

NAME: Path, with Distances and Bearings v. 3.2b

Aka: pathfind.avx

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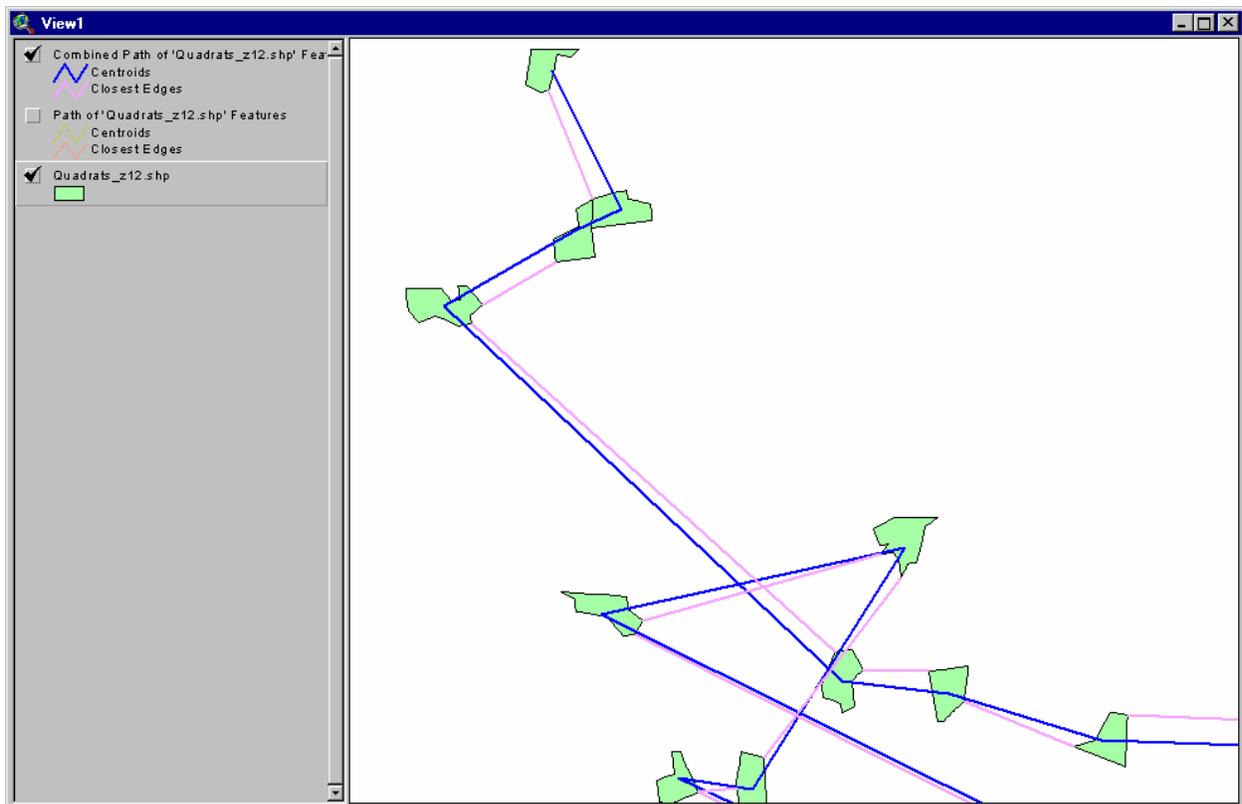


TOPICS: ArcView 3.x, Distance, Bearing, View, Analysis, Tools, Centroid, Closest Edge, Path, Route, Series, Angle, Deviation, Polyline, Direction, Statistics

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DESCRIPTION:

Build Paths from a Series of Features: This extension enables you to calculate distance, bearing and angular measurements between a series of features (points, lines or polygons). This is useful if the features represent places along a path or route and you want to calculate indices for each step of the route. The extension creates a results table (described below) and/or polyline shapefiles containing various user-selected fields such as distance and bearing between features, X/Y coordinates, centroids vs. closest edges, angular measurements, etc. Optionally, you can request graphic lines to be drawn connecting each feature with the next feature in the series.



Generate Statistics on Existing Paths: This extension generates several statistics describing the geometry of existing polyline features, and allows you to decompose them into a series of segments or vertices.

Additional Features:

Input Data can be either a Table or Point/Line/Polygon Theme: This extension can use either a Table for the input data, in which case the table will need to have fields for the X- and Y-coordinates, or a Feature Theme (point, line or polygon theme).

Centroids vs. Closest Edges: If desired, you can use this extension can calculate the distance and bearing between the centroids of the series of features as well as the distance and bearing between the closest edges of those features. For example, if a polygon theme is used in the analysis, then this extension will determine what points on the edges of the respective polygons (not necessarily vertices) are closest to each other, and calculate the distance and bearing based on these closest points. If the features intersect or if one lies within the other, the distance between edges will be zero but there will still be a calculated value for the distance between centroids. You can have graphics drawn connecting the centroids and/or the closest edges of each feature in the series.

All or only selected records: You can either use all the features or only a selected subset of features for the analysis. If any features in the input theme are selected, then only those selected features in that theme will be used when calculating the path. If no features in a theme are selected, then all features in that theme will be used in the analysis.

Projected vs. Unprojected Views: If your original data are in Lat/Long coordinates (the Geographic Projection) and your View has been projected, then you have the option of calculating RESULTS data based on either the Geographic Projection or your View Projection. The choice of projections can dramatically affect distances, bearings and coordinates of nearest edge points.

Geodesic Curves: If your data are in geographic coordinates (i.e. Latitude/Longitude or "Unprojected"), then you have to option to calculate distances and bearings using geodesic curves in order to get the most accurate measures possible. If you are building routes from a series of features, then these features must be either points or table records in order to use the Geodesic Curve option.

Output Options: If you are building a path from a series of features, you can generate your path as either a Results table, a Polyline shapefile representing the entire route, or a Polyline shapefile representing each separate segment along the route, or any combination of these. Each of these options offers a variety of data fields to calculate, reflecting segment ID values, series values, segment lengths, bearings, coordinates and internal angles. See [Data for Results Table](#) on p. 7 for a discussion of the various data fields.

If you are generating statistics on existing polyline paths, then you can produce either a Results table, a Polyline shapefile of path segments, or a Point shapefile of path vertices.

Add a Record Number Field: This extension provides a simple way to generate a field of unique ID values by adding a field of record numbers to the attribute table.

REQUIRES: This extension requires either a single feature theme (Point, Line or Polygon theme) present in a view, or a table with X/Y Coordinates available. This theme must have a field with unique values for each feature. This extension also requires that the file "avdlog.dll" be present in the ArcView/BIN32 directory (or \$AVBIN/avdlog.dll) and that the Dialog Designer extension be available in the ArcView/ext32 directory, which they almost certainly are if you're running AV3.1 or higher. You don't have to load the Dialog Designer; it just has to be available. If you are running ArcView 3.0a, you can download the appropriate files for free from ESRI, at:

<http://support.esri.com/index.cfm?fa=downloads.patchesServicePacks.viewPatch&PID=25&MetalD=483>

Recommended Citation Format: For those who wish to cite this extension, the author recommends something similar to:

Jenness, J. 2007. Path, with distances and bearings (pathfind.avx) extension for ArcView 3.x, v. 3.2b. Jenness Enterprises. Available at: <http://www.jennessent.com/arcview/path.htm>.

Please let me know if you cite this extension in a publication (jeffj@jennessent.com). I will update the citation list to include any publications that I am told about.

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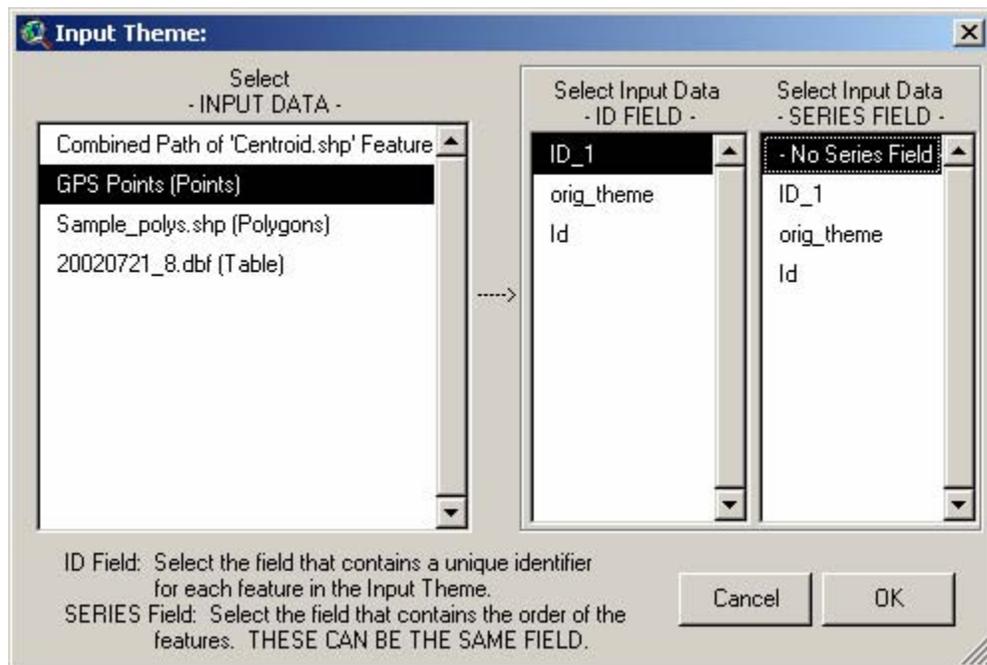
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General Instructions:

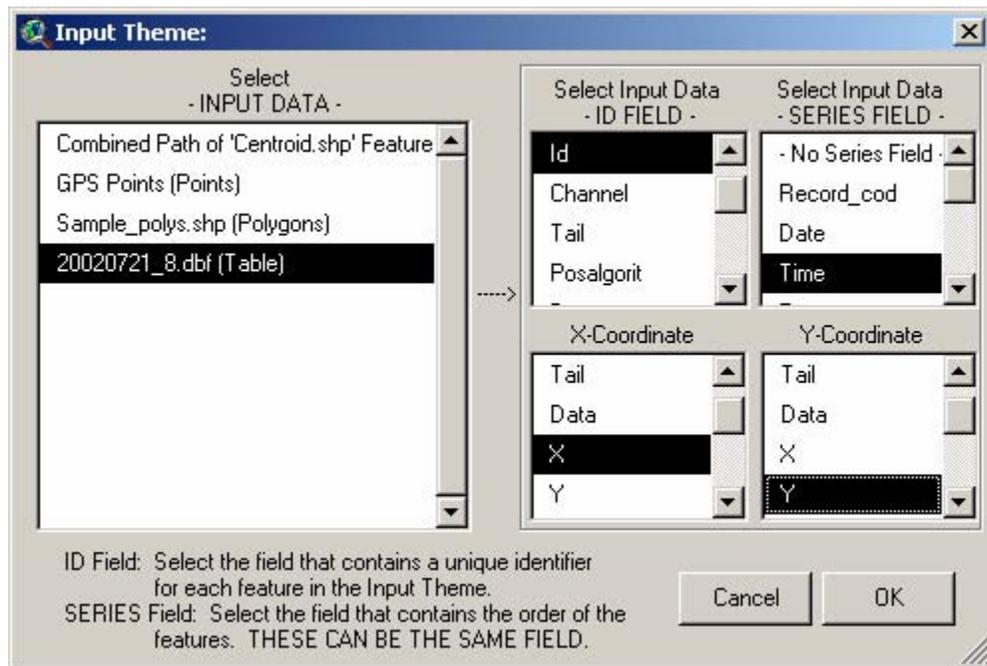
- 1) The user should begin by placing the “pathfind.avx” file into the ArcView extensions directory (../Av_gis30/Arcview/ext32/).
- 2) After starting ArcView, the user should load the extension by clicking on **File → Extensions...** , scrolling down through the list of available extensions, and then clicking on the checkbox next to the extension called “Path with Distances and Bearings, v.3.2.”
- 3) This extension will add two buttons and a menu item to your project:
 - a)  This button will generate a path from a series of features.
 - b)  This button will generate statistics on existing polylines.
 - c) This extension will also add a menu item to your Table “Edit” menu that allows you to quickly generate a field of record numbers, which make useful unique ID values.

Generating a Path from a Series of Features:

- 1) **Input Data:** Click the  button to begin the analysis. You will first be asked to identify your data source and ID field, plus the fields you would like to transfer over to the output file. If you do not have an ID field of unique ID values, you can easily create one by adding a record number field (see [Creating a Record Number Field](#) on p. 19).
 - a) **If Input Data is a Feature Theme, select Input Theme, ID Field and SERIES Field:** You will see the following dialog prompting you to select the Input Theme, an ID Field, and a Series field. This dialog is resizable by dragging on the corner, which may allow you to see the full name of themes or tables from the INPUT DATA box.



- b) **If Input Data is a Table, select Input Theme, ID Field, SERIES Field, and X/Y Coordinate Fields:** If you select a Table as your input theme, two more list boxes will appear prompting you to identify the X- and Y-coordinate fields. These listboxes will only show numeric fields:



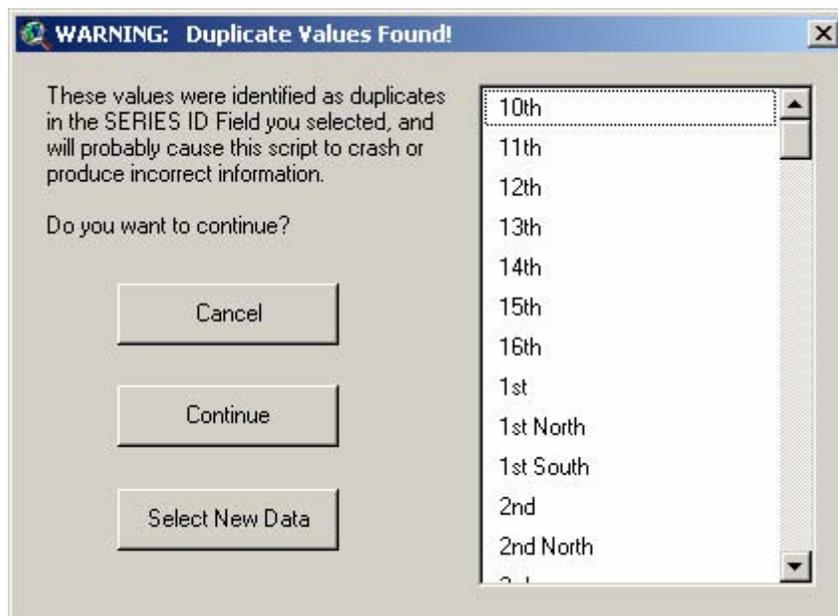
CAUTION: If you plan to make segment or route shapefiles from a table, make sure that the coordinates from the X-Coordinate and Y-Coordinate fields lie in the same coordinate system as the rest of the data in your view. New shapefiles will be added to your view regardless of their coordinate system, but they may not be visible if, for example, your Table coordinates are in UTM and the rest of your data are in Latitude/Longitude.

The INPUT ID Field should generally have unique values for each feature in the Input theme if you wish to join the RESULTS table with the Input theme Feature Attribute Table. The RESULTS table cannot be accurately joined with the Feature Attribute Table unless each record in the RESULTS table can be matched with a single specific record in the Feature Attribute Table.

The SERIES field contains the sort order for the list of features. This extension will sort all the Input features based on this field. The extension will then start with the feature with the smallest SERIES value and calculate the distance and bearing to the feature with the second smallest SERIES value. The extension will continue calculating distances and bearings between each consecutive feature being used in the analysis.

You do not have to use a SERIES field to sort your data. If you select the option "- No Series Field -" (the first option in the list), then the extension will use the record order of the features.

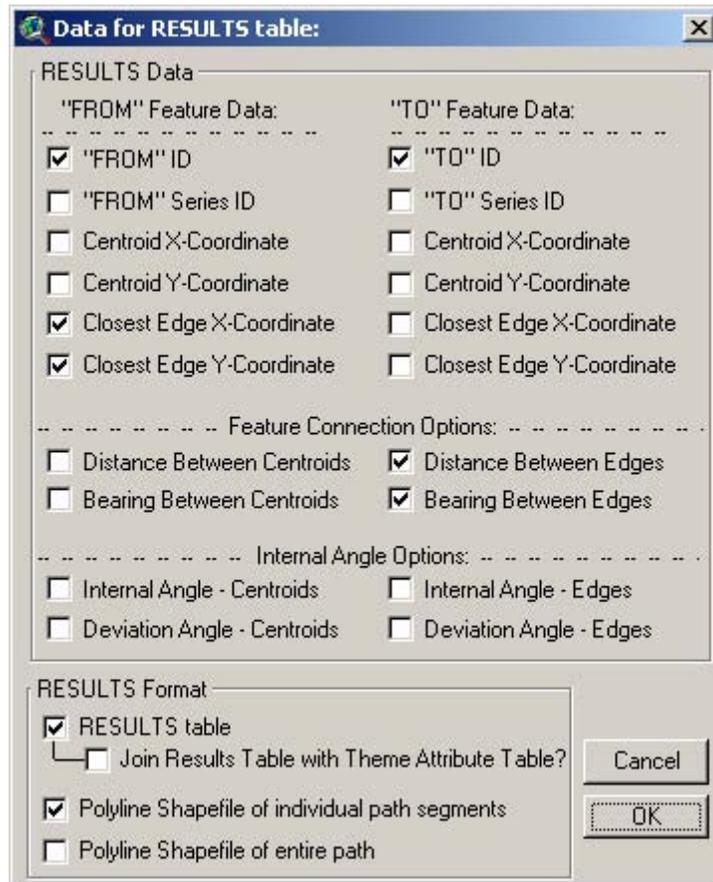
SERIES Field Considerations: If your data need to be sorted, it is critical that you select a SERIES field containing unique identifiers for each feature. Since the SERIES field contains the order of the features, duplicate values in this field cause this extension to be unable to determine how to order those duplicate values. The author has tested this extension with duplicate values in the SERIES field and found that the extension consistently crashes in these circumstances. As a safeguard, this extension will check for duplicates before continuing and prompt you for instructions if duplicates are present. If duplicates are present and you choose to continue, any results should be considered unreliable and extension will probably crash.



It is also important to know if the Series values are in "String" format or "Numerical" format. The extension will sort the features based on the SERIES field regardless of whether they are Strings or Numbers, but the user should be aware that Numbers in String format have a different sort order than Numbers in Numerical format. Strings are sorted alphabetically while numbers are sorted numerically. The numbers 1 through 21 are sorted in the following ways:

- **Numeric Format:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21
- **String Format:** 1, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 2, 20, 21, 3, 4, 5, 6, 7, 8, 9

- 2) **Data for RESULTS table:** After the Theme and associated ID and Series fields are selected, you will be prompted to select which fields you want calculated:

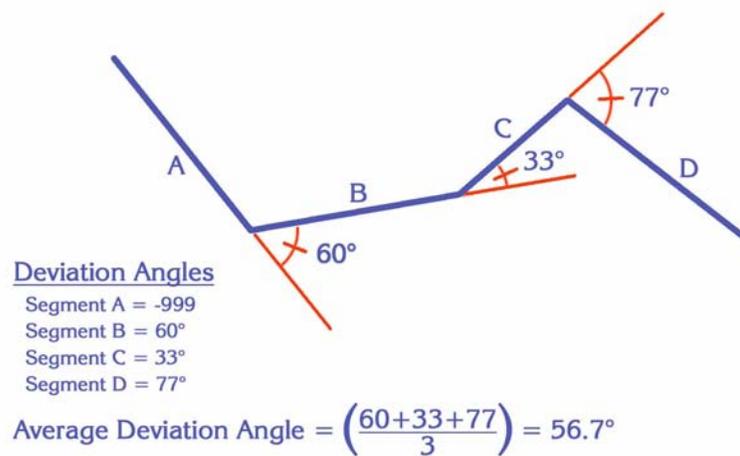


Each checked option will become a new field in your output table. The fields are described at the beginning of this manual. This dialog box also gives you the option to join the RESULTS table with the theme Feature Attribute Table or the Input Table. If you choose this option, the table can still always be separated by clicking on "Remove All Joins" in the table menu. Regardless of whether you join tables or not, the table will still be saved onto the hard drive.

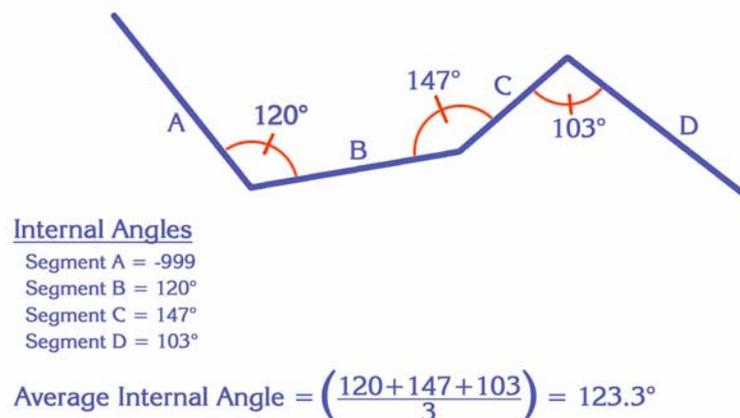
Feature Connection Options: You have the option of calculating your path/route data using either the centroids of the respective features or the closest edges between consecutive features.

Internal Angle Options: The internal angle options reflect either deviation angles or internal angles along the path route:

Deviation Angle: This value reflects how much the bearing (in degrees) of a particular segment deviates from the bearing of the segment prior to it. High deviation angles indicate that the path changes direction a lot. This deviation value will be equal to 0° if the segment continues on the exact same bearing as the segment before it, and 180° if the path doubles back and goes in exactly the opposite direction.



Internal Angle: This value reflects the internal angle (in degrees) formed by the two route segments and will always be less than or equal to 180°. This value will be equal to 180° if the segment continues on the exact same bearing as the segment before it, and 0° if the path doubles back and goes in exactly the opposite direction.



Deviation and Internal angles are supplementary, so the values for each will sum to 180°.

Calculations for Deviation and Internal Angles are based only on the bearings of the two segments and do not assume that the two segments meet at a common point. Route segments will not always connect. If you are generating a path connecting the nearest edges of polygons in a polygon theme, then some of the route segments will probably be disconnected. In such cases, deviation and internal angles will still be generated.

There are some cases in which internal or deviation angle measurements are not applicable and this extension will use the value "-999" to identify those cases. All internal and deviation angle values are based on the bearings of two consecutive segments. An angle value for any particular segment will be based on the bearing of that segment and the bearing of the segment just prior to that segment. The first segment on a route will always have a value of -999 because there is no previous route segment to compare it with. If either that segment or the segment prior to that segment have no length (and therefore no bearing), then that segment's angle values will be set at -999. Average angle values will be calculated using only those segments that have internal or deviation angles.

Output Formats: You can generate a Results table, a Polyline shapefile representing the entire route, or a Polyline shapefile representing each separate segment along the route, or any combination of these.

Results Table: The Results table will contain some or all of the following fields. These fields are chosen by you and the field will not be calculated if you do not want it. Optionally, you can request the Results table to be joined with the Input table or shapefile Feature Attribute Table.

- **[From_ID]:** ID for the "From" point, taken from the Input theme DBF file. Each Input feature is identified in the result table allowing it to be linked back to the original Input theme shapefile.
- **[To_ID]:** ID for the "To" point, taken from the Input theme DBF file. Distances and bearings are calculated for the line connecting the "From" point to the "To" point.
- **[From_#]:** Series number for the "From" point, taken from the Input theme DBF file. This number represents where this feature falls in the ascending order of the features.
- **[To_#]:** Series number for the "To" point, taken from the Input theme DBF file. This extension uses the next highest value in the Series field as the "To" point.
- **[Cent_Bear]:** The bearing of the line connecting the Centroids of the "From" and "To" points.
- **[C_Int_Ang]:** The internal angle, in degrees, formed by this segment and the previous segment. These segments connect the Centroids of the features. See [Internal Angles](#) for a discussion of internal angles.
- **[C_Dev_Ang]:** The angle of deviation, in degrees, between the bearing of this segment and the bearing of the previous segment. These segments connect the Centroids of the features. See [Deviation Angles](#) for an discussion of deviation angles.
- **[Cent_Dist]:** The distance of the line in map units connecting the Centroids of the "From" and "To" points.
- **[Edge_Bear]:** The bearing of the line connecting the Closest Edges of the "From" and "To" points.
- **[E_Int_Ang]:** The internal angle, in degrees, formed by this segment and the previous segment. These segments connect the Closest Edges of the features. See [Internal Angles](#) for a discussion of internal angles.
- **[E_Dev_Ang]:** The angle of deviation, in degrees, between the bearing of this segment and the bearing of the previous segment. These segments connect the Closest Edges of the features. See [Deviation Angles](#) for an discussion of deviation angles.
- **[Edge_Dist]:** The distance of the line in map units connecting the Closest Edges of the "From" and "To" points.
- **[Fr_Cent_X]:** The X-coordinate of the centroid of the "From" feature.
- **[Fr_Cent_Y]:** The Y-coordinate of the centroid of the "From" feature.
- **[To_Cent_X]:** The X-coordinate of the centroid of the "To" feature.
- **[To_Cent_Y]:** The Y-coordinate of the centroid of the "To" feature.
- **[Fr_Edge_X]:** The X-coordinate of the closest edge of the "From" feature.
- **[Fr_Edge_Y]:** The Y-coordinate of the closest edge of the "From" feature.
- **[To_Edge_X]:** The X-coordinate of the closest edge of the "To" feature.
- **[To_Edge_Y]:** The Y-coordinate of the closest edge of the "To" feature.

Polyline Shapefile of Route Segments: Each polyline in this shapefile will represent the route segment between consecutive features. The shapefile will appear in your view with the name "Path of [your input data name] Features." The Feature Attribute Table for this shapefile will contain some or all of the following fields, based on your choices:

- **[cent_edge]:** A String field containing either "Centroids" or "Closest Edges", reflecting what aspect of the two features are being connected.
- **[From_ID]:** ID for the "From" point, taken from the Input theme DBF file. Each Input feature is identified in the result table allowing it to be linked back to the original Input theme shapefile.
- **[To_ID]:** ID for the "To" point, taken from the Input theme DBF file. Distances and bearings are calculated for the line connecting the "From" point to the "To" point.

- **[From_#]:** Series number for the "From" point, taken from the Input theme DBF file. This number represents where this feature falls in the ascending order of the features.
- **[To_#]:** Series number for the "To" point, taken from the Input theme DBF file. This extension uses the next highest value in the Series field as the "To" point.
- **[Bearing]:** The bearing, in degrees, of this segment.
- **[Int_Angle]:** The internal angle, in degrees, formed by this segment and the previous segment. See [Internal Angles](#) for a discussion of internal angles.
- **[Dev_Angle]:** The angle of deviation, in degrees, between the bearing of this segment and the bearing of the previous segment. See [Deviation Angles](#) for an discussion of deviation angles.
- **[Distance]:** The length of this particular segment, in the units of the view's coordinate system.
- **[From_X]:** The X-coordinate of the starting point of this segment.
- **[From_Y]:** The Y-coordinate of the starting point of this segment.
- **[To_X]:** The X-coordinate of the ending point of this segment.
- **[To_Y]:** The Y-coordinate of the ending point of this segment.

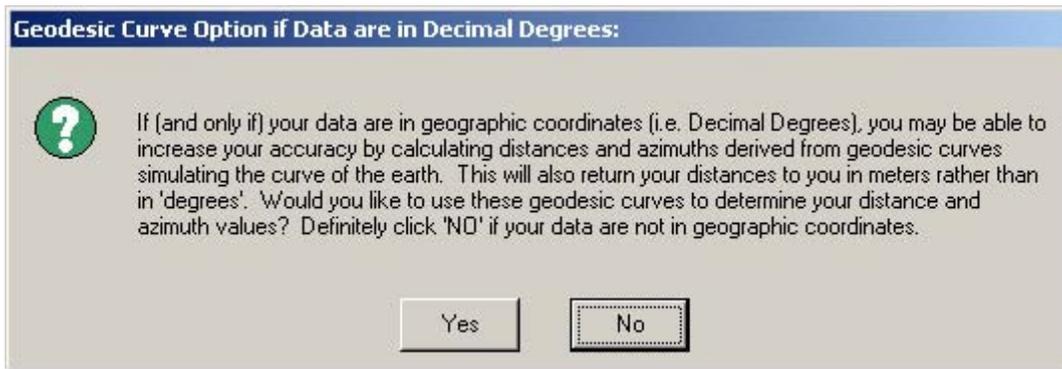
Polyline Shapefile of Complete Route: Each polyline in this shapefile will represent the complete route, representing all the route segments combined into a single polyline. The shapefile will appear in your view with the name "Combined Path of '[your input data name]' Features." The Feature Attribute Table for this shapefile will contain some or all of the following fields, based on your choices:

- **[cent_edge]:** A String field containing either "Centroids" or "Closest Edges", reflecting what aspect of the two features are being connected.
- **[ID]:** Unique numeric ID for this polyline
- **[Length]:** The total length of all the combined segments.
- **[Seg_Count]:** The number of segments in this path/route.
- **[Avg_Seg_Len]:** The average segment length, calculated by dividing the total length by the segment count.
- **[Bearing]:** The average bearing, in degrees, of this route, calculated as the bearing between the start- and end-points of the line.
- **[Av_Int_Ang]:** The average internal angle, in degrees, formed by all pairs of consecutive segments. See [Internal Angles](#) for a discussion of internal angles.
- **[Av_Dev_Ang]:** The average angle of deviation, in degrees, between the bearings of all pairs of consecutive segments. See [Deviation Angles](#) for an discussion of deviation angles.
- **[Ang_Count]:** The number of internal angles in this path/route.

3) Geodesic Curve Option: If all of the following conditions are met:

- a. Your data are points from either a table or a point theme
- b. Your view is not projected
- c. The combined extent of all themes in your view lies within the possible range of geographic coordinates (i.e. no part of any theme can have an X-coordinate < -180 or > 180, or a Y-coordinate < -90 or > 90).

Then you will be offered the option to calculate your distances and bearings using geodesic curves. These curves will give you more accurate results if your points are separated by large distances.



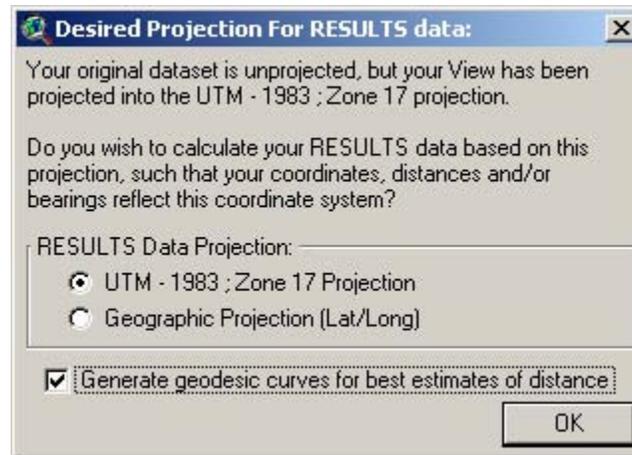
This extension is currently set up to only offer geodesic distances if working with points. This option will not be offered if you are working with polylines or polygons. Also, it assumes that the point coordinates are in Latitude/Longitude, so the results will not be accurate if your points are in anything else.

These geodesic distances are really the only way to get consistently accurate distance measures when your route goes over significant portions of the earth. This method is more accurate than using an equidistant map projection because such projections are only accurate between specific points. These geodesic curves allow us to determine distances between any two points on the globe.

For example, the following image illustrates a long-distance migration route for a hypothetical bird. It may fly in a straight line from Uruguay to Alaska, but only a equidistant projection specifically set for this route can produce accurate values for distance and azimuth. Geodesic curves do not rely on particular projections because they model the actual shape of the world in 3 dimensions. They do, however, depend on a spheroidal model, and this extension uses the WGS-80 spheroid for all geodesic calculations.



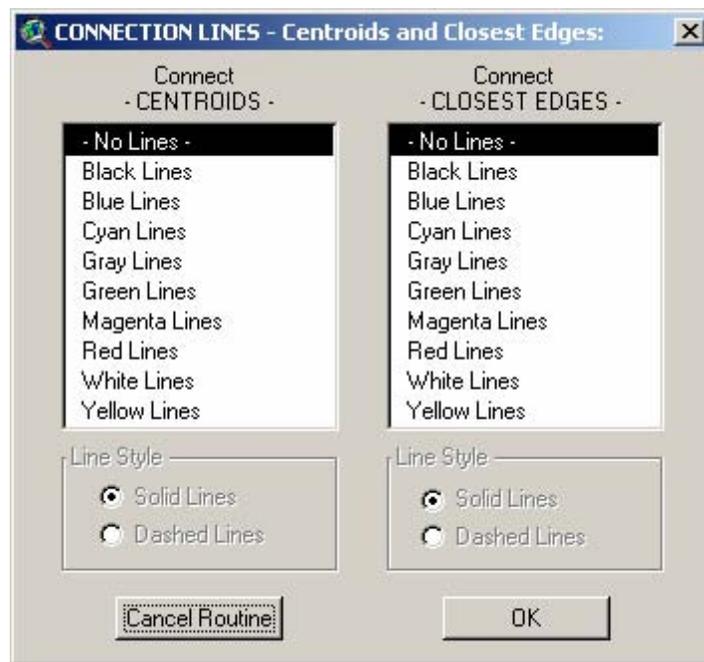
- 4) **Select Projection of RESULTS data:** If your view is projected, then you will be asked what projection you wish to use to calculate the data. In this case you have the option of calculating the distances and bearings between features based on either your View projection or on the original Geographic projection. If your input data are points, either from a table or a point theme, you also have the option to use geodesic curves to generate any distance and azimuth values (see description above). This option will be disabled if you are working with either Polygons or Polylines.



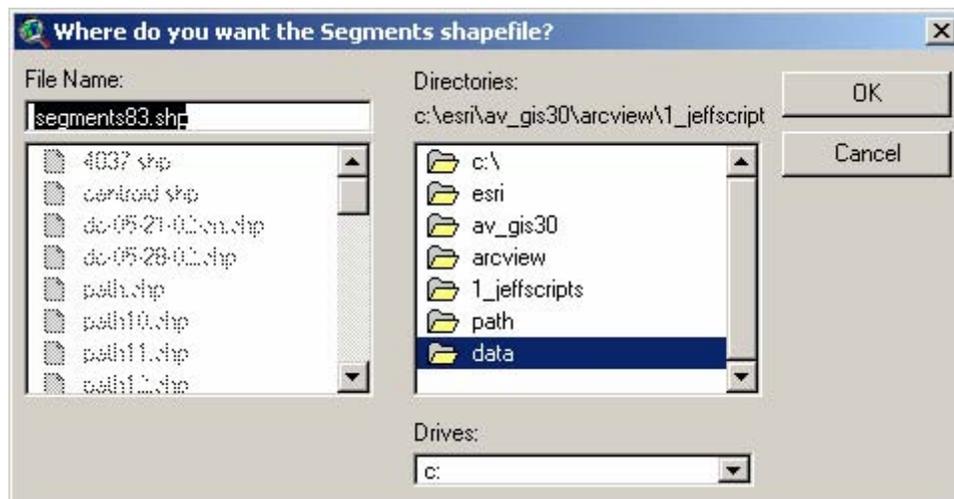
This choice can have dramatic impacts on distances, bearings and edge coordinates, and even on which parts of the features are considered "nearest" to each other. Remember that distance calculations are based on the coordinate system of the data and that therefore distances based on Latitude/Longitude coordinates will come out in units of "degrees," which are rarely useful.

Distances measured in "degrees" become especially problematic the farther you get from the equator, since longitudinal degrees are not the same as latitudinal degrees. The author recommends that you calculate your RESULTS data based on the View Projection rather than the Geographic projection, unless you have some specific reason to need the results to be based on latitude and longitude coordinates.

- 5) **Add Graphic Connection Lines:** Next, choose any desired graphics connecting each feature in the series. You have the option of creating lines connecting either centroids, closest edges, or both, and the lines can be either dashed or solid and can be selected from a variety of colors. These will appear as graphic shapes in your view and will remain until you delete them.



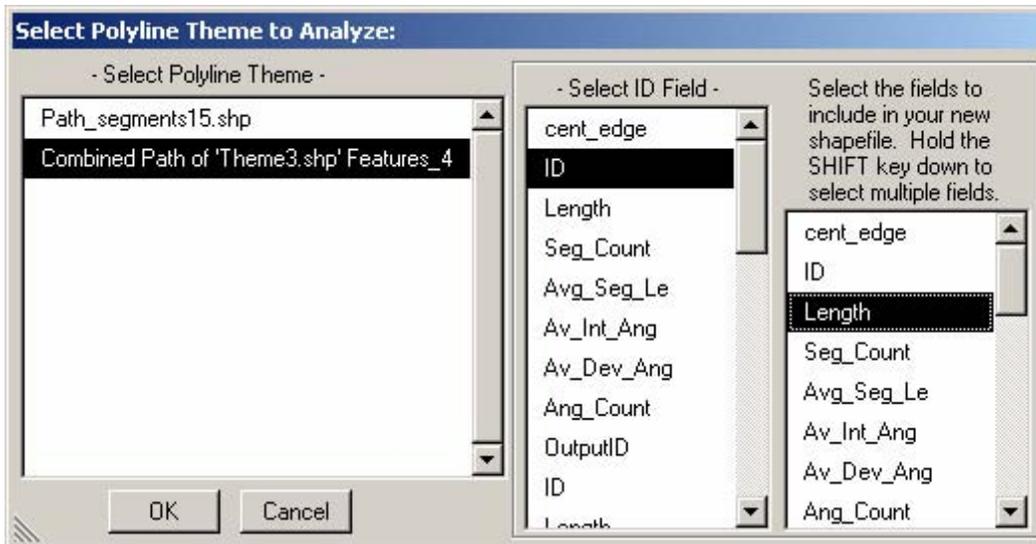
- 6) Finally, choose the location to save the Results table, Segments shapefile and/or Route shapefile on the hard drive. These are standard ArcView dialog boxes and should be familiar to most users:



Generating Statistics on Existing Polylines:

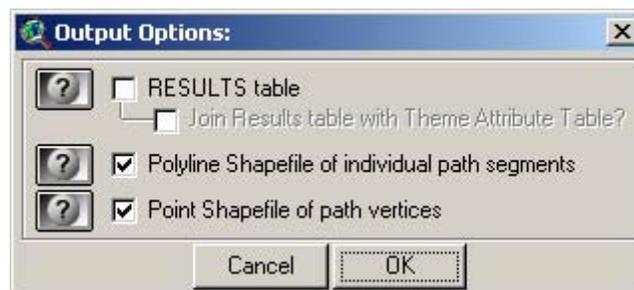
This option generates several statistics on existing polyline shapes. The button will not be enabled unless there is a polyline theme present in the view.

- 1) Click the  button to begin the analysis. You will first be asked to identify your polyline theme and ID field, and which existing data fields to copy to the output file:



If you do not have an ID field of unique ID values for each polyline, you can easily create one by adding a record number field (see [Creating a Record Number Field](#) on p. 19).

- 2) Next you will be asked what output format to use. You have the option to generate a Results table with statistics summarizing each polyline, a Polyline theme of polyline segments, and a Point theme of polyline vertices. In all cases, data will only be generated for selected polylines if any are selected, or for all polylines if none are selected:



- a. The Results table will contain the following fields:

This option produces a table of statistics describing each selected polyline in the Input theme. If no polylines are selected, then all polylines are used.

- **[OutputID]:** Unique ID number for each record.
- **[ID]:** Identical to your Input theme ID field.
- **[Length]:** Exact length of polyline.
- **[Length_str]:** Straight-line length from start- to end-point of polyline.
- **[Len_Prop]:** Equal to [Length] / [Length_str]; a measure of convolutedness.
- **[Gen_Angle]:** Azimuth from start to end of polyline; average bearing.
- **[Avg_Seg_Len]:** Average length of polyline segments (vertex-to-vertex).
- **[Int_Angle]:** Average internal angle formed by all sets of 3 consecutive, connected vertices.

- **[Dev_Angle]:** Average deviation angle formed by all sets of 3 consecutive, connected vertices.
- **[Seg_Count]:** Number of polyline segments (vertex-to-vertex).
- **[Num_Parts]:** Number of parts of polyline. Some polylines are multi-part polylines, which are composed of disconnected sections contained within a single record.
- **[Num_Angles]:** Number of internal angles in polyline. These are only those angles where segments are actually connected. Separate parts of a multipart polygon will probably not be connected, and therefore this extension will not consider any internal angle between parts.
- **[Vertices]:** Number of vertices in polyline.
- All the original fields you specified from your original polyline theme

You have the option to join this table to your original polyline theme if you wish. This join is only maintained in ArcView memory and will not affect your actual polyline theme. The Results table will be added to your project regardless of whether you join it to the polyline attribute table.

b. The Polyline Shapefile of route segments will contain the following fields:

- **[Seg_ID]:** Unique ID number for each segment record.
- **[num_in_rte]:** Number of segment within this polyline.
- **[ID]:** Identifies the polyline this segment comes from.
- **[Seg_Length]:** Exact length of segment.
- **[Seg_Azimuth]:** Azimuth of segment.
- **[Dev_Angle]:** Angle by which this segment deviates from previous segment. This value will be null if there is no previous segment to deviate from (i.e. this segment is the first segment in the polyline, or the first segment of any part of a multipart polyline).
- **[Int_Angle]:** Angle defined by this segment and the previous segment. This value will be null if there is no previous segment to form an angle with (i.e. this segment is the first segment in the polyline, or the first segment of any part of a multipart polyline).
- All the original fields you specified from your original polyline theme.

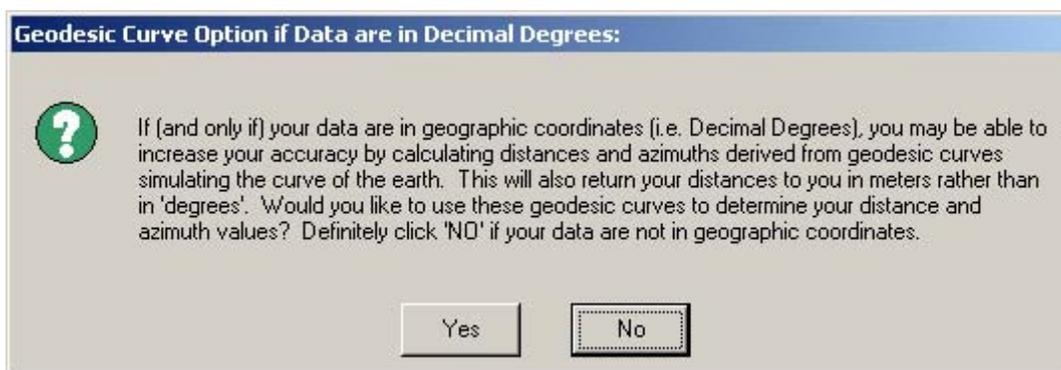
c. The Point Shapefile of path vertices will contain the following fields.

- **[Point_ID]:** Unique ID number for each point record.
- **[num_in_rte]:** Number of point within this polyline.
- **[ID]:** Identifies the polyline this vertex comes from.
- **[X_Coord]:** X-coordinate of vertex.
- **[Y_Coord]:** Y-coordinate of vertex.
- All the original fields you specified from your original polyline theme.

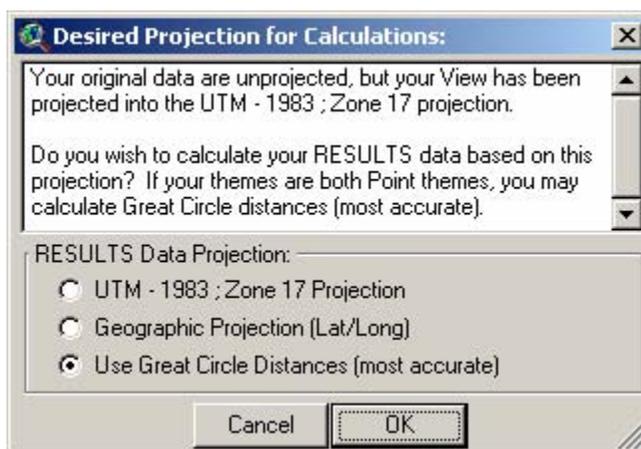
3) Projection Options: You may have the option to choose the projection to use to calculate your statistics. If all of the following conditions are met:

- Your view is unprojected
- The combined extent of all themes in your view lies within the possible range of geographic coordinates (i.e. no part of any theme can have an X-coordinate < -180 or > 180, or a Y-coordinate < -90 or > 90).

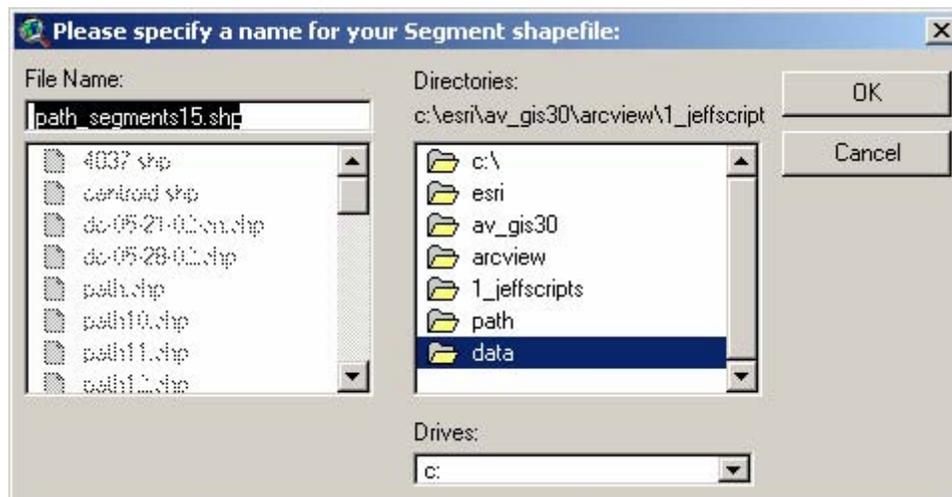
Then the extension will assume that the data may be in geographic coordinates and offer you the option to calculate your statistics based on geodesic curves (see [Geodesic Curves](#) description on p. 10). This option will generate distance values in meters.



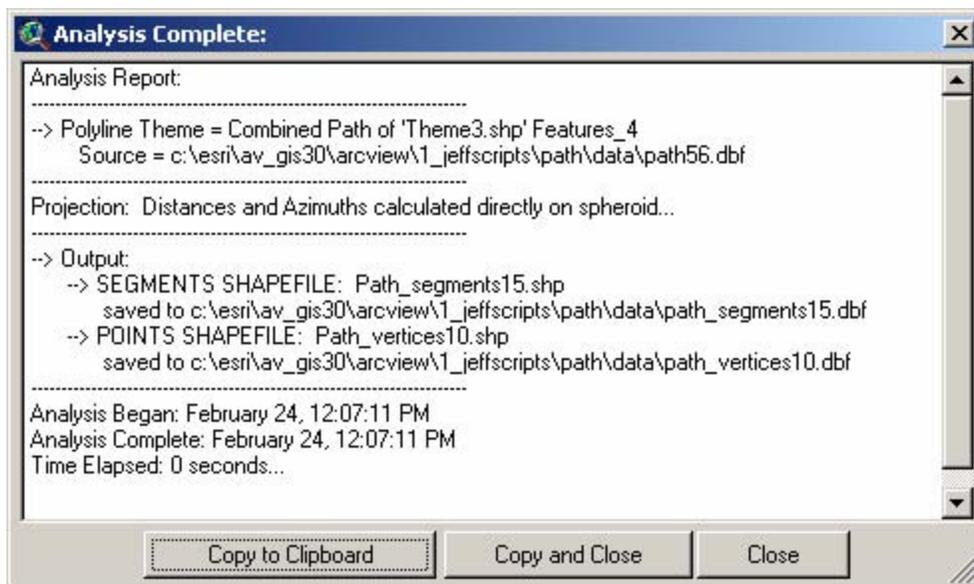
If your view is projected, then this extension will assume the data are unprojected (which they should be; views should not be projected if the data are already projected), then this extension will offer you the option to calculate statistics based on the view projection or on geodesic curves:



- 4) You will then be asked where to save your various output choices. These are standard ArcView dialogs and should be familiar to most users:



- 5) **Report:** When the extension finishes, it will open the Results table and add any new themes to the view. It will then generate a short report describing what it has done:



Creating a Record Number Field:

A few of the functions offered in this extension require that you specify a field containing values to be used to sort a set of points or records. The tools are written this way so that you will be able to match output data to input data. Unfortunately, this can be a problem if you do not have a field with unique ID values for each feature or record.

In the absence of anything better, record numbers can be used as unique identifiers and will allow you to join the input and output tables. Therefore the author added this function to create a “Record Number” field to your table. **IMPORTANT:** This function will modify your existing table and the change will be permanent. There is no UNDO operation for this. The modification is minor, though, and none of your current data will be changed. Any selection you have set will still be there after the operation.

All you need to do is open your table, click the “Edit” menu, and then click “Create Record Number Field”. The table does NOT need to be set to Editable prior to this. The tool will add a field named [rec_num] and populate it with record number values. If a field named [rec_num] already exists in your table, the tool will append an index number to the name until it finds a name that does not exist in your table (i.e. [rec_num_1], [rec_num_2], etc.)



Troubleshooting:

If you encounter some strange crash, please click the menu item “Check ‘Pathfind.avx’ Scripts” in either the View or Project Help menu. Click this as soon as you are able to following the crash. With any luck, that function will generate a report with enough information for the author to find and fix the problem.

Updates:

The 1.1 update fixes a bug involving distances and bearings to complex polygons (multipart polygons and/or those containing holes) and complex polylines. It also includes options to conduct calculations in Geographic vs. View Projections.

The 2.0 update adds the option to save output in shapefile format, adds some internal angle measures, and adds the option to use a table as input data.

The 3.0 update adds the option to calculate the distance and azimuth values using geodesic curves, provided that the path objects are points. The 3.0 update also:

- 1) Repairs a bug in which the internal angle and the deviation angle were reversed.
- 2) Removes all internal code references to global variables in order to prevent any potential conflicts with other extensions.
- 3) Includes modifications to generate any new segment and route shapefiles in the same coordinate system as the current view, ensuring that these shapefiles will be visible in the view regardless of the coordinate system of the view.

The 3.1 update again repairs the bug in which the internal angle and the deviation angle were reversed.

Version 3.2 (February 23, 2005) adds the option to generate statistics on currently existing polyline paths. This version also corrects a bug in which Date fields could not be used as ID fields.

Version 3.2b (March 14, 2007) corrects an issue in which bearings generated using geodesic curves might be reported as negative numbers, such that Due West might be reported as -90° instead of 270° .

Enjoy! Please contact the author if you have problems or find bugs.

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Updates to this extension and an on-line version of this manual are available at

<http://www.jennessent.com/arcview/path.htm>

Please visit *Jenness Enterprises* [ArcView Extensions](#) site for more ArcView Extensions and other software by the author. We also offer customized ArcView-based [GIS consultation](#) services to help you meet your specific data analysis and application development needs.

