Getting Started with the ArcGIS Predictive Analysis Add-In

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ArcGIS Predictive Analysis Add-In

At 10.1, the ArcGIS Predictive Analysis Add-In provides a set of tools for rapidly generating predictions based on multiple sets of raster data. The Add-In allows you to manually build a query, load a query built by a colleague, or derive a new query from a set of historic observations. The Add-In supports building complex queries and speed models over multiple single-band rasters. These capabilities will help you rapidly extract information from multiple rasters and easily explore and share scenarios based on different queries. You can also use the add in to create time- and distance-from rasters, estimate cross-country travel time, generate time-enabled paths, and play back paths over time.

Getting Started

The ArcGIS Predictive Analysis Add-In is designed to rapidly create queries from input rasters and constraints on their values to predict probable locations of stationary and moving targets. The Add-In consists of the Query Editor tool and the Speed Model builder, for building queries and cross country speed models; the Query Factor Impact Table tool (Q-Fit) for creating queries to match a set of observations; the SPOT tool, which allows for further analysis of the query outputs; as well as tools for creating time-from and distance-from rasters, for finding shortest routes, for measuring speed, and for playing back time-enabled paths.

The ArcGIS Predictive Analysis documentation will help you learn to use the Add-In to build, modify, and share queries.

About the documentation

This documentation contains chapters to help guide you through installing the Add-In and building queries. Before you begin using the Add-In, review the following sections:

- Contents
- Release notes
- Hardware and software requirements
- Installing the template

Once you have installed the Add-In, review the following sections to learn how to use the Predictive Analysis tools:

- Using the ArcGIS Predictive Analysis Add-In
- Building Queries
- Building Speed Models
- Time From and Distance From
- Managing Sources and Obstacles
- Building a Query Based on Known Locations
- Investigating Query Output
- Measuring Distance and Speed
- Finding the Shortest Path
- Working with the Time Analysis Window
- Conclusion

Hardware and software requirements

Hardware requirements

Hardware requirements for this Add-In are the same as those for ArcGIS Desktop 10.1 which you can review at http://resources.arcgis.com/en/help/system-requirements/10.1/#/ArcGIS_10_1_for_Desktop/015100000002000000/.

Software requirements

- ArcGIS Desktop 10.1 or higher must be installed. For a list of ArcGIS Desktop software requirements and operating system limitations, see ArcGIS Desktop System Requirements at http://resources.arcgis.com/en/help/system-requirements/10.1/#/ArcGIS_10_1_for_Desktop/015100000002000000/.
- You must have an ArcGIS Desktop license (any level).
- You must have an ArcGIS Spatial Analyst license.
- You must have the ArcGIS Predictive Analyis Add-In. The ArcGIS Predictive Analyis Add-In is now available as a download from the ArcGIS for Defense and Intelligence group on ArcGIS Online (http://www.arcgis.com).
- You must have installed an extraction utility, such as 7-Zip. You can download 7-Zip for free at http://www.7-zip.org/
- Adobe Reader 5.0 or greater must be installed in order to view the documentation. You can download this reader for free at http://get.adobe.com/reader.

Release notes

Please provide feedback and suggestions on this Add-In by making a comment on the discussion forum or the comments section for the Add-In on ArcGIS.com.

Installing the ArcGIS Predictive Analysis Add-In

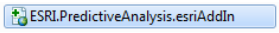
Installing the ArcGIS Predictive Analysis Add-In

The simplest way to add the ArcGIS Predictive Analysis Add-In is to use the Add-In handler.

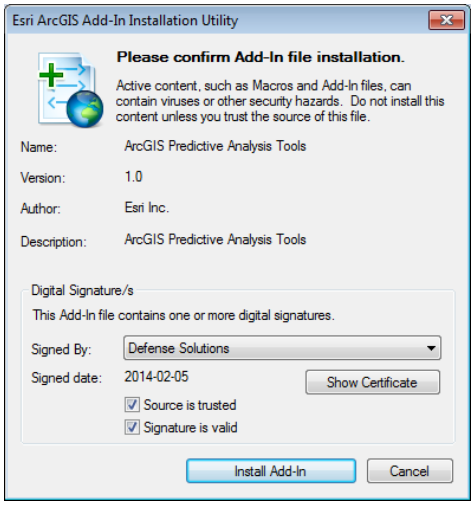
To install using the Add-In handler:

Steps:

1. In the Windows file manager, navigate to the location where you downloaded the zip file package containing the Add-In.
2. Unzip the package.
3. **Double-click** the Add-In file, named "ESRI.PredictiveAnalysis.esriAddIn".

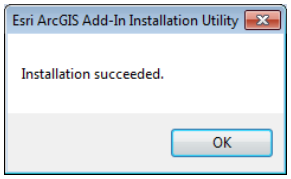


4. Click the **Install Add-In** button to confirm the file installation. The utility copies the Add-In file to your default ArcGIS Add-In folder.



Note: The default Add-In folder is located in the ArcGIS folder within the user account. For example, for someone using ArcGIS version 10.1 on a Vista or Windows 7 machine, the Add-In is copied to the following location: C:\Users\<username>\Documents\ArcGIS\AddIns\Desktop10.1.

5. Click **OK**.

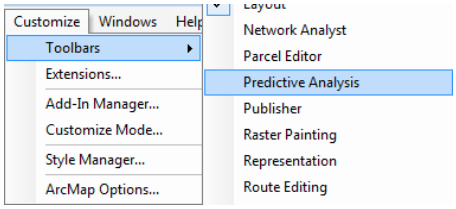


Add the ArcGIS Predictive Analysis Toolbar to ArcMap

The ArcGIS Predictive Analysis Add-In provides a toolbar for doing predictive analysis, building speed models, and working with raster queries in ArcMap. If it is not visible, add the toolbar to ArcMap. To do so:

Steps:

1. Open ArcMap.
2. In ArcMap, click **Customize** and point to **Toolbars**. Click **Predictive Analysis** to show the toolbar.



Note: The toolbar can be hidden by un-checking it.

3. Optionally, dock the **Predictive Analysis** toolbar to the ArcMap window.

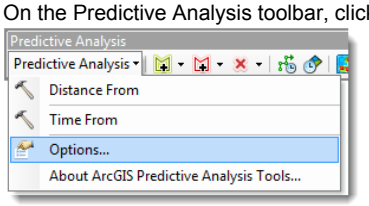
Using the ArcGIS Predictive Analysis Add-In

Set the working folder

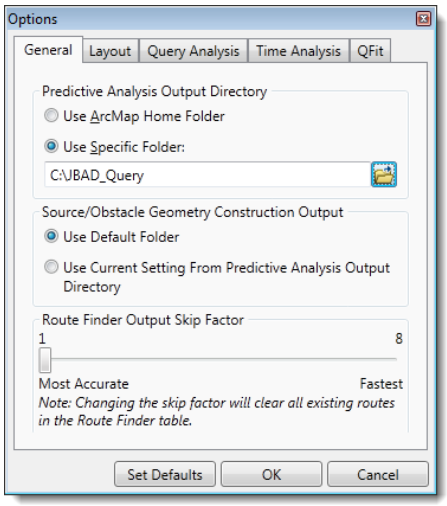
You can set the ArcGIS Predictive Analysis working folder, where queries will be saved.

Steps:

1. On the Predictive Analysis toolbar, click **Predictive Analysis** then click **Options**.



The **Options** dialog box opens.



You can use your ArcMap Home Folder (the default), or specify a folder to use.

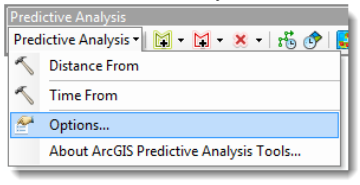
2. Click **Use Specific Folder**.
3. Navigate to the folder on your system. In this example the folder is C:\JBAD_Query.
4. Click **OK**.

Set the Output Layer Symbology

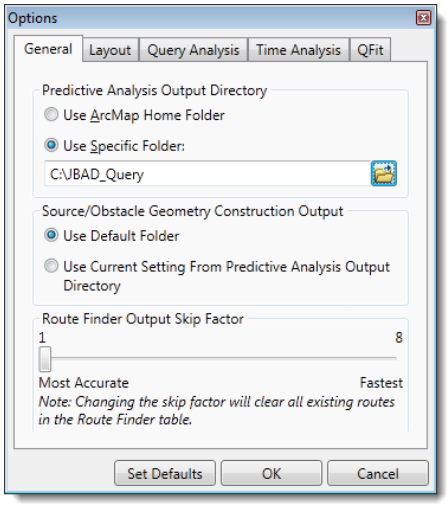
Predictive Analysis output layers have a default symbology which uses green to represent high values, red to represent low values, and transparent (no color) for results of "0". You can change the default symbology.

Steps:

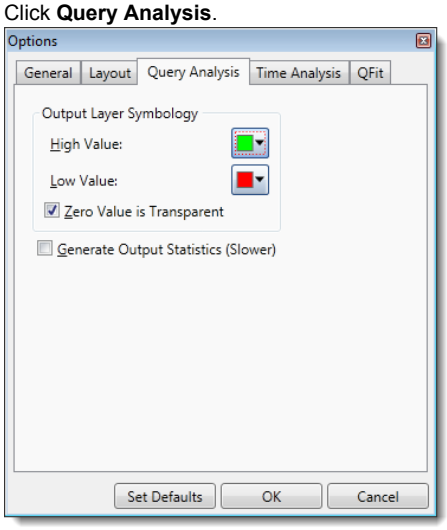
1. On the Predictive Analysis toolbar, click **Predictive Analysis** then click **Options**.



The **Options** dialog box opens.



2. Click **Query Analysis**.



3. Click one of the color patches to change the output color.
4. Optionally, uncheck **Zero Value is Transparent**.
5. Optionally, check **Generate Output Statistics**. This calculates raster statistics for the output results layers, but slows the production of results.
6. Click **OK**.

Building Queries

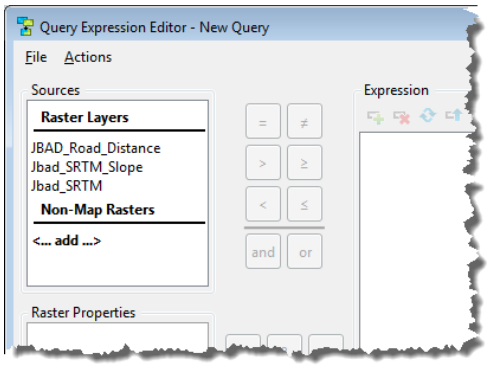
Open the Query Editor

The **Query Expression Editor** window lets you build queries on single-band rasters in your map.

Steps:

1. Click the **Query Editor** button.

The **Query Expression Editor** opens.



Build a simple query expression

To build a simple query, you need to select a raster in the **Sources** box, choose an operator, and then set a constraint.

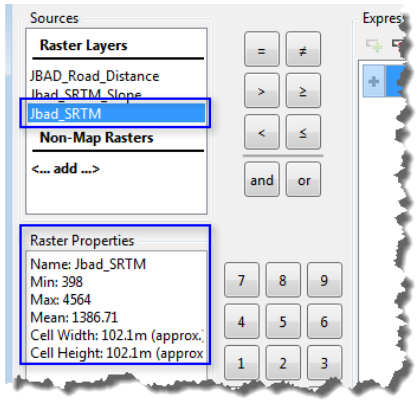
You can drag data sources to the Expression window from the Catalog or the Table of Contents to start a new clause. If you drag a data source that isn't on the map it will be added to the Non-Map Rasters category in the Sources list.

Steps:

1. Open the **Query Expression Editor** (click the **Query Editor** button).

2. Double-click one of the rasters listed in the **Sources** box. In this example, it is the Jbad_SRTM raster.

Sources



You can see some properties of the selected raster in the **Raster Properties** box. These include:

- the layer Name
- the Min and Max values
- the Mean value

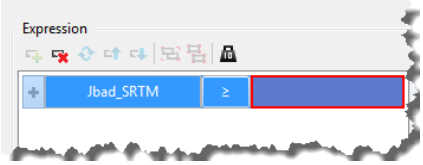
- the raster cell dimensions and units.

Note: A raster dataset's properties will only display if it has had statistics calculated.

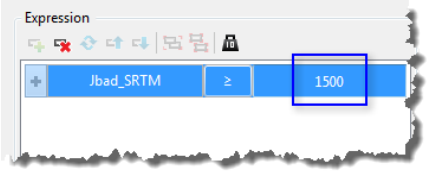
The raster is added to the Expression box. The expression is still incomplete - it needs an operator and a constraint (those boxes are highlighted in red).

3. Click one of the operators listed beside the **Expression** box. In this example, it is the Greater Than or Equal To sign.

The operator is added to the expression.



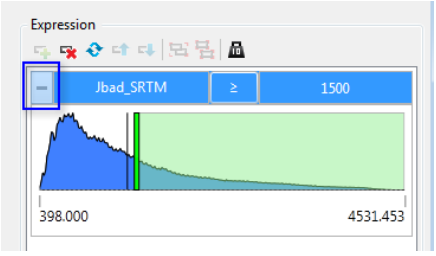
4. Type a value for the constraint. In this example, it is "1500".



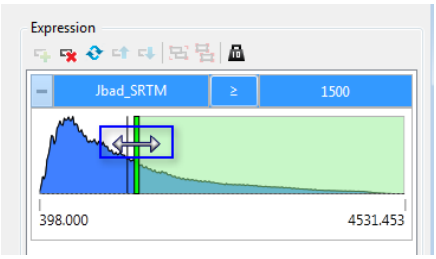
This expression will select areas that are at or above 1500 meters elevation in the Jbad_SRTM raster.

You can also use the numeric keypad buttons on the **Query Expression Editor** to enter values.

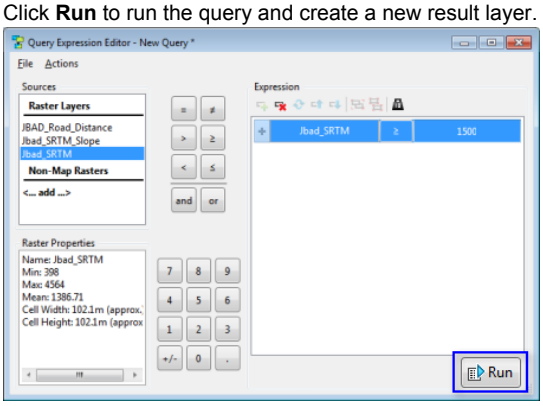
If statistics have been calculated for the raster, you can look at its histogram and interactively set the cutoff point with a slider. To see the histogram, you click the **+** sign beside the raster name in the query. It becomes a **-** sign and the histogram is displayed below the expression.

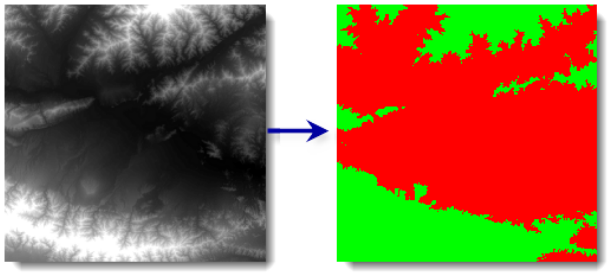


You can click and drag on the breakpoint line to reset the value.



5. Click **Run** to run the query and create a new result layer.





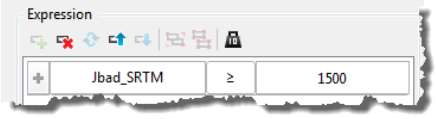
The new layer is added to the map. Areas greater than or equal to 1500 meters elevation are shown in green, areas below are shown in red.

Build a query expression for multiple rasters

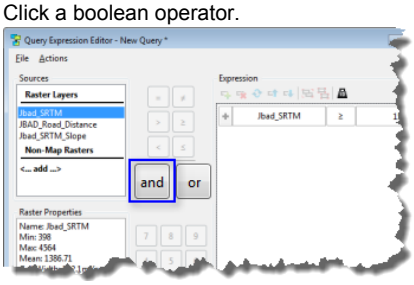
To build a query that includes multiple rasters, you need to build a simple query, which will be the first clause in the expression, then add a boolean operator (you can use **and** or **or**) and then add another raster and build its query expression.

Steps:

1. Use the steps above to build a simple query.

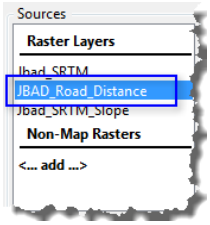


2. Click a boolean operator.

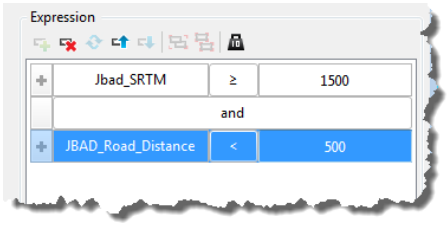


In this example the **and** operator was added.

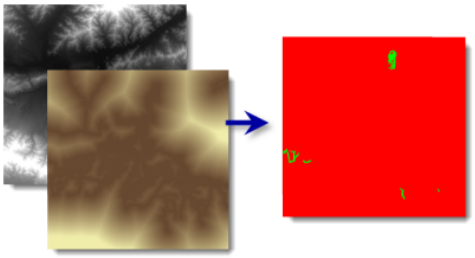
3. Double-click another raster.



4. Set an operator and constraint for the second clause in the query expression.
In this example the second raster contains Euclidean Distance calculated from local road features using the Distance From tool. This clause selects areas that are within 500 meters of a road feature.

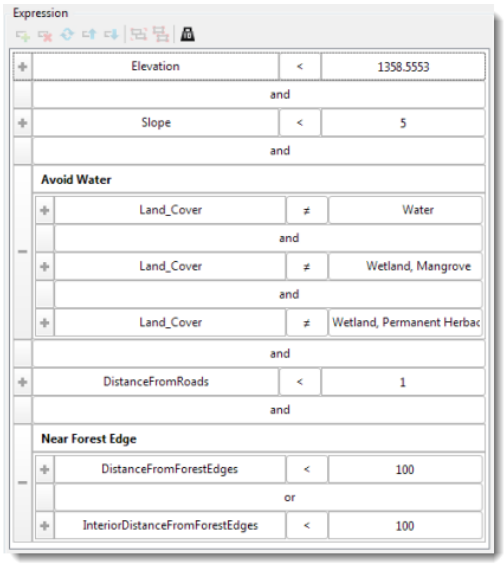


Now this query expression contains two clauses connected by the boolean **and** operator. When you run this expression it will select areas where the elevation is above 1500 meters and where the distance to roads is less than 500 meters.



Most of the roads are in the lower lying areas, so the query returns a small area (shown in green) that is both within 500 meters of a road and above 1500 meters elevation.

Here is an example of a more complex query expression. Note that it uses some categorical rasters (for example, Land_Cover) and some continuous rasters (for example, Elevation).



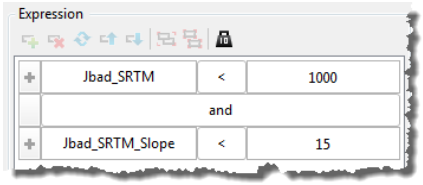
This expression also has some clauses grouped together. The "Near Forest Edge" group contains two clauses connected by an **or** expression, that select areas that are less than 100 meters from the edges of forests.

Group or ungroup clauses in a query expression

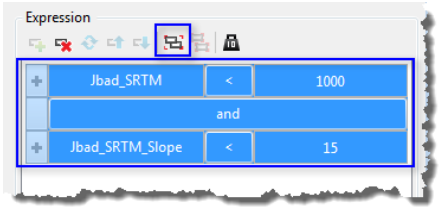
To group clauses in a query expression, you need to build a query expression with at least two clauses.

Steps:

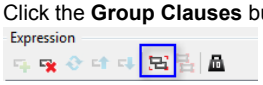
1. Use the steps above to build a query expression with at least two clauses.

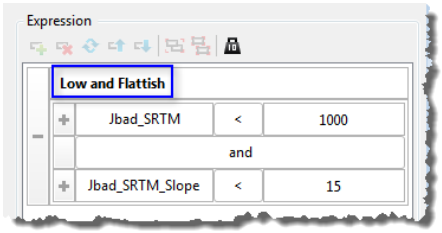


2. Click one clause, press the **Shift** key, and click the second (or last) clause that you want to group.

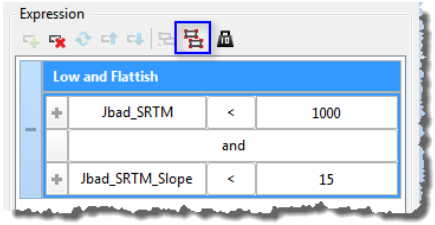


3. Click the **Group Clauses** button and type a name for the group.





Once you've grouped some clauses, if you decide to ungroup them, you can select the group and click the **Ungroup Clauses** button to ungroup them.

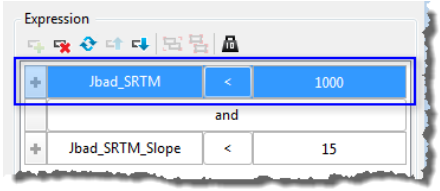


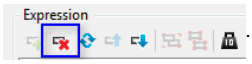
Deleting or adding clauses in a query expression

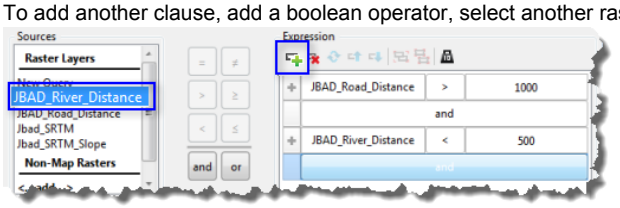
To delete clauses in a query expression, you need a query expression with at least two clauses.

Steps:

1. Click the clause that you want to delete.



2. Click the **Delete Clause** button 

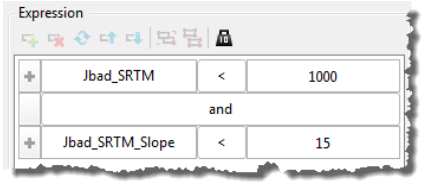
3. To add another clause, add a boolean operator, select another raster layer, and click the **Add Clause** button.


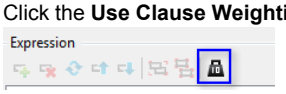
Adding Clause Weights to a query expression

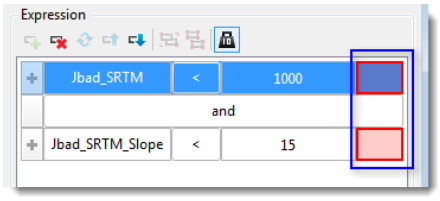
Adding weights to a query expression lets you specify the relative importance of the parts of the query. For example, suppose you want to find low elevation areas that are also relatively low slope. You can do this with a query on an elevation and a slope raster. However, suppose it is more important that the areas have a low slope than that they be under 1000 meters elevation. You could add weights to the query expression to favor areas with low slope.

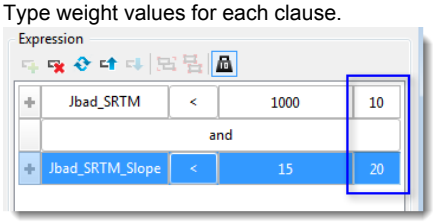
To add clause weights to a query expression, you need an expression with at least two clauses.

Steps:

1. Use the steps above to build a query expression with at least two clauses.


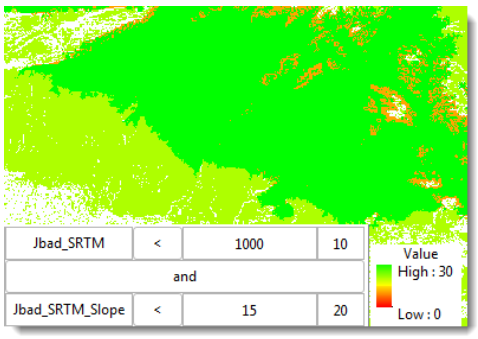
2. Click the **Use Clause Weightings** button.


   A new column is added to the **Query Expression Editor**.


3. Type weight values for each clause.


   When the query is run with weights, if a given clause's constraint passes, it adds the weight associated with that constraint to the output raster.

4. Click the **Run** button to run the query.
   So, if we have Jbad_SRTM < 1000 with a weight of 10 and Jbad_SRTM_Slope < 15 with a weight of 20, the maximum output raster value will be 30 (both constraints passed), and a minimum value of 0 (no constraints passed). In between, areas that had Jbad_SRTM < 1000 (but not Jbad_SRTM_Slope < 15) would get a value of 10. Areas that had Jbad_SRTM_Slope < 15 (but not Jbad_SRTM < 1000) would get a value of 20.

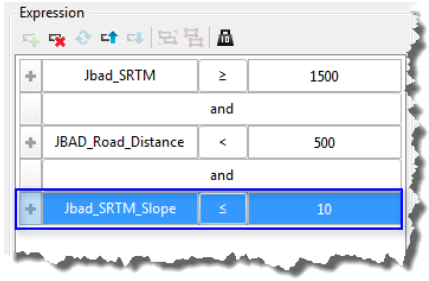


Changing the order of clauses in a query expression

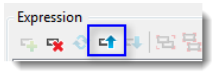
You can change the order of clauses in a query expression. This is particularly useful when you have several clauses and you decide to group some of them together. You can move the ones that you want to group closer together before grouping them.

Steps:

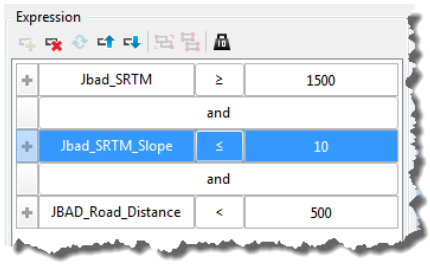
1. Click the clause that you want to move.



2. Click the **Move Clause Up** button.



The clause is moved up.



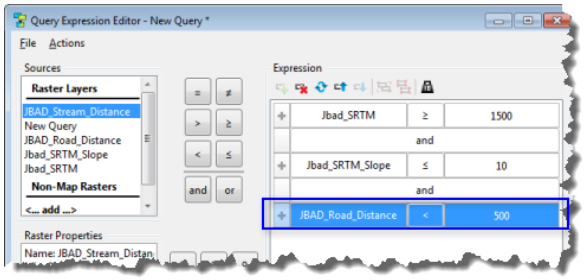
You can also move clauses down, using the same technique with the **Move Clause Down** button.

Swapping raster data sources

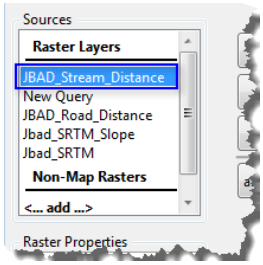
When you've defined a raster query expression, sometimes you may want to swap out the data used in part of the expression for a different dataset. For example, you might have built a query to find areas that meet several criteria and are within some distance of roads. You could reuse this query to find areas that meet the same criteria but are within some distance of streams.

Steps:

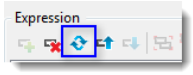
1. Click the clause that you want to swap the data source for.



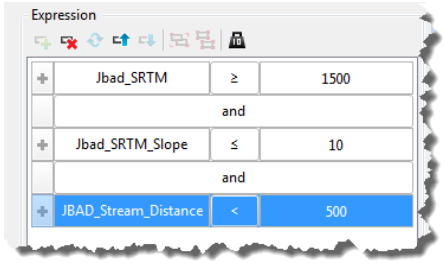
2. Click the layer in the **Sources** list that you want to use in the clause.



3. Click the **Swap Data Sources** button.



The data source for the clause is updated.



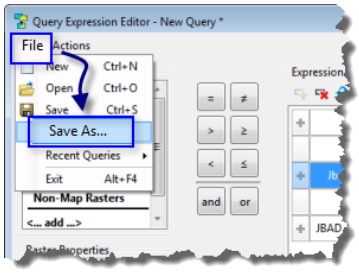
You can edit the constraint of the updated clause, if necessary.

Saving a query expression

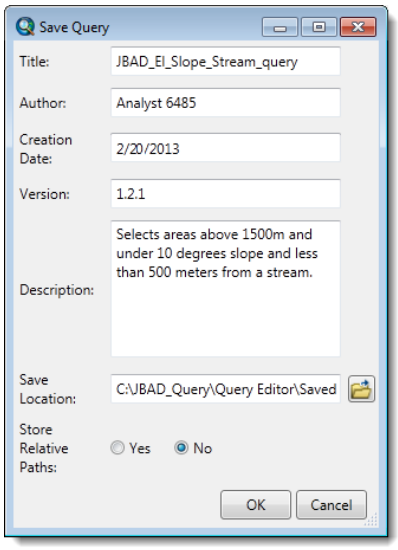
You can save a query expression to use later, or to share with someone else.

Steps:

1. Click the **File** menu and click **Save As**



2. Type a Title for the query.



It is important to add an Author and Description, in case somebody else uses the query and has questions for you.

3. Click the browse button to navigate to a location where you want to save the query.
4. Optionally, click **Yes** to Store Relative Paths.
   It is important use relative paths if you plan to send a folder of data and queries to someone else.
5. Click **OK**.
   The query is saved to the location you chose. You can use it later, or share it with others.

   To open a previously saved query, click on the **File** menu and click **Open**, then browse to the location of the saved query.

Supported data types

The Query Editor supports several single-band raster data types. The data may be continuous or categorical. Supported types include:

- File based Raster/Mosaic datasets
- Geodatabase Raster/Mosaic Datasets
- ArcGIS Server Image Services
- OGC WCS Coverages
- Query Editor Output Layers

Supported ways of referencing data

The Query Editor can save queries that refer to source rasters various ways. Supported path types include:

- Full paths
- Relative paths
- UNC paths.

An example of a **full path** is: C:\GIS\Project1\MyGDB.gdb\JBAD_Road_Distance. To share queries saved with paths to data with the full path option, everyone who uses the query must either do so on the same computer or have the data on their computer in exactly the same folder structure.

If you are planning to use the queries on your own machine, and you don't plan to move or share them, using full paths may be the most appropriate method.

It is appropriate to save your query with **relative paths** to your data when:

- Sharing queries across a network
- Sending queries to another user
- Moving queries and data to another location.

An example of a relative path is: \Project1\MyGDB.gdb\JBAD_Road_Distance. Relative paths in a query specify the location of the data referenced by the query relative to the current location on disk of the saved query file. Relative paths enable the query and its

associated data to be moved to any disk drive without the query losing a reference to the data. As long as the same directory structure is used at the new location, the query will still be able to find its data.

Note: Relative paths cannot be created when the query is saved on a different drive from the data. For example, if the query is saved at C:/QueryFolder/myQuery.xml, and the data is located at D:/DataFolder/myData, then a relative path cannot be created.

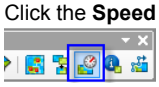
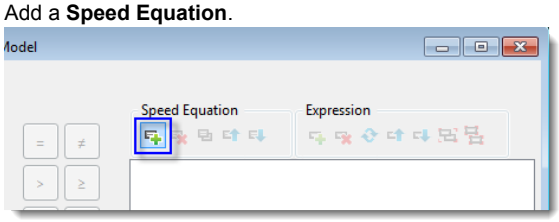
An example of a **UNC path** is: \\GISServer\GIS\Project1\ProjectGDB.gdb\JBAD_Road_Distance. Using UNC paths allows you to make a query referencing data on a computer on your organization's network so the query can be shared with others without requiring that they map the network computer as a disk drive on their local machine. Instead, the networked computer is referenced directly by name in the path.

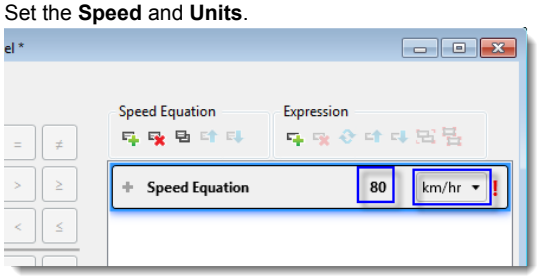
Building Speed Models

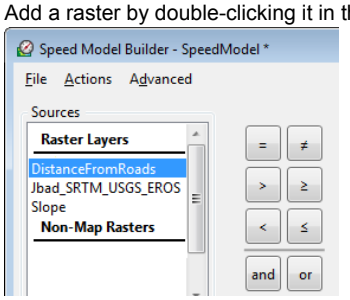
Using the Speed Model Builder

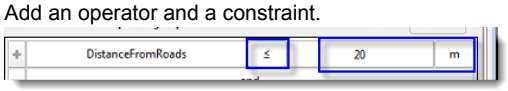
The Speed Model Builder works like the Query Editor, but is designed specifically to create speed models with multiple input factors. Speed models let you accurately model travel speed given different conditions. For example, you might have rules that combine slope and on/off road rasters to model travel speed on high and low slopes, on and off road. You could enhance such a model by adding land cover type modifiers for off-road speed.

Steps:

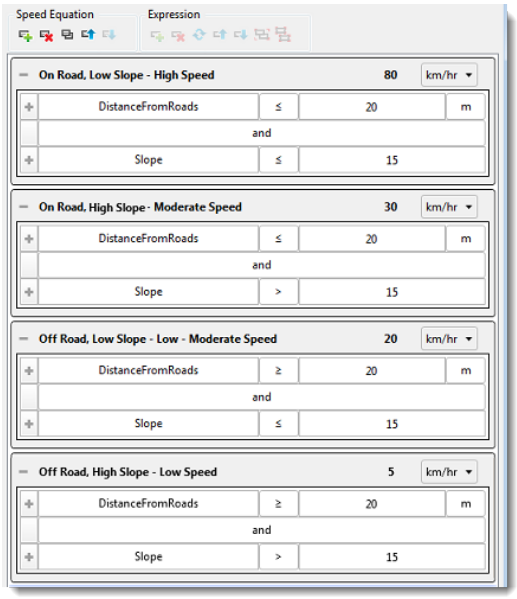
1. Click the **Speed Model Builder** button.

2. Add a **Speed Equation**.


3. Set the **Speed** and **Units**.


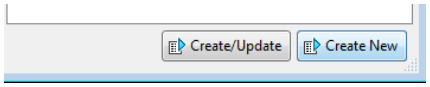
4. Add a raster by double-clicking it in the **Sources** box.


5. Add an operator and a constraint.


6. Optionally, click a boolean operator (**and** or **or**) to add another clause to the expression.
7. Optionally, add another raster from the **Sources**.
8. Optionally, repeat steps 2-7 to add additional **Speed Equations** for other conditions.
This speed model takes into account four combinations of slope and on/off road travel (with short distance to roads as a proxy measure for "on road" travel).



9. Click **Create New** to run the model and add the results to the map.



If you update the parameters in the model you can click **Create/Update** to update the results.

The new speed model is added to the map. You can use it as an input in the Time From tool to calculate how long it takes to travel from one or more locations to the rest of the Area of Interest.

Creating Time From and Distance From Rasters

Using the Time From tool

The Time From tool lets you find how long it would take to travel from a set of known points, lines, or polygons to any other location in the Area of Interest.

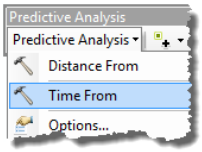
The tool lets you build surfaces that show the least accumulated travel time from each cell of the raster to the closest source location. Time From surfaces can be used to show distances in terms of travel time. For objects with a constant velocity, this is much like the distance from raster calculated by the Distance From tool. However, the Time From tool also allows you to use a speed model raster as an input. Speed model rasters can account for the effects of multiple environmental factors on travel speed.

You can use the output of the Time From tool in the Route Finder tool, which lets you interactively click on the map and get the fastest route to one of the input sources.

To use the Time From tool:

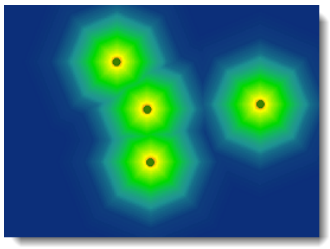
Steps:

1. Click **Predictive Analysis** and click **Time From**.

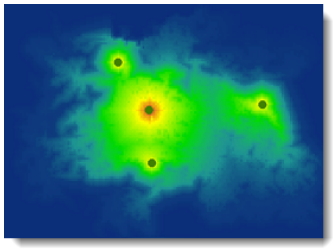


2. Add the features from which you want to derive time from, set the Area of Interest (use the smallest AOI that will serve your needs to reduce processing time), and specify the output raster name and location. If you manually added sources using one of the Sources tools on the Predictive Analysis toolbar then they will appear in the Sources list.
3. Optionally, add one or more feature classes or rasters of obstacles, and choose whether to use a constant speed or a Speed Model raster. If you manually added obstacles using one of the Obstacle tools on the Predictive Analysis toolbar, they will appear in the Obstacles list.

   For more information, see the Time From tool help.
4. Run the Time From tool.
   This graphic shows travel time from four points using a constant speed.



   This graphic shows travel time from the same four points using a Speed Model that modifies travel speed according to on/off road and slope class.



   Areas that are steeper (darker red, below), and areas off-road, take more time to get to from the input points due to lower travel speeds.

Using the Distance From tool

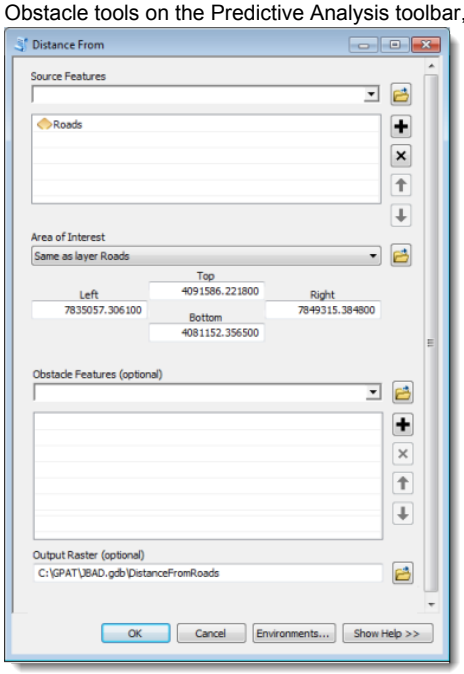
The Distance From tool lets you find how far a set of known points, lines, or polygons is from any other location in the Area of Interest.

You can build surfaces that show the shortest linear distance from a set of locations. The simplest case is finding linear distance from a set of points or lines, such as ports or roads. You could create such a layer to help estimate the location of a ship with a known top speed, which left a port a given number of hours ago. Distance from surfaces can also take into account obstacles, so for example, islands or shoals would be accounted for in the distance calculation.

To use the Distance From tool:

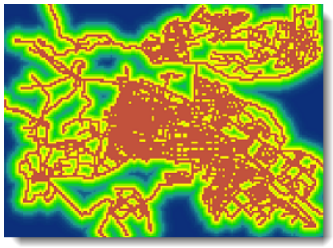
Steps:

1. Click **Predictive Analysis** and click **Distance From**.
2. Add the features from which you want to derive distance from, set the Area of Interest (use the smallest AOI that will serve your needs to reduce processing time), and specify the output raster name and location. If you manually added sources using one of the Sources tools on the Predictive Analysis toolbar then they will appear in the Sources list.
3. Optionally, add one or more feature classes or rasters of obstacles. If you manually added obstacles using one of the Obstacle tools on the Predictive Analysis toolbar, they will appear in the Obstacles list.



For more information, see the Distance From tool help.

4. Optionally, click Advanced. Here you can specify a digital elevation model to use for calculating actual distance over a surface, find interior distance from the edges of polygons, and set the spatial reference of the output.
5. Run the Distance From tool.
   Here is a simple distance from roads raster.



Managing Sources and Obstacles

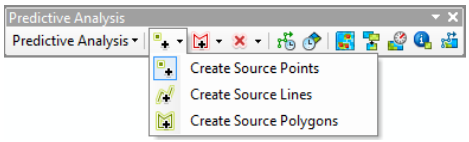
Using Sources and Obstacles with Predictive Analysis Tools

Several of the Predictive Analysis tools accept sources and obstacles. You can add point, line, and polygons that either represent sources or obstacles using tools on the Predictive Analysis toolbar.

To add Sources

Steps:

1. Click the dropdown arrow beside **Create Source Points** and click one of the tools to create points, lines, or polygons that will be used as sources.

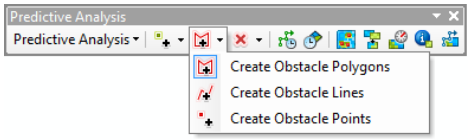


2. Add one or more sources (as point, line, or area geometries) to the map.

To add Obstacles

Steps:

1. Click the dropdown arrow beside **Create Obstacle Polygons** and click one of the tools to create points, lines, or polygons that will be used as obstacles

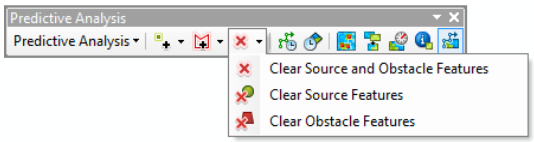


2. Add one or more obstacles (as point, line, or area geometries) to the map.

To clear Sources or Obstacles

Steps:

1. Click the dropdown arrow beside **Clear Source and Obstacle Features** and click one of the tools to clear Sources, clear Obstacles, or clear both Source and Obstacle features.



Building a Query Based on Known Locations

Using the Q-Fit tool to build a query based on known locations

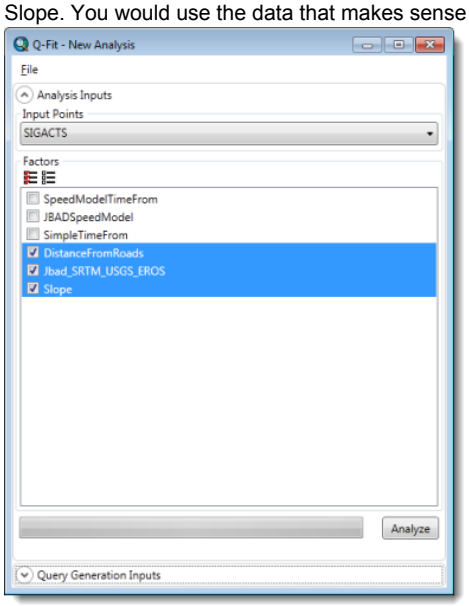
If you have a set of known locations where some target or event occurred, you can use the Q-Fit tool to compare them to environmental and distance or time from layers and develop a query that fits the events you've seen. You can then run the query to see other likely locations where these targets or events may occur.

The Q-Fit tool lets you fit a query to your observations of events.

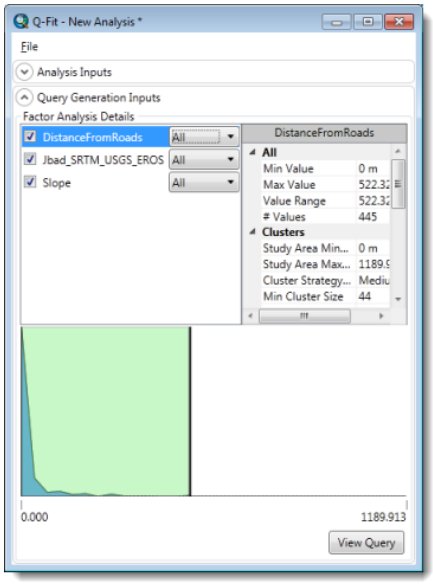
Steps:

1. Click the Q-Fit button on the Predictive Analysis toolbar.

2. Set the input points layers (your observed events) and the factors layers to be used in the query fitting process, and click Analyze. In this image the input points are SIGACTS events, and the factors are Distance from Roads, Elevation, and Slope. You would use the data that makes sense for your particular analysis.

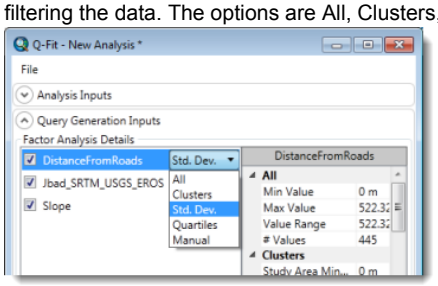


3. Look at the Analysis Details section. If you click an input raster you can see the distribution of values of that raster for all of the sample locations.

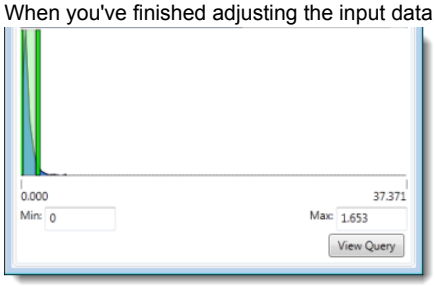


By default the Factor Analysis uses all of the data. You can change this to focus on the most important or most common data values.

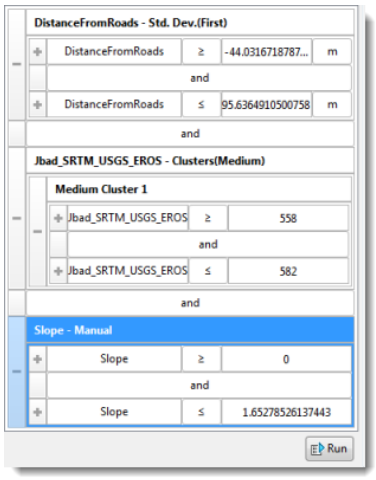
4. For each Factor (that is, each input raster to be used in the query), click the factor and then select the method to use for filtering the data. The options are All, Clusters, Standard Deviation, Quartiles, or Manual selection.



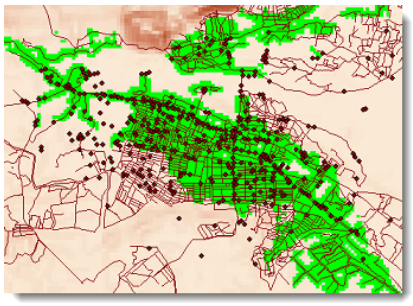
5. When you've finished adjusting the input data values, click View Query.



The Q-Fit tool builds a query to fit your selection and opens it in the Query Editor.



6. Click Run.
   The new query result is added to the map. The green shows areas that match the query. You can adjust the query parameters and re-run the query to see how different cutoff values for different factors influence your results.

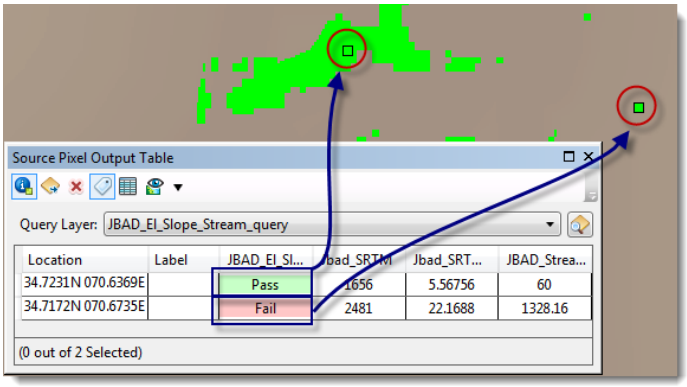


You can also use the SPOT tool to examine different locations to see why they do or do not match your query.

Investigating Query Output

Using the Source Pixel Output Table (SPOT) tool

The Source Pixel Output Table (SPOT) Tool allows you to investigate the output layers of the Query Editor at specific points on the map. Each Query Layer is made up of one or more data sources and associated rules. When you select a layer from the Query Layer dropdown list and click on one or more map locations, the SPOT window displays the query output value and the value of each data source at that location as a column in the table. A blank or unknown value indicates that the point selected is outside the area of interest (AOI) or valid area of the query.



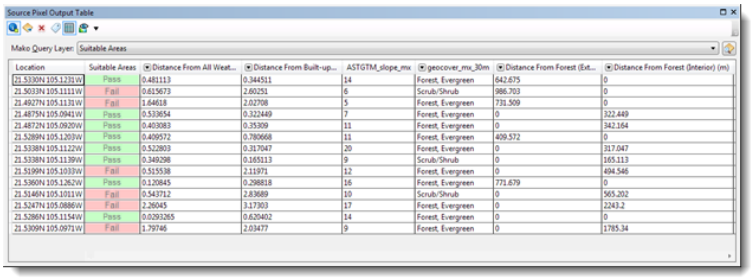
In this example, two points have been added by clicking on the map.

The first point is in an area that meets all three criteria of the JBAD_EI_Slope_Stream query. The area is marked in green on the map, and the location has the word "Pass" and a green highlight in the Query Layer column of the table. The other columns of the table give the elevation at this point, the slope, and the distance to a stream.

The second point is in an area that does not meet all three criteria. The area is not green on the map ("Fail" or "0" values are transparent for this layer, so you can see the stream distance layer below the query layer), and the location has the word "Fail" and a red highlight in the Query Layer column of the table. The other columns of the table give the elevation at this point, the slope, and the distance to a stream.

Note: For **non-weighted** queries the SPOT tool will display "Fail" with a red background for locations that fail the query, "Pass" with a green background for locations that pass the query, and blank for any areas that are excluded due to missing data, obstacles, or because they are outside the AOI. For **weighted** queries the SPOT tool will display the weighted value for each row in the table.

The SPOT tool adds a column for each of the input clauses in the query, and can display continuous and categorical raster values. The table accumulates a row for each location that you click on the map.

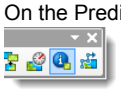


Open the SPOT tool and get values at sample locations

To use the SPOT tool, you need a map with a query layer on it.

Steps:

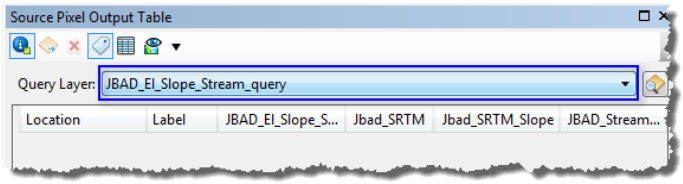
1. On the Predictive Analysis toolbar, click the **SPOT tool**.



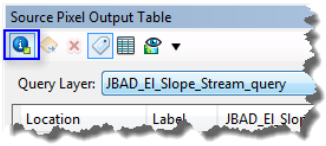
The **Source Pixel Output Table** window opens.

Note: This tool is disabled if the map does not have a valid spatial reference.

2. Click the **Query Layer** dropdown list and click the target query layer for the SPOT tool.

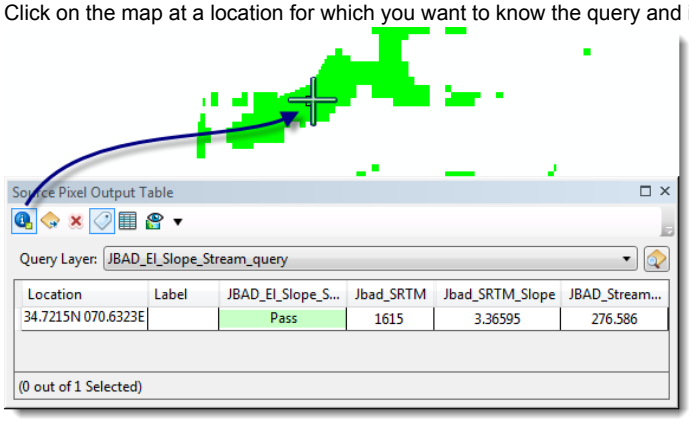


3. Click the **Activate SPOT Tool** button.



The Activate SPOT Tool button will have a square outline when the tool is activated. Click on this button to toggle between the SPOT tool being activated and deactivated. The tool will become deactivated automatically if any other map tools (such as the Pan or Zoom tools) are activated.

4. Click on the map at a location for which you want to know the query and input raster values.



5. Optionally, click other locations on the map.

   Press and hold the space bar to temporarily disable snapping while adding points to the map with the SPOT tool.

   You can also drag and drop point layers into the table to add rows for those points. If any points are selected in the layer, only selected points will be added.

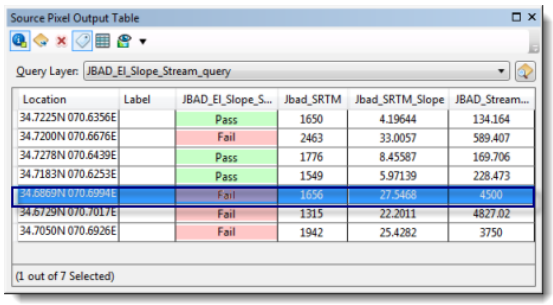
   Clicking on a column will sort the rows by that column in ascending order; click again to sort in descending order; click a third time to return the table to the unsorted state. Press and hold the shift key and click on a column to sort by multiple columns. Any points added to the table while it is sorted will be inserted in the sorted order.

Delete sample locations

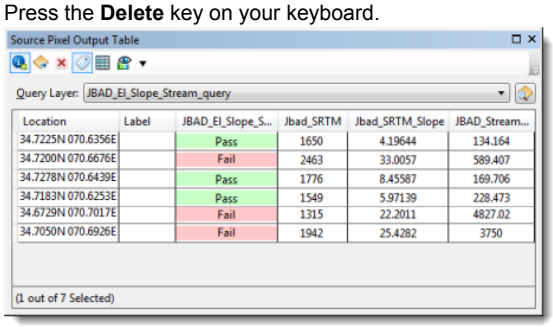
To delete sample locations you need a map with a query layer and you need to have used the SPOT tool to get query values at some locations.

Steps:

1. Click the sample location that you want to remove from the SPOT table.



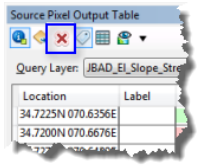
2. Press the **Delete** key on your keyboard.

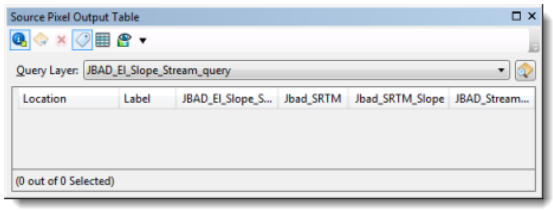


The selected row is deleted.

You can also delete rows by right-clicking them and clicking **Delete Rows**. The table also supports shift and control clicking to select multiple rows.

3. To delete all of the rows in the SPOT sample table, click the **Clear All Results** button.





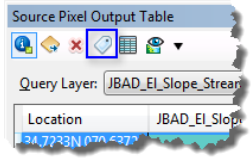
All of the rows are cleared.

Add labels to sample locations

To add labels to sample locations you need a map with a query layer and you need to have used the SPOT tool to get query values at some locations.

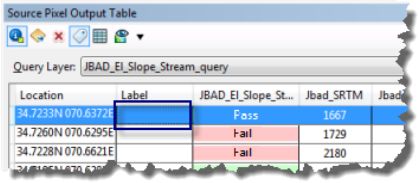
Steps:

1. Click the **Show Labels** button.

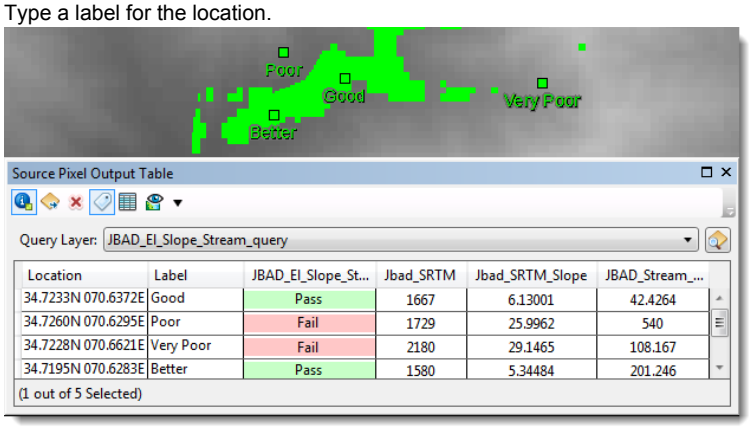


A column is added to the table for labels.

2. Click in the **Label** column for the sample location that you want to label.



3. Type a label for the location.



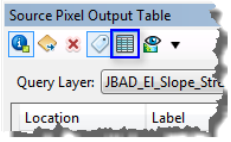
The location is labeled on the map.

Highlight a sample location

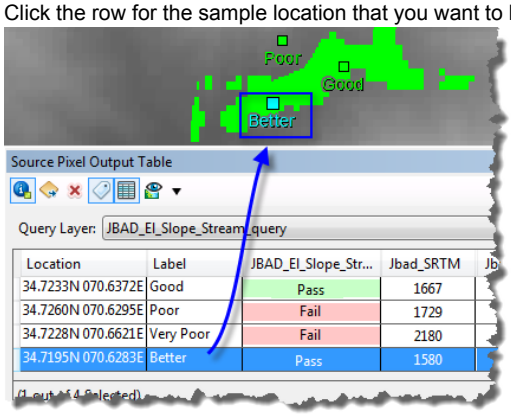
To highlight a sample location you need a map with a query layer and you need to have used the SPOT tool to get query values at some locations.

Steps:

1. Click the **Highlight Points** button.



2. Click the row for the sample location that you want to highlight.



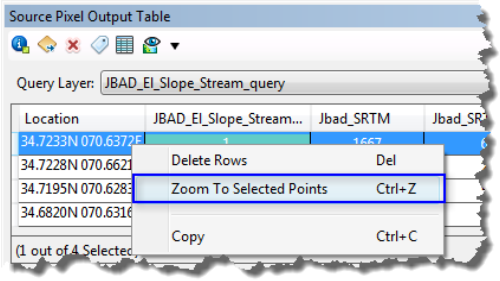
The sample location is highlighted on the map.

Zoom to a sample location

To zoom to a sample location you need a map with a query layer and you need to have used the SPOT tool to get query values at some locations.

Steps:

1. Click the row (or rows) that you want to zoom to.
2. Right-click the row and click **Zoom To Selected Points**.



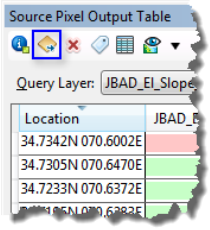
The sample location is highlighted on the map.

Export sample locations to point features

To export sample locations to point features you need a map with a query layer and you need to have used the SPOT tool to get query values at some locations.

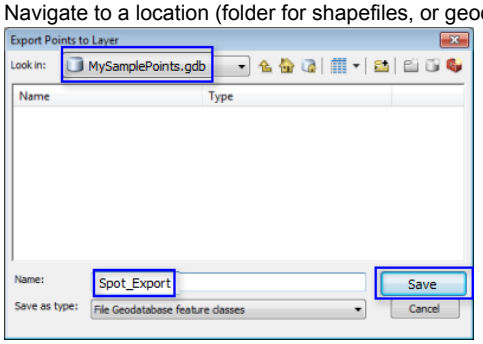
Steps:

1. Click the **Export to Layer** button.



If any rows are selected, only the selected rows will be exported to point features.

2. Navigate to a location (folder for shapefiles, or geodatabase for feature classes), specify a name, and save the output points.



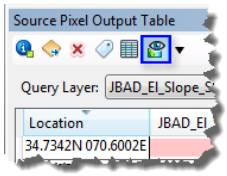
The sample locations are exported to point features.

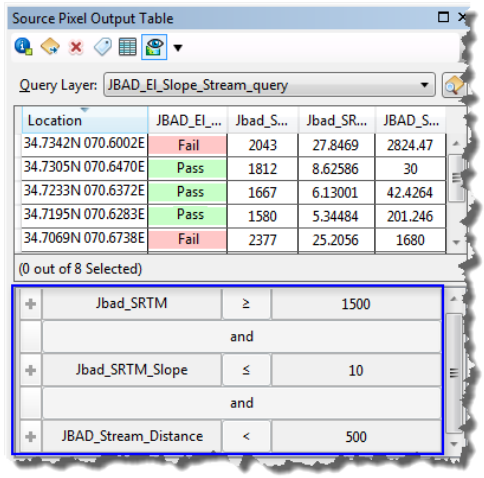
View the query for locations

To view the query for sample locations you need a map with a query layer and you need to have used the SPOT tool to get query values at some locations.

Steps:

1. Click the **View Query** button.





The query is displayed below the sample locations.

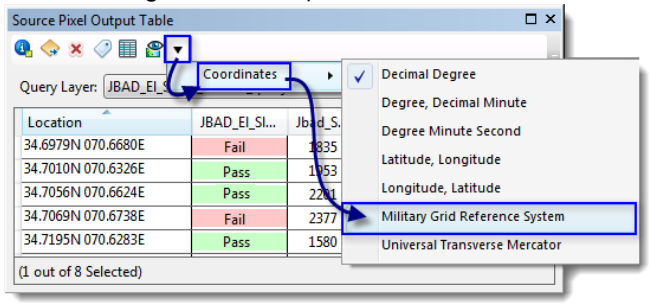
2. Click the **View Query** button again to hide the query.

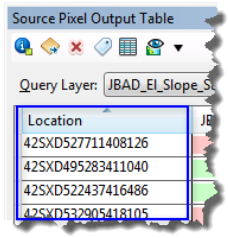
Change the coordinates for locations

To change the coordinates for sample locations you need a map with a query layer and you need to have used the SPOT tool to get query values at some locations.

Steps:

1. Click the **Change Units** button, point to **Coordinates**, and click the coordinates that you want to use.





The coordinates for the sample locations are updated.

Note: Any column that contains unit information will also have the option to change units for that particular column's values by selecting the 'Change Units' button, and selecting the desired unit type.

Measuring Distance, Bearing, and Speed

Using the Distance/Speed tool

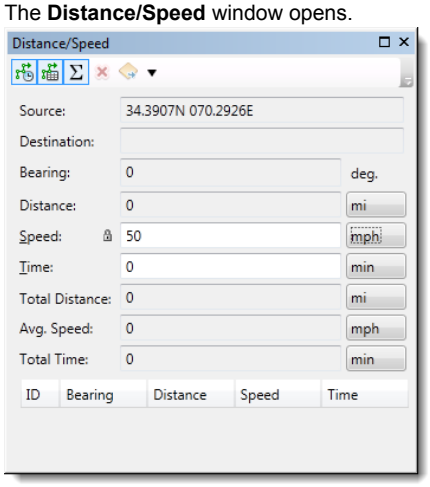
The Distance/Speed tool allows you to digitize a path and see the distance, speed and bearing for the route and for its segments. You can use the tool to determine the time it takes to travel between these points at a constant speed, or the speed it takes to travel between these points in a constant time. To use the tool you sketch a path, and geodesic measures between waypoints along the path are computed along with the initial bearing from the last selected point to the current mouse cursor position. The tool is intended to assist in route selection and planning.

To use the tool:

Steps:

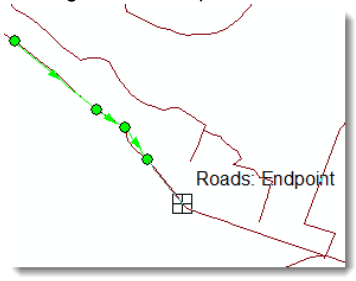
1. Click the **Distance/Speed** tool button.

2. The **Distance/Speed** window opens.

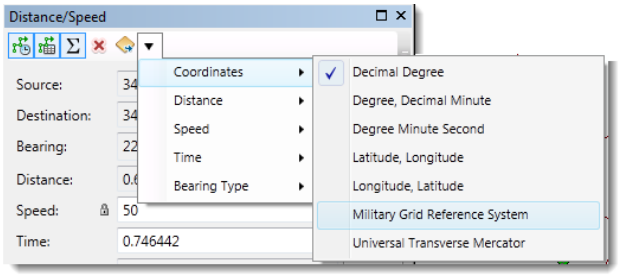


The inputs for Speed and Time are mutually exclusive. You can either enter a constant speed or a constant time. Entering a speed locks the Speed field, enabling dynamic values to be reported in the Time field. Entering a time locks the Time field and calculates the required speed for each sketched segment. By default, the speed field is locked and travel times are dynamically computed as path segments are sketched.

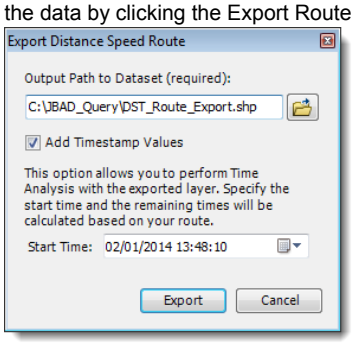
3. Enter a speed or a time value.
4. Digitize a path on the map. Each time you add a point the tool adds a row to the Distance/Time table showing the ID, Bearing, Distance, Speed, and Time for the segment.



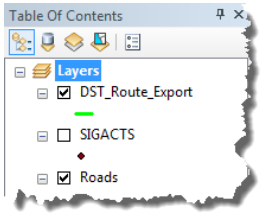
You can change the units that the tool reports. To do so, click the dropdown button on the Distance/Time window, click the type of unit to change, and click a new unit.



5. Double-click to finish a route. Once a route sketch has been completed, you can examine data in the table. You can export the data by clicking the Export Route button at the top of the Distance/Speed window.



If you set a Start Time, the route will be time enabled, which will allow you to play it back in the Time Analysis window.



Finding the Shortest Path

Using the Route Finder tool

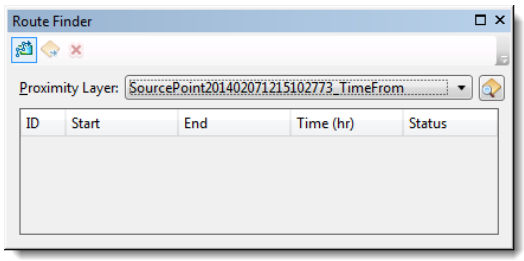
The Route Finder tool allows you to click on the map at one or more locations and returns the shortest path to the nearest of one or more source points. The shortest path can take a Speed Model into account. The resulting paths can be exported to time enabled feature classes, so they can be displayed using the Time Analysis Window.

You need a distance from or a time from layer on your map in order to use the Route Finder. To use the Route Finder:

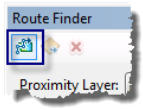
Steps:

1. Click the Route Finder button on the Predictive Analysis toolbar.

2. On the Route Finder window, choose a Proximity Layer. These can be created using the **Distance From** or the **Time From** tools.



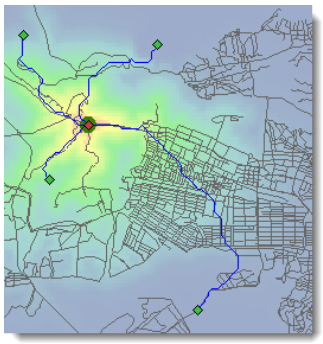
The Activate Route Finder button should be selected. If it is not, click it.



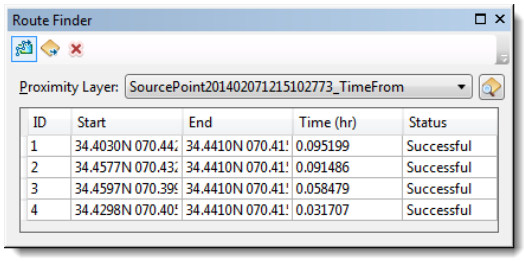
3. Click on the map to set the start location.

The route will follow the shortest distance or shortest time to the source (or sources) used when you created the proximity layer.

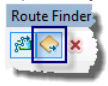
4. Optionally, click multiple locations to create multiple routes.



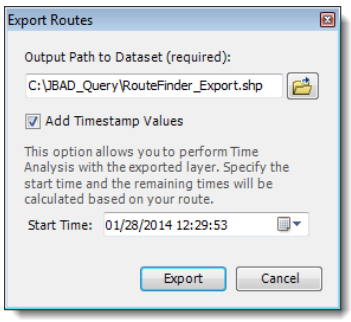
Each route will have a row in the table on the Route Finder window.



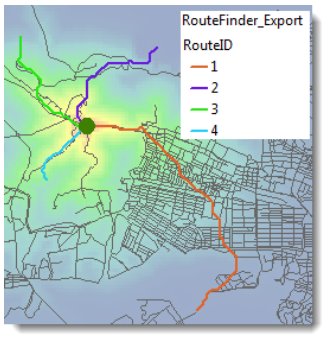
5. Optionally, click the Export to Layer button.



6. Set the output location and feature class name.
   To enable time on the output routes, set a Start Time.



Enabling time on the route features will let you play them back in the Time Analysis window. You can use this playback to look at when vehicles travelling along a given route would reach a given position, or if and when vehicles travelling along routes that merge would be likely to meet.



Working with the Time Analysis Window

Adding Features and Graphs to the Time Analysis window

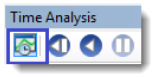
The Time Analysis window lets you manage, filter, graph, and play time-enabled data to visualize predictions, tracks, events, and other values that change over time. For example, you might export some paths to time-enabled features and then visualize the changing predicted positions for different times. Any geographic feature layer with a date/time field can be graphed, including layers from Shapefiles, File Geodatabases, SDE databases, and Mosaic datasets.

To display features and graphs in the Time Analysis window:

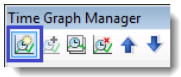
Steps:

1. Click the **Show/Hide Time Analysis window** button.

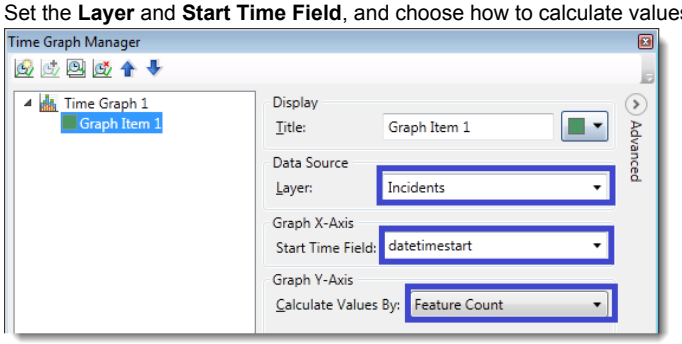
2. Click the **Time Graph Manager** button.



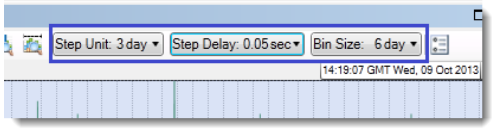
3. Click the **New Time Graph** button.

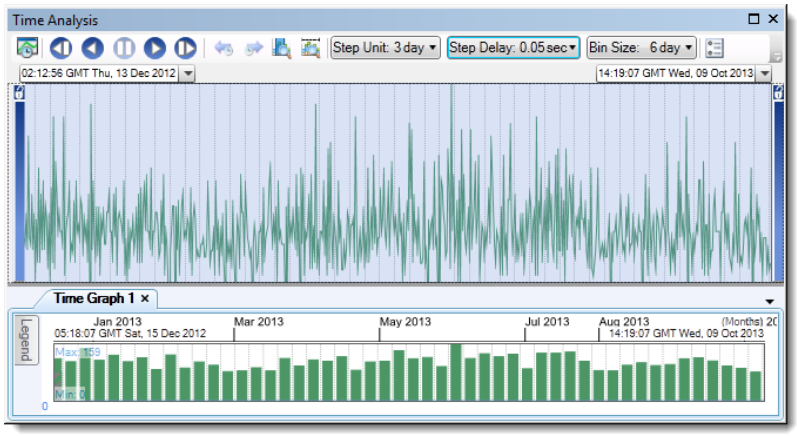


4. Set the **Layer** and **Start Time Field**, and choose how to calculate values, then click **OK**.

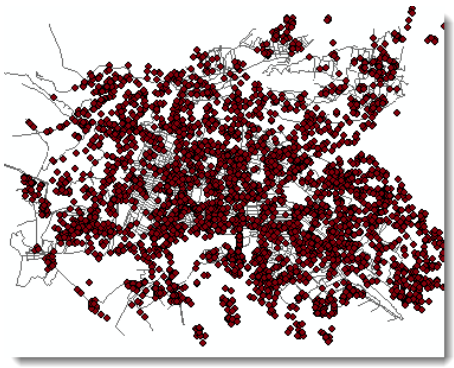


5. On the Time Analysis Window, set the **Step Unit**, **Step Delay**, and **Bin Size** to values appropriate for your data. Note the **Advanced** button on the right side of the window. This expands the window to let you set a time offset, which you might use on a second time graph to compare events from two different periods. It also lets you use an End time Field to display data with a duration from the Start Time Field until the End Time Field, instead of just events that occurred at the moment of the Start Time Field.

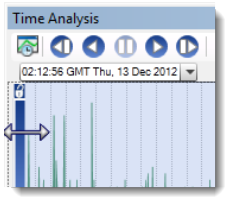




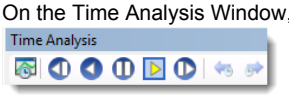
The map shows all of the features, because the visible time extent defaults to the full time extent of the data.



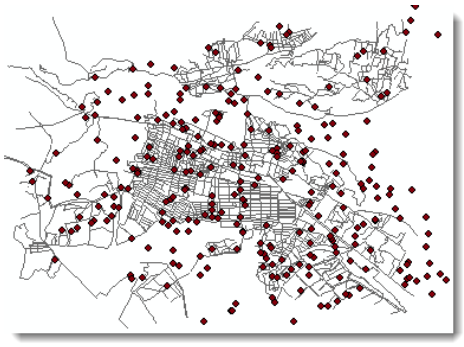
6. On the Time Analysis Window, click and drag the blue bars on either side of the **Overview** window to narrow the display to a specific period.



7. On the Time Analysis Window, click the **play** button.

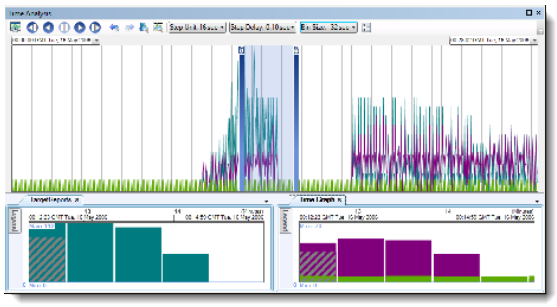


The map shows a subset of the features that changes as the visible time extent changes.



The histogram of features in the Time Graph updates as well.

You can add multiple time graphs and display multiple sets of time enabled features simultaneously in the Time Analysis Window.



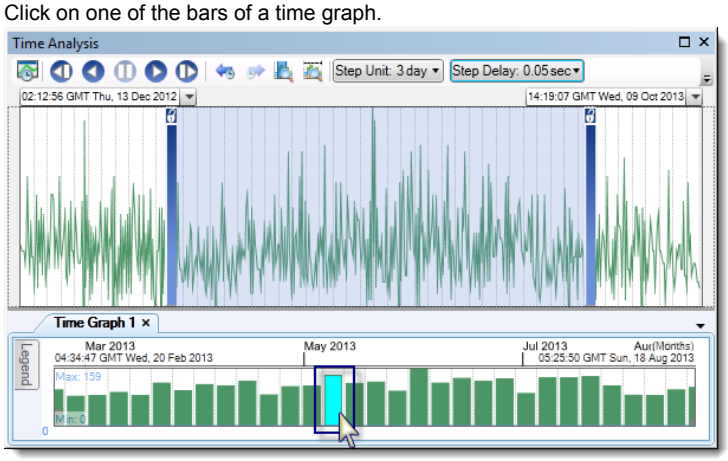
Interactive Selections in the Time Analysis window

You can interactively select features on the map by clicking on time graphs, and you can see selections you've made on the map on the time graphs.

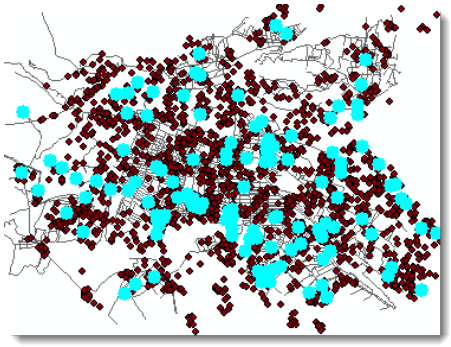
To select features from a time graph:

Steps:

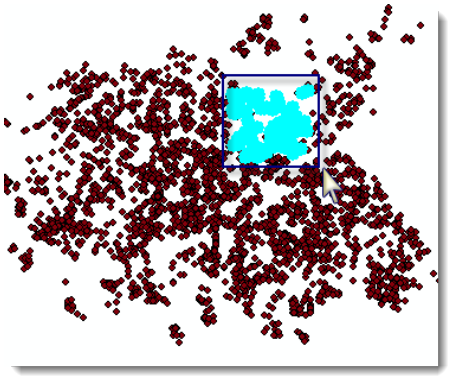
1. Click on one of the bars of a time graph.



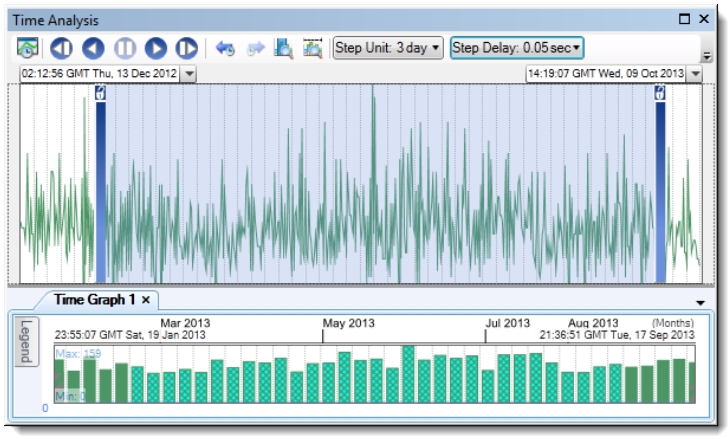
The features corresponding to this bar are selected on the map.



2. Click and drag a selection on the map (or select features using another selection method).



The bars corresponding to the selected features are shown with a hashed pattern, to indicate that they are partially selected (if not all of the features corresponding to the bar are selected) on the graph.



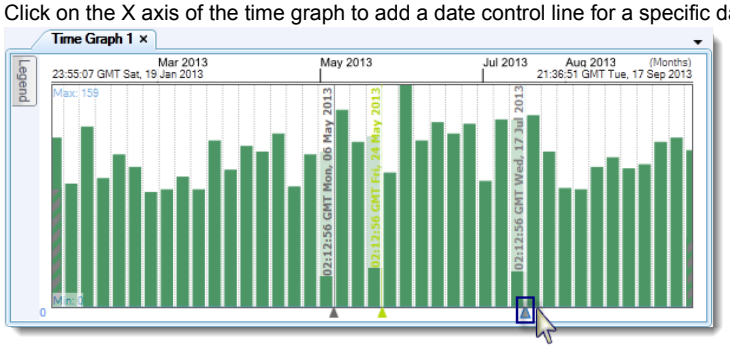
Adding Control lines to graphs

You can interactively add control lines to indicate specific dates or counts on the time graphs.

To add control lines to a time graph:

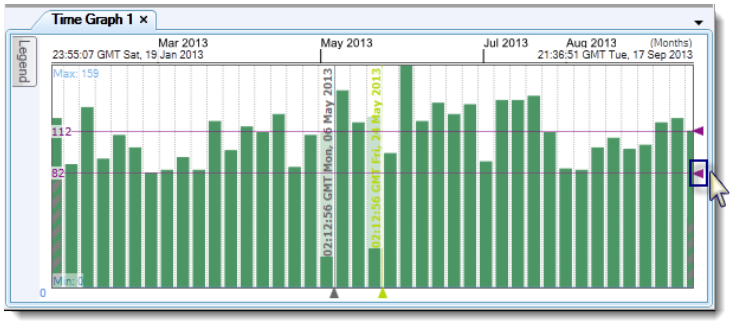
Steps:

1. Click on the X axis of the time graph to add a date control line for a specific date/time.



The control line is added to the graph. Date control lines let you mark specific places in your data. You can see them as you play back data using the Time Analysis window.

2. Click on the Y axis of the time graph to add a value control line.



The control line is added to the graph. Value control lines let you mark specific values in your data, which can be useful for quickly identifying when the graphed quantity is above or below some value.

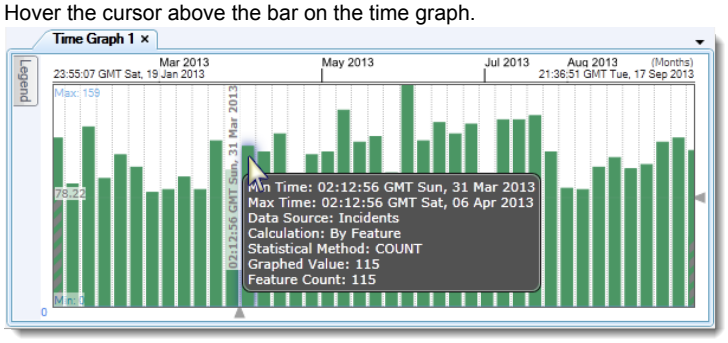
Getting more information about graphed values

You can interactively get more information about the individual bars on the time graphs.

To get more information about a bar a time graph:

Steps:

1. Hover the cursor above the bar on the time graph.



A popup shows the Min Time, Max Time, Data Source, Calculation, Statistical Method, Graphed Value, and Feature Count.

Conclusion to the ArcGIS Predictive Analysis Add-In documentation

In reading the documentation for this template you have learned about the basic features of the ArcGIS Predictive Analysis Add-In. You have seen how to create simple and complex queries and speed models, how to derive new queries from historic data, how to view query values at sample locations, how to import and export queries and query data, and how to save and share queries. You have also learned how to create distance-from and time-from rasters, find fastest routes, and play time-enabled paths.