

Chapter 5 – Advanced Transfer Panel

5.1 Modules

We will use Sample Model 3 in Figure 5.1, Sample Model 4 in Figure 5.6, and Sample Model 5 in Figure 5.20 are used to discuss both the Modules and Data Modules used from the Advanced Transfer panel in this course.

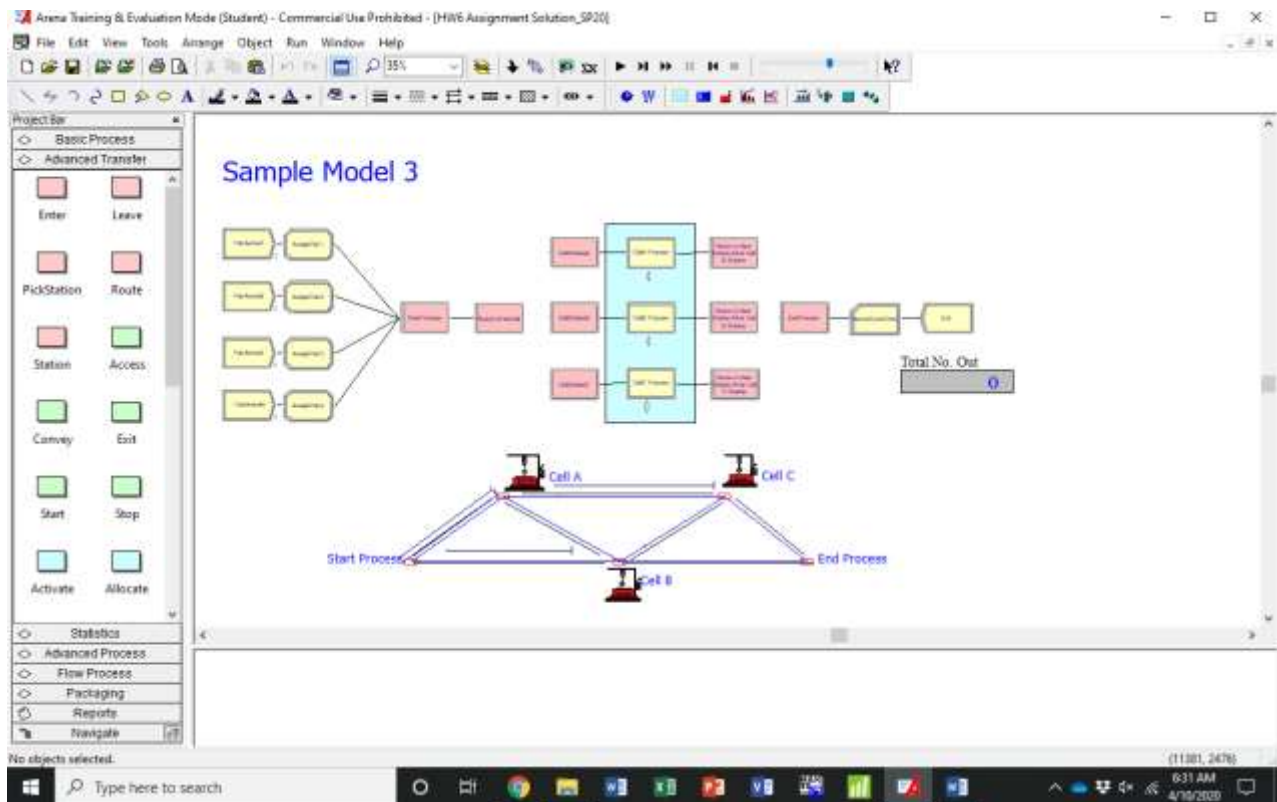


Figure 5.1. Sample Model 3.

5.1.1. The Station Flowchart Module

The Station module (see Figure 5.1) precedes a Process module and signals the arrival of an entity at that process.

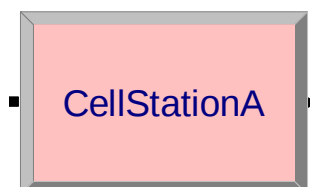


Figure 5.1. The Station module.

Double-click it to open the dialog box (see Figure 5.2).

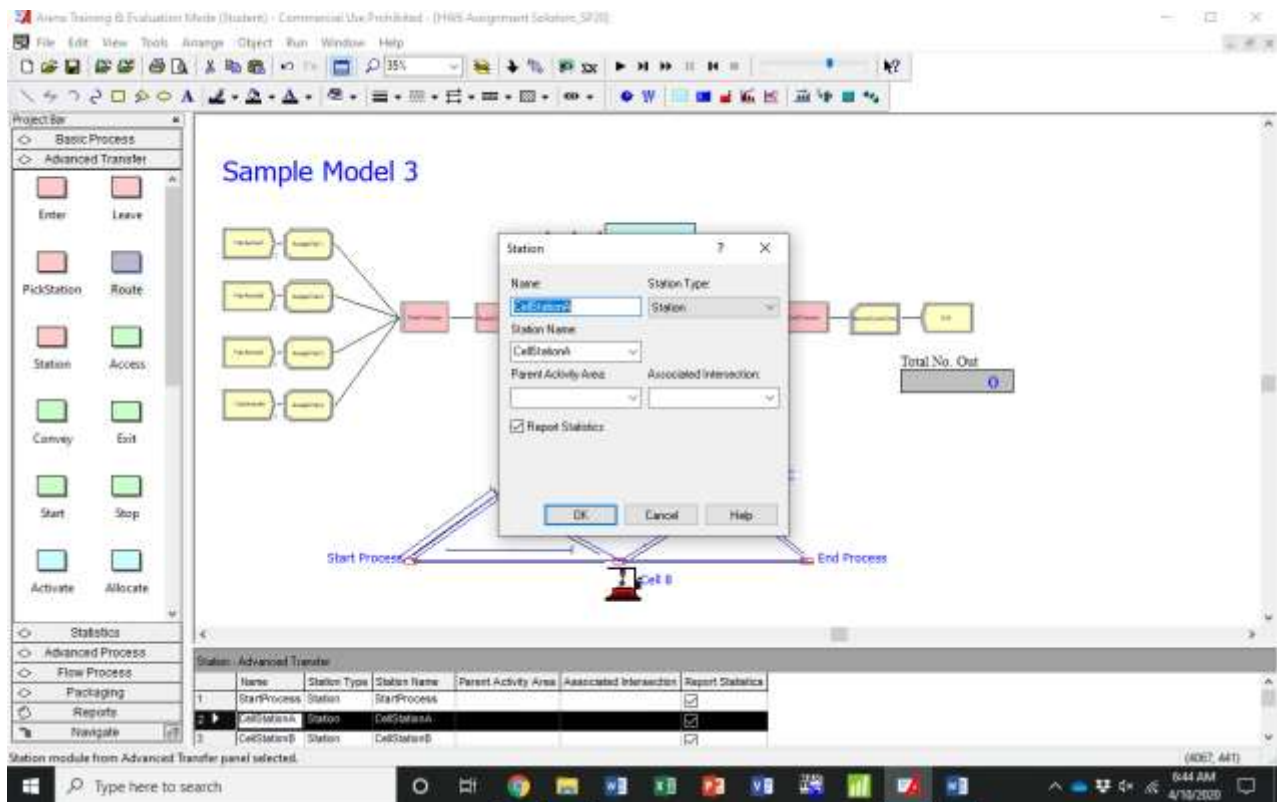


Figure 5.2. Dialog box for the Station module.

Simply enter a descriptive name in the Name field. This will become the label on the face of the Dispose module. The Station Type field offers two options: Station and Set, meaning is the current Station module an individual station or is it part of a set? In the Station Name field, click on the drop-down menu and select the appropriate previously defined Station name that represents the current station. As the analyst adds more Stations in the model, Arena will store the names of all Stations in memory and will display the current list of Stations in appropriate places. Be sure the box marked Report Statistics is checked.

5.1.2 The Route Flowchart Module

The Route module (see Figure 5.3) is used to route, or transfer, an entity from one location to another.

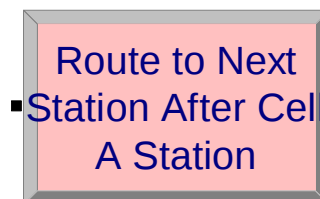


Figure 5.3. Route module.

Double-click it to open a dialog box like the one in Figure 5.4.

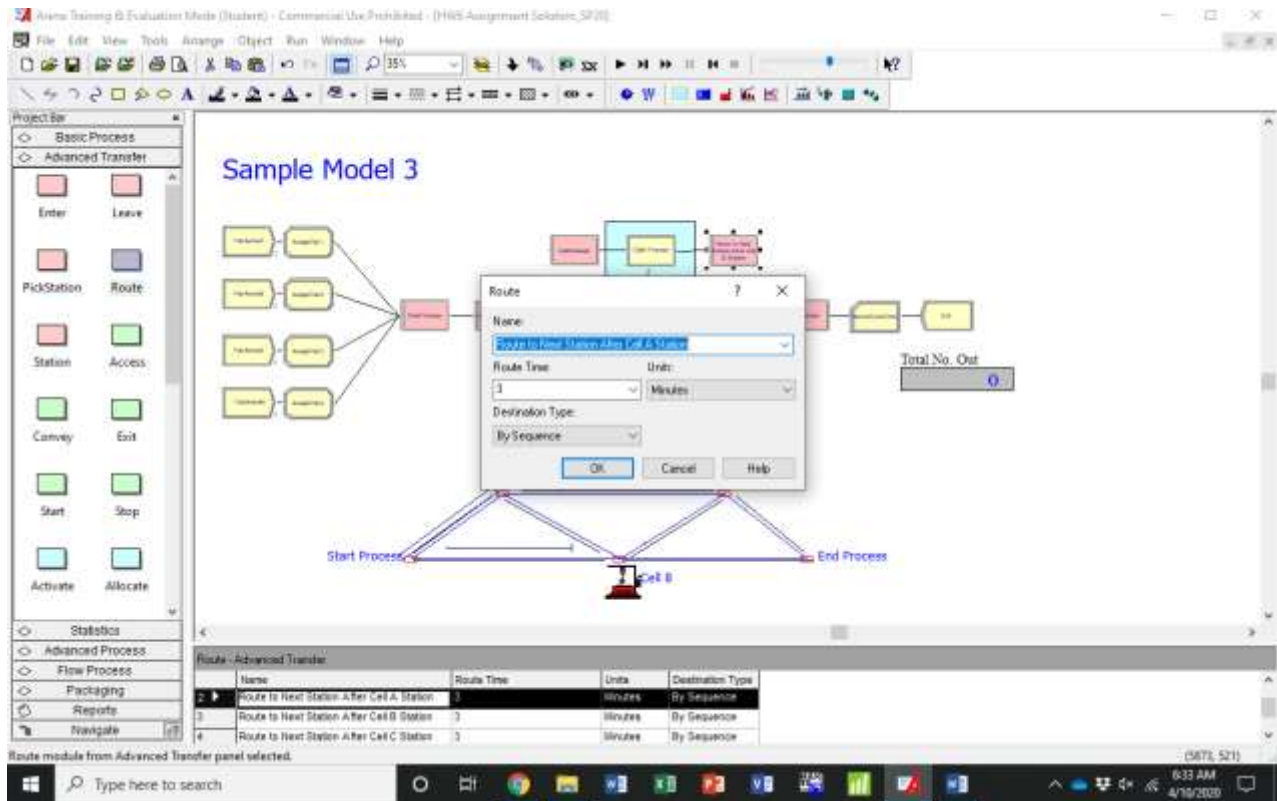


Figure 5.4. Dialog box for the Route module.

The dialog box contains fields for different kinds of information related to this particular module. In the Name field, you would type in a short descriptive name that will become the label for this Route module. In the Route Time field, you would enter a numerical value coupled with a time unit of measurement in the Units field (seconds, minutes, hours, or days) to form the entity route time. In the Destination Type field, there are four options: Station, By Sequence, Attribute, and Expression. (see Figure 5.5). That is, in its next destination, will the entity be routed to a Station, by a Sequence, by an Attribute (in which case the analyst must identify the Attribute), or by an Expression?

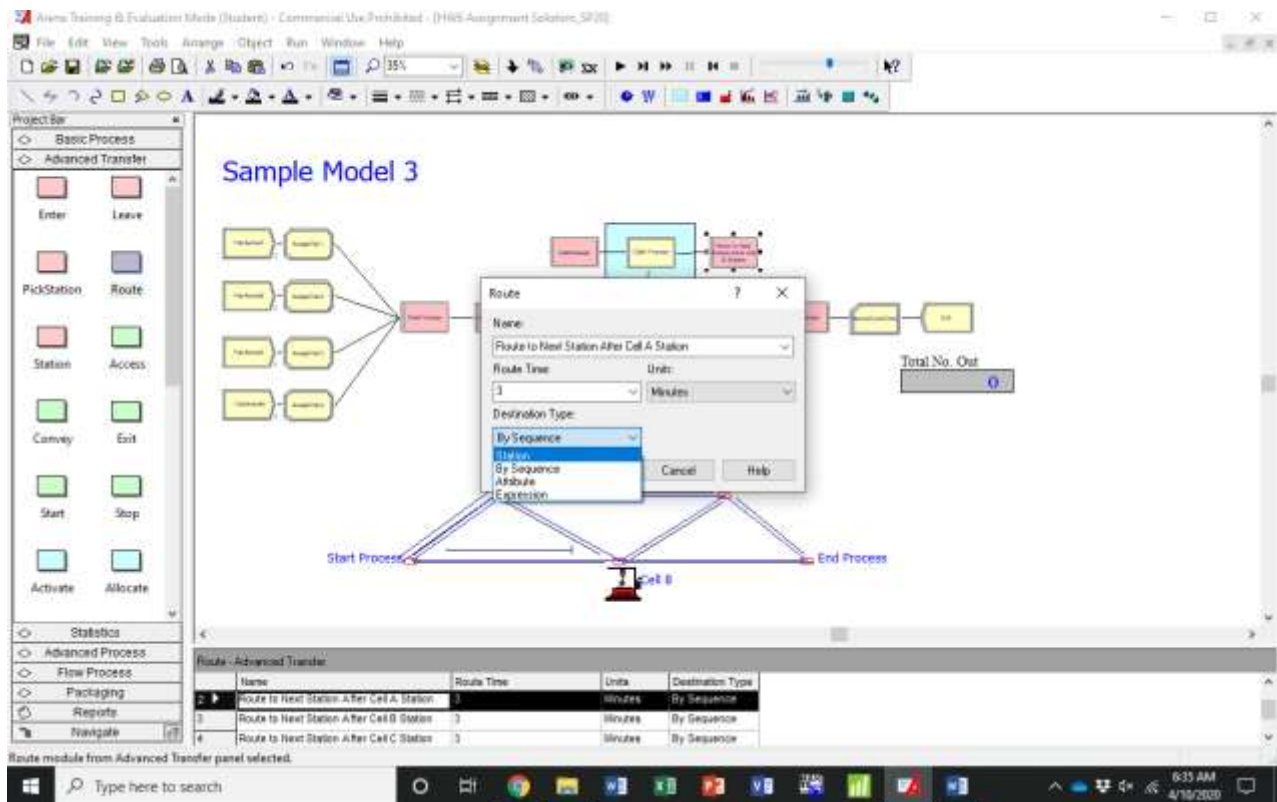


Figure 5.5. The Destination Type drop-down menu in the Route module.

You can select the appropriate distribution and manually enter the parameter values in parentheses to replace the text.

5.1.3 The Access Flowchart Module

Sample Model 4 in Figure 5.6 is used to discuss Modules pertaining to entity transfer, such as a conveyor or forklift that may be used to transport products from one location to another location. The Access, Convey, and Exit modules are used in sequence for material handling equipment, such as conveyors.

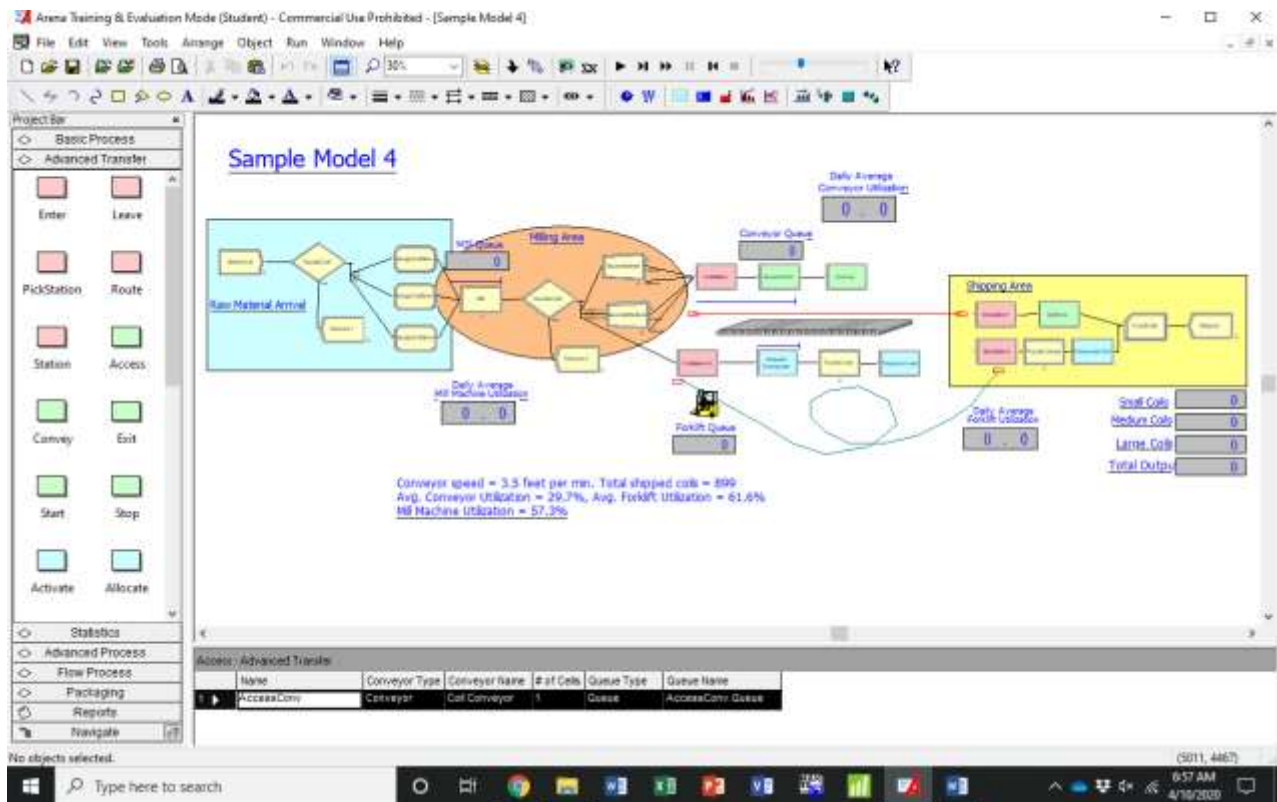


Figure 5.6. Sample Model 4.

The Access module in Figure 5.7 is used to access available space on a conveyor. If the amount of requested space is available, then the product enters the conveyor. Else, the conveyor continues until the amount of space requested becomes available for the product.

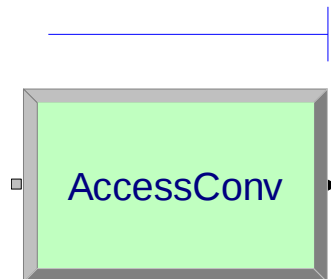


Figure 5.7. The Access module.

Double-click the Access module to open the dialog box (see Figure 5.8).

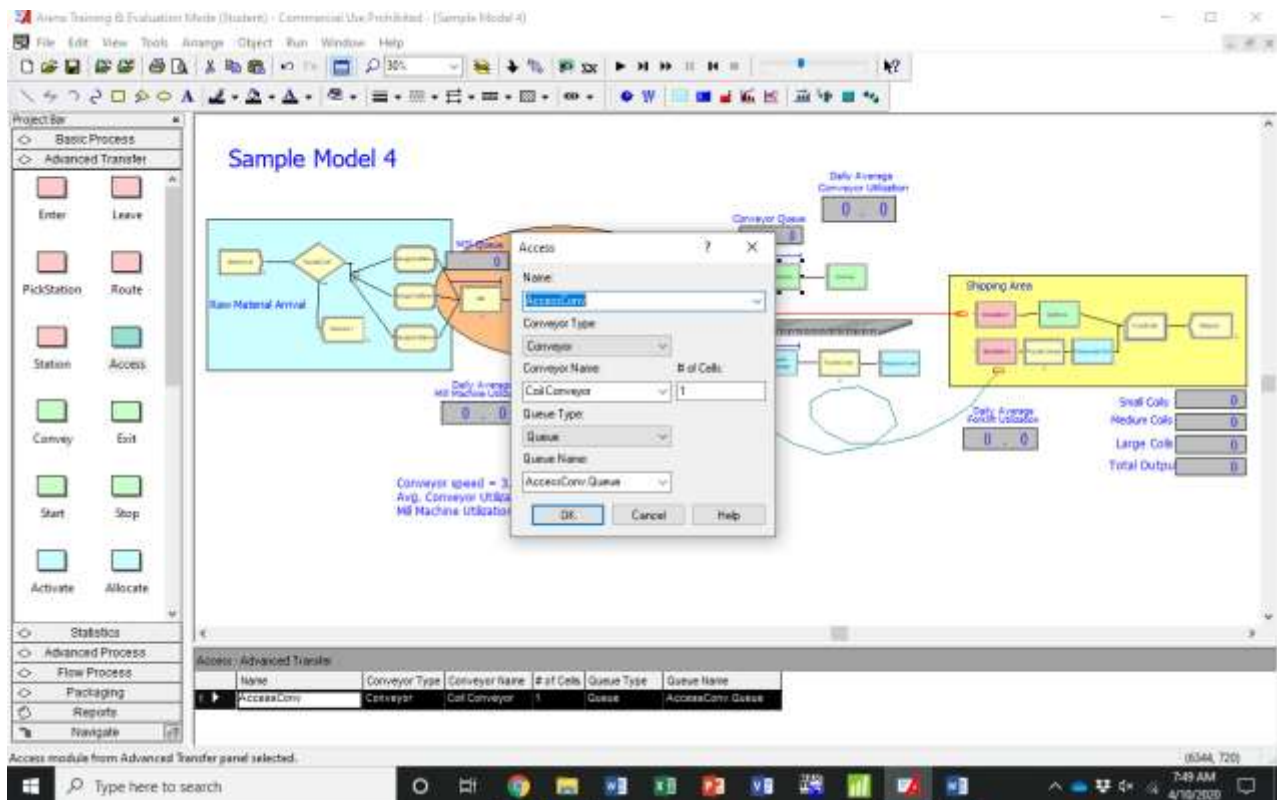


Figure 5.8. Dialog box for the Access module.

In the Name field, enter a descriptive name and this will become the label for this particular Access module. In the Conveyor Type field, we have three options: Conveyor, Attribute, or Expression. Make the appropriate selection. In the Conveyor Name field, enter the name of your conveyor. In the # of Cells field, enter the number of cells you are requesting to occupy on the conveyor. The cell size is defined by the analyst in the Conveyor data module. In the Queue field, make the appropriate selection among the options Queue, Set, Internal, Attribute, or Expression. In the Queue Name field, select the appropriate queue from the drop-down menu.

5.1.4 The Convey Flowchart Module

The Convey module in Figure 5.9 is used to convey the entity from one location to another via the chosen method, such as a conveyor.



Figure 5.9. The Convey module.

Double-click the Convey module to open the dialog box (see Figure 5.10).

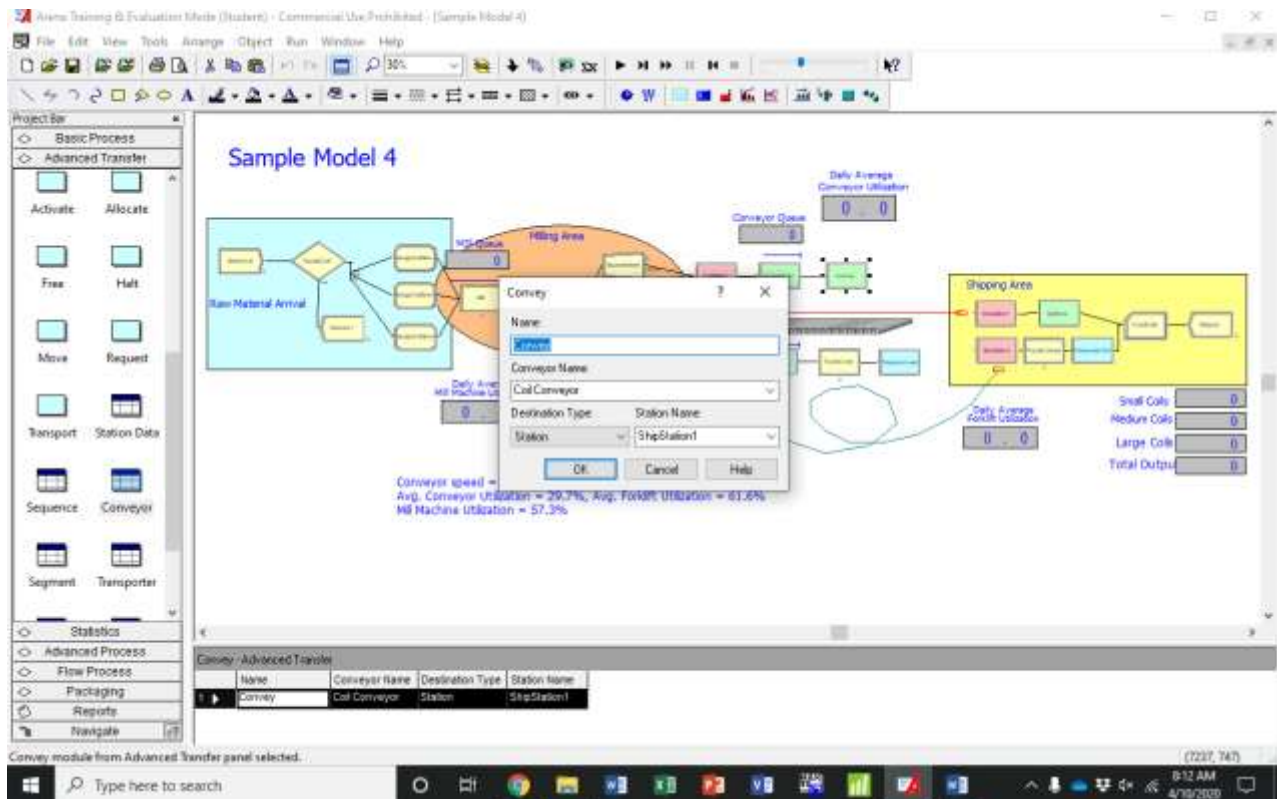


Figure 5.10. Dialog box in the Convey module.

In the Name field, enter a descriptive name and this will become the label for this particular Convey module. Select the appropriate conveyor from the drop-down menu in the Conveyor Name field. The selection would have been defined in an Access module and stored in memory by Arena. In the Destination Type field, select from the options By Sequence, Station, Attribute, or Expression. In the Station Name field, enter the name of a new destination station unless the destination station is already stored in the drop-down menu.

5.1.5 The Exit Flowchart Module

The Exit module in Figure 5.11 is used to exit the conveyor and free up the space once occupied for other entities to occupy.



Figure 5.11. The Exit module.

Double-click the Exit module to open the dialog box (see Figure 5.12).

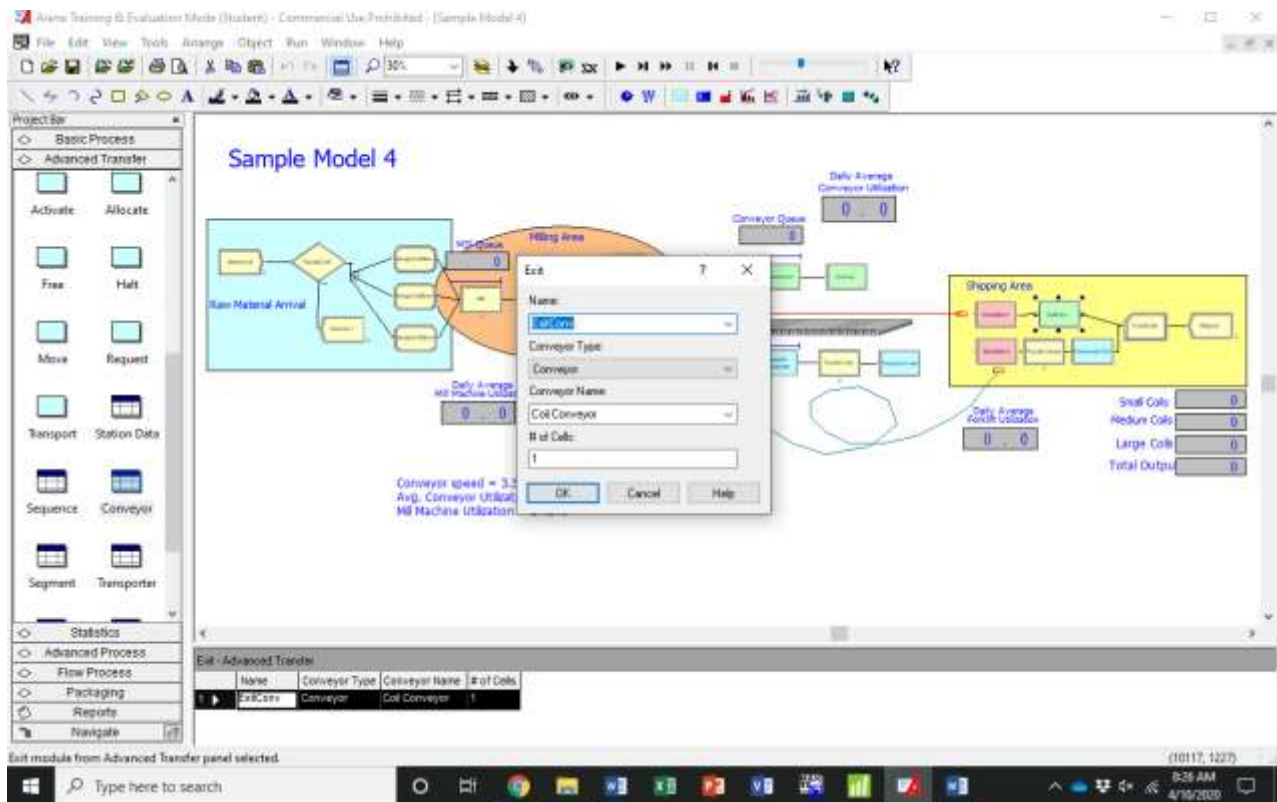


Figure 5.12. Dialog box for the Exit module.

In the Name field, enter a descriptive name and this will become the label for this particular Exit module. In the Conveyor Type field, make the appropriate selection from Conveyor, Attribute, or Expression in the drop-down menu. In the Conveyor Name field, select the conveyor that you want to exit in the drop-down menu. In the # of Cells field, enter the number of cells to be exited that were once occupied. This frees up space on the conveyor for other entities that need to be conveyed.

5.1.6 The Request Flowchart Module

Sample Model 4 in Figure 5.6 is used to discuss Modules pertaining to entity transfer, such as a conveyor or forklift that may be used to transport products from one location to another location. The Request, Transport, and Free modules are used in sequence for material handling equipment, such as forklifts.

The Request module in Figure 5.13 is used to request the availability of a transporter, such as a forklift.



Figure 5.13. The Request module.

Double-click the Request module to open the dialog box (see Figure 5.14).

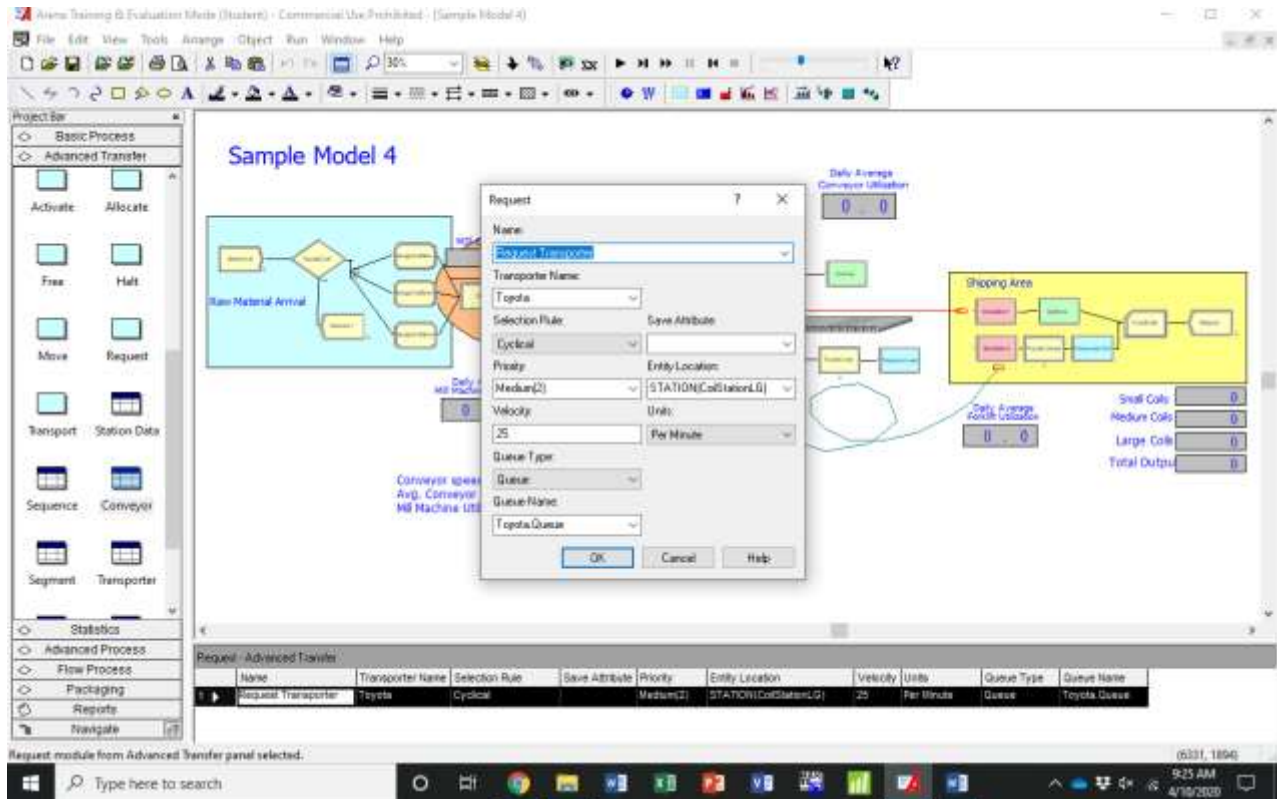


Figure 5.14. Dialog box in the Request module.

In the Name field, enter a descriptive name and this will become the label for this particular Request module. Enter the name of a transporter in the Transporter Name field. This name will be stored in memory by Arena. In the Selection Rule field, there are six options, as shown in Figure 5.15: Cyclical, Random, Preferred Order, Specific Member, Largest Distance, and Smallest Distance.

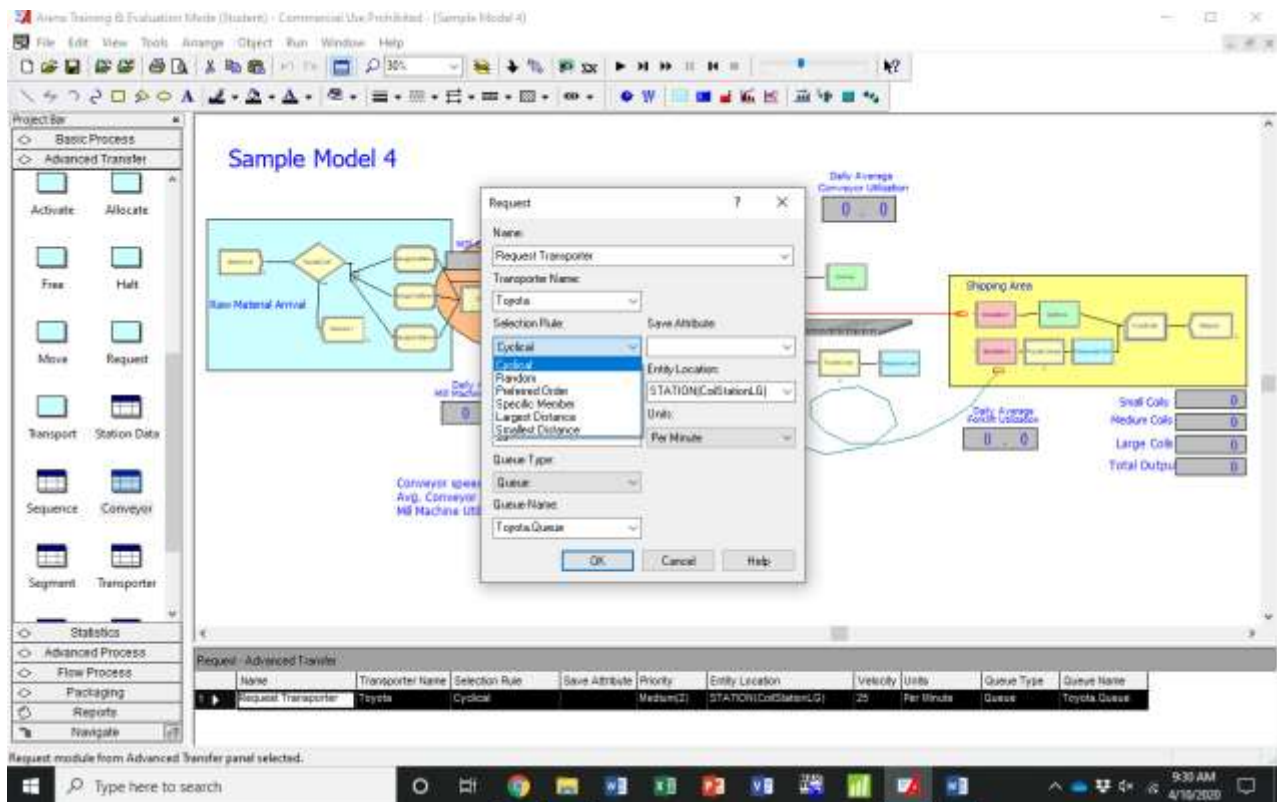


Figure 5.15. Selection Rules in Request module.

Each selection rule is defined below.

Cyclic rule: attempts to cycle through the transporters, thus leveling their utilizations

Preferred Order rule: attempts to always select the available transporter with the lowest number.

Smallest Distance rule: results in an allocation of the cart closest to the requesting entity. A new Attribute, Cart #, is defined and used to save the number of the cart that was allocated. Also select the Transport option for the Connect Type.

Largest Distance rule: results in an allocation of the cart farthest from the requesting entity. A new Attribute, Cart #, is defined and used to save the number of the cart that was allocated. Also select the Transport option for the Connect Type.

Random rule: attempts to select any available transporter at random.

Specific Member rule: attempts to select a transporter by specific name.

In the Priority field, select the appropriate Priority Rule from among High(1), Medium(2), and Low(1). In the Entity Location field, select STATION(StationID) for the current station location of the entity. Be sure to replace StationID with the name of the current station. In the Velocity field, enter a numerical value (in feet) to represent how fast the transporter moves along the path. In the Units field, select from Per Second, Per Minute, Per Hour, or Per Day. The Velocity and Units field are matched to represent the velocity per unit of time (i.e., 25 feet per minute). In the Queue Type field, select from Queue, Set, Internal, Attribute, or Expression. In the Queue Name field, select the appropriate transporter queue from the drop-down menu.

5.1.6 The Transport Flowchart Module

The Transport module in Figure 5.16 is used to transport an entity from one location to another.

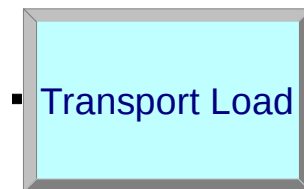


Figure 5.16. The Transport module.

Double-click the Transport module to open the dialog box (see Figure 5.17).

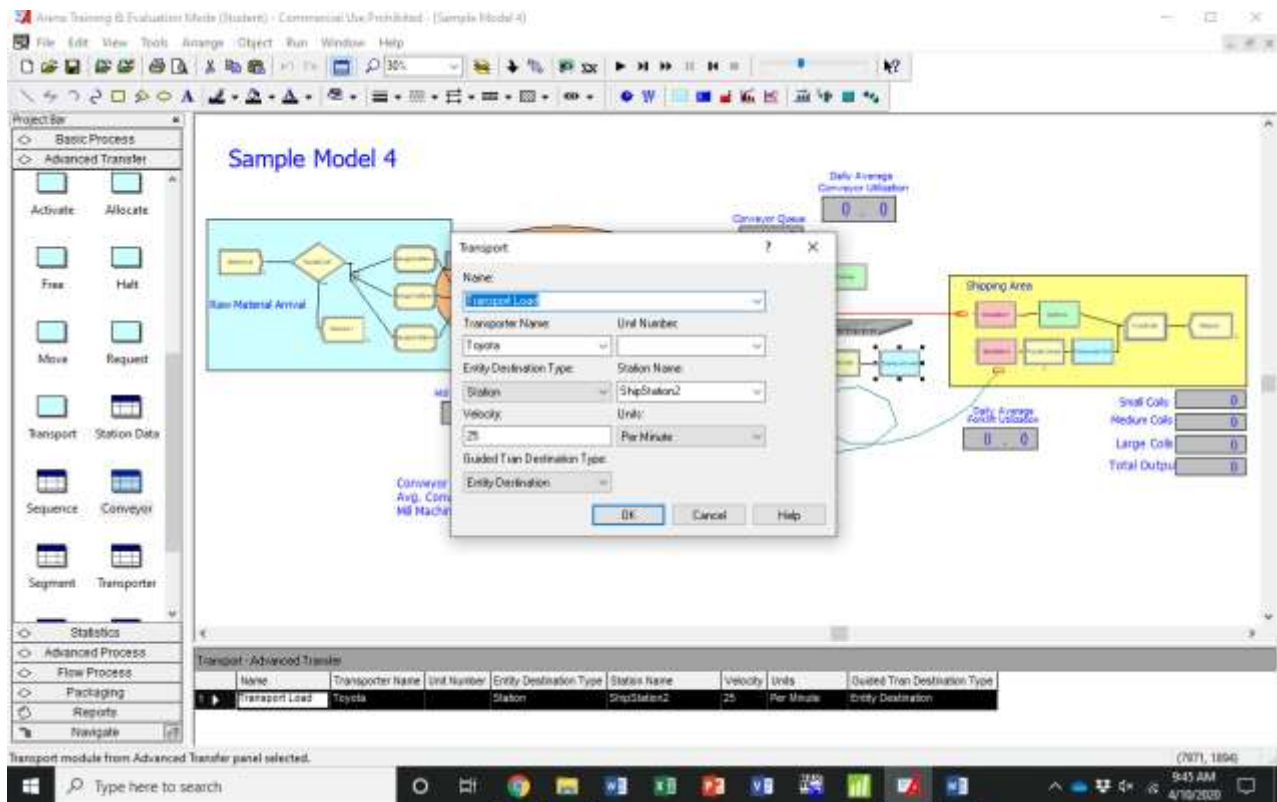


Figure 5.17. Dialog box for the Transport module.

In the Name field, enter a descriptive name and this will become the label for this particular Transport module. In the Transporter Name field, select the appropriate transporter from the drop-down menu. All transporters that appear in the drop-down menu were previously defined in a Request module. In the Unit Number field, make the appropriate selection if a transporter is identified by a unit number. In the Entity Destination Type field, select the entity's next destination type from the options in the drop-down menu: By Sequence, Station, Attribute, or Expression. In the Station Name field, enter the name of the next destination. This will be stored in memory in Arena. In the Velocity and Units fields, enter the speed of the transporter and then select the time units of measurement from the drop-down menu. In the Guided Tran Destination Type field, select Entity Destination from among the many options.

5.1.7 The Free Flowchart Module

The Free module in Figure 5.18 is used to free up a transporter so that it can continue making the rounds in the system.



Figure 5.18. The Exit module.

Double-click the Exit module to open the dialog box (see Figure 5.19).

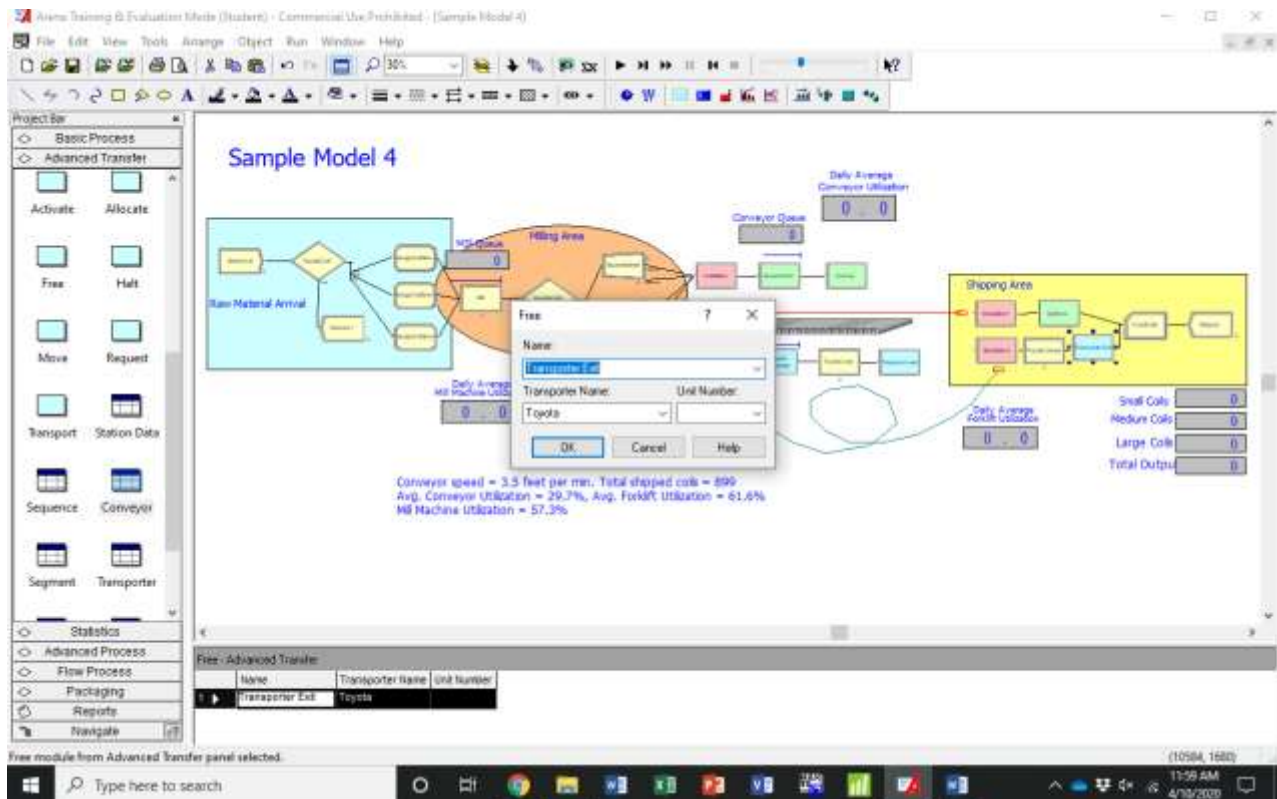


Figure 5.19. Dialog box for Free module.

In the Name field, enter a descriptive name and this will become the label for this particular Exit module. In the Transporter Name field, select the particular transporter you want to free up from the drop-down menu, including the unit number, if applicable.

5.2 Data Modules

Data modules define the characteristics of various process elements, such as entities, resources, and queues. They can also be used to set up variables and other types of numerical values and expressions that pertain to the entire model. The icons for data modules look like small spreadsheets in the Project Bar below the Modules section.

Data modules that we will use in this course for the Advanced Transfer panel include Station Data, Sequence, Conveyor, Segment, Transporter, and Distance. Other panels contain different sets of data modules. Data modules exist “behind the scenes” and define different kinds of values, expressions, and conditions. To edit a data module, click on it in the Project Bar and it will automatically appear in the Spreadsheet view of the Model Window, below the Flowchart view. If the Flowchart view takes up the entire Model Window, move your cursor down to “grab” the top of the spreadsheet view and pull it up into view. Unlike Modules that may be used more than once in the Flowchart, there is only one of each type of data module in every model. Within each data module, however, there may be any number of rows that correspond to what is included in the model for that type of data module.

Flowchart and data modules in the model are related by the names for objects that they have in common, for example, queues, resources, entity types, and variables. Arena stores in memory the names of objects the analyst defines and then presents these names in a drop-down menu in the appropriate places in the flowchart and data modules. This helps the analyst to remember what you’ve named things and maintains consistency in the model development.

5.2.1 Station Data Data Module

We will use Sample Model 5 in Figure 5.20 to discuss the data modules in the Advanced Transfer panel.

By clicking on the Station Data data module in the Project Bar, the Station Data spreadsheet opens up at the bottom of the Model Window, as shown in Figure 5.20.

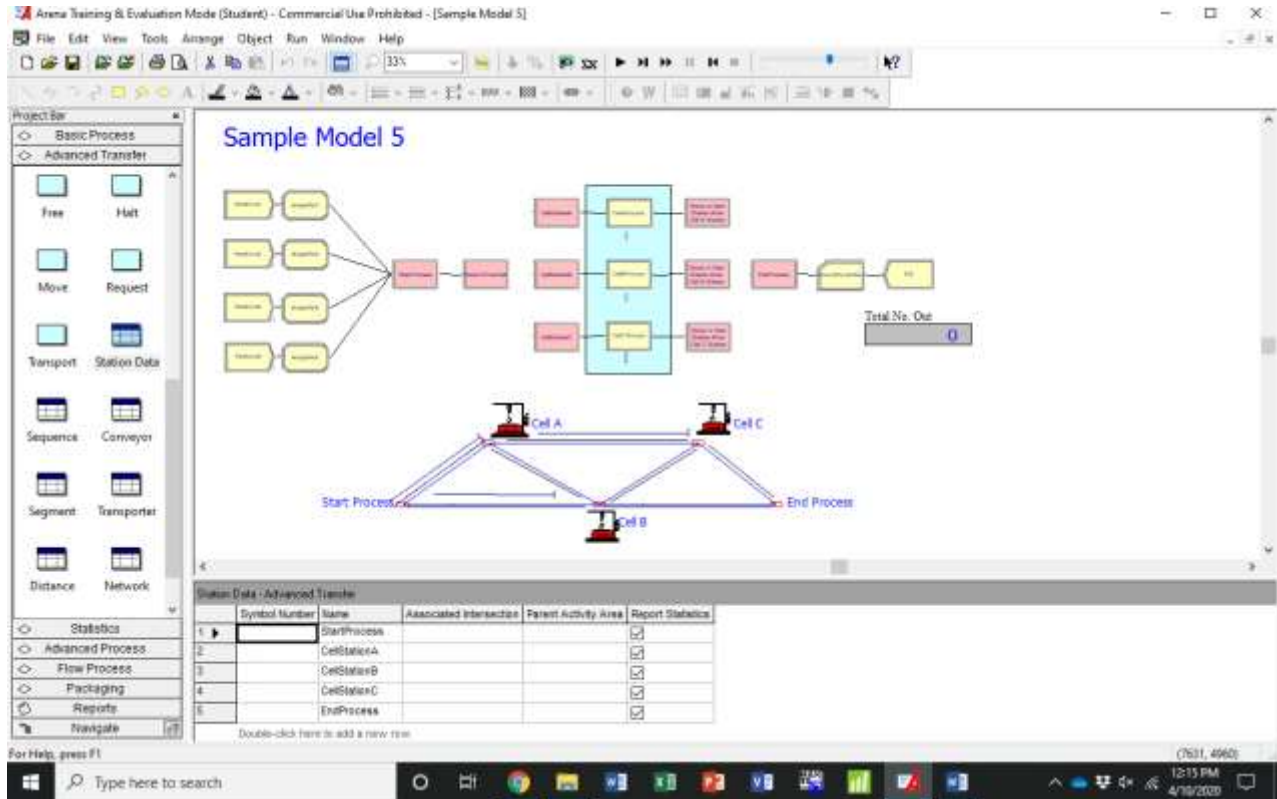


Figure 5.20. Spreadsheet view of the Station Data data module.

In this example, we observe five rows in the Station Data data module, one for each Station module that is included in the Flowchart view.

5.2.2 Sequence Data Module

By clicking on the Sequence data module in the Project Bar, the Sequence spreadsheet opens up at the bottom of the Model Window, as shown in Figure 5.21.

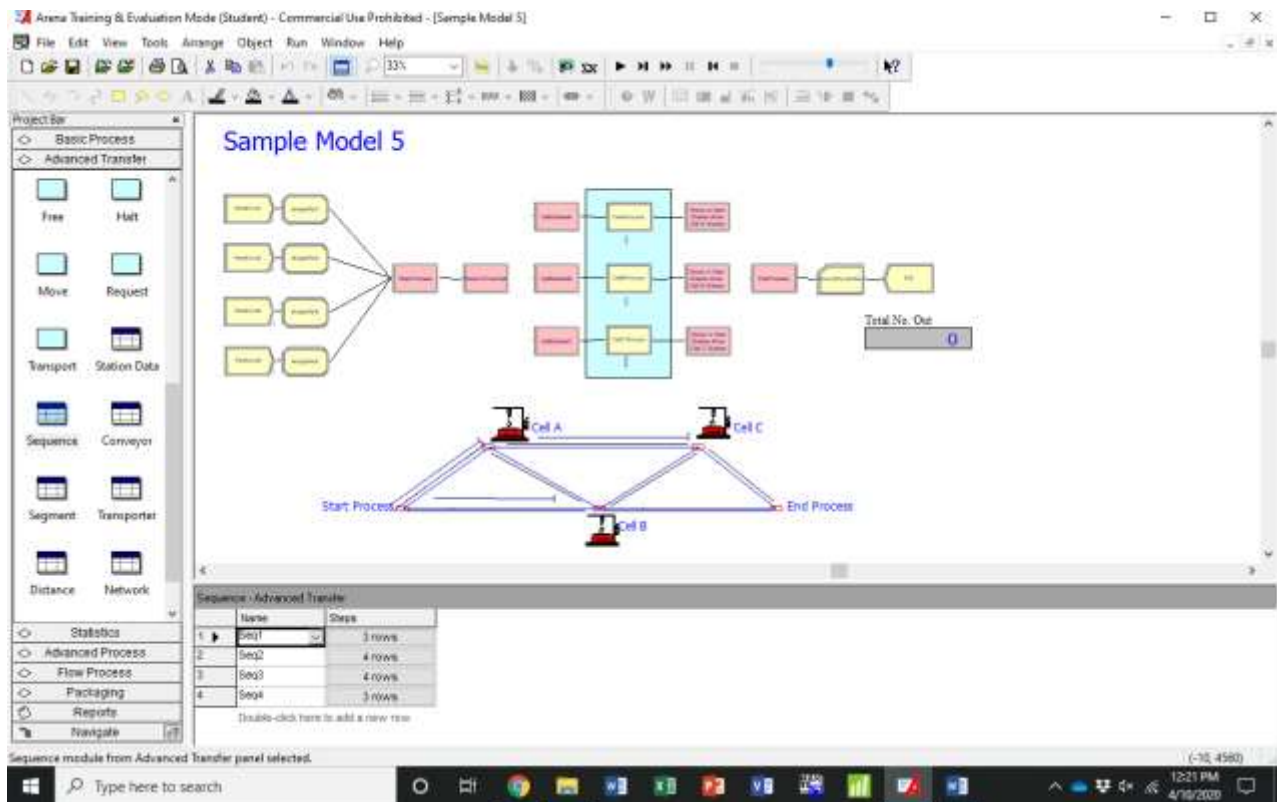


Figure 5.21. Spreadsheet view of the Sequence data module.

In the Name field, the Sequence data module displays the different sequences involved in the parts processing system. The Steps column further defines the particular sequence each part will follow (see Figure 5.22).

Double-click to add a new row for each sequence. Double-click the Steps column to add Steps (or the actual sequence that each part will follow as well as their respective processing times), also shown in Figure 5.22.

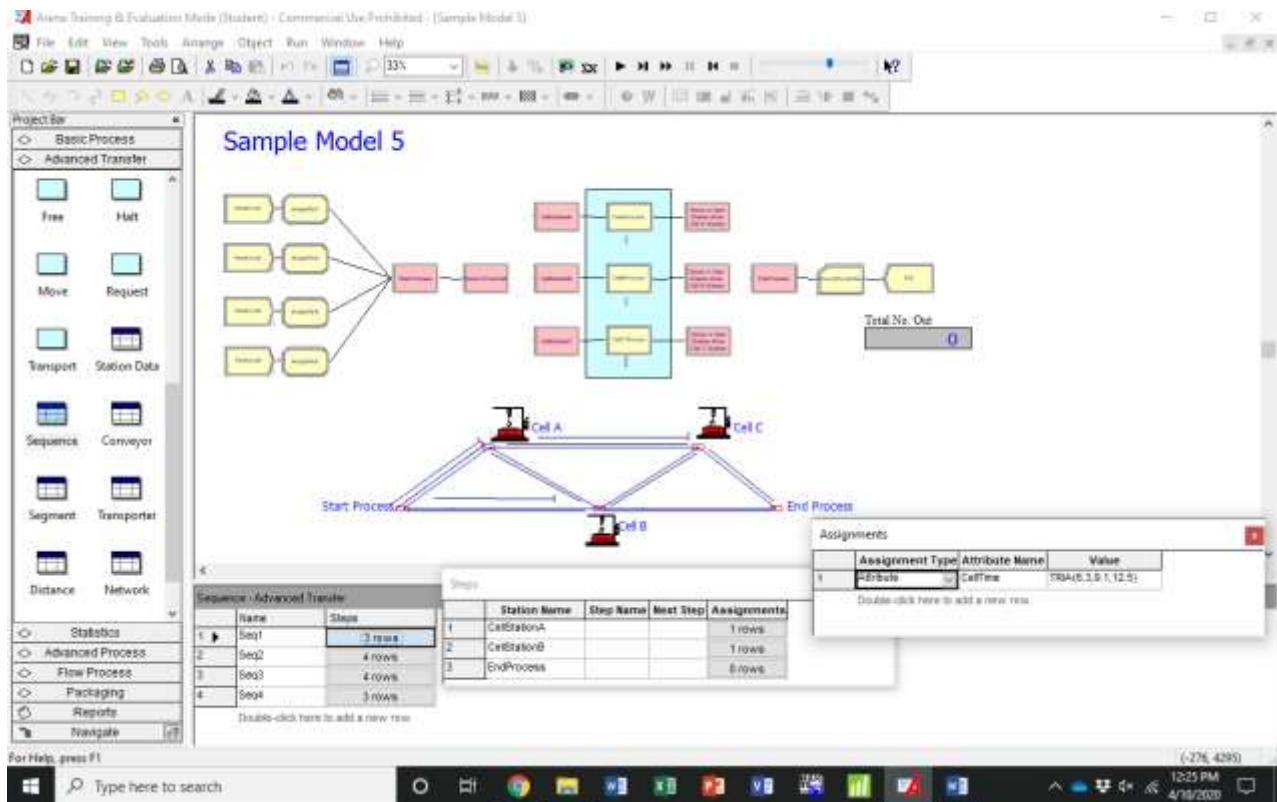


Figure 5.22. The Steps and Assignments columns in the Sequence data module.

In the Sample Model 5 example, we can define the Steps (or sequence) that each part follows. For example, Part 1 will follow the Sequence of CellStationA, then CellStationB, then EndProcess. Within each station, the analyst can define the processing time for the part in the Assignments column. For example, for CellStationA (for Part 1), the processing time follows the Attribute named CellTime and the processing time will follow a Triangular distribution with parameter times of a minimum of 6.3 minutes, a most likely processing time of 9.1 minutes, and a maximum time of 12.5 minutes). The analyst will perform this sequence of steps by defining the assignment times for each part by the sequence in which each part follows. An important, but easy to forget, point is to remember to conclude each sequence in the Steps column with a row named EndProcess. This signals to Arena the end of a sequence for a given part. Of course, the analyst would need to add the EndProcess Station in the Flowchart view prior to defining the sequence of each part.

5.2.3 Conveyor Data Module

We return to Sample Model 4 to discuss the data modules for Conveyor, Segment, Transport, and Distance in the Advanced Transfer panel.

By clicking on the Conveyor data module in the Project Bar, the Queue spreadsheet opens up at the bottom of the Model Window, as shown in Figure 5.23.

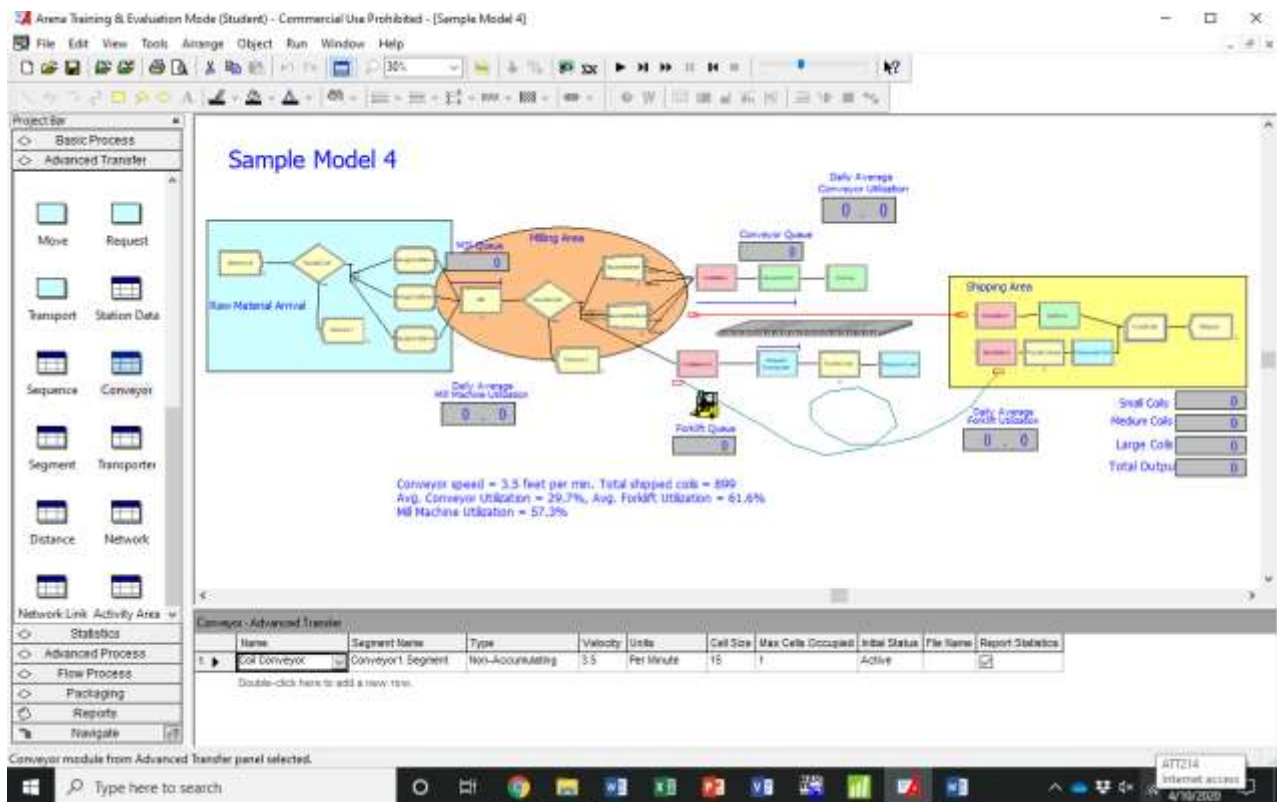


Figure 5.23. Spreadsheet view of the Conveyor data module.

The Name column displays the unique name of the conveyor entered in the Access module in the Flowchart view. The Segment Name shows the name of the first conveyor followed by a .Segment. If additional conveyors are added in the model, then the drop-down menu in the Segment Name column will show all conveyors in the order that they were added followed by a .Segment. In the Type column, a drop-down menu will display both Accumulating and Non-Accumulating options. With an Accumulating conveyor, entities will “bunch up” on the conveyor if not removed in a timely manner, much like luggage will accumulate in a cul-de-sac area at an airport baggage claim area if not retrieved by their owners in a timely manner. With a Non-Accumulating conveyor, the conveyor continues to go round and around, carrying entities (or luggage), but never accumulate if not retrieved by their owners in a timely manner. The analyst will select the appropriate option. The analyst will enter the Velocity and select the time unit of measurement in the Velocity and Units columns. The numerical value in the Velocity column represent the speed (in feet) that the conveyor travels. The Units column provides four options in the drop-down menu: Per Second, Per Minute, Per Hour, and Per Day. The analyst manually enters

a numerical value representing cubic feet to define the cell size occupied in the Cell Size column. The analyst will also enter a value for the Max Cells Occupied column. This value should correspond to the value entered in the Access module in order to free up the cell(s) once occupied. The Initial Status column drop-down menu provides options for Active and Inactive. Make the appropriate selection.

5.2.4 Segment Data Module

By clicking on the Segment data module in the Project Bar, the Segment spreadsheet opens up at the bottom of the Model Window, as shown in Figure 5.24.

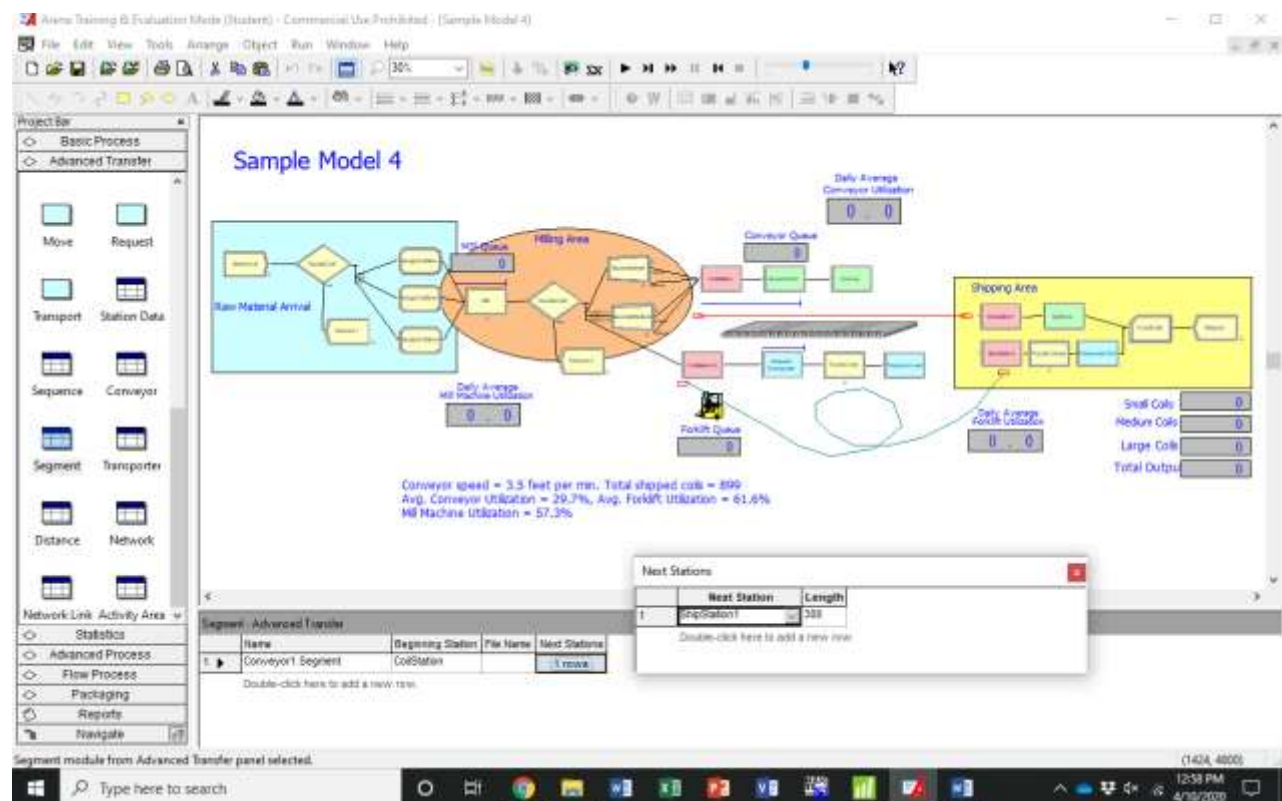


Figure 5.24. The Segment data module.

By clicking on the Segment data module, the Spreadsheet view displays rows for each Segment in the model. The Name column displays all Segments included in the model by row. The Beginning column shows the beginning station for each segment. The Next Stations column shows the next destination station by making the appropriate selection from the drop-down menu. The analyst will manually enter the length of the conveyor (in one direction) in the Length column.

5.2.5 Transporter Data Module

By clicking on the Transporter data module in the Project Bar, the Transporter spreadsheet opens up at the bottom of the Model Window, as shown in Figure 5.25.

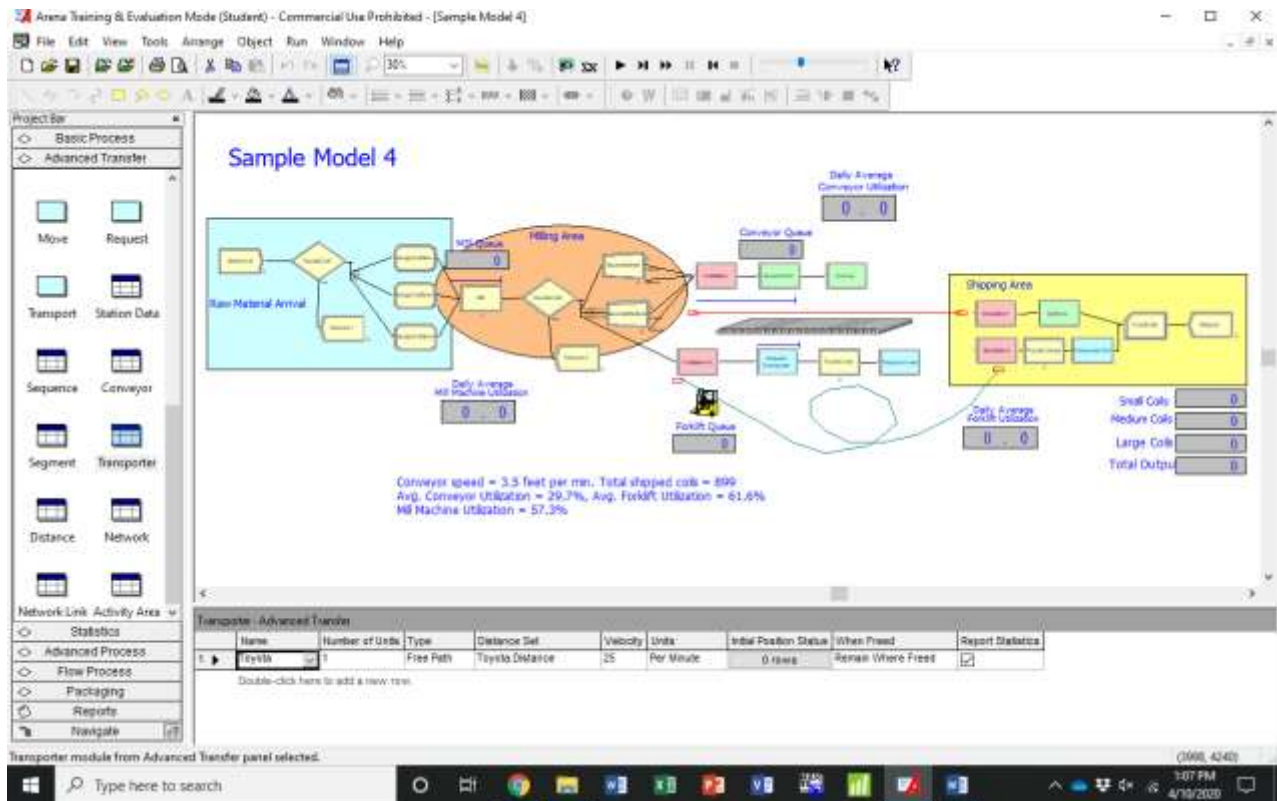


Figure 5.25. The Transporter data module.

By clicking on the Transporter data module, the Spreadsheet view displays rows for each transporter in the model. The Name column displays all transporters included in the model by row. In the Number of Units column, the Default value is one unit in each row; however, the analyst can manually change this number to any number desired. The Type column has a drop-down menu consisting to two options: Free Path and Guided Path. The Free Path option means that the transporter may travel freely in any direction desired. The Guided Path option means that the transporter must follow a guided path, much like a guided track system. Make the appropriate selection. The Distance Set column shows the transporter name followed by a .Distance for each row. The Velocity and Units columns work in conjunction to represent the speed of the transporter (in feet) per time unit of measurement (Per Second, Per Minute, Per Hour, or Per Day). The analyst will manually enter the velocity and then make the appropriate selection in the Units column. The analyst may elect to define an Initial Position Status by double-clicking in this column to add an initial status of the transporter or to simply do nothing.

5.2.6 Distance Data Module

By clicking on the Distance data module in the Project Bar, the Distance spreadsheet opens up at the bottom of the Model Window, as shown in Figure 5.26.

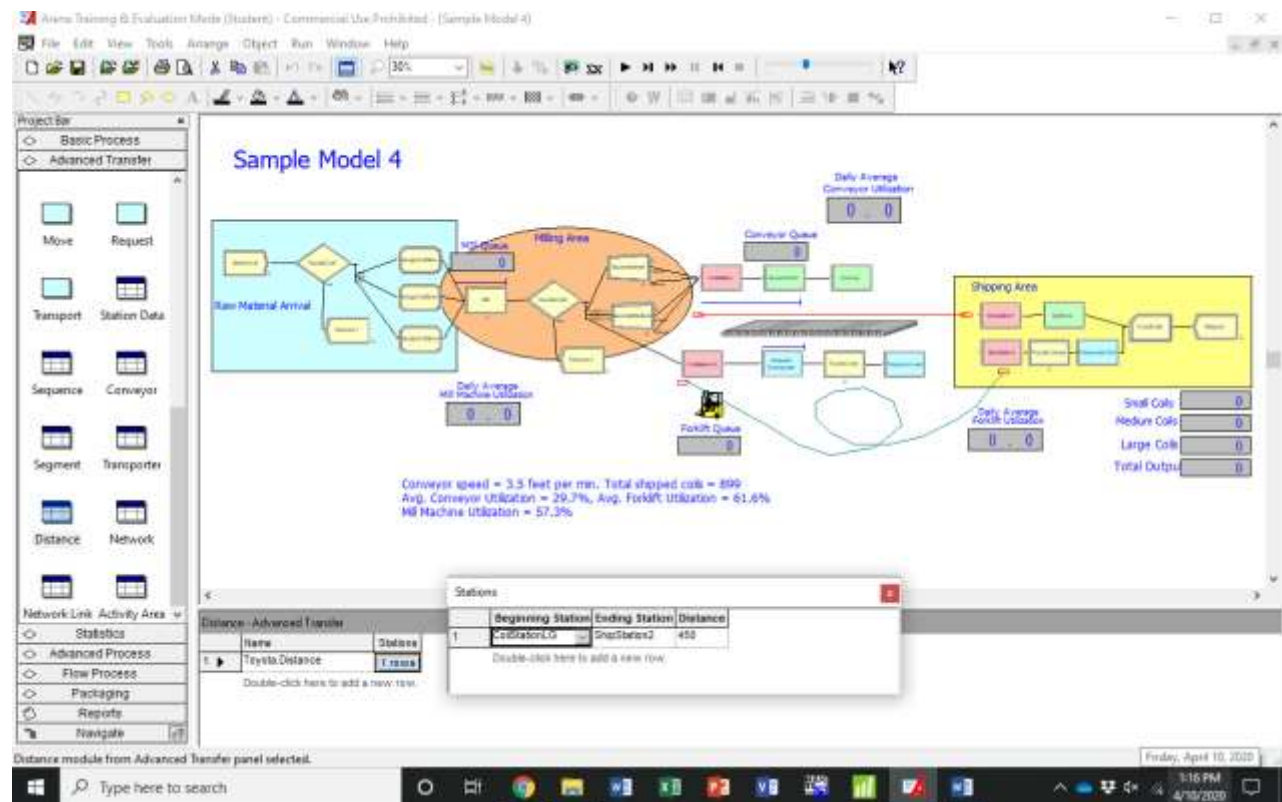


Figure 5.26. The Distance data module.

By clicking on the Distance data module, the Spreadsheet view displays rows for each type of distance traveled in the model. The Name column displays all Distances included in the model by row. Click on the Stations column in each row to define the beginning and end stations. Both beginning and end stations should be selected from their respective drop-down menu options as these stations were previously defined in the Flowchart view. The analyst will manually enter a numerical value in the Distance column to represent the distance that the transporter must travel in one direction from one location to another.