

Tomographic Imaging Software for CSL, UPV, and CS/DS »

Tomographic velocity images are powerful analysis tools used to characterize the size, shape, extent, and severity of potential defects and anomalies.



CROSSHOLE TOMOGRAPHY

Tomographic Imaging Software (TOMO) is most commonly used in conjunction with the Crosshole Sonic Logging (CSL), Ultrasonic Pulse Velocity (UPV), and Crosshole Seismic/Downhole Seismic (CS/DS) methods. This type of testing/processing is often deployed to illuminate the extent, location, and severity of a defect found with previous testing. This methodology can, however, be used in instances when the user requires a 2-D/3-D velocity image of the medium in question (e.g. soil body velocity structures).

» Applicable On:

- Concrete Drilled Shafts
- Slurry Walls and Diaphragm Walls
- Mat Foundations
- Dams
- Bridge Substructure
- Structures
- Cemented Radioactive Wastes
- Soil/Rock, Wood, Masonry

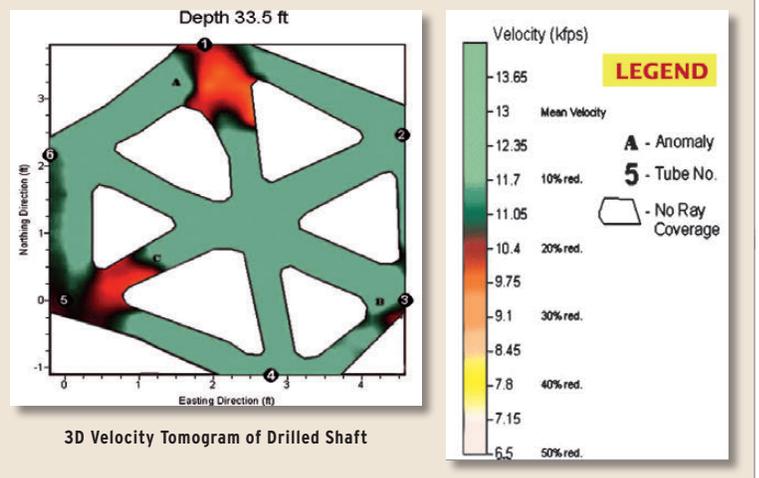
» Test For:

- Cracks
- Honeycomb
- Voids
- Uncured or Weak Concrete
- Soil/Water Intrusions
- Soil/Rock Moduli
- Soil/Rock Velocity Profiles

Features

- Inversion program can perform travel time/velocity and attenuation tomography
- Anisotropy can be specified for each point of the grid allowing for more accurate models
- Ray paths can be both straight and curved allowing for more accurate models
- Processing tools capable of identifying multiple defects
- Software packages easily interface with each other providing the user with a valuable visual tool
- Accurately characterizes the size, location and severity of defects
- 2-D/3-D analysis and display software is completely customizable to meet the user's graphical needs
- Display software can create a variety of images, including movies for visualization aids

Data Example » 1



Software Used With CSL,
UPV, and CS/DS Systems,
Sold Separately

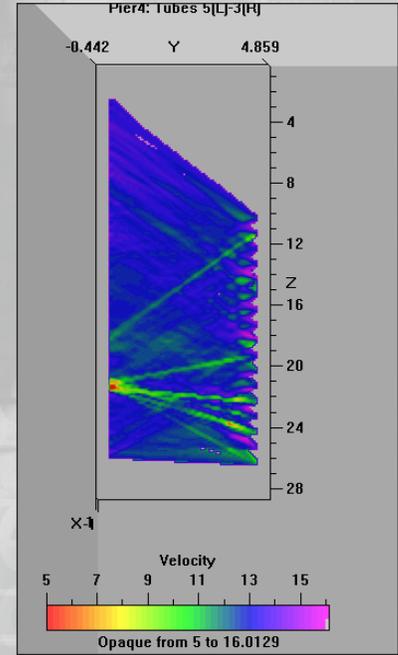
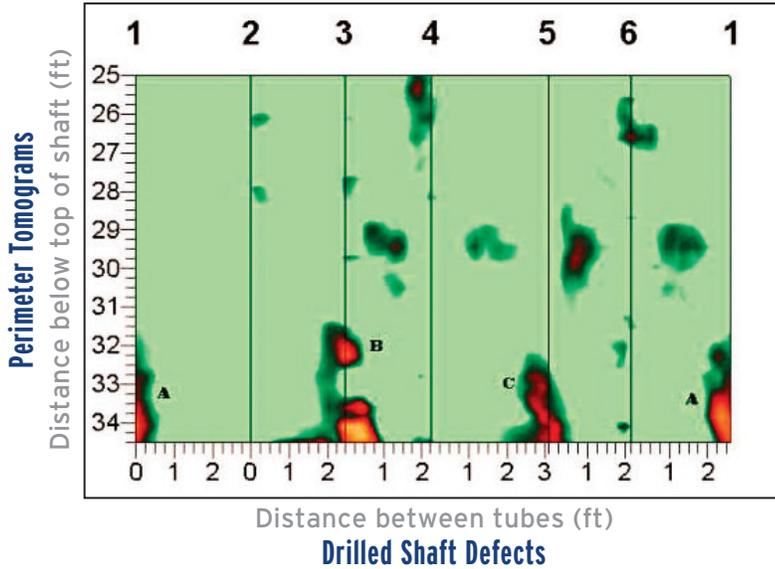
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TOMO-1 Option Available for the following systems:	Advantages
Crosshole Sonic Logging (CSL) + Tomographic Velocity Imaging	<p>Crosshole Tomography (CT) testing and analysis is used to generate velocity images of anomalies between tested tube pairs in order to better judge the extent and severity of defects. With the WinCSL-Tomo software, the CT method uses data from multiple CSL logs at different source-receiver height offsets to generate 2-D image slices of the material between a pair of access tubes in a shaft. When data is collected between multiple access tubes, the data sets can be combined to create a 3-D image model of the interior of the shaft concrete, delineating defects as shown on the previous page.</p>
Ultrasonic Pulse Velocity (UPV) or Sonic Pulse Velocity (SPV) + Tomographic Velocity Imaging	<p>Ultrasonic Pulse Velocity (UPV) Tomograms are generally used to map out the location, extent, and severity of defects in structural members. This method takes advantage of the multiple crossing test paths generated by combining direct, semi-direct, and indirect UPV testing. This data, once picked for First Arrival Time (FAT), is used to generate 2-D or 3-D velocity images. This data and model can often be a valuable resource when repairs are needed on structural members because it provides the information necessary to isolate the problem. Sonic Pulse Velocity (SPV) data is used to provide velocity images of massive dams, bridge substructures, etc.</p>
Crosshole Seismic/Downhole Seismic (CS/DS) + Tomographic Velocity Imaging	<p>The tomographic velocity images created from data acquired during Crosshole Seismic/Downhole Seismic (CS/DS) tests are generally used to look at the material properties of soil/rock. More specifically, this technique is ultimately useful to image the lateral/vertical changes in material properties for a more complete site characterization. This method uses compressional or shear wave arrival time data collected at different source-receiver height offsets to generate a 2-D image slice between boreholes. When more than two boreholes are available, then the testing can be conducted such that a 3-D image model of the material between multiple test tube pairs can be generated.</p>

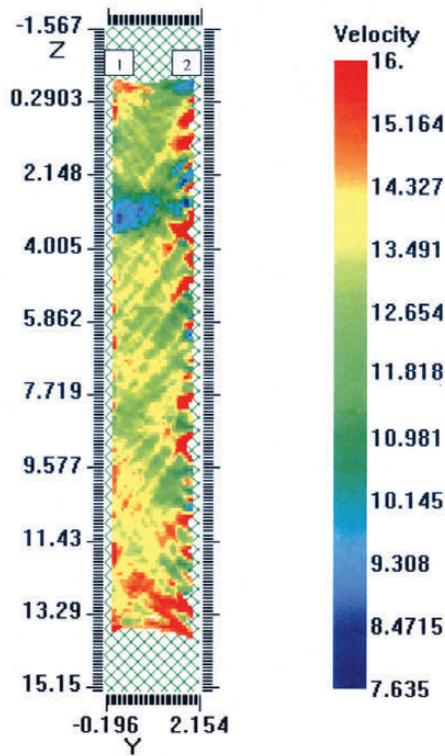


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Vertical Tomograms from Crosshole Tomography (CT) Data

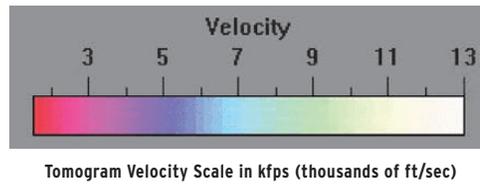


CT TOMOGRAM - Drilled Shaft

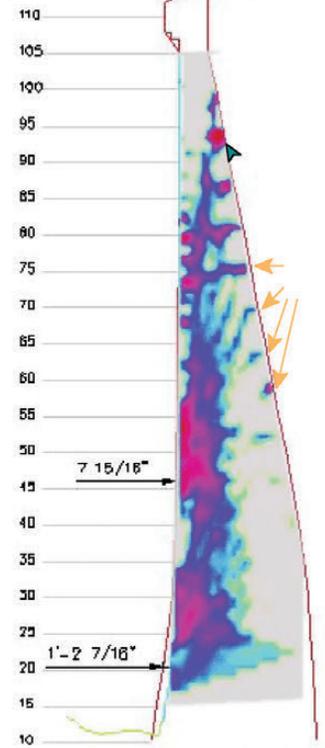


As seen in the above figure, the anomaly (represented by the cooler colors) is primarily contained between the depths of 2.5 ft and 4 ft in the proximity of Tube 1, assuming that Tube 1 was the source tube.

Thin-Arch Concrete Dam Tomography 2-D Test Results



As seen in the figure at right, low velocity zones at downstream face (left side) correspond to degraded concrete from freeze-thaw cracking damage on downstream face.



TOMOGRAPHIC IMAGING SOFTWARE



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Method

The tomographic imaging software is used in conjunction with the CSL, UPV/SPV, and CS/DS methods/systems. Please refer to the method sections for these systems in this catalog.

Data Collection

The user-friendly WinCSL software, used for CT testing, is written and tested at Olson Instruments' corporate office in Colorado. Olson Instruments has extensive experience with tomography data analysis software. We do not outsource any tech support questions and, should you require software support, we welcome your questions and comments.

Available Imaging Software

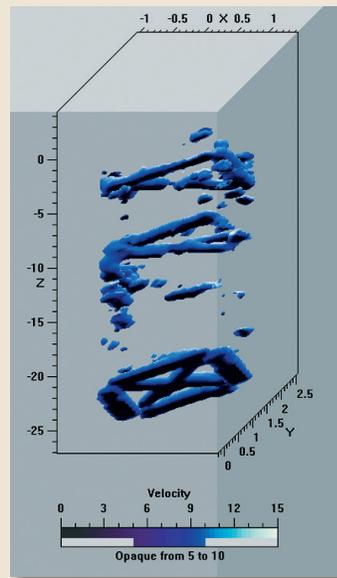
The Tomographic Imaging Software is an add-on option to either of the Olson Instruments, Inc. CSL systems, the UPV system, and/or the CS/DS system. In the instance that this add-on is purchased for either of the CSL systems, the WinCSL software package includes the Tomo option. The WinCSL software has a tomography data collection and export function that provides automated user prompting for test execution as well as direct output to the GEOTOM® inversion program.

In the instance that this add-on is purchased for either the UPV or CS/DS systems, which includes the GEOTOM® inversion program, the GEOTOM® software can perform either first arrival time tomography or attenuation tomography, use both straight and bending rays, and allows for the specification of anisotropy at any defined grid point. The Slicer Dicer® visualization package allows the user to create both 2-D and 3-D images as well as animations from the output generated through the GEOTOM® inversion.



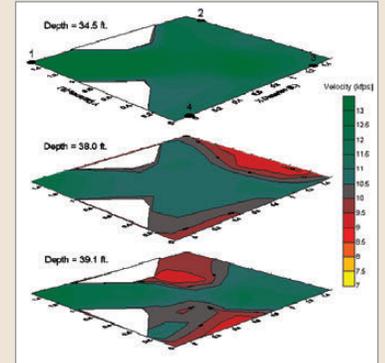
Crosshole Seismic/Downhole Seismic Testing

Data Example » 1



Slicer Dicer® 3-D visualization of defect in a drilled shaft

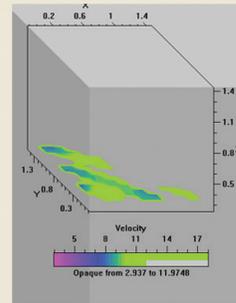
Image at left shows a 3-D visualization where the higher velocity sections of a drilled shaft have been removed leaving only the lower velocity areas for easy viewing of defects.



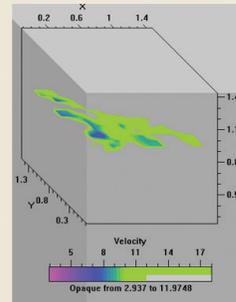
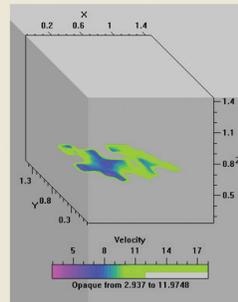
Sample 2: GeoTomCG® 2-D Slice

Image above displays several 2-D horizontal slices of data. Note that red colors indicate areas of low velocity and therefore low strength.

Data Example » 2



These images were created using Ultrasonic Pulse Velocity (UPV) data taken on a column that had visible exterior damage after the forms were removed. The tomographic images were generated to determine the extent (e.g. depth) of the spalling seen at the surface. The three images are cross-sectional slices to show the interior conditions of the damaged corner. As can be seen, the defect was primarily confined to the surface of the volume.



This example illustrates the primary utility of structural tomography images when defects are encountered. The images allowed for the problem to be isolated and locally repaired instead of the entire concrete member being removed and replaced, which would have cost a considerably larger amount of time and money.

Slicer Dicer® 3-D visualization data results from column shown