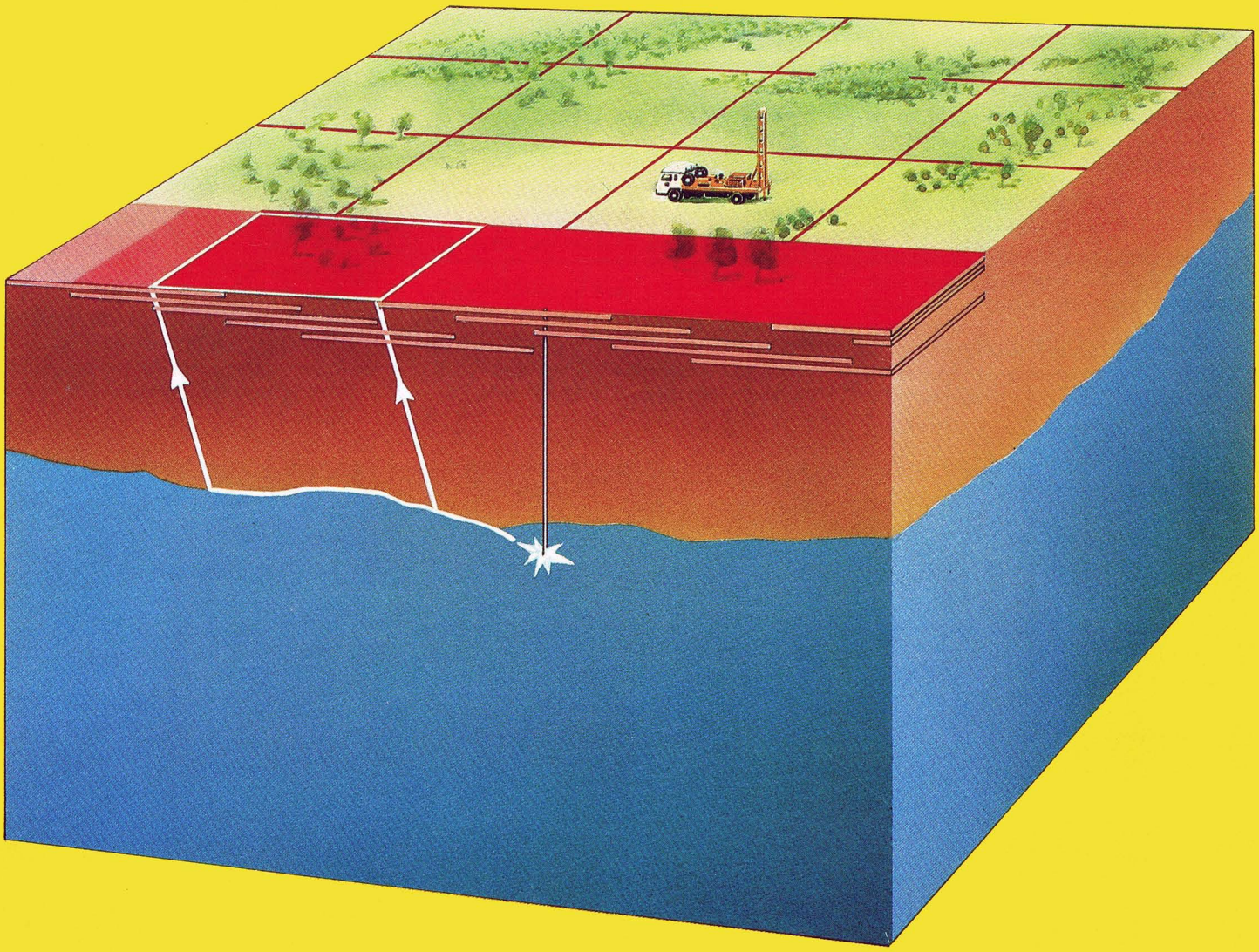
PRAKLA-SEISMOS INFORMATION No. 34

Static Corrections for 3-D Surveys



Static Corrections for 3-D Surveys

The determination of basic static corrections in 3-D surveys is very time consuming and limited in its possibilities when carried out manually. PRAKLA-SEISMOS now offers two efficient programs for surveys where the shotpoints lie below the weathered layer. These programs enable a considerably wider range of possibilities for the determination of corrections.

1. **ARIBASC** (**AR**eal **I**nterpolated **BA**sic **S**tatic **C**orrections) determines basic static corrections using depths of boreholes and uphole times at the shot positions and calculates the corrections at the receiver positions by areal interpolation.

2. When the shotpoint density is insufficient, and where short period variations in the thickness of the weathered layer exist, program **ARBASCO** (**AR**eal **BA**sic **S**tatic **CO**rrections) can be applied. Here the basic static corrections are individually determined after calculating the delay times of the first arrivals for each receiver position.

Both programs use the same data-input-routines. In addition first arrival times have to be picked for ARBASCO. A description of ARBASCO follows:

Purpose of Program ARBASCO

ARBASCO determines for 3-D shot-seismics:

- surface-consistent basic static corrections for every geophone position,
- surface-consistent basic static corrections for every shotpoint,
- thickness of the weathered layer (D_w),
- velocity of the weathered layer (V_w),
- velocity of the consolidated layer (V_s).

Prerequisites

The following must be available:

- first arrivals of the production seismograms,
- borehole depths and uphole times at the shot positions,
- field geometry,
- elevations,
- datum level.

Method

- determination of delay time and velocity V_s for every geophone position,
- areal tie-in of the delay times and uphole times considering a regional averaged velocity V_s,
- determination of static corrections for the shot-points,
- individual determination of static corrections for the geophone positions.

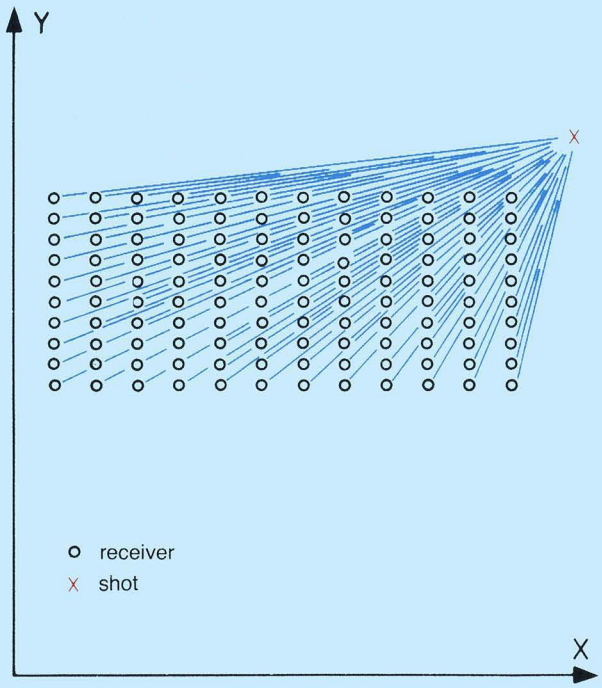
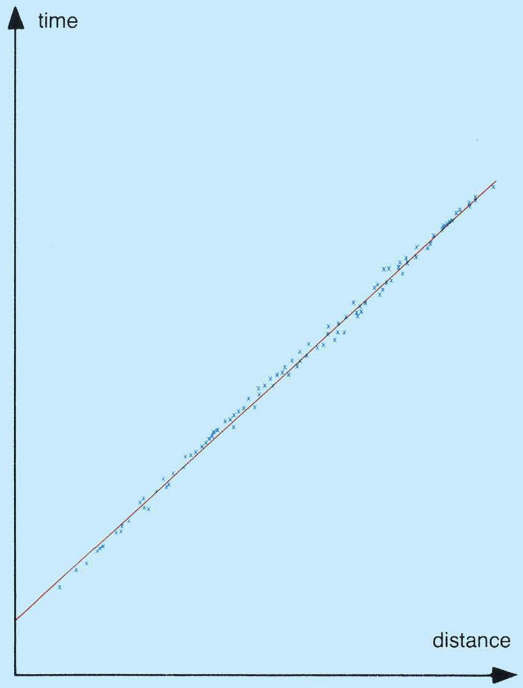


Fig. 1: Field geometry



Corresponding traveltime curve in the common shot domain

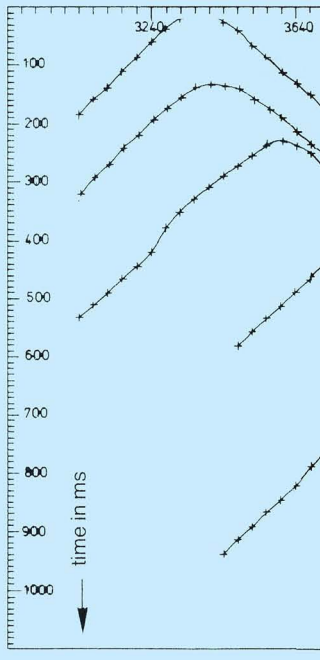


Fig. 2: Traveltime curves for part

Program Sequence

Data Requirements

Field Data

Input for every geophone position:
- X/Y-coordinates,
- elevation.

In order to determine the shotpoint-geophone distance for the traveltime diagrams the X/Y-coordinate must be obtained. This input is simplified by means of a standard block. The standard block is the geophone arrangement which is recorded from one shot (refer to front page). From the standard block the relationship record-number to layout is established by means of the X/Y-coordinates of trace 1 for every record.

Input for every shot (every record-number):
- X/Y-coordinates,
- elevation at the shotpoint,
- borehole depth.

Seismic Data

- uphole times,
- first arrivals.

The first arrivals are automatically picked or manually digitized. In order to recognize incorrect data the following control possibilities are available:
- output of all distance-dependent traveltime curves containing calculated regression lines (see fig. 1); anomaly check of the correlation;
- output of traveltime curves for specific geophone rows, no longer distance-dependent but instead surface consistent (see fig. 2).

Calculation of the Delay Times and Velocities of the Consolidated Layer

The following is carried out for every geophone position:
- arrangement of the traveltimes in the common receiver domain,
- calculation of a traveltime curve as a regresssion line. The best-fit regression line is found iteratively, where-by values which lie outside an error limit around the regression line are not considered (see fig. 3).

Individual delay times (d) and refractor velocities (V_s) are the result. In order to keep the velocity change low, a smoothing of the individual V_s-values is made (see fig. 4). A revised regression line is then calculated with these "regional" velocities, thus achieving an improvement of the delay times (d').

Calculation of the Weathered Layer Velocity V_w

The following is carried out for every shotpoint:
- averaging the delay times d' and velocities V_s from the corresponding data of the adjacent geophone positions (see fig. 5, red circles),
- calculation of velocity V_w from borehole depth, uphole time, delay time and V_s.

Calculation of the Static Corrections

For every geophone position the velocity V_w, known at the shot positions, is determined within a selected area using an areal compensation and weighting (see fig. 5, blue circles). This allows the thickness of the weathered layer and the geophone-side correction to be determined.

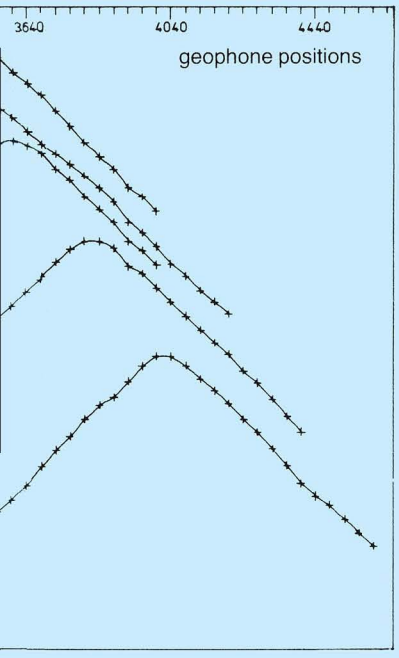
The shot-side correction is calculated from the bottom of the borehole with the velocity V_s. In order to detect errors in the shot-side correction which have originated from digitizing the incorrect phase or from the input of incorrect borehole parameters, the mean of the difference between the first arrival time and the revised regression line is produced for every record number.

Data Output

The following can be output in lists:
- correction at geophone position,
- correction at shotpoint,
- weathered layer velocity,
- thickness of weathered layer,
- all available shot data sorted according to common positions.

Graphic presentation of the following data is possible:
- elevation,
- velocity V_s,
- delay time,
- velocity V_w,
- thickness of weathered layer,
- static correction,
- borehole depth / uphole time (traveltime curve) of shots with common positions.

Additionally, for checking the input data and selected parameters, lists and diagrams of intermediate results can be displayed.
Subsequent to the input interactive control parameters are determined; the ARBASCO program then continues automatically.



part of a specific geophone row

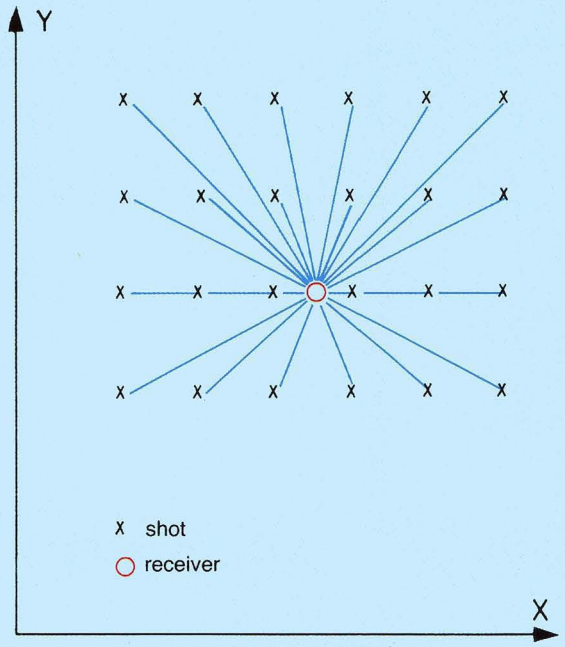
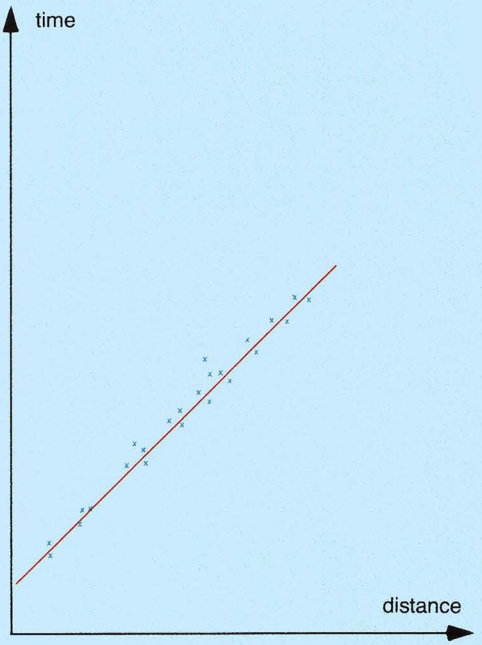


Fig. 3: Field geometry



Corresponding traveltime curve in the common receiver domain

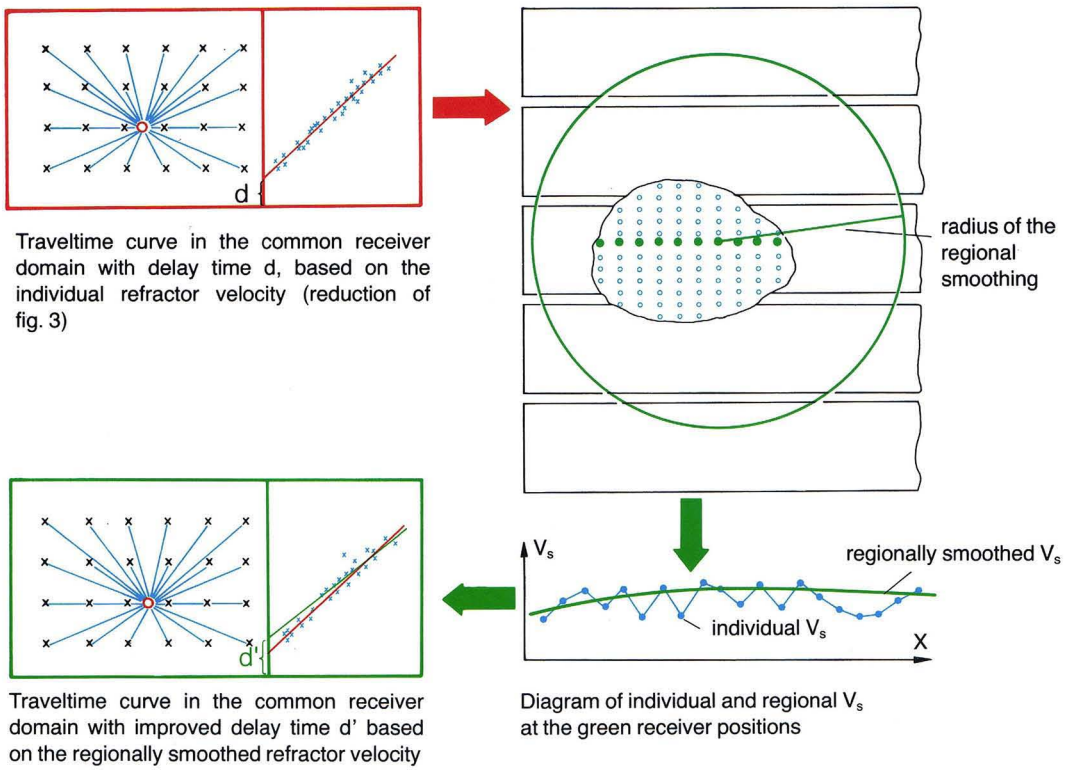


Fig. 4: Improvement of delay times by regional smoothing the refractor velocities V_s

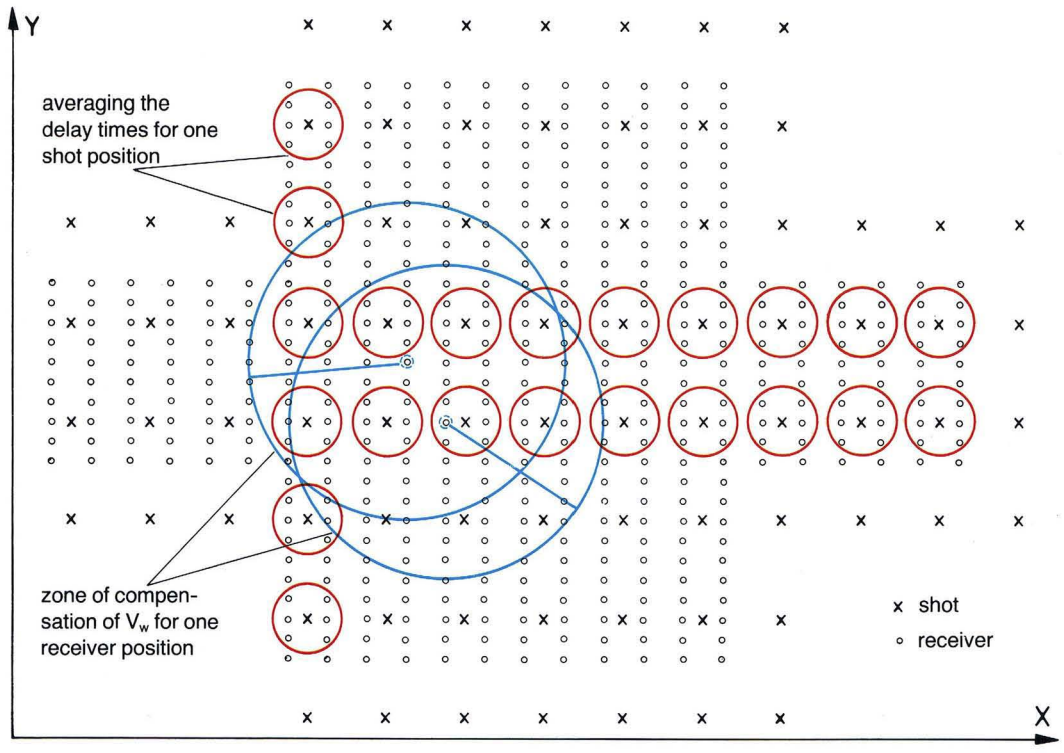


Fig. 5: Averaging of delay times and refractor velocities (V_s) for every shotpoint and areal compensation of weathering velocities (V_w) for every geophone position

PRAKLA-SEISMOS GMBH · BUCHHOLZER STR. 100 · P.O.B. 510530 · D-3000 HANNOVER 51
PHONE: (511) 6460-0 · TELEX: 922847 + 922419 + 923250 · CABLE: PRAKLA · GERMANY