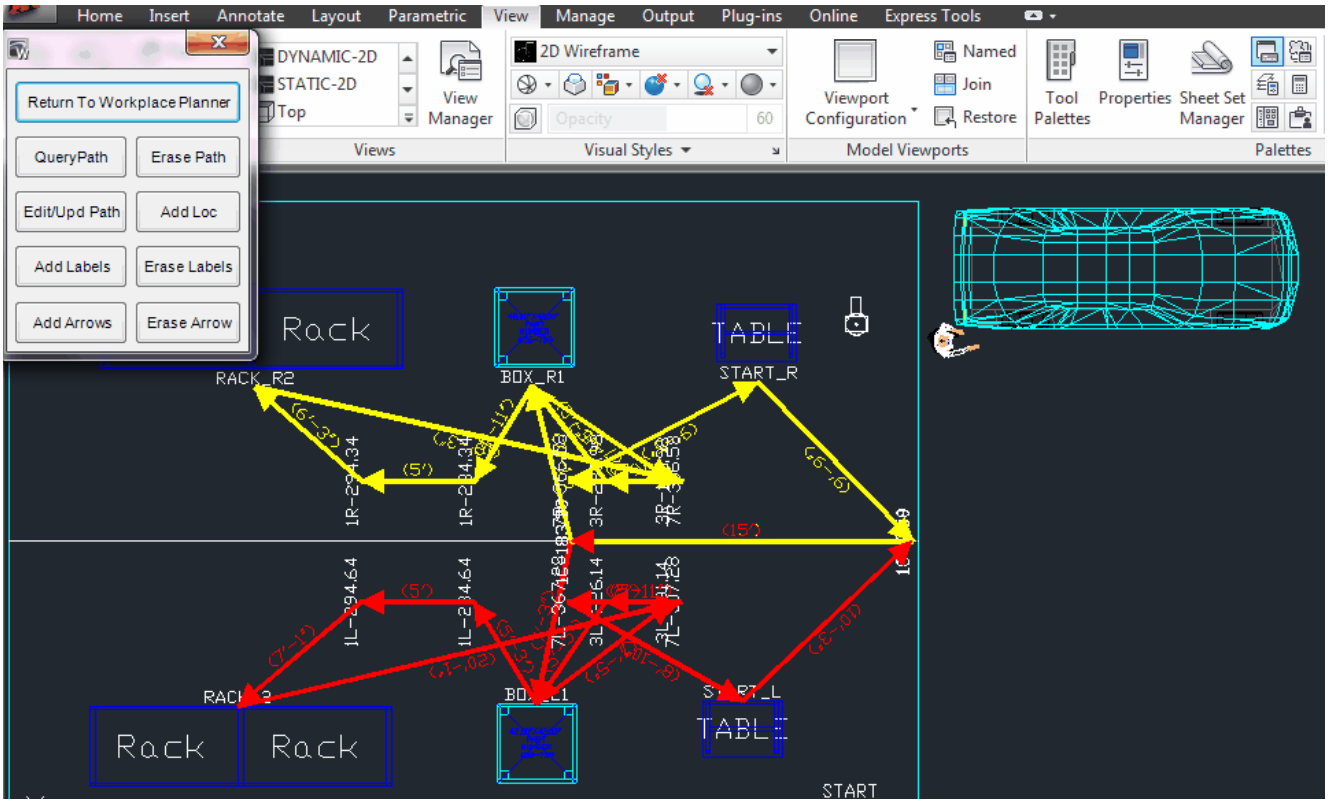
6.2 Moving Part Analysis

STEP 1: To get started, make sure all other drawings in AutoCAD are closed. If you have already been working in Workplace Planner, click the New (Clear) button in the ***Routings*** tab. Then ***Open*** the file WALKPATH-FCAD.DWG for Metric tutorials or WPP_Moving.DWG for FootInch, just as you did in the first Tutorial.

If you are already in AutoCAD you need not leave and reload AutoCAD, however, you will also need to go to the ***Routings*** tab and select the ***Goto AutoCAD*** button as shown below.

STEP 2: You should now be in the AutoCAD screen and will be looking at the 2D or 3D static workplace layout. To view the moving part (dynamic) workplace layout select the view icon, or type in the ***VIEW*** command in the command line, and double-click on the **DYNAMIC-2D** option and select ***OK***.



Dynamic-2D Option Drawing

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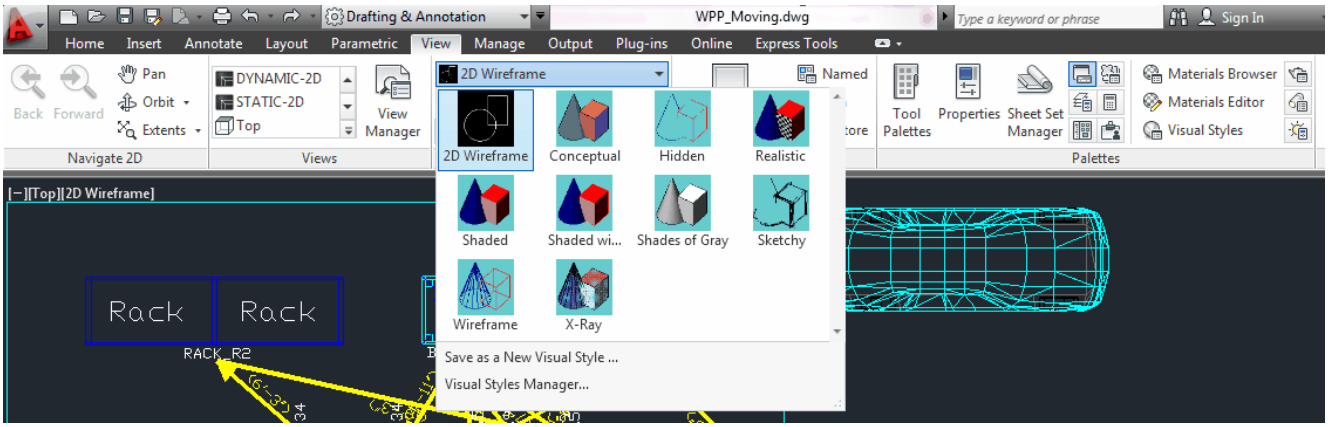
If your layout drawing looks like the top view of a 3D drawing (solid filled boxes) instead of wire-frame outlines, as shown above, then you need to select the 2-D wire-frame view of the layout. To do this select the 2D Wireframe icon located in the top right corner of the AutoCAD, or within the view tab dropdown depending on your AutoCAD version. If you could not find the 2D Wireframe icon, please right click at the blank space on the toolbar, choose from the popup menu "ACAD => Shade" or "ACAD=>View Style" depending on your AutoCAD version.



2D Wireframe

STEP 3: Once your view is correct, you will want to go into the WPP application. Depending upon how you are starting this tutorial do the following

- **New into AutoCAD:** Perform step 2 in the first Tutorial.
- **From *Goto AutoCAD* in WPP:** Select the ***Return to Workplace Planner*** button from the WPP modeless window located in the top left corner of the screen.

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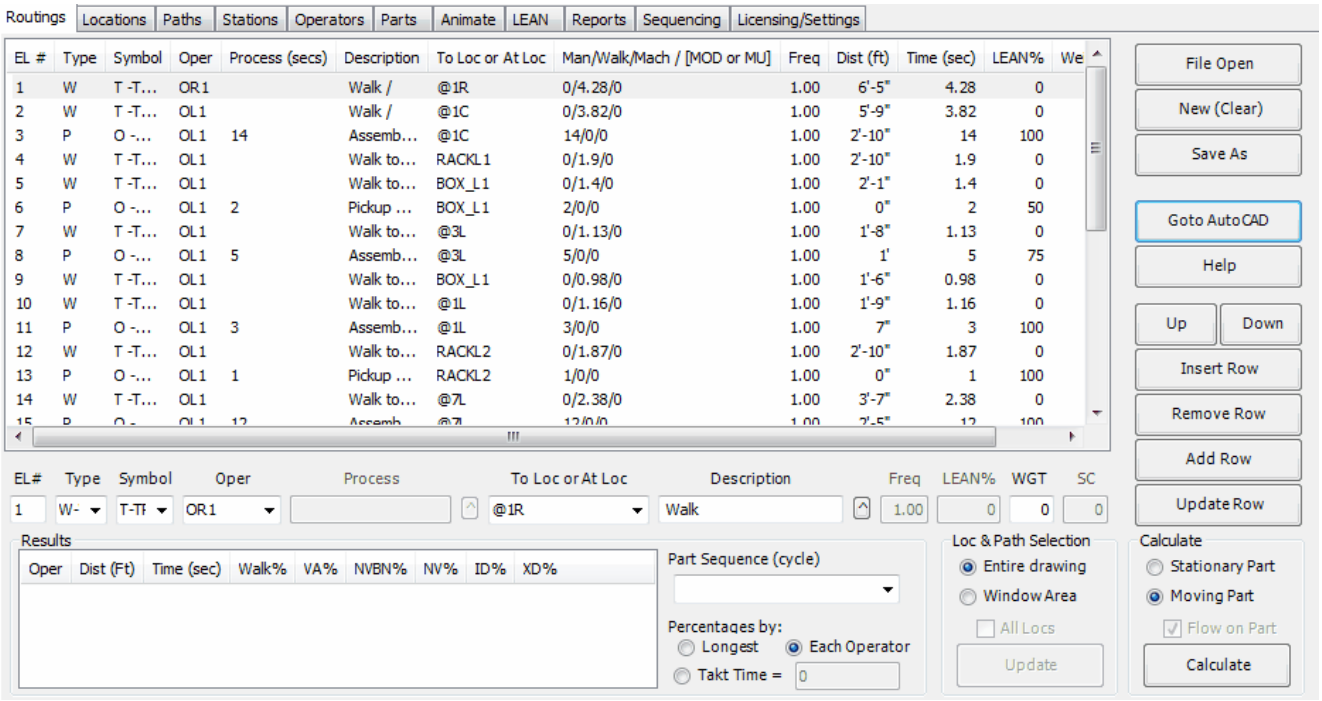
STEP 4: Now in the ***Routings*** tab select the ***File Open*** button at the top right and load the **MOVING.CSV** file. Your screen should look like that shown below when you are done.



File Open - Routings Tab

You will notice that in the lower right of the screen, that your Calculate option was changed from Stationary part to Moving Part because the application noticed the @ characters at the beginning of some of your From and To locations.

From a routing file perspective, the only difference between a stationary part and a moving part analysis is that in a moving part study you need to reference where you want to be on the part and let the WPP determine where the part is at the time that you wish to go to (or from) it.

In order to specify where you wish to be on the part, you use a simple coding system that is prefixed with an @ character to specify that the location is a relative one (just like in AutoCAD). The second character is a number representative of a fraction of the total distance back from the front of the part followed by an **L** or an **R** (uppercase as are all location names).

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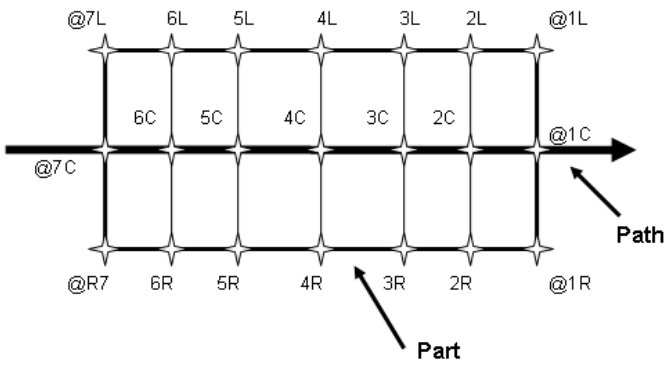
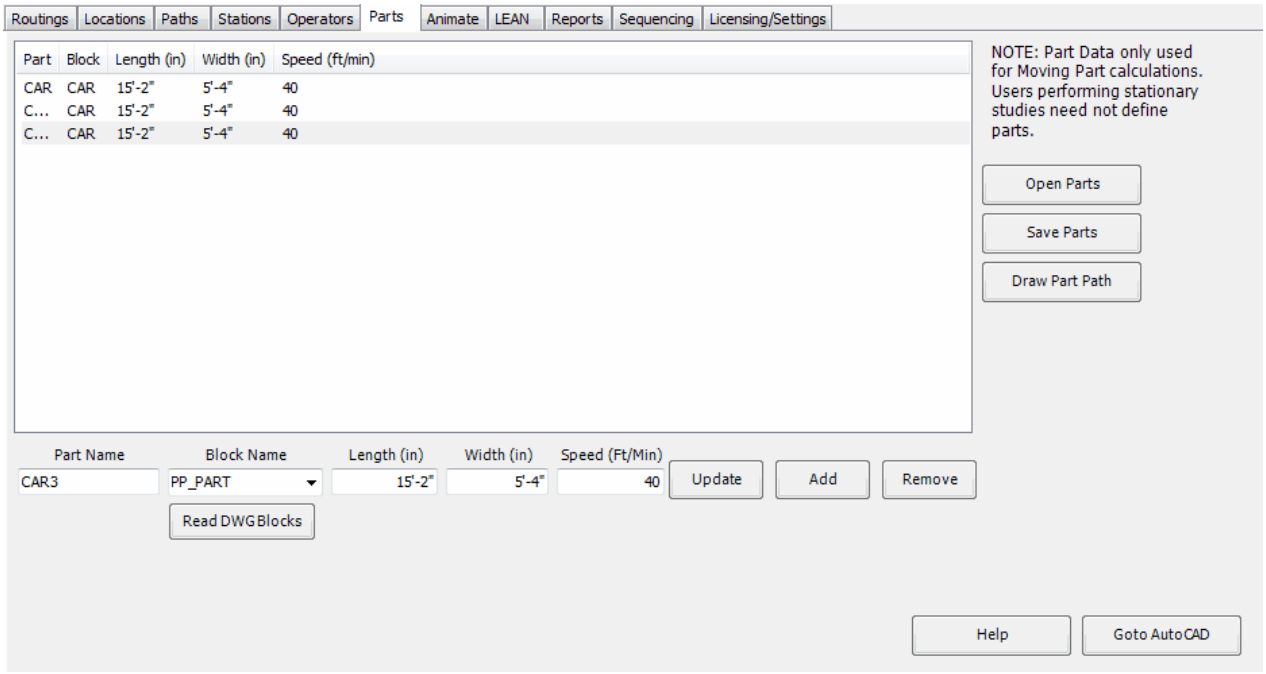


Grid Location

The method to specify a location on a Moving part: A number from 1 to N (where n is from 1 to 25) that specifies how many zones are longitudinally spaced along the part followed by the letter L for Left, R for Right, or C for Center. A number 7 is the default amount of longitudinal divisions. The first and last zones are directly at the front and the back of the part respectively.

- @2L (specifies a location on the left side at the width and 2/7 back)
- @1R (specifies a location on the right side at the front)
- @3C (specifies a location at the center and 3/7 back)

The actual distances of the width and length offsets are determined by the part size, which is specified in the ***Parts*** tab in the WPP as shown below.



Parts Tab - Actual Distances Of Offsets

STEP 5: Now that the routing file is loaded, you should ensure that your part dimensions and part path speeds are correct. The ***Parts*** tab shown above is also where the parts are assigned blocks to be animated with.

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For the Foot-Inch example, a part speed of 40 feet/minute and a part length and width of 15'-2" (or 182 inches) and 5'-4" (or 64) inches has been used. When entering feet, do not forget to include the single-quote after the number or the program will assume that your input is being specified in Inches.

You may also wish to select the Operators tab to verify that the default operator speed is what you want. The WPP sets Operator walking speeds to 4.17' per second which is an industry standard used in MTM time studies. Another option on this tab is to set a max distance that the operator can travel into a previous station to reach the part. If the part size is too big, the operator may still go further than the limit so part length should be taken into consideration when setting this number or the length of the part path.

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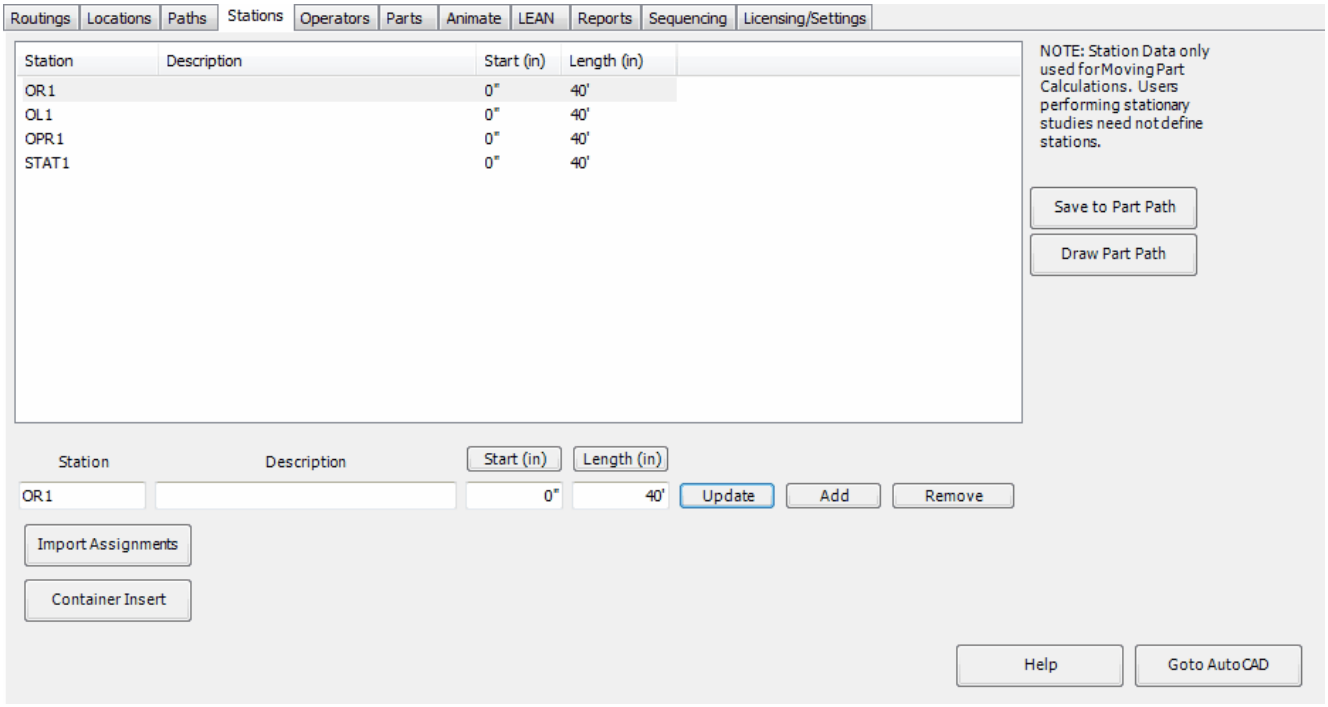
STEP 6: The Calculation is nearly ready to be ran. The only step left is to define the station dimensions on the ***Stations*** tab shown below. Name the station, select what distance on the part path the station begins, and how long the station is. Hit the add button to add the station or the update button to save changes and now you're ready to do a Calculate. In this example, the correct station information should have be present, if not, enter 40' as the length.



Stations Tab - Dimensions

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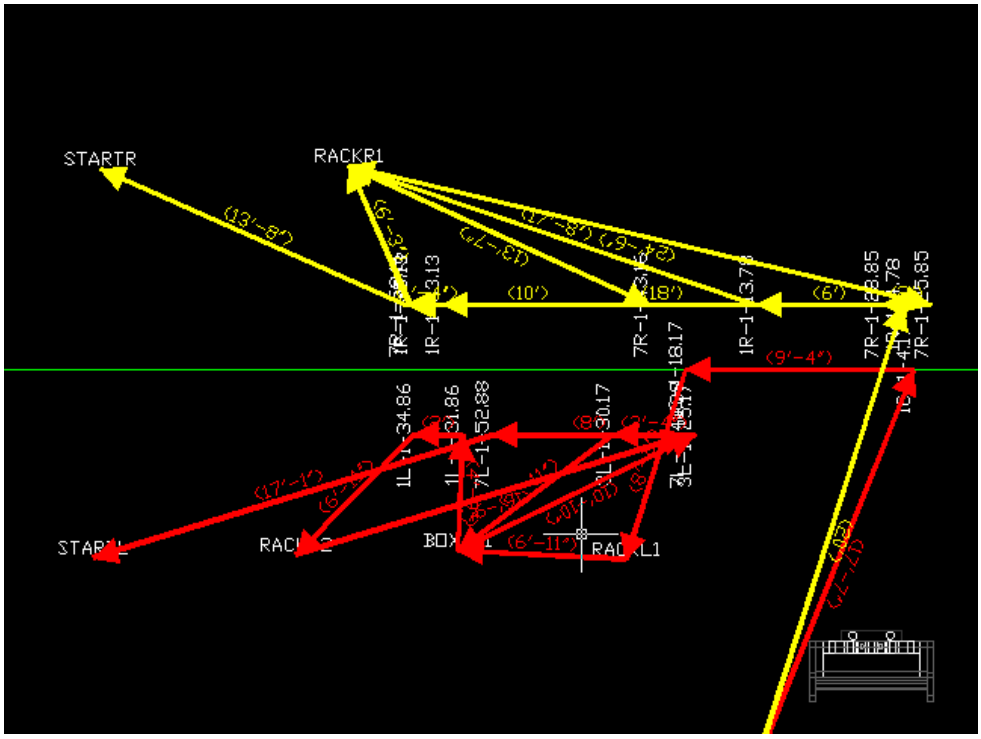
Now you can return to the ***Routings*** tab and simply select the ***Calculate*** button at the lower right of the window. You will see the results shown in the Results Window (lower left of window) and Drawing - see examples below (actual results will vary slightly from these examples due to changes in the individual sample files).

Results

Oper	Dist (Ft)	Time (sec)	Walk%	VA%	NVBN%	NV%	ID%	XD%
OR1	155'-7"	59.41	54	43	0	3	0	0
OL1	132'-7"	57.51	40	60	0	0	0	0

Results



Drawing

You will notice that in this example, you have two different operators and their flow paths are shown in different colors.

To generate this diagram, the WPP computed the speed of the vehicle, and the speed of the operator walking. The WPP then took into account the process times at the vehicle and at the containers and racks along the line. The WPP then computed all of the line part/operator intersection locations, created labels for these locations along the part path (white text perpendicular to part path), and generated the flow lines accordingly with path labels and flow arrows.

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STEP 7: Once you have completed the analysis you can select the ***Parts*** tab to make sure that the part block is set to CAR, ***Operator*** tab to make sure the operator is set to 3OPSDFEM, and then proceed to the ***Animate*** tab to perform the following step.

STEP 8: Now on the ***Animate*** tab select the ***Animate*** button in the bottom right of the screen and watch the operators at work. You will notice that when the operators are working on the car, they travel at the speed of the car, but when the walk around the workplace, they travel at their walking speeds (which are faster – and must be – than that of the car).

Step 9: Finally, (and once the animation is complete, but before selecting the Return to WalkPath button) you will need to select the view icon or type in the ***VIEW*** command to see the animation in 3D **[if using FCAD DWG]**. Now double-click on the **DYNAMIC-3D** option and select **OK**.

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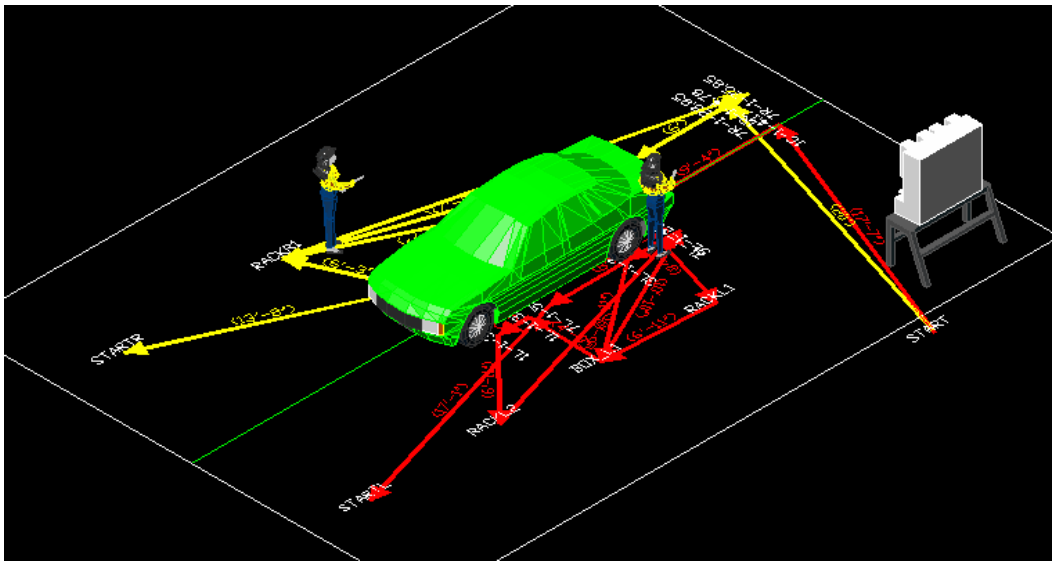
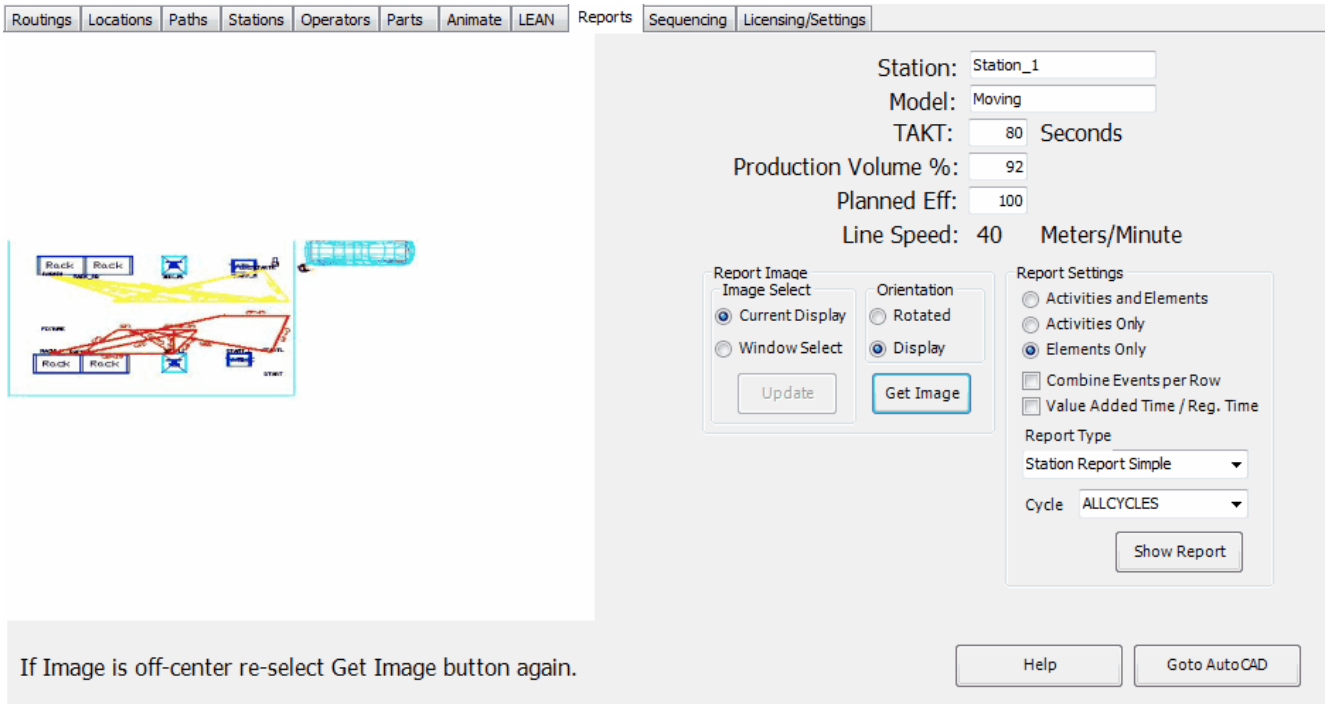
STEP 10: Now select the ***ReRun Animation*** button and watch the show! Remember that selecting the ***Alt*** key and reselecting it will start and stop the animation.



ReRun Animation View

STEP 11: After all the calculations have been completed, you can go to the reports window.



Reports Window

The workstation report includes an image of your workstation, along with workstation header information that you can enter in the top right of the screen. Similarly the Man/Machine report displays the breakdown of both manual and machine related labor times. These reports can be set to output Activities and their Elements or either option separately.

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Select the **Get Image** button to get the current view of your workplace. You may need to select the Goto AutoCAD button in order to adjust your display such that the workstation view looks correct. You can also get image from a window. For best results getting image by a selected window hit “Get Image” twice.

Once your view is acceptable; select the Station Report button to generate your report. This report can also be made to show VA/NVA percentages by checking the checkbox. Once the report is generated, simply select the File Save option in the browser window to save your report.

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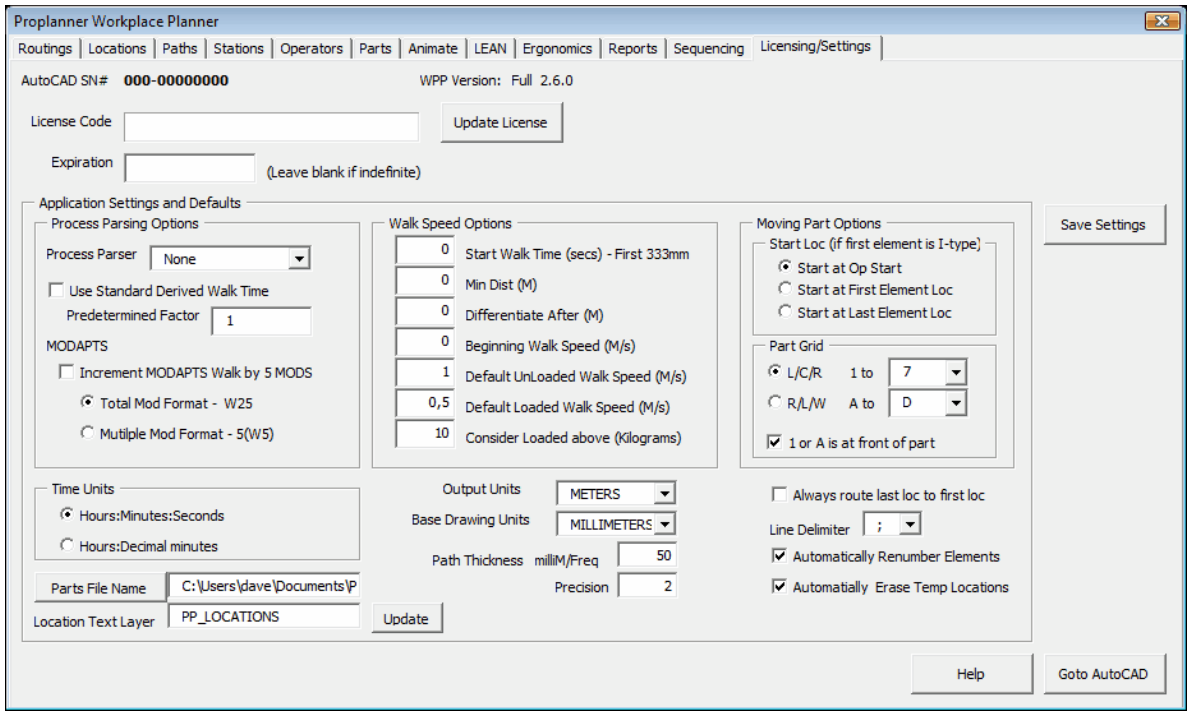
6.3 Stationary Part Analysis Metric

This tutorial was developed with the drawing units set to millimeters and the reporting units set to meters. In addition, the files have been saved in a semi-colon (;) delimited format with numbers specified in the format (1.200,15) which is common in France, Germany, Italy, Sweden and other countries. Before starting the tutorial, it is advised that you go to the "Licensing Settings" tab and ensure that your settings are set as shown below.



Licensing Settings

STEP 1: To get started, make sure all other drawings in AutoCAD are closed. If you have already been working in Workplace Planner, click the New (Clear) button in the ***Routings*** tab. Then **Open** the file "WALKPATH-2D.DWG" (make certain that you use only the tutorial files from the metric-semicolon directory). You should be able to see the Proplanner Applications menu on your screen. If not, you will need to load this menu using the Menu Installation Guide included in the Install.pdf.

STEP 2: If Workplace Planner is not already open, select the "W" icon button in the Proplanner ribbon.

STEP 3: To import an existing workplace routing file, select the **File Open** button from the top right corner of the **Routings** tab screen as shown below. Then select the STATIONARY.CSV file provided with the WPP application.

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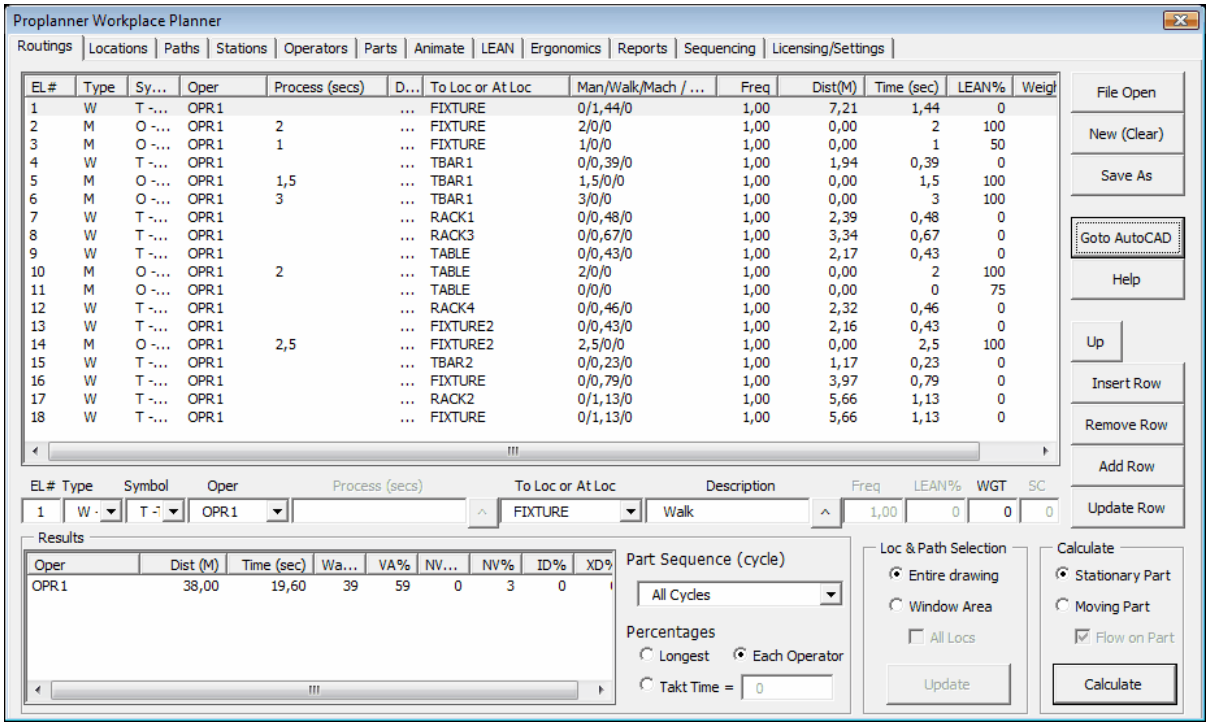
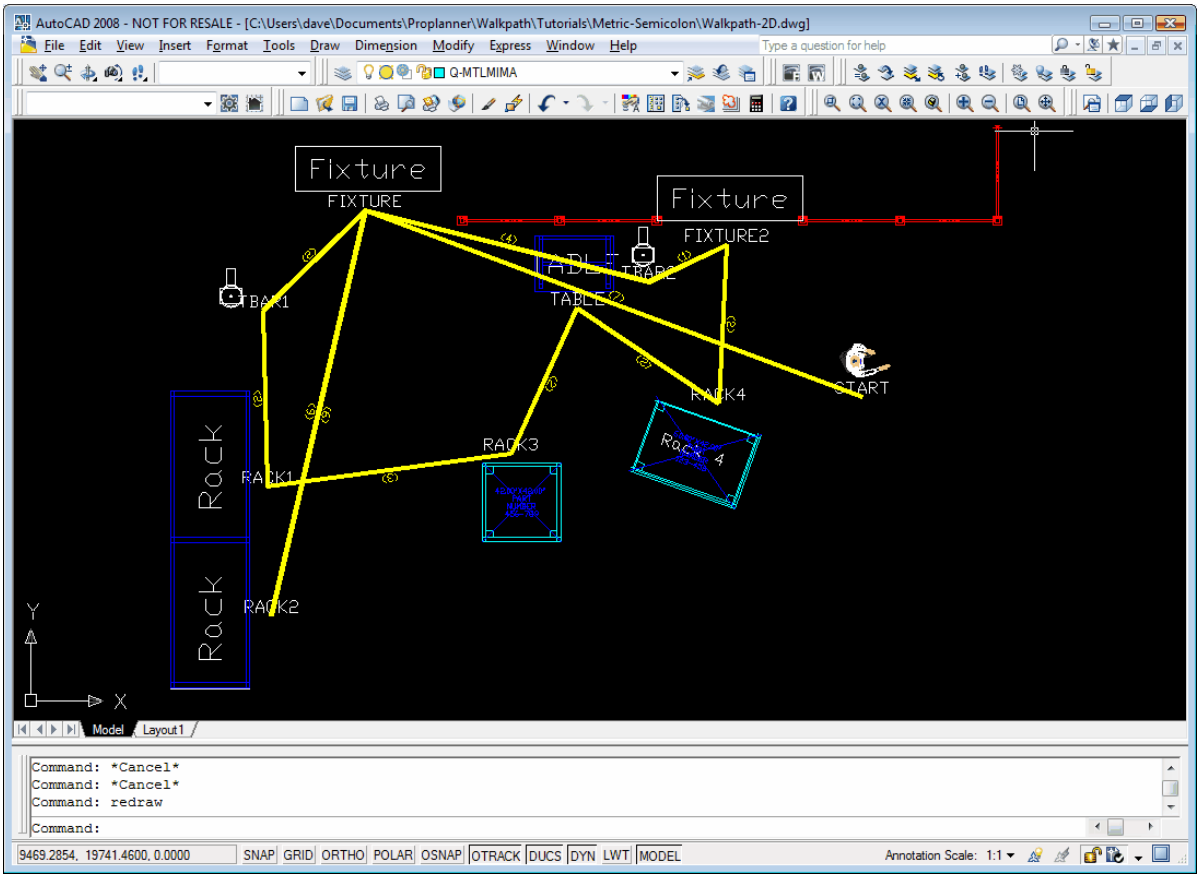


File Open - Routing File

STEP 4: You should now be able to select the ***Calculate*** button (bottom right of the screen) to analyze the initial workplace layout. The results of this Calculate can be seen in the Distance and Time columns in the right side of the routings window and in the Results Area in the bottom left corner. In addition, the flow lines should have been drawn in your layout as shown below.



Workplace Layout & Results

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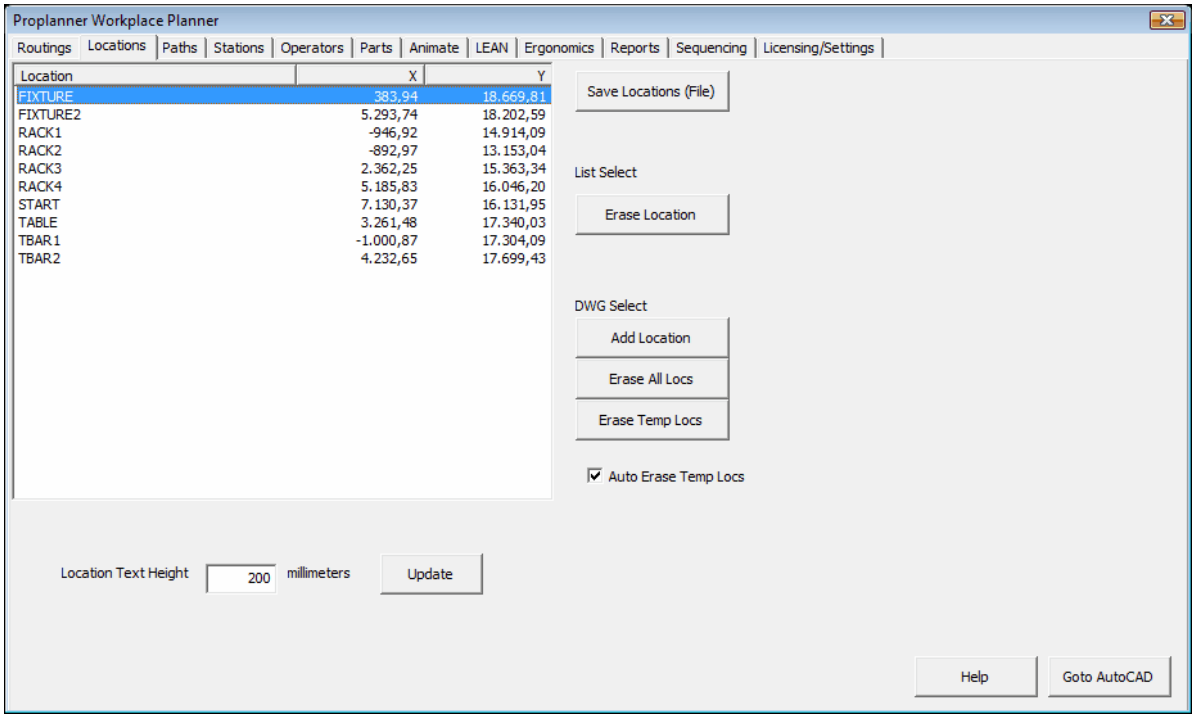
STEP 5: You can now select the ***Locations*** tab to see the location text that Proplanner found on the PP_LOCATIONS layer within the drawing. This text has already been added for you, however you could add additional location(s) by selecting the ***Add Location*** button in the middle right of this screen, under DWG Select, or by going into AutoCAD and simply placing text manually on this layer.



Adding A Location

STEP 6: You can now select the ***GotoAutoCAD*** to see the walk paths that were drawn by Proplanner in the workplace between the locations. Proplanner automatically generates flow paths using Euclidean (point-to-point) lines.

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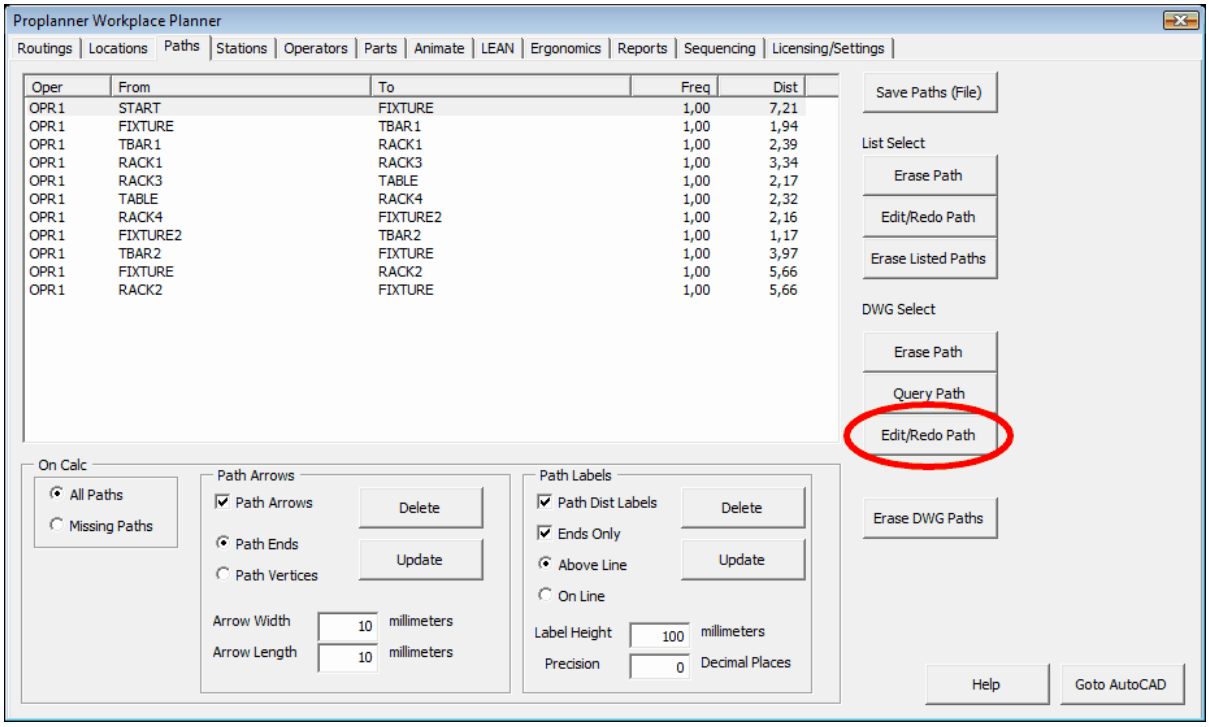
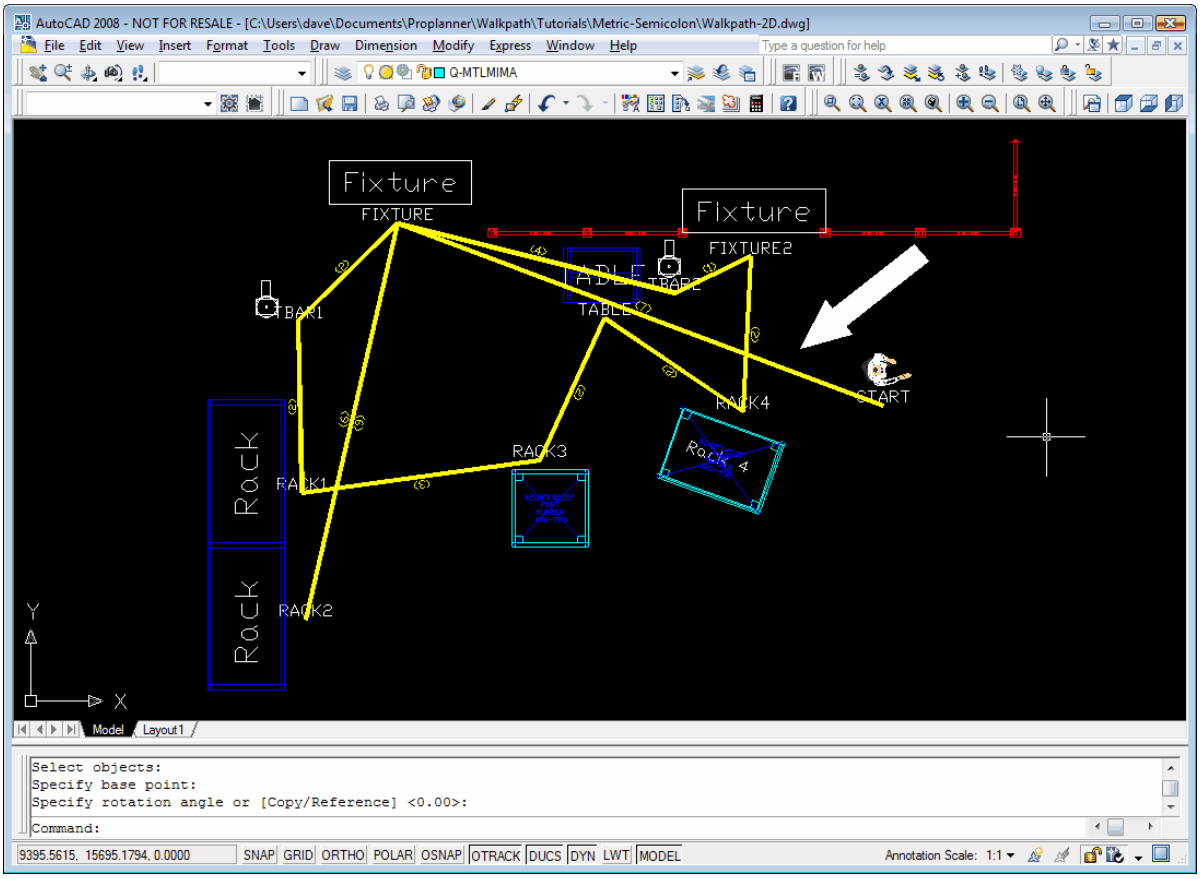
STEP 7: One of the flow paths currently moves through a table. To replace this straight line flow path with one that moves around the table select the ***Edit/Redo Path*** button in the ***DWG Select*** section of the **Paths Tab** (shown below in red oval).



Edit/Redo Path

STEP 8: The WPP window will now disappear and you will be in the AutoCAD application window. AutoCAD is prompting you to select a path to replace with a new manually drawn one. Select the path in the top middle as indicated by the white arrow below.



Selecting A Path

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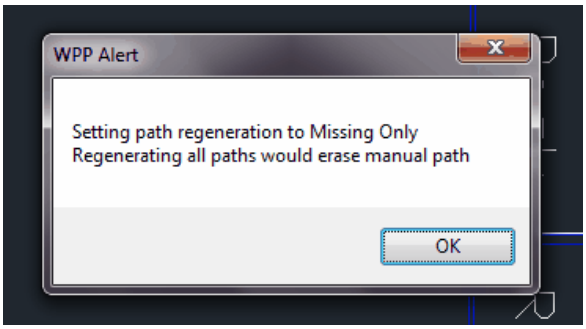
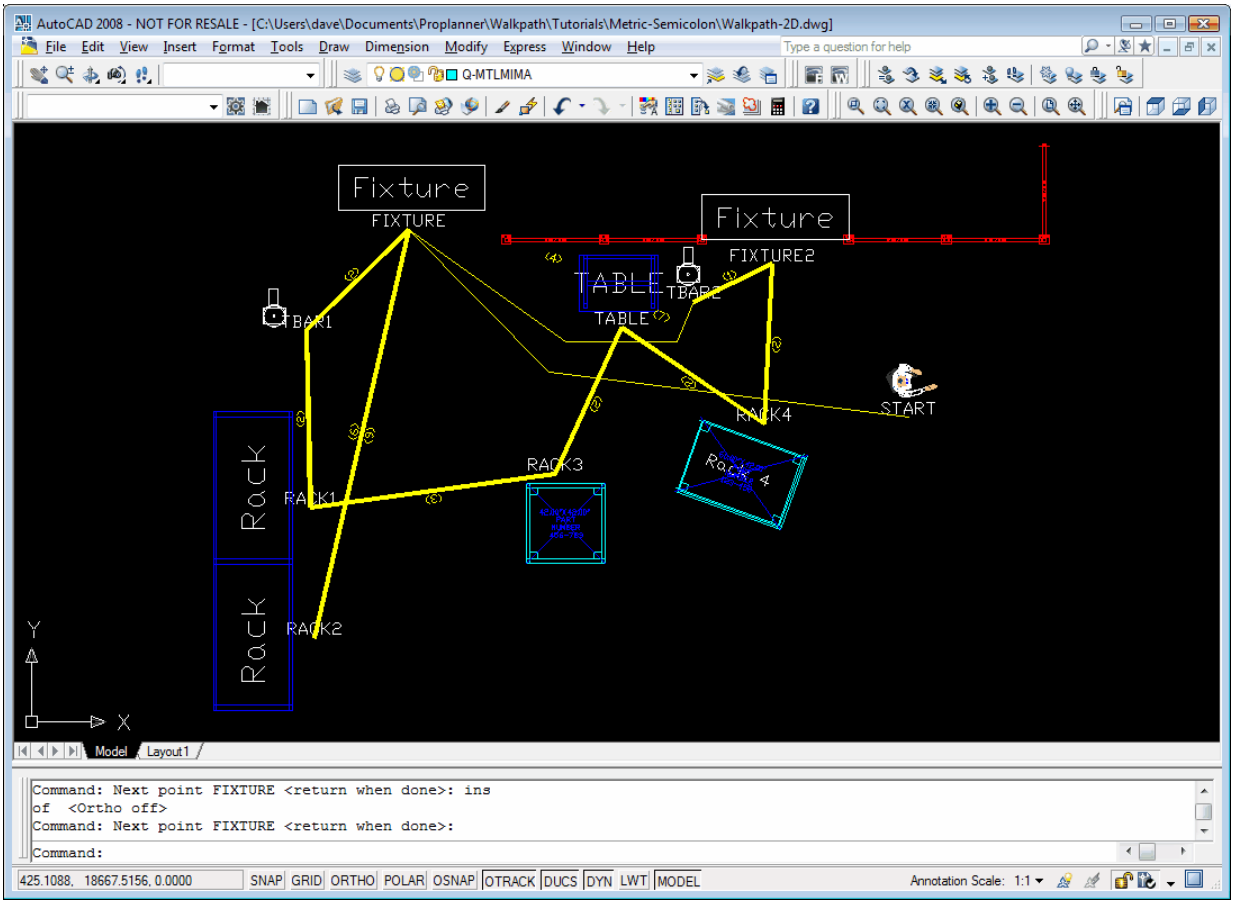
STEP 9: The original path will now disappear and you will be prompted to enter a path from START to FIXTURE. Simply pick points starting from where the path originated around the table and then finally to the FIXTURE as shown below. When you pick your last point at the fixture you can press ***Enter*** on the keyboard, or your Right mouse button. A WPP Alert window will show up. Click "OK". You will then be returned to the Paths tab in the WPP application.



WPP Alert

You can do this again for the line from TBAR2 to the FIXTURE. When complete, you drawing should now look as shown below.



Drawing

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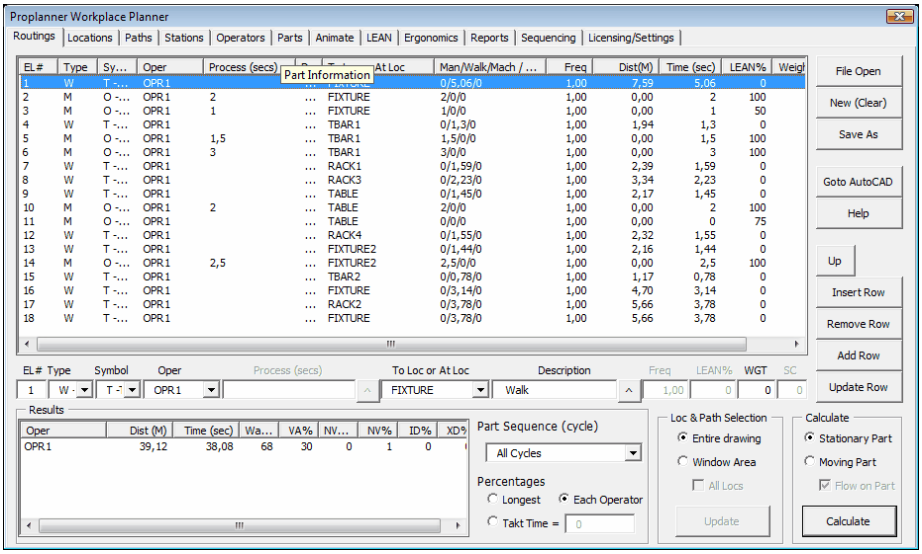
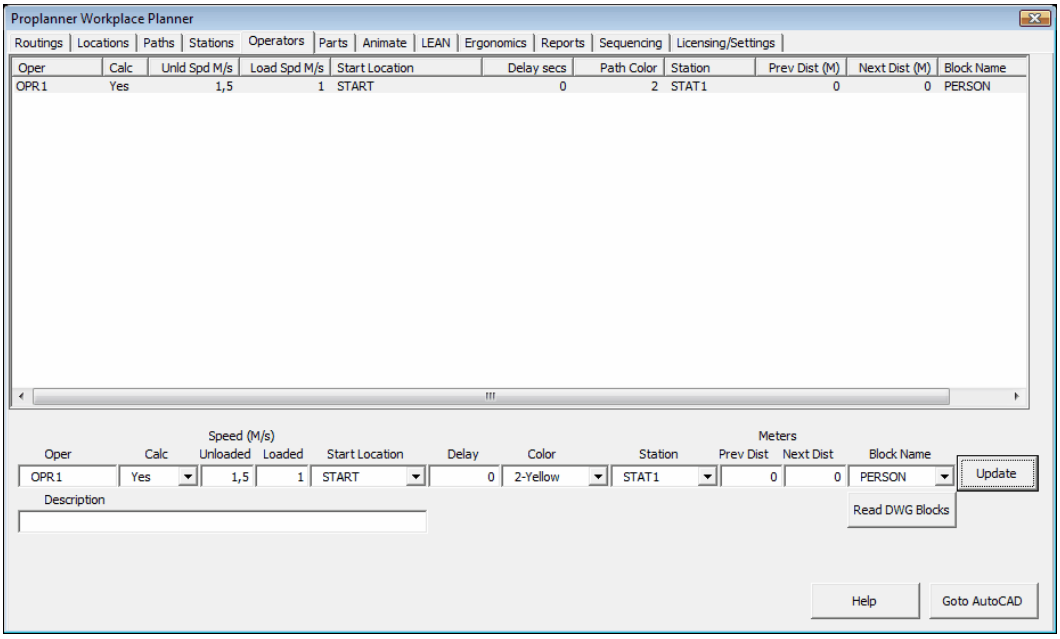
STEP 10: To evaluate the impact of this change. Simply select the ***Routings*** tab at the top and re-select the ***Calculate*** button. Make sure that the study is set to stationary part Calculate in the bottom right of the routings tab. Your new total walk distance and time will be updated, and your paths will look like those shown below.



Calculate - Updated Paths

STEP 11: Now select the ***Operators*** tab to see the operator in your study. This window is filled when you load, or define, your routings. Every time that you use a unique operator name, it will appear in this window. From this window, you can set the walking speed of your operators and the color of their flow paths. An ability to set the maximum distance traveled into the previous workstation to work on a moving part has also been included here.



Operators Tab

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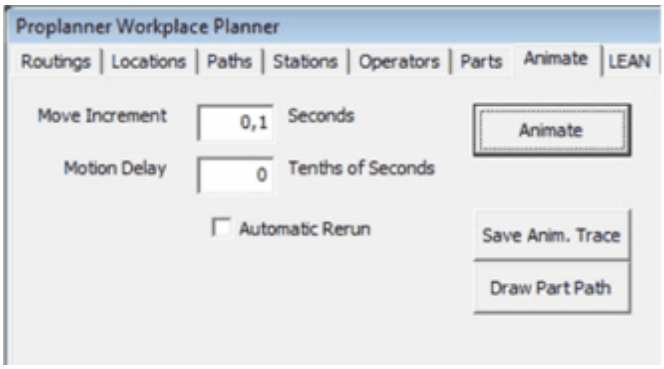
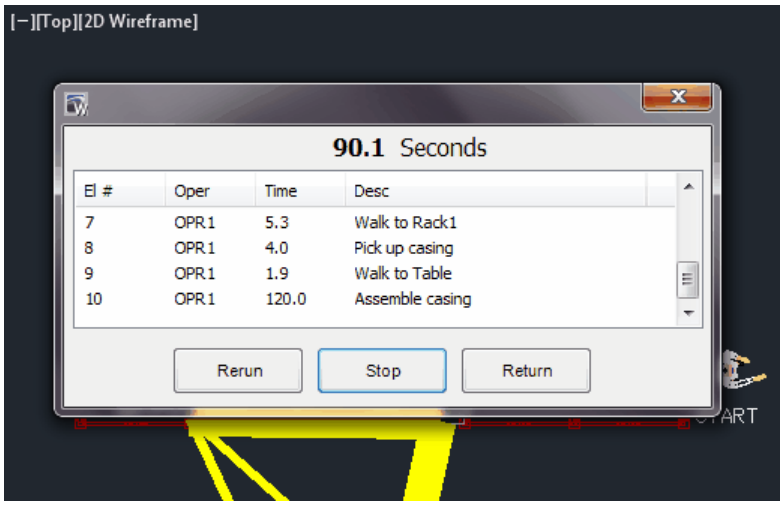
STEP 12: Select the ***Operators*** tab and select the Person Block name of "PERSON" in the pull-down box (shown above). Next, select the ***Animate*** tab, and set the animation options (see below). Finally select the ***Animate*** button in the bottom right corner to watch the operator perform the work in 2D.



Person Block Name

When the animation finishes, you will see the screen shown below with the total animation time displayed (Note: this time is dependent on your simulation ***Move Increment*** value specified in the ***Animate*** tab window and thus may not agree exactly with the final results). Decreasing the move increment will increase the accuracy of your results and will slow down your animation. You can also slow down the animation by entering a delay factor in the ***Motion Delay*** input box.



Animation Window

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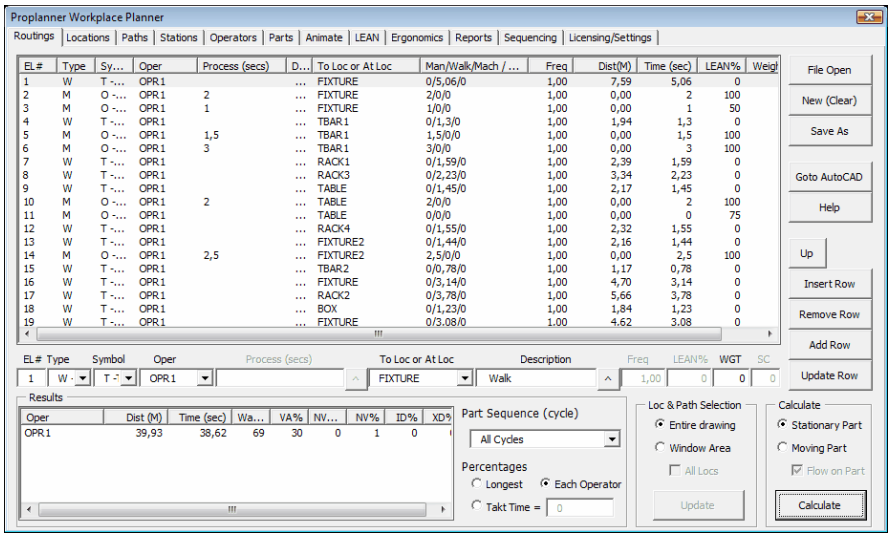
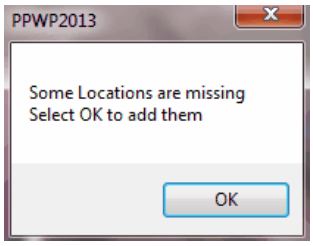
STEP 13: Now you are going to add a new route just before the end of our existing routing. To do this, select the last row in the routing window (Element 18) and press the ***Insert Row*** button. Now select this new row and enter the location name BOX in the **To Loc** column and then press the ***Update*** button.

You have just changed the routing from RACK2 to the FIXTURE to instead go from RACK2 to the BOX and then to the FIXTURE. At this point you could go to the Locations tab and add the location BOX, however we are instead just going to let the WPP prompt us for this location when we select the Calculate button. Your final result should look like that below.



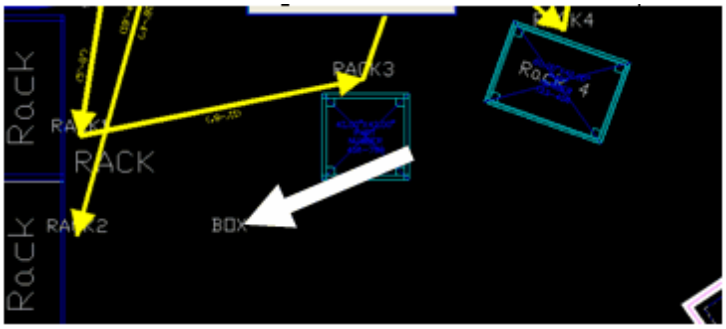
Final Result - Changed Routing

STEP 14: Select the ***Calculate*** button to re-Calculate the workstation cycle time and paths. Since you added a new location that has not yet been placed in the drawing, the WPP will display the following window alerting you to this fact. Selecting ***OK*** on this window will take you into the AutoCAD window and allow you to select the position for the missing location.



WPP Alert

Now select a position in the drawing for our new BOX in the place shown below.



New BOX

Moving Locations

To move locations select the ***Goto AutoCAD*** button and either use the AutoCAD ***Stretch*** command (crossing window option) or the ***Move*** command to relocate the Location text. Using the Stretch option will also move the end points for the flow paths, whereby the Move option will not. The user may also just grab the location text and drag it to the new location.

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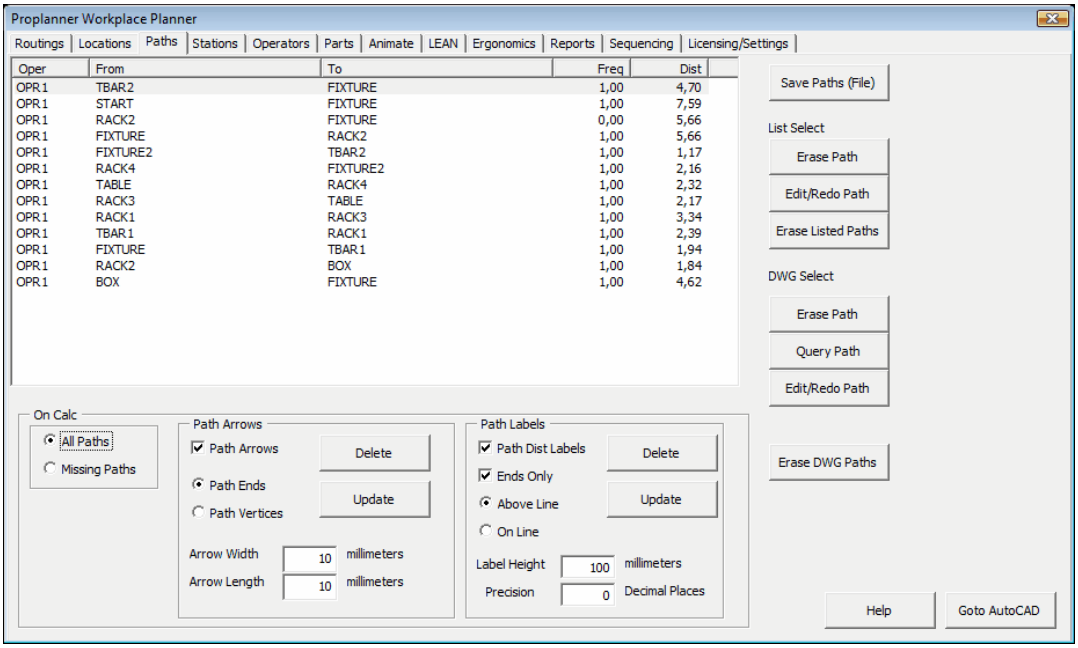
Upon returning to the WPP and selecting ***Calculate***, the flow paths that were stretched will report their new distances correctly, however the program will not automatically regenerate new flow paths for the relocated Location text, so those paths will report the same distances that they had in the prior Calculate. As such, you need to either go to the ***Paths Tab*** and delete the paths that would be affected by the relocated Location text labels, or you need to select the ***All Paths*** *on Calc* option in this menu and then select the ***Calculate*** button (as shown in the example screen below). Selecting ***All Paths*** will tell the WPP to first delete all of the flow paths and then regenerate them to their current Location text positions. Selecting ***All Paths*** is recommended in situations whereby you do not have many manual paths specified, as those manual paths will also be deleted by the ***All Paths*** option thus requiring the user to re-specify them.



All Paths Selection

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Step 15: The output abilities of the WPP can be seen in the summary results window in the bottom left side of the routings window, the Lean chart on the LEAN tab, and the reports created on the Reports tab.

The Lean chart is automatically created for the stationary example should look similar to that below.

LEAN Chart Summary Results

The Station Report can be created on the Reports tab by selecting get image, setting your stations takt time, and hitting Generate Report. The Station Report output can be exported directly to Excel, saved, or printed.

Congratulations!! You have now completed the first tutorial on using the Proplanner Workplace Planner for stationary parts. You may now continue on to the next tutorial on using the WPP for moving parts, or you may wish to continue on to the WPP Manual.pdf for more detailed information on the WPP options.

Special Note: Your analysis summary will appear in the lower left corner of the routings screen. You may right-click in this window to copy these results to the clipboard. In fact, you can right-click and copy all WPP display list window information for subsequent pasting into other windows applications, such as MS Word or MS Excel.

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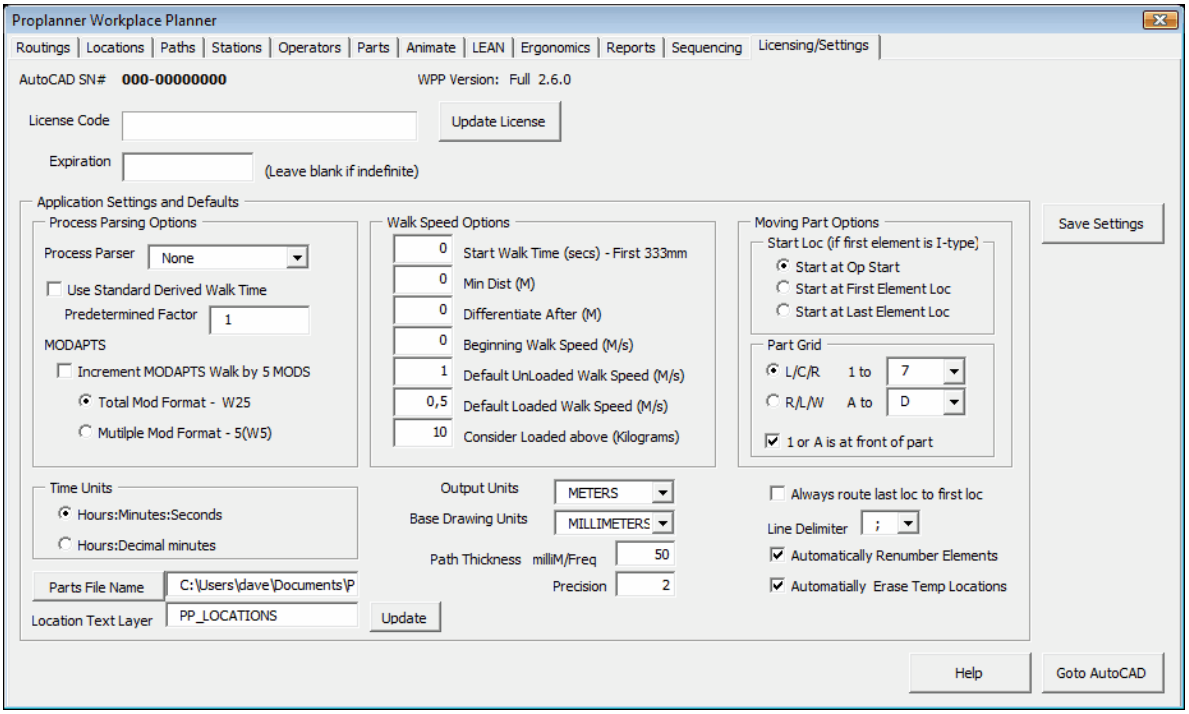
6.4 Moving Part Analysis Metric

This tutorial was developed with the drawing units set to millimeters and the reporting units set to meters. In addition, the files have been saved in a semi-colon (;) delimited format with numbers specified in the format (1.200,15) which is common in France, Germany, Italy, Sweden and other countries. Before starting the tutorial, it is advised that you go to the "Licensing Settings" tab and ensure that your settings are set as shown below.



Licensing Settings

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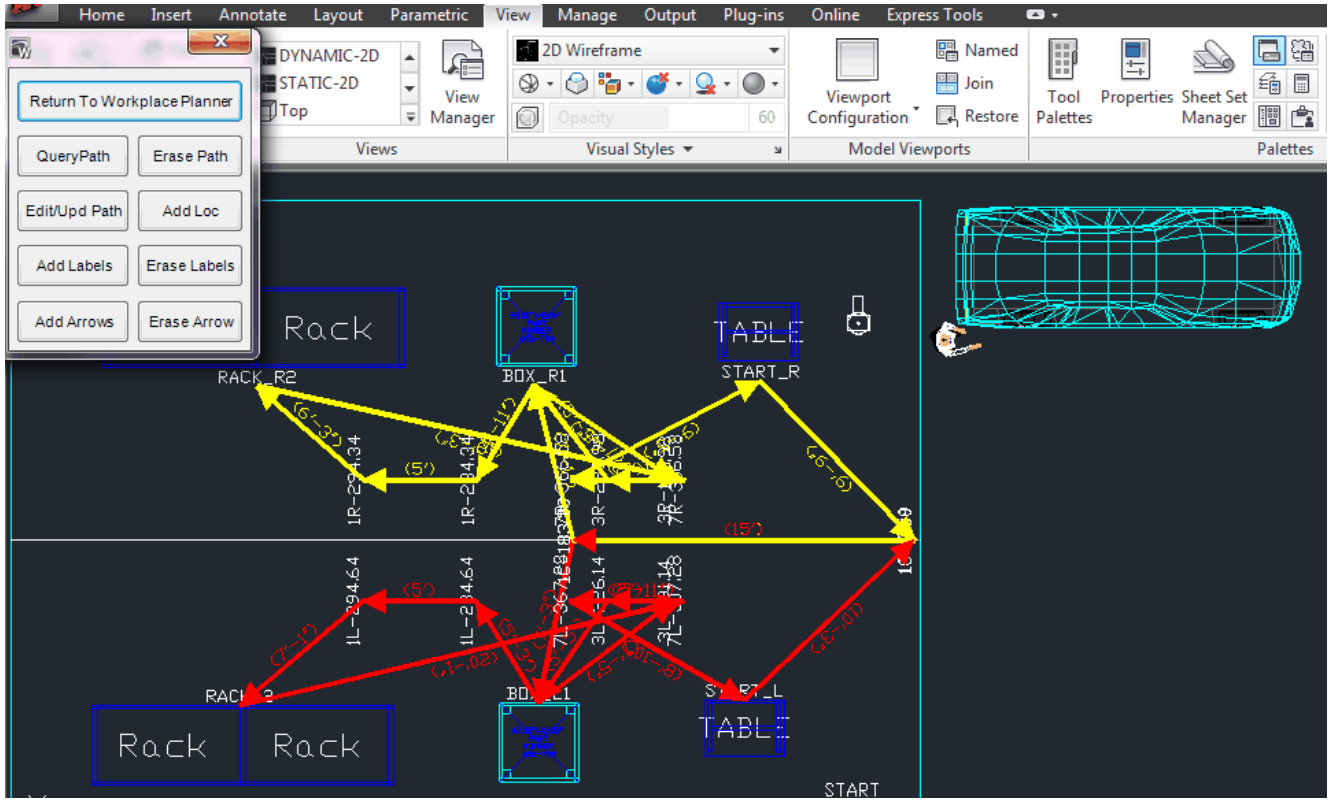
STEP 1: To get started, make sure all other drawings in AutoCAD are closed. If you have already been working in Workplace Planner, click the New (Clear) button in the ***Routings*** tab. Then ***Open*** the file WALKPATH-FCAD.DWG, just as you did in the first Tutorial.

<u>If you are already in AutoCAD</u> you need not leave and reload AutoCAD, however, you will need to go to the ***Routings*** tab and select the ***Goto AutoCAD*** button as shown below.

STEP 2: You should now be in the AutoCAD screen and will be looking at the 2D or 3D static workplace layout. To view the moving part (dynamic) workplace layout select the view icon, or type in the ***VIEW*** command just as you did in Step 15 of the first tutorial, and double-click on the **DYNAMIC-2D** option and select ***OK***.



Dynamic-2D View

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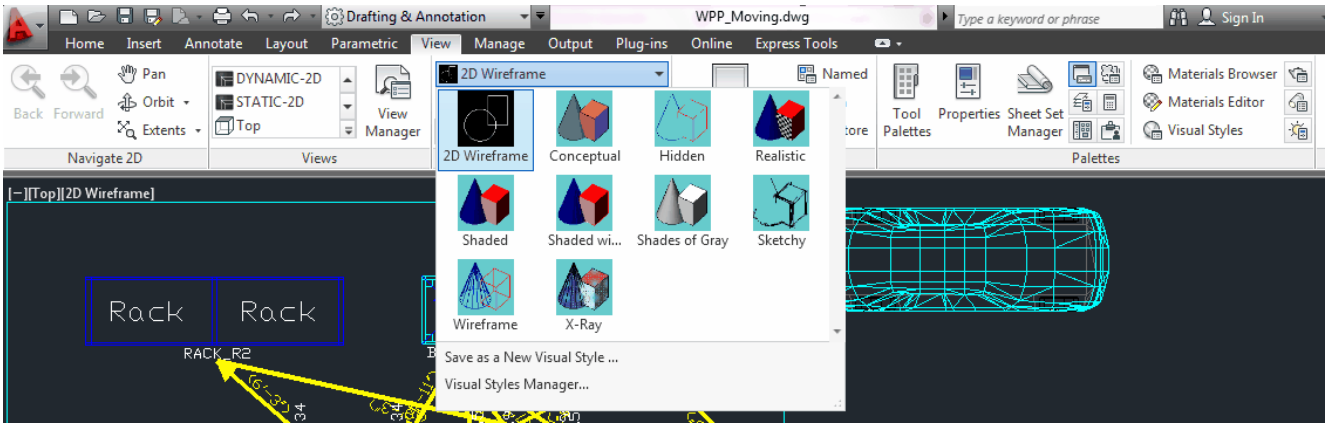
If your layout drawing looks like the top view of a 3D drawing (solid filled boxes) instead of wire-frame outlines, as shown above, then you need to select the 2-D wire-frame view of the layout. To do this select the 2D Wireframe icon located in the top right corner of the AutoCAD window as shown below (If you could not find the 2D Wireframe icon, please right click at the blank space on the toolbar, choose from the popup menu "ACAD => Shade" or "ACAD=>View Style" depending on your AutoCAD version).



2D Wireframe

STEP 3: Once your view is correct, you will want to go into the WPP application. Depending upon how you are starting this tutorial do the following

- **New into AutoCAD:** Perform steps 2, 3 and 4 in the first Tutorial.
- **From *Goto AutoCAD* in WPP:** Select the ***Return to Walkplace Planner*** button from the WPP modeless window located in the top left corner of the screen.

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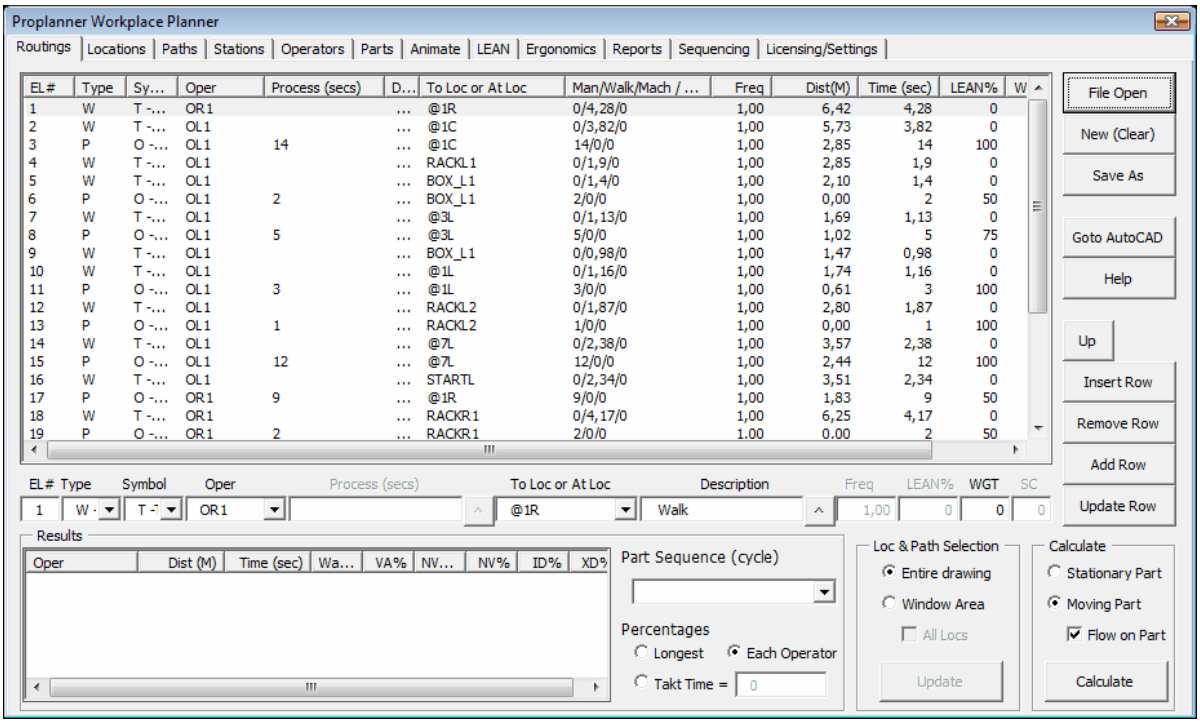
STEP 4: Now in the ***Routings*** tab select the ***File Open*** button at the top right and load the **MOVING.CSV** file. Your screen should look like that shown below when you are done.



File Open - Routing File

You will notice that in the lower right of the screen, that your Calculate option was changed from Stationary part to Moving Part because the application noticed the @ characters at the beginning of some of your From and To locations.

From a routing file perspective, the only difference between a stationary part and a moving part analysis is that in a moving part study you need to reference where you want to be on the part and let the WPP determine where the part is at the time that you wish to go to (or from) it.

In order to specify where you wish to be on the part, you use a simple coding system that is prefixed with an @ character to specify that the location is a relative one (just like in AutoCAD). The second character is a number representative of a fraction of the total distance back from the front of the part followed by an **L** or an **R** (uppercase as are all location names).

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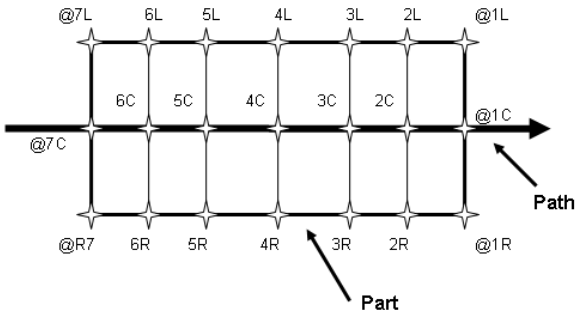
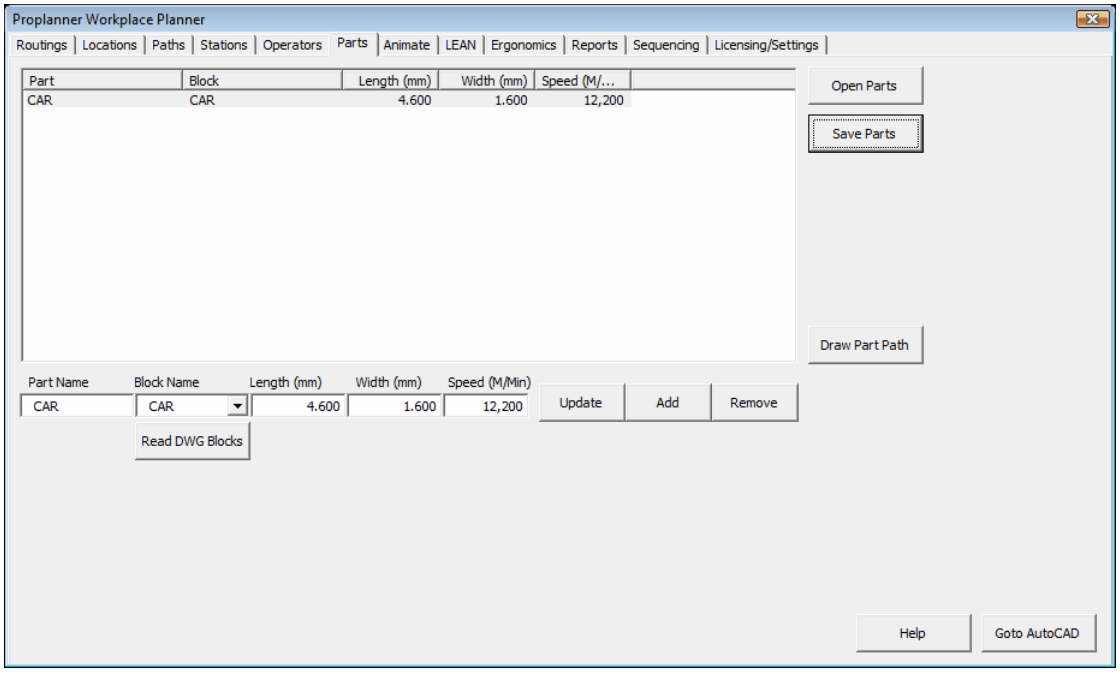


Location Grid

The method to specify a location on a Moving part: A number from 1 to N (where n is from 1 to 25) that specifies how many zones are longitudinally spaced along the part followed by the letter L for Left, R for Right, or C for Center. A number 7 is the default amount of longitudinal divisions. The first and last zones are directly at the front and the back of the part respectively.

- @2L (specifies a location on the left side at the width and 2/7 back)
- @1R (specifies a location on the right side at the front)
- @3C (specifies a location at the center and 3/7 back)

The actual distances of the width and length offsets are determined by the part size, which is specified in the ***Parts*** tab in the WPP as shown below.



Parts Tab - Actual Distances Of Offsets

STEP 5: Now that the routing file is loaded, you should ensure that your part dimensions and part path speeds are correct. The ***Parts*** tab shown above is also where the parts are assigned blocks to be animated with.

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For the Foot-Inch example, a part speed of 12,2 meters/minute and a part length and width of 4,6 meters and 1,6 meters has been used.

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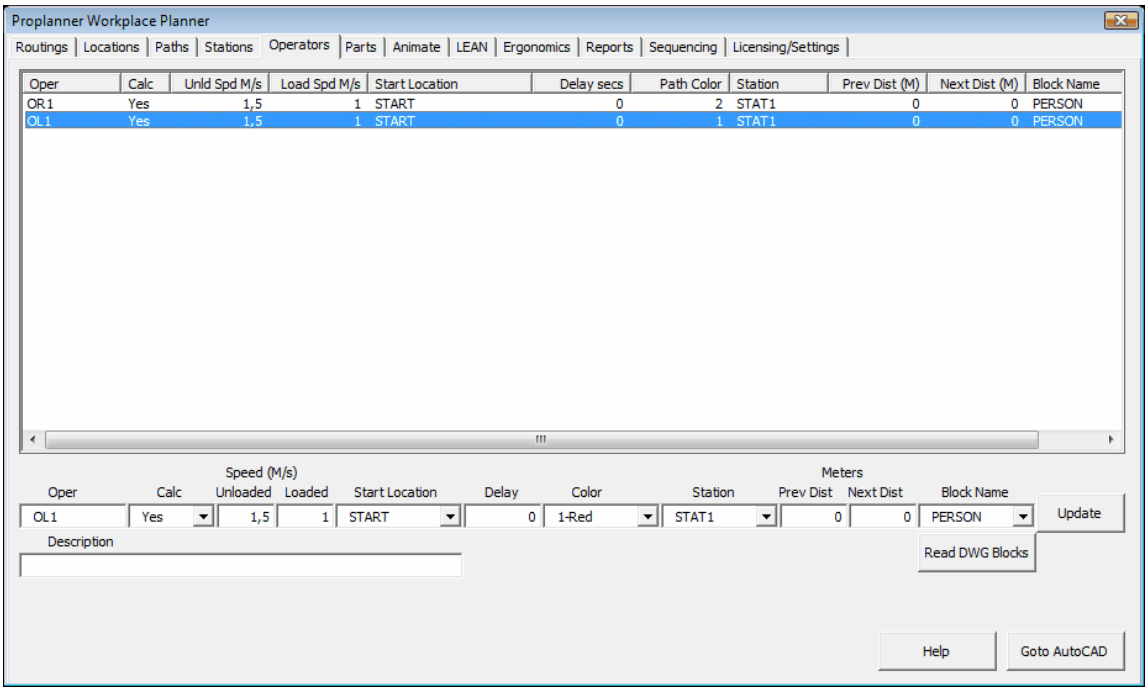
You may also wish to select the Operators tab to verify that the default operator speed is what you want. The WPP sets Operator walking speeds to 1,5 meters per second. Another option on this tab is to set a max distance that the operator can travel into a previous station to reach the part. If the part size is too big, the operator may still go further than the limit so part length should be taken into consideration when setting this number or the length of the part path.



Operators Tab

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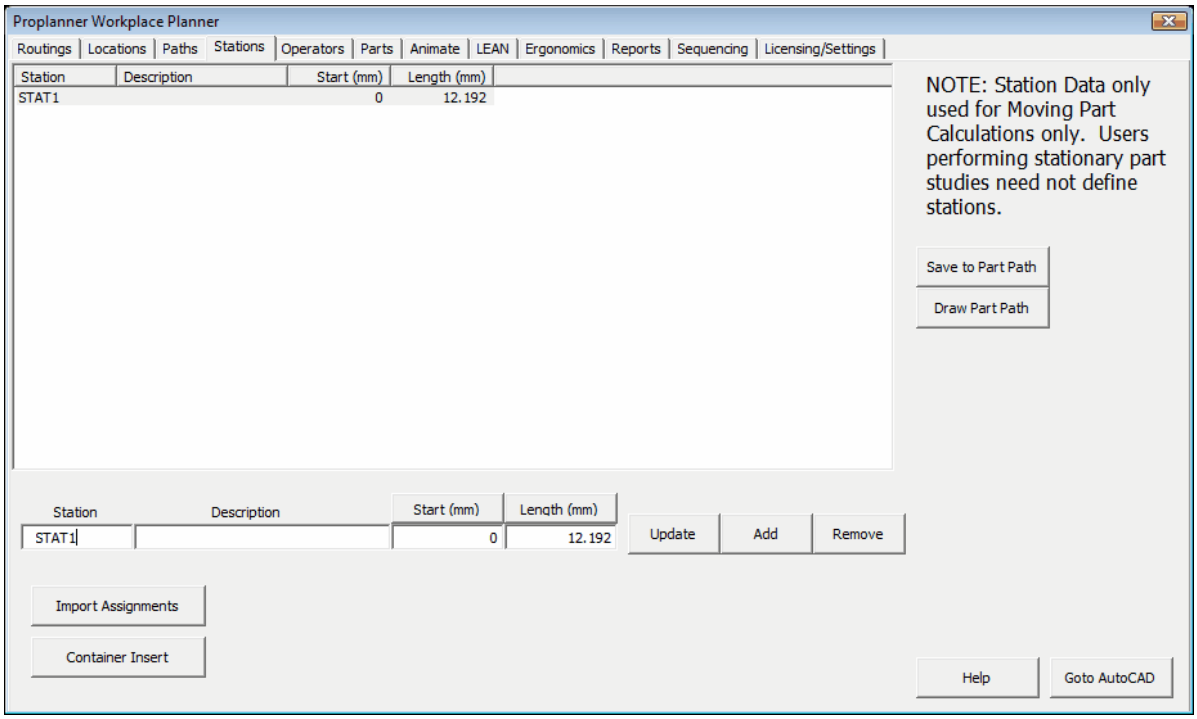
STEP 6: The Calculation is nearly ready to be ran. The only step left is to define the station dimensions on the ***Stations*** tab shown below. Name the station, select what distance on the part path the station begins, and how long the station is. Hit the add button to add the station and now you're ready to do a Calculate. In this example, the correct station information has already been input.



Station Tab - Dimensions

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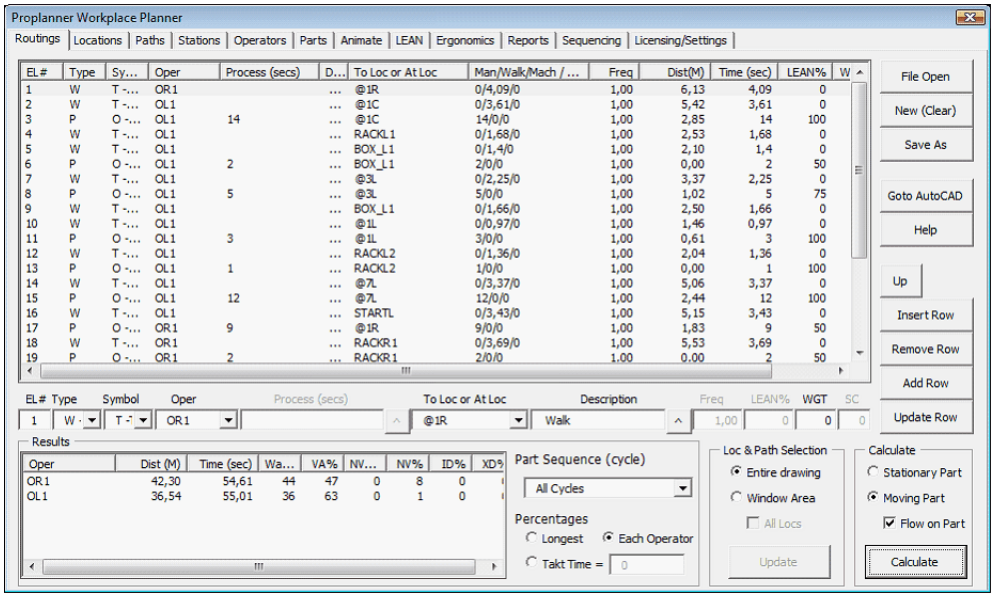
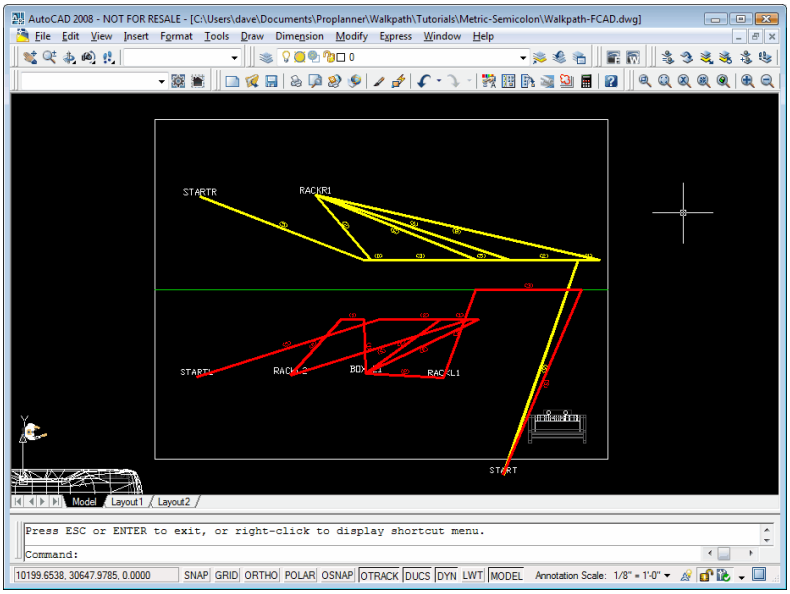
Now you can return to the ***Routings*** tab and simply select the ***Calculate*** button at the lower right of the window. You will see the results shown in the Results Window (lower left of window) and Drawing - see examples below (actual results will vary slightly from these examples due to changes in the individual sample files).



Calculate



Drawing

You will notice that in this example, you have two different operators and their flow paths are shown in different colors.

To generate this diagram, the WPP computed the speed of the vehicle, and the speed of the operator walking. The WPP then took into account the process times at the vehicle and at the

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containers and racks along the line. The WPP then computed all of the line part/operator intersection locations, created labels for these locations along the part path (white text perpendicular to part path), and generated the flow lines accordingly with path labels and flow arrows.

STEP 7: Once you have completed the analysis you can select the ***Parts*** tab to make sure that the part block is set to CAR, ***Operator*** tab to make sure the operator is set to PERSON, and then proceed to the ***Animate*** tab to perform the following step.

STEP 8: Now on the ***Animate*** tab select the ***Animate*** button in the bottom right of the screen and watch the operators at work. You will notice that when the operators are working on the car, they travel at the speed of the car, but when the walk around the workplace, they travel at their walking speeds (which are faster – and must be – than that of the car). For optimal animation, you will want to set your animation move increment to 0,1 seconds.

Step 9: Finally, (and once the animation is complete, but before selecting the Return to WalkPath button) you will need to select the view icon or type in the ***VIEW*** command to see the animation in 3D **[if using FCAD DWG]**. Now double-click on the **DYNAMIC-3D** option and select **OK**.

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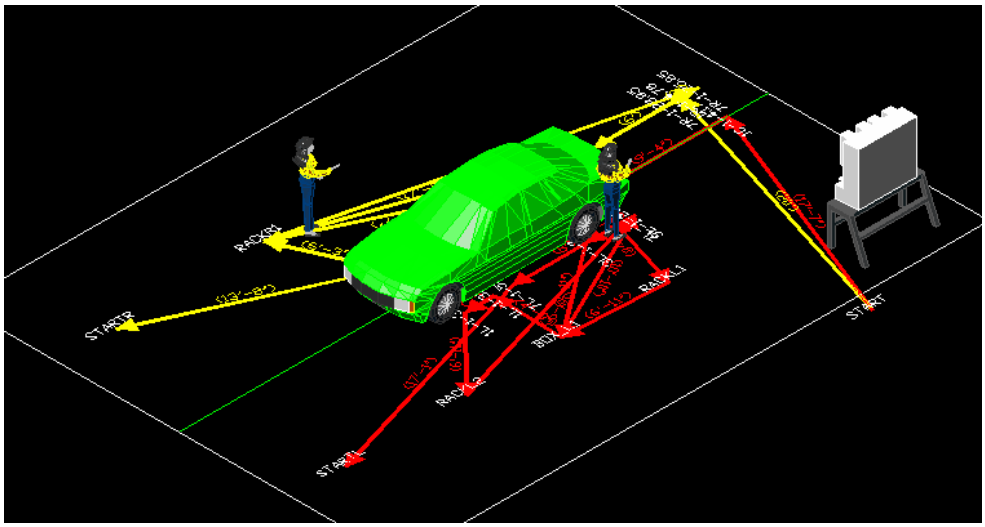
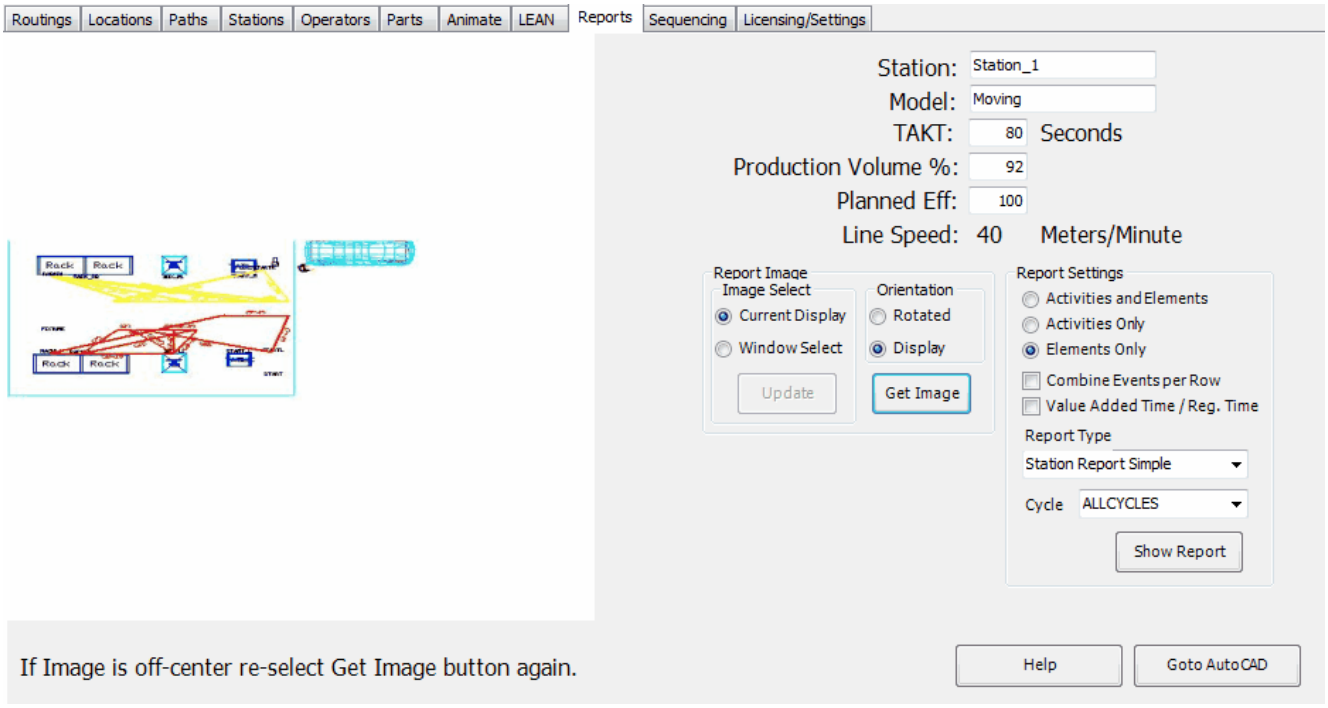
STEP 10: Now select the ***ReRun Animation*** button and watch the show! Remember that selecting the ***Alt*** key and reselecting it will start and stop the animation.



ReRun Animation View

STEP 11: After all the calculations have been completed, you can go to the reports window.



Reports Window

The workstation report includes an image of your workstation, along with workstation header information that you can enter in the top right of the screen. Similarly the Man/Machine report displays the breakdown of both manual and machine related labor times. These reports can be set to output Activities and their Elements or either option separately.

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Select the **Get Image** button to get the current view of your workplace. You may need to select the Goto AutoCAD button in order to adjust your display such that the workstation view looks correct. You can also get image from a window. For best results getting image by a selected window hit “Get Image” twice.

Once your view is acceptable; select the Station Report button to generate your report. This report can also be made to show VA/NVA percentages by checking the checkbox. Once the report is generated, simply select the File Save option in the browser window to save your report.

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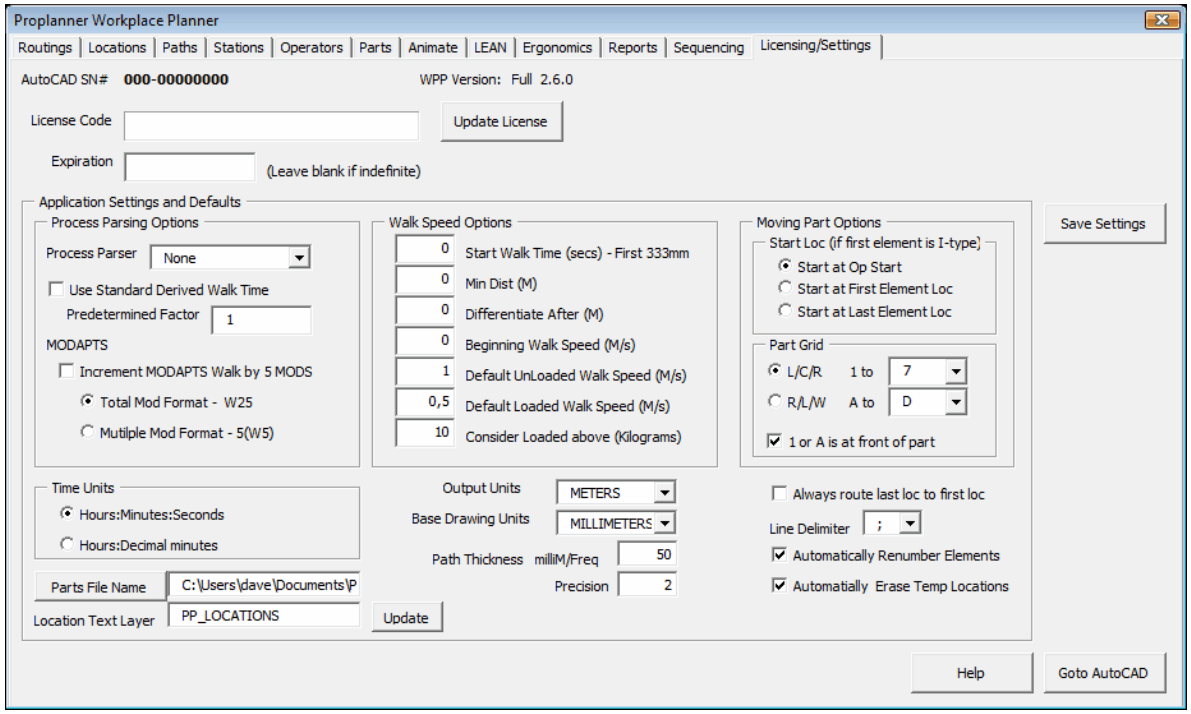
6.5 Sequencing from Line Balance data Metric

This tutorial was developed with the drawing units set to millimeters and the reporting units set to meters. In addition, the files have been saved in a semi-colon (;) delimited format with numbers specified in the format (1.200,15) which is common in France, Germany, Italy, Sweden and other countries. Before starting the tutorial, it is advised that you go to the "Licensing Settings" tab and ensure that your settings are set as shown below.



Licensing Settings

STEP 1: Now that you have learned how to run a part study from a pre-constructed routing file it is time to create one from data that has been output from Proplanner Line Balance. The first step is to open the drawing file “Multi-Station Moving.dwg”. You will notice that this example has multiple stations and parts.

STEP 2: Start the Workplace Planner by clicking on the “W” in the menu bar and clicking anywhere on the splash screen that pops up. This will take you to the routings tab, the main interface of the WPP.

STEP 3: Click on the “Sequencing” tab to start importing the Line Balance data and select “Open Scenario”.

STEP 4: Open the pre-made Line Balance scenario file “LBData.xml”. This can be found in the same directory as the other example files, usually in “c:\Program Files\Proplanner\AutoCAD Programs”. For more information on making the Line Balance input file with Proplanner Line

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Balance, sold separately, consult the Line Balance user manual.

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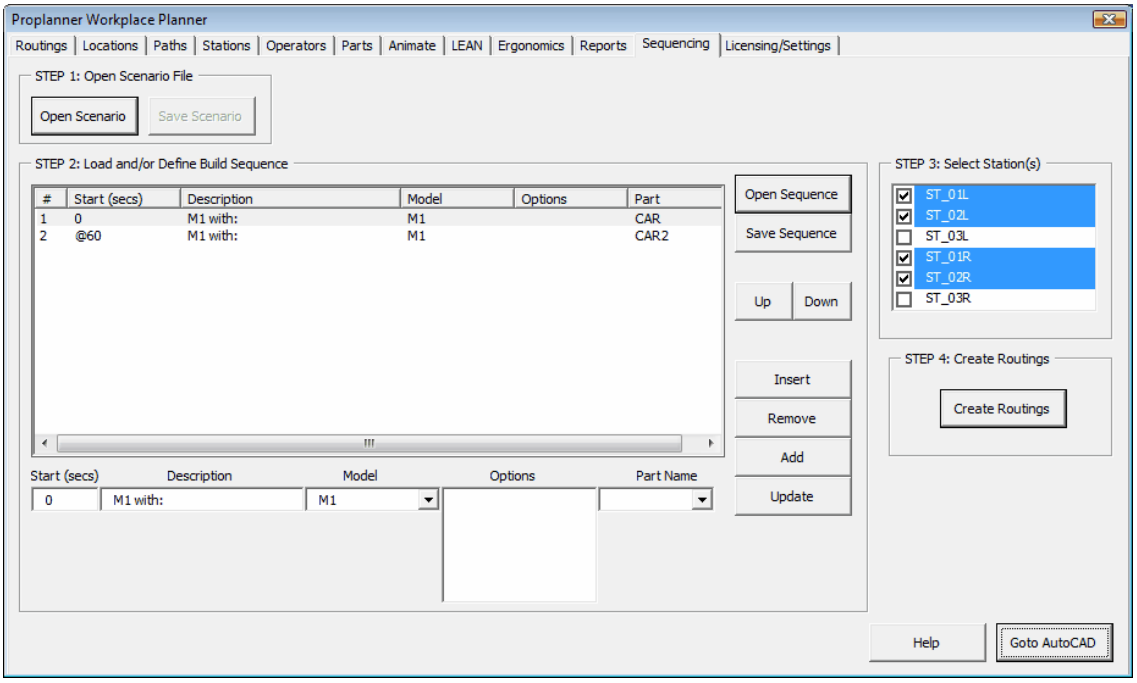
STEP 5: To begin with we will start by manually creating a build sequence. The first step of this is setting up the build information. The first build's information should be a start time of 0, model should be set to M1, and the part name CAR. Click the "Add" button. This step is where options would be selected as well; however this line balance data does not contain option information.

STEP 6: To create a second build, set the start time to a relative time sixty seconds after the first build's start with "@60". Again use model M1 and to use a different part select "CAR2". Click "Add" again.

STEP 7: Next select the stations for which you wish to simulate. For this example select station ST_01L, ST_01R, ST_02L, and ST_02R. Your screen should look similar to below.



Simulating Stations

STEP 8: Click "Create Routings" and Yes when it asks you if you're sure. You will then be taken to the Routings tab automatically where the routings will have been created for the two cycles using two different parts in four work locations.

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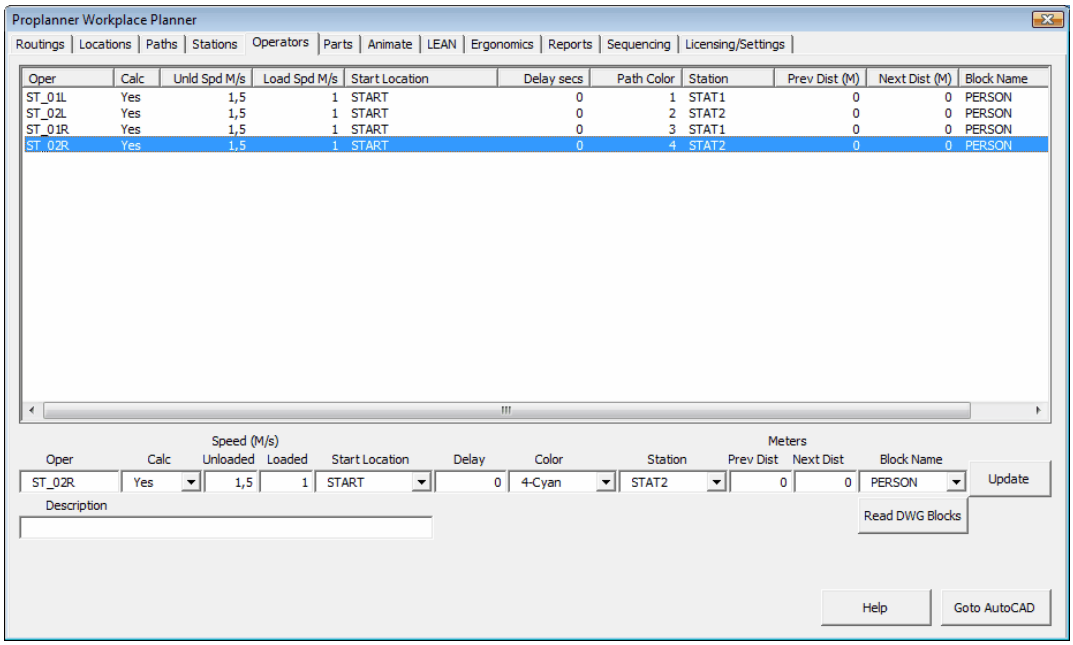
STEP 9: Chose the Operators tab to make sure that your four operators have been created. Assign each operator to the station with their same name. They will be assigned to station Stat1 and Stat2 at first. This is done by selecting the operator you wish to edit, selecting the station pull-down menu, selecting the appropriate station and then selecting the “Update” button. When completed it should look like the example below.



Operators Tab - Four Operators Assigned

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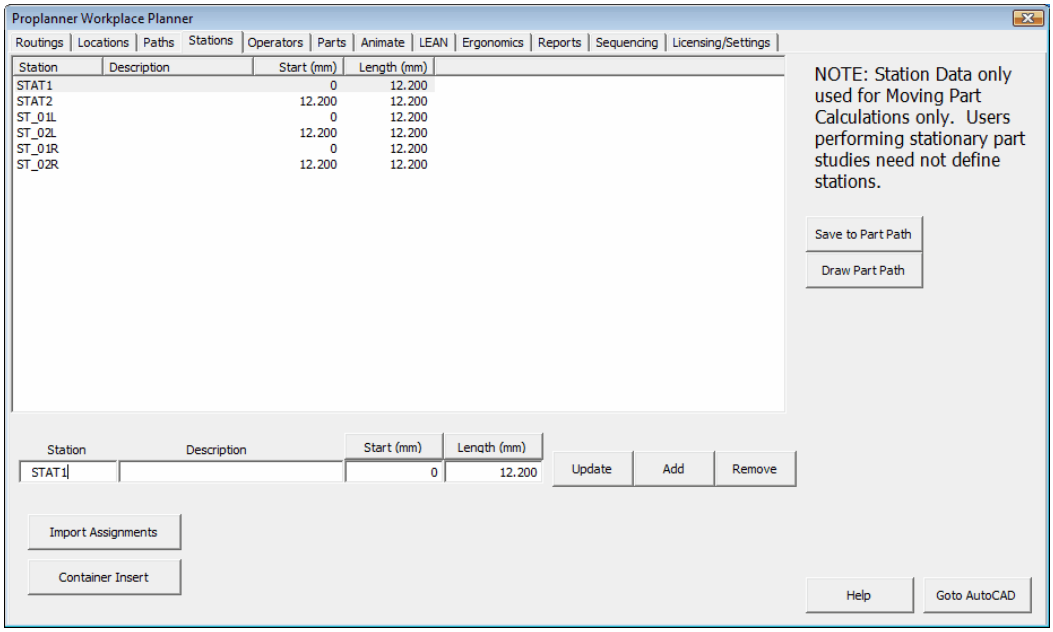
STEP 10: Go to the Stations tab and make sure that the stations used are defined correctly. The ST_01L and ST_01R stations should start at the 0 distance along the part path and have a distance of 12,2 meters. The ST_02L and ST_02R stations should have a start at the 12,2 meter and be an additional 12,2 meters long. Because the input is in millimeters, this will be in put as 12.200. Your Station information should look like that below.



Stations Defined Correctly

Because stat1 and stat2 were unassigned from the operators remove them at this point.

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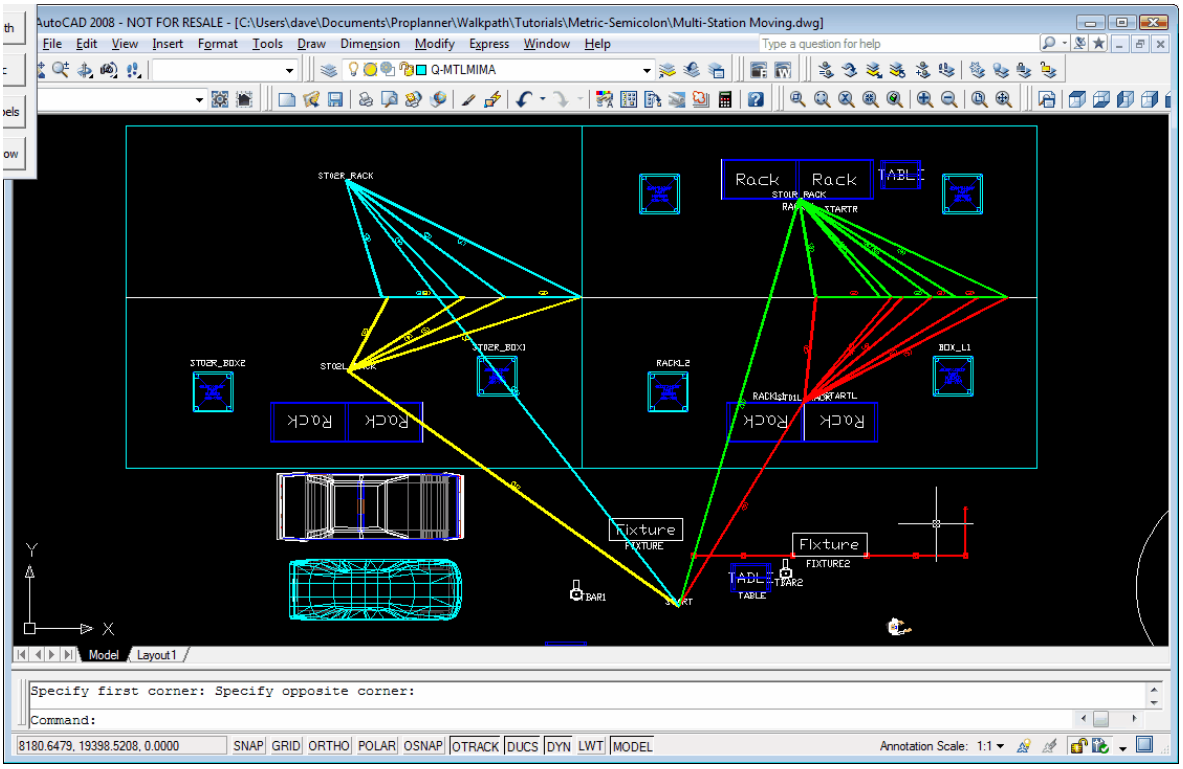
STEP 11: The only information left to be checked is on the Parts tab. Make sure that CAR and CAR2 are going at 12,2 M/min. You can also assign a different block to CAR2 at this point by selecting CAR2 and in the Block Name pull-down menu selecting “police” and hitting “Update”, a different vehicle will be animated to represent that part.

STEP 12: The final step is to go to the Routings tab, select “Moving Part” as calculation method, and hit Calculate for the routings that you have created. The output should look like this, and you will notice that when you animate, two different vehicles are animated representing the two cycles of work.



Output - Animation

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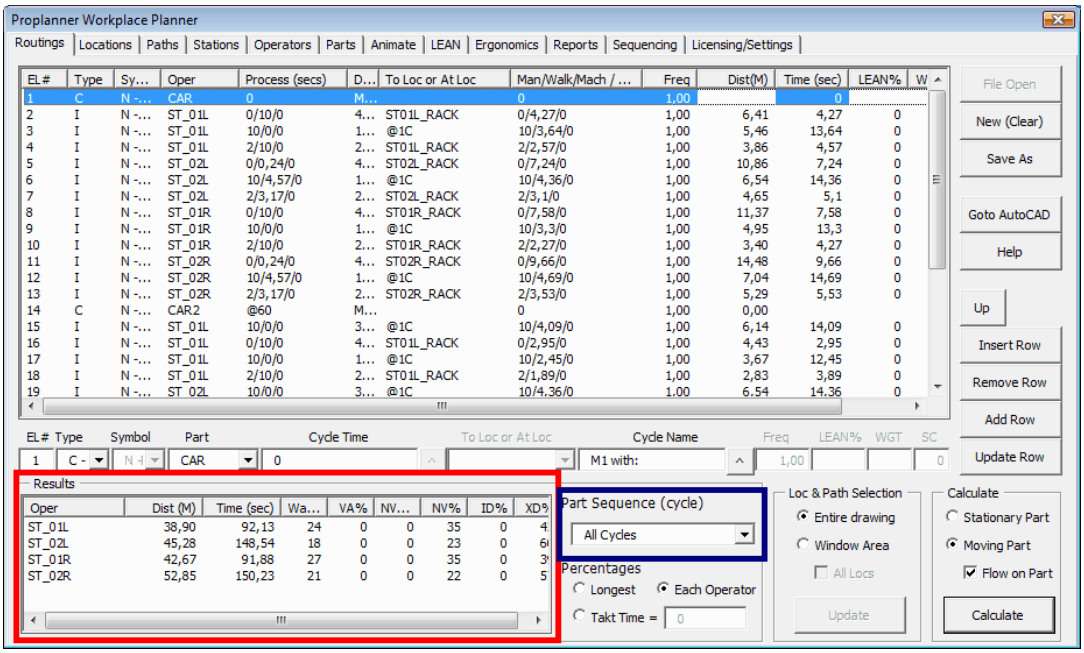
STEP 13: Returning to the Workplace Planner and selecting the Sequencing tab again will allow you to save the created build sequence or upload a pre-existing one. Selecting “Open Sequence” will allow you to open LBData_Seq.xml which is the same as the sequence you just simulated. If you create routings and Calculate, the results should be the same.

STEP 14: To see the results Calculated there are three main places for this. First of all the rough summary output can be seen in the bottom left side of the routings tab shown below. The results are boxed in red.



Rough Summary Output & Results

The blue box highlights the pull down window that selects which cycle to show results for, whether all or individual part cycles. Below that are radio buttons that select how the output percentages are Calculated. This can be set to be a percentage of the longest operator’s time, each individual operator’s time, or as a percentage of a set TAKT time.

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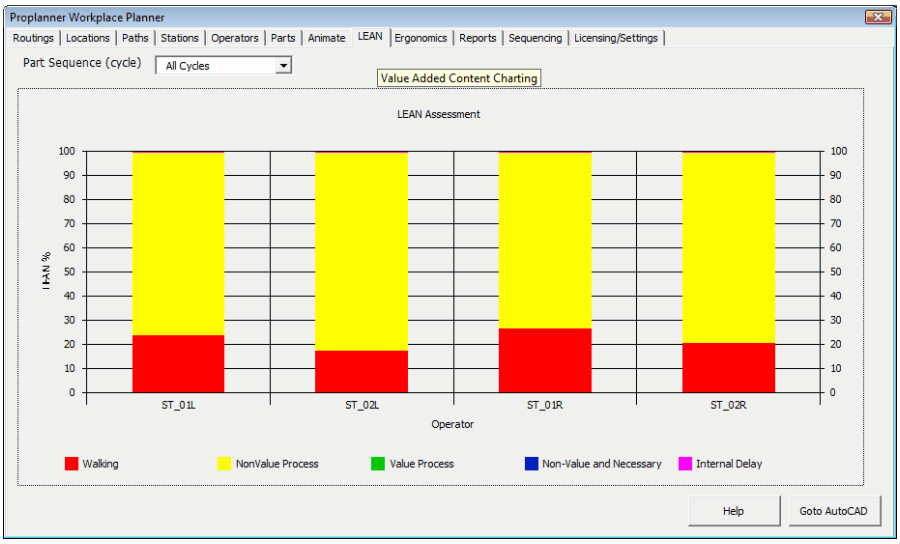
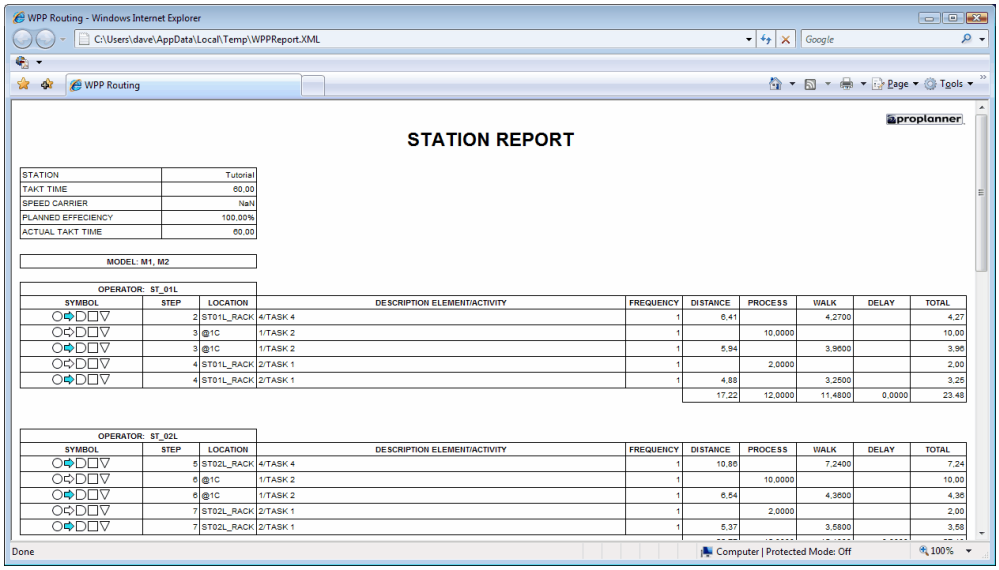
The second output tool of the WPP is the LEAN tab which automatically creates a bar chart depicting the percentages of time performing value added, non-value added, non-value added but necessary, and delay times. This can be representative of all the cycles or an individual cycle, selected in the pull down window and should look like that below for the sequencing tutorial.



LEAN Tab

The final and most comprehensive output is the report generated on the Reports tab. These are generated by selecting get image to take a picture of the current screen, setting a station takt time, selecting which cycle or all to show results for and pushing the Generate Report button. Selecting a sequence to report for is done in the pull down window. The report generated should look similar to the one below.



Reports Tab - Report Output

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7 Exercise

Plant wide material flow analysis

The objective of this exercise will be to use the techniques learned in the Tutorial, along with the aid of the How To Guide and **Sample WPP Input** (in Proplanner fold \Help Files \PPWPP_Exercise_Samples), to take a simple set of workplace and operator data and perform a complete Workplace Planner analysis.

Exercise One: Format a data set for importing to the Workplace Planner

Use this **Excel spreadsheet** (in Proplanner fold \Help Files\PPWPP_Exercise_Samples\WPP1.xls) of station and operator data along with the **Sample WPP Input** to create a CSV file to import into the WPP.

1. To do this extract the data and format it similar to the sample input.
2. Include only the necessary information outlined in the sample input file. It will need picked out of the original spreadsheet and re-organized.
3. Make sure there are no special characters in the CSV data by opening it in notepad. Also remove any superfluous commas at the end of the element lines. The Sample WPP Input has more details on this. Most common errors include spaces and quotation marks.
4. Once the data is set up correctly open the WPP within AutoCAD and try opening the CSV. If done correctly the files will open flawlessly.
5. If the files cause an error, consult your instructor or the Troubleshooting Guide.

Results – Workplace Planner will open the files with no errors.

Exercise Two: Prepare layout drawing

1. Open "in Proplanner fold \Help Files\PPWPP_Exercise_Samples\WPP_Stationary_1.dwg" in AutoCAD. You may note that there is a person block placed in the drawing. Leave this there for use when animating if you chose to do so at a later time.
2. Create layer PP_LOCATIONS by opening the WPP.
3. Insert the names of the locations using the Workplace Planner's Add Location command. The location names can be found in the CSV file.
4. Once this is done, open "in Proplanner fold \Help Files\PPWPP_Exercise_Samples\WPP2.csv" to run a stationary part calculation.

Results – Workplace Planner will not ask user to place locations when a calculation is run.

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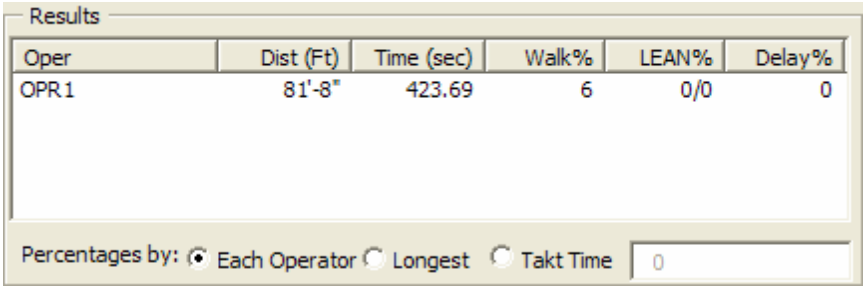
Exercise Three: Perform a Stationary Part study

Using "in Proplanner fold \Help Files\PPWPP_Exercise_Samples\WPP_Stationary_2.dwg" instead of the drawing file just created, along with "in Proplanner fold \Help Files\PPWPP_Exercise_Samples \WPP2.csv" will ensure that we get the same results when this exercise is complete.

1. Open the drawing and notice that all the locations have been placed as in exercise two. You may note that there is a person block placed in the drawing. Leave this there for use when animating if you chose to do so at a later time.
2. Start the Workplace Planner and open the CSV mentioned above. It should be identical, for the most part, to the CSV file created in the first exercise.
3. Check the Routings tab to make sure all the data has been imported into the correct fields.
4. Go to the Licensing/Settings tab to ensure that the units are in feet and inches and that the operator start location is set to Operator Start.
5. Return to the Routings tab and select the Stationary Part Calculation radio button. If this option is set to moving, the calculation will not complete because that method needs a path for the part to move on.
6. Run the calculation. A Stationary part study will now be drawn on the AutoCAD drawing.
7. Now that the calculation is complete, return to the Routings tab and look at the Results Window in the lower left side of the WPP window.

Results – The results window should equal those below if the calculation has been run correctly.



Stationary Part Study Results

Exercise Four: Perform a Moving Part study

1. Open the drawing "in Proplanner fold \Help Files\PPWPP_Exercise_Samples\WPP_Moving.dwg". You may note that there is a person and car block placed in the drawing. Leave this there for use when animating if you chose to do so at a later time.
2. Start the Workplace Planner and open the CSV "in Proplanner fold \Help Files

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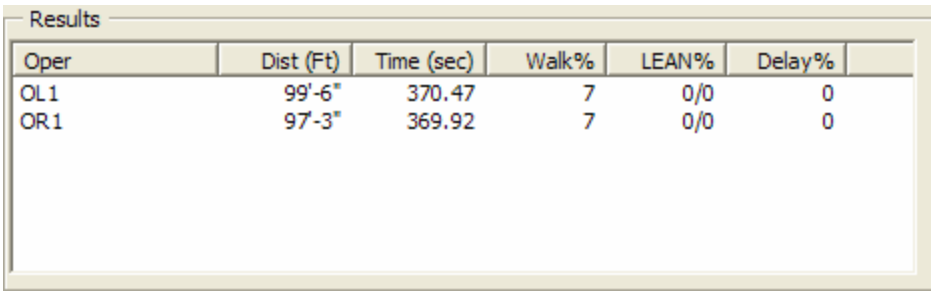
\PPWPP_Exercise_Samples\WPP3.csv".

3. Check the Routings tab to make sure all the data has been imported into the correct fields.
4. Go to the Options tab to ensure that the units are in feet and inches and that the operator start location is set to Operator Start instead of first or last activity location.
5. On the Licensing/Settings tab set the part speed to 5 feet per minute.
6. Use the Draw Part Path button to go to AutoCAD and draw a horizontal line connecting the middle of both vertical cell boundary lines, similar to the moving example in the Tutorial.
7. On the Operators tab assign the two operators their respective start locations of START_L and START_R.
8. Make sure they are assigned to station "stat1" on the operators tab and that the station "stat1" is defined with the start of 0 and length of 480" or 40'.
9. Return to the Routings tab and select the Moving Part Calculation radio button. If this option is set to stationary, the calculation will ask for all the on part or moving locations as static locations.
10. Run the calculation. A Moving part study will now be drawn on the AutoCAD drawing.
11. Now that the calculation is complete, return to the Routings tab and look at the Results Window in the lower left side of the WPP window.

Results – The results window should equal those below if the calculation has been run correctly.


Results

Oper	Dist (Ft)	Time (sec)	Walk%	LEAN%	Delay%
OL1	99'-6"	370.47	7	0/0	0
OR1	97'-3"	369.92	7	0/0	0

Moving Part Study Results

Exercise Five: Improving layout to reduce labor times

There are many different ways to improve our layouts. For now we will use the drawing, "in Proplanner fold \Help Files\PPWPP_Exercise_Samples\WPP_Stationary_3.dwg" and "in Proplanner fold \Help Files\PPWPP_Exercise_Samples\ WPP2.csv" so that we have a common set of output.

The most obvious ways of improving a layout may be to push locations closer together. Because in many cases there are locations which cannot be moved, we assumed the racks and tables to be the only mobile locations. To move the locations simply grab the text for the location and drag it to the new desired locations.

1. Open the drawing in AutoCAD and CSV within the WPP.

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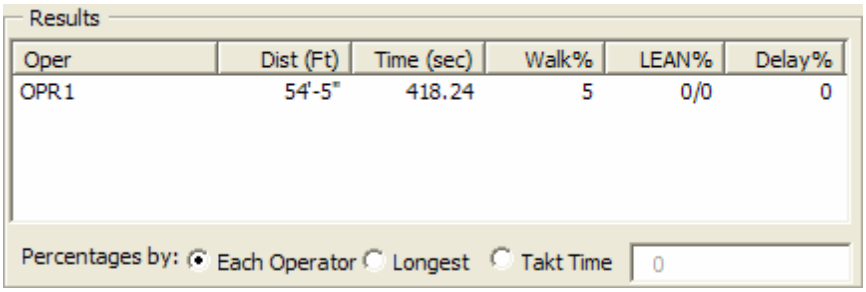
2. Notice that the racks have been moved to reduce walk time and increase free space.
3. Run a Stationary calculation to see the results.

Results – You should see results similar to below. Notice the drop in time and walk percentage.



Stationary Calculation Results

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8 Troubleshoot

Symptom	Possible Causes	Solution
1. WPP will not start up.	Proplanner Ribbon did not load properly.	Try entering 'ppfp' in the command line to open the program.
	Previous version was not uninstalled before this installation.	Uninstall by going to Add/ Remove Programs in the control panel, selecting Proplanner AutoCAD Programs and selecting remove. When done, install from the disk.
2. .csv file does not open.	Excel by default saved the file as a tab-delimited .csv or an .xls instead of a comma-delimited .csv.	In Excel, select "Save As" and choose .csv (comma-delimited) from the "Save As Type" pull down menu. Note that there is also an option to save as .csv(tab-delimited). This is sometimes the default .csv setting within Excel and is what causes this problem most ofen.
	An extra comma has been placed in the document, making the program think there is an extra column of information.	Open the file in Excel and do a "Find and Replace" or "ctrl + h". Replace the comma symbol with nothing.
5. Distances and times are drastically incorrect.	Proplanner units differ from drawing units.	Go to the "Options/Help" tab and select the appropriate units, "feet, inches, meters, and millimeters". If you do not know the drawing units, go to AutoCAD and type "UNITS" into the command line. This will bring up a window where you can get or enter the desired units.
6. No paths, reports, or output information is shown.	Calculation has not been performed since new information has been added. All this information is stored on the drawing or in the input files once the calculation is run, but this is not automatically created until the first calculation is run or any time there is a change in information.	Hit "Calculate" on the routings tab before generating the reports or checking the Paths tab.
7. Reports are showing no information or format is being distorted when opened.	Operator is using old version of Internet Explorer with which some of the reporting	Go to Windows Update, for which a link is usually located in the Control Panel under

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	functions are not compatible.	Settings and update to the latest version.
8. When moving part calculation is run it asks for the "on part" locations as fixed locations.	Analysis type is set to Stationary Part.	Change the radio button on the Routings tab to Moving Part.
9. Part locations do not work correctly.	There are now two syntaxes for entering the part location. The wrong one being selected will cause an error.	On the Options/Help tab make sure that the part grid format is set to the r/l/w or l/c/r, whichever is the format the routings follow. Also the number of spots on the part is now default of 7 and set to letters up to D. This can be changed to the desired amount of divisions in the pull down window to the right of the Part Grid box.
10. Path lines are either too small or too large.	These do not automatically scale so must be set manually.	These can be set manually on the Routings tab under Path Thickness/Frequency. This thickness is scaled in the drawing units.
11. Despite the operator being limited to a set distance it can go into the previous station, it still walks further than that to reach the back of the moving part.	This is due to the length of the part/path.	This can be overcome by adding a delay to the process to let the part enter the work zone or shortening the part path so that the worker does not start working on it until the entire part has moved within the work zone.
12. Simulation sends worker to other stations or to the origin when doing a moving part study.	There are duplicate part paths or locations in the drawing often caused by drawings with multiple stations.	Select by Window Area on the Routings tab and put a box around the workstation the study is focusing on.
13. Frequency, line, and arrow thickness are increasing every time a calculation is performed.	Operator name contains an improper character.	Operator names are only allowed to have letters, numbers, dashes, and underscores. Remove any other characters from the operator name and hit update, on the operators tab.

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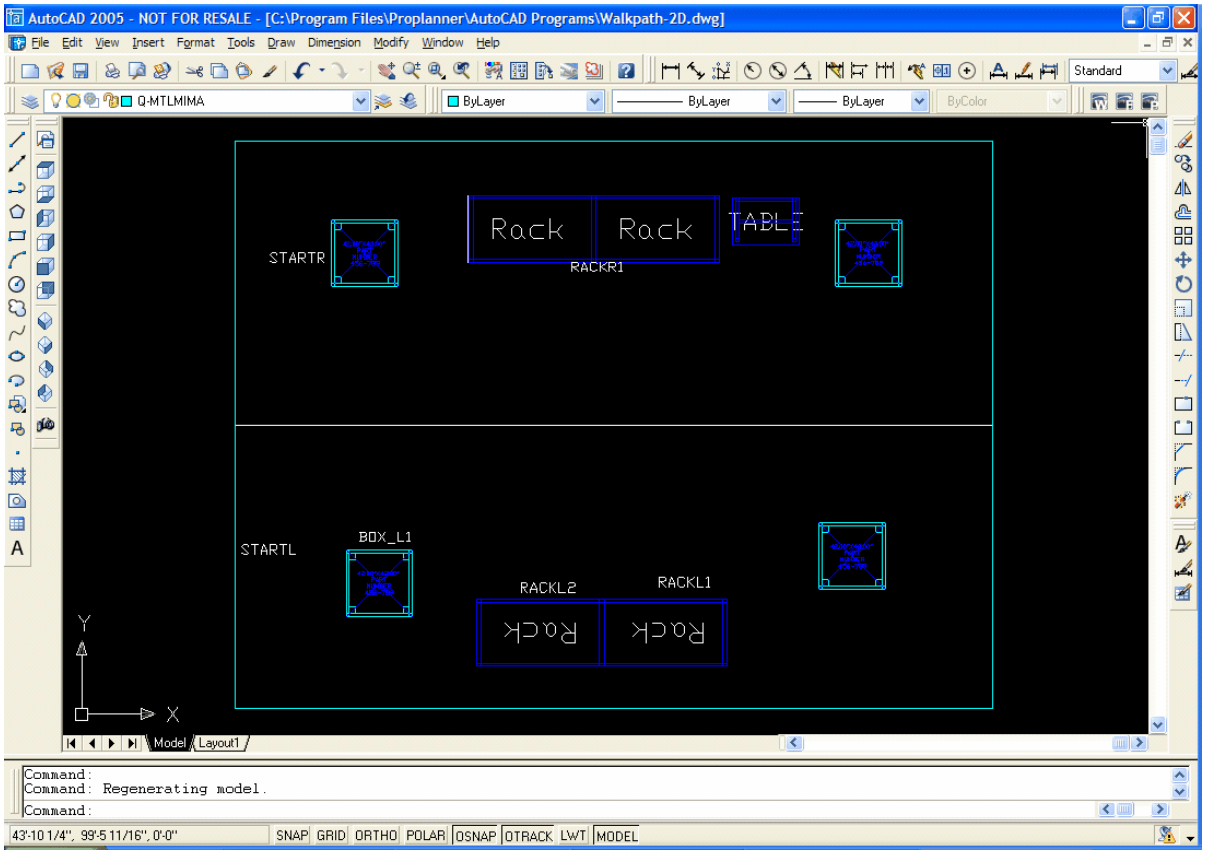
8.1 How To Guide

Workstation Labor Analysis

Base Steps:

1. Import plant drawing to AutoCAD.



Plant Drawing

2. Input routing information by using our route building system or using Excel to copy and paste the larger quantities of information into the proper columns to be imported directly to WPP.

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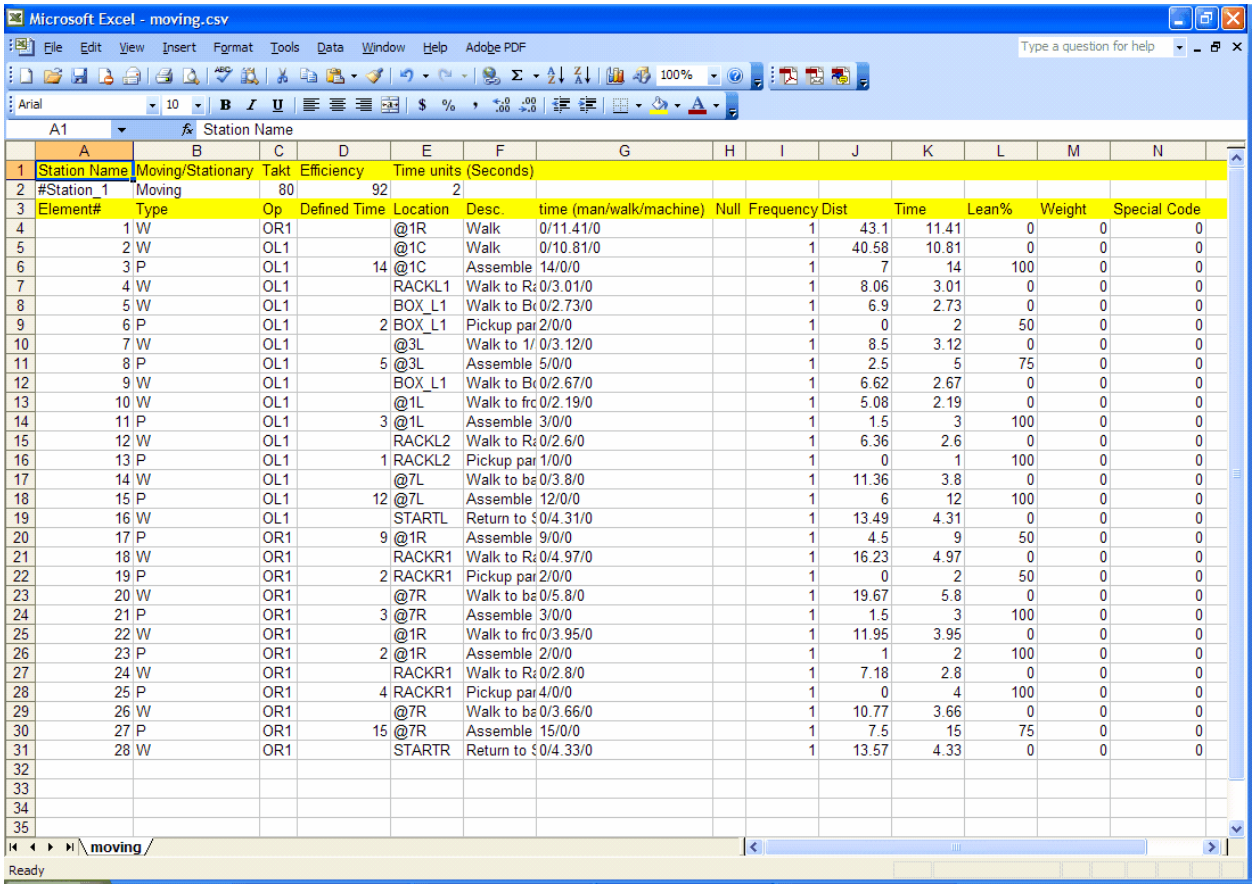

Microsoft Excel - moving.csv

File Edit View Insert Format Tools Data Window Help Adobe PDF

Type a question for help

100%

Arial 10

A1 Station Name

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Station Name	Moving/Stationary	Takt	Efficiency	Time units (Seconds)									
2	#Station_1	Moving	80	92	2									
3	Element#	Type	Op	Defined Time	Location	Desc.	time (man/walk/machine)	Null	Frequency	Dist	Time	Lean%	Weight	Special Code
4	1	W	OR1		@1R	Walk	0/11.41/0		1	43.1	11.41	0	0	0
5	2	W	OL1		@1C	Walk	0/10.81/0		1	40.58	10.81	0	0	0
6	3	P	OL1	14	@1C	Assemble	14/0/0		1	7	14	100	0	0
7	4	W	OL1		RACKL1	Walk to R	0/3.01/0		1	8.06	3.01	0	0	0
8	5	W	OL1		BOX_L1	Walk to B	0/2.73/0		1	6.9	2.73	0	0	0
9	6	P	OL1	2	BOX_L1	Pickup par	2/0/0		1	0	2	50	0	0
10	7	W	OL1		@3L	Walk to 1/	0/3.12/0		1	8.5	3.12	0	0	0
11	8	P	OL1	5	@3L	Assemble	5/0/0		1	2.5	5	75	0	0
12	9	W	OL1		BOX_L1	Walk to B	0/2.67/0		1	6.62	2.67	0	0	0
13	10	W	OL1		@1L	Walk to fr	0/2.19/0		1	5.08	2.19	0	0	0
14	11	P	OL1	3	@1L	Assemble	3/0/0		1	1.5	3	100	0	0
15	12	W	OL1		RACKL2	Walk to R	0/2.6/0		1	6.36	2.6	0	0	0
16	13	P	OL1	1	RACKL2	Pickup par	1/0/0		1	0	1	100	0	0
17	14	W	OL1		@7L	Walk to ba	0/3.8/0		1	11.36	3.8	0	0	0
18	15	P	OL1	12	@7L	Assemble	12/0/0		1	6	12	100	0	0
19	16	W	OL1		STARTL	Return to S	0/4.31/0		1	13.49	4.31	0	0	0
20	17	P	OR1	9	@1R	Assemble	9/0/0		1	4.5	9	50	0	0
21	18	W	OR1		RACKR1	Walk to R	0/4.97/0		1	16.23	4.97	0	0	0
22	19	P	OR1	2	RACKR1	Pickup par	2/0/0		1	0	2	50	0	0
23	20	W	OR1		@7R	Walk to ba	0/5.8/0		1	19.67	5.8	0	0	0
24	21	P	OR1	3	@7R	Assemble	3/0/0		1	1.5	3	100	0	0
25	22	W	OR1		@1R	Walk to fr	0/3.95/0		1	11.95	3.95	0	0	0
26	23	P	OR1	2	@1R	Assemble	2/0/0		1	1	2	100	0	0
27	24	W	OR1		RACKR1	Walk to R	0/2.8/0		1	7.18	2.8	0	0	0
28	25	P	OR1	4	RACKR1	Pickup par	4/0/0		1	0	4	100	0	0
29	26	W	OR1		@7R	Walk to ba	0/3.66/0		1	10.77	3.66	0	0	0
30	27	P	OR1	15	@7R	Assemble	15/0/0		1	7.5	15	75	0	0
31	28	W	OR1		STARTR	Return to S	0/4.33/0		1	13.57	4.33	0	0	0
32														
33														
34														
35														

moving

Ready

Excel File

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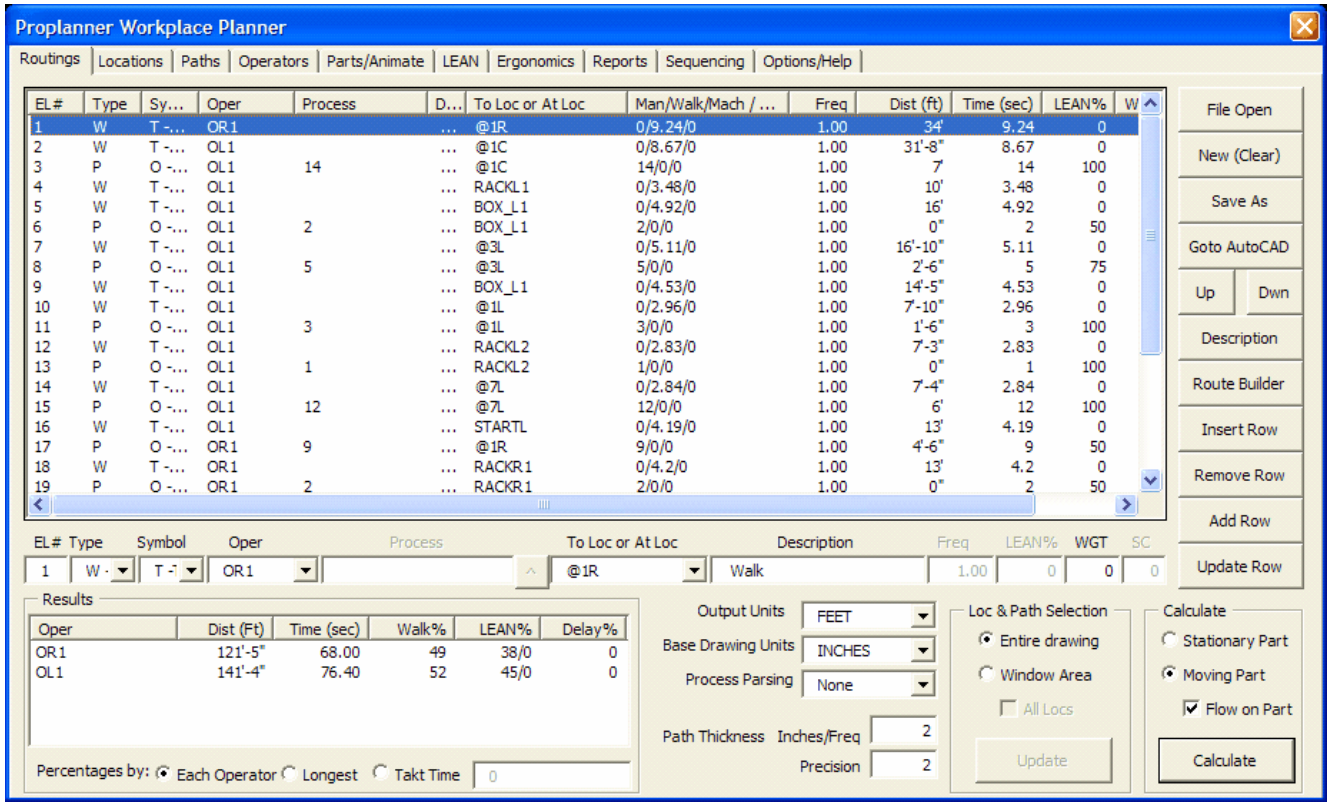

Routings Editor

3. Make sure that either Moving or Stationary is selected on the routings tab, dependant on if you want to have workers moving with a moving part or if they work on it in stationary positions. More specific details on the two types can be found below.

4. Once calculate is selected on the routings tab, WPP will take the locations and route the operator between them and calculate the times based upon the task times entered plus the walk times.

5. This walking diagram will be created directly on the drawing file.

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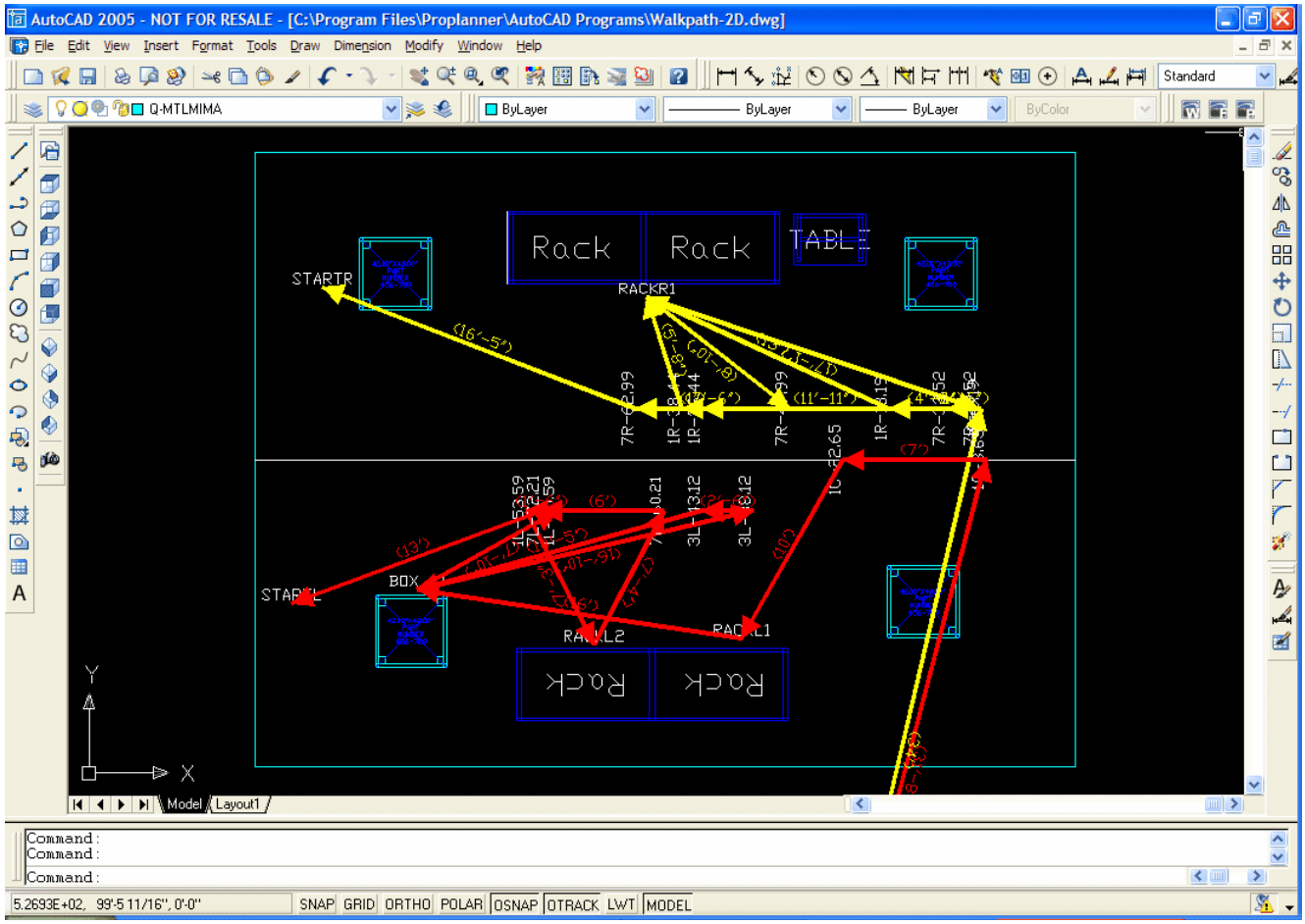

Walking Diagram

6. Observe summary results on the routings tab, path information, Lean information, or reported information.

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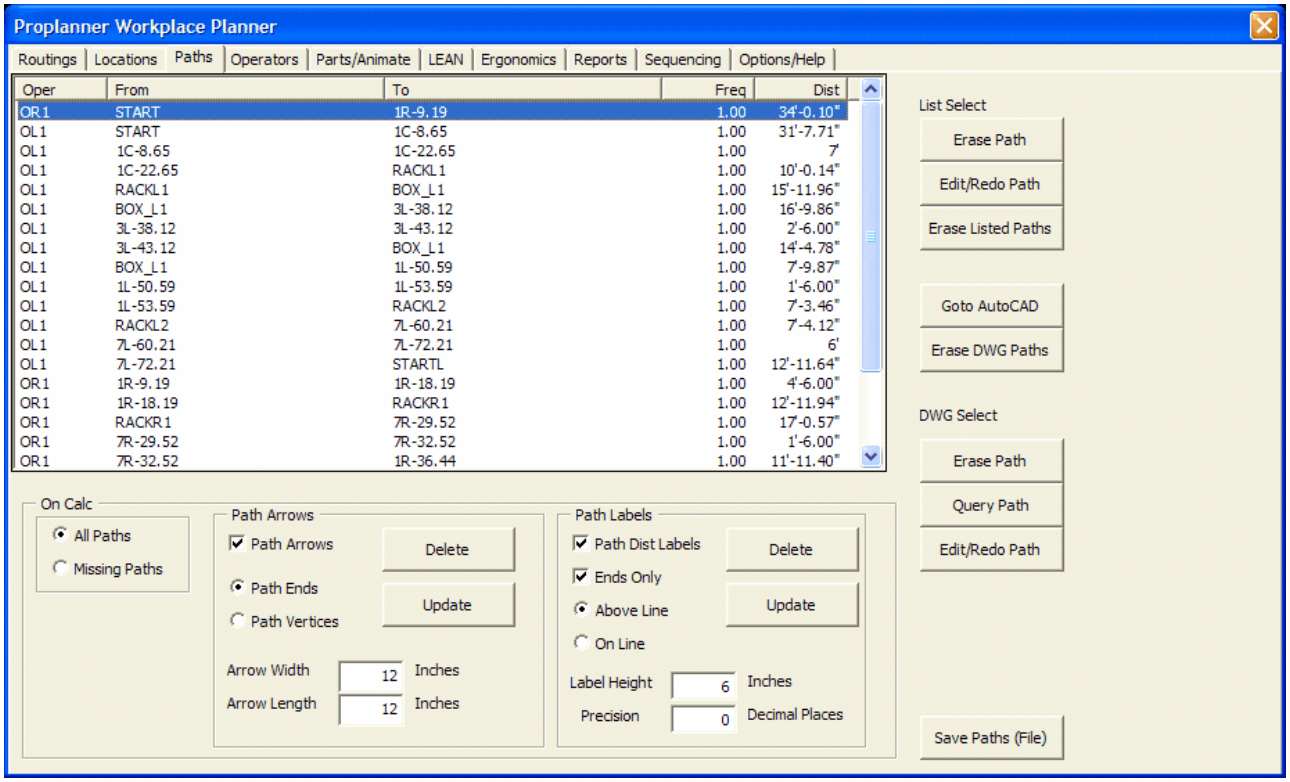

Path Information

LEAN Information

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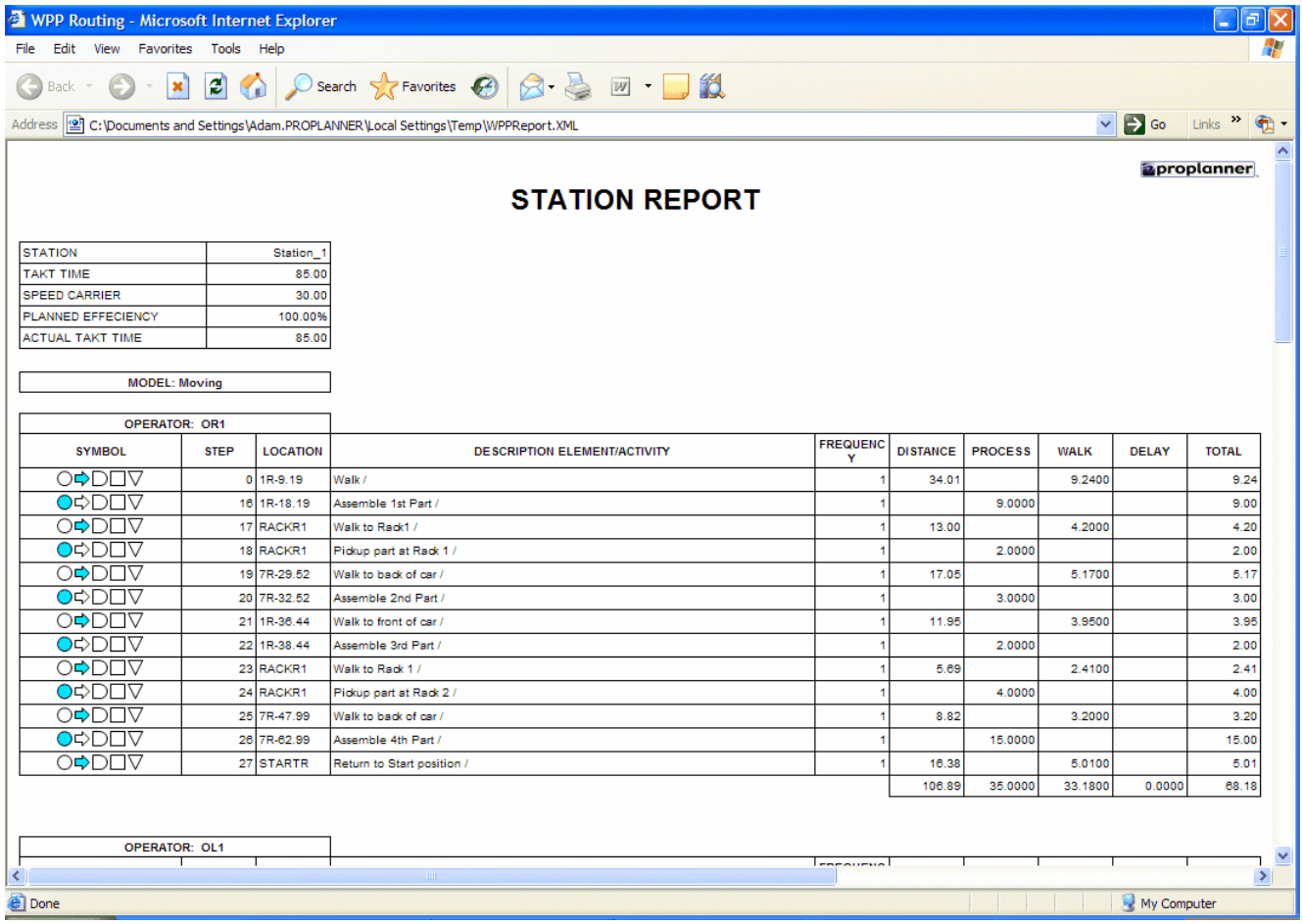

WPP Routing - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

Address C:\Documents and Settings\Adam.PROPLANNER\Local Settings\Temp\WPPReport.XML Go Links

proplanner

STATION REPORT

STATION	Station_1
TAKT TIME	85.00
SPEED CARRIER	30.00
PLANNED EFFECIENCY	100.00%
ACTUAL TAKT TIME	85.00

MODEL: Moving

OPERATOR: OR1

SYMBOL	STEP	LOCATION	DESCRIPTION ELEMENT/ACTIVITY	FREQUENCY	DISTANCE	PROCESS	WALK	DELAY	TOTAL
	0	1R-9.19	Walk /	1	34.01		9.2400		9.24
	16	1R-18.19	Assemble 1st Part /	1		9.0000			9.00
	17	RACKR1	Walk to Rack1 /	1	13.00		4.2000		4.20
	18	RACKR1	Pickup part at Rack 1 /	1		2.0000			2.00
	19	7R-29.52	Walk to back of car /	1	17.05		5.1700		5.17
	20	7R-32.52	Assemble 2nd Part /	1		3.0000			3.00
	21	1R-36.44	Walk to front of car /	1	11.95		3.9500		3.95
	22	1R-38.44	Assemble 3rd Part /	1		2.0000			2.00
	23	RACKR1	Walk to Rack 1 /	1	5.69		2.4100		2.41
	24	RACKR1	Pickup part at Rack 2 /	1		4.0000			4.00
	25	7R-47.99	Walk to back of car /	1	8.82		3.2000		3.20
	26	7R-62.99	Assemble 4th Part /	1		15.0000			15.00
	27	STARTR	Return to Start position /	1	16.38		5.0100		5.01
					106.89	35.0000	33.1800	0.0000	68.18

OPERATOR: OL1

Done My Computer

Report Information

Moving Vs. Stationary part studies

1. Moving studies represent lines where work is done on the part when it is moving and a travel distance will exist while a process is being done on the part.

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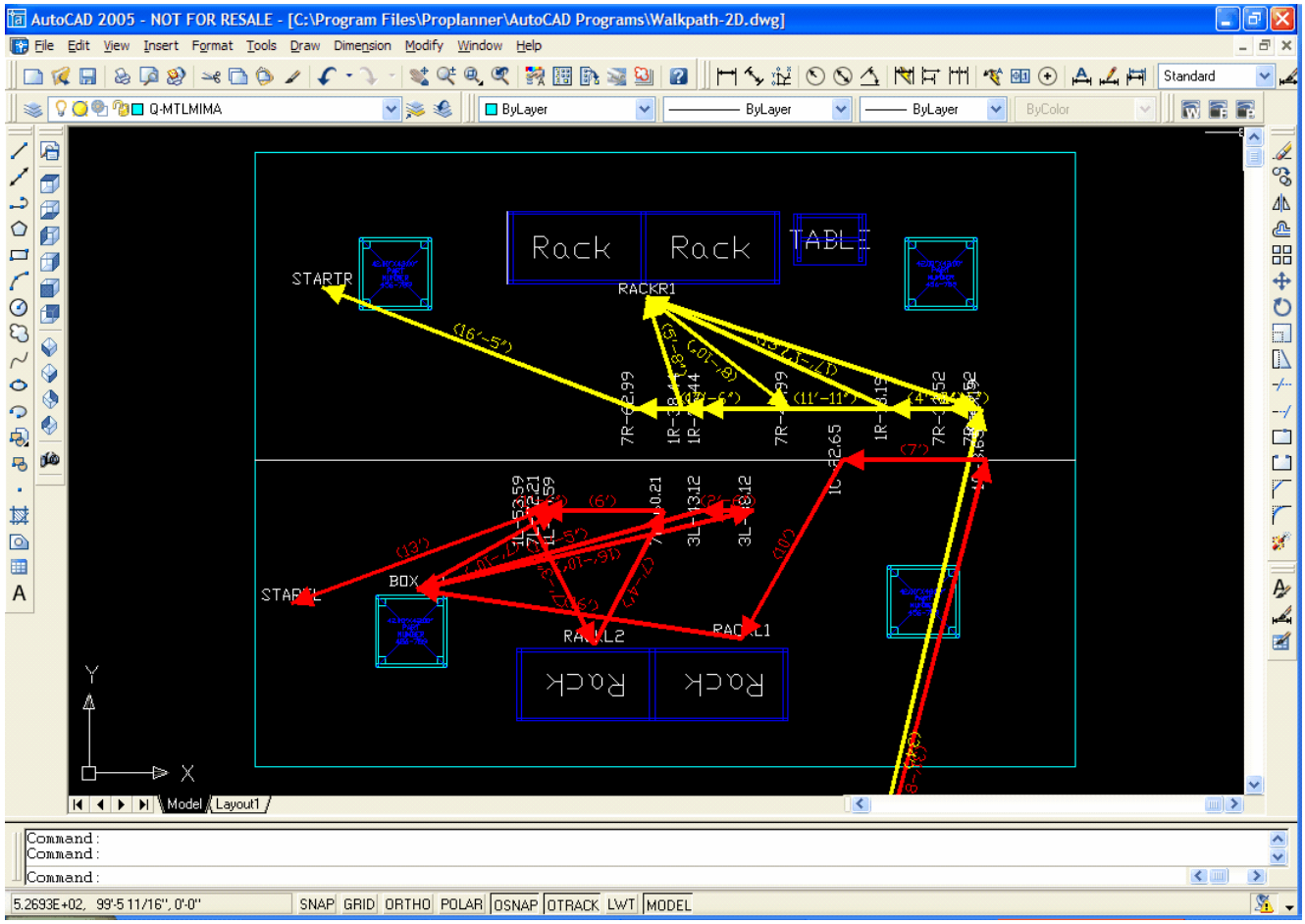

Moving Studies

- These studies deal with the different locations a worker can be at, on the part, with the use of @ characters followed by a number to represent the fraction of the part's total distance back from the front and lastly followed by a R, C, or L indicating which side work is done on. Ie. @3R would be 3/7 back from the front right side.

- When the calculation is done for a moving study, all routings are regenerated every time. This will mean anytime the user needs to edit a path, to go around an object, it will be redrawn straight unless the user puts an interim location at the vertices to avoid an object instead of walking through it.

2. Stationary studies represent either a cellular type manufacturing where the part is still while work is performed. It can also be used to represent a part that is on a conveyer and stopped or picked off to be worked on. In this example picture the user can make the operator go around that table he is currently walking through.

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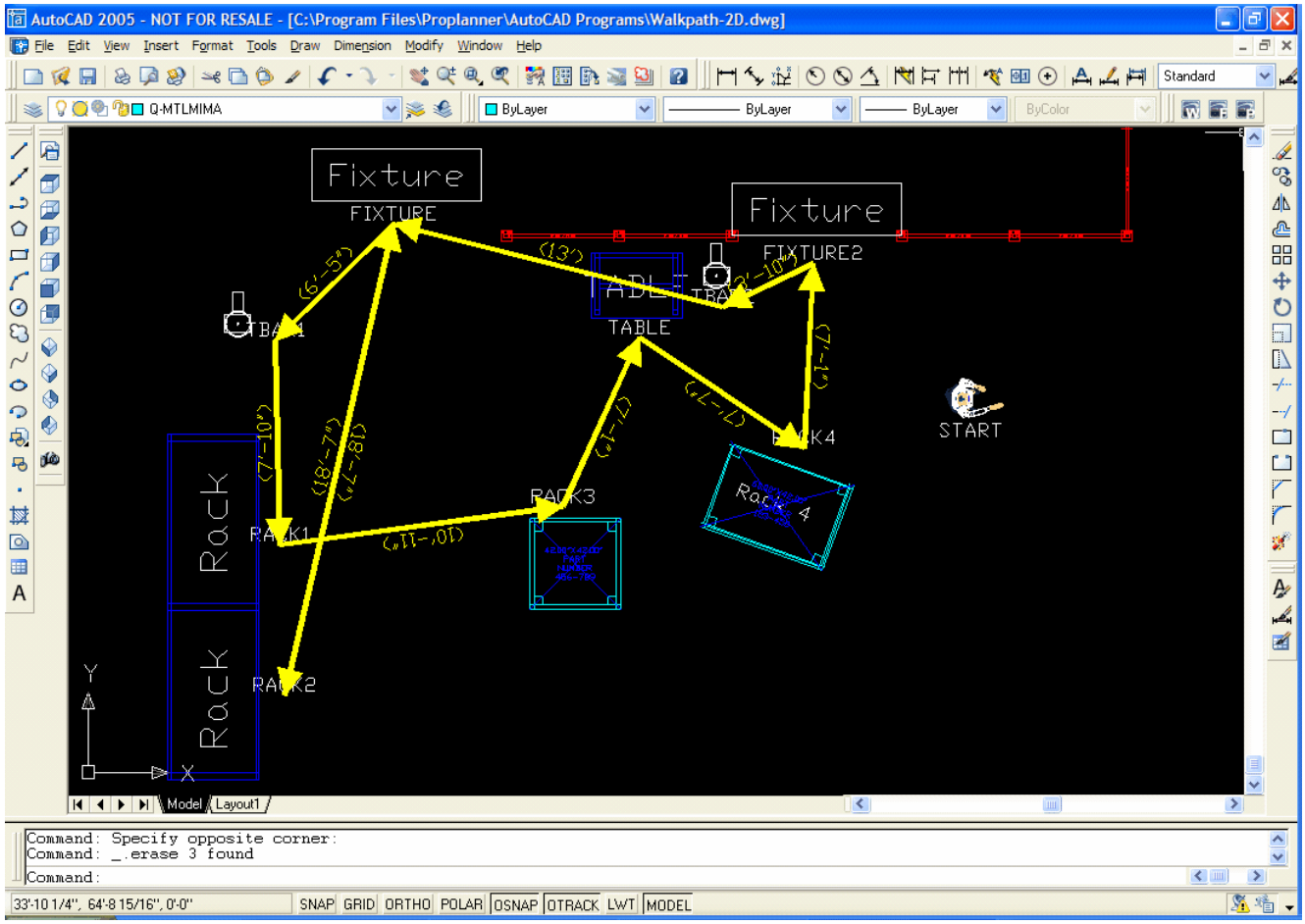

Stationary Studies

Multi-station, operator, and part

1. Multiple operators are created whenever more operators are referenced within the routing.

2. Multiple stations can be simulated by spacing the work locations in different cells or further down the part path if it is a moving study. These are defined on the stations tab by entering the distance along the part path at which the station starts and how long the station is.

3. Multiple parts are simulated by cycles. These are explained below.

4. For a system of stations linked together along a moving part line, the operators will need to have a station defined on the stations tab and assigned to them on the operators tab, to ensure they don't start working until the part enters their station.

Cycles

1. Cycles create a new part going down the line.

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2. There are two ways to define the start of a new cycle. The start time can be absolute, starting from time 0, or relative, starting from the beginning of the previous part's time.

3. Absolute start times are noted by a plain number being input in the cycle time field.

4. For relative start times a @ is used in front of the number.

5. If the first cycle takes too long, the second cycle will start later due to waiting on the operator. These results will be very obvious when the moving part study is animated.

Synchronization

1. Synchronization can be used to make sure that all included operators have a mutual start time.

2. The Synchronization line is just a line linking up to four operators that will begin the following tasks after their preceding tasks are complete. The operation checks to see that all routings before it's row are found true before any of the synchronized operator's routings after this row can begin.

3. If the operators need to be working on the same task, an equal time for their process at this location can be given to both of them.

Predetermined time parsing

1. The pre-loaded parsers can be set to read input in predetermined time systems such as Modapts, MTM, and user defined systems.

2. The output will be in either seconds or decimal minutes.

3. The WPP can also create walk type element data to update the walk codes.

User defined time parsing

1. Using this type of parsing is just like using the MTM parser, however; the operator can open the user-k1.csv and edit key words and their times to personalize their own standard.

2. Exact details on the format of this file can be found in the user manual.

3. Once the desired key words are defined and times are assigned to them, go to the Licensing/Settings (also known in older versions as options/help) tab and set the Process Parse Default type to User-K1.

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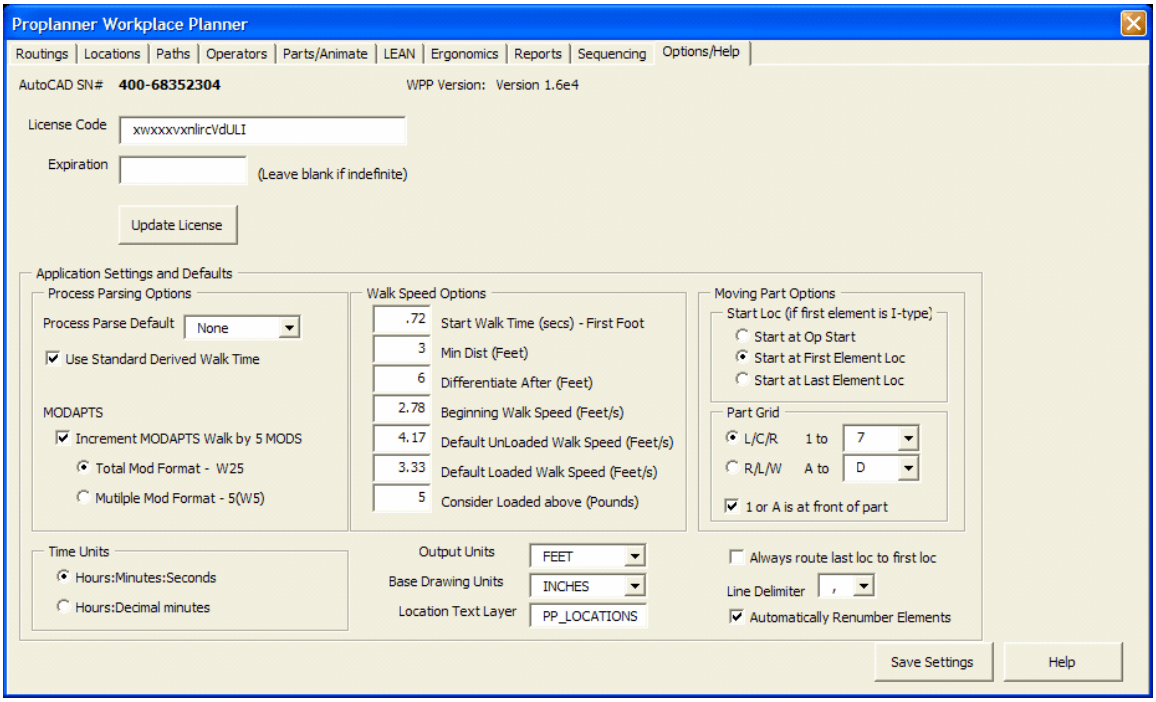

Liscensing/Settings

4. From now on, any time one of the key words is used in the process field, the predetermined time for that word will be used to calculate the results.

Sequencing/Line Balancing Interaction

1. The Workplace Planner has the ability to interact with Proplanner Line Balancing as well.

2. The WPP takes Line Balancing data and imports it into the program to create a simulated sequence.

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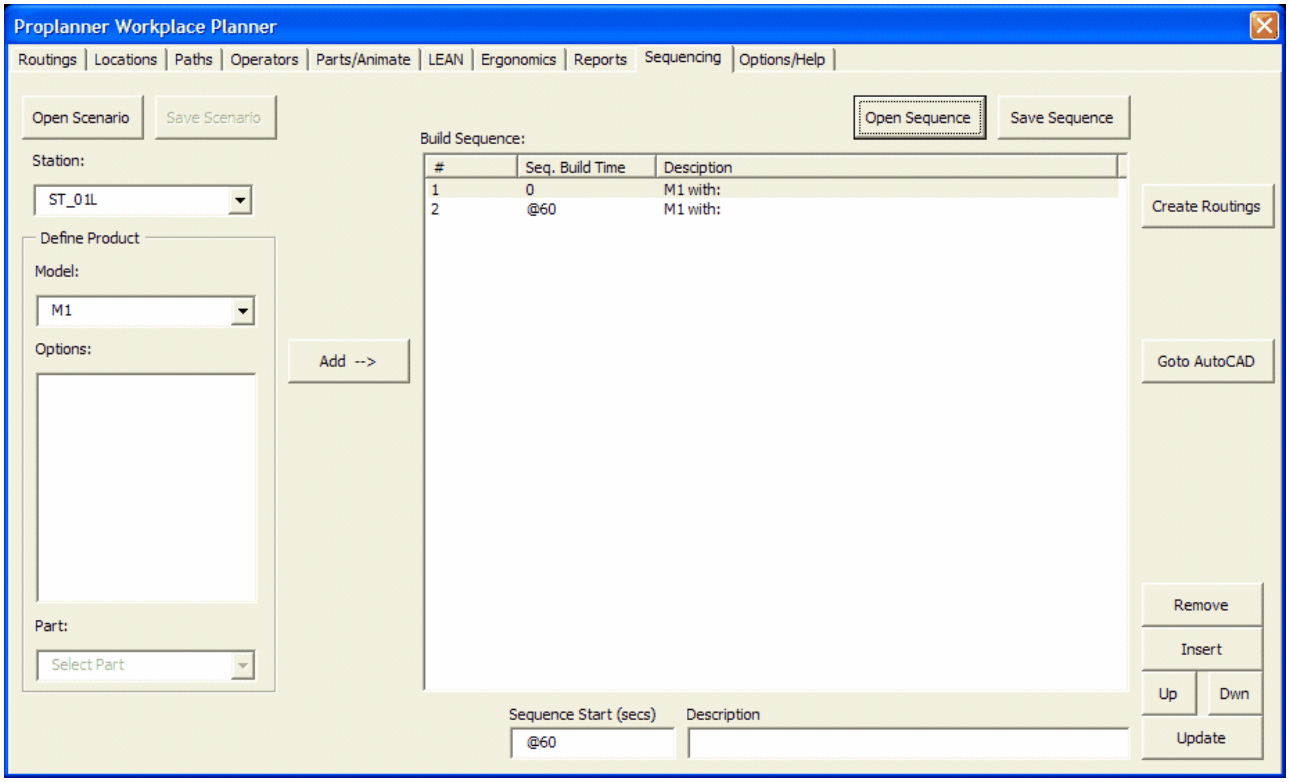

Line Balancing

3. From there it can create and save the build order sequence, save elemental order data, or add new tasks.

4. New elements can be added here and returned from WPP to the Line Balancing tool as well.

5. This acts as a powerful evaluation tool for ensuring the quality and functionality of a Line Balancing Scenario.

Advanced Reporting

The WPP offers numerous ways of reporting the simulation data, once a calculation is run.

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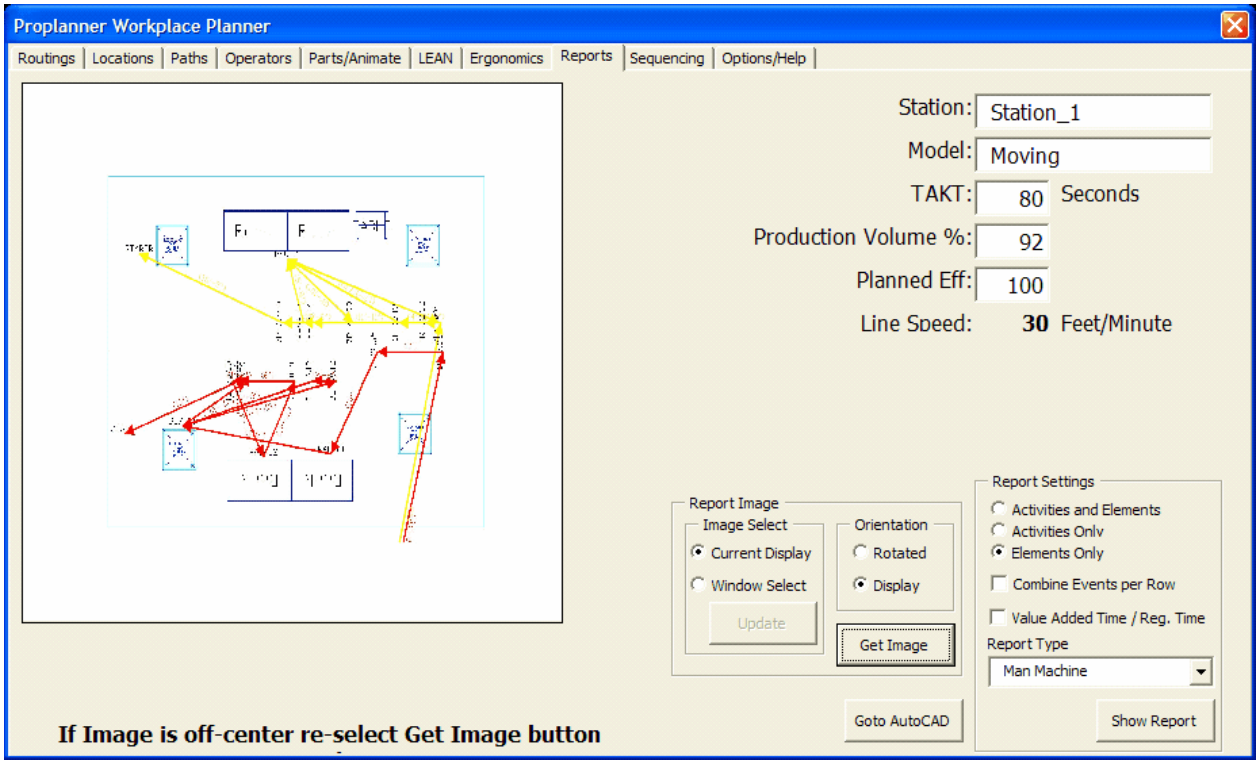

Reporting

1. The drawing can be imported to the WPP as a jpg file and displayed within the Station Report.

2. A man/machine time chart can be used to display the operators activity times in a Gantt chart layout.

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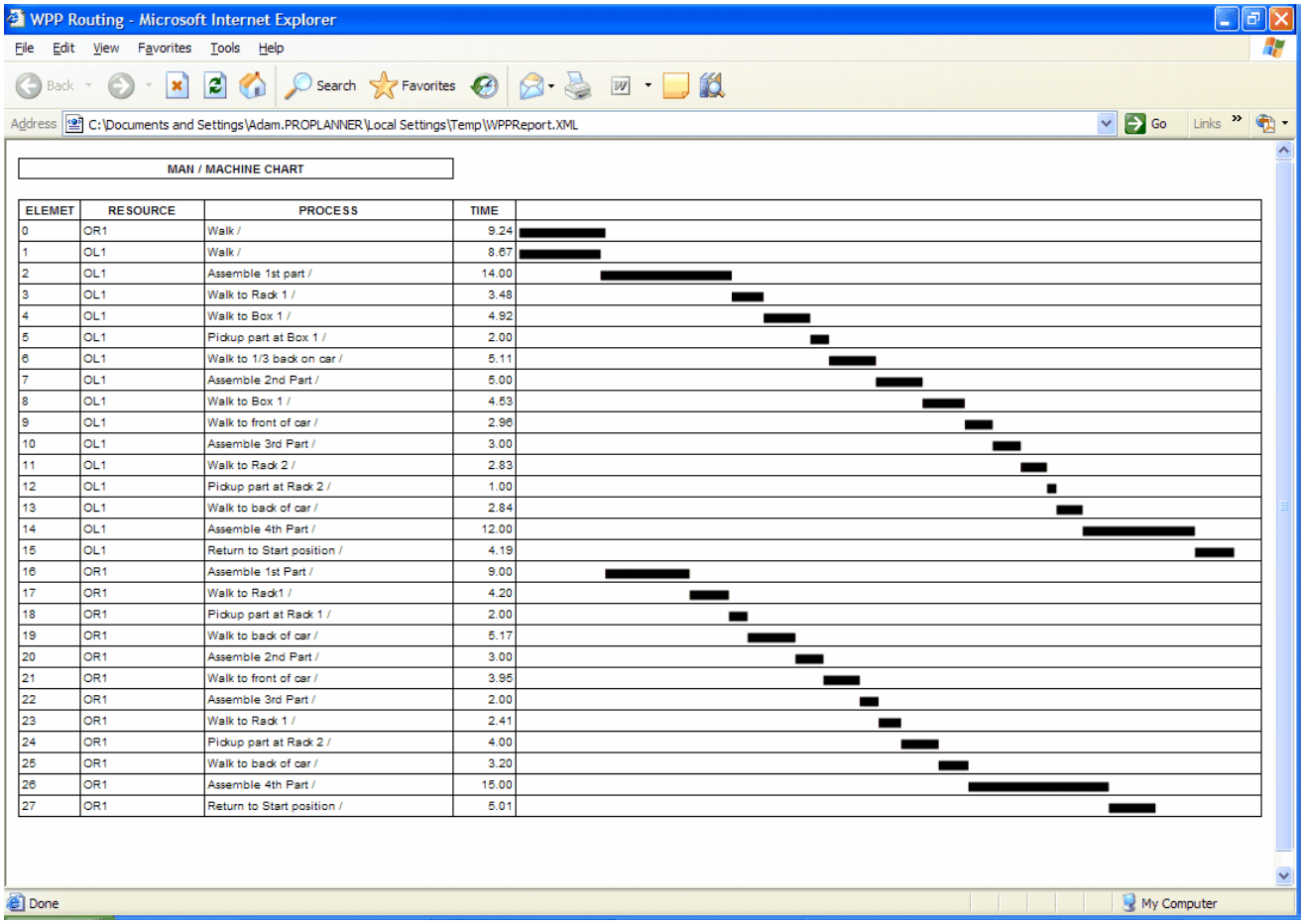

MAN / MACHINE CHART

ELEMET	RESOURCE	PROCESS	TIME
0	OR1	Walk /	9.24
1	OL1	Walk /	8.67
2	OL1	Assemble 1st part /	14.00
3	OL1	Walk to Rack 1 /	3.48
4	OL1	Walk to Box 1 /	4.92
5	OL1	Pickup part at Box 1 /	2.00
6	OL1	Walk to 1/3 back on car /	5.11
7	OL1	Assemble 2nd Part /	5.00
8	OL1	Walk to Box 1 /	4.53
9	OL1	Walk to front of car /	2.96
10	OL1	Assemble 3rd Part /	3.00
11	OL1	Walk to Rack 2 /	2.83
12	OL1	Pickup part at Rack 2 /	1.00
13	OL1	Walk to back of car /	2.84
14	OL1	Assemble 4th Part /	12.00
15	OL1	Return to Start position /	4.19
16	OR1	Assemble 1st Part /	9.00
17	OR1	Walk to Rack1 /	4.20
18	OR1	Pickup part at Rack 1 /	2.00
19	OR1	Walk to back of car /	5.17
20	OR1	Assemble 2nd Part /	3.00
21	OR1	Walk to front of car /	3.95
22	OR1	Assemble 3rd Part /	2.00
23	OR1	Walk to Rack 1 /	2.41
24	OR1	Pickup part at Rack 2 /	4.00
25	OR1	Walk to back of car /	3.20
26	OR1	Assemble 4th Part /	15.00
27	OR1	Return to Start position /	5.01

Man/Machine Time Chart

3. The station report is the comprehensive report file for all the time, distance, and performance data, calculated within the Workplace Planner.

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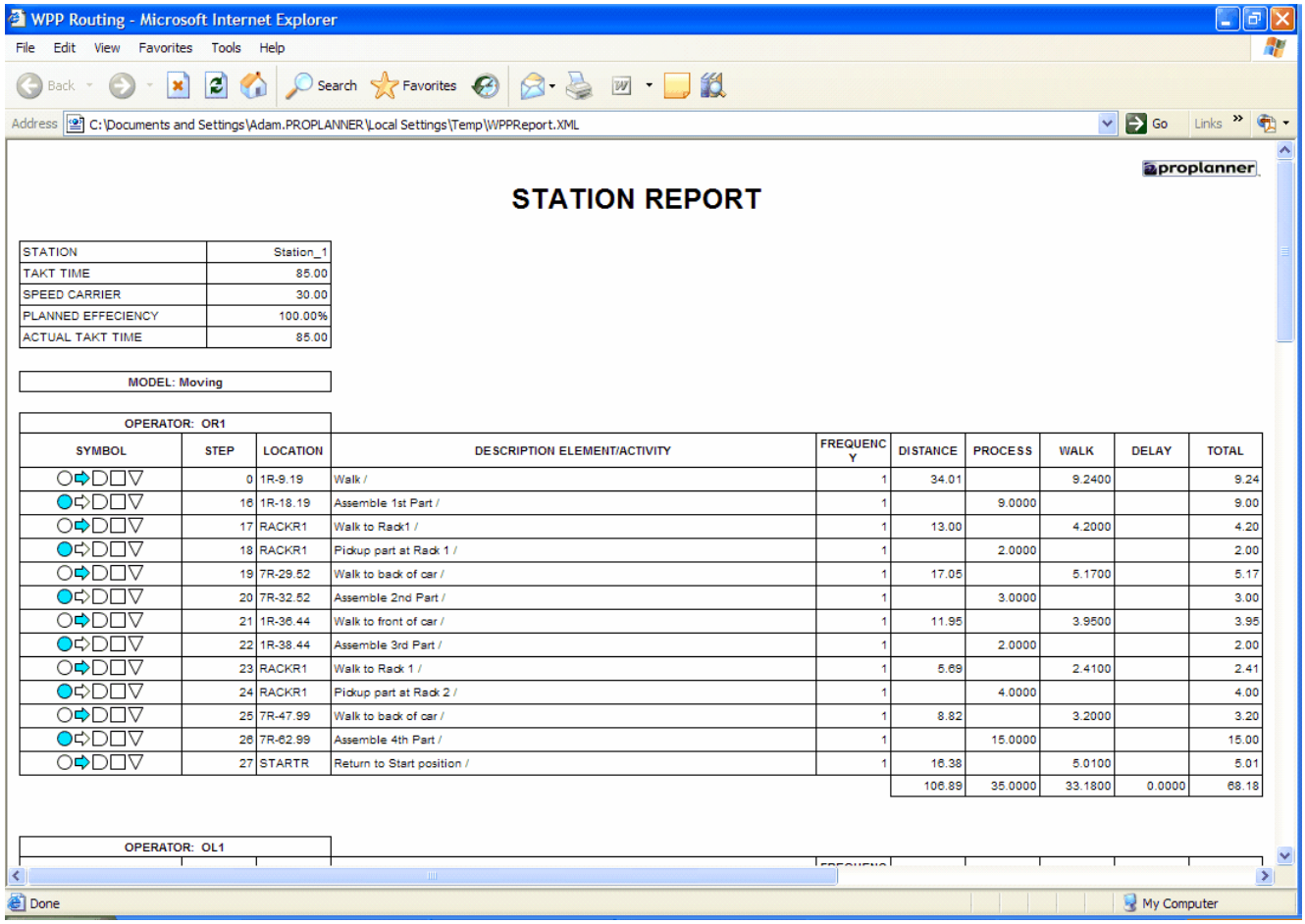

Station Report

4. Lean station report is similar to the Station report. Instead of the time and distance information, all the lean VA/NVA/NVABN information for each operator is displayed.

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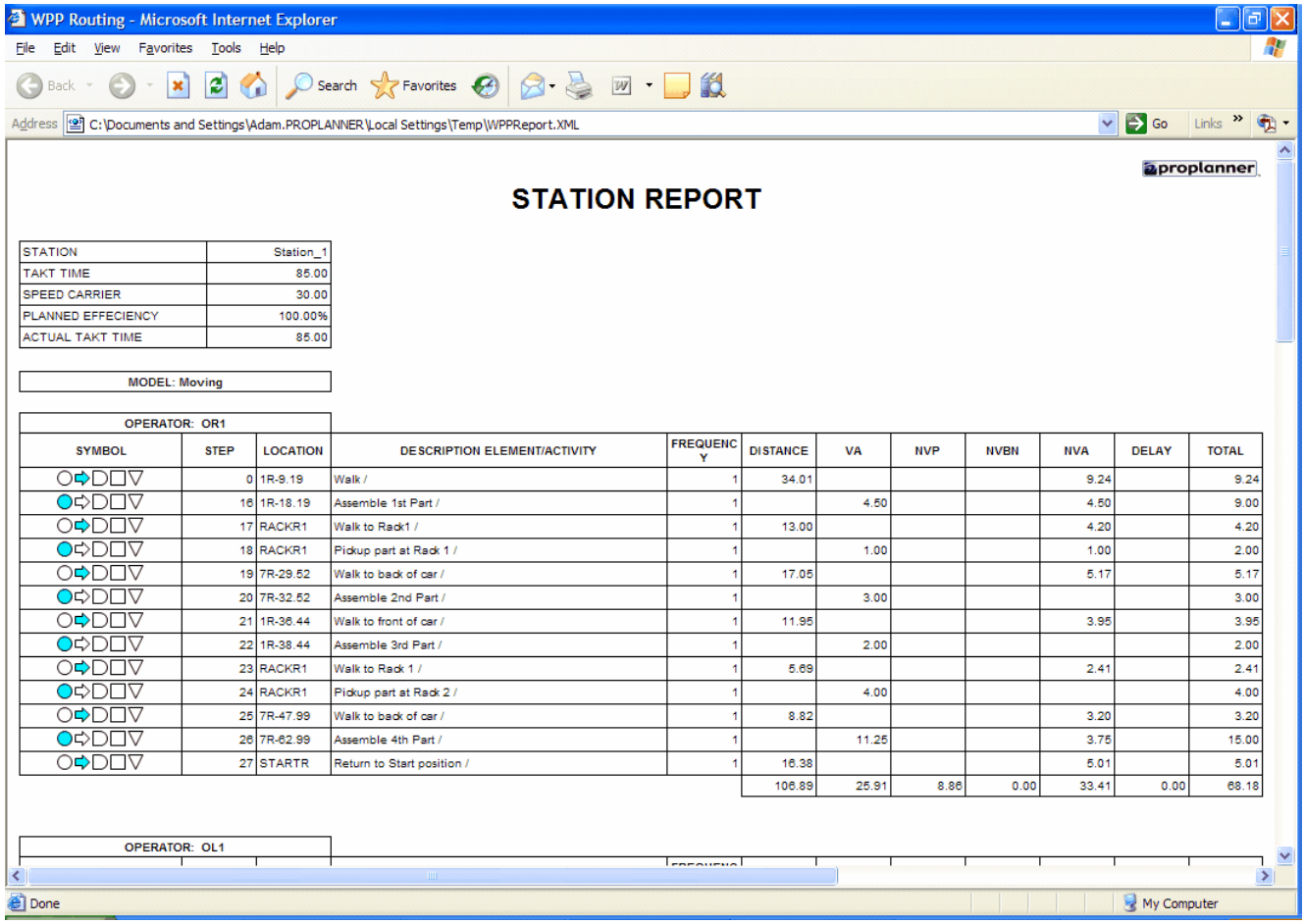

WPP Routing - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address C:\Documents and Settings\Adam.PROPLANNER\Local Settings\Temp\WPPReport.XML

proplanner

STATION REPORT

STATION	Station_1
TAKT TIME	85.00
SPEED CARRIER	30.00
PLANNED EFFECIENCY	100.00%
ACTUAL TAKT TIME	85.00

MODEL: Moving

OPERATOR: OR1

SYMBOL	STEP	LOCATION	DESCRIPTION ELEMENT/ACTIVITY	FREQUENCY	DISTANCE	VA	NVP	NVBN	NVA	DELAY	TOTAL
	0	1R-9.19	Walk /	1	34.01				9.24		9.24
	16	1R-18.19	Assemble 1st Part /	1		4.50			4.50		9.00
	17	RACKR1	Walk to Rack1 /	1	13.00				4.20		4.20
	18	RACKR1	Pickup part at Rack 1 /	1		1.00			1.00		2.00
	19	7R-29.52	Walk to back of car /	1	17.05				5.17		5.17
	20	7R-32.52	Assemble 2nd Part /	1		3.00					3.00
	21	1R-36.44	Walk to front of car /	1	11.95				3.95		3.95
	22	1R-38.44	Assemble 3rd Part /	1		2.00					2.00
	23	RACKR1	Walk to Rack 1 /	1	5.69				2.41		2.41
	24	RACKR1	Pickup part at Rack 2 /	1		4.00					4.00
	25	7R-47.99	Walk to back of car /	1	8.82				3.20		3.20
	26	7R-62.99	Assemble 4th Part /	1		11.25			3.75		15.00
	27	STARTR	Return to Start position /	1	16.38				5.01		5.01
					106.89	25.91	8.86	0.00	33.41	0.00	68.18

OPERATOR: OL1

Done My Computer

LEAN Station Report

Animation

1. Once the calculations have been completed, the WPP can be used to animate the operator's performance.

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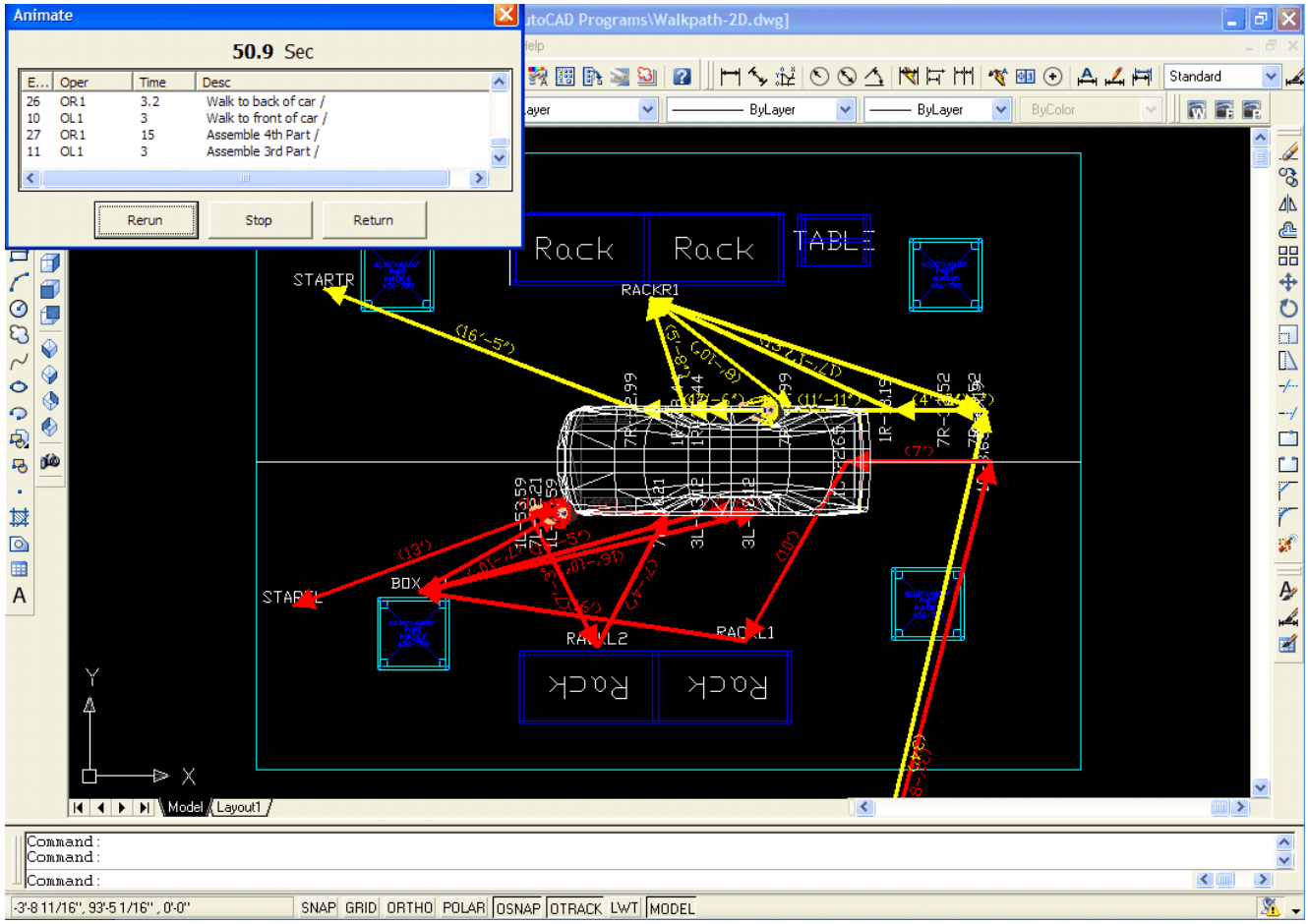

Animation

2. This can take place in the static 2-D view or 3-D if the blocks and drawing was originally created in this perspective.

3. The trace file can also be saved to be used with other 3-D animation engines.

4. Operator and one car block is included with the demo files. To replace these in the simulation with custom blocks, the user needs only place the desired blocks within the drawing before opening WPP. They will be available to set as the part or operator blocks from then on.

5. The animation speed can be changed by altering the increments at which AutoCAD renders. The smaller the increment, the slower the animation will move.

6. These animations are a powerful tool in picking up incorrect routing information that may not have been obvious in the calculation output.

Robot analysis

1. To simulate a robot working, the drawing needs to be loaded as usual. The effective work zone of the robot should also be defined within the drawing to help spot when the work may need to be moved closer.

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2. The main difference is that the robot arm will be simulated by a block representing the manipulator and not the entire arm. It will calculate the times for the operations and travel of the manipulator itself.

3. Note that the WPP will not alert when there are interference problems with the manipulator arm and the surrounding environment. This tool can be used to identify problems if the operator's path crosses paths between the active manipulator and its base, seen in the animation.

4. To show interactions between the manipulator and the worker, a synchronize route will be needed to make them meet at the right place and time. This will show when delays are added due to one waiting on the other.

5. When these interactions are calculated, the man/machine time chart can be generated on the reports tab where the man and machine times will be optionally displayed in a chart where machine time is displayed parallel to manual labor times.

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9 Appendix

Application Limitations
Application Layers
Application Blocks
File Formats

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9.1 Application Limitations

These application limitations have been defined in order to limit potentially excessive memory requirements of the application. If these limits prove constraining for certain situations, please contact your Proplanner representative with your specific request.

Input Routing Lines (file length): 2,000 Total
Flow Paths: 1,000 Total
Operators: 25 Total
Dynamic Cycles: 25 Total
Locations: 2,000 Total
Synchronous Operators: 4 Total
Manual Flow Path Segments: 10 Total
Part Flow Path Segments: 5 Total

9.2 Application Layers

All Proplanner layers begin with "**PP_**". The application will consistently add and remove graphics from those layers. Proplanner will not alter any graphics on layers other than those beginning with "**PP_**".

Note: *opname* is the operator name specified in the routing file

PP_LOCATIONS (contains the location text)
PP_FLOW-*opname* (contains the flow paths for the specified operator)
PP_FLOW-ARO-*opname* (contains arrows and text labels for the flow paths)
PP_PART-PATH (contains the polyline that defines the part path)
PP_PART-LOCATIONS (contains the temporary locations along the part path)

Also: Animation of operators occurs on the respective PP_FLOW layer for that operator. Animation of the part occurs on the PP_PART-PATH layer. Thus blocks being animated will assume the color of the respective operators layer color provided that those blocks were defined on layer 0 with their entities having the color property of BYLAYER.

9.3 Application Blocks

- Proplanner will create a block called **PP_ARROW** for representing the arrowheads along the flow lines.
- Proplanner will also create a person block **PP_PERSON** and
- A part block **PP_PART** if the user selects animation and does not specify any different blocks to be animated.

9.4 File Formats

Input File Format

Output File Formats

- Routing file (CSV)
- Location file (LOC)
- Path file (PTH)
- Trace file (TRC)

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9.4.1 Input File Format

The input file is a comma delimited file with a CSV extension. As such, no commas are allowed within the text in a field. Proplanner can also read the output files as input files. In this situation, Proplanner will ignore the first row that specifies the distance units (since it will also ignore those distances) and also the last rows from the word **SUMMARY** on to the end of the file.

Column	Data Value
1	Element ID (Integer Number 1-2000)
2	Element Type (F/P/S/T/M/X)
3	Operator (String up to 10 Chars, or 3 opers sep. by dash
4	Process Code, a slash seperates LCode from RCode
5	From Loc/LCode (based on F/P), (String up to 25 Chars)
6	LCode Desc, (String up to 255 Chars)
7	To Loc/RCode (based on F/P), (String up to 25 Chars)
8	RCode Desc, (String up to 255 Chars)
9	Frequency, (Real Number 0-inf)
10	Distance (only used on F), (Real Number 0-inf)
	Specified in Feet or Meters depending on first row value
11	Time, (Real Number 0-inf) in seconds
12	LEAN % (Integer from 0 to 100)
13	Weight (String FHK code prefixes whole number weight)
14	Special Codes (String up to 10 Chars)
15	Miscellaneous user field [OPTIONAL]
16	Activity ID information from Proplanner (Proplanner USE ONLY) [OPTIONAL]

Sample Input File

1	M	OPR1	G1A					1	0	0.072	0
2	M	OPR1	R1A					1	0	0.09	0
3	F	OPR1		FIXTURE	Desc	TBAR1		1	9.05439	1.81088	0
4	M	OPR1	G1A					1	0	0.072	0
5	M	OPR1	R1A					1	0	0.09	0
6	F	OPR1		TBAR1	Desc	RACK1		1	6.9345	1.3869	0
7	F	OPR1		RACK1	Desc	RACK3		1	13.3539	2.67079	0
8	F	OPR1		RACK3	Desc	TABLE		1	7.55798	1.5116	0
9	M	OPR1	G1A					1	0	0.072	0
10	M	OPR1	R1A					1	0	0.09	0
11	F	OPR1		TABLE	Desc	RACK4		1	7.86218	1.57244	0
12	F	OPR1		RACK4	Desc	FIXTURE2		1	8.66101	1.7322	0
13	M	OPR1	M10B/R10B					1	0	0.072	0
14	F	OPR1		FIXTURE2	Desc	TBAR2		1	4.28715	0.85743	0
15	F	OPR1		TBAR2	Desc	FIXTURE		1	16.0786	3.21571	0
16	F	OPR1		FIXTURE	Desc	RACK2		1	19.913	3.98261	0
17	F	OPR1		RACK2	Desc	FIXTURE		1	19.8488	3.96977	0

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9.4.2 Output File Formats

Routing file (CSV)
Location file (LOC)
Path file (PTH)
Trace file (TRC)

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9.4.2.1 Routing File (CSV)

The WPP application automatically adds a first line to the original routing CSV file that specifies the units of measurement for the distances in that file. The WPP also adds a Summary table at the end that contains the operator total walk distance and time for each unique operator referenced in the routing file.

File Example

FEET

1F	OPER1		START1	START1	@L	L-6.29	0	377.9845	6.2851
2P	OPER1	PROC	@L	L-6.29		L-20.29	0	140	14
3F	OPER1		@L	L-20.29	RACK1-2		0	130.7043	2.178404
4F	OPER1		RACK1-2		BOX1		0	105.0387	1.750646
5P	OPER1	PROC	BOX1				0	0	2
6F	OPER1		BOX1	BOX1	@LW<B	LW<B-27.23	0	60.52937	1.0129
7P	OPER1	PROC	@LW<B	LW<B-27.23		LW<B-32.23	0	50	5
8F	OPER1		@LW<B	LW<B-32.23	BOX1		0	31.08403	0.518067
9F	OPER1		BOX1	BOX1	@LW	LW-34.09	0	82.43454	1.3455
10P	OPER1	PROC	@LW	LW-34.09		LW-37.09	0	30	3
12F	OPER1		@LW	LW-37.09	RACK1-2		0	212.7002	3.545004
13P	OPER1	PROC	RACK1-2				0	0	1
14F	OPER1		RACK1-2	RACK1-2	@LW<D	LW<D-43.61	0	119.9929	1.9711
15P	OPER1	PROC	@LW<D	LW<D-43.61		LW<D-55.61	0	120	12
16F	OPER1		@LW<D	LW<D-55.61	START1		0	64.72373	1.078729
17F	OPER2		START2	START2	@RW	RW-4.98	0	298.9874	4.9813
18P	OPER2	PROC	@RW	RW-4.98		RW-13.98	0	90	9
19F	OPER2		@RW	RW-13.98	RACK2-2		0	99.04411	1.650735
20P	OPER2	PROC	RACK2-2				0	0	2
21F	OPER2		RACK2-2	RACK2-2	@RW<D	RW<D-20.63	0	182.0529	2.9999
22P	OPER2	PROC	@RW<D	RW<D-20.63		RW<D-23.63	0	30	3
23F	OPER2		@RW<D	RW<D-23.63	@RW	RW-27.17	0	215	3.5417
24P	OPER2	PROC	@RW	RW-27.17		RW-29.17	0	20	2
25F	OPER2		@RW	RW-29.17	RACK2-2		0	137.4169	2.290282
26P	OPER2	PROC	RACK2-2				0	0	4
27F	OPER2		RACK2-2	RACK2-2	@RW<D	RW<D-36.93	0	87.99504	1.4661
28P	OPER2	PROC	@RW<D	RW<D-36.93		RW<D-42.93	0	60	6
29F	OPER2		@RW<D	RW<D-42.93	START2		0	105.6544	1.760907

CSV File Example

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9.4.2.2 Location File (LOC)

The WPP application can create a comma-delimited text file that contains the X,Y coordinates of all locations in the drawing, as well as the limits of the drawing for use in scaling these values into other coordinate systems.

File Example

LOCATIONS (NAME	X	Y)	
START	-41.27886074	959.0241136	
STARTL-1	-14.39969858	959.4311767	
RACKL-1	184.3432071	895.1150395	
BOX1	336.2512049	944.3698027	
STARTR-1	-37.20626017	1054.277127	
RACKR-1	180.2706065	1101.089505	
L-6.34	365.5085379	1002.456442	
L-20.34	225.5085379	1002.45643	
LW<B-29.23	197.0274325	966.4564334	
LW<B-34.23	147.0274325	966.456429	
LW-43.00	-0.453680626	966.4564263	
LW-46.00	-30.45368063	966.4564236	
LW<D-52.81	81.95607918	966.4564466	
LW<D-64.81	-38.04392082	966.4564362	
RW-6.66	362.0426321	1038.456442	
RW-15.66	272.0426321	1038.456434	
RW<D-22.97	379.1037947	1038.456458	
RW<D-25.97	349.1037947	1038.456456	
RW-29.51	134.1038002	1038.456456	
RW-31.51	114.1038002	1038.456454	
RW<D-38.30	226.4649621	1038.456476	
RW<D-53.30	76.46496209	1038.456463	
DRAWING EXTENTS (MINX	MINY	MAXX	MAXY) in NCHES
-122.8498	478.9541	428.6794	1182.4564

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9.4.2.3 Path File (PTH)

The WPP application can create a comma-delimited text file that contains the X,Y coordinates of all path vertices in the drawing, as well as the limits of the drawing for use in scaling these. Additional information about the path is also provided (such as distance, frequency, operator, from and to location)

File Example

FLOW PATHS (PATHNUM	OPERATOR	FROM LOC	TO LOC	DISTANCE	FREQUENCY)
1	OPERL-1	STARTL-1	L-6.34	382.336817	1
2	OPERL-1	L-6.34	L-20.34	140	1
3	OPERL-1	L-20.34	RACKL-1	114.9641622	1
4	OPERL-1	RACKL-1	BOX1	159.6936802	1
5	OPERL-1	BOX1	LW<B-29.23	140.9648114	1
6	OPERL-1	LW<B-29.23	LW<B-34.23	50	1
7	OPERL-1	LW<B-34.23	BOX1	190.5084121	1
8	OPERL-1	BOX1	LW-43.00	337.4285092	1
9	OPERL-1	LW-43.00	LW-46.00	30	1
10	OPERL-1	LW-46.00	RACKL-1	226.3344783	1
11	OPERL-1	RACKL-1	LW<D-52.81	124.7907061	1
12	OPERL-1	LW<D-52.81	LW<D-64.81	120	1
13	OPERL-1	LW<D-64.81	STARTL-1	24.665837	1
14	OPERR-1	STARTR-1	RW-6.66	399.5622255	1
15	OPERR-1	RW-6.66	RW-15.66	90	1
16	OPERR-1	RW-15.66	RACKR-1	111.1080832	1
17	OPERR-1	RACKR-1	RW<D-22.97	208.4647098	1
18	OPERR-1	RW<D-22.97	RW<D-25.97	30	1
19	OPERR-1	RW<D-25.97	RW-29.51	214.9999946	1
20	OPERR-1	RW-29.51	RW-31.51	20	1
21	OPERR-1	RW-31.51	RACKR-1	91.10952362	1
22	OPERR-1	RACKR-1	RW<D-38.30	77.82554028	1
23	OPERR-1	RW<D-38.30	RW<D-53.30	150	1
24	OPERR-1	RW<D-53.30	STARTR-1	114.7668949	1

DRAWING EXTENTS (MINX	MINY	MAXX	MAXY) in INCHES
-122.8498	478.9541	428.6794	1182.4564

Path File Example

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PATH VERTICES (PATHNUM	#VERTICES	X1	Y1	X2	Y2 ...)
1	2	14.39969858	959.4311767	365.5085379	1002.456442
2	2	365.5085379	1002.456442	225.5085379	1002.45643
3	2	225.5085379	1002.45643	184.3432071	895.1150395
4	2	184.3432071	895.1150395	336.2512049	944.3698027
5	2	336.2512049	944.3698027	197.0274325	966.4564334
6	2	197.0274325	966.4564334	147.0274325	966.456429
7	2	147.0274325	966.456429	336.2512049	944.3698027
8	2	336.2512049	944.3698027	0.453680626	966.4564263
9	2	0.453680626	966.4564263	30.45368063	966.4564236
10	2	30.45368063	966.4564236	184.3432071	895.1150395
11	2	184.3432071	895.1150395	81.95607918	966.4564466
12	2	81.95607918	966.4564466	38.04392082	966.4564362
13	2	38.04392082	966.4564362	14.39969858	959.4311767
14	2	37.20626017	1054.277127	362.0426321	1038.456442
15	2	362.0426321	1038.456442	272.0426321	1038.456434
16	2	272.0426321	1038.456434	180.2706065	1101.089505
17	2	180.2706065	1101.089505	379.1037947	1038.456458
18	2	379.1037947	1038.456458	349.1037947	1038.456456
19	2	349.1037947	1038.456456	134.1038002	1038.456456
20	2	134.1038002	1038.456456	114.1038002	1038.456454
21	2	114.1038002	1038.456454	180.2706065	1101.089505
22	2	180.2706065	1101.089505	226.4649621	1038.456476
23	2	226.4649621	1038.456476	76.46496209	1038.456463
24	2	76.46496209	1038.456463	37.20626017	1054.277127

Example

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9.4.2.4 Trace File (TRC)

The WPP application can create a text file that contains the animation event sequence for all operators in a WPP Analysis. This trace file includes the event time (in seconds from time 0) as well as the event AT/FROM location and event TO location if appropriate. Position and Path information reference by locations and paths in this trace file can be found in the Locations (LOC) and Paths (PTH) output files.

LEGEND of Event Types
D – User defined Delay at beginning of operator cycle (such as waiting for part to enter workstation)
W - Walking FROM a location TO a location
P – Processing AT a static location
R – Processing AT a moving location
I – Internal delay at a static position caused by operator synchronization
L – Internal delay at a moving position caused by operator synchronization

File Example
OPERL-1
W6:STARTL-1/L-5.96
R20:L-5.96/L-19.96
W22:L-19.96/RACKL-1
W24.8:RACKL-1/BOX1
P26.8:BOX1
W29.1:BOX1/LW<B-29.10
R34.1:LW<B-29.10/LW<B-34.10
W37.3:LW<B-34.10/BOX1
W42.9:BOX1/LW-42.93
R45.9:LW-42.93/LW-45.93
W49.6:LW-45.93/RACKL-1
P50.6:RACKL-1
W53:RACKL-1/LW<D-52.98
R65:LW<D-52.98/LW<D-64.98
W66.1:LW<D-64.98/STARTL-1

OPERR-1
W5.8:STARTR-1/RW-5.84
R14.8:RW-5.84/RW-14.84
W16.8:RW-14.84/RACKR-1
P18.8:RACKR-1
W22.4:RACKR-1/RW<D-22.37
R25.4:RW<D-22.37/RW<D-25.37
W28.9:RW<D-25.37/RW-28.91
R30.9:RW-28.91/RW-30.91
W32.3:RW-30.91/RACKR-1
I45.9:RACKR-1
P49.9:RACKR-1
W52.1:RACKR-1/RW<D-52.11
R67.1:RW<D-52.11/RW<D-67.11
W68.8:RW<D-67.11/STARTR-1

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