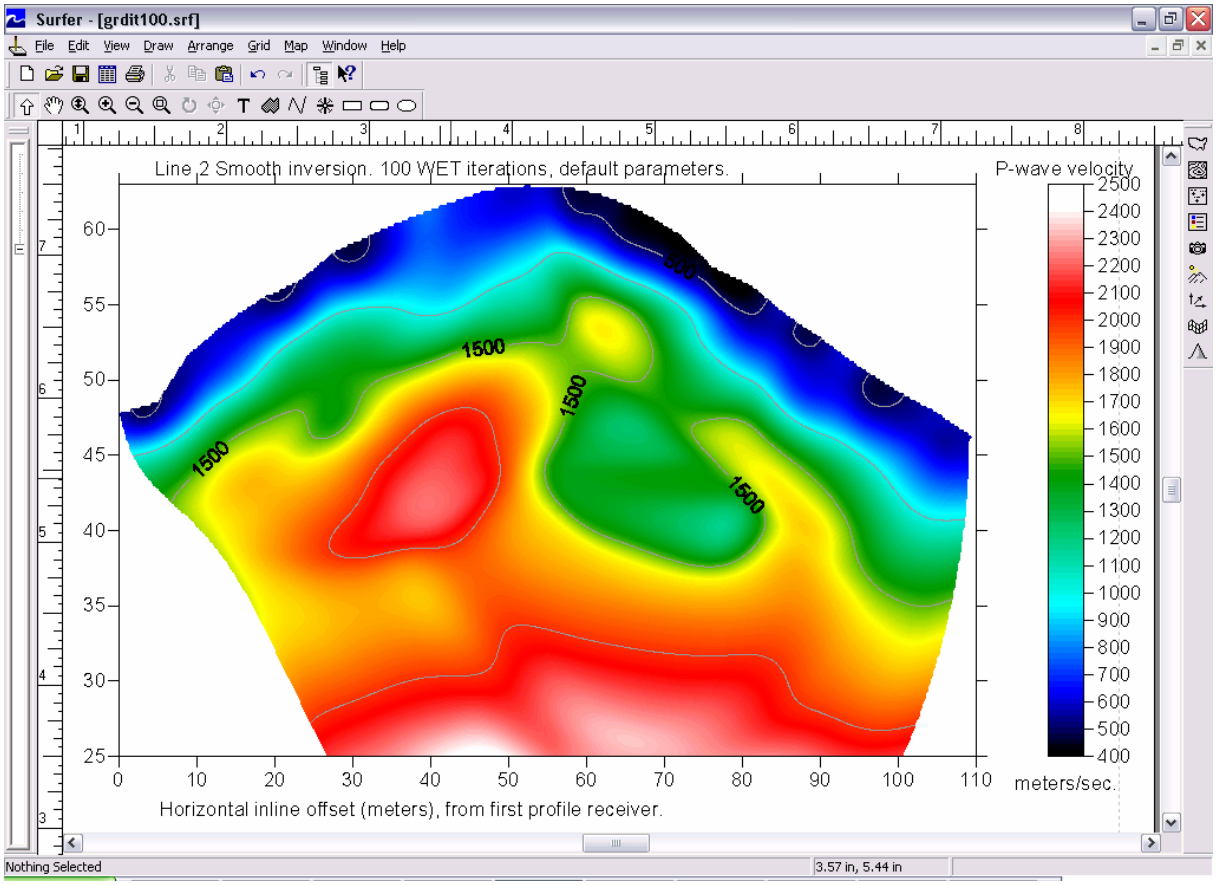
Smooth inversion and conventional Wavefront inversion of LINE2 as sent by Subsurface Engineering in October 2004 :

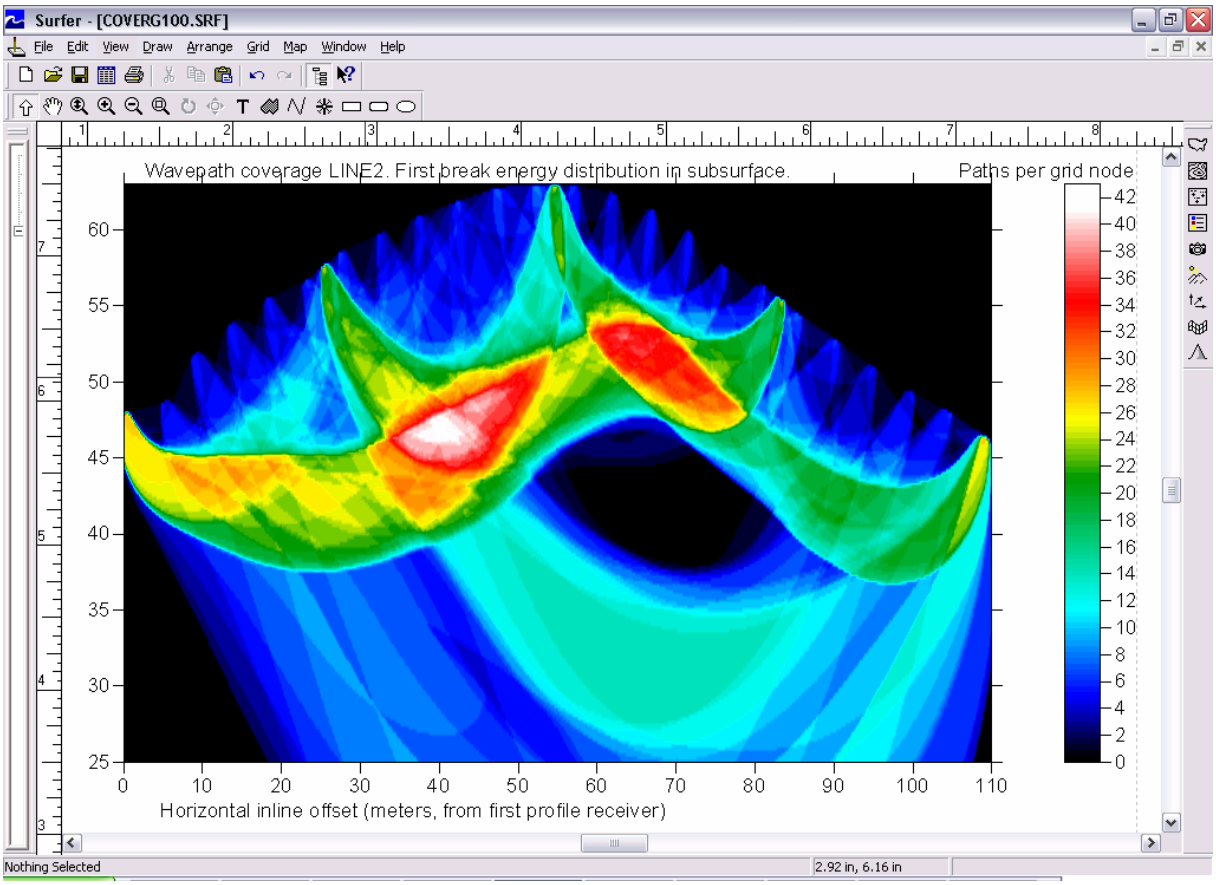
Here we show how to invert the same data set with two completely different seismic refraction methods. Please proceed as follows :

1. create a new profile database named LINE2 with a *Station spacing* of 5 meters. See our manual http://rayfract.com/help/manual.pdf chapter 1.1
2. download an archive with the original SEG-2 formatted binary trace files and Rimrock Geophysics .PIK first break pick files from http://rayfract.com/tutorials/line2.zip, into directory \RAY32\LINE2\INPUT
3. unzip archive \RAY32\LINE2\INPUT\LINE2.ZIP, and store the contents into the same directory
4. uncheck *File|Import Data Settings|Round shot station to nearest whole station*, to round to .5 station numbers e.g. 0.5, 1.0, 1.5 etc.
5. import the binary trace data and first breaks as described in our manual, chapter 1.2. Specify *Import data type* SEG-2, *Default shot hole depth* of 0.0. Leave *Default spread type* at 10:360 channels.
6. select *File|Update header data|Update First Breaks...* . Specify file \RAY32\LINE2\INPUT\BREAKS.LST
7. *File|Update header data|Update Station Coordinates...* with file \RAY32\LINE2\INPUT\COORDS.COR
8. *File|Update header data|Update Shotpoint coordinates...* with file \RAY32\LINE2\INPUT\SHOTPTS.SHO
9. invert the data with *Smooth invert|WET with gradient initial model*. Proceed as lined out in chapter 1.4
10. select *WET Tomo|Interactive WET tomography....* Click on field *Number of WET tomography iterations*
11. enter the new value of 100. Set field *Maximum valid velocity* to 3000 m/sec
12. click on button *Edit grid file generation*, and set field *Store each nth iteration only* to 20
13. click on button *Accept parameters*, and button *Start tomography processing*

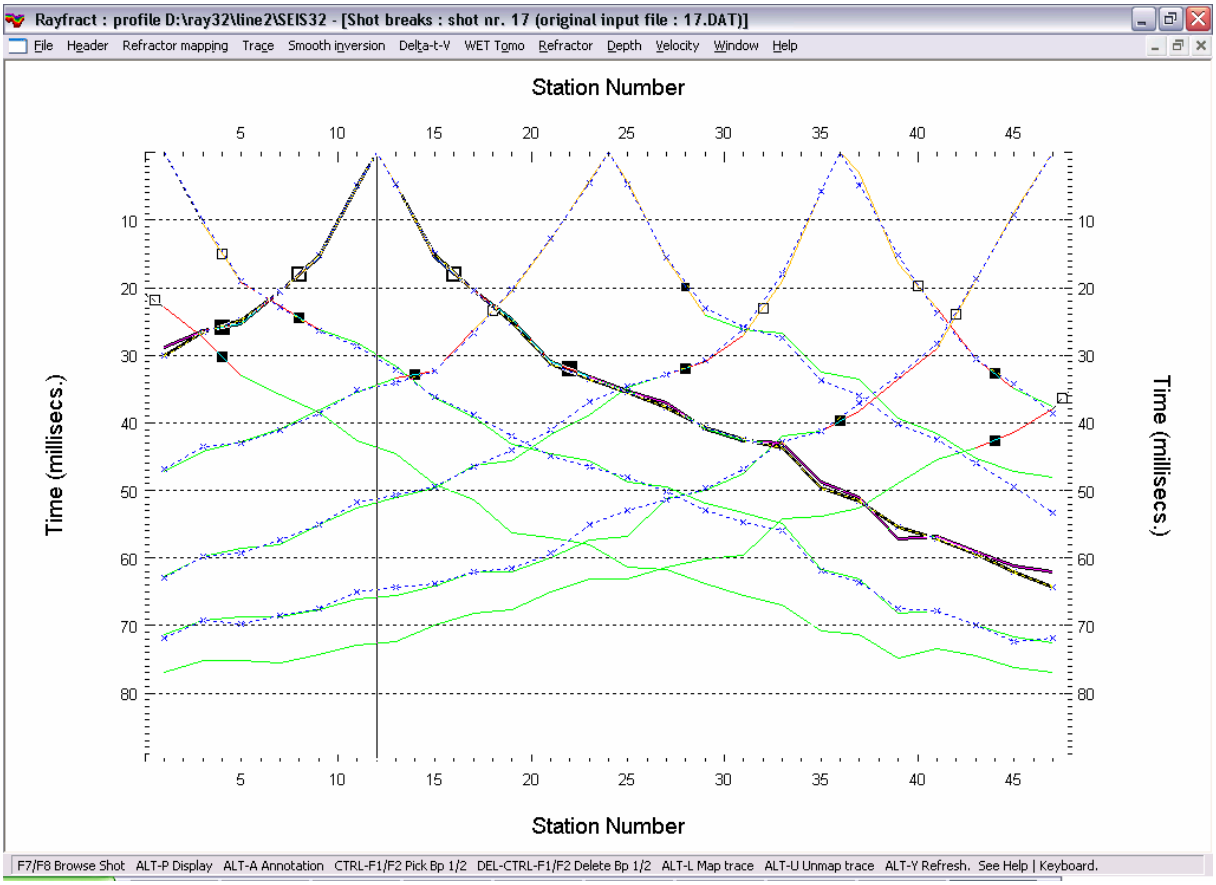
Once the WET inversion finishes, you will obtain the following velocity tomogram and wavepath coverage plot :



Smooth inversion LINE2, with 1D gradient initial model. 100 WET iterations, max. velocity 3,000 m/sec.



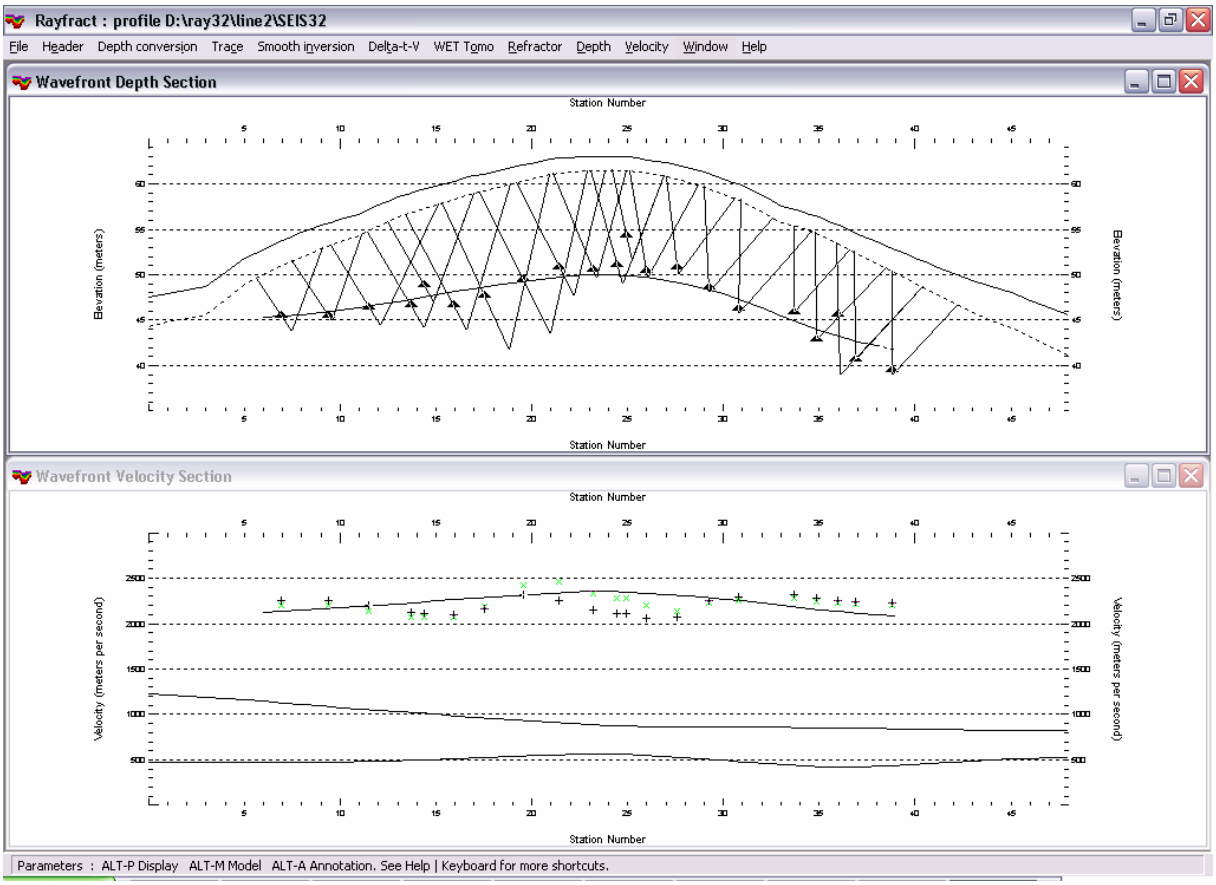
Coverage of LINE2 subsurface with first break energy, corresponding to above tomogram / 100 WET iterations.



LINE2 fit of modeled (blue) to picked (colored) traveltime curves, after 100 WET iterations. Branch points (outlined squares : red refractor 1; black filled squares : green refractor 2) have been picked interactively; see manual chapter 1.8. Yellow traveltime curve segments are mapped to the weathering layer.

Now invert the same data set with our conventional Wavefront method (Glyn M. Jones and D.B. Jovanovich 1985). Proceed as described in our manual chapters 1.8 and 1.9 :

1. position branch points defining refractor 1 and refractor 2 as shown above.
2. map traces to refractors with ALT-L.
3. select *Header|Station*, and press button *v0 from Shots*. Confirm the prompt and hit ESC.
4. select *Window|Close All* and then *Depth|Wavefront*. Confirm the following prompts.
5. select *Velocity|Wavefront* to display estimated refractor velocities.
6. select *Depth conversion|Display Wavefront rays*.
7. scale the resulting Wavefront depth and Wavefront velocity sections as described in chapter 1.6.
8. select *Window|Tile horizontal* to obtain the following plot :



Conventional Wavefront method interpretation of LINE2. Modeling of two refractors.

Note the shallow refractor 2 (i.e. basement) depth below station nr. 25, corresponding to a horizontal inline offset of about 60 meters. Above WET inversion tomogram shows a shallow high velocity anomaly at the same inline offset. This anomaly may be caused by an isolated former bedrock block.

Above WET inversion (100 iterations, 7 shots into 24 receivers i.e. 168 traces) took about 15 minutes, on a Toshiba A40 portable with a 2.8 GHz Intel Celeron processor and 512 Mbytes of RAM.

 Vancouver, May 10th 2010