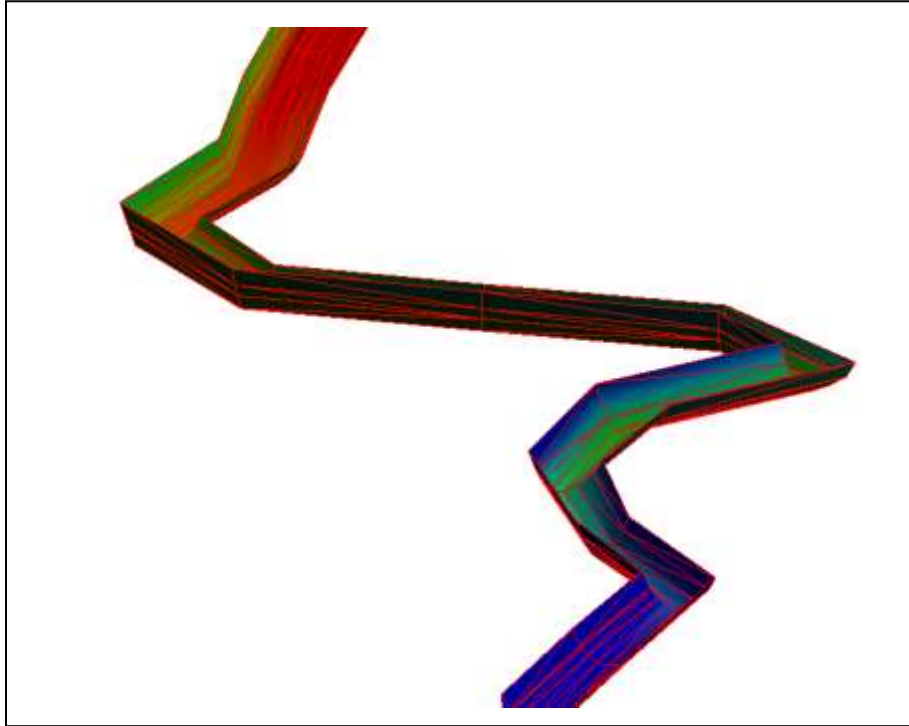


SMS 13.1 Tutorial

Working with Annotated Cross Sections



Objectives

This tutorial demonstrates how to import annotated cross sections and create a channel surface

Prerequisites

- SMS Overview
- Map Module
- Scatter Data – Import/Export

Requirements

- Scatter Module
- Map Module

Time

- 15–30 minutes

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1 Introduction

This tutorial demonstrates how to create a surface from an annotated set of cross sections. A cross section database can be created as these cross sections are imported into SMS. These cross sections can then be used to create a surface in the form of a scatter set.

This tutorial uses an arbitrary set of sample data for illustration. The project begins with a 1D-hydraulic centerline map coverage. Since this project is for demonstration purposes only, the projection is set to be a local projection.

The tutorial will show how to import a cross section database into SMS, how to convert the database into a scatter set surface, and then review and improve the surface.

2 Getting Started

Start by importing a project file containing the centerline coverage:

1. Launch the SMS application.
2. If SMS is already running, select *File* / **New** to ensure that the program settings are restored to their default state.
3. If asked to save changes, click **Don't Save** to close the dialog and restore SMS to a default state.
4. Select *File* | **Open...** to bring up the *Open* dialog.
5. Select "Project Files (*.sms)" from the *Files of type* drop-down.
6. Browse to the *data files* folder for this tutorial and select "input.sms".
7. Click **Open** to import the project and exit the *Open* dialog.

The project should appear similar to Figure 1.

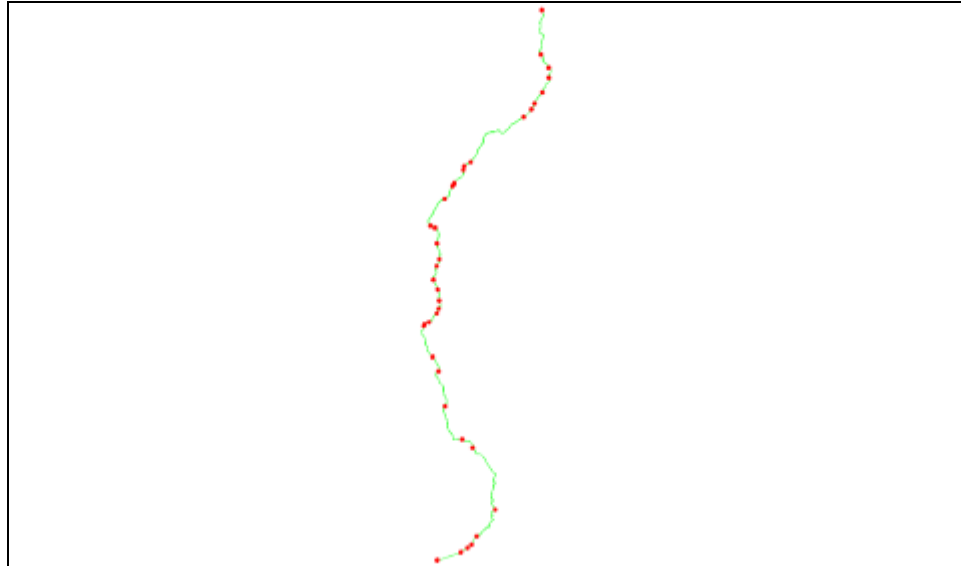



Figure 1 Initial project containing the river centerline arcs.

3 Importing the Cross Section Database

This project imports a cross section database from a text file containing definitions for each cross section. This file also contains additional attributes of the cross sections. Some of these attributes are:

- LV: left embankment top
- LU: left embankment bottom
- FS: centerline
- RU: right embankment bottom
- RV: right embankment top
- K: ceiling of a bridge
- P1–Pn: abutments or piers of a bridge.
- WSP: measured water surface elevation point

The attributes will be imported into an SMS map coverage. The attributes used in the scatter set will be selected when converting the map coverage to a scatter set.

1. In the Project Explorer, right-click on “ Map Data” and select **New Coverage** to open the *New Coverage* dialog.
2. For the *Coverage Type*, select the *1D-Hyd Cross Sections* type.
3. Click **OK** to close the *New Coverage* dialog.


This creates a coverage to store the cross sections as they are read.

4. Select *File* | **Open...** to bring up the *Open* dialog.
5. Select “All Files (*.*)” from the *Files of type* drop-down.
6. In the *data files* folder for this tutorial, select “XS_csv.csv”.

7. Click **Open** to exit the *Open* dialog and bring up the *Step 1 of 2* page of the *File Import Wizard* dialog.






This dialog defines how the cross section attributes are imported.

8. In the *File import options* section, turn on *Comma*.
9. Make sure *Treat consecutive delimiters as one* is turned off.
10. Click **Next >** to go to the *Step 2 of 2* page of the *File Import Wizard* dialog.
11. Select “Feature Data” from the *SMS data type* data.
12. Make sure the name “1D-Hyd Cross Section” is displayed on the *Coverage* button. This indicates where the cross sections will be stored.
13. In the *Mapping options* section, turn on *Cross section database*.
14. In the *File preview* section, change the *Type* for the following headers:
 - a. In the *CSnumber* column, select “XS ID” from the *Type* drop-down.
 - b. In the *station* column, select “Station” from the *Type* drop-down.
 - c. In the *xJabr* column, select “Distance” from the *Type* drop-down.
 - d. In the *Z*, *X*, and *Y* columns, select “Z”, “X”, and “Y” (respectively) from the *Type* drop-downs if not already selected.
 - e. In the *Attribute* column, select “Pt Type” from the *Type* drop-down to bring up the *Point Property Types* dialog.
 - f. Accept the default settings and click **OK** to close the *Point Property Types* dialog.
15. Click **Finish** to close the *File Import Wizard* dialog.

The cross section coverage “ 1D-Hyd Cross Section” should now be visible in the Project Explorer with the cross sections also appearing in the Graphics Window.

4 Viewing a Cross Section

To view an individual cross section and the attributes that were imported:

1. In the Project Explorer, expand the “ Annotation Data” and turn on the “ Zone #1” layer.
2. Right-click on the “ Zone #1” layer and select **Zoom to Layer**.
3. Select the “ 1D-Hyd Cross Section” coverage to make it active.
4. Using the **Select Feature Arc**  tool, click on each of the four cross sections in the zone and make note of the cross section ids.

The id will appear in the information box at the bottom of the screen when the arc is selected. Note this zone includes arcs 243, 26, 244 and 245.

5. Double-click on arc 243 to open the *River Cross Section Attributes* dialog.

This dialog displays the cross section station as well as a preview of cross section shape.

6. Click on the **Assign Cross Section** button to bring up the *Assign Cross Section* dialog.
7. Click the **Edit** button to bring up the *Cross Section Attributes* dialog.
8. Click on the *Point Props* tab to view the annotated properties loaded for this cross section.
9. Click **Cancel** to close the *Cross Section Attribute* dialog.
10. Click **Cancel** to close the *Assign Cross Section* dialog.
11. Click **Cancel** to close the *River Cross Section Attributes* dialog.

5 Viewing an Excluded Cross Section

Some cross sections include data that is not appropriate for building a surface of the channel bed. For these situations, either individual points or entire cross sections will be excluded later. To illustrate this condition:

1. Double-click on arc 26 to open the *River Cross Section Attributes* dialog.


Note that the cross section includes several points representing the bottom side of the bridge as well as points that represent the base of bridge piers.

If desired, you can review the point properties as shown in the previous section.

2. Click **Cancel** to close the *River Cross Section Attributes* dialog.

6 Creating a Scatter Set from a Cross Section Database

The cross section database can be used to create a scatter set surface which honors the annotations on the cross sections. This surface will connect the features along the channel. As an example, the channel centerline from each cross section will be connected to create a continuous centerline. To create this surface:

1. Right-click on “ 1D-Hyd Cross Section” and select *Convert | Map → 2D Scatter* to open the *Map → Scatter* dialog.
2. In the *Create Scatter Point Set Source* section, select *Cross-section database*.
3. Click **OK** to close the *Map → Scatter* dialog and open the *Excluded Features* dialog.

The *Excluded Features* dialog allows determining which of the cross section attributes will be used in creating the scatter set. In this case, the bridge surface cross sections are not needed, and the water surface points should be excluded.

4. To exclude the water surface points, turn on *Exclude Point* on the *WSP* row.

These water level points are not part of the ground surface, but other points on the cross section are still valid.

5. Turn on *Exclude Cross Section* on the *K* row.



These cross sections represent the underside of a bridge deck and therefore are not part of the ground surface.

6. Click **OK** to close the *Excluded Features* dialog and finish generating the scatter set.
7. A warning dialog appears stating that some points cannot be triangulated. This will be discussed later, so click **OK**.

SMS has created a scatter set surface by connecting cross sections and honoring the connection of common point types. It has been added to the project and displayed. Note that cross sections 26 and 244 were not included. These cross sections include a bridge and have *K* points, so they were excluded from the triangulation.





7 Viewing Issues with the Scatter Set

Now to review the triangulation to understand what has been created as well as what problems exist. Adjusting the display option can help in seeing how the cross-section database was converted to a surface. To set the display options:

1. Click **Display Options**  to open the *Display Options* dialog.
2. Select *Scatter* from the list on the left.
3. On the *Scatter* tab, click **All Off**.
4. Turn on *Triangles*
5. Turn on *Contours*.
6. On the *Contours* tab, in the *Contour method* section, select “Color Fill” from the first drop-down.
7. Switch to the *General* display options from the list on the left side of the dialog.
8. Select the *Lighting* tab, and enable the *Enable lights* option.
9. Click **OK** to close the *Display Options* dialog.
10. Click on the “ 1D-Hyd Centerline” coverage to make it active.

7.1 Excluded Cross Sections and Connections

To see the connections and how SMS has created this surface:

1. In plan view, turn on the “ Zone #2” layer under “ Annotation Data” in the Project Explorer.
2. Right-click on “ Zone #2” and select **Zoom to Layer**.
3. In the Project Explorer, select “ Scatter Data”.
4. Issue the *Data | Set Contour Min/Max* command to set the contour levels.

The graphics window should now appear as shown in Figure 2.

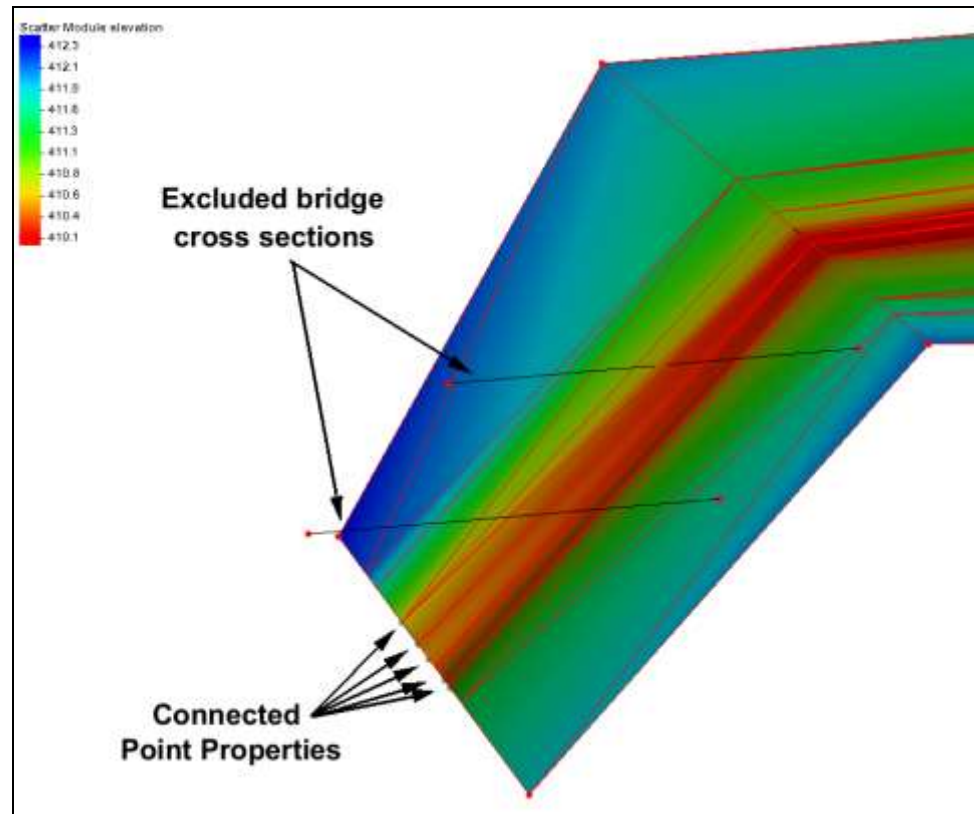






Figure 2 Connected point properties and excluded cross sections

Figure 2 shows the river centerline, channel toes and channel banks connected in adjacent cross sections. It also illustrates the excluded bridge cross sections.

7.2 Triangulation Error

When the surface was generated, SMS gave a message that there was an error in the triangulation of the channel surface. To see the connections and how SMS has created this surface:

1. In plan view, turn on the “ Zone #3” layer under “ Annotation Data” in the Project Explorer.
2. Right-click on “ Zone #3” and select **Zoom to Layer**.
3. In the Project Explorer, select “ Scatter Data”.
4. Issue the *Data* | **Set Contour Min/Max** command to set the contour levels.

The graphics window should now appear as shown in Figure 3.

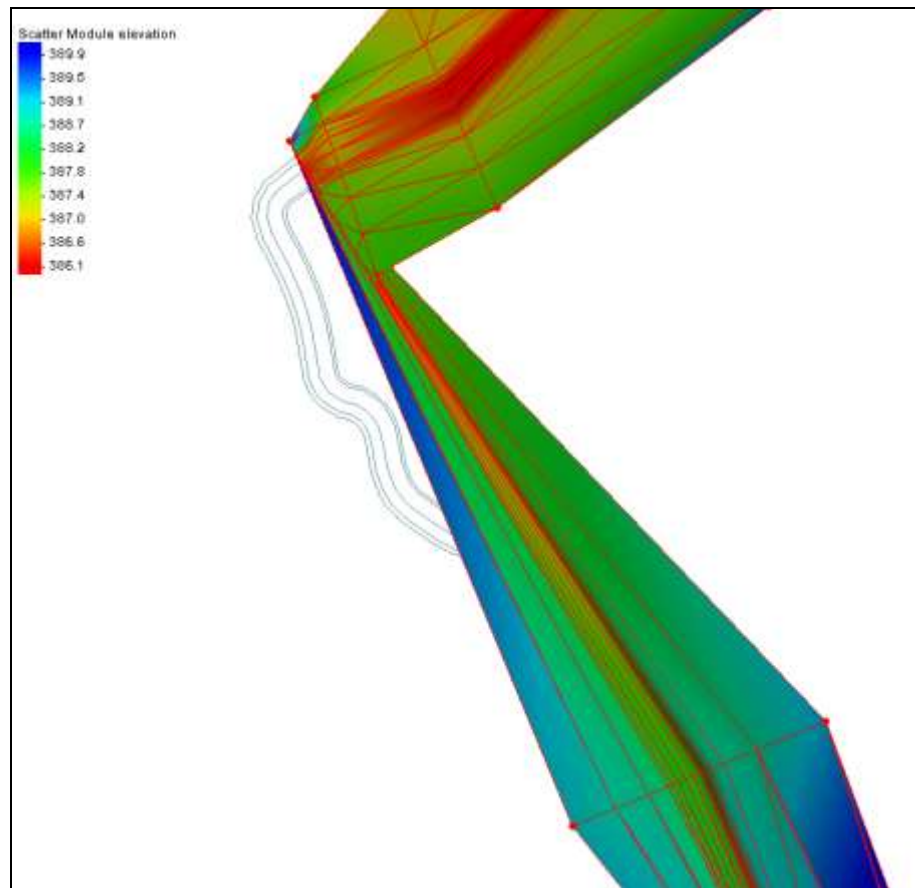


Figure 3 Bend in river not adequately represented by cross sections resulting in triangulation error

Figure 3 shows features from the centerline coverage that are not adequately represented by the distribution of the cross sections. As a result, the channel surface in this area does not represent the channel.

This scatter set has illustrated the problem and can now be deleted.



5. Right-click on “ 1D-Hyd Cross Section scatter” and select **Delete**.

8 Improving Representation Using Interpolated Cross Sections

Interpolated cross sections can be used to improve the channel representation. To do this:


1. Right-click on “ 1D-Hyd Cross Section” and select **Duplicate**.

This creates a new cross-section coverage that we will update to include interpolated cross-sections.


2. Right-click on “ 1D-Hyd Cross Section (2)” and select **Rename**.
3. Rename it to “Interpolated”.
4. Using the **Select Feature Arc**  tool, right-click in the Graphics Window and select **Select All**.
5. Right-click again and select **Interpolate Cross Sections...**

6. SMS will bring up a warning that the river stations will be recomputed. Click **Yes** to this warning and open the *Interpolate Cross Sections* dialog.
7. Enter a *Target spacing* of “20” (this is in meters in this case).
8. Click **OK** to close the *Interpolate Cross Sections* dialog and open the *Excluded Features* dialog.
9. Turn on *Exclude Point* on the *WSP* row.
10. Turn on *Exclude Cross Section* on the *K* row.
11. Click **OK** to close the *Excluded Features* dialog.
12. Click **OK** at the message that states 365 cross sections were created.


Note that many of these cross sections intersect each other in areas of high sinuosity and high curvature of the river. These intersections create ambiguous river stationing. To resolve this, trim the cross sections to the channel.

13. If the cross sections have been unselected, use the **Select Feature Arc**  tool to right-click and select **Select All**.
14. Right-click and select **Trim Cross-section(s)...** to open the *Excluded Features* dialog.
15. Turn on *Trim Left Of* in the *LV* row. This is the left bank.
16. Turn on *Trim Right Of* in the *RV* row. This is the right bank.
17. Click **OK** to close the *Excluded Features* dialog and perform the trim operation.
18. Click **OK** to close the notification about the trimmed cross sections.

Next, generate a surface of the trimmed channel. This is a repeat of the steps in section 6 above. To do this:

19. Right-click on “ Interpolated” coverage and select *Convert | Map → 2D Scatter* to open the *Map → Scatter* dialog.
20. In the *Create Scatter Point Set Source* section, select *Cross-section database*.
21. Change the *New scatter point set name* to “Interpolated Channel”.
22. Click **OK** to close the *Map → Scatter* dialog and open the *Excluded Features* dialog.
23. Turn on *Exclude Point* on the *WSP* row.
24. Turn on *Exclude Cross Section* on the *K* row.
25. Click **OK** to close the *Excluded Features* dialog and finish generating the scatter set.

A new scatter set surface should now be visible in the Project Explorer.

As desired, use the **Zoom**  tool and **Rotate**  tools to review this surface. Note how the thalweg, bank points and other attributes are connected.

9 Conclusion

This concludes the “Working with Annotated Cross Sections” tutorial. Feel free to continue to experiment with cross sections in SMS or exit the program.