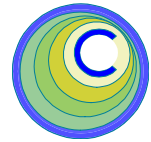


The CEDRA Corporation's COMMAND OF THE MONTH

A monthly information bulletin

January 2011

FEATURED COMMAND
Mass Projection of
Point Features



Application Description

An application recently arose where it was desired to: (a) project a group of point features upon a group of line features and (b) assign to the point that was projected an attribute value of another point close to the point of projection.

This particular application involved assigning to a group of water meters the identification value of a junction node closest to the water meter. Since water meters are tied to water mains, the approach of using the projection of the water meter upon a water main had to be used rather than a spatial search of a junction node closest to a water meter.

As usual there was no out-of-the-box solution for this specific problem but after reviewing the problem we determined that we could develop a new command, which would address this application relatively quickly.

The CEDRA Solution

To address this issue, the [Project Points on Lines] command has been added to the {Skeletonize Tools} menu combo box, which is within the CEDRA-Skeletonization-Tools toolbar shown in Figure 1. Note that this new command has been added to the combo box within the last month.

Project Points on Lines Overview

The [Project Points on Lines] menu command enables the user to project a group of selected point features on one or more

line features, which may reside in one or more layers. The point and line layers are made active or selected by the user in the Table of Contents prior to activating the command.

When a line layer is made active, the command will process the current selection set for the line layer. If the line layer does not contain any selected features, then all line features in the layer will be processed. So that, if the user wishes the command to only project points upon specific lines, the user will need to select these line features prior to activating the command.

Command Of The Month bulletin

This month's issue discusses how to project a group of selected point features upon one or more line features and transfer an attribute value.

Additionally, and optionally, the user is able to specify a point layer from which an attribute value can be transferred to the selected points. This layer is referred to as the Point 2 Layer and must be made active in the Table of Contents prior to activating the command.

This command is able to create:

- Point features denoting the point of projection for a point that was projected. The new point feature is stored in the current active layer.
- Line features which connect the point to be projected with the re-

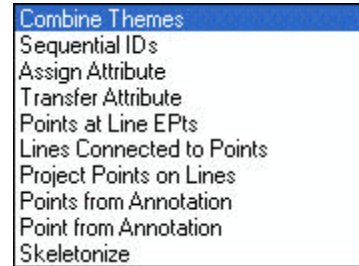


Figure 1
CEDRA-Skeletonization-Tools Toolbar

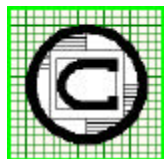
sultant point of projection. The new line feature is stored in the current active layer.

- Optionally, transfer an attribute value from a point in the Point 2 Layer that is closest to the point of projection, not the point which was projected.

Upon activation, the command determines if there are any active layers in the Table of Contents. The command will then determine if there are any active point and line layers and finally if there are any selected point features. The points that are to be projected must be selected prior to activating the command.

Once the validation process has finished, a multi-input dialog box is displayed from which the user can specify the various projection parameters.

Clicking the OK button results in the command to begin the projection of the selected point features upon the line features in the active line layers. A progress bar is displayed informing the user as to the status of the processing.



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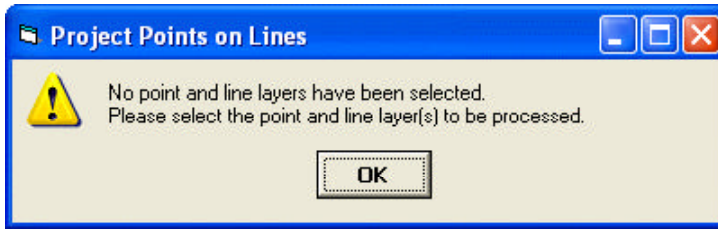


Figure 2
No Active Point and Line Layers Error Message

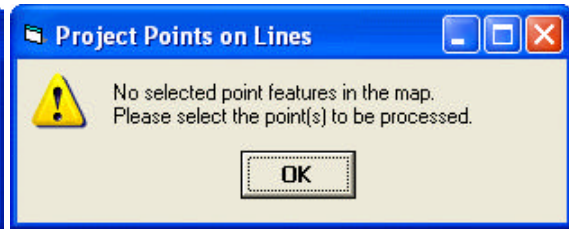


Figure 3
No Selected Point Features Error Message

Once the command has finished its operations, the command will display in the status bar area: (a) the number of points that were projected, (b) the number of point features that were created, and (c) the number of line features that were created. Depending upon the geometry of the points and lines, there may be cases where a projection can not be computed.

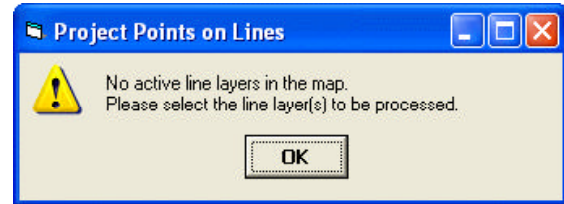


Figure 4
No Active Line Layer Error Message

Project Points on Lines Operation

- **1** **Select** the point feature(s) to be projected.
- **2** If appropriate, **select** the line feature(s) to be processed. If an active line layer does not contain any selected line features then all line features in the layer will be processed.
- **3** If appropriate, **select** the point feature(s) in the Point 2 Layer to be processed. If a Point 2 Layer has been specified, the command will process the selected points in the Point 2 Layer. If the Point 2 Layer does not contain any selected point features then all point features in the layer will be processed. This step needs to be performed only if the user wishes to transfer an attribute from the Point 2 Layer to the selected points.
- **4** **Activate** in the Table of Contents all of the point and line layers to be processed.
- **5** **Scroll** down in the {Skeletonize Tools} menu combo box, and **select** the [Project Points on Lines] command.

If there are no active point and line layers at the time the command is activated, or if there are no selected point features, or if there are no active line layers, an appropriate error message will be displayed. Shown in Figures 2, 3 and 4 are some of the error messages that can appear.

At this point, click the OK button, perform the appropriate adjustment(s) and re-select the command.

- **6** **Enter** the appropriate information for the various parameters shown in Figures 5 and 6. If there is only one active point layer, the multi-input dialog box that is displayed will resemble the one displayed in Figure 5. If there is more than one active point layer, see Figures 6 and 7.

In specifying the information requested by the parameters shown in Figures 5 and 6, the user should note the following:

- The *Point 2 Layer* parameter enables the user to specify the point layer from which an attribute value will be transferred to the

points to be projected. This parameter has an effect only if there is more than 1 active point layer.

- The *Point 2 ID Field* parameter enables the user to specify the field in the Point 2 Layer that contains the value to be transferred to the points to be projected. This parameter has an effect only if a Point 2 Layer has been specified.

- The *Selected Points ID Field* parameter enables the user to specify the field that is to receive the Point 2 ID Field value. This parameter has an effect only if a Point 2 Layer has been specified.

- The *Create Point at Projection* parameter enables the user to indicate whether or not new point features are to be created denoting the point of projection. Selecting the Yes option will result in a new point feature being created at the point of projection. This new feature will be stored in the current active layer.

- The *Create Connecting Lines* parameter enables the user to indicate whether or not new line features are to be created con-

necting the point that was projected with the point of projection. Selecting the Yes option will result in a new line feature being created that connects the point being projected with the point of projection.

- The *Maximum Projection Offset* parameter enables the user to specify a value in world units denoting the maximum allowable projection distance. A value of zero denotes that there is no maximum.

- The *Point 2 Proximity Tolerance* parameter enables the user to specify a value in world units denoting the maximum offset of a Point 2 Layer feature from a line feature. A value of zero denotes that there is no maximum. This parameter has an effect only if a Point 2 Layer has been specified.

- The *Extrapolate Projection* parameter enables the user to indicate whether or not the command should allow projections that fall outside the end points of a line feature. Selecting the No option for this parameter denotes that the projection must fall within the end points of a line feature in order for it to be considered valid. Selecting the Yes option denotes that the command will accept projections which fall outside the end points of the line feature.

- **7** Click at the **OK** button to begin the processing, or click at the **Cancel** button to abort the command.

If the OK button is selected, the command cycles through the selected point features which may appear in one or more layers.

As a point is processed, the command projects the point on the lines within the active line layers. If a line layer contains selected

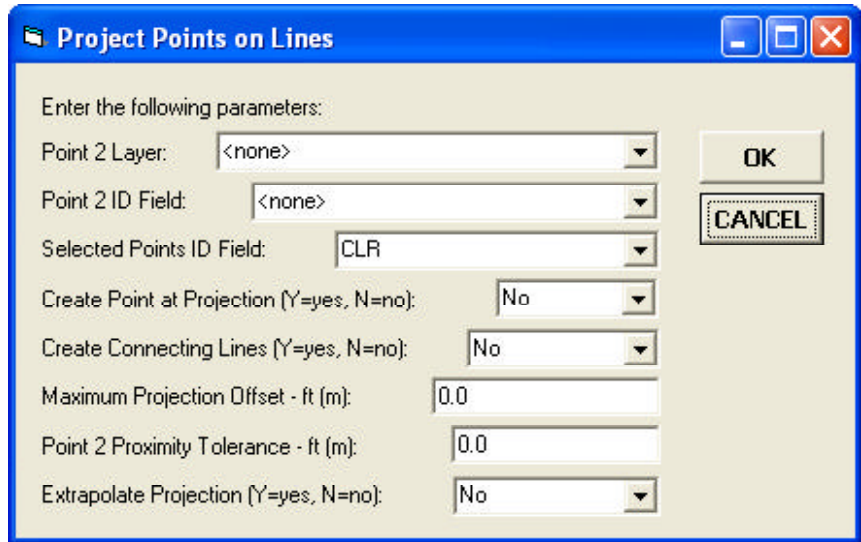


Figure 5
Multi-Input Dialog Box when there is only 1 Active Point Layer

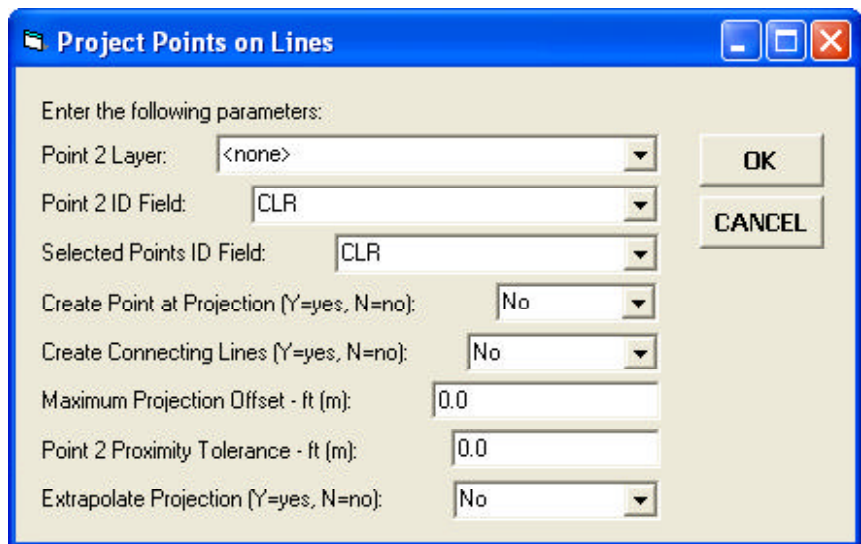


Figure 6
Multi-Input Dialog Box when there are more than 1 Active Point Layer

features then only these lines are examined. If the line layer does not contain selected features then all lines in the layer are examined.

As a projection is computed, the command determines the plus and offset values from the start point of the line feature. The projection that is used is the one which has the smallest offset value. If a nonzero Maximum Projection Offset value has been specified, the



Figure 7
Drop-Down List of Potential Point 2 Layers

command will further check to ensure that the offset is less than the maximum projection offset value. If the computed offset value is greater than the maximum

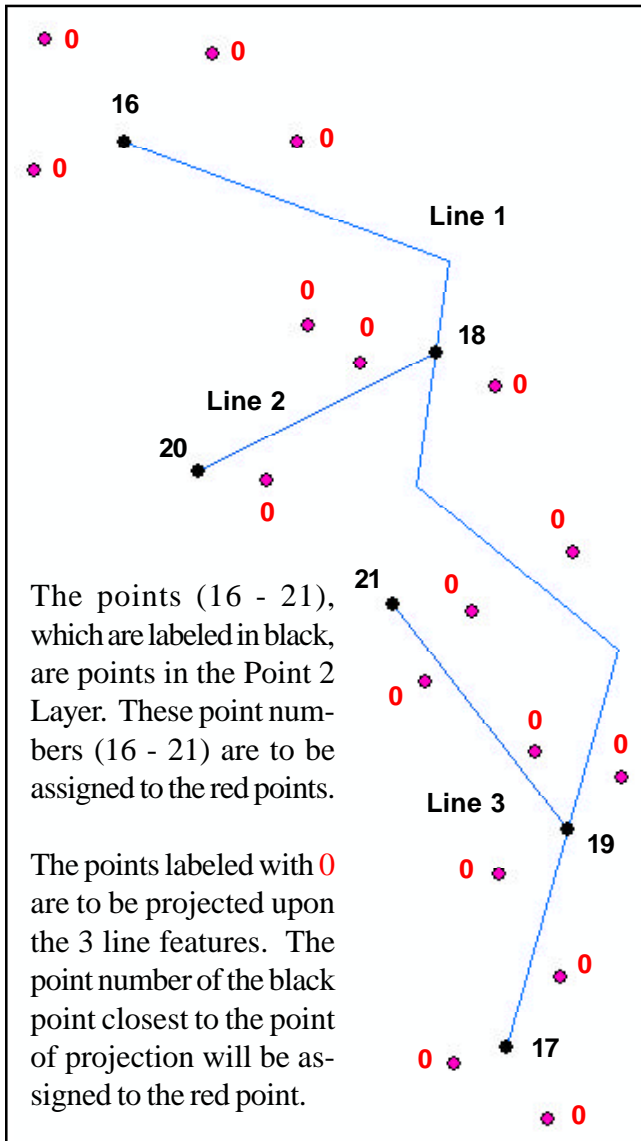


Figure 8
17 Point Features to be Projected upon 3 Line Feature

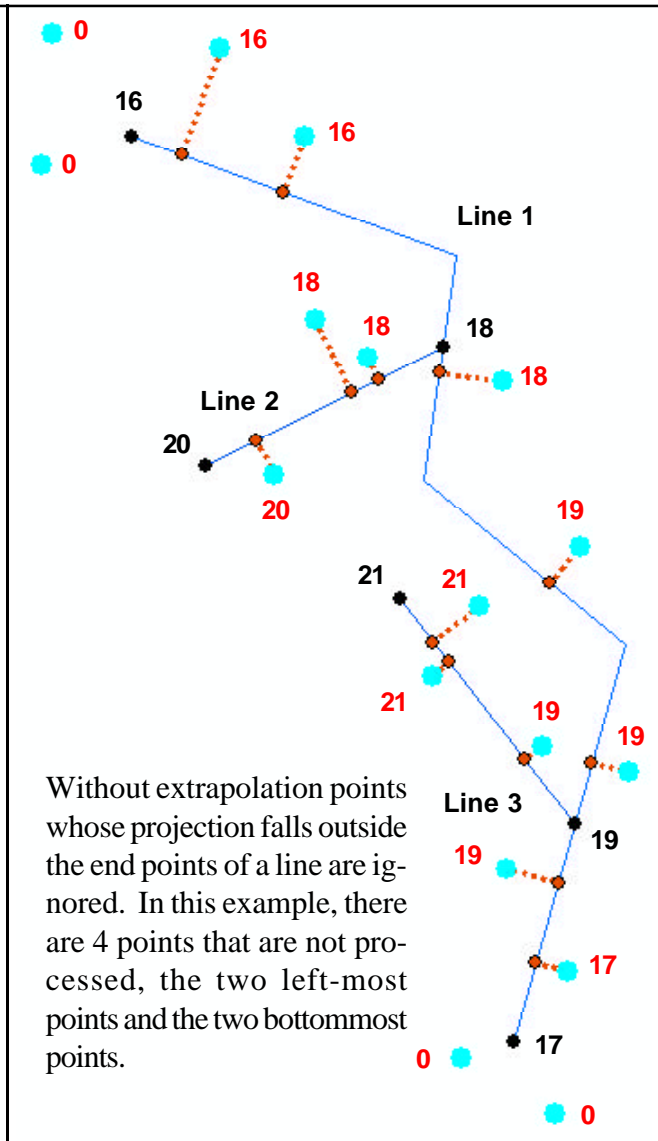


Figure 9
Projection with No Extrapolation

projection offset value, the projection is considered invalid.

The MaximumProjectionOffset value is also used to improve performance in processing the line features. This is accomplished by checking if the point to be projected is within the enclosing envelope of a line feature that has been increased in height and width by the Maximum Projection Offset value. If the point does not fall within this enclosing rectangle then the command knows that

the resulting projection will be invalid. As such, the command can skip the process of projecting the point upon the line feature which in turn improves performance.

When extrapolation is active, as defined by selecting the Yes option within the Extrapolate Projection parameter, the Maximum ProjectionOffset value can also be used to effect the results. In this case, the command will check if the plus value of the projection is

larger than the MaximumProjection Offset value. If so, the projection is considered invalid.

Shown in Figure 8 are three line features, one of which is a polyline. The red points which are labeled with 0 represent the points to be projected upon the three line features. The 0 in this example indicates a point number, while the black points which are labeled 16 through 21 represent points in the Point 2 Layer.

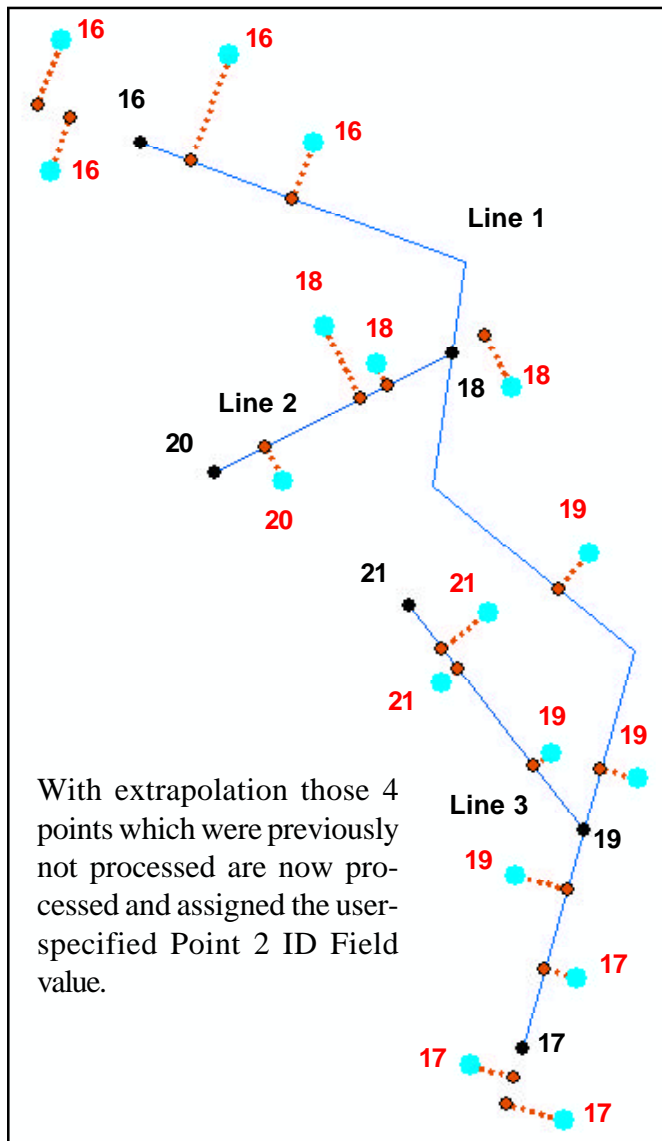


Figure 10
Projection with Extrapolation

In this example, it is desired to transfer the point number of the black points to the red points. The point number that will be transferred is the point number of the black point that is closest to the projection of the red point upon a line feature.

Shown in Figure 9 are the results when the [Project Points on Lines] command is used without extrapolation. Note that the two left-most and two bottommost points have not been assigned a point

number (the value 0 appears next to the highlighted point). This is due to the fact that the point of projection falls outside the end points of the line feature.

In this example, a Maximum Projection Offset value of 600 was used, as well as a Point 2 Proximity Tolerance value of 10.

Shown in Figure 10 are the results when the command is re-executed using the same parameter values mentioned above with the excep-

tion that extrapolation has been activated. Notice the two left-most and two bottommost points, which previously were not assigned a point number, have now been assigned a point number. In the case of the two left-most red points, the point number 16 has been assigned, while for the two bottommost red points, the point number 17 has been assigned.

Notes

- a. If the user is interested in just projecting points upon line features to create point features, specify:
 - ▶ the <none> option for the Point 2 Layer parameter,
 - ▶ the Yes option for the Create Point at Projection parameter and
 - ▶ the appropriate values for the Maximum Projection Offset and Extrapolation Projection parameters.
- b. Shown in Figure 11 is an example of four points projected upon a single line which is drawn in blue. Depending upon the setting of the Maximum Projection Offset and Extrapolation Projection parameters, the projections can be valid or invalid.
- c. Shown in Figure 12 is an illustration of how the Point 2 Proximity Tolerance value is used. Points 1, 2 and 3 denote point features in the Point 2 Layer. The point to be projected is projected upon the blue line resulting in the point of projection which is the green point.

To determine which Point 2 feature will be used in transferring the Point 2 ID Field value, the command will project the Point 2 features (points 1, 2 and 3) onto the blue line and determine if the offset of the projection is within the Point 2 Proximity Tolerance value.

In the sample shown in Figure 12, points 1 and 3 are considered potential candidates, while Point 2 is ruled invalid since it is outside the

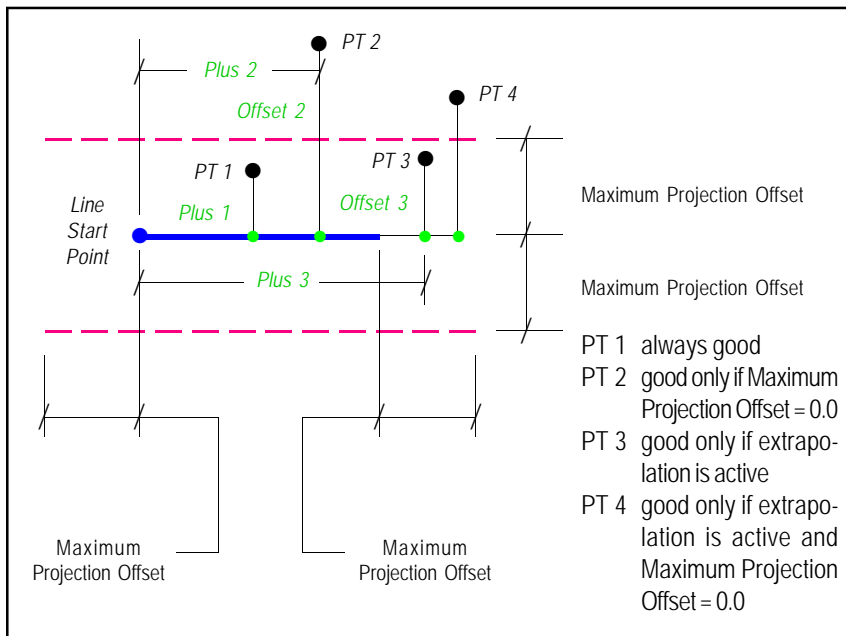


Figure 11
 Sample Projection of 4 Points upon a Single Line Feature

allowable limit. Finally, the command computes the distance from the point of projection to the potential candidates using the point that has the smallest distance value. In this example, point 1 is considered the closest Point 2 feature to the point to be projected.

Summary

In dealing with the application described at the beginning of this publication, the [Project Points on Lines] command turned out to be a tremendous time saver because without this command the user would have had to process the points to be projected on a one-to-one basis. That is, project the point on a line. Determine which junction node was closest to the point of projection and then assign the identification value to the point that was projected. When you are dealing with a dozen or so points it's not such a big deal, but imagine if you have tens of thousands of points to process. Then that's a different story altogether.

Users with a software support agreement should check with The CEDRA Corporation on how to obtain a software update so as to be able to utilize this new functionality.

As always, users who have a need for functionality that is not presently available in CEDRA software should feel free to forward these requests to CEDRA, as well as, any other comments or suggestion you may have.

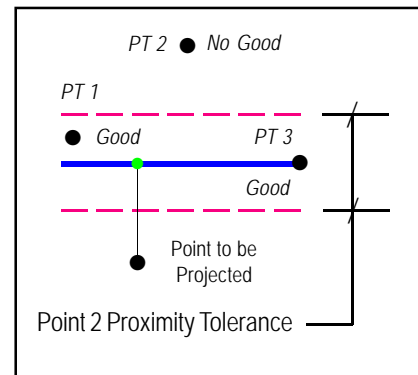


Figure 12
 Illustration of how the Point 2 Proximity Tolerance is used

If you have a request for Command Of The Month, feel free to phone, fax or e-mail your request to The CEDRA Corporation.