Tools Menu : Depth Conversion Tool : Compute the Average Velocity Map

Compute the Average Velocity Map

Tools > Depth Conversion > Compute Average Velocity Map

In the **Compute Average Velocity Map** dialog box you can calculate the average velocity between the seismic datum and a time surface (grid or horizon) or a specific formation top. The time surface may or may not be parallel to the seismic datum.

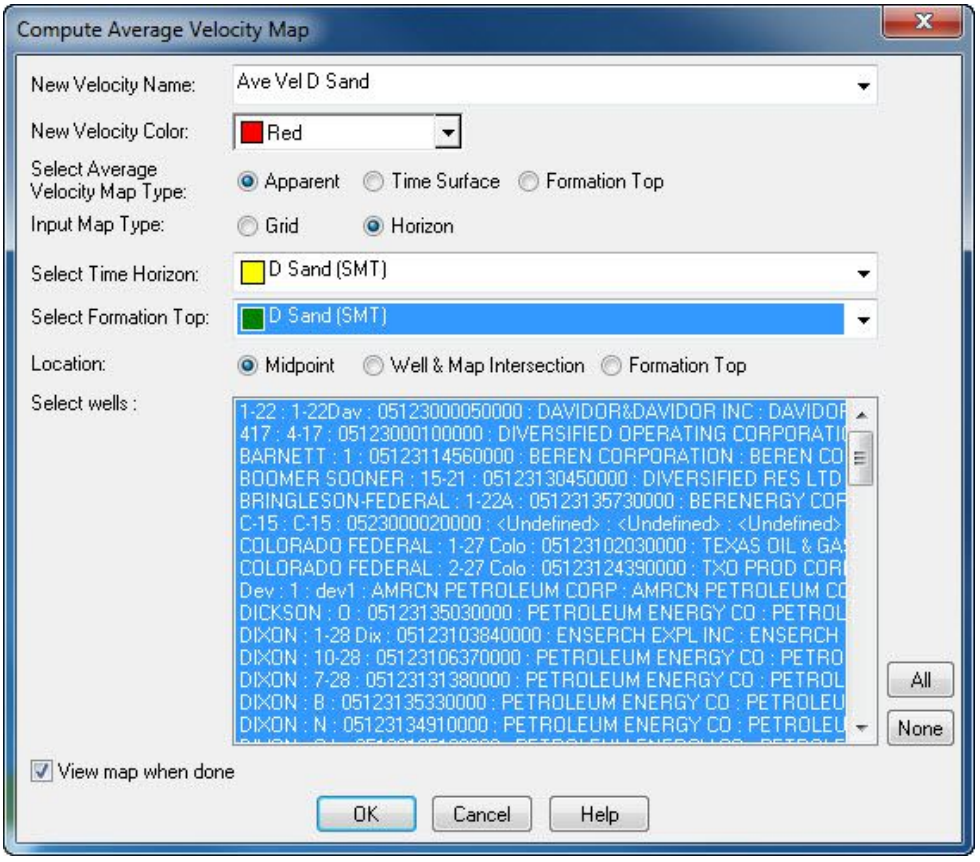
Average velocity is the depth divided by the travel time of a wave to that depth as shown in the following equation:

Average Velocity = (2 * Depth) / Two-way Time

An average velocity map is generated from velocity control points, or time-depth pairs at well locations.

The average velocity is calculated at every control point and gridded based on the selected algorithm.

Whether the input is a horizon, grid, and/or a formation top, the **output** will be a grid in feet/second or meters/second, and a control point file ***.cpt**. The control point file *.cpt will be stored in the Project Folder.

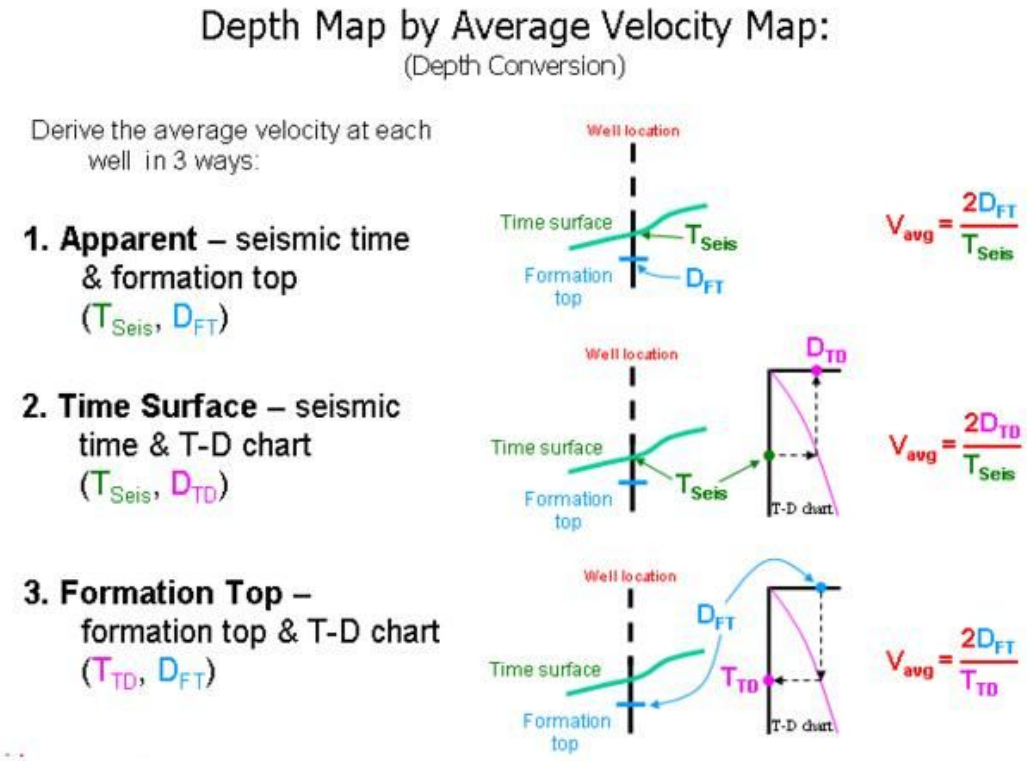


Dialog box items include:

- **New Velocity Name**—displays the name of the output average velocity grid. Enter a new name or use the down arrow to select an existing grid. This existing grid will be overwritten. Only grids with **[*Velocity (Time)]** as the grid data type will appear in this list.

- **New Velocity Color**—use the down arrow to display the color palette from which you can select a color for the new grid.
- **Select Average Velocity Map Type** allows three calculation choices for the average velocity map. An average velocity map can be calculated using a time surface and a formation top, just a time surface, or just a formation top:
  - **Apparent**—requires a time surface (grid or horizon) and a formation top. The time value for the velocity control point comes from the time surface. The depth value for the velocity control point comes from the formation top.

    The TVD (Seismic) depth value is retrieved from the project database for the formation top, along with the time surface value where the surface intersects the well. The procedure is repeated for all the selected wells, thereby providing a set of velocity control points. The average velocity map is then constructed from these velocity control points using one of the various gridding algorithms.
  - **Time Surface**—requires a time surface and wells populated with time-depth charts. Given a time-depth chart, a depth value can be determined given any time value. The grid or horizon time is retrieved at each well and the active time-depth chart is used to derive an equivalent TVD (Seismic) depth value. A set of velocity control points results, which are gridded to produce an average velocity map.
  - **Formation Top**—requires a named formation top and wells populated with time-depth charts. Given a time-depth chart, a time value can be determined given any depth value. At each well, the TVD (Seismic) depth is retrieved from the project database for the formation top. The active time-depth chart is used to derive an equivalent time value. A set of velocity control points results, which are gridded to produce an average velocity map.

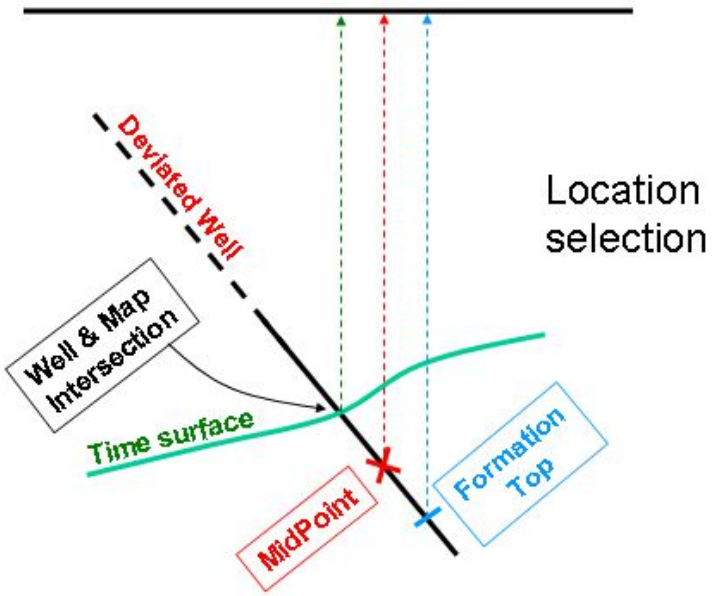


The **Apparent** average velocity map type is illustrated with coinciding **Formation Top** (blue) and **Time Surface** (green). The **Time Surface** average velocity map type is illustrated with only the **Time Surface** and the well time-depth chart. The **Formation Top** average velocity map type is illustrated with only the **Formation Top** and the well time-depth chart.

- **Input Map Type**—displayed and active when either **Apparent** or **Time Surface** is selected for the **Select Average Velocity Map Type**.
  - **Grid**—select if input map is a grid.
  - **Horizon**—select if input map is a horizon.
- **Select Time Horizon/Grid**—displayed and active when either **Apparent** or **Time Surface** is selected for the **Select Average Velocity Map Type**. Use the down arrow to select the input time horizon or grid that will be used to calculate the velocity control points.
- **Select Formation Top**—displayed and active when either **Apparent** or **Formation Top** is selected for the **Select**

Average Velocity Map Type. Use the down arrow to select the input formation top that will be used to calculate the velocity control points.

- **Location**—active when **Apparent** is selected for the **Select Average Velocity Map Type**. used with deviated wells. Since the time surface and the formation top locations may not coincide, three X/Y choices are available for determining where average velocity values should be calculated:
  - **Midpoint**—select to use X/Y location at the midpoint between the intersection of the time surface with the borehole and the formation top.
  - **Well & Map Intersection**—select to use X/Y location at the intersection of the time surface and the well borehole.
  - **Formation Top**—select to use X/Y location where formation top and the well borehole coincide.



  - The Horizon and Formation Top mistie. Therefore, each of the three Location X/Y choices is represented along the deviated well.

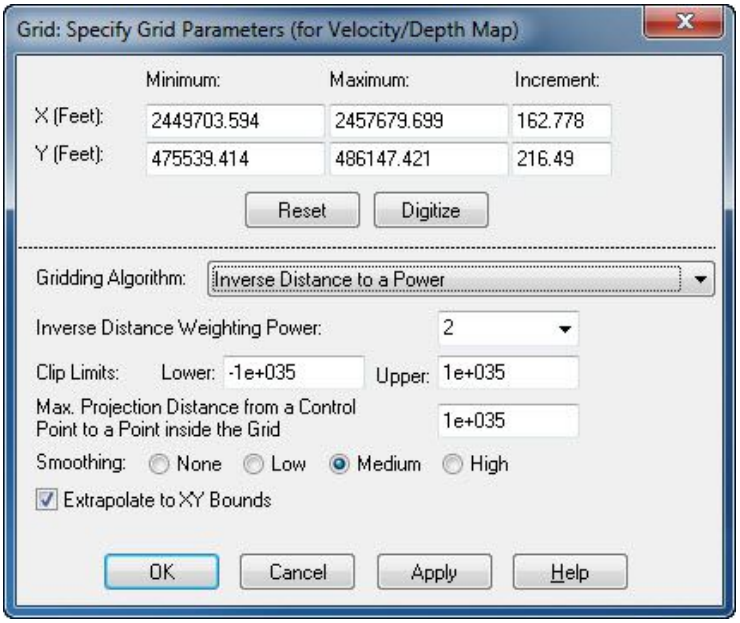
    If misties exist between the formation top and the time surface in deviated wells, then each **Location** selection will produce a slightly different grid.

    However, if all the formation tops have been tied to the time surface, then all three maps will be the same.
  - If the **Formation Top** and **Time Surface** intersection are at exactly the same location, then all three **Location** options will produce the same average velocity map.
  - If the **Formation Top** and **Time Surface** intersection are in close proximity, then each **Location** option will produce a different average velocity map but the difference between the maps may not be detectable if the grid interval is large enough.
  - If most of the wells are vertical with only a few deviated wells, then, the final average velocity maps will be the same for most areas no matter what **Location** option is selected. However, some differences near the deviated wells will be noticeable if the grid interval is not too large. A large grid interval usually smooths out small details.
- **Select Wells**—a list of all wells in the current working set. Select the wells to use to calculate the velocity control points. Requirements include at least three wells that are not in a line and within the survey bounds, and that contain a reference elevation and an active time-depth chart.

Tip: To narrow down the displayed wells, use Select Wells to Display > Select Wells or Surveys by Query to eliminate wells that do not contain the selected formation top, or wells that do not have time-depth charts.

- **All**—click to select all of the wells in the **Select wells** list.
- **None**—click to deselect all previously selected wells.
- **View map when done**—click to displays the calculated velocity map in a new base map. When unchecked, the resulting average velocity map will not display on a base map but will be available in the **Project Tree**.

- **OK**—click to accept specified values and close the **Compute Average Velocity Map** dialog box, and open the Grid: Specify Grid Parameter (for Velocity/Depth Map) dialog box opens.



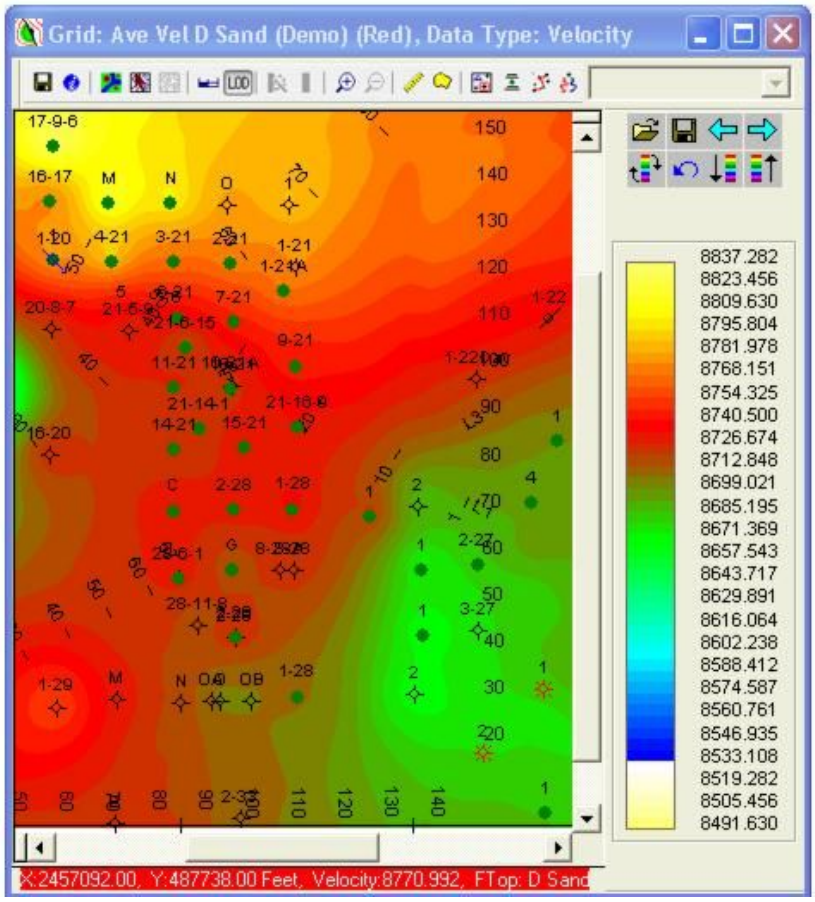
  - Select the gridding algorithm parameters for the velocity or depth map, or accept the defaults and click **OK.**

    If wells were selected but did not qualify for use, then the **List** message box will appear which lists the wells not used in the calculation.

  - Click **Close** to continue.

The average velocity map, **Grid: Ave Vel,** is displayed.

Example:



Above is the resulting D Sand Average Velocity Map with values 8,837.282 to 8,664.730 feet/second. This map was created using the Apparent method with Midpoint location.

To review the calculated values, check the project directory for a **control point file** named **[grid name].cpt**.This is a file created when wells are used in velocity map calculation. Open this file using Notepad.

The control point file contains the **X**, **Y**, **average velocity**, **well name**, **borehole name**, **depth**, and **time** for each velocity control point.

Renaming the grid does not rename the ***.cpt** file.

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