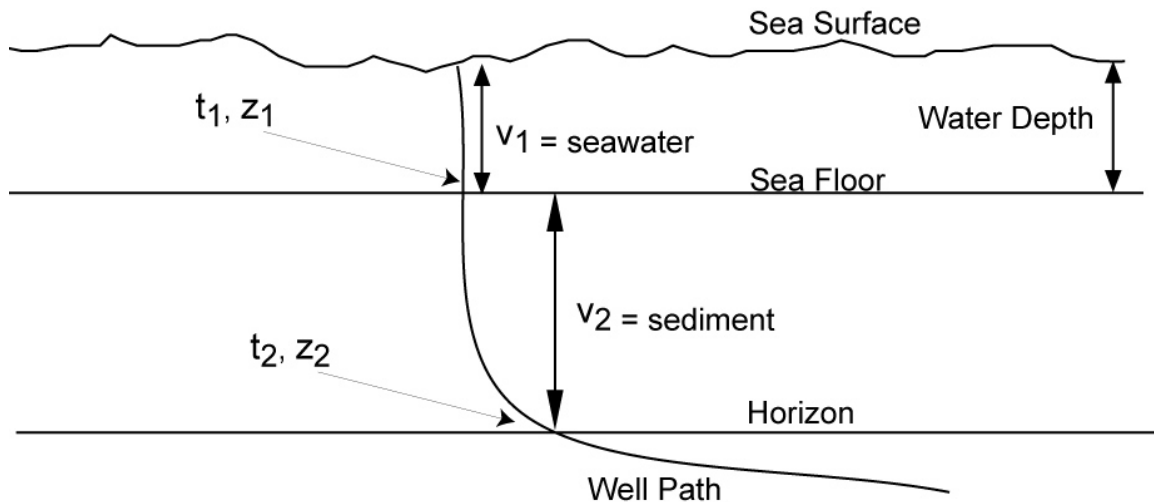


Approximating a Seismic Horizon Time-Depth Conversion Using a Two-Velocity Layer Approach in SeisWorks

Frequently in industry you will want to display a horizon map in depth (FT) instead of the Landmark SeisWorks default, which is two-way time (TWT). To convert from time (s) to depth (ft) you must know the velocity of the material. In this case, to reach the horizon, the signal is traveling through two different materials with differing velocities (seawater and sediment). This guide will show you how to approximate a time-depth conversion for a particular seismic horizon using two velocity layers; seawater (v_1) and sediment (v_2). All calculations will be done in SeisWorks.

This exercise assumes that you have two horizons mapped already in SeisWorks; 1) the seafloor and 2) a lower horizon.



Choose one well that you will work with for the process of conversion.

For both the seafloor (SF) and the lower horizon you will need two pieces of information. The first is the TWT value exactly where each horizon crosses the well path. You can acquire this information by opening a Seisworks window, choosing a line or trace that exactly crosses your well path, and reading the TWT value from the SeisWorks seismic window.

The second piece of information is the depth of each horizon (seafloor and lower horizon), in feet, from the Bob Brown database. If you do not have access to this information you can get it from Heather or one of the grad students working on the project. As an aside - When looking at the well path in the Seismic View ignore the picks shown on the well, they don't mean anything because you don't know what time-depth conversion was used to calculate these values.

Before you begin your conversion you must first calculate the velocity of the seawater and the velocity of the sediment in feet per second.

Velocity of the seawater:**SF pick in feet/(SF TWT/2/1000) = velocity of seawater in ft/s**

You must divide the time by 2 to get one way time and then divide by 1000 to convert from ms to seconds.

Example: 2873ft/(1165.45ms/2/1000) = 4930.50 ft/s = velocity of water column**Velocity of the sediment:**

$$\text{Sediment Velocity} = \frac{z_2 - z_1}{t_2 - t_1}$$

where z = depth of pick in feet, and t = TWT where horizon crosses the well path (ms)
1 refers to the seafloor, 2 to the lower horizon

You must divide the time by 2 to get one way time and then divide by 1000 to convert from ms to seconds.

Example: (15368.7ft – 2873ft)/(4582.93ms-1165.45ms) = 12495.7/3417.48

Must divide the time by 2 and then by 1000 to convert to one-way time in seconds

3417.48/2/1000 = 1.709

So, 12495.7/1.709 = 7311.70 ft/s = velocity of the sediment

You are now ready to perform the calculations in SeisWorks:**STEP 1: CONVERT SEAFLOOR (SF) FROM TWT TO FT****The basic calculation is as follows:**

For the seafloor: Start with the SF in TWT (ms)

Divide by 2 to get one-way time

Divide by 1000 to convert ms into seconds

Multiply by velocity of water (ft/s) (See calculation above)

In SeisWorks seismic view

Horizon -> Computations -> Standard

Click on “Horizon (oper) Constant” and choose your SF horizon

Multiply by the above constant. SeisWorks will not accept decimal numbers, so you will have to input the number as an exponent (for example 2465 x 10⁻³ for 2.465). Choose a name for your output file and click “OK”.

STEP 2: CALCULATE SEDIMENT THICKNESS IN TWT**The basic calculation is as follows:**

Subtract the SF in TWT from the horizon in TWT to get sediment thickness

In SeisWorks seismic view

Horizon -> Computations -> Standard

Click on “Horizon (oper) Horizon” and choose your lower horizon in TWT

Choose Subtract, then enter the name of your SF horizon in TWT. Choose a name for your output file and click “OK”.

STEP 3: CONVERT SEDIMENT THICKNESS FROM TWT TO FT

The basic calculation is as follows:

Divide by 2 to get one-way time

Divide by 1000 to get ms into seconds

Multiply by velocity of sediment (ft/s) (See calculation above)

In SeisWorks seismic view

Horizon -> Computations -> Standard

Click on “Horizon (oper) Constant” and choose your output from step 2. Multiply by the above sediment constant. SeisWorks will not accept decimal numbers, so you will have to input the number as an exponent (for example 2465×10^{-3} for 2.465). Choose a name for your output file and click “OK”.

STEP 4: ADD SEDIMENT THICKNESS (FT) TO SEAFLOOR (FT) TO GET TOTAL DEPTH OF THE HORIZON (FT)

The basic calculation is as follows:

Add the SF in FT to the horizon in FT to get a total depth to the horizon in FT.

In SeisWorks seismic view

Horizon -> Computations -> Standard

Click on “Horizon (oper) Horizon” and choose your output from step 3. Add the output from step 1. Choose a name for your output file and click “OK”.

You can now view this horizon in SeisWorks Map View. Click on View -> Contents, choose your new horizon file and change your color bar to reflect the depth of your horizon in feet.