**JFP-3A - Analysis of Geodetic Data**

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## CONTENTS

## SCOPE OF WORK

The scope of work defined by the WPPSS Geotechnical Advisory Panel for task JFP-3A is as follows:

1. Available geodetic leveling data in western Washington and western Oregon used by Ando and Balazs (1979) and Reilinger and Adams (1982) are to be analyzed to determine their reliability. Depending on the results of the data reliability analysis, further analysis to the extent necessary is to be effected that will support the conclusions of Ando and Balazs (1979) and Reilinger and Adams (1982), or provide qualitative alternative interpretations of the data.

2. Available geodetic trilateration and triangulation data acquired in western Washington by the USGS and reported by Savage et al. (1981) is to be analyzed separately to determine its reliability. Depending on the results of the data reliability analysis, further data analysis to the extent necessary to either support or refute the position taken by Savage et al. (1981) shall be provided. If applicable, alternative qualitative models to explain the data shall be provided.

In order to carry out task JFP-3A according to the outline just given, the following work was done:

Geodetic Leveling Data

1. Corrections for level-collimation error, rod-temperature variations, rod-scale error, refraction error, and tidal acceleration variations were applied to the observed height data for the level lines under consideration:

    a. Ando and Balasz (1979);

    b. Reilinger and Adams (1982), except for the Bandon to Coquille (Oregon) line;

    c. eastward extensions of 2 east-west lines in western Washington and 1 east-west line in western Oregon.

2. Net relative vertical displacements (i.e., the dDh values discussed below) were computed using the corrected observed height data for 15 east-west profiles in western Washington, 5 east-west profiles in western Oregon, and 2 north-south profiles on the Olympic peninsula.

3. The estimated standard deviation of the random error for each dDh value on each profile was computed.

4. Bench mark descriptions for the profiles were searched to identify individual bench mark types and those bench marks suspected to be disturbed by vandalism, construction projects, and other non-tectonic processes.

5. An unweighted linear least squares regression of dDh on distance along the level line was calculated for each profile to provide some quantification of apparent regional tilt.

6. The potential for systematic accumulation of residual rod-scale error on uniform slopes was calculated for each rod pair used in the levelings under consideration.

7. The available literature on magnetic error was investigated to determine which levelings used in this study may be adversely affected.

Geodetic Trilateration/Triangulation Data

8. The procedures of Savage et al. (1981) were investigated to make sure that adequate corrections were applied to trilateration data for atmospheric refraction.

9. The NGS horizontal data base was searched for additional triangulation or trilateration data in western Washington and western Oregon that could be used to determine crustal strain.

## PROCEDURE

### CALCULATION OF NET RELATIVE VERTICAL DISPLACEMENTS

A net relative vertical displacement is equivalent to a net relative change in orthometric height difference, and a net relative change in orthometric height difference is equivalent to a net relative change in observed height difference (Vanicek et al., 1980; Pelton and Smith, 1982). Therefore:

$$dDh(BM,REF,t2-t1) = Dl(BM,REF,t2) - Dl(BM,REF,t1) \qquad (1)$$

where dDh(BM,REF,t2-t1) is the net relative vertical displacement of BM relative to REF between times t1 and t2 > t1, and Dl(BM,REF,ti) is the (corrected) observed height difference of BM relative to REF at time ti.

All dDh values presented in this report have been calculated with (1). Thus it is important to know what corrections have been applied to the Dl data. The following corrections have been applied (with a few exceptions documented in appendix 2) to each Dl datum before substitution in (1):

1. level-collimation

2. rod-temperature

3. rod-scale

4. refraction

5. astronomic.

The corrections were computed and applied by an NGS computer program referred to as REDUC4.

Most leveling done to high orders of precision involves a forward and backward running of each section. The Dl values so determined are averaged after application of the above mentioned corrections. This averaging serves to reduce the random error and to eliminate some types of systematic error.

The standard deviation of the random error in a dDh value is given by the square root of the sum of the squares of the standard deviations of the Dl values, assuming that the Dl values are independent. The standard statistical model for random leveling error predicts that the standard deviation of a Dl value is given by $s\sqrt{L}$ , where s is a constant. The parameter s may be estimated from discrepancies between forward and backward levelings of sections, or from circuit closures. The experience of the NGS in computing s for levelings of different vintages and orders is summarized by Vanicek et al. (1980). Standard deviations of all dDh values presented in this study have been computed as described above using the summary in Vanicek et al. (1980) as a source for s values.

## LEVEL-COLLIMATION CORRECTION

Level-collimation error results when the optical axis of the telescope is not exactly aligned in a horizontal plane. This error is minimized by using balanced sights and by application of a level- collimation correction to the Dl data. The level-collimation correction Cc added with the resultant algebraic sign to the section Dl data of this study was computed in REDUC4 according to the procedure described in Balazs and Young (1982):

$$Cc(mm) = -(k)(SDS) \qquad (2)$$

where k is the collimation error constant in mm/m and SDS is the accumulated difference in sight lengths for the section in meters (backsight-foresight). The basic assumptions here are that k is correctly determined and unchanging during leveling over the section.

## ROD-TEMPERATURE CORRECTION

The calibration procedure for a leveling rod results in the determination of errors in the placement of graduations along the rod scale at the standardization temperature (see next section). Since corrections for these errors are designed for application to observations made at the standardization temperature, it is first necessary to reduce a given Dl value to the value it would have if the rod pair was at the standardization temperature. The correction which reduces a Dl value to its value at the standardization temperature is called the rod-temperature correction. The rod-temperature correction Ct added with the resultant algebraic sign to the section Dl data of this study was computed in REDUC4 according to the procedure described in Balazs and Young (1982):

$$Ct = (Tm-Ts)(Dl)(CE) \qquad (3)$$

where Tm is the mean observed temperature of the scale (begining and end of the section), Ts is the standardization temperature (described below), and CE is the coefficient of thermal expansion for the scale per unit temerature. The unit of Ct is the same as that of Dl. The basic assumptions here are that CE is accurately known (this is debatable for some scales where CE is simply assumed), that CE is independent of temperature over the range encountered during leveling, and that CE is independent of position along the scale. The effect of an incorrect temperature correction is to add an unknown component to the residual rod-scale error (see discussion below).

## ROD-SCALE CORRECTION

A graduation on the rod-scale is related to the nominal length of its distance from the bottom of the rod base. The rod error at a graduation is this nominal length minus the corresponding true length. Because of thermal expansion, rod error is a function not only of the graduation (i.e., the nominal length to the graduation), but also of the temperature. The temperature at which rod error is determined is called the standardization temperature. During calibration, the true length is measured either by comparison with a length standard (usually an invar bar) which has its true length at the standardization temperature (coarse calibration - before late 1980), or by laser interferometry (detailed calibration - since late 1980).

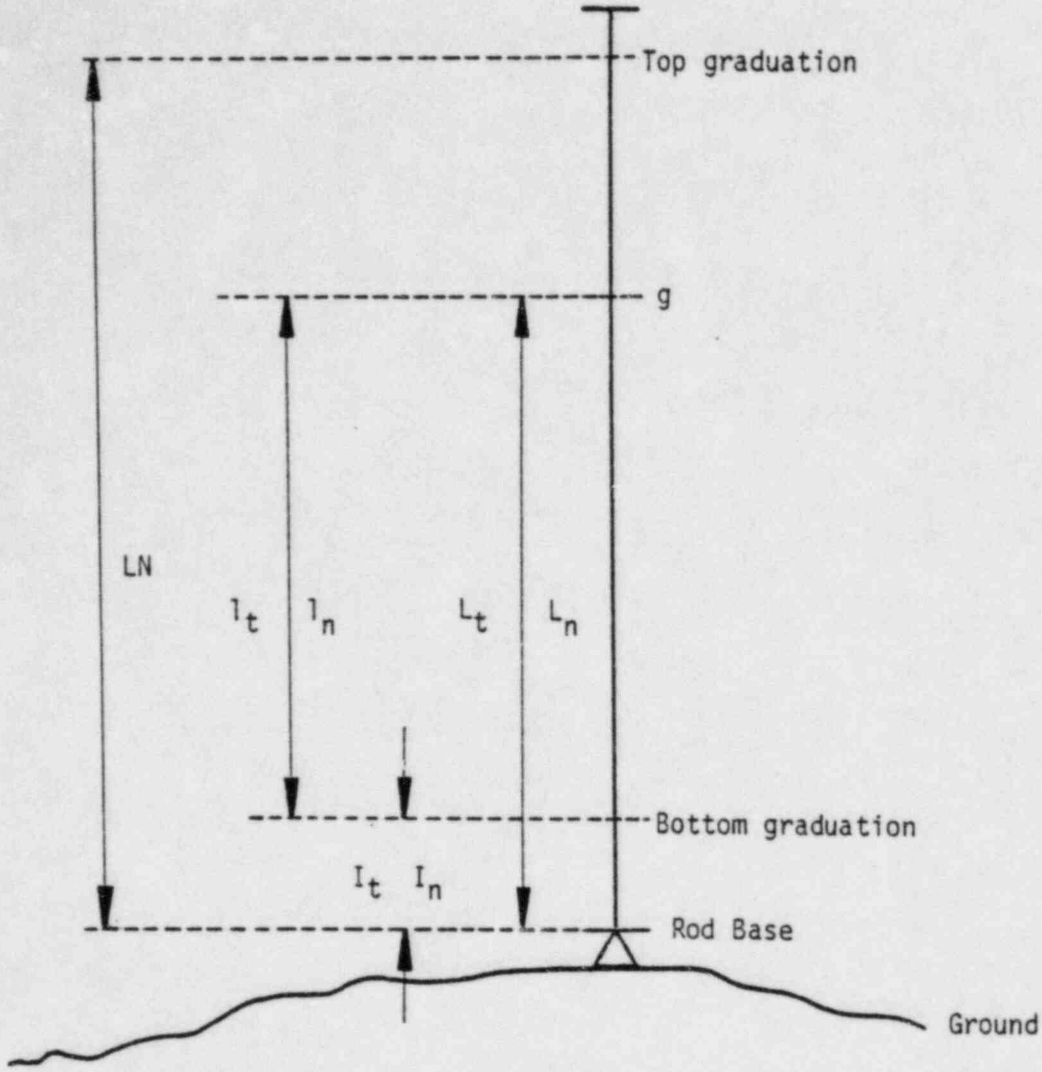
### Coarse rod calibration

Before late 1980, the calibration procedure for NGS leveling rods resulted in the determination of rod error at only three or four graduations. The rod error for these "coarsely" calibrated rods was broken down into two parts: the index error and the rod-scale error. Currently, the NGS uses two different methods to determine the index error and a linearized rod-scale error from the coarse calibration data. The same method is used for both rods in any given rod pair.

### Nominal index length to graduation format

Refer to figure 1 for the definition of symbols. The rod error at graduation g is given by:

$$
\begin{aligned}
RE(Ln) &= Ln-Lt \\
&= (ln-lt) + (In-It) \qquad (Ln > In) \qquad (4) \\
&= E(Ln) + I \qquad (Ln > In)
\end{aligned}
$$




subscript n indicates nominal length

subscript t indicates true length

LN is the nominal length of the distance from the bottom of the rod base to the top graduation where E(Ln)=ln-lt is the rod-scale error at g and I=In-It is the index error. E(Ln)=0 for Ln=In because ln=lt=0 there, and E(Ln) need not be defined for Ln<In because no calibration measurements or observations are ever made there. A linearized rod-scale error at g is defined by:

$$\tilde{E}(Ln) = -(e)(Ln-In) \tag{5}$$

where e is a constant called the "excess". The excess for a particular rod is now computed by the NGS by a linear least squares regression of -E(Ln) in mm on (Ln-In) in meters with the constraint that the regression line goes through the origin (Ln=In). Previously, the NGS would have determined e for a single rod as follows:

$$e \text{ mm/m} = -E(LN) \text{ mm}/(LN-In) \text{ m} \tag{6}$$

where LN and In were usually 3.2 m and 0.2 m, respectively.

**Zero to graduation format**

Again, RE(Ln) = Ln - Lt. Now define a linearized rod error at g:

$$\begin{aligned}\tilde{RE}(Ln) &= -(e)(Ln) - Ic \\ &= \tilde{E}(Ln) - Ic\end{aligned} \tag{7}$$

where e is a constant called the "excess", $\tilde{E}(Ln) = -(e)(Ln)$ is the linearized rod-scale error, and Ic is constant called the index correction. Constants e and Ic are found by a linear least squares regression of -RE(Ln) in mm on Ln in meters. With Ic determined, the true rod-scale error E(Ln) at g is logically defined by:

$$E(Ln) = RE(Ln) + Ic \tag{8}$$

Thus:

$$RE(Ln) = E(Ln) + I \tag{9}$$

as before where I = -Ic is the index error. The basic difference between this format and the preceding one is that E is defined for all positive Ln<LN even though no calibrations measurements or observations are ever made for sufficiently small Ln. Notice that at the imaginary zero graduation where Ln = 0, I corresponds to the difference between the imaginary zero graduation and the bottom of the rod base if we define E(0) to be zero in both formats.

## Index error

The index error may be neglected for three reasons:

1. it is generally less than 0.1 mm,

2. a pair of rods having nearly equal index errors is used so that a backsight - foresight difference almost cancels the net index error at each setup,

3. the rods of the pair are leapfrogged to eliminate accumulation of the net index error.

## Residual rod-scale error

For coarsely calibrated rods, the NGS assumes that for both rods of a rod pair, E is given by an average linearized rod-scale error, where the average excess is that of the two individual rods. The rod-scale correction Cr to be added with its algebraic sign to a section Dl value then becomes:

$$Cr \text{ mm} = (\tilde{e} \text{ mm/m})(Dl \text{ m}) \quad (10)$$

where $\tilde{e}$ is the average excess in mm/m (Balazs and Young, 1982). This procedure is implemented in REDUC4 and was used to correct all of the Dl data used in this study except for two lines whose rods underwent detailed calibration: L-24471/2 and L-24471/3 run in 1982, see profiles 11 and 15.

In fact, it is quite possible that E for both rods of a pair is not adequately represented by a single linear function. The difference between E for a rod and the average linearized rod-scale error for the pair of which it is a member may be called the residual rod-scale error:

$$ER(Ln) = E(Ln) - \tilde{E}a(Ln) \quad (11)$$

where ER(Ln) is the residual rod-scale error at Ln, and $\tilde{E}a(Ln)$ is the average linearized rod-scale error at Ln and is computed with the average excess $\tilde{e}$ and either $(\tilde{e})\cdot(Ln-In)$ or $(\tilde{e})\cdot(Ln)$ depending on the calibration format. An observed height difference at a singel setup will be in error by the backsight - foresight difference in residual rod-scale errors:

$$Tij = ER(BS)i - ER(FS)j \quad (12)$$

where the notation means that rod i is used on the backsight and rod j is used on the foresight, and Tij is the residual rod-scale error in the observed height difference at the setup. For two consecutive setups with rods 1 and 2 on a uniform slope with uniform sight lengths, the residual rod-scale error S in the observed height difference for the two setups will be:

$$S = T21 + T12 \quad (13)$$

assuming that the rods are leapfrogged which is standard practice. If S does not equal zero and leveling continues on a uniform slope with uniform sight lengths and leapfrogging of rods, then a significant systematic error accumulates in the observed height difference; this is a direct result of the fact that the same graduation is used every time for the backsight, and similarly for the foresight, so that the same S error occurs every two setups.

For this report, a matrix of S values have been computed for every rod pair used in the levelings under consideration (see Appendix 1). Each value in the matrix pertains to a backsight - foresight pair of graduations at which calibration measurements were made. In other words, the matrix (usually either 3x3 or 4x4) represents a digitized version of S which is better visualized as a continuous function defined in the backsight - foresight graduation plane. All values in the S matrix are scaled by 50 to give the systematic error after 100 setups (about 5-10 km) on a uniform slope with uniform sight lengths and leapfrogging of rods.

A casual study of the S matrices in Appendix 1 will reveal that residual rod-scale error is worse in older rods than in more modern rods which is to be expected. For example, the average maximum accumulated (100 setups) residual rod-scale error for code 312 rod pairs is 6.6 mm (maximum = 14.4 mm); for the newer code 316 rods it is 3 mm (maximum = 3.7 mm). This is only a general observation and does not mean that residual rod-scale error cannot be large in the newer rods.

It should be emphasized that the S values of Appendix 1 for a particular rod pair may not necessarily reflect the true accumulation of residual rod-scale error for that pair. There are three reasons for this:

1. The calibration of the invar scale can change with time. Some NGS rods were used for long periods (say 10 years) between calibrations. It seems probable to the author that the invar scale in these cases was subject to conditions capable of changing the calibration.

2. Errors in the rod-temperature correction add an unknown component to the residual rod-scale error. This component may or may not cancel when backsight and foresight are differenced at a setup.

3. The shape of the residual rod-scale error function between the widely spaced calibrated graduations is not known. If it changes randomly from graduation to adja-

cent graduation, then realistic leveling (even on a uniform slope) will not result in accumulation of error. On the other hand, monotonic behavior between the widely spaced calibrated graduations would imply accumulation on uniform slopes.

Despite these uncertainties, the S data set is useful because it provides us with estimates of what an average or maximum residual rod-scale error can be like if it is allowed to accumulate on a uniform slope. For example, an apparent tilt of up to 2.9 mm/km could be developed on a uniform slope from residual rod-scale error in a code 312 rod pair, whereas that for a code 316 rod pair could be as much as 0.7 mm/km.

### Detailed rod calibration

Begining with late 1980, all graduations on NGS leveling rods were calibrated with a new measuring device using laser interferometry. According to Balazs and Young (1982), the observed graduation is converted to its true distance above the bottom of the rod base and then the micrometer reading is converted to the proper units and added on. This is accomplished during computer processing by accessing the pertinent rod calibration file. Rod error should be virtually eliminated in this method unless the rod calibration changes with time and/or errors in the rod-temperature correction do not cancel.

## REFRACTION CORRECTION

Refraction error contaminates an observed height difference at a setup if there is unequal refraction of light on the foresight and backsight. Even for balanced sights this can occur if the refractive index functions along the paths traversed by the foresight and backsight differ, a condition believed to be primarily a result of temperature-induced air density variations. Refraction error is most likely to arise and accumulate when leveling on a uniform slope where the foresight and backsight pass through consistently different (non-linear) temperature distributions. In this situation the refraction error in the observed height difference for a section is approximately proportional to a near-surface vertical temperature difference parameter dt, the observed height difference Dl for the section, and the sight length s squared. Because of the proportionality to Dl, the refraction error is not normally subject to cancellation when forward and backward Dl measurements are averaged. When Dl measurements from two levelings separated in time are differenced to obtain dDh, the refraction errors should cancel if both levelings were carried out along the same route with similar sight lengths and atmospheric conditions. However, experience has proven that it is not safe to assume cancellation of refraction error in dDh computations. For example, modern sight length maximums are markedly smaller than those in the past, and level line routes have shifted away from railroad tracks which are characterized by abnormally high dt parameters. Recent references are Bomford (1971), Strange(1981), Holdahl(1982), and Stein et al. (1982).

The formulas for the refraction correction which were applied to the Dl data of this study are relatively complex; Balasz and Young (1982) and Holdahl (1982) may be consulted for details. However, it is important to point out that the field temperature observations necessary to obtain the dt parameter at each setup have only been made since the fall of 1980 by the NGS. Thus the Dl data from only two lines used in this study were refraction-corrected with observed temperature data: L-24471/2 and L-24471/3 run in 1982, see profiles 11 and 15. The remaining Dl data used in this study are refraction-corrected, but dt parameters have been predicted from the temperature stratification model of Holdahl(1981). The model as implemented via REDUC4 requires as input the latitude and longitude of the bench marks defining each section. Because of time restrictions, the latitude and longitude of a limited set of bench marks was determined by the NGS; the remaining bench mark positions were interpolated from these by an option available in REDUC4.

Field experiments suggest that the procedures used by the NGS to apply refraction corrections are successful in removing most of the refraction error (Strange, 1981; Holdahl, 1982; Stein et al., 1982). This statement applies whether the dt parameter is taken from observed data or is predicted by the Holdahl (1981) model. However, field testing is still in progress and there is some indication that the dt parameters predicted by the Holdahl (1981) model may be too large in some cases (Ross Stein, USGS, personal communication, 1983). In addition, it is known that the surface over which leveling proceeds can have a profound effect on the dt parameter; thus surfaces of unusually high or low dt are a source of incompatibility with the Holdahl (1981) temperature stratification model.

**ASTRONOMIC CORRECTION**

The tidal distortions of the Earth's equipotential surfaces causes the measurement of a Dl value to be time-dependent. The purpose of the astronomic correction is to remove this time-dependency. The equations for the astronomic correction which was applied to the D1 data used in this study are complex; Balazs and Young (1982) should be consulted for details. The correction is only significant for north-south lines and at most amounts to 0.1 mm/km.

## MAGNETIC ERROR

The effect of the Earth's magnetic field on compensator levels, particularly the Zeiss NI1 and NI2, was discovered in the Federal Republic of Germany during releveling of that country's first-order network. The magnetic error can be quite large, requiring corrections of up to 1.5 mm/km, and is most evident in levelings oriented in the magnetic meridian, with observed height differences measured to magnetic north being too small (Rumpf and Meurisch, 1981).

All 1973 and 1974 levelings used in this study were carried out with Zeiss NI1 compensator instruments. These lines are: L-23453, L-23514, L-23456, L-23140, L-23136, L-23117, and L-23527. The affected profiles are 1, 5, 2, 8, 7, 10, 14, 21, and 22, all located in the Puget Sound area. In addition, the two 1982 level lines used in this study, L-24471/2 and L-24471/3, were carried out with Zeiss NI2 compensator instruments. The affected profiles are 11 and 15, both located east of Puget Sound. The magnetic declination in Washington is about 23 degrees east of true north. Any of the above mentioned profiles which have a significant component of length in that direction should be interpreted with caution because of the potential rapid accumulation of the magnetic error.

At this time it is not possible to correct the D1 data used in this study for magnetic error. The NGS is constructing a calibration facility to calibrate the response of their compensator levels to magnetic fields, but the facility is not yet in operation (Charles Whalen, NGS, personal communication, May 1983). Even when it becomes operational, it may be that some instruments cannot be directly calibrated because the compensator mechanisms have been changed and the exact configuration used in the field is thus not recoverable.

## BENCHMARK STABILITY

Karcz et al. (1976) has shown that a correlation exists between benchmark type and the magnitude of net relative vertical displacement inferred from repeat levelings. Bomford (1971) states that the only benchmarks suitable for determination of vertical crustal movements are those anchored to bedrock. Benchmark types were identified from the benchmark descriptions for the level lines used in this study. It was discovered that very few dDh values are for rock-anchored benchmarks. The remainder are in concrete posts, metal pipes and rods, boulders, buildings, and other structures such as bridges and culverts. Data from Karcz et al. (1976) suggests that rock-anchcored benchmarks are the most likely to be stable, followed in descending order by buildings, bridges and culverts, and concrete posts. Benchmarks on metal pipes and rods or in boulders were not included in the Karcz et al. (1976) study.

## REGRESSION

Since most of the profiles contain a linear trend over their length (approximately 20 to 180 km), it seems reasonable to suppose that this linear trend may in some cases be an indication of regional tilt, in others, the result of systematic error. To provide some quantification of apparent regional tilt, an unweighted linear least squares regression of dDh on distance along the level line was run for each profile. The regression line was constrained to go through the origin because dDh is necessarily zero there. Obviously bad data points were removed before the regression. Each regression provided a statistical T test of the null hypothesis: the slope of the regression line is zero. The usefulness of this simple test in what is actually a very complex situation is open to question, but the T test information is included for the sake of completeness.

The purpose of the regression is to provide some quantification of apparent regional tilt in the dDh profiles. If western Washington and Oregon are indeed tilting in a regional manner either east or west, and the tilting is rapid enough to overcome noise (random error and bench mark instabilities) in the dDh data, then the number, length, and areal distribution of east-west profiles compiled for this study should be sufficient to define the regional tilt in an unequivocal way. This statement assumes that systematic errors have been eliminated to an extent that they can be discounted as a source of apparent tilt. Although there are many sources of systematic error in leveling, it can probably be stated that the most serious, most common, and most difficult to deal with when using pre-1980 leveling data in the United States are refraction error and residual rod-scale error, and, in the case of lines carried out with compensator levels as late as 1982, the magnetic error. In the author's opinion, refraction error in the Dl data used for this study has been adequately corrected except for those situations where the leveling may have progressed over surfaces of unusually high or low dt parameter. This opinion is based on the field tests (referenced above) of the

NGS refraction-correction procedure. There is no reliable correction for residual rod-scale error for levelings carried out with coarsely calibrated rods. To make matters worse, this type of systematic error may not even reveal itself as a correlation with topography; the S matrices clearly show that in some cases the error can be of the same algebraic sign when leveling up a unifrom slope and down a uniform slope, as long as the slope gradients or sight lengths are different so that certain pairs of graduations are used. Another complication arises because the effect of residual rod-scale error will either be reinforced or cancelled largely by chance when a dDh value is computed. There is also no reliable way to correct NGS D1 data obtained with compensator levels for magnetic error. Therefore, it is probably imprudent to interpret as tectonic tilt any dDh profiles with significant components of length in the magnetic meridian.

## TRILATERATION/TRIANGULATION

The program outlined in Savage and Prescott (1973) for the analysis of error associated with trilateration measurements is adequate in the sense that it takes into account all known systematic errors (i.e., those associated with atmospheric refraction) and provides an estimate of random error. Recent questions concerning the effects of these systematic errors on the determination of crustal dilatation (Cheng et al., 1981; Cheng and Jackson, 1982) were successfully addressed by Savage and Prescott (1982) and Prescott et al. (1982). There is no reason to demand an error analysis in addition to that presented by Savage et al. (1981).

A better way to check the conclusions of Savage et al. (1981) is to analyze additional trilateration/triangulation data from western Washington and western Oregon. However, a search of the NGS data base shows that no additional data exists (Richard Snay, NGS, personal communication, 1983).

## DISCUSSION

The objective is to find evidence in the profiles for regional tilt. Therefore the discussion is limited to that theme. All straight line distances l are given to the nearest 5 km. All tilts are taken from the regression data (see Appendix 2), and are smaller than values that would be obtained if the regression had been done on straight line distance rather than distance along the level line (the latter is greater).

## INDIVIDUAL PROFILES

### Profile 1

Neah Bay to 5.6 mi SE of Clallam Bay (l = 35 km) 1974-1942

Despite the small number of bench marks there is evidence for down to the southeast tilt of 0.4 mm/km. The 1974 leveling is subject to magnetic error, but the line is primarily perpendicular to magnetic north. The last four points follow the topography, but this is too small a sample to make a strong case for topography-dependent systematic error, and the relief is only 50 meters. No evidence from benchmark descriptions for disturbed benchmarks.

### Profile 2

11.4 mi W of Joyce to Blyn (l = 70 km) 1974-1931

Strong evidence for down to the east tilt of 1.0 mm/km. The 1974 leveling is subject to magnetic error, but the direction of the profile is about 80 degrees to magnetic north. No obvious correlation with topography. Benchmark descriptions indicate that N 14 and T 14 have been mutilated, the concrete post at Z 13 has been chipped, and TIDAL 8 has new concrete work around it but is presumed undisturbed.

**Profile 3**

1.5 mi W of Bay City to 0.3 mi NE of Aberdeen (l = 25 km) 1968-1947

There is evidence for down to the northeast tilt of 0.8 mm/km. No magnetic error. Topographic relief is only 26 m over the western 13 km of the profile. No evidence from benchmark descriptions for disturbed benchmarks.

**Profile 4**

Bay City to Montesano (l = 35 km) 1947-1920

There is no evidence of significant tilt. No magnetic error. No obvious correlation with topography which has only 18 m relief. Benchmark descriptions indicate that G 12 may have settled, that most of the disk of S 12 has been torn off, and that M 12 has been obliterated so that the stamping cannot be read.

**Profile 5**

4.3 mi W of Montesano to Elma (l = 20 km) 1974-1920

The last four benchmarks of this short line show tilt of about 2.9 mm/km down to the east, but the interpretation of this in terms of regional tilt is not warranted because it occurs over a short distance (less than 15 km). The 1974 leveling is subject to magnetic error, and the direction of the profile is within 55 degrees of magnetic north. Topographic relief is only 18 m over 20 km. No evidence from benchmark descriptions for disturbed benchmarks.

**Profile 6**

Olympia to Auburn (l = 60 km) 1928-1920

The estimated standard deviations are large relative to the dDh values, but there is some indication for tilt down to the northeast. The upward trend from Tacoma to Auburn is consistent with a closed vertical velocity low between Tacoma and Seattle in figures 4 and 6 in Holdahl and Hardy (1979). Savage et al. (1981) suggested that this low is the result of the 1965 Ms 6.5 Seattle earthquake; this profile indicates that the low may have been developing prior to the earthquake. No magnetic error. The two additional benchmarks at 0 km are on a spur from the reference. Benchmark descriptions indicate that O 10 is set on an iron pipe that is leaning and shows abrasion on the side opposite to the direction of lean.

**Profile 7**

Olympia to Tacoma (l = 40 km) 1973-1920

There is evidence for tilt of 1.7 mm/km down to the northeast. The 1973 leveling is subject to magnetic error. The direction of this profile is close to that of magnetic north, and the direction of downward tilt is in the direction expected for magnetic error. Therefore the tilt should not be regarded as real vertical movement. This profile enters the velocity low of Holdahl and Hardy (1979) which was interpreted by Savage et al. (1981) to be a result of the 1965 Seattle earthquake (see discussion of profile 6). Another possibility is that the velocity low is a result of magnetic error in the 1973-74 surveys, and has nothing to do with the Seattle earthquake. The two bench marks at 0 km are on a spur from the reference. There is very little topographic relief (about 15 m) along this profile to generate a topography-dependent systematic error. No evidence from benchmark descriptions for disturbed benchmarks.

**Profile 8**

Olympia to Tacoma (l = 40 km) 1973-1928

This profile is simply profile 7 minus profile 6. There is evidence for tilt of 1.4 mm/km down to the northeast as in profile 7, and the remarks made there concerning magnetic error also pertain to this profile. Therefore the tilt should not be regarded as real vertical movement. There is more topographic relief along this profile than in profile 7, but there is no obvious correlation with the dDh values. Benchmark descriptions indicate that TIDAL 6 is badly weathered.

**Profile 9**

Auburn to Ellensburg (l = 130 km) 1944-1904

This profile suggests that the reference benchmark N at Auburn has subsided relative to the rest of the benchmarks. If benchmark P had been chosen as reference, tilt down to the east would be interpreted. The 1904 leveling was observed with paraffin rods of unknown calibration. No magnetic error. There is nothing in the benchmark descriptions that indicates that N has subsided, but S and W were reported loose in the ground, E1 and F1 are corroded (F1 badly), and part of the cement has been chipped from around the disk of E1.

## Profile 10

East Auburn to 3.3 mi NW of Eagle Gorge (l = 30 km)
1973-1944

The estimated standard deviations of the dDh values are too large relative to the dDh values to permit an interpretation of real vertical movement. The 1973 leveling is subject to magnetic error but the direction of this profile is roughly perpendicular to magnetic north. The topography is ideal for accumulation of topography-dependent systematic error, but there is no obvious correlation. No evidence from benchmark descriptions for disturbed benchmarks.

## Profile 11

3.6 mi NW of Eagle Gorge to Cle Elum (l = 70 km)
1982-1944

The estimated standard deviations are too large relative to the dDh values to permit an interpretation of real vertical movement, although there does appear to be a tilt of 0.1 mm/km up to the east. Possible magnetic error in the 1982 leveling. Ideal topography for the accumulation of topography-dependent systematic error, but there is no obvious correlation. Benchmark descriptions indicate that 2103 T USGS is slightly loose in the ground, and that the top of the cap (disk) has been hit.

## Profile 12

Anacortes to Burlington (l = 20 km) 1952-1922

There is evidence for a tilt of 1.7 mm/km down to the east. No magnetic error. Very little topographic relief. Benchmark descriptions indicate that TIDAL 4 is in a building that has settled, and that TIDAL 10 is in a building whose foundation has cracked. If TIDAL 4 which is the reference for this profile has really settled, then the tilt may be greater than indicated.

**Profile 13**

Sedro Woolley to 7.6 mi SE of Concrete (l = 45 km)
1958-1934

There is evidence for a tilt of 1.6 mm/km up to the east. No magnetic error; perhaps a negative correlation with topography. The other benchmark at D = 0 km is on a spur from the reference. If this benchmark was chosen as the reference, a tilt of up to the east would still be interpreted. Benchmark descriptions indicate that Q 61 which is the reference is mutilated.

**Profile 14**

Sedro Woolley to 1.45 mi NE of Rockport (l = 45 km)
1973-1958

There is good evidence for a tilt of 1.2 mm/km down to the east. However, the 1973 leveling is subject to magnetic error and a substantial portion of the profile is at 60 degrees to magnetic north. A negative correlation with topography exists, suggesting that topography-dependent systematic error may be an alternative interpretation of the tilt, but the topographic relief over the distance is quite small. No indication of disturbed benchmarks from benchmark descriptions.

**Profile 15**

0.75 mi NE of Rockport to Winthrop (l = 105 km)
1982-1958

The first portion of the profile shows good evidence for a tilt of 1.0 mm/km up to the northeast. The middle part of the profile has no benchmarks common to both levelings. The last portion of the profile suggests a down to the southeast tilt. The overall regression line is not significantly different from zero, but this is misleading. The possibility of magnetic error in the 1982 leveling exists, but it would be expected to act opposite to the upward tilt. The topography over the middle portion of the profile is not accurately represented because only elevations of benchmarks with dDh values are used to construct the topography profiles in this report. No indication of disturbed benchmarks from benchmark descriptions.

**Profile 16**

Astoria to Portland (l = 115 km) 1941-1920

This profile shows good evidence for a tilt of 0.7 mm/km down to the southeast. The first half of the profile is east-west and the second half of the profile is north-south. No magnetic error. Very little topographic relief because the profile follows the Columbia river. Benchmark descriptions indicate that in Septmeber 1934 W 14 was reported to be covered with a steel plate; the concrete post at K 30 was found broken off in 1925, but the disk was replaced in its original position with new concrete cast around the mark; the foundation block at Q 30 was reported in February 1935 to be settling; the cap at V 30 was reported in October 1940 to be mutilated.

**Profile 17**

Portland to approx. 5 mi W of Quinton (l = 170 km) 1941/42-1921

This profile shows good evidence for a tilt of 0.6 mm/km down to the east. No magnetic error. The topographic relief is quite small for a profile of this length because it follows the Columbia river. No evidence of disturbed benchmarks from benchmark descriptions.

**Profile 18**

Hebo to Salem (l = 75 km) 1941-1930

There is some indication of short wavelength vertical movement along this profile, but no evidence for a regional tilt. The standard deviations are large relative to many of the dDh values. No magnetic error. A slight suggestion of negative correlation with topography. No evidence of disturbed benchmarks from benchmark descriptions.

**Profile 19**

Newport to Albany (l = 80 km) 1941-1930

There is some evidence for a tilt of 0.2 mm/km down to the east. However, the standard deviations are large relative to many of the dDh values and the plot does not give the appearance of a progressive increase in tilt down to the east. No magnetic error. A slight suggestion of negative correlation with topography. No evidence of disturbed benchmarks from benchmark descriptions.

**Profile 20**

Reedsport to Drain (l = 65 km) 1941-1930

This profile shows some evidence for a tilt of 0.2 mm/km down to the east. The estimated standard deviations are large relative to many of the dDh values. There is a suggestion of a negative topographic correlation, but the relief is only 100 m over 85 km. No magnetic error. No evidence of disturbed benchmarks from benchmark descriptions.

**Profile 21**

Aberdeen to 0.5 mi S of Sappho (l = 130 km)
1974-1933

Very little evidence for tilt in the first half of the profile; the second half shows tilt down to the north. The direction of this profile is north-northeast, so that the magnetic error in the 1974 leveling may have an effect on the overall tilt of 0.4 mm/km down to the north. There is no consistent correlation with topography. No evidence of disturbed benchmarks from benchmark descriptions.

**Profile 22**

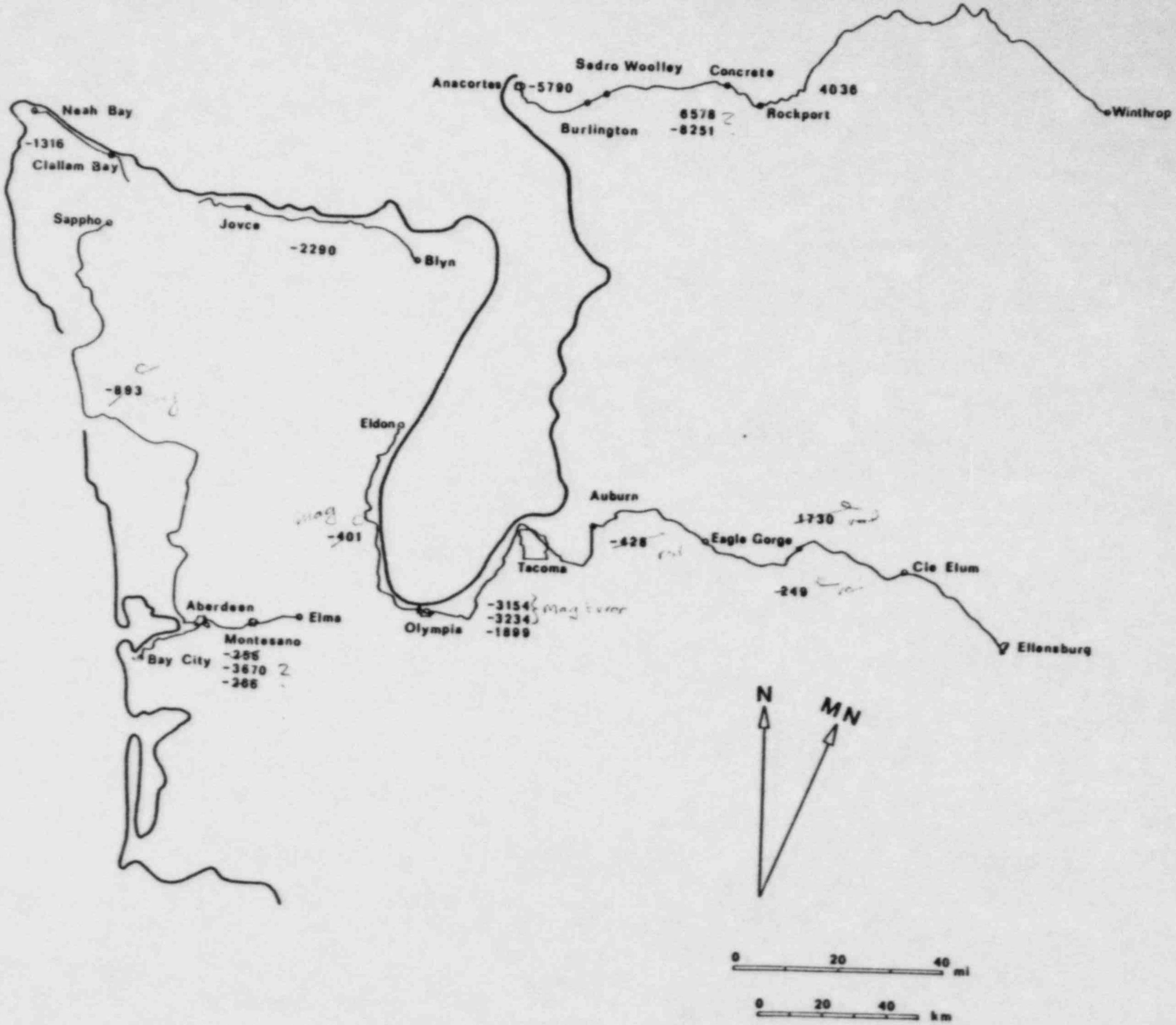
Olympia to 1.7 mi N of Eldon (l = 60 km) 1973-1931

The standard deviations are large relative to many of the dDh values. Thus vertical movements probably should not be interpreted from this profile. The 1973 leveling is subject to magnetic error; since the direction of the profile is north, this may explain the tendency of the data to indicate a tilt of down to the north. Benchmark descriptions indicate that Y 16 may have settled with the bridge in which it is set.

## PROFILE SUMMARY

The profiles may be viewed as a set of apparent regional tilt indicators discretized in space and time. The tilt (slope of the regression line) for each profile was divided by the number of years between the constituent levelings to give a tilt rate in mm per km-year. The tilt rates have been plotted near their profiles in figures 2 through 5 to give an indication of the areal distribution of tilt. (The tilt rates in mm per km-year have been scaled by 100,000 in the figures for convenience; negative numbers mean tilt down to the east and positive numbers mean tilt up to the east for east-west profiles; the two north-south profiles on the Olympic peninsula are down to the north.) In figures 2 and 3, tilt rates for all 22 profiles are represented; in figures 4 and 5, the only tilt rates represented are those from profiles which in the author's judgment provide real indications of regional tilt. Both sets of figures show the same thing: down to the east tilting of western Washington and western Oregon and up to the east tilting farther to the east in Washington. Figure 2 suggests that the change from negative to positive tilt takes place about 200 km inland from the coast in Washington, but we can only conclude this for northern Washington if we restrict attention to Figures 4 and 5. Again refering only to figures 4 and 5, the tilt rate appears to be a factor of three greater near Aberdeen, Astoria, and Portland than in areas a few hundred kilometers to the north and south along the coast. However, the highest consistent tilt rate is observed in northern Washington between Anacortes and Burlington. Between Burlington and Rockport there are conflicting indications of the direction of tilt and no conclusions can be drawn there, except that the area appears to straddle the divide between negative tilt to the west and positive tilt to the east.

If a further reduction is made in the profiles considered reliable by eliminating those associated with compensator levels, then only profiles 3, 12, 13, 16, 17, and 20 are left (see Appendix 2). These remaining profiles still indicate the features already interpreted.


Neah Bay
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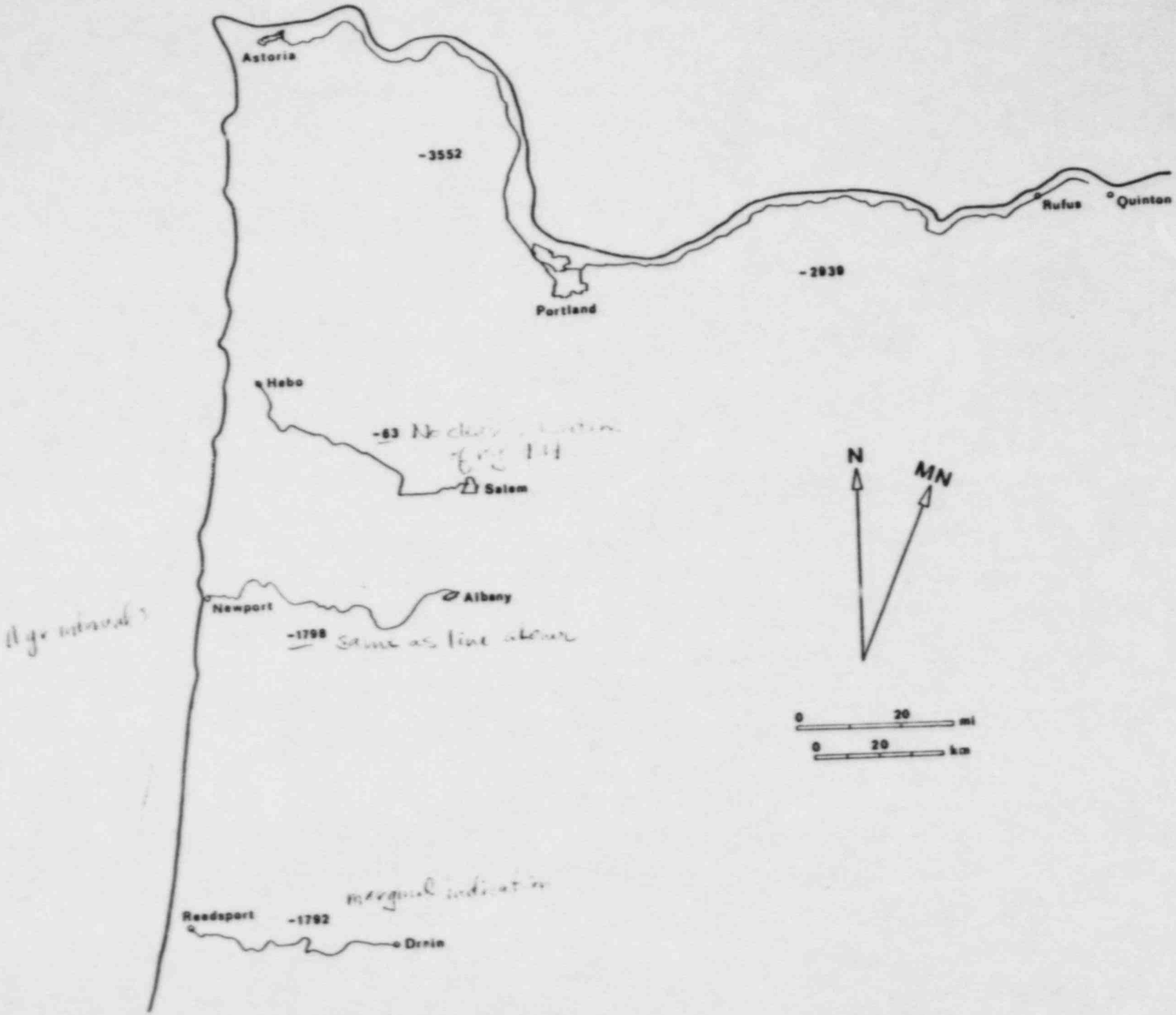
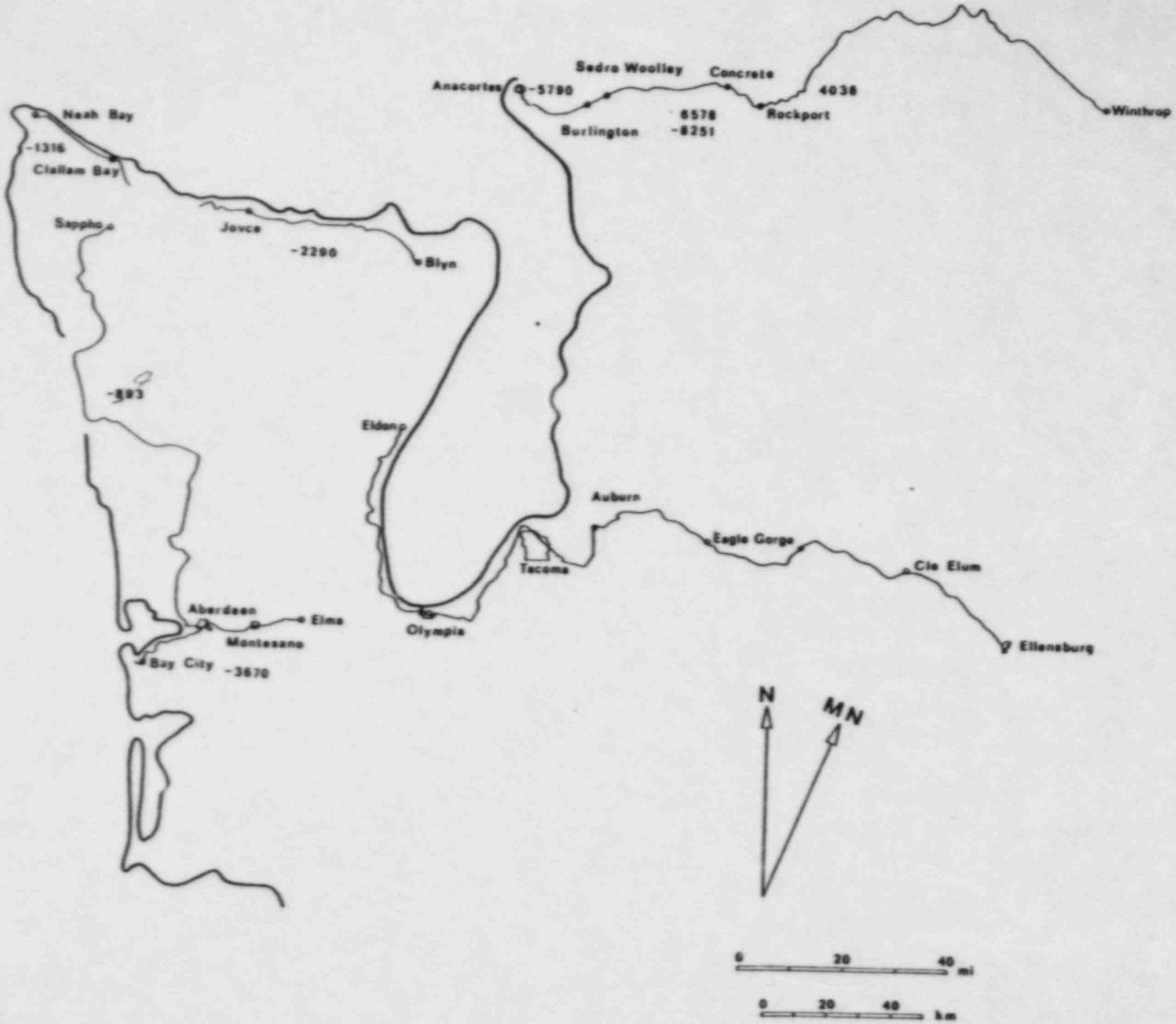
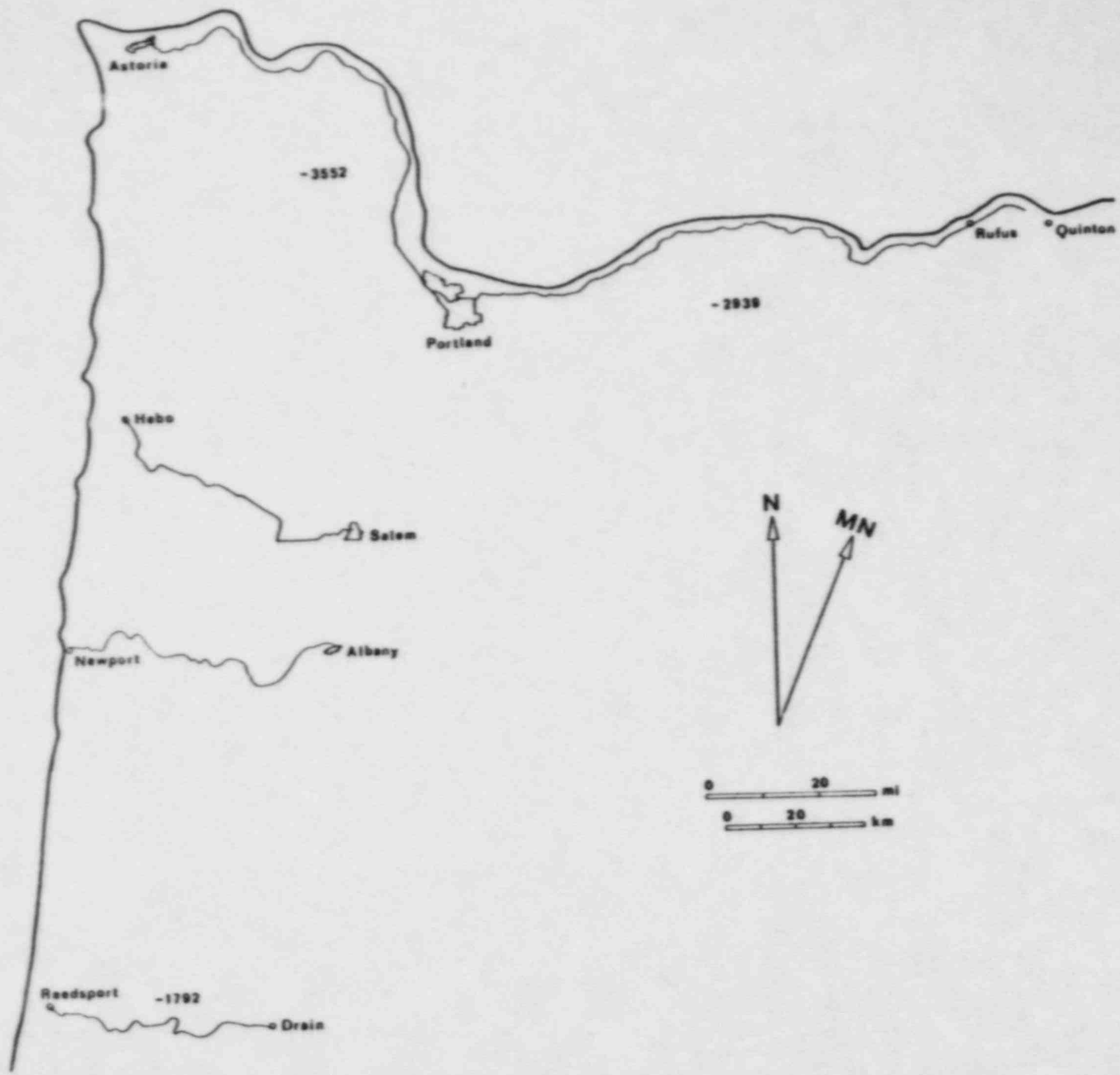
Clallam Bay
Sappho
Jovce
-2290
Blyn
-893
Eldon
-401
Aberdeen
Elma
Montesano
Bay City
-286
-3670
-286
Olympia
-3154
-3234
-1899
Tacoma
Auburn
-428
Eagle Gorge
1730
-249
Cle Elum
Ellensburg
Anacortes
-5790
Sedro Woolley
Burlington
Concrete
6578
-8251
Rockport
4036
Winthrop
N
MN
0
20
40
mi
0
20
40
km

2


Astoria
-3552
Portland
-2939
Rufus
Quinton
Hebo
-63
Salem
N
MN
Newport
Albany
-1798
same as line above
0
20
mi
0
20
km
Reedsport
-1792
Drain
marginal indication


Neah Bay
-1316
Clallam Bay
Sappho
Joyce
-2290
Blyn
-893
Anacortes
-5790
Sedro Woolley
Burlington
Concrete
6578
-8251
Rockport
4038
Winthrop
Eldon
Olympia
Tacoma
Auburn
Eagle Gorge
Cle Elum
Ellensburg
Aberdeen
Montesano
Elma
Bay City
-3670
N
MN
0
20
40
mi
0
20
40
km

4


Astoria
-3552
Portland
-2939
Rufus
Quinton
Hebo
Salem
Newport
Albany
Reedsport
-1792
Drain
N
MN
0
20
mi
0
20
km

## SUMMARY

1. Refraction error has probably been adequately removed from the D1 data used in this report by application of the NGS refraction correction. This conclusion is based on the results of recent field tests (referenced above) of the NGS refraction-correction procedure. It is possible that at least some of the pre-1980 leveling was carried out over surfaces of unusually high or low values of the temperature difference parameter. In this situation the predicted values from the Holdahl (1981) temperature stratification model might result in too much or too little correction. Nonetheless, it is probably true that most of the leveling is adequately corrected so that refraction error is not expected to be a serious problem in the dDh data.

2. Residual rod-scale error may be a component of the D1 data used in this report. Analysis of all pertinent rod pairs indicates that if residual rod-scale error is allowed to accumulate on a uniform slope, it may do so at a rate of up to 2.9 mm/km for a code 312 rod pair, and up to 0.7 mm/km for a code 316 rod pair. There is no fully adequate method for correcting for residual rod-scale error, or even for detecting its existence. Thus the possibility of apparent regional tilt from this single source of systematic error cannot be eliminated.

3. Magnetic error may be a component of the 1973, 1974, and 1982 D1 data used in this report. There is no way at present to correct this error because the compensator levels involved have not yet been calibrated by the NGS. However, we at least know which levelings are affected and what the effect is likely to be on the dDh data: a tilt down in the direction of magnetic north of up to 1.5 mm/km.

4. A synthesis of the dDh data for 22 profiles suggests that a regional tilt down to the east of rate 0.01-0.06 mm per km-year affects the western Oregon-Washington area. These tilt rate estimates are probably low relative to their actual values because they were determined by regression on level line length which is larger than straight-line distance. The direction of tilt may change to up to the east in Washington at a distance of about 200 km inland from the coast. No such change is observed in Oregon even though one profile does extend a similar distance to the east.

5. The error analysis done by Savage et al. (1981) on the trilateration data from the Puget Sound area is adequate in the sense that all known systematic errors are corrected and random error is estimated. A check was made

at the NGS for additional trilateration/triangulation data but none was discovered that was suitable for a crustal strain determination in either Washington or Oregon.

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# APPENDIX 1

# ANALYSIS OF ROD CALIBRATION DATA

```
INPUT
NO CALIBRATION DATA
NO OF CAL MEAS = 0
NOMINAL LENGTH OF FOOTPIECE =
              ROD1              ROD2
NGS CODE      311               311
SERIAL NO        V                 W
CAL DATE      19020322          19020326
LABORATORY
STD TEMP       0.0C              0.0C
EXP COEF       4.00X10(-6)/C     4.00X10(-6)/C
EXCESS         0.3933 MM/M       0.5433 MM/M
INDEX COR      0.0000 MM         0.0000 MM
AVG FOR 57499 PAIR 1      0.0C  4.00X10(-6)/C  0.4683 MM/M

NOTE:  THE RODS OF THIS PAIR ARE PARAFFIN.
       THERE IS NO CALIBRATION DATA FOR THEM
       IN THE NGS ROD AND INSTRUMENT FILE.
       VALUES FOR STD. TEMP., EXP. COEF., AND
       EXCESS ARE IN THE FILE.  THEIR ULTIMATE
       SOURCE IS THE ARCHIVAL RECORDS.
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1                ROD2
NGS CODE      312                 312
SERIAL NO        201                 202
CAL DATE      19201127            19201127
LABORATORY    NGS                 NGS
STD TEMP       0.0C                0.0C
EXP COEF       1.00X10(-6)/C       1.00X10(-6)/C
EXCESS         0.0623 MM/M         0.1810 MM/M
INDEX COR     -0.1770 MM           0.0770 MM
AVG FOR 82270 PAIR 2       0.0C  1.00X10(-6)/C  0.1216 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0007 200.0104 300.0187
MEAS. LEN. OF INTER. ROD2 CM 100.0109 200.0257 300.0543

OUTPUT
ROD-SCALE ER.(ROD1)          MM  -0.0070   -0.1040   -0.1870
RES. ROD-SCALE ER.(ROD1)     MM   0.1146    0.1392    0.1778
ROD-SCALE ER.(ROD2)          MM  -0.1090   -0.2570   -0.5430
RES. ROD-SCALE ER.(ROD2)     MM   0.0126   -0.0138   -0.1782
                                 120.0000  220.0000  320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000    0.2928    0.3174    0.3560
 220.0000    0.1284    0.1530    0.1916
 120.0000    0.1020    0.1266    0.1652
           120.0000  220.0000  320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   -0.1652   -0.1916   -0.3560
 220.0000   -0.1266   -0.1530   -0.3174
 120.0000   -0.1020   -0.1284   -0.2928
           120.0000  220.0000  320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS                  down slope
 320.0000    6.3800    6.2900    0.0000
 220.0000    0.0900    0.0000   -6.2900
 120.0000    0.0000   -0.0900   -6.3800   up slope
           120.0000  220.0000  320.0000   BS
```

matrix

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SERIAL NO        204               206
CAL DATE      19200812          19200812
LABORATORY    NGS               NGS
STD TEMP       0.0C              0.0C
EXP COEF       1.00X10(-6)/C     1.00X10(-6)/C
EXCESS         0.1757 MM/M       0.0993 MM/M
INDEX COR     -0.3180 MM        -0.2920 MM
AVG FOR 74223 PAIR 2       0.0C  1.00X10(-6)/C  0.1375 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0184 200.0584 300.0527
MEAS. LEN. OF INTER. ROD2 CM 100.0260 200.0254 300.0298

OUTPUT
ROD-SCALE ER.(ROD1)        MM  -0.1840  -0.5840  -0.5270
RES. ROD-SCALE ER.(ROD1)  MM  -0.0465  -0.3090  -0.1145
ROD-SCALE ER.(ROD2)        MM  -0.2600  -0.2540  -0.2980
RES. ROD-SCALE ER.(ROD2)  MM  -0.1225   0.0210   0.1145
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000  -0.1610  -0.4235  -0.2290
 220.0000  -0.0675  -0.3300  -0.1355
 120.0000   0.0760  -0.1865   0.0080
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000  -0.0080   0.1355   0.2290
 220.0000   0.1865   0.3300   0.4235
 120.0000  -0.0760   0.0675   0.1610
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000  -8.4500 -14.4000   0.0000
 220.0000   5.9500   0.0000  14.4000
 120.0000   0.0000  -5.9500   8.4500
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
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NGS CODE     312             312
SERIAL NO      208             209
CAL DATE     19200325        19200325
LABORATORY   NGS             NGS
STD TEMP      0.0C            0.0C
EXP COEF      1.00X10(-6)/C   1.00X10(-6)/C
EXCESS        0.0497 MM/M     0.1687 MM/M
INDEX COR     0.1300 MM       0.1100 MM
AVG FOR 82195 PAIR 1      0.0C  1.00X10(-6)/C  0.1092 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0003 200.0197 300.0149
MEAS. LEN. OF INTER. ROD2 CM 100.0168 200.0363 300.0506

OUTPUT
ROD-SCALE ER.(ROD1)          MM  -0.0030  -0.1970  -0.1490
RES. ROD-SCALE ER.(ROD1)     MM   0.1062   0.0214   0.1786
ROD-SCALE ER.(ROD2)          MM  -0.1680  -0.3630  -0.5060
RES. ROD-SCALE ER.(ROD2)     MM  -0.0588  -0.1446  -0.1784
                                120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.2846   0.1998   0.3570
 220.0000   0.2508   0.1660   0.3232
 120.0000   0.1650   0.0802   0.2374
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000  -0.2374  -0.3232  -0.3570
 220.0000  -0.0802  -0.1660  -0.1998
 120.0000  -0.1650  -0.2508  -0.2846
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   2.3600  -6.1700   0.0000
 220.0000   8.5300   0.0000   6.1700
 120.0000   0.0000  -8.5300  -2.3600
          120.0000 220.0000 320.0000  BS
```

```
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CAL. DATA HAS (IN-GRAD) FORMAT
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NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
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NGS CODE      312               312
SERIAL NO       212               213
CAL DATE      19200527          19200527
LABORATORY    NGS               NGS
STD TEMP       0.0C              0.0C
EXP COEF      11.40X10(-6)/C 11.40X10(-6)/C
EXCESS        -0.1287 MM/M    -0.1200 MM/M
INDEX COR     -0.1390 MM       0.1270 MM
AVG FOR 74223 PAIR 1      0.0C 11.40X10(-6)/C -0.1243 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9735 199.9713 299.9614
MEAS. LEN. OF INTER. ROD2 CM  99.9812 199.9701 299.9640

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.2650   0.2870   0.3860
RES. ROD-SCALE ER.(ROD1)   MM   0.1407   0.0384   0.0131
ROD-SCALE ER.(ROD2)        MM   0.1880   0.2990   0.3600
RES. ROD-SCALE ER.(ROD2)   MM   0.0637   0.0504  -0.0129
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.1536   0.0513   0.0260
 220.0000   0.0903  -0.0120  -0.0373
 120.0000   0.0770  -0.0253  -0.0506
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0506   0.0373  -0.0260
 220.0000   0.0253   0.0120  -0.0513
 120.0000  -0.0770  -0.0903  -0.1536
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000  10.2100   4.4300   0.0000
 220.0000   5.7800   0.0000  -4.4300
 120.0000   0.0000  -5.7800 -10.2100
          120.0000 220.0000 320.0000  BS
```

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LABORATORY   NGS               NGS
STD TEMP      0.0C              0.0C
EXP COEF      1.00X10(-6)/C   1.00X10(-6)/C
EXCESS        0.0367 MM/M      0.0493 MM/M
INDEX COR    -0.0250 MM        0.0250 MM
AVG FOR 82315 PAIR 1      0.0C  1.00X10(-6)/C  0.0430 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0024 200.0023 300.0110
MEAS. LEN. OF INTER. ROD2 CM 100.0074 200.0086 300.0148

OUTPUT
ROD-SCALE ER.(ROD1)         MM  -0.0240  -0.0230  -0.1100
RES. ROD-SCALE ER.(ROD1)    MM   0.0190   0.0630   0.0190
ROD-SCALE ER.(ROD2)         MM  -0.0740  -0.0860  -0.1480
RES. ROD-SCALE ER.(ROD2)    MM  -0.0310  -0.0000  -0.0190
                                120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.0380   0.0820   0.0380
 220.0000   0.0190   0.0630   0.0190
 120.0000   0.0500   0.0940   0.0500
         120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000  -0.0500  -0.0190  -0.0380
 220.0000  -0.0940  -0.0630  -0.0820
 120.0000  -0.0500  -0.0190  -0.0380
         120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000  -0.6000   3.1500   0.0000
 220.0000  -3.7500   0.0000  -3.1500
 120.0000   0.0000   3.7500   0.6000
         120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
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NGS CODE      312               312
SERIAL NO       224               225
CAL DATE      19210429          19210429
LABORATORY    NGS               NGS
STD TEMP       0.0C              0.0C
EXP COEF       0.10X10(-6)/C     0.10X10(-6)/C
EXCESS         0.0330 MM/M       0.0377 MM/M
INDEX COR      0.1400 MM         0.1150 MM
AVG FOR 82270 PAIR 1      0.0C  0.10X10(-6)/C  0.0353 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0046 200.0066 300.0099
MEAS. LEN. OF INTER. ROD2 CM 100.0059 200.0067 300.0113

OUTPUT
ROD-SCALE ER.(ROD1)        MM  -0.0460  -0.0660  -0.0990
RES. ROD-SCALE ER.(ROD1)   MM  -0.0107   0.0046   0.0069
ROD-SCALE ER.(ROD2)        MM  -0.0590  -0.0670  -0.1130
RES. ROD-SCALE ER.(ROD2)   MM  -0.0237   0.0036  -0.0071
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000  -0.0036   0.0117   0.0140
 220.0000  -0.0143   0.0010   0.0033
 120.0000   0.0130   0.0283   0.0306
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000  -0.0306  -0.0033  -0.0140
 220.0000  -0.0283  -0.0010  -0.0117
 120.0000  -0.0130   0.0143   0.0036
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000  -1.7100   0.4200   0.0000
 220.0000  -2.1300   0.0000  -0.4200
 120.0000   0.0000   2.1300   1.7100
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
               ROD1              ROD2
NGS CODE       312               312
SERIAL NO         228               229
CAL DATE       19280720          19280720
LABORATORY     NBS               NBS
STD TEMP       28.7C             28.9C
EXP COEF        1.40X10(-6)/C  1.40X10(-6)/C
EXCESS          0.0267 MM/M     0.0067 MM/M
INDEX COR       0.1000 MM      -0.1000 MM
AVG FOR L-163 PAIR 2     28.8C  1.40X10(-6)/C  0.0167 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9980 200.0040 300.0080
MEAS. LEN. OF INTER. ROD2 CM  99.9960 200.0000 300.0020

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.0200  -0.0400  -0.0800
RES. ROD-SCALE ER.(ROD1)  MM   0.0367  -0.0066  -0.0299
ROD-SCALE ER.(ROD2)        MM   0.0400   0.0000  -0.0200
RES. ROD-SCALE ER.(ROD2)  MM   0.0567   0.0334   0.0301
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.0066  -0.0367  -0.0600
 220.0000   0.0033  -0.0400  -0.0633
 120.0000  -0.0200  -0.0633  -0.0866
          . 120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0866   0.0633   0.0600
 220.0000   0.0633   0.0400   0.0367
 120.0000   0.0200  -0.0033  -0.0066
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   4.6600   1.3300   0.0000
 220.0000   3.3300   0.0000  -1.3300
 120.0000   0.0000  -3.3300  -4.6600
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
            ROD1              ROD2
NGS CODE    312               312
SERIAL NO      229               230
CAL DATE    19280720          19301003
LABORATORY  NBS               NBS
STD TEMP    28.9C             20.0C
EXP COEF      1.40X10(-6)/C  1.40X10(-6)/C
EXCESS        0.0067 MM/M    -0.0643 MM/M
INDEX COR   -0.1000 MM       -0.1000 MM
AVG FOR L-751 PAIR 3     24.4C  1.40X10(-6)/C -0.0288 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9960 200.0000 300.0020
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 299.9800

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.0400   0.0000  -0.0200
RES. ROD-SCALE ER.(ROD1) MM     0.0112  -0.0576  -0.1064
ROD-SCALE ER.(ROD2)        MM   0.1000   0.1000   0.2000
RES. ROD-SCALE ER.(ROD2) MM     0.0712   0.0424   0.1136
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000  -0.1024  -0.1712  -0.2200
 220.0000  -0.0312  -0.1000  -0.1488
 120.0000  -0.0600  -0.1288  -0.1776
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.1776   0.1488   0.2200
 220.0000   0.1288   0.1000   0.1712
 120.0000   0.0600   0.0312   0.1024
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   3.7600  -1.1200   0.0000
 220.0000   4.8800   0.0000   1.1200
 120.0000   0.0000  -4.8800  -3.7600
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (O-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE =  0.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO       243               244
CAL DATE      19270610          19270610
LABORATORY    NBS               NBS
STD TEMP      21.6C             21.7C
EXP COEF       2.50X10(-6)/C  2.50X10(-6)/C
EXCESS         0.2000 MM/M     0.1500 MM/M
INDEX COR     -0.2000 MM      -0.1500 MM
AVG FOR L-13 PAIR 1      21.6C  2.50X10(-6)/C  0.1750 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0000 200.0200 300.0400
MEAS. LEN. OF INTER. ROD2 CM 100.0000 200.0200 300.0300

OUTPUT
ROD ER.(ROD1)               MM   0.0000  -0.2000  -0.4000
ROD-SCALE ER.(ROD1)         MM  -0.2000  -0.4000  -0.6000
RES. ROD-SCALE ER.(ROD1)    MM  -0.0250  -0.0500  -0.0750
ROD ER.(ROD2)               MM   0.0000  -0.2000  -0.3000
ROD-SCALE ER.(ROD2)         MM  -0.1500  -0.3500  -0.4500
RES. ROD-SCALE ER.(ROD2)    MM   0.0250   0.0000   0.0750
                               100.0000 200.0000 300.0000
RES ROD-SCALE ERROR MM
 PS=ROD2
 300.0000  -0.1000  -0.1250  -0.1500
 200.0000  -0.0250  -0.0500  -0.0750
 100.0000  -0.0500  -0.0750  -0.1000
          100.0000 200.0000 300.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 PS=ROD1
 300.0000   0.1000   0.0750   0.1500
 200.0000   0.0750   0.0500   0.1250
 100.0000   0.0500   0.0250   0.1000
          100.0000 200.0000 300.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 PS
 300.0000  -0.0000  -2.5000   0.0000
 200.0000   2.5000   0.0000   2.5000
 100.0000   0.0000  -2.5000   0.0000
          100.0000 200.0000 300.0000   BS
```

```
INPUT
CAL. DATA HAS (0-GRAD) FORMAT
NO OF CAL MEAS = 4
NOMINAL LENGTH OF FOOTPIECE =  0.0 CM
              ROD1                ROD2
NGS CODE      312                 312
SERIAL NO         243                 256
CAL DATE      19450504            19450614
LABORATORY    NBS                 NBS
STD TEMP      28.5C               28.5C
EXP COEF        2.50X10(-6)/C   2.50X10(-6)/C
EXCESS        -0.0373 MM/M      -0.0373 MM/M
INDEX COR       0.0115 MM         0.0115 MM
AVG FOR L-14696 PAIR 2  28.5C  2.50X10(-6)/C -0.0373 MM/M
NOM. LENGTH OF INTERVALS  CM  20.0000 120.0000 220.0000 320.0000
MEAS. LEN. OF INTER. ROD1 CM  20.0000 120.0000 219.9900 319.9900
MEAS. LEN. OF INTER. ROD2 CM  20.0000 120.0000 219.9900 319.9900

OUTPUT
ROD ER.(ROD1)                MM   0.0000    0.0000    0.1000    0.1000
ROD-SCALE ER.(ROD1)          MM   0.0115    0.0115    0.1115    0.1115
RES. ROD-SCALE ER.(ROD1) MM   0.0040   -0.0333    0.0294   -0.0079
ROD ER.(ROD2)                MM   0.0000    0.0000    0.1000    0.1000
ROD-SCALE ER.(ROD2)          MM   0.0115    0.0115    0.1115    0.1115
RES. ROD-SCALE ER.(ROD2) MM   0.0040   -0.0333    0.0294   -0.0079
                                 20.0000  120.0000  220.0000  320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000    0.0119   -0.0254    0.0373    0.0000
 220.0000   -0.0254   -0.0627    0.0000   -0.0373
 120.0000    0.0373    0.0000    0.0627    0.0254
  20.0000    0.0000   -0.0373    0.0254   -0.0119
            20.0000  120.0000  220.0000  320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000    0.0119   -0.0254    0.0373    0.0000
 220.0000   -0.0254   -0.0627    0.0000   -0.0373
 120.0000    0.0373    0.0000    0.0627    0.0254
  20.0000    0.0000   -0.0373    0.0254   -0.0119
            20.0000  120.0000  220.0000  320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000    1.1900   -2.5400    3.7300    0.0000
 220.0000   -2.5400   -6.2700    0.0000   -3.7300
 120.0000    3.7300    0.0000    6.2700    2.5400
  20.0000    0.0000   -3.7300    2.5400   -1.1900
            20.0000  120.0000  220.0000  320.0000   BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
             ROD1              ROD2
NGS CODE     312               312
SERIAL NO       247               252
CAL DATE     19300627          19300627
LABORATORY   NBS               NBS
STD TEMP     28.0C             31.0C
EXP COEF       2.50X10(-6)/C  2.50X10(-6)/C
EXCESS       -0.0071 MM/M    -0.0214 MM/M
INDEX COR      0.0000 MM        0.0000 MM
AVG FOR L-163 PAIR 1      29.5C  2.50X10(-6)/C -0.0142 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 200.0000 300.0000
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 300.0000

OUTPUT
ROD-SCALE ER.(ROD1)          MM    0.1000    0.0000    0.0000
RES. ROD-SCALE ER.(ROD1)  MM    0.0858   -0.0284   -0.0426
ROD-SCALE ER.(ROD2)          MM    0.1000    0.1000    0.0000
RES. ROD-SCALE ER.(ROD2)  MM    0.0858    0.0716   -0.0426
                                 120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000    0.1284    0.0142    0.0000
 220.0000    0.0142   -0.1000   -0.1142
 120.0000    0.0000   -0.1142   -0.1284
          120.0000 220.0000 320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000    0.1284    0.1142    0.0000
 220.0000    0.1142    0.1000   -0.0142
 120.0000    0.0000   -0.0142   -0.1284
          120.0000 220.0000 320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   12.8400    6.4200    0.0000
 220.0000    6.4200    0.0000   -6.4200
 120.0000    0.0000   -6.4200  -12.8400
          120.0000 220.0000 320.0000   BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO        248               254
CAL DATE      19310117          19450115
LABORATORY    NBS               NBS
STD TEMP      24.0C             23.0C
EXP COEF       2.50X10(-6)/C  2.50X10(-6)/C
EXCESS        -0.0429 MM/M    -0.0293 MM/M
INDEX COR      0.0000 MM      -0.0266 MM
AVG FOR L-17026 PAIR 5  23.5C  2.50X10(-6)/C -0.0361 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 199.9900 299.9900
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 299.9900

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.1000    0.1000    0.1000
RES. ROD-SCALE ER.(ROD1) MM     0.0639    0.0278   -0.0083
ROD-SCALE ER.(ROD2)        MM   0.1000    0.1000    0.1000
RES. ROD-SCALE ER.(ROD2) MM     0.0639    0.0278   -0.0083
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000    0.0722    0.0361    0.0000
 220.0000    0.0361    0.0000   -0.0361
 120.0000    0.0000   -0.0361   -0.0722
           120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000    0.0722    0.0361    0.0000
 220.0000    0.0361    0.0000   -0.0361
 120.0000    0.0000   -0.0361   -0.0722
           120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000    7.2200    3.6100    0.0000
 220.0000    3.6100    0.0000   -3.6100
 120.0000    0.0000   -3.6100   -7.2200
           120.0000 220.0000 320.0000  BS

NOTE: THIS PAIR HAD MIXED FORMAT.
      ROD 254 WAS CONVERTED TO IN-GRAD
      FORMAT.
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
             ROD1              ROD2
NGS CODE     312               312
SERIAL NO      248               261
CAL DATE     19310117          19301231
LABORATORY   NBS               NBS
STD TEMP     24.0C             23.0C
EXP COEF      2.50X10(-6)/C  2.50X10(-6)/C
EXCESS       -0.0429 MM/M    -0.0643 MM/M
INDEX COR     0.0000 MM       0.0000 MM
AVG FOR L-293 PAIR 1     23.5C  2.50X10(-6)/C -0.0536 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 199.9900 299.9900
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 299.9800

OUTPUT
ROD-SCALE ER.(ROD1)         MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD1)  MM   0.0464  -0.0072  -0.0608
ROD-SCALE ER.(ROD2)         MM   0.1000   0.1000   0.2000
RES. ROD-SCALE ER.(ROD2)  MM   0.0464  -0.0072   0.0392
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000    0.0072  -0.0464  -0.1000
 220.0000    0.0536   0.0000  -0.0536
 120.0000    0.0000  -0.0536  -0.1072
          120.0000 220.0000 320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000    0.1072   0.0536   0.1000
 220.0000    0.0536   0.0000   0.0464
 120.0000    0.0000  -0.0536  -0.0072
          120.0000 220.0000 320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000    5.7200   0.3600   0.0000
 220.0000    5.3600   0.0000  -0.3600
 120.0000    0.0000  -5.3600  -5.7200
          120.0000 220.0000 320.0000   BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
             ROD1             ROD2
NGS CODE     312              312
SERIAL NO       249              250
CAL DATE     19280720         19280720
LABORATORY   NBS              NBS
STD TEMP     28.4C            28.1C
EXP COEF      2.50X10(-6)/C  2.50X10(-6)/C
EXCESS        0.0133 MM/M    -0.0033 MM/M
INDEX COR    -0.1000 MM      -0.1000 MM
AVG FOR L-293 PAIR 2     28.2C  2.50X10(-6)/C  0.0050 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0030 200.0030 300.0040
MEAS. LEN. OF INTER. ROD2 CM 100.0000 200.0000 299.9990

OUTPUT
ROD-SCALE ER.(ROD1)        MM  -0.0300  -0.0300  -0.0400
RES. ROD-SCALE ER.(ROD1)  MM  -0.0250  -0.0200  -0.0250
ROD-SCALE ER.(ROD2)        MM   0.0000   0.0000   0.0100
RES. ROD-SCALE ER.(ROD2)  MM   0.0050   0.0100   0.0250
                             120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000  -0.0500  -0.0450  -0.0500
 220.0000  -0.0350  -0.0300  -0.0350
 120.0000  -0.0300  -0.0250  -0.0300
          120.0000 220.0000 320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0300   0.0350   0.0500
 220.0000   0.0250   0.0300   0.0450
 120.0000   0.0300   0.0350   0.0500
          120.0000 220.0000 320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000  -1.0000  -0.5000   0.0000
 220.0000  -0.5000   0.0000   0.5000
 120.0000   0.0000   0.5000   1.0000
          120.0000 220.0000 320.0000   BS
```

```
INPUT
CAL. DATA HAS (0-GRAD) FORMAT
NO OF CAL MEAS = 4
NOMINAL LENGTH OF FOOTPIECE =  0.0 CM
               ROD1             ROD2
NGS CODE       312              312
SERIAL NO         251              310
CAL DATE       19530130         19530130
LABORATORY     NBS              NBS
STD TEMP       25.0C            25.0C
EXP COEF        2.50X10(-6)/C    1.00X10(-6)/C
EXCESS          0.0000 MM/M      0.0000 MM/M
INDEX COR       0.0000 MM        0.0000 MM
AVG FOR L-17026 PAIR 4  25.0C  1.75X10(-6)/C  0.0000 MM/M
NOM. LENGTH OF INTERVALS  CM  20.0000 120.0000 220.0000 320.0000
MEAS. LEN. OF INTER. ROD1 CM  20.0000 120.0000 220.0000 320.0000
MEAS. LEN. OF INTER. ROD2 CM  20.0000 120.0000 220.0000 320.0000

OUTPUT
ROD ER.(ROD1)               MM   0.0000   0.0000   0.0000   0.0000
ROD-SCALE ER.(ROD1)         MM   0.0000   0.0000   0.0000   0.0000
RES. ROD-SCALE ER.(ROD1)    MM   0.0000   0.0000   0.0000   0.0000
ROD ER.(ROD2)               MM   0.0000   0.0000   0.0000   0.0000
ROD-SCALE ER.(ROD2)         MM   0.0000   0.0000   0.0000   0.0000
RES. ROD-SCALE ER.(ROD2)    MM   0.0000   0.0000   0.0000   0.0000
                                20.0000 120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.0000   0.0000   0.0000   0.0000
 220.0000   0.0000   0.0000   0.0000   0.0000
 120.0000   0.0000   0.0000   0.0000   0.0000
  20.0000   0.0000   0.0000   0.0000   0.0000
           20.0000 120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0000   0.0000   0.0000   0.0000
 220.0000   0.0000   0.0000   0.0000   0.0000
 120.0000   0.0000   0.0000   0.0000   0.0000
  20.0000   0.0000   0.0000   0.0000   0.0000
           20.0000 120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   0.0000   0.0000   0.0000   0.0000
 220.0000   0.0000   0.0000   0.0000   0.0000
 120.0000   0.0000   0.0000   0.0000   0.0000
  20.0000   0.0000   0.0000   0.0000   0.0000
           20.0000 120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
             ROD1            ROD2
NGS CODE     312             312
SERIAL NO       254             263
CAL DATE     19300627        19300627
LABORATORY   NBS             NBS
STD TEMP     31.0C           31.0C
EXP COEF      2.50X10(-6)/C  2.50X10(-6)/C
EXCESS        0.0214 MM/M     0.0571 MM/M
INDEX COR     0.1000 MM       0.1000 MM
AVG FOR L-751 PAIR 2     31.0C  2.50X10(-6)/C  0.0392 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0000 200.0000 300.0100
MEAS. LEN. OF INTER. ROD2 CM 100.0000 200.0100 300.0200

OUTPUT
ROD-SCALE ER.(ROD1)         MM   0.0000   0.0000  -0.1000
RES. ROD-SCALE ER.(ROD1)  MM   0.0392   0.0784   0.0176
ROD-SCALE ER.(ROD2)         MM   0.0000  -0.1000  -0.2000
RES. ROD-SCALE ER.(ROD2)  MM   0.0392  -0.0216  -0.0824
                               120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.1216   0.1608   0.1000
 220.0000   0.0608   0.1000   0.0392
 120.0000   0.0000   0.0392  -0.0216
          120.0000 220.0000 320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0216  -0.0392  -0.1000
 220.0000  -0.0392  -0.1000  -0.1608
 120.0000   0.0000  -0.0608  -0.1216
          120.0000 220.0000 320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   7.1600   6.0800   0.0000
 220.0000   1.0800   0.0000  -6.0800
 120.0000   0.0000  -1.0800  -7.1600
          120.0000 220.0000 320.0000   BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO        264               287
CAL DATE      19301003          19330817
LABORATORY    NBS               NBS
STD TEMP      20.0C             27.0C
EXP COEF       2.50X10(-6)/C  1.00X10(-6)/C
EXCESS         0.0000 MM/M    0.0000 MM/M
INDEX COR      0.0000 MM      0.0000 MM
AVG FOR L-751 PAIR 1     23.5C  1.75X10(-6)/C  0.0000 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD2 CM 100.0000 200.0000 300.0000

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.0000   0.0000   0.0000
RES. ROD-SCALE ER.(ROD1)  MM   0.0000   0.0000   0.0000
ROD-SCALE ER.(ROD2)        MM   0.0000   0.0000   0.0000
RES. ROD-SCALE ER.(ROD2)  MM   0.0000   0.0000   0.0000
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.0000   0.0000   0.0000
 220.0000   0.0000   0.0000   0.0000
 120.0000   0.0000   0.0000   0.0000
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0000   0.0000   0.0000
 220.0000   0.0000   0.0000   0.0000
 120.0000   0.0000   0.0000   0.0000
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   0.0000   0.0000   0.0000
 220.0000   0.0000   0.0000   0.0000
 120.0000   0.0000   0.0000   0.0000
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO        267               274
CAL DATE      19341003          19321101
LABORATORY    NBS               NBS
STD TEMP      20.0C             23.0C
EXP COEF       2.50X10(-6)/C  2.50X10(-6)/C
EXCESS        -0.0670 MM/M    -0.0452 MM/M
INDEX COR      0.0000 MM       0.0000 MM
AVG FOR L-9402 PAIR 2   21.5C  2.50X10(-6)/C -0.0561 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 280.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 199.9900 279.9800
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 279.9900

OUTPUT
ROD-SCALE ER.(ROD1)         MM   0.1000   0.1000   0.2000
RES. ROD-SCALE ER.(ROD1)  MM   0.0439  -0.0122   0.0429
ROD-SCALE ER.(ROD2)         MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD2)  MM   0.0439  -0.0122  -0.0571
                               120.0000 220.0000 300.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 300.0000   0.1010   0.0449   0.1000
 220.0000   0.0561   0.0000   0.0551
 120.0000   0.0000  -0.0561  -0.0010
          120.0000 220.0000 300.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 300.0000   0.0010  -0.0551  -0.1000
 220.0000   0.0561   0.0000  -0.0449
 120.0000   0.0000  -0.0561  -0.1010
          120.0000 220.0000 300.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 300.0000   5.0980  -0.5120   0.0000
 220.0000   5.6100   0.0000   0.5120
 120.0000   0.0000  -5.6100  -5.0980
          120.0000 220.0000 300.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
             ROD1              ROD2
NGS CODE     312               312
SERIAL NO     270               275
CAL DATE     19321101          19321101
LABORATORY   NBS               NBS
STD TEMP     23.0C             23.0C
EXP COEF      2.50X10(-6)/C  2.50X10(-6)/C
EXCESS       -0.0670 MM/M    -0.0826 MM/M
INDEX COR     0.0000 MM        0.0000 MM
AVG FOR L-11184 PAIR 2  23.0C  2.50X10(-6)/C -0.0748 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 280.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 199.9900 279.9800
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9800 279.9800

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.1000   0.1000   0.2000
RES. ROD-SCALE ER.(ROD1) MM   0.0252  -0.0496  -0.0094
ROD-SCALE ER.(ROD2)        MM   0.1000   0.2000   0.2000
RES. ROD-SCALE ER.(ROD2) MM   0.0252   0.0504  -0.0094
                            120.0000 220.0000 300.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 300.0000   0.0346  -0.0402   0.0000
 220.0000  -0.0252  -0.1000  -0.0598
 120.0000   0.0000  -0.0748  -0.0346
          120.0000 220.0000 300.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 300.0000   0.0346   0.0598   0.0000
 220.0000   0.0748   0.1000   0.0402
 120.0000   0.0000   0.0252  -0.0346
          120.0000 220.0000 300.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 300.0000   3.4640   0.9840   0.0000
 220.0000   2.4800   0.0000  -0.9840
 120.0000   0.0000  -2.4800  -3.4640
          120.0000 220.0000 300.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO        301               304
CAL DATE      19830712          19830712
LABORATORY    NBS               NBS
STD TEMP      23.0C             23.0C
EXP COEF        1.00X10(-6)/C  1.00X10(-6)/C
EXCESS        -0.0071 MM/M     0.0000 MM/M
INDEX COR     -0.1000 MM      -0.1000 MM
AVG FOR L-12216 PAIR 1  23.0C  1.00X10(-6)/C -0.0035 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 200.0000 300.0000
MEAS. LEN. OF INTER. ROD2 CM 100.0000 200.0000 300.0000

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.1000   0.0000   0.0000
RES. ROD-SCALE ER.(ROD1)  MM   0.0965  -0.0070  -0.0105
ROD-SCALE ER.(ROD2)        MM   0.0000   0.0000   0.0000
RES. ROD-SCALE ER.(ROD2)  MM  -0.0035  -0.0070  -0.0105
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.1070   0.0035   0.0000
 220.0000   0.1035   0.0000  -0.0035
 120.0000   0.1000  -0.0035  -0.0070
          120.0000 220.0000 320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0070   0.0035   0.0000
 220.0000   0.0035   0.0000  -0.0035
 120.0000  -0.1000  -0.1035  -0.1070
          120.0000 220.0000 320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   5.7000   0.3500   0.0000
 220.0000   5.3500   0.0000  -0.3500
 120.0000   0.0000  -5.3500  -5.7000
          120.0000 220.0000 320.0000   BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
               ROD1            ROD2
NGS CODE       312             312
SERIAL NO         313             316
CAL DATE       19330712        19330712
LABORATORY     NBS             NBS
STD TEMP       23.0C           23.0C
EXP COEF        1.00X10(-6)/C   1.00X10(-6)/C
EXCESS         -0.0429 MM/M    -0.0429 MM/M
INDEX COR       0.0000 MM       0.0000 MM
AVG FOR L-9052/4 PAIR 2 23.0C  1.00X10(-6)/C -0.0429 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 199.9900 299.9900
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 299.9900

OUTPUT
ROD-SCALE ER.(ROD1)       MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD1)  MM   0.0571   0.0142  -0.0287
ROD-SCALE ER.(ROD2)       MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD2)  MM   0.0571   0.0142  -0.0287
                             120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.0858   0.0429   0.0000
 220.0000   0.0429   0.0000  -0.0429
 120.0000   0.0000  -0.0429  -0.0858
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0858   0.0429   0.0000
 220.0000   0.0429   0.0000  -0.0429
 120.0000   0.0000  -0.0429  -0.0858
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   8.5800   4.2900   0.0000
 220.0000   4.2900   0.0000  -4.2900
 120.0000   0.0000  -4.2900  -8.5800
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO       323               376
CAL DATE      19520826          19450115
LABORATORY    NBS               NBS
STD TEMP      25.0C             25.0C
EXP COEF       1.00X10(-6)/C  1.00X10(-6)/C
EXCESS        -0.0214 MM/M    -0.0195 MM/M
INDEX COR      0.0000 MM      -0.0178 MM
AVG FOR L-17026 PAIR 2  25.0C  1.00X10(-6)/C -0.0204 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0000 200.0000 299.9900
MEAS. LEN. OF INTER. ROD2 CM  99.9900 200.0000 299.9900

OUTPUT
ROD-SCALE ER.(ROD1)          MM    0.0000    0.0000    0.1000
RES. ROD-SCALE ER.(ROD1)     MM   -0.0204   -0.0408    0.0388
ROD-SCALE ER.(ROD2)          MM    0.1000    0.0000    0.1000
RES. ROD-SCALE ER.(ROD2)     MM    0.0796   -0.0408    0.0388
                                 120.0000  220.0000  320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000  -0.0592  -0.0796   0.0000
 220.0000   0.0204   0.0000   0.0796
 120.0000  -0.1000  -0.1204  -0.0408
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0408  -0.0796   0.0000
 220.0000   0.1204   0.0000   0.0796
 120.0000   0.1000  -0.0204   0.0592
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000  -0.9200  -7.9600   0.0000
 220.0000   7.0400   0.0000   7.9600
 120.0000   0.0000  -7.0400   0.9200
          120.0000 220.0000 320.0000  BS
```

NOTE: THIS PAIR HAD MIXED FORMAT. ROD 376 WAS CONVERTED TO IN-GRAD FORMAT.

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE     312               312
SERIAL NO       336               346
CAL DATE     19510521          19510521
LABORATORY   NBS               NBS
STD TEMP     25.0C             25.0C
EXP COEF       1.00X10(-6)/C  1.00X10(-6)/C
EXCESS         0.0214 MM/M     0.0429 MM/M
INDEX COR      0.0000 MM       0.0000 MM
AVG FOR L-14696 PAIR 1  25.0C  1.00X10(-6)/C  0.0321 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0100 200.0100 300.0000
MEAS. LEN. OF INTER. ROD2 CM 100.0100 200.0100 300.0100

OUTPUT
ROD-SCALE ER.(ROD1)         MM  -0.1000  -0.1000   0.0000
RES. ROD-SCALE ER.(ROD1) MM  -0.0679  -0.0358   0.0963
ROD-SCALE ER.(ROD2)         MM  -0.1000  -0.1000  -0.1000
RES. ROD-SCALE ER.(ROD2) MM  -0.0679  -0.0358  -0.0037
                                120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000  -0.0642  -0.0321   0.1000
 220.0000  -0.0321   0.0000   0.1321
 120.0000   0.0000   0.0321   0.1642
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000  -0.1642  -0.1321  -0.1000
 220.0000  -0.0321   0.0000   0.0321
 120.0000   0.0000   0.0321   0.0642
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000 -11.4200  -8.2100   0.0000
 220.0000  -3.2100   0.0000   8.2100
 120.0000   0.0000   3.2100  11.4200
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO        344               345
CAL DATE      19830811          19830809
LABORATORY    NBS               NBS
STD TEMP      24.0C             27.0C
EXP COEF        1.00X10(-6)/C   1.00X10(-6)/C
EXCESS        -0.0429 MM/M     -0.0429 MM/M
INDEX COR       0.0000 MM        0.0000 MM
AVG FOR L-2396 PAIR 1    25.5C  1.00X10(-6)/C -0.0429 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 199.9900 299.9900
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 299.9900

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD1)  MM   0.0571   0.0142  -0.0287
ROD-SCALE ER.(ROD2)        MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD2)  MM   0.0571   0.0142  -0.0287
                             120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.0858   0.0429   0.0000
 220.0000   0.0429   0.0000  -0.0429
 120.0000   0.0000  -0.0429  -0.0858
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0858   0.0429   0.0000
 220.0000   0.0429   0.0000  -0.0429
 120.0000   0.0000  -0.0429  -0.0858
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   8.5800   4.2900   0.0000
 220.0000   4.2900   0.0000  -4.2900
 120.0000   0.0000  -4.2900  -8.5800
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO       368               387
CAL DATE      19330809          19450115
LABORATORY    NBS               NBS
STD TEMP      27.0C             23.0C
EXP COEF       1.00X10(-6)/C     1.00X10(-6)/C
EXCESS        -0.0214 MM/M      -0.0275 MM/M
INDEX COR      0.0000 MM         0.0204 MM
AVG FOR L-17026 PAIR 3  25.0C  1.00X10(-6)/C -0.0244 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0000 200.0000 299.9900
MEAS. LEN. OF INTER. ROD2 CM 100.0000 200.0000 299.9900

OUTPUT
ROD-SCALE ER.(ROD1)         MM    0.0000    0.0000    0.1000
RES. ROD-SCALE ER.(ROD1) MM  -0.0244   -0.0488    0.0268
ROD-SCALE ER.(ROD2)         MM    0.0000    0.0000    0.1000
RES. ROD-SCALE ER.(ROD2) MM  -0.0244   -0.0488    0.0268
                                 120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000  -0.0512  -0.0756   0.0000
 220.0000   0.0244   0.0000   0.0756
 120.0000   0.0000  -0.0244   0.0512
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000  -0.0512  -0.0756   0.0000
 220.0000   0.0244   0.0000   0.0756
 120.0000   0.0000  -0.0244   0.0512
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000  -5.1200  -7.5600   0.0000
 220.0000   2.4400   0.0000   7.5600
 120.0000   0.0000  -2.4400   5.1200
          120.0000 220.0000 320.0000  BS

NOTE:  THIS PAIR HAS MIXED FORMAT.
       ROD 387 WAS CONVERTED TO IN-GRAD
       FORMAT.
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO        397               398
CAL DATE      19331215          19331215
LABORATORY    NBS               NBS
STD TEMP      25.0C             25.0C
EXP COEF        1.00X10(-6)/C   1.00X10(-6)/C
EXCESS        -0.0286 MM/M     -0.0071 MM/M
INDEX COR     -0.1000 MM       -0.1000 MM
AVG FOR L-10017 PAIR 1  25.0C  1.00X10(-6)/C -0.0178 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 200.0000 299.9900
MEAS. LEN. OF INTER. ROD2 CM  99.9900 200.0000 300.0000

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.1000   0.0000    0.1000
RES. ROD-SCALE ER.(ROD1)  MM   0.0822  -0.0356    0.0466
ROD-SCALE ER.(ROD2)        MM   0.1000   0.0000    0.0000
RES. ROD-SCALE ER.(ROD2)  MM   0.0822  -0.0356   -0.0534
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000    0.1356    0.0178    0.1000
 220.0000    0.1178    0.0000    0.0822
 120.0000    0.0000   -0.1178   -0.0356
           120.0000 220.0000 320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000    0.0356   -0.0822   -0.1000
 220.0000    0.1178    0.0000   -0.0178
 120.0000    0.0000   -0.1178   -0.1356
           120.0000 220.0000 320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000    8.5600   -3.2200    0.0000
 220.0000   11.7800    0.0000    3.2200
 120.0000    0.0000  -11.7800   -8.5600
           120.0000 220.0000 320.0000   BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
             ROD1              ROD2
NGS CODE     312               312
SERIAL NO       408               410
CAL DATE     19831215          19831215
LABORATORY   NBS               NBS
STD TEMP     25.0C             25.0C
EXP COEF      1.00X10(-6)/C    1.00X10(-6)/C
EXCESS       -0.0429 MM/M     -0.0429 MM/M
INDEX COR     0.0000 MM        0.0000 MM
AVG FOR L-9155 PAIR 1   25.0C  1.00X10(-6)/C -0.0429 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 199.9900 299.9900
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 299.9900

OUTPUT
ROD-SCALE ER.(ROD1)         MM    0.1000    0.1000    0.1000
RES. ROD-SCALE ER.(ROD1)    MM    0.0571    0.0142   -0.0287
ROD-SCALE ER.(ROD2)         MM    0.1000    0.1000    0.1000
RES. ROD-SCALE ER.(ROD2)    MM    0.0571    0.0142   -0.0287
                                120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000    0.0858    0.0429    0.0000
 220.0000    0.0429    0.0000   -0.0429
 120.0000    0.0000   -0.0429   -0.0858
          120.0000 220.0000 320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000    0.0858    0.0429    0.0000
 220.0000    0.0429    0.0000   -0.0429
 120.0000    0.0000   -0.0429   -0.0858
          120.0000 220.0000 320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000    8.5800    4.2900    0.0000
 220.0000    4.2900    0.0000   -4.2900
 120.0000    0.0000   -4.2900   -8.5800
          120.0000 220.0000 320.0000   BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
              ROD1              ROD2
NGS CODE      312               312
SERIAL NO        422               438
CAL DATE      19510521          19510521
LABORATORY    NBS               NBS
STD TEMP      25.0C             25.0C
EXP COEF       0.50X10(-6)/C  0.50X10(-6)/C
EXCESS         0.0214 MM/M     0.0000 MM/M
INDEX COR      0.0000 MM       0.0000 MM
AVG FOR L-17026 PAIR 1  25.0C  0.50X10(-6)/C  0.0107 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0000 200.0000 300.0100
MEAS. LEN. OF INTER. ROD2 CM 100.0000 200.0000 300.0000

OUTPUT
ROD-SCALE ER.(ROD1)        MM    0.0000    0.0000   -0.1000
RES. ROD-SCALE ER.(ROD1)   MM    0.0107    0.0214   -0.0679
ROD-SCALE ER.(ROD2)        MM    0.0000    0.0000    0.0000
RES. ROD-SCALE ER.(ROD2)   MM    0.0107    0.0214    0.0321
                               120.0000  220.0000  320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000  -0.0214  -0.0107  -0.1000
 220.0000  -0.0107   0.0000  -0.0893
 120.0000   0.0000   0.0107  -0.0786
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0786   0.0893   0.1000
 220.0000  -0.0107   0.0000   0.0107
 120.0000   0.0000   0.0107   0.0214
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   2.8600   3.9300   0.0000
 220.0000  -1.0700   0.0000  -3.9300
 120.0000   0.0000   1.0700  -2.8600
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
             ROD1              ROD2
NGS CODE     312               312
SERIAL NO       433               436
CAL DATE     19350402          19350402
LABORATORY   NBS               NBS
STD TEMP     22.3C             22.3C
EXP COEF      0.50X10(-6)/C  0.50X10(-6)/C
EXCESS       -0.0429 MM/M    -0.0429 MM/M
INDEX COR     0.0000 MM       0.0000 MM
AVG FOR L-9052/4 PAIR 1 22.3C  0.50X10(-6)/C -0.0429 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 199.9900 299.9900
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 299.9900

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD1) MM   0.0571   0.0142  -0.0287
ROD-SCALE ER.(ROD2)        MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD2) MM   0.0571   0.0142  -0.0287
                              120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.0858   0.0429   0.0000
 220.0000   0.0429   0.0000  -0.0429
 120.0000   0.0000  -0.0429  -0.0858
          120.0000 220.0000 320.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0858   0.0429   0.0000
 220.0000   0.0429   0.0000  -0.0429
 120.0000   0.0000  -0.0429  -0.0858
          120.0000 220.0000 320.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   8.5800   4.2900   0.0000
 220.0000   4.2900   0.0000  -4.2900
 120.0000   0.0000  -4.2900  -8.5800
          120.0000 220.0000 320.0000   BS
```

```
INPUT
CAL. DATA HAS (IN-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE = 20.0 CM
             ROD1              ROD2
NGS CODE     312               312
SERIAL NO      452               456
CAL DATE     19850402          19850402
LABORATORY   NBS               NBS
STD TEMP     22.3C             22.3C
EXP COEF      0.50X10(-6)/C   0.50X10(-6)/C
EXCESS       -0.0429 MM/M     -0.0429 MM/M
INDEX COR     0.0000 MM        0.0000 MM
AVG FOR L-10017 PAIR 2  22.3C  0.50X10(-6)/C -0.0429 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9900 199.9900 299.9900
MEAS. LEN. OF INTER. ROD2 CM  99.9900 199.9900 299.9900

OUTPUT
ROD-SCALE ER.(ROD1)        MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD1) MM   0.0571   0.0142  -0.0287
ROD-SCALE ER.(ROD2)        MM   0.1000   0.1000   0.1000
RES. ROD-SCALE ER.(ROD2) MM   0.0571   0.0142  -0.0287
                             120.0000 220.0000 320.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 320.0000   0.0858   0.0429   0.0000
 220.0000   0.0429   0.0000  -0.0429
 120.0000   0.0000  -0.0429  -0.0858
          120.0000 220.0000 320.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 320.0000   0.0858   0.0429   0.0000
 220.0000   0.0429   0.0000  -0.0429
 120.0000   0.0000  -0.0429  -0.0858
          120.0000 220.0000 320.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 320.0000   8.5800   4.2900   0.0000
 220.0000   4.2900   0.0000  -4.2900
 120.0000   0.0000  -4.2900  -8.5800
          120.0000 220.0000 320.0000  BS
```

```
INPUT
CAL. DATA HAS (O-GRAD) FORMAT
NO OF CAL MEAS = 4
NOMINAL LENGTH OF FOOTPIECE =  0.0 CM
              ROD1              ROD2
NGS CODE      316               316
SERIAL NO      87839            121177
CAL DATE      19660912          19660912
LABORATORY    NBS               NBS
STD TEMP      25.0C             25.0C
EXP COEF       1.43X10(-6)/C  1.56X10(-6)/C
EXCESS        -0.0070 MM/M    -0.0010 MM/M
INDEX COR     -0.0720 MM      -0.0810 MM
AVG FOR L-21396 PAIR 1  25.0C  1.49X10(-6)/C -0.0040 MM/M
NOM. LENGTH OF INTERVALS  CM  20.0000 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  19.9920  99.9940 199.9900 299.9910
MEAS. LEN. OF INTER. ROD2 CM  19.9920  99.9930 199.9890 299.9930

OUTPUT
ROD ER.(ROD1)                MM   0.0800   0.0600   0.1000   0.0900
ROD-SCALE ER.(ROD1)          MM   0.0080  -0.0120   0.0280   0.0180
RES. ROD-SCALE ER.(ROD1)     MM   0.0072  -0.0160   0.0200   0.0060
ROD ER.(ROD2)                MM   0.0800   0.0700   0.1100   0.0700
ROD-SCALE ER.(ROD2)          MM  -0.0010  -0.0110   0.0290  -0.0110
RES. ROD-SCALE ER.(ROD2)     MM  -0.0018  -0.0150   0.0210  -0.0230
                                 20.0000 100.0000 200.0000 300.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 300.0000   0.0302   0.0070   0.0430   0.0290
 200.0000  -0.0138  -0.0370  -0.0010  -0.0150
 100.0000   0.0222  -0.0010   0.0350   0.0210
  20.0000   0.0090  -0.0142   0.0218   0.0078
           20.0000 100.0000 200.0000 300.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 300.0000  -0.0078  -0.0210   0.0150  -0.0290
 200.0000  -0.0218  -0.0350   0.0010  -0.0430
 100.0000   0.0142   0.0010   0.0370  -0.0070
  20.0000  -0.0090  -0.0222   0.0138  -0.0302
           20.0000 100.0000 200.0000 300.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 300.0000   1.1200  -0.7000   2.9000   0.0000
 200.0000  -1.7800  -3.6000   0.0000  -2.9000
 100.0000   1.8200   0.0000   3.6000   0.7000
  20.0000   0.0000  -1.8200   1.7800  -1.1200
           20.0000 100.0000 200.0000 300.0000  BS
```

INPUT
CAL. DATA HAS (0-GRAD) FORMAT
NO OF CAL MEAS = 4
NOMINAL LENGTH OF FOOTPIECE = 0.0 CM

| | ROD1 | ROD2 |
|---|---|---|
| NGS CODE | 316 | 316 |
| SERIAL NO | 87849 | 121178 |
| CAL DATE | 19660912 | 19660912 |
| LABORATORY | NBS | NBS |
| STD TEMP | 25.0C | 25.0C |
| EXP COEF | 0.80X10(-6)/C | 0.80X10(-6)/C |
| EXCESS | -0.0220 MM/M | -0.0130 MM/M |
| INDEX COR | 0.0480 MM | 0.0120 MM |

AVG FOR L-21396 PAIR 2 25.0C 0.80X10(-6)/C -0.0175 MM/M

| | | | | | |
|---|---|---|---|---|---|
| NOM. LENGTH OF INTERVALS | CM | 20.0000 | 100.0000 | 200.0000 | 300.0000 |
| MEAS. LEN. OF INTER. ROD1 | CM | 20.0040 | 100.0040 | 200.0000 | 299.9980 |
| MEAS. LEN. OF INTER. ROD2 | CM | 20.0000 | 100.0020 | 199.9980 | 299.9970 |

OUTPUT

| | | | | | |
|---|---|---|---|---|---|
| ROD ER.(ROD1) | MM | -0.0400 | -0.0400 | 0.0000 | 0.0200 |
| ROD-SCALE ER.(ROD1) | MM | 0.0080 | 0.0080 | 0.0480 | 0.0680 |
| RES. ROD-SCALE ER.(ROD1) | MM | 0.0045 | -0.0095 | 0.0130 | 0.0155 |
| ROD ER.(ROD2) | MM | 0.0000 | -0.0200 | 0.0200 | 0.0300 |
| ROD-SCALE ER.(ROD2) | MM | 0.0120 | -0.0080 | 0.0320 | 0.0420 |
| RES. ROD-SCALE ER.(ROD2) | MM | 0.0085 | -0.0255 | -0.0030 | -0.0105 |
| | | 20.0000 | 100.0000 | 200.0000 | 300.0000 |

RES ROD-SCALE ERROR MM
FS=ROD2

| | | | | | |
|---|---|---|---|---|---|
| 300.0000 | 0.0150 | 0.0010 | 0.0235 | 0.0260 | |
| 200.0000 | 0.0075 | -0.0065 | 0.0160 | 0.0185 | |
| 100.0000 | 0.0300 | 0.0160 | 0.0385 | 0.0410 | |
| 20.0000 | -0.0040 | -0.0180 | 0.0045 | 0.0070 | |
| | 20.0000 | 100.0000 | 200.0000 | 300.0000 | BS=ROD1 |

RES ROD-SCALE ERROR MM
FS=ROD1

| | | | | | |
|---|---|---|---|---|---|
| 300.0000 | -0.0070 | -0.0410 | -0.0185 | -0.0260 | |
| 200.0000 | -0.0045 | -0.0385 | -0.0160 | -0.0235 | |
| 100.0000 | 0.0180 | -0.0160 | 0.0065 | -0.0010 | |
| 20.0000 | 0.0040 | -0.0300 | -0.0075 | -0.0150 | |
| | 20.0000 | 100.0000 | 200.0000 | 300.0000 | BS=ROD2 |

RES ROD-SCALE ERROR (100 SETUPS) MM
FS

| | | | | | |
|---|---|---|---|---|---|
| 300.0000 | 0.4000 | -2.0000 | 0.2500 | 0.0000 | |
| 200.0000 | 0.1500 | -2.2500 | 0.0000 | -0.2500 | |
| 100.0000 | 2.4000 | 0.0000 | 2.2500 | 2.0000 | |
| 20.0000 | 0.0000 | -2.4000 | -0.1500 | -0.4000 | |
| | 20.0000 | 100.0000 | 200.0000 | 300.0000 | BS |

```
INPUT
CAL. DATA HAS (0-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE =  0.0 CM
             ROD1             ROD2
NGS CODE     316              316
SERIAL NO    119358           119362
CAL DATE     19660609         19660609
LABORATORY   NBS              NBS
STD TEMP     25.0C            25.0C
EXP COEF      0.80X10(-6)/C   0.80X10(-6)/C
EXCESS       -0.0250 MM/M    -0.0150 MM/M
INDEX COR    -0.0067 MM       0.0333 MM
AVG FOR L-23140 PAIR 2  25.0C  0.80X10(-6)/C -0.0200 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  99.9970 199.9940 299.9920
MEAS. LEN. OF INTER. ROD2 CM 100.0020 200.0000 299.9990

OUTPUT
ROD ER.(ROD1)               MM   0.0300    0.0600    0.0800
ROD-SCALE ER.(ROD1)         MM   0.0233    0.0533    0.0733
RES. ROD-SCALE ER.(ROD1)    MM   0.0033    0.0133    0.0133
ROD ER.(ROD2)               MM  -0.0200    0.0000    0.0100
ROD-SCALE ER.(ROD2)         MM   0.0133    0.0333    0.0433
RES. ROD-SCALE ER.(ROD2)    MM  -0.0067   -0.0067   -0.0167
                               100.0000  200.0000  300.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 300.0000   0.0200   0.0300   0.0300
 200.0000   0.0100   0.0200   0.0200
 100.0000   0.0100   0.0200   0.0200
          100.0000 200.0000 300.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 300.0000  -0.0200  -0.0200  -0.0300
 200.0000  -0.0200  -0.0200  -0.0300
 100.0000  -0.0100  -0.0100  -0.0200
          100.0000 200.0000 300.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 300.0000   0.0000   0.5000   0.0000
 200.0000  -0.5000   0.0000  -0.5000
 100.0000   0.0000   0.5000  -0.0000
          100.0000 200.0000 300.0000  BS
```

```
INPUT
CAL. DATA HAS (0-GRAD) FORMAT
NO OF CAL MEAS = 4
NOMINAL LENGTH OF FOOTPIECE =  0.0 CM
              ROD1               ROD2
NGS CODE      316                316
SERIAL NO     120898             120899
CAL DATE      19670408           19670408
LABORATORY    NBS                NBS
STD TEMP      25.0C              25.0C
EXP COEF       5.47X10(-6)/C   0.80X10(-6)/C
EXCESS        -0.0120 MM/M      0.0000 MM/M
INDEX COR     -0.0570 MM       -0.0300 MM
AVG FOR L-23453 PAIR 2  25.0C  3.13X10(-6)/C -0.0060 MM/M
NOM. LENGTH OF INTERVALS  CM  20.0000 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  19.9940  99.9940 199.9910 299.9910
MEAS. LEN. OF INTER. ROD2 CM  19.9960  99.9990 199.9960 299.9970

OUTPUT
ROD ER.(ROD1)               MM  0.0600   0.0600   0.0900   0.0900
ROD-SCALE ER.(ROD1)         MM  0.0030   0.0030   0.0330   0.0330
RES. ROD-SCALE ER.(ROD1)    MM  0.0018  -0.0030   0.0210   0.0150
ROD ER.(ROD2)               MM  0.0400   0.0100   0.0400   0.0300
ROD-SCALE ER.(ROD2)         MM  0.0100  -0.0200   0.0100  -0.0000
RES. ROD-SCALE ER.(ROD2)    MM  0.0088  -0.0260  -0.0020  -0.0180
                               20.0000 100.0000 200.0000 300.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 300.0000   0.0198   0.0150   0.0390   0.0330
 200.0000   0.0038  -0.0010   0.0230   0.0170
 100.0000   0.0278   0.0230   0.0470   0.0410
  20.0000  -0.0070  -0.0118   0.0122   0.0062
           20.0000 100.0000 200.0000 300.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 300.0000  -0.0062  -0.0410  -0.0170  -0.0330
 200.0000  -0.0122  -0.0470  -0.0230  -0.0390
 100.0000   0.0118  -0.0230   0.0010  -0.0150
  20.0000   0.0070  -0.0278  -0.0038  -0.0198
           20.0000 100.0000 200.0000 300.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 300.0000   0.6800  -1.3000   1.1000   0.0000
 200.0000  -0.4200  -2.4000   0.0000  -1.1000
 100.0000   1.9800   0.0000   2.4000   1.3000
  20.0000   0.0000  -1.9800   0.4200  -0.6800
           20.0000 100.0000 200.0000 300.0000  BS
```

```
INPUT
CAL. DATA HAS (0-GRAD) FORMAT
NO OF CAL MEAS = 4
NOMINAL LENGTH OF FOOTPIECE =  0.0 CM
             ROD1              ROD2
NGS CODE     316               316
SERIAL NO    124734            124735
CAL DATE     19670408          19670408
LABORATORY   NBS               NBS
STD TEMP     25.0C             25.0C
EXP COEF      0.80X10(-6)/C     0.80X10(-6)/C
EXCESS       -0.0140 MM/M       0.0100 MM/M
INDEX COR    -0.0140 MM         0.0000 MM
AVG FOR L-23514 PAIR 1  25.0C  0.80X10(-6)/C -0.0020 MM/M
NOM. LENGTH OF INTERVALS  CM  20.0000 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM  19.9980  99.9990 199.9940 299.9950
MEAS. LEN. OF INTER. ROD2 CM  20.0010 100.0010 199.9990 300.0050

OUTPUT
ROD ER.(ROD1)                MM   0.0200   0.0100   0.0600   0.0500
ROD-SCALE ER.(ROD1)          MM   0.0060  -0.0040   0.0460   0.0360
RES. ROD-SCALE ER.(ROD1)     MM   0.0056  -0.0060   0.0420   0.0300
ROD ER.(ROD2)                MM  -0.0100  -0.0100   0.0100  -0.0500
ROD-SCALE ER.(ROD2)          MM  -0.0100  -0.0100   0.0100  -0.0500
RES. ROD-SCALE ER.(ROD2)     MM  -0.0104  -0.0120   0.0060  -0.0560
                                 20.0000 100.0000 200.0000 300.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 300.0000   0.0616   0.0500   0.0980   0.0860
 200.0000  -0.0004  -0.0120   0.0360   0.0240
 100.0000   0.0176   0.0060   0.0540   0.0420
  20.0000   0.0160   0.0044   0.0524   0.0404
           20.0000 100.0000 200.0000 300.0000  BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 300.0000  -0.0404  -0.0420  -0.0240  -0.0860
 200.0000  -0.0524  -0.0540  -0.0360  -0.0980
 100.0000  -0.0044  -0.0060   0.0120  -0.0500
  20.0000  -0.0160  -0.0176   0.0004  -0.0616
           20.0000 100.0000 200.0000 300.0000  BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 300.0000   1.0600   0.4000   3.7000   0.0000
 200.0000  -2.6400  -3.3000   0.0000  -3.7000
 100.0000   0.6600   0.0000   3.3000  -0.4000
  20.0000   0.0000  -0.6600   2.6400  -1.0600
           20.0000 100.0000 200.0000 300.0000  BS
```

```
INPUT
CAL. DATA HAS (0-GRAD) FORMAT
NO OF CAL MEAS = 3
NOMINAL LENGTH OF FOOTPIECE =  0.0 CM
             ROD1            ROD2
NGS CODE     316             316
SERIAL NO    141351          141353
CAL DATE     19690515        19690515
LABORATORY   NBS             NBS
STD TEMP     25.0C           25.0C
EXP COEF      1.20X10(-6)/C   1.00X10(-6)/C
EXCESS        0.0175 MM/M     0.0212 MM/M
INDEX COR     0.0583 MM       0.0308 MM
AVG FOR L-23514 PAIR 2  25.0C  1.10X10(-6)/C  0.0193 MM/M
NOM. LENGTH OF INTERVALS  CM 100.0000 200.0000 300.0000
MEAS. LEN. OF INTER. ROD1 CM 100.0060 200.0100 300.0080
MEAS. LEN. OF INTER. ROD2 CM 100.0040 200.0080 300.0080

OUTPUT
ROD ER.(ROD1)               MM  -0.0600  -0.1000  -0.0800
ROD-SCALE ER.(ROD1)         MM  -0.0017  -0.0417  -0.0217
RES. ROD-SCALE ER.(ROD1)    MM   0.0176  -0.0031   0.0362
ROD ER.(ROD2)               MM  -0.0400  -0.0800  -0.0800
ROD-SCALE ER.(ROD2)         MM  -0.0092  -0.0492  -0.0492
RES. ROD-SCALE ER.(ROD2)    MM   0.0101  -0.0106   0.0087
                                100.0000 200.0000 300.0000
RES ROD-SCALE ERROR MM
 FS=ROD2
 300.0000   0.0089  -0.0118   0.0275
 200.0000   0.0282   0.0075   0.0468
 100.0000   0.0075  -0.0132   0.0261
          100.0000 200.0000 300.0000   BS=ROD1
RES ROD-SCALE ERROR MM
 FS=ROD1
 300.0000  -0.0261  -0.0468  -0.0275
 200.0000   0.0132  -0.0075   0.0118
 100.0000  -0.0075  -0.0282  -0.0089
          100.0000 200.0000 300.0000   BS=ROD2
RES ROD-SCALE ERROR (100 SETUPS) MM
 FS
 300.0000  -0.8600  -2.9300   0.0000
 200.0000   2.0700   0.0000   2.9300
 100.0000   0.0000  -2.0700   0.8600
          100.0000 200.0000 300.0000   BS
```

# APPENDIX 2

# PROFILES

KEY TO BENCHMARK TYPE SYMBOLS

filled circle: concrete post or stone post

open circle: metal pipe or metal rod or metal plug, possibly concrete-filled and/or encased in concrete and/or in a street or sidewalk

filled square: building (wall, step, floor, window ledge, entrance)

open square: other structure (bridge, culvert, curb, retaining wall, sidewalk, water tank foundation, misc.)

filled triangle: bedrock

open triangle: boulder

cross bar: unknown (an unknown benchmark type is indicated in the data listings by XXXXXXXX)

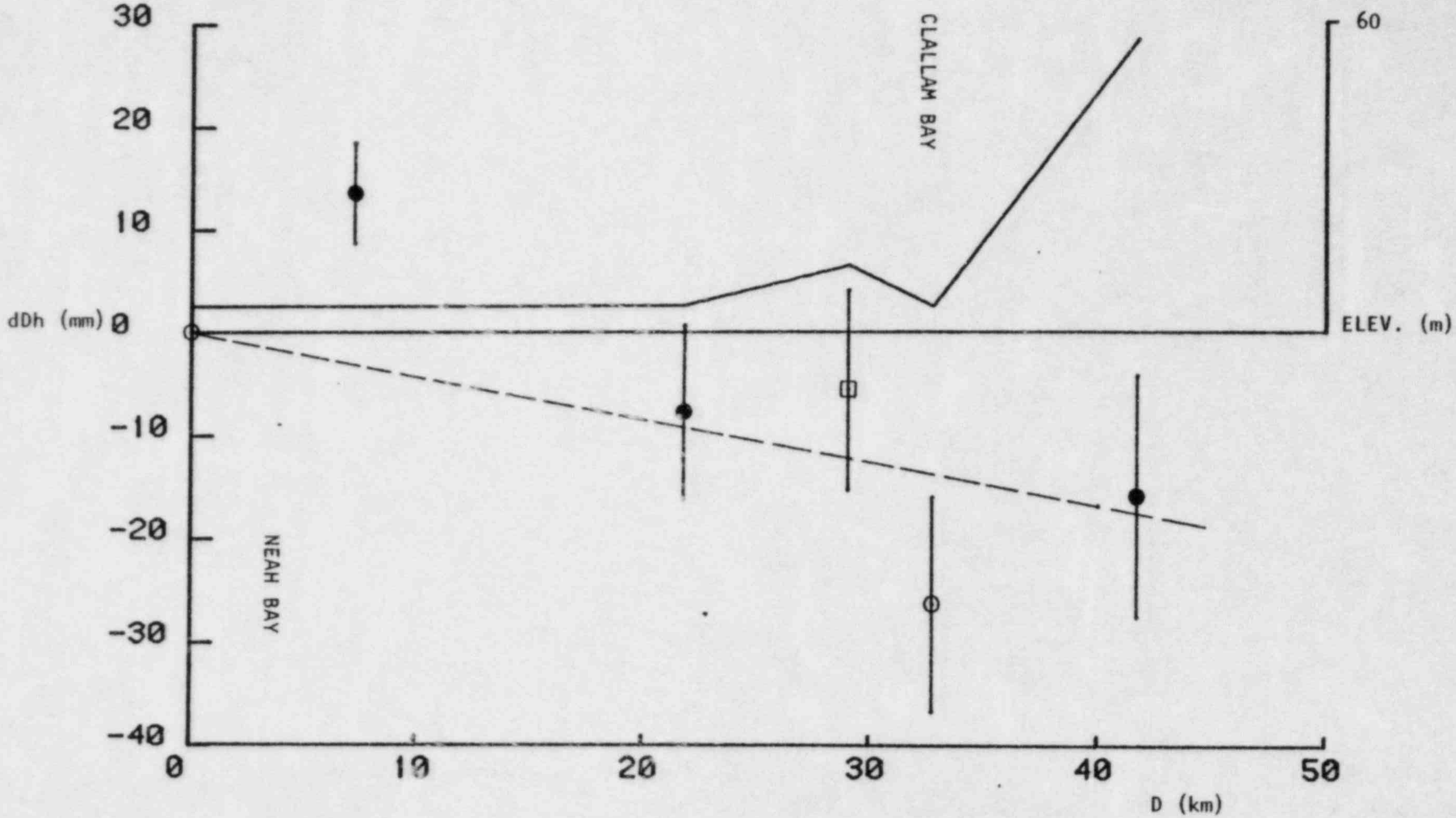
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| NE(1) | P1P2 | 5.02442 | 4.88774 | 0.00000 | 0.00000 | 0.00 |
| A 13 USE | | 4.98036 | 4.83010 | -0.04406 | -0.05764 | 13.58 |
| R 242 | | 5.34828 | 5.21940 | 0.32386 | 0.33166 | -7.80 |
| TIDAL 3 | | 13.22193 | 13.09086 | 8.19751 | 8.20312 | -5.61 |
| PTS(2) | | 4.97745 | 4.86715 | -0.04697 | -0.02059 | -26.38 |
| P 242 | P1P2 | 56.82552 | 56.70472 | 51.80110 | 51.81698 | -15.88 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR07 L-10017 1942 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR01 L-23453 1974 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| NE(1) | 0.00 | 0.00 | 0.00 | 0.00 | MET PIPE | |
| A 13 USE | 13.58 | 4.85 | 7.22 | 7.22 | CON POST | |
| R 242 | -7.80 | 8.42 | 21.78 | 21.78 | CON POST | |
| TIDAL 3 | -5.61 | 9.73 | 29.02 | 29.12 | BUILDING | @ |
| PTS(2) | -26.38 | 10.32 | 32.76 | 32.76 | MET PIPE | |
| F 242 | -15.88 | 11.65 | 41.75 | 41.75 | CON POST | |

SD = 1.803 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR07 L-10017 1942 1ST

NEAH BAY to 5.6 mi SE of CLALLAM BAY 1974 - 1942 -0.421 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -2.48
Pr greater abs T = 0.0683



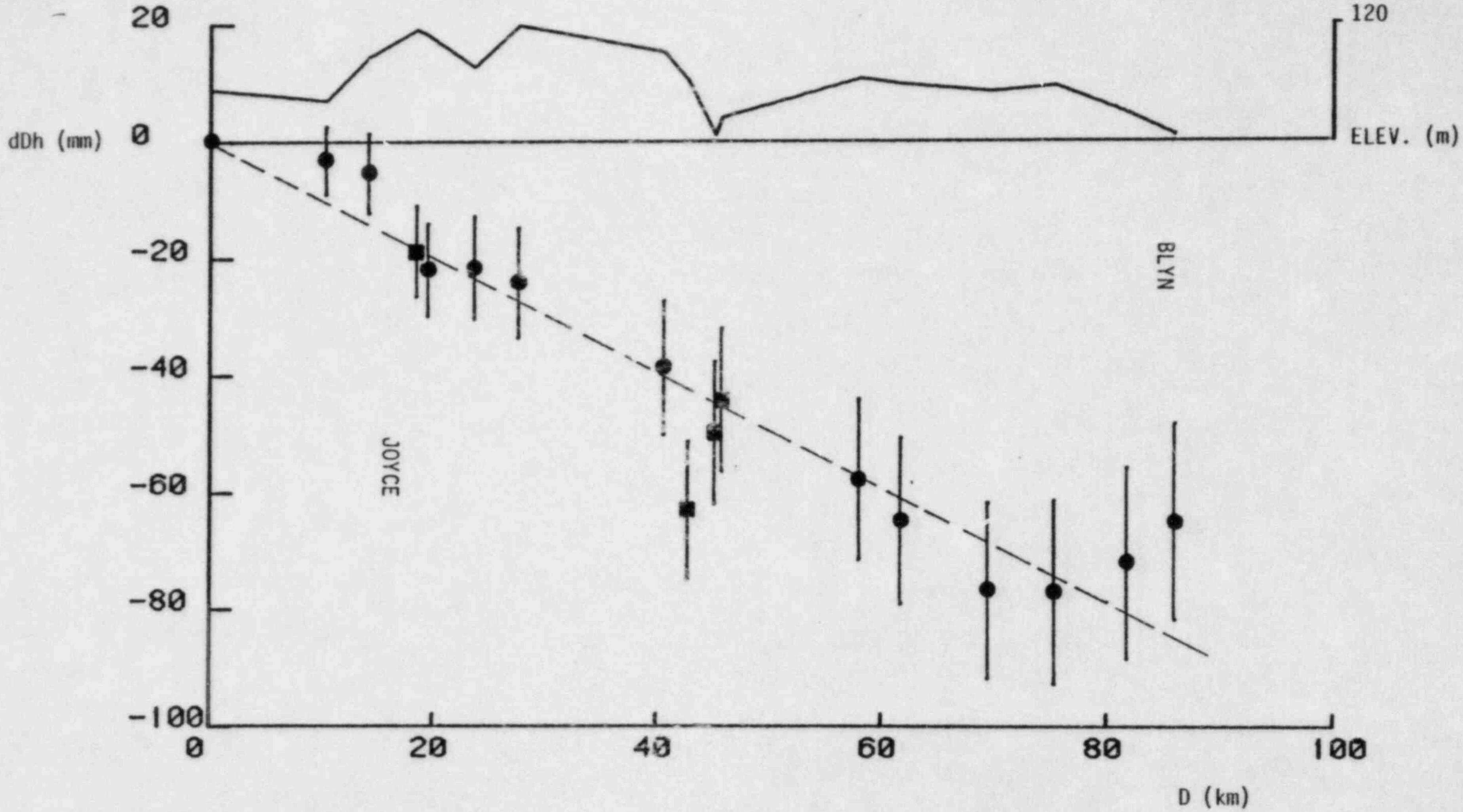
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| U 13 | P1P2 | 53.59360 | 53.54422 | 0.00000 | 0.00000 | 0.00 |
| W 13 | | 42.04816 | 42.00208 | -11.54544 | -11.54214 | -3.30 |
| X 13 | | 86.76380 | 86.71985 | 33.17020 | 33.17563 | -5.43 |
| Y 13 | | 114.29907 | 114.26854 | 60.70547 | 60.72432 | -18.85 |
| Z 13 | | 108.32839 | 108.30103 | 54.73479 | 54.75681 | -22.02 |
| TIDAL 3 | | 1.64458 | 1.61148 | -51.94902 | -51.93274 | -16.28 |
| B 14 | | 76.08996 | 76.06216 | 22.49636 | 22.51794 | -21.58 |
| C 14 | | 117.85309 | 117.82797 | 64.25949 | 64.28375 | -24.26 |
| F 14 | | 91.61697 | 91.60642 | 38.02337 | 38.06220 | -38.83 |
| G 14 | | 62.53813 | 62.55200 | 8.94453 | 9.00778 | -63.25 |
| H 14 | | 5.92795 | 5.92849 | -47.66565 | -47.61573 | -49.92 |
| TIDAL 6 | | 6.12164 | 6.29400 | -47.47196 | -47.25022 | -221.74 |
| TIDAL 8 | | 9.79732 | 9.79564 | -43.79628 | -43.74858 | -47.70 |
| J 14 | | 24.83265 | 24.82754 | -28.76095 | -28.71668 | -44.27 |
| N 14 | | 64.23713 | 64.24567 | 10.64353 | 10.70145 | -57.92 |
| P 14 | | 58.32137 | 58.33695 | 4.72777 | 4.79273 | -64.96 |
| R 14 | | 51.34856 | 51.37605 | -2.24504 | -2.16817 | -76.87 |
| T 14 | P1P2 | 57.26030 | 57.28805 | 3.66670 | 3.74383 | -77.13 |
| J 3 USGS | P2 | 55.77338 | 55.80302 | 2.17978 | 2.25880 | -79.02 |
| V 14 | | 28.60788 | 28.63066 | -24.98572 | -24.91356 | -72.16 |
| W 14 | | 5.86575 | 5.88143 | -47.72785 | -47.66279 | -65.06 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR11 L-293 1931 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR01 L-2345366 1974 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE |
|---|---|---|---|---|---|
| U 13 | 0.00 | 0.00 | 0.00 | 0.00 | CON POST |
| W 13 | -3.30 | 5.80 | 10.36 | 10.36 | CON POST |
| X 13 | -5.43 | 6.80 | 14.21 | 14.21 | CON POST |
| Y 13 | -18.85 | 7.75 | 18.48 | 18.48 | BUILDING |
| Z 13 | -22.02 | 7.96 | 19.50 | 19.50 | CON POST |
| TIDAL 3 | -16.28 | 8.69 | 19.50 | 23.24 | XXXXXXXX# @ |
| B 14 | -21.58 | 8.77 | 23.66 | 23.66 | CON POST |
| C 14 | -24.26 | 9.47 | 27.57 | 27.57 | CON POST |
| F 14 | -38.83 | 11.49 | 40.59 | 40.59 | CON POST |
| G 14 | -63.25 | 11.79 | 42.78 | 42.78 | BUILDING |
| H 14 | -49.92 | 12.12 | 45.16 | 45.16 | BUILDING |
| TIDAL 6 | -221.74 | 12.12 | 45.21 | 45.21 | BUILDING#? |
| TIDAL 8 | -47.70 | 12.14 | 45.34 | 45.34 | XXXXXXXX# |
| J 14 | -44.27 | 12.19 | 45.72 | 45.72 | BUILDING |
| N 14 | -57.92 | 13.73 | 58.02 | 58.02 | CON POST |
| P 14 | -64.96 | 14.17 | 61.79 | 61.79 | CON POST |
| R 14 | -76.87 | 15.02 | 69.43 | 69.43 | CON POST |
| T 14 | -77.13 | 15.70 | 75.32 | 75.80 | CON POST @ |
| J 3 USGS | -79.02 | 15.72 | 75.32 | 75.99 | BUILDING# @ |
| V 14 | -72.16 | 16.31 | 81.83 | 81.83 | CON POST |
| W 14 | -65.06 | 16.73 | 86.06 | 86.06 | CON POST |

SD = 1.803 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR11 L-293 1931 1ST

11.4 mi W of JOYCE to BLYN 1974 - 1931 -0.985 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -26.74
Pr greater abs T = 0.0001



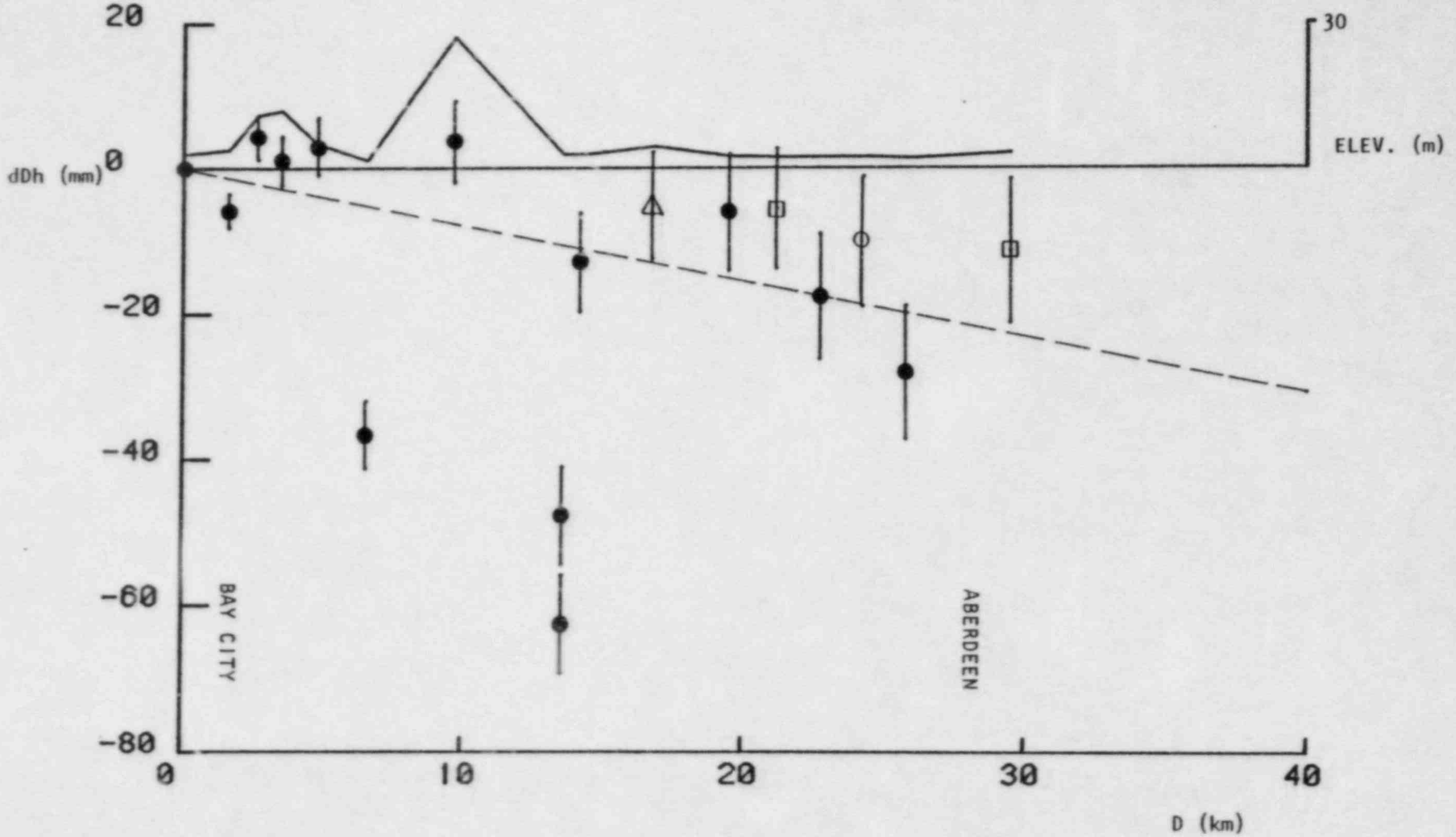
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| E 295 | | 2.78400 | 2.77844 | 0.00000 | 0.00000 | 0.00 |
| GRM2 | | 4.22512 | 4.22591 | 1.44112 | 1.44747 | -6.35 |
| GUNVILLE | | 3.82610 | 3.82655 | 1.04210 | 1.04811 | -6.01 |
| GRM1 | | 3.44514 | 3.44017 | 0.66114 | 0.66173 | -0.59 |
| KRM2 | | 11.25584 | 11.24685 | 8.47184 | 8.46841 | 3.43 |
| KRM1 | | 11.25720 | 11.24801 | 8.47320 | 8.46957 | 3.63 |
| KITE | | 10.90995 | 10.90020 | 8.12595 | 8.12176 | 4.19 |
| D 295 | P1P2 | 11.88948 | 11.88303 | 9.10548 | 9.10459 | 0.89 |
| C 295 | | 4.87544 | 4.86697 | 2.09144 | 2.08853 | 2.91 |
| B 295 | | 1.48525 | 1.51647 | -1.29875 | -1.26197 | -36.78 |
| Y 285 | | 27.11121 | 27.10215 | 24.32721 | 24.32371 | 3.50 |
| S2RM2 | | 2.88791 | 2.93027 | 0.10391 | 0.15183 | -47.92 |
| S2RM1 | | 2.55842 | 2.61555 | -0.22558 | -0.16289 | -62.69 |
| X 285 | | 2.94851 | 2.95597 | 0.16451 | 0.17753 | -13.02 |
| WALTZ | | 3.89800 | 4.17635 | 1.11400 | 1.39791 | -283.91 |
| T 285 | | 4.39610 | 4.39578 | 1.61210 | 1.61734 | -5.24 |
| S 285 | | 2.19708 | 2.19769 | -0.58692 | -0.58075 | -6.17 |
| Q 12 | P1P2 | 2.10050 | 2.10060 | -0.68350 | -0.67784 | -5.66 |
| R 285 | | 2.19251 | 2.20469 | -0.59149 | -0.57375 | -17.74 |
| NEWS | | 2.16656 | 2.17117 | -0.61744 | -0.60727 | -10.17 |
| NRM1 | | 2.27941 | 2.28316 | -0.50459 | -0.49528 | -9.31 |
| NRM2 | | 2.16692 | 2.17201 | -0.61708 | -0.60643 | -10.65 |
| Q 285 | | 1.86955 | 1.89218 | -0.91445 | -0.88626 | -28.19 |
| N 285 | | 2.30110 | 2.55442 | -0.48290 | -0.22402 | -258.88 |
| E 285 | P1 | 3.11516 | 3.12104 | 0.33116 | 0.34260 | -11.44 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR12 L-12216 1947 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR07 L-21396 1968 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE |
|---|---|---|---|---|---|
| E 295 | 0.00 | 0.00 | 0.00 | 0.00 | CON POST |
| GRM2(1) | -6.35 | 2.30 | 1.63 | 1.63 | CON POST# |
| GUNVILLE | -6.01 | 2.31 | 1.64 | 1.64 | CON POST |
| GRM1(2) | -0.59 | 2.32 | 1.66 | 1.66 | CON POST# |
| KRM2(3) | 3.43 | 3.04 | 2.67 | 2.85 | CON POST# @ |
| KRM1(4) | 3.63 | 3.05 | 2.67 | 2.86 | CON POST# @ |
| KITE | 4.19 | 3.06 | 2.67 | 2.89 | CON POST @ |
| D 295 | 0.89 | 3.39 | 3.53 | 3.53 | CON POST |
| C 295 | 2.91 | 3.95 | 4.81 | 4.81 | CON POST |
| B 295 | -36.78 | 4.62 | 6.56 | 6.56 | CON POST |
| Y 285 | 3.50 | 5.61 | 9.68 | 9.68 | CON POST |
| S2RM2(5) | -47.92 | 6.65 | 13.59 | 13.61 | CON POST @ |
| S2RM1(6) | -62.69 | 6.66 | 13.59 | 13.64 | CON POST @ |
| X 285 | -13.02 | 6.79 | 14.19 | 14.19 | CON POST |
| WALTZ | -283.91 | 7.28 | 16.29 | 16.29 | BOULDER #? |
| T 285 | -5.24 | 7.38 | 16.75 | 16.75 | BOULDER |
| S 285 | -6.17 | 7.96 | 19.49 | 19.49 | CON POST |
| Q 12 | -5.66 | 8.30 | 21.18 | 21.18 | OTHER ST |
| R 285 | -17.74 | 8.60 | 22.74 | 22.74 | CON POST |
| NEWS | -10.17 | 8.93 | 24.28 | 24.52 | MET PIPE @ |
| NRM1(7) | -9.31 | 8.94 | 24.28 | 24.56 | MET PIPE# @ |
| NRM2(8) | -10.65 | 8.93 | 24.28 | 24.55 | MET PIPE# @ |
| Q 285 | -28.19 | 9.16 | 25.83 | 25.83 | CON POST |
| N 285 | -258.88 | 9.51 | 27.83 | 27.83 | CON POST#? |
| E 285 | -11.44 | 9.89 | 29.52 | 30.08 | OTHER ST @ |

SD = 1.803 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR12 L-12216 1947 1ST

1.5 mi W of BAY CITY to 0.3 mi NE of ABERDEEN 1968-1947 -0.771 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -3.40
Pr greater abs T = 0.0027



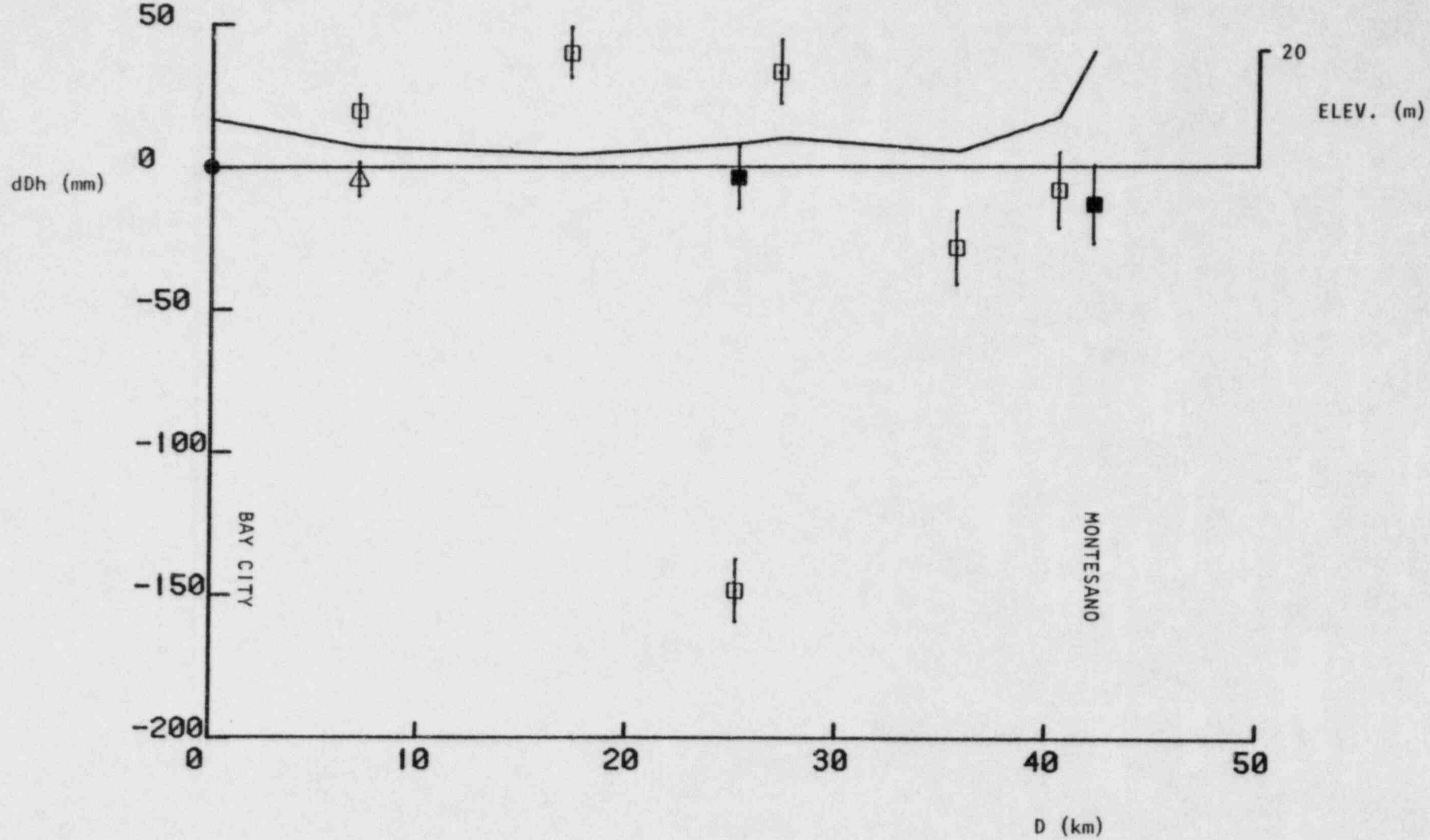
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| U 12 | P1P2 | 8.37771 | 8.63317 | 0.00000 | 0.00000 | 0.00 |
| S 12 | | 3.46227 | 3.69785 | -4.91544 | -4.93532 | 19.88 |
| M 12 | | 2.87101 | 3.13125 | -5.50670 | -5.50192 | -4.78 |
| Q 12 | P1P2 | 2.10060 | 2.31605 | -6.27711 | -6.31712 | 40.01 |
| L 12 | P1P2 | 3.72400 | 4.12823 | -4.65371 | -4.50494 | -148.77 |
| K 12 | | 4.02494 | 4.28441 | -4.35277 | -4.34876 | -4.01 |
| J 12 | | 3.22763 | 3.48843 | -5.15008 | -5.14474 | -5.34 |
| I 12 | | 4.90060 | 5.12285 | -3.47711 | -3.51032 | 33.21 |
| G 12 | P1P2 | 2.59223 | 2.87656 | -5.78548 | -5.75661 | -28.87 |
| F 12 | | 8.80797 | 9.07206 | 0.43026 | 0.43889 | -8.63 |
| D 12 | P1P2 | 20.02085 | 20.28990 | 11.64314 | 11.65673 | -13.59 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR18 74223 1920 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR12 L-12216 1947 1ST
Note: 74223 was not corrected for level collimation error.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| U 12 | 0.00 | 0.00 | 0.00 | 0.00 | CON POST | |
| S 12 | 19.88 | 5.64 | 7.07 | 7.07 | OTHER ST | |
| M 12 | -4.78 | 5.89 | 7.07 | 7.71 | BOULDER | @ |
| Q 12 | 40.01 | 8.79 | 17.18 | 17.18 | OTHER ST | |
| L 12 | -148.77 | 10.65 | 25.22 | 25.22 | OTHER ST ? | |
| K 12 | -4.01 | 10.79 | 25.22 | 25.87 | BUILDING | @ |
| J 12 | -5.34 | 10.80 | 25.22 | 25.93 | BUILDING# | @ |
| I 12 | 33.21 | 11.07 | 27.25 | 27.25 | OTHER ST | |
| G 12 | -28.87 | 12.67 | 35.70 | 35.70 | OTHER ST | |
| F 12 | -8.63 | 13.51 | 40.56 | 40.56 | OTHER ST | |
| D 12 | -13.59 | 13.88 | 42.20 | 42.81 | BUILDING | @ |

SD = 2.121 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR18 74223 1920 1ST

BAY CITY to MONTESANO 1947-1920 -0.069 mm/km (regression line not shown)
refraction-corrected
length of bars = ± 1 standard deviation
T = -0.25
Pr greater abs T = 0.8064



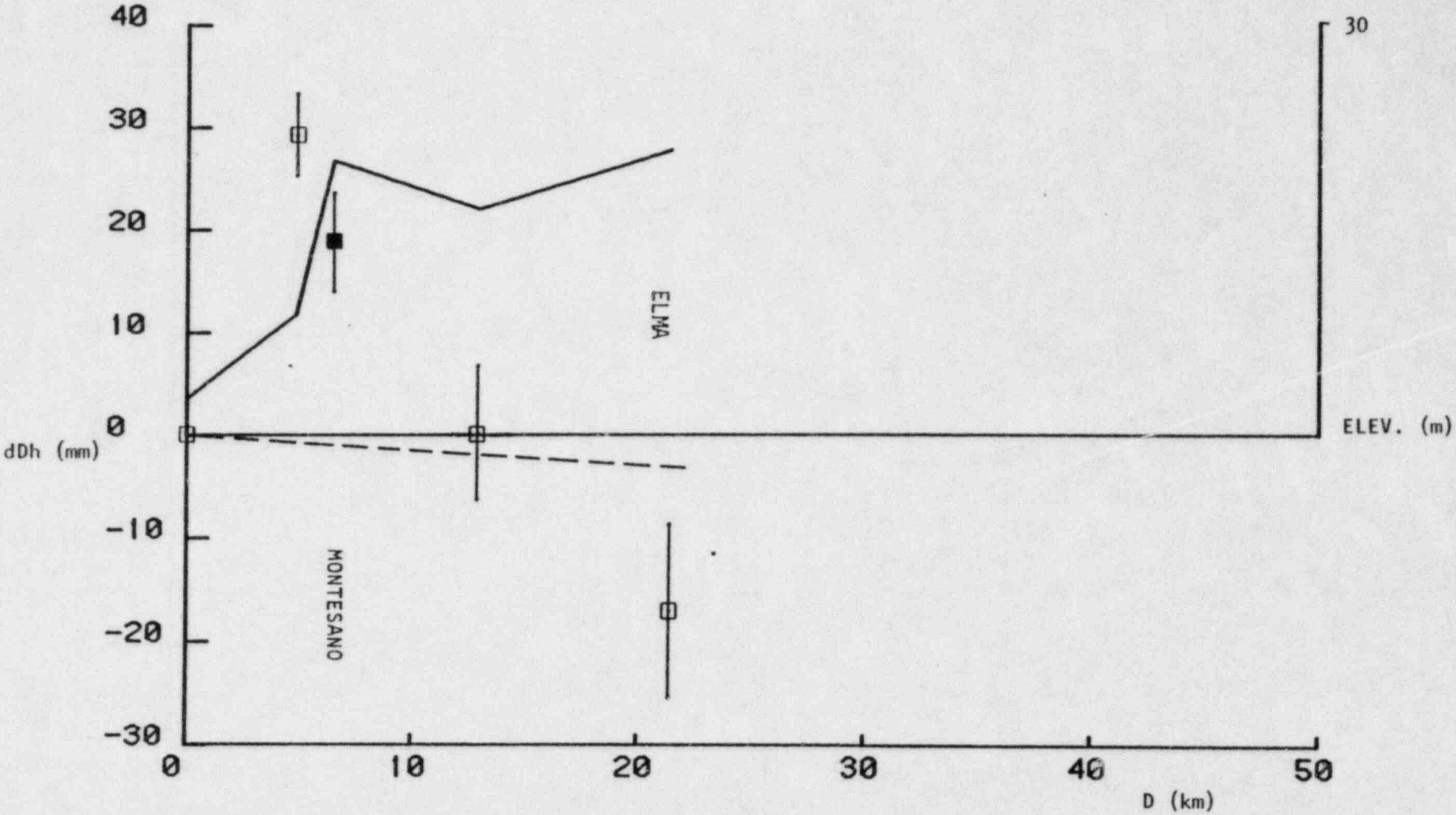
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| G 12 | P1P2 | 2.65749 | 2.87656 | 0.00000 | 0.00000 | 0.00 |
| F 12 | P1P2 | 8.88228 | 9.07206 | 6.22479 | 6.19550 | 29.29 |
| D 12 | P1P2 | 20.08961 | 20.28990 | 17.43212 | 17.41334 | 18.78 |
| C 12 | | 16.52407 | 16.74295 | 13.86658 | 13.86639 | 0.19 |
| B 12 | P1P2 | 20.80275 | 21.03893 | 18.14526 | 18.16237 | -17.11 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR18 74223 1920 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR03 L-23514 1974 1ST
Note: 74223 was not corrected for level collimation error.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| G 12 | 0.00 | 0.00 | 0.00 | 0.00 | OTHER ST | |
| F 12 | 29.29 | 3.97 | 4.86 | 4.86 | OTHER ST | |
| D 12 | 18.78 | 4.81 | 6.50 | 7.11 | BUILDING | @ |
| C 12 | 0.19 | 6.47 | 12.89 | 12.89 | OTHER ST | |
| B 12 | -17.11 | 8.34 | 21.39 | 21.39 | OTHER ST | |

SD = 1.803 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR18 74223 1920 1ST

4.3 mi W of MONTESANO to ELMA 1974 - 1920 -0.144 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -0.17
Pr greater abs T = 0.8763



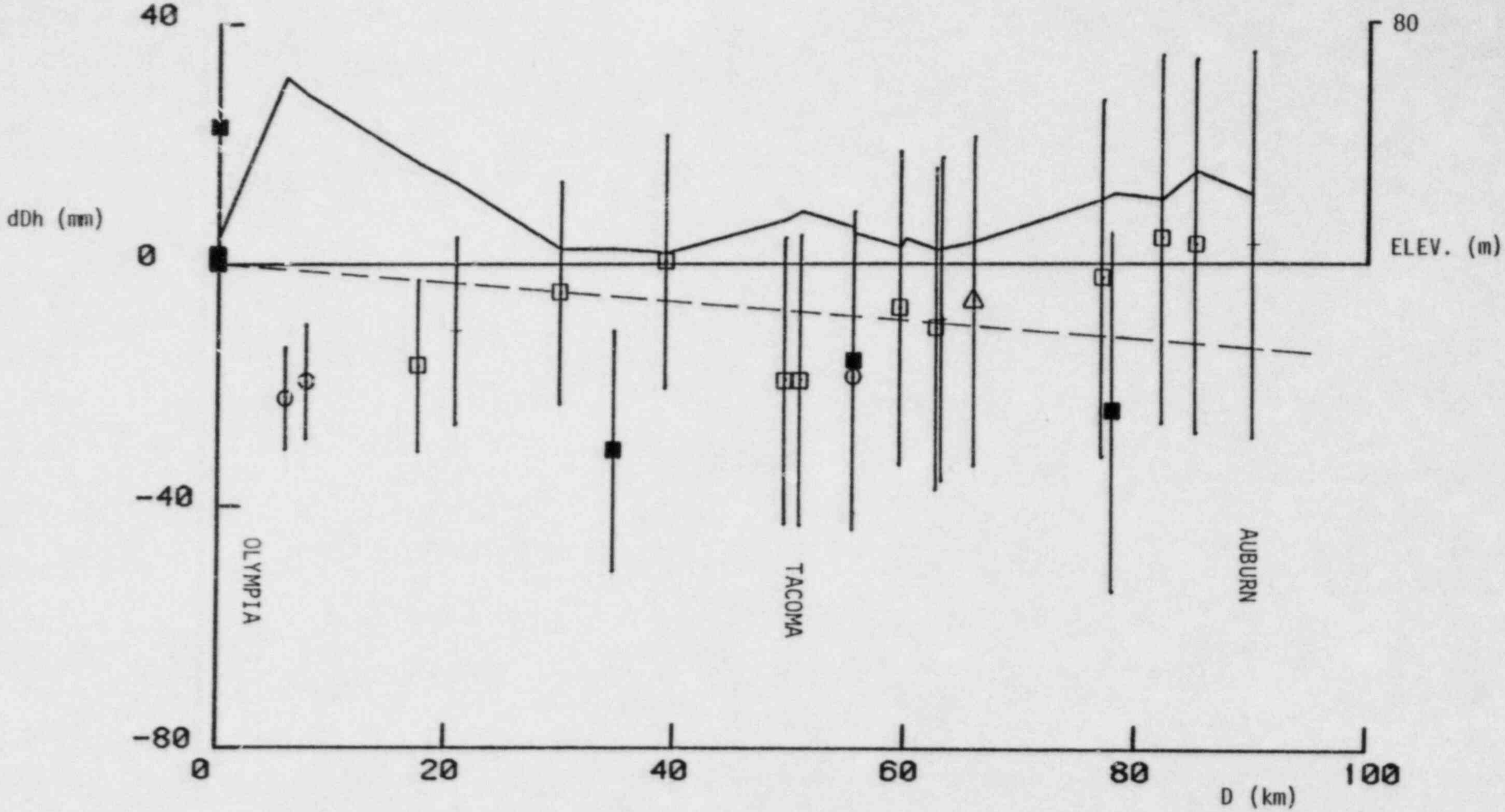
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| M 10 | P1P2 | 8.55166 | 8.54612 | 0.00000 | 0.00000 | 0.00 |
| TIDAL 7 | | 8.33663 | 8.32961 | -0.21503 | -0.21651 | 1.48 |
| TIDAL 6 | | 8.33933 | 8.31095 | -0.21233 | -0.23517 | 22.84 |
| TIDAL 5 | | 7.71559 | 7.70872 | -0.83607 | -0.83740 | 1.33 |
| N 10 | | 62.11415 | 62.13093 | 53.56249 | 53.58481 | -22.32 |
| O 10 | | 56.57289 | 56.58688 | 48.02123 | 48.04076 | -19.53 |
| Q 10 | | 33.27808 | 33.28942 | 24.72642 | 24.74330 | -16.88 |
| R 10 | | 26.62943 | 26.63497 | 18.07777 | 18.08885 | -11.08 |
| S 10 | | 4.84007 | 4.83939 | -3.71159 | -3.70673 | -4.86 |
| TIDAL 1 | | 4.87855 | 4.90394 | -3.67311 | -3.64218 | -30.93 |
| TIDAL 4 | | 5.57996 | 5.60583 | -2.97170 | -2.94029 | -31.41 |
| T 10 | | 3.60521 | 3.59928 | -4.94645 | -4.94684 | 0.39 |
| W 10 | | 14.70271 | 14.71654 | 6.15105 | 6.17042 | -19.37 |
| X 10 | P1P2 | 17.37419 | 17.38791 | 8.82253 | 8.84179 | -19.26 |
| Z 10 | | 11.94569 | 11.95898 | 3.39403 | 3.41286 | -18.83 |
| Y 10 | | 10.04156 | 10.05233 | 1.48990 | 1.50621 | -16.31 |
| G 11 | | 5.62401 | 5.62576 | -2.92765 | -2.92036 | -7.29 |
| F 11 | | 8.28836 | 8.29031 | -0.26330 | -0.25581 | -7.49 |
| H 11 | | 4.59574 | 4.60098 | -3.95592 | -3.94514 | -10.78 |
| I 11 | | 5.10847 | 5.11203 | -3.44319 | -3.43409 | -9.10 |
| J 11 | | 7.17591 | 7.17649 | -1.37575 | -1.36963 | -6.12 |
| P 11 | | 9.86531 | 9.71883 | 1.31365 | 1.17271 | 140.94 |
| L 11 | | 21.51245 | 21.50927 | 12.96079 | 12.96315 | -2.36 |
| M 11 | | 23.19399 | 23.21282 | 14.64233 | 14.66670 | -24.37 |
| N 11 | | 21.23254 | 21.22279 | 12.68088 | 12.67667 | 4.21 |
| O 11 | P1P2 | 30.78865 | 30.78001 | 22.23699 | 22.23389 | 3.10 |
| M | | 22.84060 | 22.83176 | 14.28894 | 14.28564 | 3.30 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR14 74216/C 1920 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR15 L-13 1928 2ND
Note: 74216/C is not corrected for level collimation error.
L-13 is only about 50% double-run.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| M 10 | 0.00 | 0.00 | 0.00 | 0.00 | BUILDING | @ |
| TIDAL 7 | 1.48 | 0.00 | 0.00 | 0.00 | BUILDING | @ |
| TIDAL 6 | 22.84 | 0.00 | 0.00 | 0.00 | BUILDING | @ |
| TIDAL 5 | 1.33 | 1.50 | 0.00 | 0.20 | OTHER ST# | @ |
| N 10 | -22.32 | 8.36 | 5.90 | 6.21 | MET PIPE | |
| O 10 | -19.53 | 9.49 | 7.70 | 8.01 | MET PIPE | |
| Q 10 | -16.88 | 14.16 | 17.52 | 17.83 | OTHER ST | |
| R 10 | -11.08 | 15.41 | 20.80 | 21.11 | XXXXXXXX | |
| S 10 | -4.86 | 18.44 | 29.92 | 30.23 | OTHER ST | |
| TIDAL 1 | -30.93 | 19.81 | 34.59 | 34.90 | BUILDING | @ |
| TIDAL 4 | -31.41 | 19.81 | 34.59 | 34.90 | BUILDING# | @ |
| T 10 | 0.39 | 21.04 | 39.06 | 39.37 | OTHER ST | |
| W 10 | -19.37 | 23.68 | 49.53 | 49.84 | OTHER ST | |
| X 10 | -19.26 | 23.99 | 50.87 | 51.18 | OTHER ST | |
| Z 10 | -18.83 | 25.05 | 55.46 | 55.77 | MET PIPE | |
| Y 10 | -16.31 | 25.06 | 55.51 | 55.82 | BUILDING | |
| G 11 | -7.29 | 25.94 | 59.50 | 59.81 | OTHER ST | |
| F 11 | -7.49 | 26.04 | 59.96 | 60.27 | BUILDING | |
| H 11 | -10.78 | 26.61 | 62.64 | 62.95 | OTHER ST | |
| I 11 | -9.10 | 26.73 | 63.21 | 63.52 | XXXXXXXX | |
| J 11 | -6.12 | 27.31 | 65.98 | 66.29 | BOULDER | |
| P 11 | 140.94 | 28.04 | 69.56 | 69.87 | XXXXXXXX#? | |
| L 11 | -2.36 | 29.51 | 77.10 | 77.41 | OTHER ST | |
| M 11 | -24.37 | 29.68 | 77.99 | 78.30 | BUILDING | |
| N 11 | 4.21 | 30.47 | 82.24 | 82.55 | OTHER ST | |
| O 11 | 3.10 | 31.01 | 85.16 | 85.47 | OTHER ST | |
| M | 3.30 | 31.89 | 90.08 | 90.39 | XXXXXXXX | |

SD = 3.354 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR14 74216/C 1920 1ST

OLYMPIA to AUBURN 1928 - 1920 -0.152 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -2.94
Pr greater abs T = 0.0071



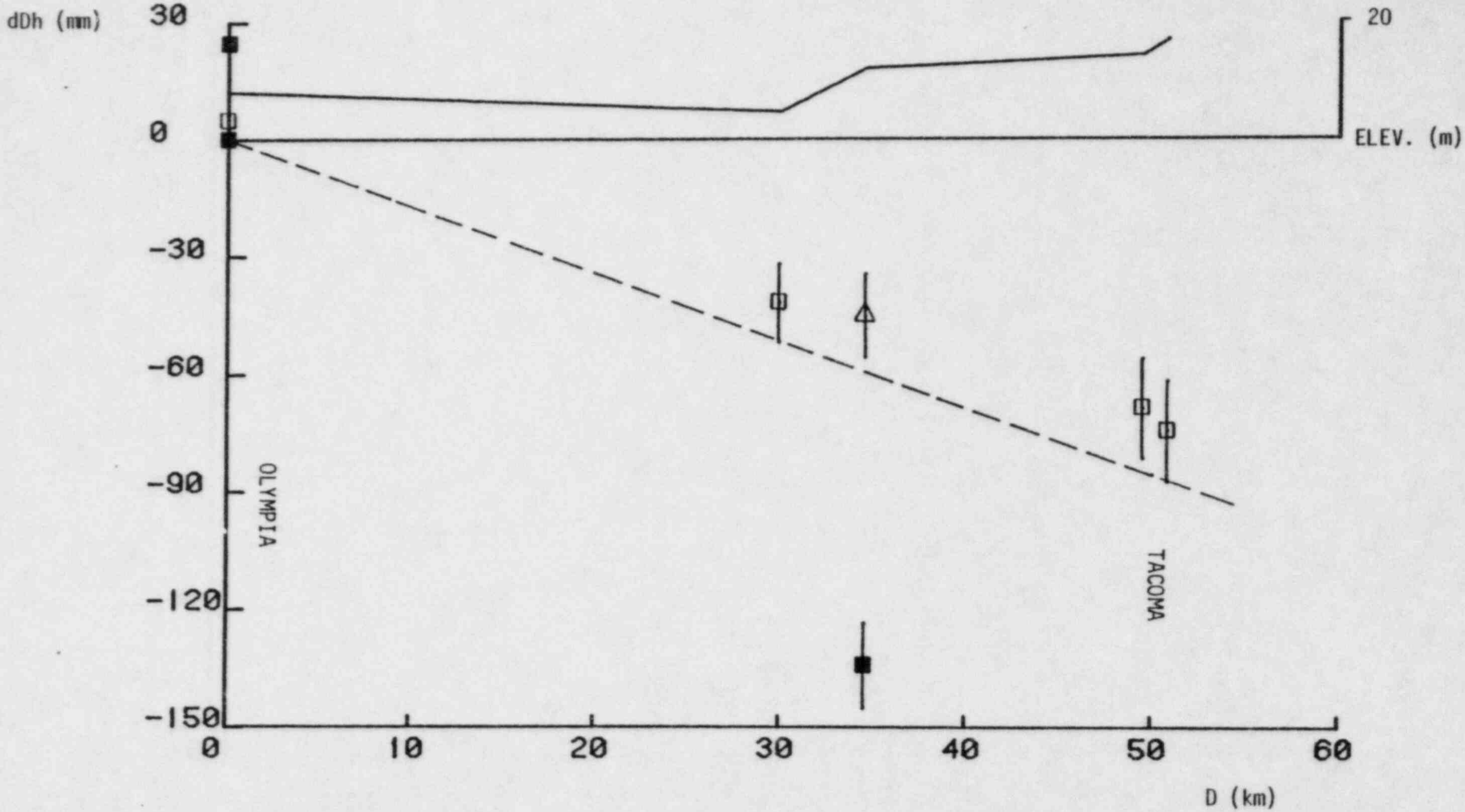
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| M 10 | P1P2 | 8.30113 | 8.54612 | 0.00000 | 0.00000 | 0.00 |
| TIDAL 6 | | 8.09073 | 8.31095 | -0.21040 | -0.23517 | 24.77 |
| TIDAL 5 | | 7.46874 | 7.70872 | -0.83239 | -0.83740 | 5.01 |
| S 10 | | 4.55236 | 4.83939 | -3.74877 | -3.70673 | -42.04 |
| TIDAL 1 | | 4.52443 | 4.90394 | -3.77670 | -3.64218 | -134.52 |
| TIDAL 2 | | 19.80276 | 20.09304 | 11.50163 | 11.54692 | -45.29 |
| TIDAL 3 | | 15.48682 | 15.77927 | 7.18569 | 7.23315 | -47.46 |
| W 10 | | 14.40268 | 14.71654 | 6.10155 | 6.17042 | -68.87 |
| X 10 | P1P2 | 17.06830 | 17.38791 | 8.76717 | 8.84179 | -74.62 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR14 74216/C 1920 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR19 L-23140 1973 1ST
Note: 74216/C is not corrected for level collimation error.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| M 10 | 0.00 | 0.00 | 0.00 | 0.00 | BUILDING | @ |
| TIDAL 6 | 24.77 | 0.00 | 0.00 | 0.00 | BUILDING | @ |
| TIDAL 5 | 5.01 | 0.81 | 0.00 | 0.20 | OTHER ST | @ |
| S 10 | -42.04 | 9.91 | 29.92 | 30.23 | OTHER ST | |
| TIDAL 1 | -134.52 | 10.65 | 34.59 | 34.90 | BUILDING | @ |
| TIDAL 2 | -45.29 | 10.65 | 34.59 | 34.90 | BOULDER | @ |
| TIDAL 3 | -47.46 | 10.65 | 34.59 | 34.90 | CON POST# | @ |
| W 10 | -68.87 | 12.73 | 49.53 | 49.84 | OTHER ST | |
| X 10 | -74.62 | 12.90 | 50.87 | 51.18 | OTHER ST | |

SD = 1.803 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR14 74216/C 1920 1ST

OLYMPIA to TACOMA 1973 - 1920 -1.714 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -5.24
Pr greater abs T = 0.0012



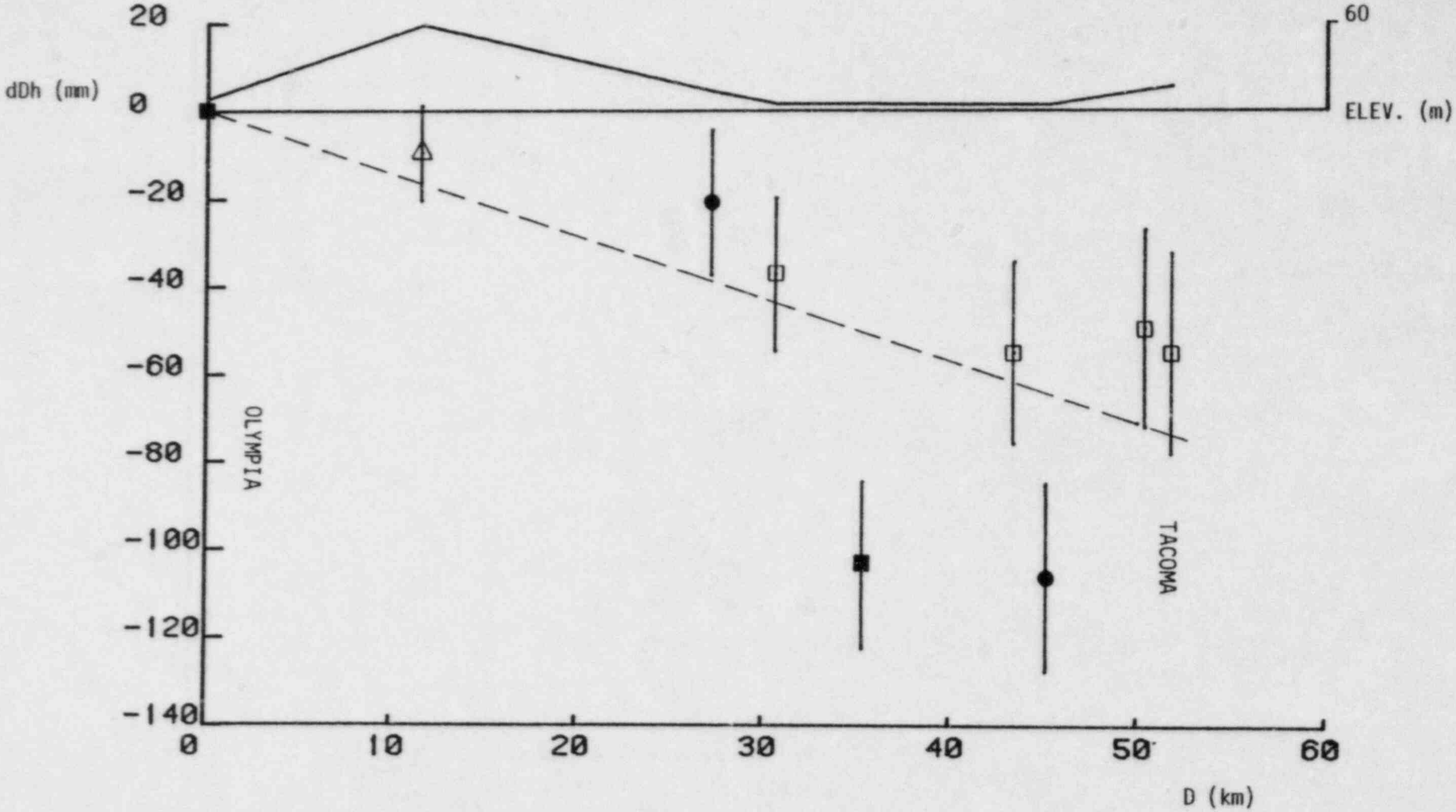
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| M 10 | P1P2 | 8.30113 | 8.55166 | 0.00000 | 0.00000 | 0.00 |
| TIDAL 6 | | 8.09073 | 8.33933 | -0.21040 | -0.21233 | 1.93 |
| TIDAL 5 | | 7.46874 | 7.71559 | -0.83239 | -0.83607 | 3.68 |
| Q 13 | | 58.98427 | 59.24441 | 50.68314 | 50.69275 | -9.61 |
| DUP BM 1 | | 13.59500 | 13.86643 | 5.29387 | 5.31477 | -20.90 |
| DUP | | 13.73868 | 14.01396 | 5.43755 | 5.46230 | -24.75 |
| DUP BM 2 | | 13.91779 | 14.19498 | 5.61666 | 5.64332 | -26.66 |
| S 10 | | 4.55236 | 4.84007 | -3.74877 | -3.71159 | -37.18 |
| TIDAL 1 | | 4.52443 | 4.87855 | -3.77670 | -3.67311 | -103.59 |
| N 13 | | 4.10923 | 4.41489 | -4.19190 | -4.13677 | -55.13 |
| O 13 | | 4.19963 | 4.55653 | -4.10150 | -3.99513 | -106.37 |
| W 10 | | 14.40268 | 14.70271 | 6.10155 | 6.15105 | -49.50 |
| X 10 | P1P2 | 17.06830 | 17.37419 | 8.76717 | 8.82253 | -55.36 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR15 L-13 1928 2ND
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR19 L-23140 1973 1ST
Note: L-13 is only about 50% double-run.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| M 10 | 0.00 | 0.00 | 0.00 | 0.00 | BUILDING | @ |
| TIDAL 6 | 1.93 | 0.94 | 0.00 | 0.09 | BUILDING# | @ |
| TIDAL 5 | 3.68 | 1.21 | 0.00 | 0.15 | OTHER ST# | @ |
| Q 13 | -9.61 | 10.78 | 11.61 | 11.61 | BOULDER | |
| DUP BM 1 | -20.90 | 16.49 | 27.20 | 27.20 | CON POST | |
| DUP | -24.75 | 16.50 | 27.20 | 27.22 | CON POST# | @ |
| DUP BM 2 | -26.66 | 16.51 | 27.20 | 27.25 | CON POST# | @ |
| S 10 | -37.18 | 17.50 | 30.64 | 30.64 | OTHER ST | |
| TIDAL 1 | -103.59 | 18.81 | 35.38 | 35.38 | BUILDING | |
| N 13 | -55.13 | 20.85 | 43.46 | 43.46 | OTHER ST | |
| O 13 | -106.37 | 21.29 | 45.14 | 45.35 | CON POST | @ |
| W 10 | -49.50 | 22.45 | 50.42 | 50.42 | OTHER ST | |
| X 10 | -55.36 | 22.76 | 51.82 | 51.82 | OTHER ST | |

SD = 3.162 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR15 L-13 1928 2ND

OLYMPIA to TACOMA 1973 - 1928 -1.419 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -6.97
Pr greater abs T = 0.0001



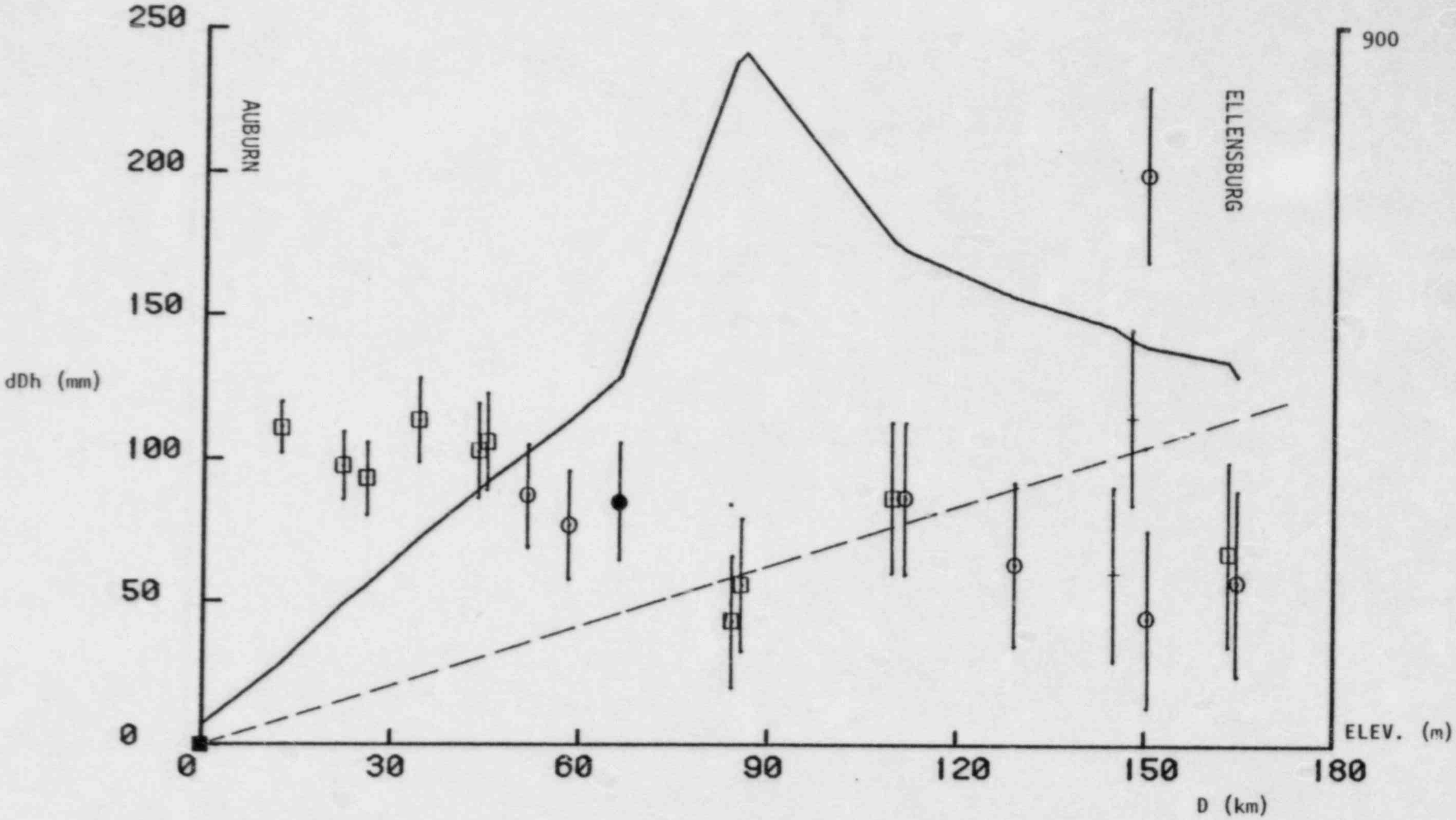
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| N | P1P2 | 25.38044 | 25.51599 | 0.00000 | 0.00000 | 0.00 |
| P | P1P2 | 100.78663 | 100.81155 | 75.40619 | 75.29556 | 110.63 |
| Q | P1 | 105.52275 | 105.55066 | 80.14231 | 80.03467 | 107.64 |
| R | P1P2 | 175.70658 | 175.74512 | 150.32614 | 150.22913 | 97.01 |
| S | | 188.20168 | 188.55099 | 162.82124 | 163.03500 | -213.76 |
| T | P1 | 198.43000 | 198.47291 | 173.04956 | 172.95692 | 92.64 |
| V | P1 | 258.43973 | 258.46228 | 233.05929 | 232.94629 | 113.00 |
| W | P1 | 261.57573 | 261.59765 | 236.19529 | 236.08166 | 113.63 |
| 1046 T | | 319.02034 | 319.05370 | 293.63990 | 293.53771 | 102.19 |
| Y | P1 | 329.23563 | 329.26576 | 303.85519 | 303.74977 | 105.42 |
| 1205 T | P1P2 | 367.58912 | 367.63799 | 342.20868 | 342.12200 | 86.68 |
| 1335 T | P1 | 407.18072 | 407.23998 | 381.80028 | 381.72399 | 76.29 |
| A 1 | | 462.74376 | 462.79475 | 437.36332 | 437.27876 | 84.56 |
| E 1 | P1 | 856.50948 | 856.60249 | 831.12904 | 831.08650 | 42.54 |
| F 1 | P1 | 868.47727 | 868.55731 | 843.09683 | 843.04132 | 55.51 |
| I 1 | P1 | 661.45204 | 661.15865 | 636.07160 | 635.64266 | 428.94 |
| J 1 | P1P2 | 632.15958 | 632.20938 | 606.77914 | 606.69339 | 85.75 |
| 2030 T | P1P2 | 619.16807 | 619.21810 | 593.78763 | 593.70211 | 85.52 |
| 1838 T | P1P2 | 560.28327 | 560.35617 | 534.90283 | 534.84018 | 62.65 |
| O 1 | P1 | 521.63863 | 521.71467 | 496.25819 | 496.19868 | 59.51 |
| 1658 T | P1 | 505.65521 | 505.67699 | 480.27477 | 480.16100 | 113.77 |
| 1634 T | P1 | 498.19228 | 498.12915 | 472.81184 | 472.61316 | 198.68 |
| P 1 | P1 | 497.77586 | 497.86763 | 472.39542 | 472.35164 | 43.78 |
| 1571 T | P1 | 478.92460 | 478.99375 | 453.54416 | 453.47776 | 66.40 |
| R 1 | P1P2 | 468.33313 | 468.39769 | 442.95269 | 442.88170 | 70.99 |
| S 1 | P1 | 461.65226 | 461.73165 | 436.27182 | 436.21566 | 56.16 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: 57499 1904 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-11184 1944 1ST
Note: Paraffin rods were used on 57499.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE |
|---|---|---|---|---|---|
| N | 0.00 | 0.00 | 0.00 | 0.00 | BUILDING |
| P | 110.63 | 8.82 | 12.45 | 12.45 | OTHER ST |
| Q | 107.64 | 9.14 | 13.38 | 13.38 | CON POST# |
| R | 97.01 | 11.81 | 22.33 | 22.33 | OTHER ST |
| S | -213.76 | 12.32 | 24.29 | 24.29 | CON POST#? |
| T | 92.64 | 12.75 | 26.02 | 26.02 | OTHER ST |
| V | 113.00 | 14.64 | 34.31 | 34.31 | OTHER ST |
| W | 113.63 | 14.74 | 34.77 | 34.77 | CON POST# |
| 1046 T | 102.19 | 16.53 | 43.70 | 43.70 | OTHER ST |
| Y | 105.42 | 16.78 | 45.04 | 45.04 | OTHER ST |
| 1205 T | 86.68 | 17.98 | 51.71 | 51.71 | MET PIPE |
| 1335 T | 76.29 | 19.07 | 58.21 | 58.21 | MET PIPE |
| A 1 | 84.56 | 20.39 | 66.25 | 66.54 | CON POST @ |
| E 1 | 42.54 | 22.95 | 84.25 | 84.25 | OTHER ST |
| F 1 | 55.51 | 23.16 | 85.82 | 85.85 | OTHER ST @ |
| I 1 | 428.94 | 25.16 | 101.27 | 101.27 | XXXXXXXX#? |
| J 1 | 85.75 | 26.18 | 109.66 | 109.66 | OTHER ST |
| 2030 T | 85.52 | 26.43 | 111.78 | 111.78 | MET PIPE |
| 1838 T | 62.65 | 28.42 | 129.21 | 129.21 | MET PIPE |
| O 1 | 59.51 | 30.09 | 144.90 | 144.90 | XXXXXXXX |
| 1658 T | 113.77 | 30.40 | 147.85 | 147.85 | XXXXXXXX |
| 1634 T | 198.68 | 30.66 | 150.37 | 150.37 | MET PIPE |
| P 1 | 43.78 | 30.68 | 150.37 | 150.56 | MET PIPE @ |
| 1571 T | 66.40 | 31.95 | 163.30 | 163.30 | OTHER ST |
| R 1 | 70.99 | 32.02 | 164.06 | 164.06 | XXXXXXXX# |
| S 1 | 56.16 | 32.08 | 164.68 | 164.68 | MET PIPE |

SD = 2.500 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: 57499 1904 1ST

AUBURN to ELLENSBURG 1944 - 1904 0.692 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = 5.42
Pr greater abs T = 0.0001



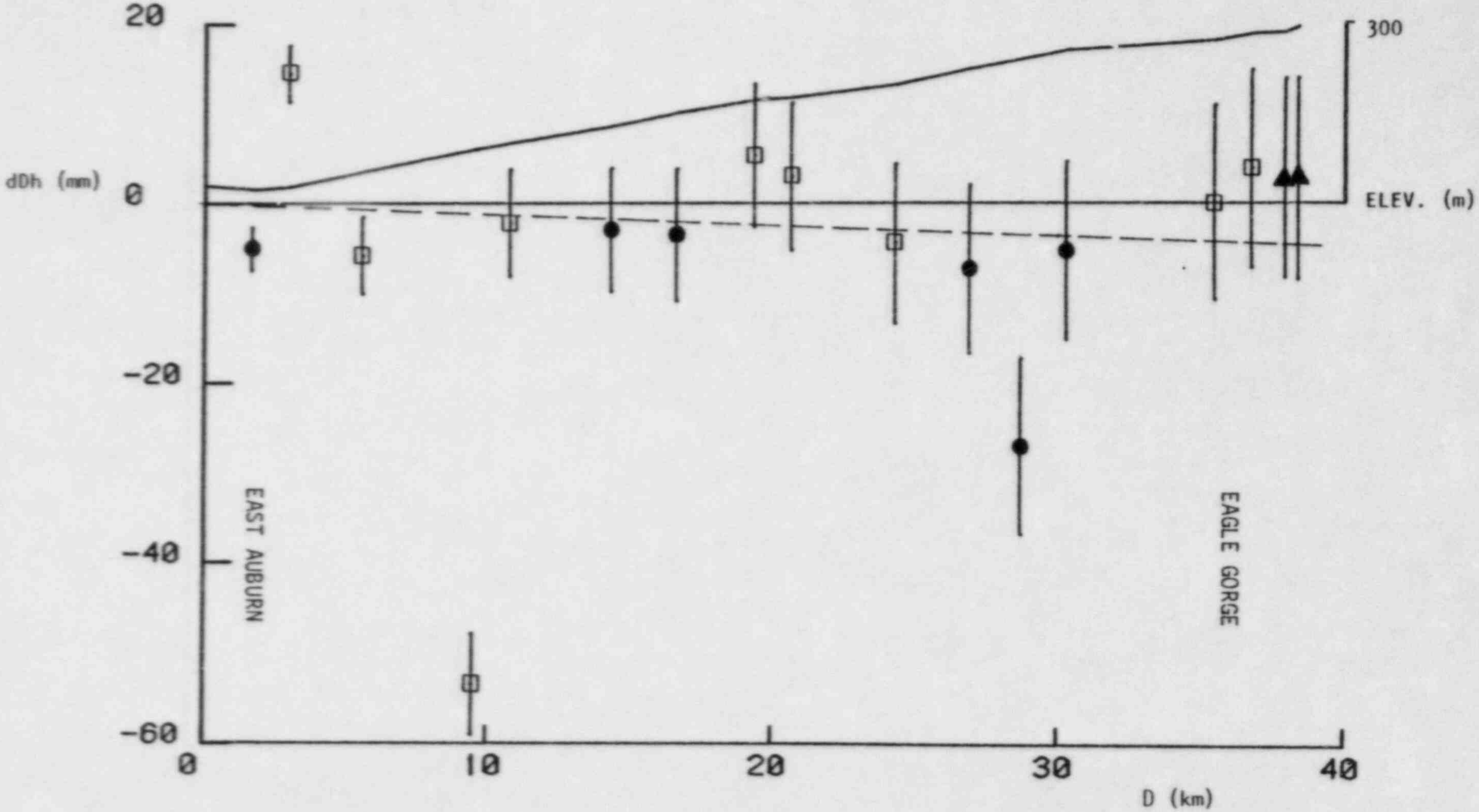
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| ZZ 249 | P1P2 | 27.98517 | 27.98511 | 0.00000 | 0.00000 | 0.00 |
| Y 249 | | 21.50872 | 21.51377 | -6.47645 | -6.47134 | -5.11 |
| Q 252 | | 26.57093 | 26.55648 | -1.41424 | -1.42863 | 14.39 |
| P 252 | | 52.18909 | 52.19492 | 24.20392 | 24.20981 | -5.89 |
| M 252 | | 89.40870 | 89.46214 | 61.42353 | 61.47703 | -53.50 |
| P | P1P2 | 100.78445 | 100.78663 | 72.79928 | 72.80152 | -2.24 |
| K 252 | | 128.96587 | 128.96884 | 100.98070 | 100.98373 | -3.03 |
| J 252 | | 151.36326 | 151.36681 | 123.37809 | 123.38170 | -3.61 |
| Z 253 | | 172.08537 | 172.08004 | 144.10020 | 144.09493 | 5.27 |
| Y 253 | | 175.91531 | 175.91237 | 147.93014 | 147.92726 | 2.88 |
| R | P1P2 | 175.70984 | 175.70658 | 147.72467 | 147.72147 | 3.20 |
| W 253 | | 198.35915 | 198.36366 | 170.37398 | 170.37855 | -4.57 |
| U 253 | | 225.48757 | 225.49491 | 197.50240 | 197.50980 | -7.40 |
| X 249 | | 241.38099 | 241.40801 | 213.39582 | 213.42290 | -27.08 |
| W 249 | | 255.09612 | 255.10138 | 227.11095 | 227.11627 | -5.32 |
| BM 3 | | 271.82610 | 271.82602 | 243.84093 | 243.84091 | 0.02 |
| L 249 | P1 | 282.83356 | 282.82969 | 254.84839 | 254.84458 | 3.81 |
| KK 249 | | 285.18607 | 285.18335 | 257.20090 | 257.19824 | 2.66 |
| K 249 | P1P2 | 294.18678 | 294.18403 | 266.20161 | 266.19892 | 2.69 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: L-11184 1944 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-23136 1973 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| ZZ 249 | 0.00 | 0.00 | 0.00 | 0.00 | XXXXXXXX | |
| Y 249 | -5.11 | 2.32 | 1.66 | 1.66 | CON POST | |
| Q 252 | 14.39 | 3.12 | 2.99 | 2.99 | OTHER ST | |
| P 252 | -5.89 | 4.26 | 5.59 | 5.59 | OTHER ST | |
| M 252 | -53.50 | 5.55 | 9.48 | 9.48 | OTHER ST | |
| P | -2.24 | 5.92 | 10.78 | 10.78 | OTHER ST | |
| K 252 | -3.03 | 6.83 | 14.35 | 14.35 | CON POST | |
| J 252 | -3.61 | 7.36 | 16.64 | 16.64 | CON POST | |
| Z 253 | 5.27 | 7.93 | 19.34 | 19.34 | OTHER ST | |
| Y 253 | 2.88 | 8.19 | 20.66 | 20.66 | OTHER ST | |
| R | 3.20 | 8.20 | 20.68 | 20.68 | OTHER ST# | |
| W 253 | -4.57 | 8.89 | 24.33 | 24.33 | OTHER ST | |
| U 253 | -7.40 | 9.36 | 26.93 | 26.93 | CON POST | |
| X 249 | -27.08 | 9.66 | 28.72 | 28.72 | CON POST | |
| W 249 | -5.32 | 9.93 | 30.31 | 30.31 | CON POST | |
| BM 3 | 0.02 | 10.75 | 35.48 | 35.54 | OTHER ST | @ |
| L 249 | 3.81 | 10.94 | 36.79 | 36.79 | OTHER ST | |
| KK 249 | 2.66 | 11.11 | 37.95 | 37.97 | BEDROCK | @ |
| K 249 | 2.69 | 11.17 | 38.39 | 38.39 | BEDROCK | |

SD = 1.803 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: L-11184 1944 1ST

EAST AUBURN to 3.3 mi NW of EAGLE GORGE 1973 - 1944 -0.124 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -0.84
Pr greater abs T = 0.4118



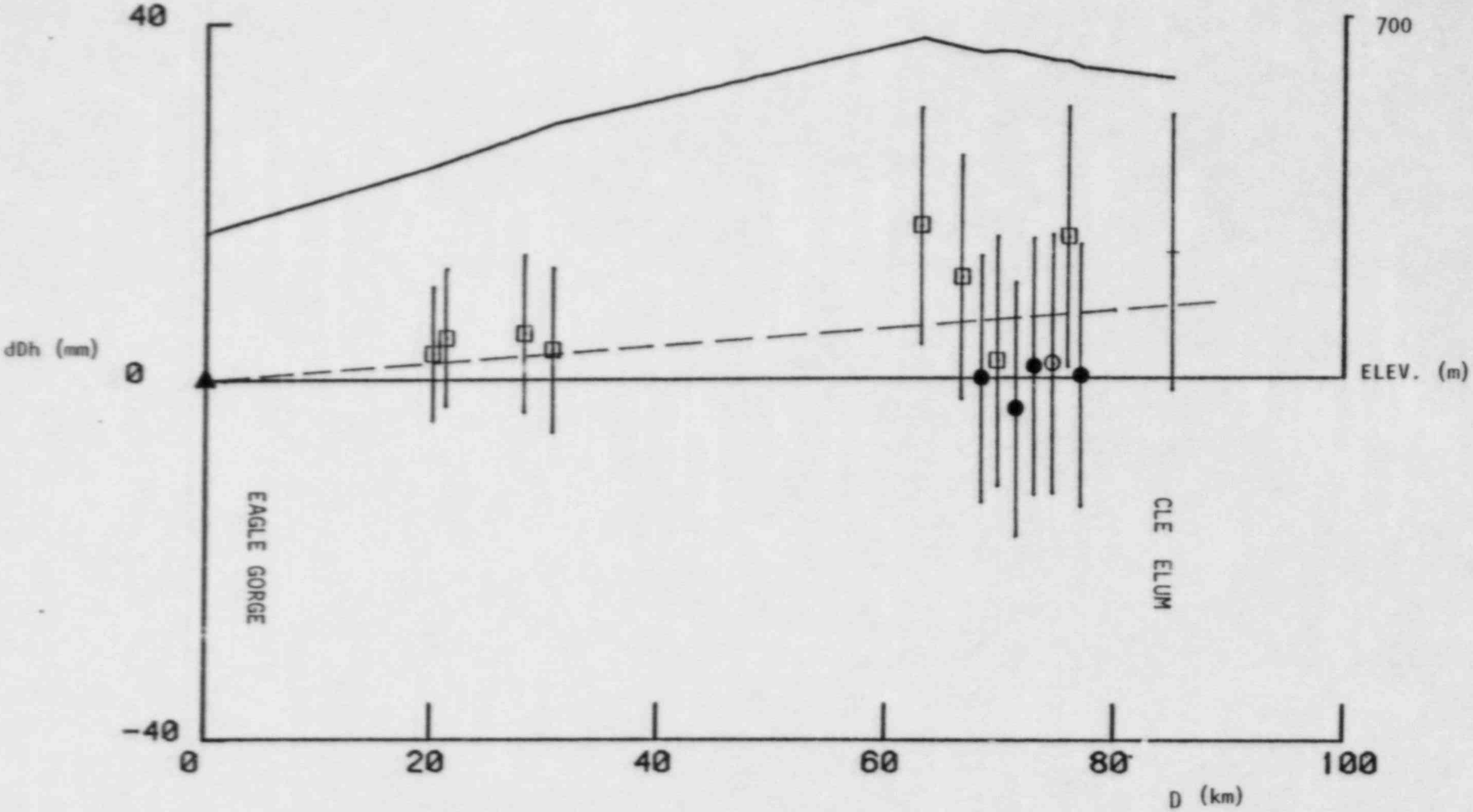
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| KK 249 | | 285.19600 | 285.18335 | 0.00000 | 0.00000 | 0.00 |
| K 249 | | 294.19646 | 294.18403 | 9.00046 | 9.00068 | -0.22 |
| T 248 | | 418.49131 | 418.47570 | 133.29531 | 133.29235 | 2.96 |
| 1373 | | 418.48970 | 418.47255 | 133.29370 | 133.28920 | 4.50 |
| S 248 | | 426.93127 | 426.91387 | 141.73527 | 141.73052 | 4.75 |
| M 248 | | 480.88048 | 480.86260 | 195.68448 | 195.67925 | 5.23 |
| K 248 | | 501.23472 | 501.21872 | 216.03872 | 216.03537 | 3.35 |
| X 247 | | 665.67371 | 665.64405 | 380.47771 | 380.46070 | 17.01 |
| W 247 | | 665.17328 | 665.14701 | 379.97728 | 379.96366 | 13.62 |
| K 244 | | 663.79278 | 663.76763 | 378.59678 | 378.58428 | 12.50 |
| U 247 | | 644.75477 | 644.73084 | 359.55877 | 359.54749 | 11.28 |
| T 247 | | 636.56914 | 636.55649 | 351.37314 | 351.37314 | 0.00 |
| S 247 | | 640.30531 | 640.29068 | 355.10931 | 355.10733 | 1.98 |
| 2103 T | | 641.51857 | 641.50154 | 356.32257 | 356.31819 | 4.38 |
| R 247 | | 636.58724 | 636.57799 | 351.39124 | 351.39464 | -3.40 |
| J 1 | | 632.17504 | 632.15958 | 346.97904 | 346.97623 | 2.81 |
| Q 247 | | 628.08471 | 628.07066 | 342.88871 | 342.88731 | 1.40 |
| 2030 T | | 619.18234 | 619.16807 | 333.98634 | 333.98472 | 1.62 |
| P 247 | | 616.29784 | 616.26948 | 331.10184 | 331.08613 | 15.71 |
| N 247 | | 605.18241 | 605.16938 | 319.98641 | 319.98603 | 0.38 |
| M 17 | | 581.66921 | 581.64259 | 296.47321 | 296.45924 | 13.97 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: L-11184 1944 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-24471/2 1982 1ST
Note: No interpolated positions were used on this profile.
L-24471/2 is almost entirely single-run.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| KK 249 | 0.00 | 0.00 | 0.00 | 0.00 | BEDROCK | @ |
| K 249 | -0.22 | 1.13 | 0.45 | 0.47 | BEDROCK | |
| T 248 | 2.96 | 7.43 | 20.13 | 20.15 | OTHER ST | |
| 1373 | 4.50 | 7.43 | 20.14 | 20.16 | OTHER ST# | |
| S 248 | 4.75 | 7.64 | 21.26 | 21.28 | OTHER ST | |
| M 248 | 5.23 | 8.79 | 28.18 | 28.20 | OTHER ST | |
| K 248 | 3.35 | 9.17 | 30.67 | 30.69 | OTHER ST | |
| X 247 | 17.01 | 13.15 | 63.13 | 63.14 | OTHER ST | |
| W 247 | 13.62 | 13.16 | 63.13 | 63.23 | BEDROCK # | @ |
| K 244 | 12.50 | 13.23 | 63.72 | 63.86 | OTHER ST# | @ |
| U 247 | 11.28 | 13.52 | 66.68 | 66.70 | OTHER ST | |
| T 247 | 0.00 | 13.69 | 68.42 | 68.44 | CON POST | |
| S 247 | 1.98 | 13.83 | 69.85 | 69.87 | OTHER ST | |
| 2103 T | 4.38 | 13.84 | 69.96 | 69.98 | MET PIPE# | |
| R 247 | -3.40 | 13.99 | 71.47 | 71.49 | CON POST | |
| J 1 | 2.81 | 14.10 | 72.55 | 72.61 | OTHER ST# | @ |
| Q 247 | 1.40 | 14.14 | 72.98 | 73.00 | CON POST | |
| 2030 T | 1.62 | 14.30 | 74.68 | 74.70 | MET PIPE | |
| P 247 | 15.71 | 14.43 | 76.04 | 76.06 | OTHER ST | |
| N 247 | 0.38 | 14.54 | 77.11 | 77.19 | CON POST | @ |
| M 17 | 13.97 | 15.27 | 85.11 | 85.13 | XXXXXXXX | |

SD = 1.655 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: L-11184 1944 1ST

3.6 mi NW of EAGLE GORGE to CLE ELUM 1982 - 1944 0.0947 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = 4.34
Pr greater abs T = 0.0004



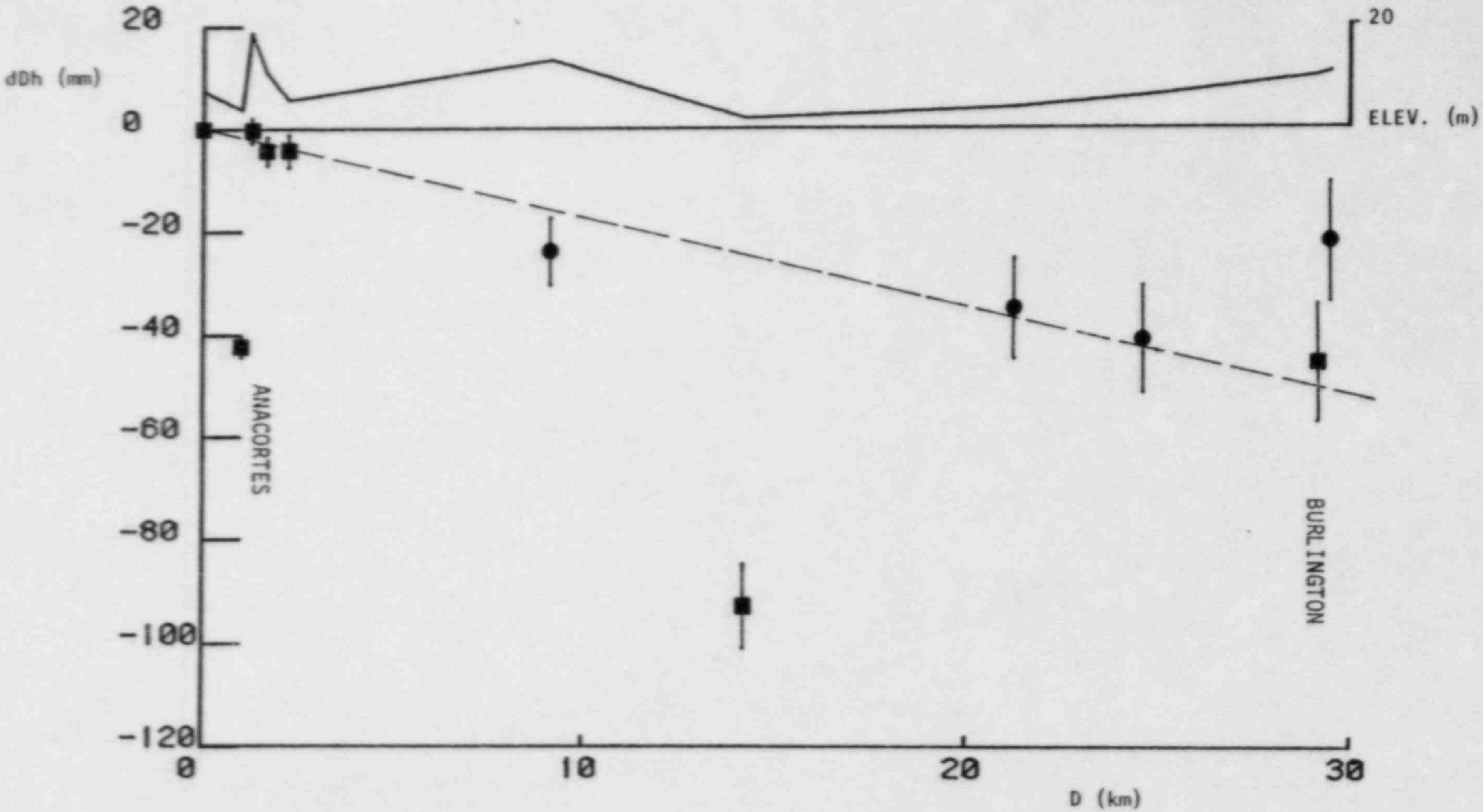
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| TIDAL 4 | | 7.39963 | 7.47476 | 0.00000 | 0.00000 | 0.00 |
| TIDAL 10 | P1P2 | 3.62503 | 3.74257 | -3.77460 | -3.73219 | -42.41 |
| TIDAL 9 | P1P2 | 18.83585 | 18.91137 | 11.43622 | 11.43661 | -0.39 |
| TIDAL 8 | P1P2 | 10.97775 | 11.05740 | 3.57812 | 3.58264 | -4.52 |
| TIDAL 6 | P1P2 | 5.66388 | 5.74350 | -1.73575 | -1.73126 | -4.49 |
| K 13 | P2 | 13.42861 | 13.52773 | 6.02898 | 6.05297 | -23.99 |
| J 13 | P2 | 1.86663 | 2.03485 | -5.53300 | -5.43991 | -93.09 |
| G 13 | P1P2 | 4.03986 | 4.15011 | -3.35977 | -3.32465 | -35.12 |
| F 13 | P1P2 | 6.35443 | 6.47061 | -1.04520 | -1.00415 | -41.05 |
| E 13 | P1P2 | 10.20059 | 10.32129 | 2.80096 | 2.84653 | -45.57 |
| X 6 USGS | P1P2 | 10.92830 | 11.02548 | 3.52867 | 3.55072 | -22.05 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: 82315 1922 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-14696 1952 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE |
|---|---|---|---|---|---|
| TIDAL 4 | 0.00 | 0.00 | 0.00 | 0.00 | BUILDING |
| TIDAL 10 | -42.41 | 2.15 | 1.03 | 1.03 | BUILDING |
| TIDAL 9 | -0.39 | 2.41 | 1.29 | 1.29 | BUILDING |
| TIDAL 8 | -4.52 | 2.75 | 1.69 | 1.69 | BUILDING |
| TIDAL 6 | -4.49 | 3.18 | 2.25 | 2.25 | BUILDING |
| K 13 | -23.99 | 6.41 | 9.13 | 9.13 | CON POST |
| J 13 | -93.09 | 8.00 | 14.21 | 14.21 | OTHER ST |
| G 13 | -35.12 | 9.79 | 21.29 | 21.29 | CON POST |
| F 13 | -41.05 | 10.52 | 24.62 | 24.62 | CON POST |
| E 13 | -45.57 | 11.45 | 29.16 | 29.16 | BUILDING |
| X 6 USGS | -22.05 | 11.52 | 29.48 | 29.48 | MET PIPE |

SD = 2.121 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: 82315 1922 1ST

ANACORTES to BURLINGTON 1952 - 1922 -1.737 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -3.39
Pr greater abs T = 0.0081



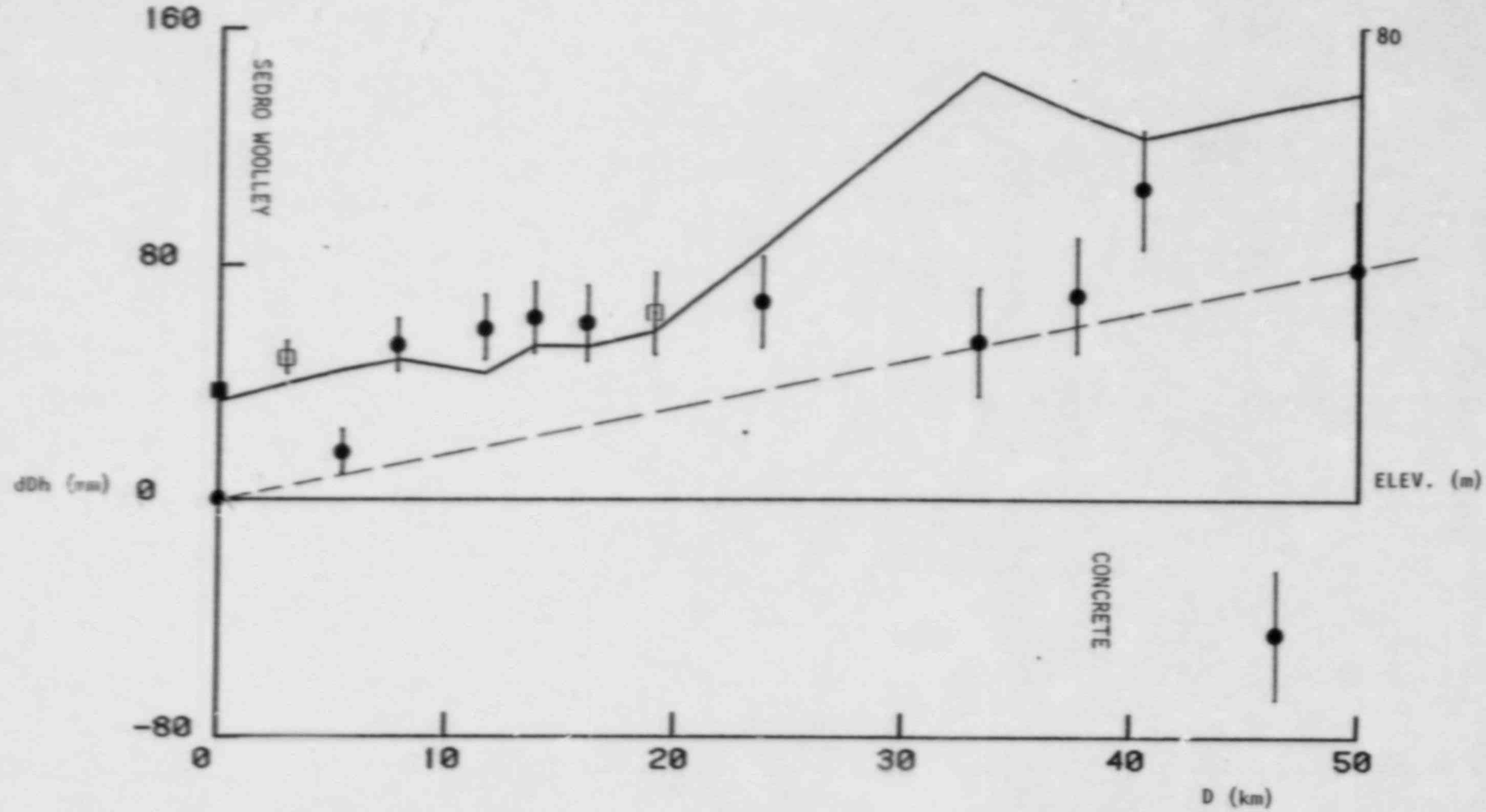
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| Q 61 | P1 | 16.67967 | 16.76653 | 0.00000 | 0.00000 | 0.00 |
| 5o USGS | P1P2 | 16.98080 | 17.03058 | 0.30113 | 0.26405 | 37.08 |
| P 61 | | 19.85423 | 19.89274 | 3.17456 | 3.12621 | 48.35 |
| N 61 | | 22.24946 | 22.31992 | 5.56979 | 5.55339 | 16.40 |
| M 61 | | 23.91154 | 23.94563 | 7.23187 | 7.17910 | 52.77 |
| L 61 | | 21.60879 | 21.63700 | 4.92912 | 4.87047 | 58.65 |
| K 61 | | 26.28439 | 26.30933 | 9.60472 | 9.54280 | 61.92 |
| J 61 | | 26.11341 | 26.14016 | 9.43374 | 9.37363 | 60.11 |
| H 61 | | 28.79032 | 28.81385 | 12.11065 | 12.04732 | 63.33 |
| F 61 | | 42.85712 | 42.87639 | 26.17745 | 26.10986 | 67.59 |
| C 61 | | 72.63864 | 72.67186 | 55.95897 | 55.90533 | 53.64 |
| B 61 | | 65.43294 | 65.45031 | 48.75327 | 48.68378 | 69.49 |
| A 61 | P1P2 | 61.48294 | 61.46436 | 44.80327 | 44.69783 | 105.44 |
| Y 60 | P1P2 | 66.49097 | 66.62308 | 49.81130 | 49.85655 | -45.25 |
| X 60 | | 68.88910 | 68.89746 | 52.20943 | 52.13093 | 78.50 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR16 L-2396 1934 2ND
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-17026 1958 1ST
Note: L-2396 is only about 20% double-run.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| Q 61 | 0.00 | 0.00 | 0.00 | 0.00 | CON POST | |
| 56 USGS | 37.08 | 0.97 | 0.00 | 0.10 | BUILDING | @ |
| P 61 | 48.35 | 5.47 | 2.98 | 3.00 | OTHER ST | @ |
| N 61 | 16.40 | 7.37 | 5.43 | 5.43 | CON POST | |
| M 61 | 52.77 | 8.85 | 7.83 | 7.83 | CON POST | |
| L 61 | 58.65 | 10.79 | 11.64 | 11.64 | CON POST | |
| K 61 | 61.92 | 11.75 | 13.80 | 13.80 | CON POST | |
| J 61 | 60.11 | 12.70 | 16.12 | 16.12 | CON POST | |
| H 61 | 63.33 | 13.81 | 19.08 | 19.08 | OTHER ST | |
| F 61 | 67.59 | 15.41 | 23.75 | 23.75 | CON POST | |
| C 61 | 53.64 | 18.25 | 33.30 | 33.30 | CON POST | |
| B 61 | 69.49 | 19.39 | 37.60 | 37.60 | CON POST | |
| A 61 | 105.44 | 20.12 | 40.48 | 40.48 | CON POST | |
| Y 60 | -45.25 | 21.54 | 46.42 | 46.42 | CON POST | |
| X 60 | 78.50 | 22.34 | 49.90 | 49.90 | CON POST | |

SD = 3.162 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR16 L-2396 1934 2ND

SEDRO WOOLLEY to 7.6 mi SE of CONCRETE 1958 - 1934 1.579 mm/km
refraction-corrected
length of bars = ±1 standard deviation
T = 3.52
Pr greater abs T = 0.0038



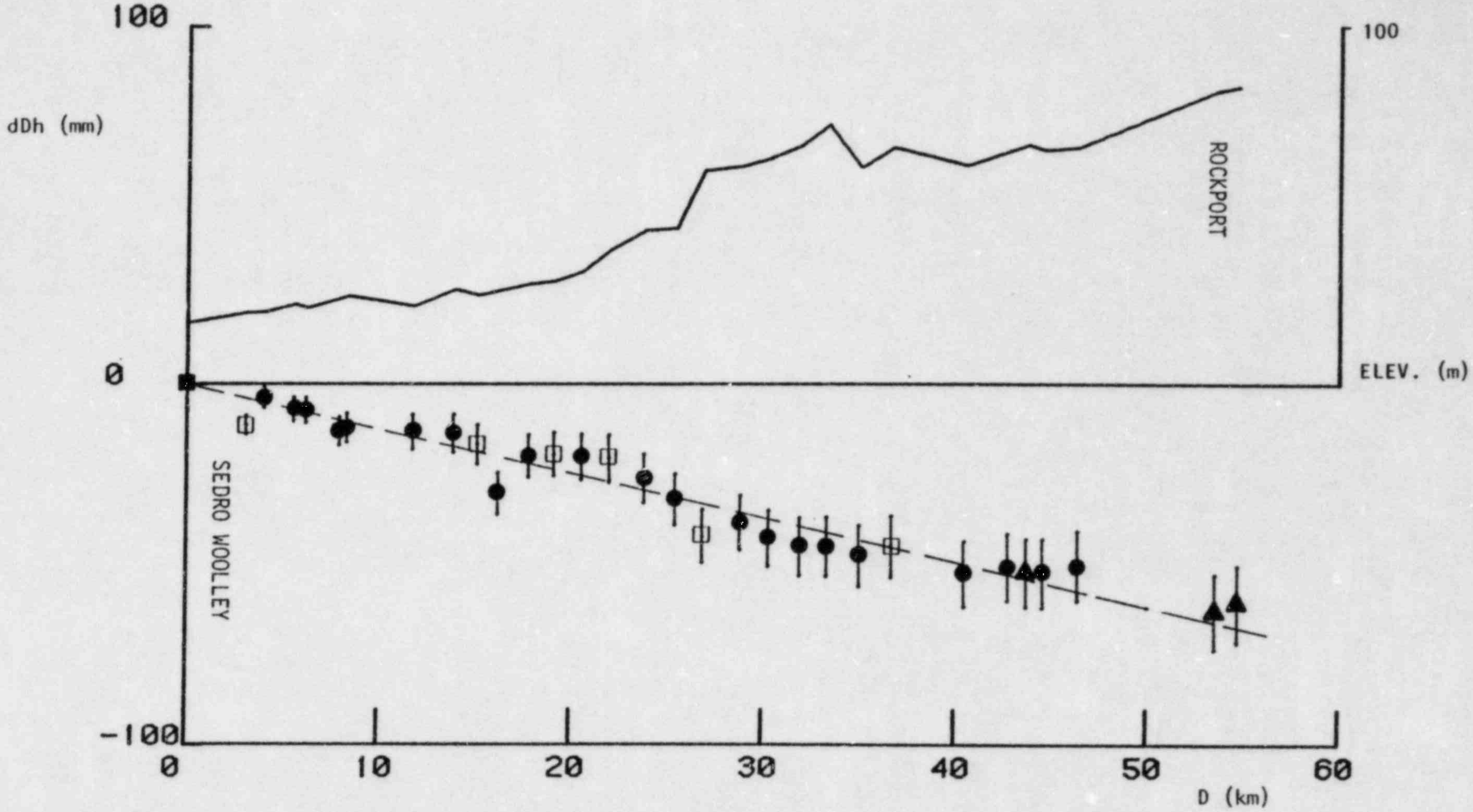
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| 56 USGS | P1P2 | 17.06858 | 16.98080 | 0.00000 | 0.00000 | 0.00 |
| P 61 | | 19.93062 | 19.85423 | 2.86204 | 2.87343 | -11.39 |
| W 374 | | 20.16763 | 20.08371 | 3.09905 | 3.10291 | -3.86 |
| N 61 | | 22.33004 | 22.24946 | 5.26146 | 5.26866 | -7.20 |
| V 374 | | 21.17585 | 21.09536 | 4.10727 | 4.11456 | -7.29 |
| M 61 | | 23.98619 | 23.91154 | 6.91761 | 6.93074 | -13.13 |
| U 374 | | 24.52174 | 24.44620 | 7.45316 | 7.46540 | -12.24 |
| L 61 | | 21.68318 | 21.60879 | 4.61460 | 4.62799 | -13.39 |
| K 61 | | 26.35833 | 26.28439 | 9.28975 | 9.30359 | -13.84 |
| S 374 | | 24.80666 | 24.73583 | 7.73808 | 7.75503 | -16.95 |
| J 61 | | 26.17048 | 26.11341 | 9.10190 | 9.13261 | -30.71 |
| R 374 | | 28.09315 | 28.02550 | 11.02457 | 11.04470 | -20.13 |
| H 61 | | 28.85841 | 28.79032 | 11.78983 | 11.80952 | -19.69 |
| G 61 (1) | | 31.72718 | 31.65983 | 14.65860 | 14.67903 | -20.43 |
| P 374 | | 37.62621 | 37.55919 | 20.55763 | 20.57839 | -20.76 |
| F 61 | | 42.91852 | 42.85712 | 25.84994 | 25.87632 | -26.38 |
| N 374 | | 43.56481 | 43.50930 | 26.49623 | 26.52850 | -32.27 |
| M 374 | | 60.06387 | 60.01859 | 42.99529 | 43.03779 | -42.50 |
| K 374 | | 61.28436 | 61.23529 | 44.21578 | 44.25449 | -38.71 |
| D 61 (2) | | 63.53196 | 63.48720 | 46.46338 | 46.50640 | -43.02 |
| J 374 | | 67.13207 | 67.08964 | 50.06349 | 50.10884 | -45.35 |
| C 61 | | 72.68112 | 72.63864 | 55.61254 | 55.65784 | -45.30 |
| H 374 | | 60.78229 | 60.74231 | 43.71371 | 43.76151 | -47.80 |
| D 374 | | 66.36369 | 66.32112 | 49.29511 | 49.34032 | -45.21 |
| E 374 | | 71.36511 | 71.32344 | 54.29653 | 54.34264 | -46.11 |
| F 374 | | 78.11882 | 78.07730 | 61.05024 | 61.09650 | -46.26 |
| G 374 | | 78.18548 | 78.14359 | 61.11690 | 61.16279 | -45.89 |
| 263.7 | | 80.33121 | 80.29422 | 63.26263 | 63.31342 | -50.79 |
| A 61 | P1P2 | 61.51793 | 61.48294 | 44.44935 | 44.50214 | -52.79 |
| B 374 | | 65.41480 | 65.37800 | 48.34622 | 48.39720 | -50.98 |
| A 380 | | 67.05653 | 67.02129 | 49.98795 | 50.04049 | -52.54 |
| B 380 | | 65.56783 | 65.53263 | 48.49925 | 48.55183 | -52.58 |
| Y 60 | P1P2 | 66.52817 | 66.49097 | 49.45959 | 49.51017 | -50.58 |
| E 380 | P1 | 81.96343 | 81.93890 | 64.89485 | 64.95810 | -63.25 |
| F 380 | P1P2 | 83.28508 | 83.25838 | 66.21650 | 66.27758 | -61.08 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: L-17026 1958 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR18 L-23117 1973 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE |
|---|---|---|---|---|---|
| 56 USGS | 0.00 | 0.00 | 0.00 | 0.00 | BUILDING |
| P 61 | -11.39 | 2.49 | 3.10 | 3.10 | OTHER ST |
| W 374 | -3.86 | 2.83 | 4.00 | 4.00 | CON POST |
| N 61 | -7.20 | 3.33 | 5.56 | 5.56 | CON POST |
| V 374 | -7.29 | 3.52 | 6.19 | 6.19 | CON POST |
| M 61 | -13.13 | 3.98 | 7.93 | 7.93 | CON POST |
| U 374 | -12.24 | 4.08 | 8.33 | 8.33 | CON POST |
| L 61 | -13.39 | 4.84 | 11.72 | 11.72 | CON POST |
| K 61 | -13.84 | 5.27 | 13.87 | 13.87 | CON POST |
| S 374 | -16.95 | 5.49 | 15.10 | 15.10 | OTHER ST |
| J 61 | -30.71 | 5.69 | 16.18 | 16.18 | CON POST |
| R 374 | -20.13 | 5.96 | 17.79 | 17.79 | CON POST |
| H 61 | -19.69 | 6.18 | 19.10 | 19.10 | OTHER ST |
| G 61 (1) | -20.43 | 6.41 | 20.53 | 20.53 | CON POST |
| P 374 | -20.76 | 6.62 | 21.95 | 21.95 | OTHER ST |
| F 61 | -26.38 | 6.90 | 23.79 | 23.79 | CON POST |
| N 374 | -32.27 | 7.13 | 25.40 | 25.40 | CON POST |
| M 374 | -42.50 | 7.33 | 26.84 | 26.84 | OTHER ST |
| K 374 | -38.71 | 7.59 | 28.83 | 28.83 | CON POST |
| D 61 (2) | -43.02 | 7.78 | 30.28 | 30.28 | CON POST |
| J 374 | -45.35 | 7.99 | 31.94 | 31.94 | CON POST |
| C 61 | -45.30 | 8.16 | 33.32 | 33.32 | CON POST |
| H 374 | -47.80 | 8.37 | 35.02 | 35.02 | CON POST |
| D 374 | -45.21 | 8.56 | 36.68 | 36.68 | OTHER ST |
| E 374 | -46.11 | 8.62 | 36.68 | 37.17 | OTHER ST# @ |
| F 374 | -46.26 | 8.64 | 36.68 | 37.35 | CON POST# @ |
| G 374 | -45.89 | 8.65 | 36.68 | 37.43 | CON POST# @ |
| 263.7 | -50.79 | 8.67 | 36.68 | 37.60 | BOULDER # @ |
| A 61 | -52.79 | 9.00 | 40.48 | 40.48 | CON POST |
| B 374 | -50.98 | 9.24 | 42.75 | 42.75 | CON POST |
| A 380 | -52.54 | 9.35 | 43.69 | 43.69 | BEDROCK |
| B 380 | -52.58 | 9.44 | 44.55 | 44.55 | CON POST |
| Y 60 | -50.58 | 9.63 | 46.38 | 46.38 | CON POST |
| E 380 | -63.25 | 10.35 | 53.54 | 53.54 | BEDROCK |
| F 380 | -61.08 | 10.46 | 54.70 | 54.70 | BEDROCK |

SD = 1.414 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: L-17026 1958 1ST

SEDRO WOOLLY to 1.45 mi NE of ROCKPORT 1973 - 1958 -1.238 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -49.93
Pr greater abs T = 0.0001



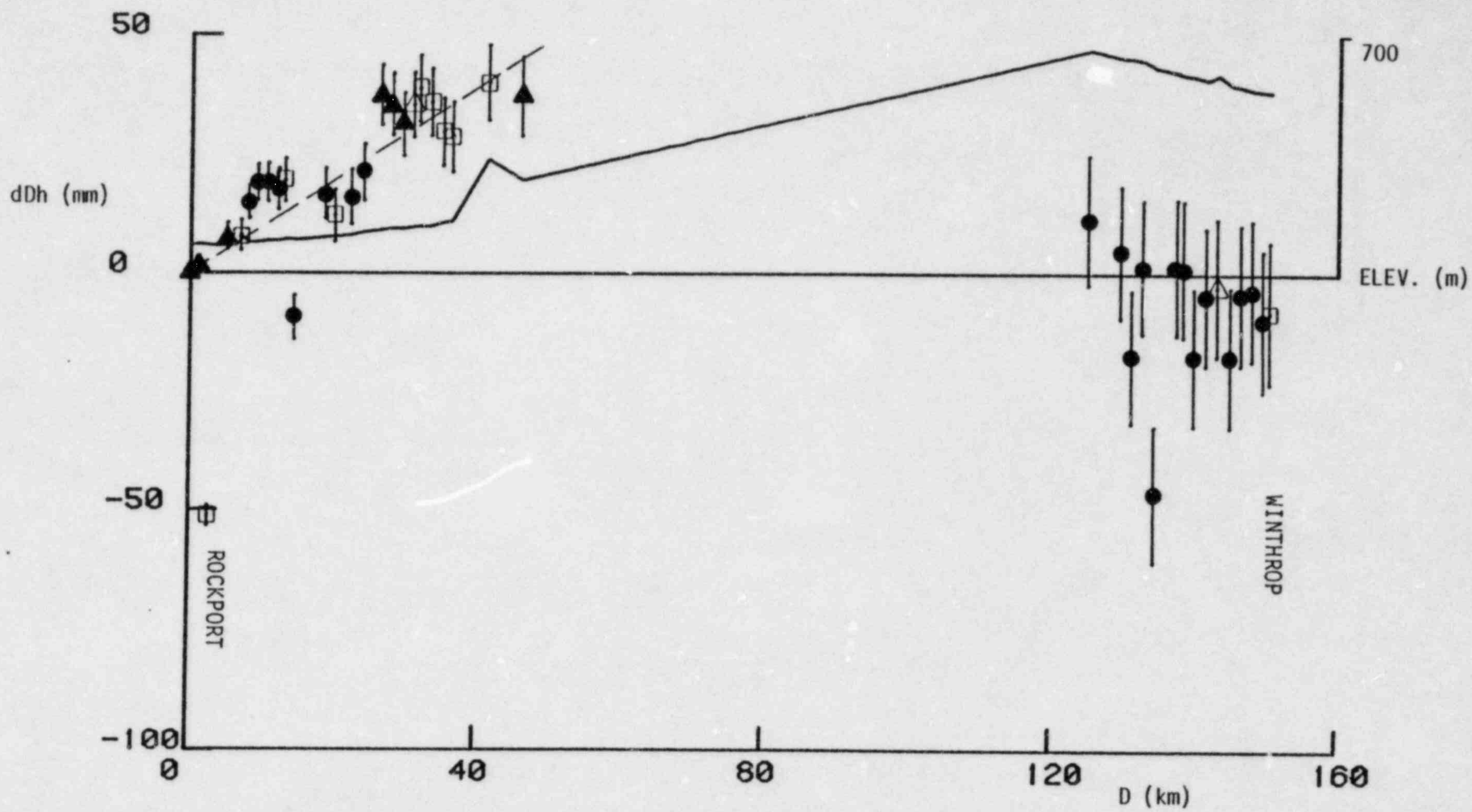
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| E 380 | | 82.11663 | 81.93890 | 0.00000 | 0.00000 | 0.00 |
| F 380 | | 83.43787 | 83.25838 | 1.32124 | 1.31948 | 1.76 |
| G 380 | | 81.85053 | 81.72420 | -0.26610 | -0.21470 | -51.40 |
| GA ST | | 78.15724 | 77.97180 | -3.95939 | -3.96710 | 7.71 |
| J 380 | | 108.34161 | 108.15599 | 26.22498 | 26.21709 | 7.89 |
| K 380 | | 89.31881 | 89.12612 | 7.20218 | 7.18722 | 14.96 |
| L 380 | | 91.54030 | 91.34358 | 9.42367 | 9.40468 | 18.99 |
| M 380 | | 94.76580 | 94.56904 | 12.64917 | 12.63014 | 19.03 |
| N 380 | | 95.86567 | 95.67033 | 13.74904 | 13.73143 | 17.61 |
| C 1 USE | | 99.72929 | 99.53206 | 17.61266 | 17.59316 | 19.50 |
| P 380 | | 97.63188 | 97.46377 | 15.51525 | 15.52487 | -9.62 |
| Y 375 | | 106.39996 | 106.20551 | 24.28333 | 24.26661 | 16.72 |
| R 375 | | 108.10874 | 107.91897 | 25.99211 | 25.98007 | 12.04 |
| S 375 | | 113.87400 | 113.68021 | 31.75737 | 31.74131 | 16.06 |
| T 375 | | 122.39062 | 122.19174 | 40.27399 | 40.25284 | 21.15 |
| U 375 | | 127.15278 | 126.93769 | 45.03615 | 44.99879 | 37.36 |
| V 375 | | 132.01278 | 131.79968 | 49.89615 | 49.86078 | 35.37 |
| W 375 | | 131.37592 | 131.16696 | 49.25929 | 49.22806 | 31.23 |
| Q 375 | | 137.85716 | 137.64414 | 55.74053 | 55.70524 | 35.29 |
| P 375 | | 138.05817 | 137.84163 | 55.94154 | 55.90273 | 38.81 |
| N 375 | | 139.23542 | 139.02191 | 57.11879 | 57.08301 | 35.78 |
| M 375 | | 148.94968 | 148.74236 | 66.83305 | 66.80346 | 29.59 |
| H 375 | | 153.44778 | 153.24148 | 71.33115 | 71.30258 | 28.57 |
| L 375 | | 334.30593 | 334.08822 | 252.18930 | 252.14932 | 39.98 |
| A 375 | | 274.14370 | 273.92891 | 192.02707 | 191.99001 | 37.06 |
| B 379 | | 658.58099 | 658.39216 | 576.46436 | 576.45326 | 11.10 |
| W 376 | | 634.31036 | 634.12807 | 552.19373 | 552.18917 | 4.56 |
| X 376 | | 632.13549 | 631.97545 | 550.01886 | 550.03655 | -17.69 |
| Y 376 | | 625.60691 | 625.42776 | 543.49028 | 543.48886 | 1.42 |
| Z 376 | | 605.97302 | 605.84187 | 523.85639 | 523.90297 | -46.58 |
| B 377 | | 590.07245 | 589.89337 | 507.95582 | 507.95447 | 1.35 |
| U 378 | | 584.06030 | 583.88159 | 501.94367 | 501.94269 | 0.98 |
| T 378 | | 579.78868 | 579.62876 | 497.67205 | 497.68986 | -17.81 |
| S 378 | | 571.28984 | 571.11698 | 489.17321 | 489.17808 | -4.87 |
| R 378 | | 583.82353 | 583.64870 | 501.70690 | 501.70980 | -2.90 |
| Q 378 | | 555.11652 | 554.95651 | 472.99989 | 473.01761 | -17.72 |
| P 378 | | 548.64529 | 548.47210 | 466.52866 | 466.53320 | -4.54 |
| N 378 | | 541.19025 | 541.01618 | 459.07362 | 459.07728 | -3.66 |
| 2 M USGS | | 537.04622 | 536.87862 | 454.92959 | 454.93972 | -10.13 |
| L 378 | | 534.64369 | 534.47424 | 452.52706 | 452.53534 | -8.28 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: L-17026 1958 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-24471/3 1982 1ST
Note: This profile has no interpolated positions (except GA ST on L-17026).
L-24471/3 is almost entirely single-run.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| E 380 | 0.00 | 0.00 | 0.00 | 0.00 | BEDROCK | |
| F 380 | 1.76 | 1.31 | 1.15 | 1.15 | BEDROCK | |
| G 380 | -51.40 | 2.03 | 2.75 | 2.75 | OTHER ST | |
| GA ST | 7.71 | 2.78 | 5.17 | 5.17 | BEDROCK | |
| J 380 | 7.89 | 3.23 | 7.00 | 7.00 | OTHER ST | |
| K 380 | 14.96 | 3.49 | 8.16 | 8.16 | CON POST | |
| L 380 | 18.99 | 3.73 | 9.36 | 9.36 | CON POST | |
| M 380 | 19.03 | 4.01 | 10.79 | 10.79 | CON POST | |
| N 380 | 17.61 | 4.26 | 12.16 | 12.16 | CON POST | |
| C 1 USE | 19.50 | 4.43 | 13.14 | 13.14 | OTHER ST | |
| P 380 | -9.62 | 4.67 | 14.61 | 14.61 | CON POST | |
| Y 375 | 16.72 | 5.28 | 18.67 | 18.67 | CON POST | |
| R 375 | 12.04 | 5.47 | 20.10 | 20.10 | OTHER ST | |
| S 375 | 16.06 | 5.77 | 22.35 | 22.35 | CON POST | |
| T 375 | 21.15 | 5.99 | 24.03 | 24.03 | CON POST | |
| U 375 | 37.36 | 6.28 | 26.49 | 26.49 | BEDROCK | |
| V 375 | 35.37 | 6.46 | 28.00 | 28.00 | BEDROCK | |
| W 375 | 31.23 | 6.63 | 29.51 | 29.51 | BEDROCK | |
| Q 375 | 35.29 | 6.79 | 30.91 | 30.91 | BOULDER | |
| P 375 | 38.81 | 6.88 | 31.74 | 31.74 | OTHER ST | |
| N 375 | 35.78 | 7.05 | 33.36 | 33.36 | OTHER ST | |
| M 375 | 29.59 | 7.23 | 35.03 | 35.03 | OTHER ST | |
| H 375 | 28.57 | 7.36 | 36.36 | 36.36 | OTHER ST | |
| L 375 | 39.98 | 7.84 | 41.28 | 41.28 | OTHER ST | |
| A 375 | 37.06 | 8.27 | 45.93 | 45.93 | BEDROCK | |
| B 379 | 11.10 | 13.71 | 125.21 | 126.12 | CON POST | @ |
| W 376 | 4.56 | 13.91 | 129.77 | 129.77 | CON POST | |
| X 376 | -17.69 | 13.99 | 131.23 | 131.23 | CON POST | |
| Y 376 | 1.42 | 14.07 | 132.85 | 132.85 | CON POST | |
| Z 376 | -46.58 | 14.16 | 134.49 | 134.49 | CON POST | |
| B 377 | 1.35 | 14.32 | 137.57 | 137.57 | CON POST | |
| U 378 | 0.98 | 14.37 | 138.47 | 138.47 | CON POST | |
| T 378 | -17.81 | 14.44 | 139.94 | 139.94 | CON POST | |
| S 378 | -4.87 | 14.53 | 141.62 | 141.62 | CON POST | |
| R 378 | -2.90 | 14.61 | 143.20 | 143.20 | BOULDER | |
| Q 378 | -17.72 | 14.70 | 145.00 | 145.00 | CON POST | |
| P 378 | -4.54 | 14.78 | 146.50 | 146.50 | CON POST | |
| N 378 | -3.66 | 14.85 | 147.98 | 147.98 | CON POST | |
| 2 A USGS | -10.13 | 14.93 | 149.59 | 149.59 | CON POST | |
| L 378 | -8.28 | 14.98 | 150.44 | 150.44 | OTHER ST | |

SD = 1.221 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: L-17026 1958 1ST

0.75 mi NE of ROCKPORT to WINTHROP 1982 -1958 -0.007 mm/km (regression line not shown)
first-half regression: 0.969 mm/km, T=8.51, Pr greater abs T = 0.0001
refraction - corrected
length of bars = ±1 standard deviation
T = -0.16
Pr greater abs T = 0.8700



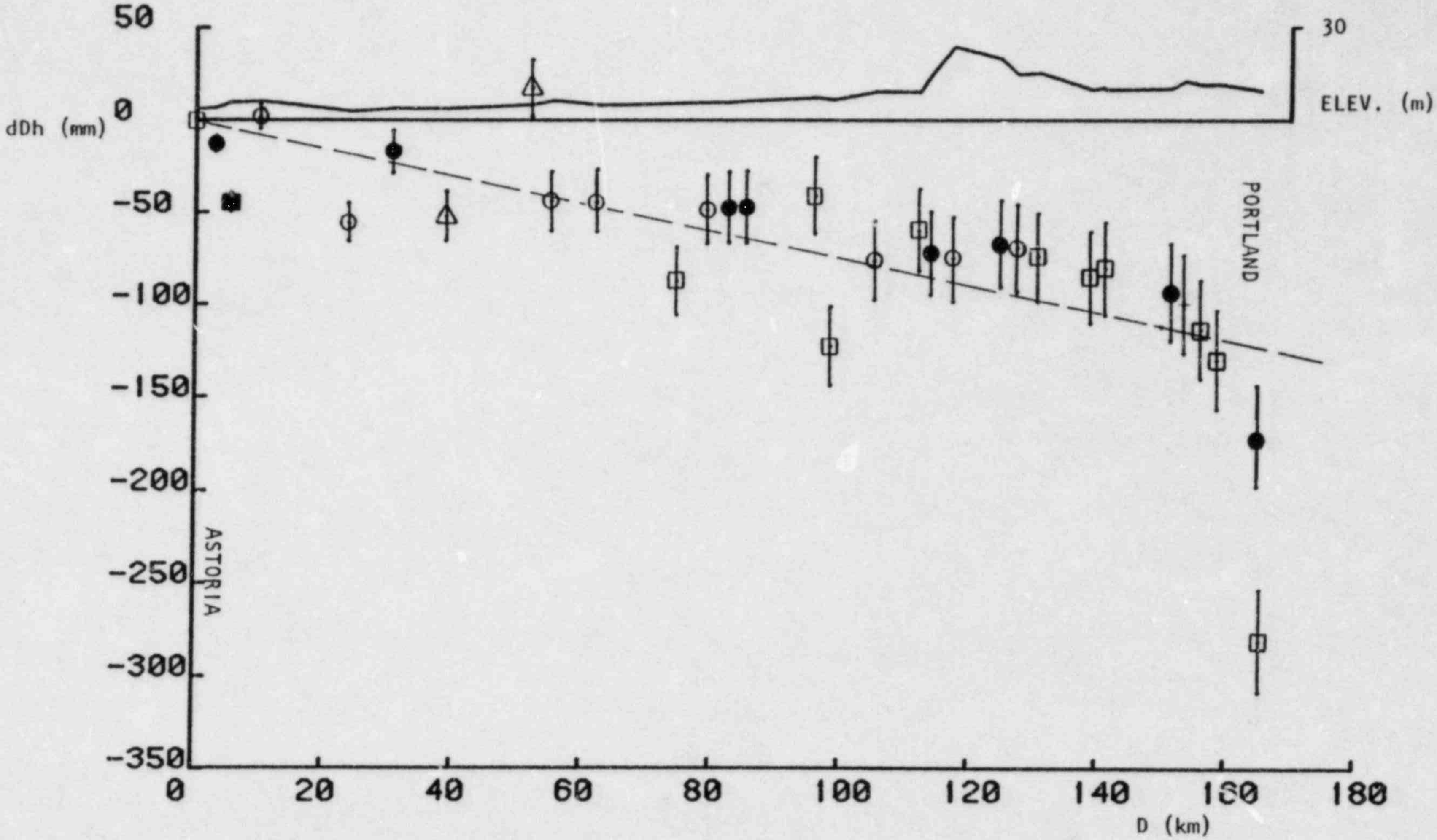
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| D 31 | P1P2 | 3.36590 | 3.28025 | 0.00000 | 0.00000 | 0.00 |
| E 31 | P1P2 | 3.86625 | 3.79367 | 0.50035 | 0.51342 | -13.07 |
| F 31 | P1P2 | 5.79329 | 5.75271 | 2.42739 | 2.47246 | -45.07 |
| H 31 | P1P2 | 6.08789 | 6.00074 | 2.72199 | 2.72049 | 1.50 |
| P 31 | P1P2 | 2.78380 | 2.75372 | -0.58210 | -0.52653 | -55.57 |
| J 31 | P1P2 | 3.62818 | 3.55999 | 0.26228 | 0.27974 | -17.46 |
| K 31 | P1P2 | 2.86217 | 2.80768 | -0.50373 | -0.47257 | -31.16 |
| L 31 | P1P2 | 3.75870 | 3.72544 | 0.39280 | 0.44519 | -52.39 |
| T 31 | | 4.87504 | 4.77237 | 1.50914 | 1.49212 | 17.02 |
| O 31 | | 6.34455 | 6.30346 | 2.97865 | 3.02321 | -44.56 |
| V 31 | P2 | 9.80318 | 9.75425 | 6.43728 | 6.47400 | -36.72 |
| Y 31 | P1P2 | 4.75106 | 4.70937 | 1.38516 | 1.42912 | -43.96 |
| X 30 | P1P2 | 5.40796 | 5.41012 | 2.04206 | 2.12987 | -87.81 |
| V 30 | P1P2 | 5.61919 | 5.58222 | 2.25329 | 2.30197 | -48.68 |
| U 30 | | 5.70416 | 5.66629 | 2.33826 | 2.38604 | -47.78 |
| T 30 | P1P2 | 6.35445 | 6.31640 | 2.98855 | 3.03615 | -47.60 |
| Z 30 | P2 | 7.13157 | 7.08712 | 3.76567 | 3.80687 | -41.20 |
| Q 30 | P1P2 | 6.46520 | 6.50274 | 3.09930 | 3.22249 | -123.19 |
| O 30 | P1P2 | 9.20688 | 9.19777 | 5.84098 | 5.91752 | -76.54 |
| L 30 | P1P2 | 8.99427 | 8.96873 | 5.62837 | 5.68848 | -60.11 |
| K 30 | | 14.70050 | 14.68762 | 11.33460 | 11.40737 | -72.77 |
| J 30 | P1P2 | 23.74664 | 23.73689 | 20.38074 | 20.45664 | -75.90 |
| H 30 | P1P2 | 19.73344 | 19.71517 | 16.36754 | 16.43492 | -67.38 |
| G 30 | | 14.79172 | 14.77583 | 11.42582 | 11.49558 | -69.76 |
| F 30 | P1P2 | 15.18099 | 15.17019 | 11.81509 | 11.88994 | -74.85 |
| C 30 | | 9.68471 | 9.68486 | 6.31881 | 6.40461 | -85.80 |
| B 30 | | 10.36897 | 10.35765 | 7.00307 | 7.07740 | -74.33 |
| A 30 | P1P2 | 9.71895 | 9.71439 | 6.35305 | 6.43414 | -81.09 |
| Y 14 | P1P2 | 10.34416 | 10.35209 | 6.97826 | 7.07184 | -93.58 |
| X 14 | | 12.37290 | 12.38737 | 9.00700 | 9.10712 | -100.12 |
| W 14 | P1P2 | 11.12462 | 11.15279 | 7.75872 | 7.87254 | -113.82 |
| V 14 | P1P2 | 11.57111 | 11.61581 | 8.20521 | 8.33556 | -130.35 |
| Q 14 | P1P2 | 9.45065 | 9.53589 | 6.08475 | 6.25564 | -170.89 |
| P 14 | P1 | 9.29731 | 9.49280 | 5.93141 | 6.21255 | -281.14 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: 82195 1920 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-9052/4 1941 1ST
Note: 82195 was not corrected for level collimation error.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| D 31 | 0.00 | 0.00 | 0.00 | 0.00 | OTHER ST | @ |
| E 31 | -13.07 | 3.89 | 3.19 | 3.37 | CON POST | @ |
| F 31 | -45.07 | 5.01 | 5.59 | 5.59 | BUILDING | |
| H 31 | 1.50 | 6.69 | 9.95 | 9.95 | CON POST | @ |
| P 31 | -55.57 | 10.35 | 23.80 | 23.80 | MET PIPE | |
| J 31 | -17.46 | 11.72 | 30.53 | 30.53 | CON POST | |
| K 31 | -31.16 | 11.73 | 30.53 | 30.58 | MET PIPE# | @ |
| L 31 | -52.39 | 13.21 | 38.81 | 38.81 | BOULDER | |
| T 31 | 17.02 | 15.30 | 52.02 | 52.02 | BEDROCK | |
| O 31 | -44.56 | 15.75 | 55.14 | 55.14 | MET PIPE | |
| V 31 | -36.72 | 15.77 | 55.14 | 55.28 | OTHER ST# | @ |
| Y 31 | -43.96 | 16.73 | 62.25 | 62.25 | MET PIPE | |
| X 30 | -87.81 | 18.33 | 74.65 | 74.65 | OTHER ST | |
| V 30 | -48.68 | 18.88 | 79.27 | 79.27 | MET PIPE | |
| U 30 | -47.78 | 19.29 | 82.70 | 82.70 | CON POST | |
| T 30 | -47.60 | 19.60 | 85.39 | 85.39 | CON POST | |
| Z 30 | -41.20 | 20.79 | 96.04 | 96.04 | OTHER ST | @ |
| Q 30 | -123.19 | 21.06 | 98.60 | 98.60 | OTHER ST | ? |
| O 30 | -76.54 | 21.78 | 105.48 | 105.48 | MET PIPE | |
| L 30 | -60.11 | 22.48 | 112.37 | 112.37 | OTHER ST | |
| K 30 | -72.77 | 22.67 | 114.23 | 114.23 | CON POST | |
| J 30 | -75.90 | 23.01 | 117.69 | 117.69 | MET PIPE | |
| H 30 | -67.38 | 23.73 | 125.13 | 125.13 | CON POST | |
| G 30 | -69.76 | 23.96 | 127.64 | 127.64 | MET PIPE | |
| F 30 | -74.85 | 24.27 | 130.89 | 130.89 | OTHER ST | |
| C 30 | -85.80 | 25.01 | 138.99 | 138.99 | OTHER ST | |
| B 30 | -74.33 | 25.17 | 140.87 | 140.87 | OTHER ST# | |
| A 30 | -81.09 | 25.21 | 141.31 | 141.31 | OTHER ST | |
| Y 14 | -93.58 | 26.10 | 151.40 | 151.40 | CON POST | |
| X 14 | -100.12 | 26.28 | 153.50 | 153.50 | XXXXXXXX | |
| W 14 | -113.82 | 26.50 | 156.10 | 156.10 | OTHER ST | |
| V 14 | -130.35 | 26.71 | 158.58 | 158.58 | OTHER ST | |
| Q 14 | -170.89 | 27.24 | 164.91 | 164.91 | CON POST | |
| P 14 | -281.14 | 27.27 | 165.32 | 165.32 | OTHER ST | |

SD = 2.121 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: 82195 1920 1ST

ASTORIA to PORTLAND 1941 - 1920 -0 746 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T= -12.17
Pr greater abs T = 0.0001



| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| O 14 | P1 | 9.91010 | 9.99476 | 0.00000 | 0.00000 | 0.00 |
| K 23 | P1P2 | 40.24128 | 40.33141 | 30.33118 | 30.33665 | -5.47 |
| L 23 | P1P2 | 67.30807 | 67.40900 | 57.39797 | 57.41424 | -16.27 |
| T 23 | | 62.47994 | 62.58134 | 52.56984 | 52.58658 | -16.74 |
| O 23 | | 46.83303 | 46.97486 | 36.92293 | 36.98010 | -57.17 |
| P 23 | | 33.70842 | 33.83442 | 23.79832 | 23.83966 | -41.34 |
| Q 23 | | 14.36849 | 14.49896 | 4.45839 | 4.50420 | -45.81 |
| S 23 | | 12.09498 | 12.22794 | 2.18488 | 2.23318 | -48.30 |
| U 23 | P1 | 12.38047 | 12.49923 | 2.47037 | 2.50447 | -34.10 |
| V 23 | | 17.58198 | 17.71242 | 7.67188 | 7.71766 | -45.78 |
| W 23 | | 12.69884 | 12.82514 | 2.78874 | 2.83038 | -41.64 |
| Z 23 | | 12.71478 | 12.85766 | 2.80468 | 2.86290 | -58.22 |
| A 24 | P1 | 18.75439 | 18.88947 | 8.84429 | 8.89471 | -50.42 |
| B 24 | | 21.85415 | 22.03534 | 11.94405 | 12.04058 | -96.53 |
| F 24 | | 37.24743 | 37.39386 | 27.33733 | 27.39910 | -61.77 |
| H 24 | | 29.76876 | 29.92091 | 19.85866 | 19.92615 | -67.49 |
| I 24 | | 30.36190 | 30.49648 | 20.45180 | 20.50172 | -49.92 |
| L 24 | | 31.16409 | 31.31330 | 21.25399 | 21.31854 | -64.55 |
| K 24 | P1 | 29.13460 | 29.29292 | 19.22450 | 19.29816 | -73.66 |
| N 24 | | 36.07511 | 36.18785 | 26.16501 | 26.19309 | -28.08 |
| P 24 | P1P2 | 30.75733 | 30.91729 | 20.84723 | 20.92253 | -75.30 |
| O 24 | | 35.16081 | 35.32578 | 25.25071 | 25.33102 | -80.31 |
| Q 24 | P1P2 | 30.37990 | 30.53808 | 20.46980 | 20.54332 | -73.52 |
| V 24 | | 29.36442 | 29.53521 | 19.45432 | 19.54045 | -86.13 |
| X 24 | P1P2 | 31.69725 | 31.86567 | 21.78715 | 21.87091 | -83.76 |
| Y 24 | P1P2 | 38.64504 | 38.80378 | 28.73494 | 28.80902 | -74.08 |
| A 25 | | 30.94019 | 31.12671 | 21.03009 | 21.13195 | -101.86 |
| B 25 | | 29.66901 | 29.83386 | 19.75891 | 19.83910 | -80.19 |
| C 25 | | 31.96586 | 32.12061 | 22.05576 | 22.12585 | -70.09 |
| E 25 | P1P2 | 34.29305 | 34.44659 | 24.38295 | 24.45183 | -68.88 |
| F 25 | P1P2 | 41.25833 | 41.41371 | 31.34823 | 31.41895 | -70.72 |
| G 25 | | 41.35624 | 41.50994 | 31.44614 | 31.51518 | -69.04 |
| J 25 | P1P2 | 48.93425 | 49.08895 | 39.02415 | 39.09419 | -70.04 |
| K 25 | | 53.19794 | 53.35165 | 43.28784 | 43.35689 | -69.05 |
| P 25 | P1P2 | 48.66894 | 48.83722 | 38.75884 | 38.84246 | -83.62 |
| L 25 | | 46.04671 | 46.20971 | 36.13661 | 36.21495 | -78.34 |
| M 25 | | 50.84254 | 51.00964 | 40.93244 | 41.01488 | -82.44 |
| N 25 | | 49.41588 | 49.58950 | 39.50578 | 39.59474 | -88.96 |
| O 25 | P1P2 | 52.34128 | 52.51905 | 42.43118 | 42.52429 | -93.11 |
| Y 25 | P1P2 | 54.72951 | 54.90543 | 44.81941 | 44.91067 | -91.26 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: 82270 1921 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-9402 1941/42 1ST
Note: 82270 was not corrected for level collimation error.

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| O 14 | 0.00 | 0.00 | 0.00 | 0.00 | XXXXXXXX | |
| K 23 | -5.47 | 4.09 | 3.71 | 3.71 | OTHER ST | |
| L 23 | -16.27 | 5.94 | 7.84 | 7.84 | OTHER ST | |
| T 23 | -16.74 | 7.11 | 11.24 | 11.24 | MET PIPE | @ |
| O 23 | -57.17 | 8.74 | 16.97 | 16.97 | XXXXXXXX | |
| P 23 | -41.34 | 9.61 | 20.51 | 20.51 | OTHER ST | |
| Q 23 | -45.81 | 10.50 | 24.50 | 24.50 | OTHER ST | |
| S 23 | -48.30 | 11.28 | 28.26 | 28.26 | OTHER ST | |
| U 23 | -34.10 | 12.03 | 32.15 | 32.15 | OTHER ST | |
| V 23 | -45.78 | 12.97 | 37.40 | 37.40 | MET PIPE | |
| W 23 | -41.64 | 13.57 | 40.91 | 40.91 | OTHER ST | |
| Z 23 | -58.22 | 15.10 | 50.70 | 50.70 | OTHER ST | |
| A 24 | -50.42 | 15.56 | 53.85 | 53.85 | CON POST | |
| B 24 | -96.53 | 16.11 | 57.71 | 57.71 | XXXXXXXX | |
| F 24 | -61.77 | 17.84 | 70.71 | 70.71 | OTHER ST | |
| H 24 | -67.49 | 18.81 | 78.66 | 78.66 | XXXXXXXX | |
| I 24 | -49.92 | 19.08 | 80.95 | 80.95 | CON POST | |
| L 24 | -64.55 | 19.87 | 87.74 | 87.74 | MET PIPE | |
| K 24 | -73.66 | 20.01 | 89.02 | 89.02 | BEDROCK | |
| N 24 | -28.08 | 20.65 | 94.82 | 94.82 | BEDROCK | |
| P 24 | -75.30 | 21.24 | 100.25 | 100.25 | MET PIPE | |
| O 24 | -80.31 | 21.24 | 100.25 | 100.29 | OTHER ST# | @ |
| Q 24 | -73.52 | 21.28 | 100.63 | 100.63 | OTHER ST | |
| V 24 | -86.13 | 23.17 | 119.29 | 119.29 | BOULDER | |
| X 24 | -83.76 | 23.79 | 125.76 | 125.76 | BEDROCK | |
| Y 24 | -74.08 | 24.14 | 129.58 | 129.58 | OTHER ST | |
| A 25 | -101.86 | 24.54 | 133.87 | 133.87 | BUILDING | |
| B 25 | -80.19 | 24.55 | 134.01 | 134.01 | BUILDING | |
| C 25 | -70.09 | 24.60 | 134.57 | 134.57 | XXXXXXXX# | |
| E 25 | -68.88 | 24.90 | 137.77 | 137.77 | OTHER ST | |
| F 25 | -70.72 | 25.07 | 139.70 | 139.70 | OTHER ST | |
| G 25 | -69.04 | 25.21 | 141.23 | 141.30 | OTHER ST | @ |
| J 25 | -70.04 | 25.71 | 146.89 | 146.89 | BEDROCK | |
| K 25 | -69.05 | 25.81 | 148.06 | 148.06 | ??????? | |
| P 25 | -83.62 | 26.30 | 153.70 | 153.70 | MET PIPE | |
| L 25 | -78.34 | 26.31 | 153.88 | 153.88 | OTHER ST# | |
| M 25 | -82.44 | 26.74 | 158.91 | 158.91 | OTHER ST | |
| N 25 | -88.96 | 26.98 | 161.76 | 161.76 | OTHER ST | |
| O 25 | -93.11 | 27.38 | 166.66 | 166.66 | MET PIPE | |
| Y 25 | -91.26 | 28.03 | 174.68 | 174.68 | XXXXXXXX | |

SD = 2.121 * SQRT(DSD) MM

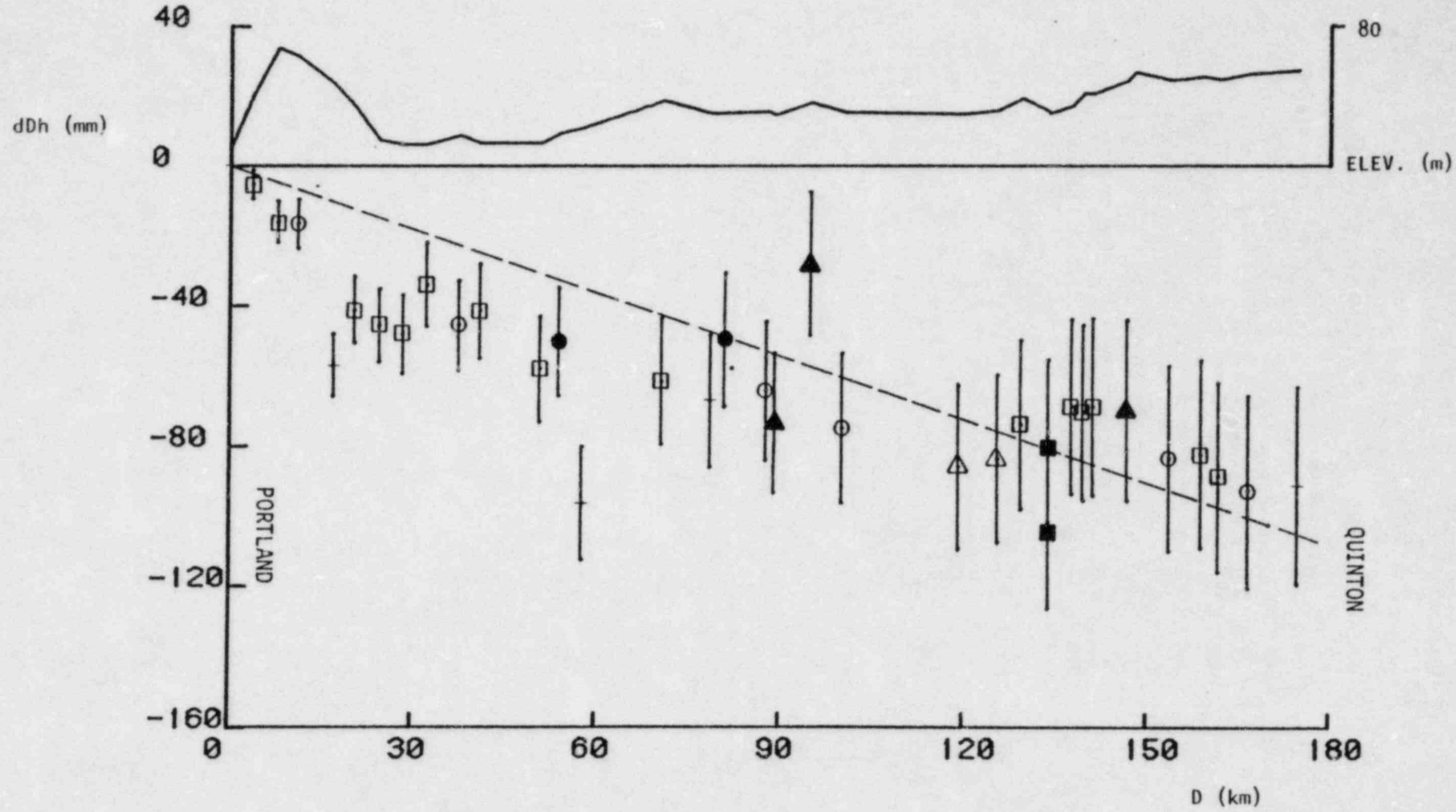
\# BM NOT PLOTTED ON PROFILE

? BM NOT USED IN REGRESSION

@ BM ON SPUR

D & DSD CALC. FROM REDUC4 OUTPUT: 82270 1921 1ST

PORTLAND to approx. 5 mi W of QUINTON 1941/42 - 1921 -0.603 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -18.98
Pr greater abs T = 0.0001



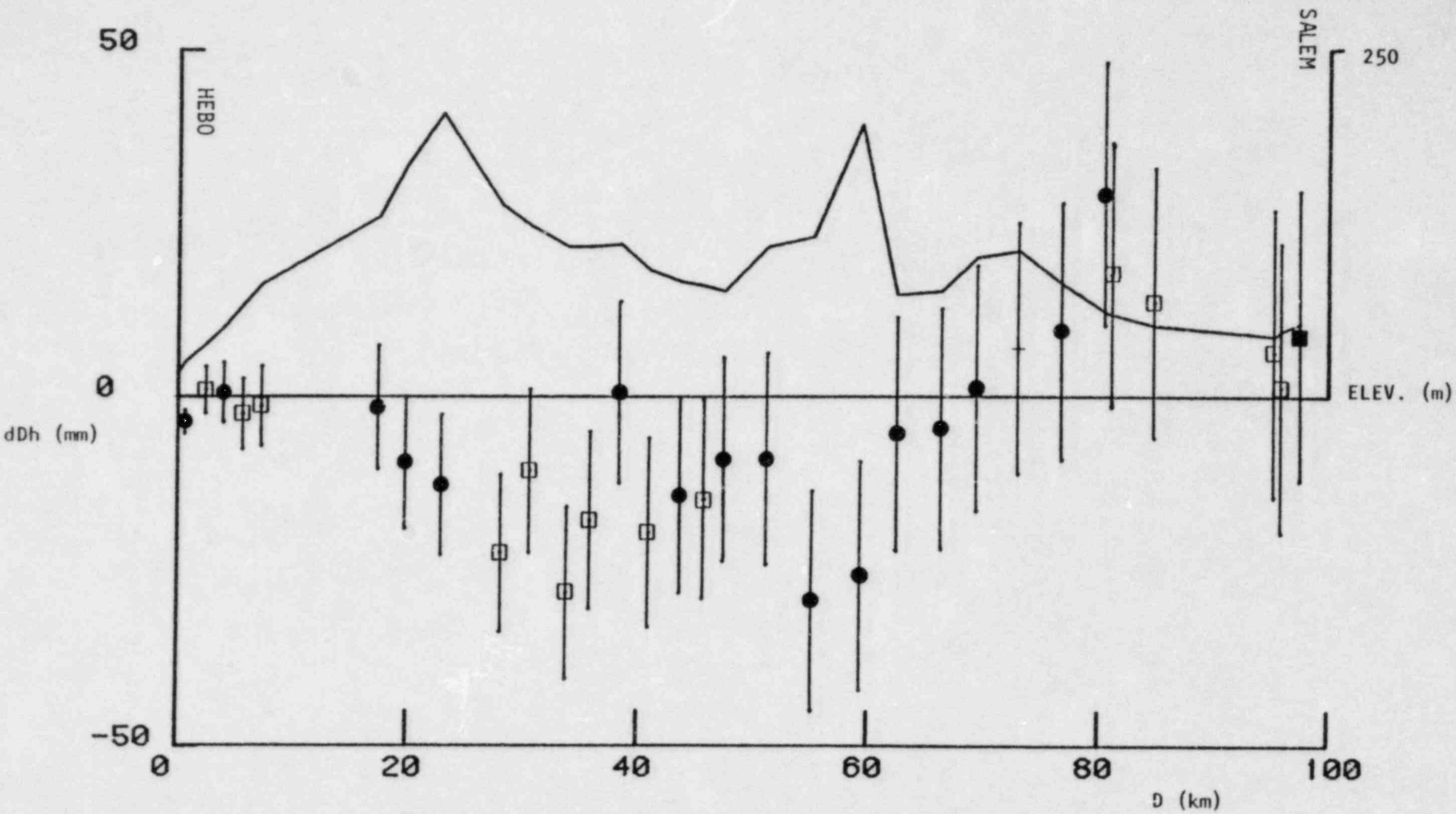
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| K 49 | P1P2 | 16.46336 | 16.30420 | 0.00000 | 0.00000 | 0.00 |
| J 49 | | 24.82319 | 24.66779 | 8.35983 | 8.36359 | -3.76 |
| H 50 | | 37.66983 | 37.50981 | 21.20647 | 21.20561 | 0.86 |
| J 50 | | 50.13251 | 49.97279 | 33.66915 | 33.66859 | 0.56 |
| K 50 | | 66.40546 | 66.24895 | 49.94210 | 49.94475 | -2.65 |
| L 50 | | 81.51730 | 81.35953 | 65.05394 | 65.05533 | -1.39 |
| S 50 | | 130.13446 | 129.97687 | 113.67110 | 113.67267 | -1.57 |
| T 50 | | 167.40603 | 167.25645 | 150.94267 | 150.95225 | -9.58 |
| U 50 | | 204.68473 | 204.53828 | 188.22137 | 188.23408 | -12.71 |
| W 50 | | 137.84154 | 137.70495 | 121.37818 | 121.40075 | -22.57 |
| X 50 | | 122.69864 | 122.55020 | 106.23528 | 106.24600 | -10.72 |
| Y 50 | | 107.80411 | 107.67319 | 91.34075 | 91.36899 | -28.24 |
| Z 50 | P1P2 | 108.27904 | 108.13767 | 91.81568 | 91.83347 | -17.79 |
| A 51 | | 109.99246 | 109.83274 | 93.52910 | 93.52854 | 0.56 |
| B 51 | | 90.98643 | 90.84691 | 74.52307 | 74.54271 | -19.64 |
| D 51 | | 82.71030 | 82.56539 | 66.24694 | 66.26119 | -14.25 |
| E 51 | | 79.24131 | 79.09691 | 62.77795 | 62.79271 | -14.76 |
| G 51 | | 75.75844 | 75.60834 | 59.29508 | 59.30414 | -9.06 |
| F 51 | | 72.59162 | 72.45228 | 56.12826 | 56.14808 | -19.82 |
| H 51 | | 108.10640 | 107.95630 | 91.64304 | 91.65210 | -9.06 |
| J 51 | | 115.45191 | 115.32206 | 98.98855 | 99.01786 | -29.31 |
| K 51 | | 196.85086 | 196.71743 | 180.38750 | 180.41323 | -25.73 |
| L 51 | | 73.42173 | 73.26793 | 56.95837 | 56.96373 | -5.36 |
| M 51 | | 76.18697 | 76.03243 | 59.72361 | 59.72823 | -4.62 |
| N 51 | | 100.65763 | 100.49724 | 84.19427 | 84.19304 | 1.23 |
| P 51 | P1P2 | 105.33838 | 105.17225 | 88.87502 | 88.86805 | 6.97 |
| R 51 | | 95.76838 | 95.60672 | 79.30502 | 79.30252 | 2.50 |
| MAG STA | P1P2 | 97.60782 | 97.42704 | 81.14446 | 81.12284 | 21.62 |
| S 51 | | 80.79842 | 80.62990 | 64.33506 | 64.32570 | 9.36 |
| T 51 | | 60.77619 | 60.58778 | 44.31283 | 44.28358 | 29.25 |
| U 51 | | 58.52490 | 58.34818 | 42.06154 | 42.04398 | 17.56 |
| V 51 | | 50.66366 | 50.49098 | 34.20030 | 34.18678 | 13.52 |
| X 51 | | 42.71171 | 42.54637 | 26.24835 | 26.24217 | 6.18 |
| Y 51 | | 47.04370 | 46.88338 | 30.58034 | 30.57918 | 1.16 |
| Z 51 | | 44.46241 | 44.29902 | 27.99905 | 27.99482 | 4.23 |
| A 52 | P1P2 | 52.79645 | 52.62856 | 36.33309 | 36.32436 | 8.73 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: L-163 1930 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-9155 1941 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE |
|---|---|---|---|---|---|
| K 49 | 0.00 | 0.00 | 0.00 | 0.00 | XXXXXXXX |
| J 49 | -3.76 | 1.66 | 0.61 | 0.61 | CON POST |
| H 50 | 0.86 | 3.33 | 2.47 | 2.47 | OTHER ST |
| J 50 | 0.56 | 4.26 | 4.03 | 4.03 | CON POST |
| K 50 | -2.65 | 5.07 | 5.71 | 5.71 | OTHER ST |
| L 50 | -1.39 | 5.74 | 7.33 | 7.33 | OTHER ST |
| S 50 | -1.57 | 8.86 | 17.45 | 17.45 | CON POST |
| T 50 | -9.58 | 9.44 | 19.79 | 19.79 | CON POST |
| U 50 | -12.71 | 10.15 | 22.90 | 22.90 | CON POST |
| W 50 | -22.57 | 11.24 | 28.10 | 28.10 | OTHER ST |
| X 50 | -10.72 | 11.73 | 30.56 | 30.56 | OTHER ST |
| Y 50 | -28.24 | 12.34 | 33.86 | 33.86 | OTHER ST |
| Z 50 | -17.79 | 12.70 | 35.85 | 35.85 | OTHER ST |
| A 51 | 0.56 | 13.14 | 38.36 | 38.36 | CON POST |
| B 51 | -19.64 | 13.57 | 40.92 | 40.92 | OTHER ST |
| D 51 | -14.25 | 14.01 | 43.66 | 43.66 | CON POST |
| E 51 | -14.76 | 14.33 | 45.62 | 45.62 | OTHER ST |
| G 51 | -9.06 | 14.60 | 47.37 | 47.37 | CON POST |
| F 51 | -19.82 | 14.68 | 47.37 | 47.90 | OTHER ST# @ |
| H 51 | -9.06 | 15.18 | 51.19 | 51.19 | CON POST |
| J 51 | -29.31 | 15.75 | 55.15 | 55.15 | CON POST |
| K 51 | -25.73 | 16.34 | 59.36 | 59.36 | CON POST |
| L 51 | -5.36 | 16.76 | 62.45 | 62.45 | CON POST |
| M 51 | -4.62 | 17.28 | 66.37 | 66.37 | CON POST |
| N 51 | 1.23 | 17.67 | 69.37 | 69.37 | CON POST |
| P 51 | 6.97 | 18.12 | 73.02 | 73.02 | XXXXXXXX |
| R 51 | 2.50 | 18.20 | 73.02 | 73.60 | OTHER ST# @ |
| MAG STA | 21.62 | 18.29 | 73.02 | 74.33 | CON POST# @ |
| S 51 | 9.36 | 18.59 | 76.82 | 76.82 | CON POST |
| T 51 | 29.25 | 19.04 | 80.58 | 80.58 | CON POST |
| U 51 | 17.56 | 19.10 | 81.12 | 81.12 | OTHER ST |
| V 51 | 13.52 | 19.54 | 84.86 | 84.86 | OTHER ST |
| X 51 | 6.18 | 20.70 | 95.21 | 95.21 | OTHER ST |
| Y 51 | 1.16 | 20.77 | 95.87 | 95.87 | OTHER ST |
| Z 51 | 4.23 | 20.78 | 95.87 | 95.98 | OTHER ST# @ |
| A 52 | 8.73 | 20.94 | 97.47 | 97.47 | BUILDING |

SD = 2.121 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: L-163 1930 1ST

HEBO to SALEM 1941 - 1920 -0.007 mm/km (regression line not shown)
refraction - corrected
length o f bars = ±1 standard deviation
T = -0.17
Pr greater abs T = 0.8691



| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| S 52 | P1P2 | 42.81330 | 42.68970 | 0.00000 | 0.00000 | 0.00 |
| U 52 | | 102.74629 | 102.63550 | 59.93299 | 59.94580 | -12.81 |
| V 52 | | 3.13582 | 3.01783 | -39.67748 | -39.67187 | -5.61 |
| W 52 | | 4.33156 | 4.25854 | -38.48174 | -38.43116 | -50.58 |
| X 52 | | 19.43787 | 19.33637 | -23.37543 | -23.35333 | -22.10 |
| Y 52 | | 9.49303 | 9.38531 | -33.32027 | -33.30439 | -15.88 |
| Z 52 | | 7.19115 | 7.11223 | -35.62215 | -35.57747 | -44.68 |
| A 53 | | 21.67436 | 21.57634 | -21.13894 | -21.11336 | -25.58 |
| B 53 | P1P2 | 127.17785 | 127.07356 | 84.36455 | 84.38386 | -19.31 |
| C 53 | | 37.69749 | 37.59197 | -5.11581 | -5.09773 | -18.08 |
| D 53 | | 12.09158 | 11.98116 | -30.72172 | -30.70854 | -13.18 |
| F 53 | | 18.55477 | 18.44363 | -24.25853 | -24.24607 | -12.46 |
| G 53 | | 25.24470 | 25.12848 | -17.56860 | -17.56122 | -7.38 |
| H 53 | | 28.03702 | 27.93862 | -14.77628 | -14.75108 | -25.20 |
| J 53 | | 27.88429 | 27.76979 | -14.92901 | -14.91991 | -9.10 |
| K 53 | | 30.93550 | 30.84030 | -11.87780 | -11.84940 | -28.40 |
| L 53 | | 44.35069 | 44.23905 | 1.53739 | 1.54935 | -11.96 |
| M 53 | | 60.23065 | 60.12639 | 17.41735 | 17.43669 | -19.34 |
| N 53 | | 86.23729 | 86.12661 | 43.42399 | 43.43691 | -12.92 |
| P 53 | | 245.13223 | 245.02445 | 202.31893 | 202.33475 | -15.82 |
| U 53 | | 205.92323 | 205.82777 | 163.10993 | 163.13807 | -28.14 |
| V 53 | | 202.18845 | 202.09255 | 159.37515 | 159.40285 | -27.70 |
| W 53 | | 199.67838 | 199.57634 | 156.86508 | 156.88664 | -21.56 |
| X 53 | | 228.39103 | 228.28236 | 185.57773 | 185.59266 | -14.93 |
| Y 53 | | 230.18180 | 230.07759 | 187.36850 | 187.38789 | -19.39 |
| Z 53 | | 192.72891 | 192.63672 | 149.91561 | 149.94702 | -31.41 |
| A 54 | | 216.97778 | 216.86664 | 174.16448 | 174.17694 | -12.46 |
| B 54 | | 243.03507 | 242.93114 | 200.22177 | 200.24144 | -19.67 |
| C 54 | | 177.50837 | 177.39686 | 134.69507 | 134.70716 | -12.09 |
| D 54 | | 135.16049 | 135.04920 | 92.34719 | 92.35950 | -12.31 |
| E 54 | | 131.33074 | 131.21798 | 88.51744 | 88.52828 | -10.84 |
| F 54 | P1P2 | 156.06856 | 155.95764 | 113.25526 | 113.26794 | -12.68 |
| G 54 | | 210.47564 | 210.35760 | 167.66234 | 167.66790 | -5.56 |
| H 54 | | 95.07272 | 94.92859 | 52.25942 | 52.23889 | 20.53 |
| W 54 | | 87.37336 | 87.25471 | 44.56006 | 44.56501 | -4.95 |
| J 54 | | 85.05466 | 84.91928 | 42.24136 | 42.22958 | 11.78 |
| T 54 | | 76.48229 | 76.38354 | 33.66899 | 33.69384 | -24.85 |
| U 54 | | 76.54958 | 76.44191 | 33.73628 | 33.75221 | -15.93 |
| V 54 | | 72.35250 | 72.24225 | 29.53920 | 29.55255 | -13.35 |
| 235 USGS | | 71.62467 | 71.51486 | 28.81137 | 28.82516 | -13.79 |
| MAG STA | | 68.84501 | 68.71942 | 26.03171 | 26.02972 | 1.99 |
| K 54 | | 68.42282 | 68.31647 | 25.60952 | 25.62677 | -17.25 |
| L 54 | | 61.67263 | 61.57318 | 18.85933 | 18.88348 | -24.15 |
| M 54 | | 69.19281 | 69.08105 | 26.37951 | 26.39135 | -11.84 |
| N 54 | | 58.59030 | 58.48897 | 15.77700 | 15.79927 | -22.27 |
| S 54 | P1P2 | 63.36898 | 63.26453 | 20.55568 | 20.57483 | -19.15 |
| P 54 | P1P2 | 63.03266 | 62.93222 | 20.21936 | 20.24252 | -23.16 |
| R 54 | | 62.20718 | 62.10791 | 19.39388 | 19.41821 | -24.33 |
| O 12 | P1P2 | 65.10957 | 65.00992 | 22.29627 | 22.32022 | -23.95 |

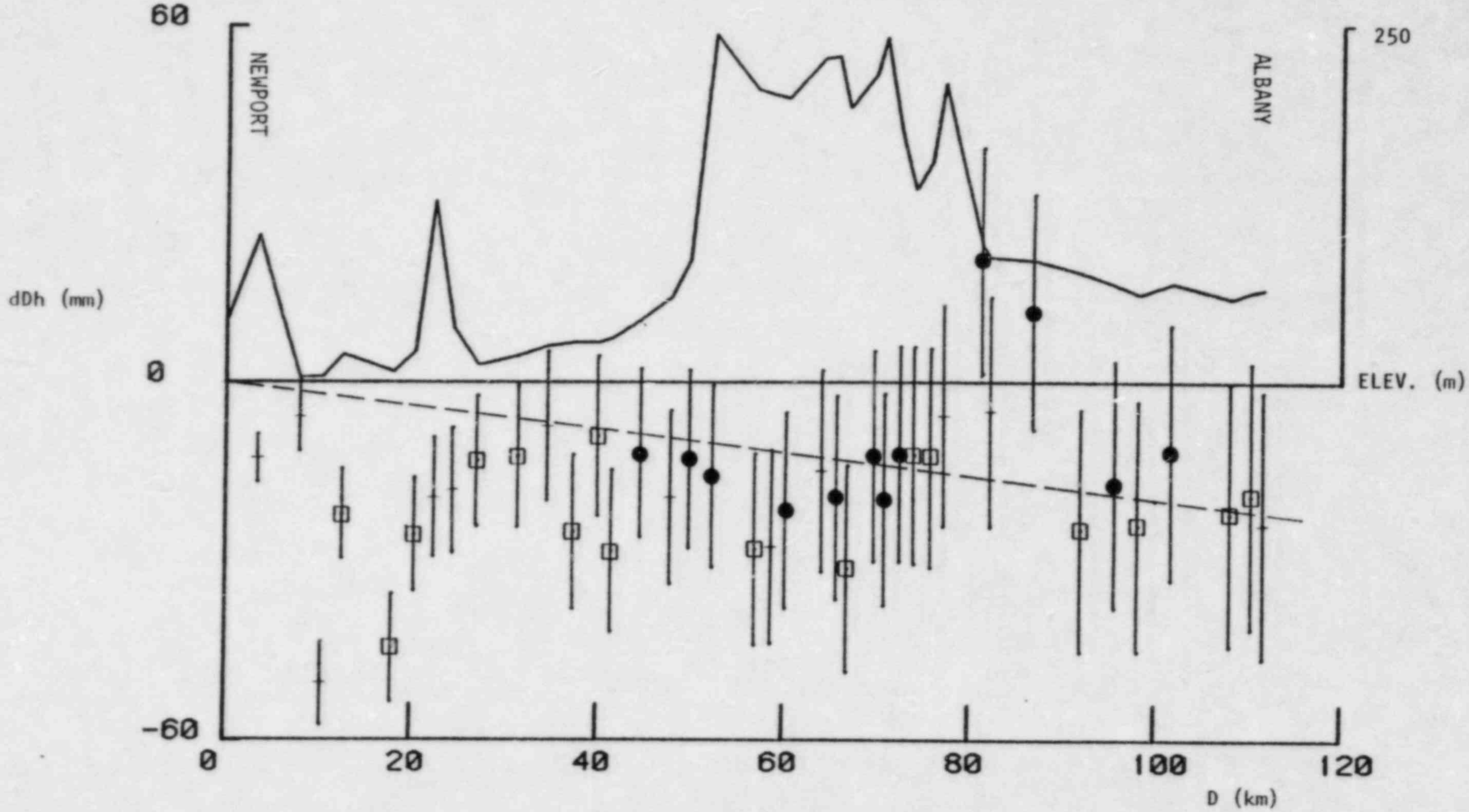
LINE 1 OH DATA FROM REDUC4 OUTPUT: L-176 1930 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-9145 1941 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| S 52 | 0.00 | 0.00 | 0.00 | 0.00 | XXXXXXXX | |
| U 52 | -12.81 | 3.97 | 3.51 | 3.51 | XXXXXXXX | |
| V 52 | -5.61 | 6.01 | 7.99 | 8.02 | XXXXXXXX | @ |
| W 52 | -50.58 | 6.87 | 10.49 | 10.49 | XXXXXXXX | |
| X 52 | -22.10 | 7.53 | 12.62 | 12.62 | OTHER ST | |
| Y 52 | -15.88 | 7.61 | 12.62 | 12.87 | BUILDING# | @ |
| Z 52 | -44.68 | 9.00 | 18.00 | 18.00 | OTHER ST | |
| A 53 | -25.58 | 9.57 | 20.36 | 20.36 | OTHER ST | |
| B 53 | -19.31 | 10.04 | 22.39 | 22.39 | XXXXXXXX | |
| C 53 | -18.08 | 10.49 | 24.46 | 24.46 | XXXXXXXX | |
| D 53 | -13.18 | 11.02 | 27.02 | 27.02 | OTHER ST | |
| F 53 | -12.46 | 11.89 | 31.44 | 31.44 | OTHER ST | |
| G 53 | -7.38 | 12.47 | 34.54 | 34.54 | XXXXXXXX | |
| H 53 | -25.20 | 12.98 | 37.45 | 37.45 | OTHER ST | |
| J 53 | -9.10 | 13.42 | 40.04 | 40.04 | OTHER ST | |
| K 53 | -28.40 | 13.66 | 41.50 | 41.50 | OTHER ST | |
| L 53 | -11.96 | 14.17 | 44.65 | 44.65 | CON POST | |
| M 53 | -19.34 | 14.67 | 47.85 | 47.85 | OTHER ST | |
| N 53 | -12.92 | 14.97 | 49.82 | 49.82 | CON POST | |
| P 53 | -15.82 | 15.35 | 52.39 | 52.39 | CON POST | |
| U 53 | -28.14 | 16.00 | 56.93 | 56.93 | OTHER ST | |
| V 53 | -27.70 | 16.25 | 58.73 | 58.73 | XXXXXXXX | |
| W 53 | -21.56 | 16.47 | 60.31 | 60.31 | CON POST | |
| X 53 | -14.93 | 16.99 | 64.18 | 64.18 | XXXXXXXX | |
| Y 53 | -19.39 | 17.20 | 65.74 | 65.74 | CON POST | |
| Z 53 | -31.41 | 17.35 | 66.88 | 66.88 | OTHER ST | |
| A 54 | -12.46 | 17.72 | 69.76 | 69.76 | CON POST | |
| B 54 | -19.67 | 17.85 | 70.86 | 70.86 | CON POST | |
| C 54 | -12.09 | 18.06 | 72.51 | 72.51 | CON POST | |
| D 54 | -12.31 | 18.26 | 74.14 | 74.14 | OTHER ST | |
| E 54 | -10.84 | 18.32 | 74.59 | 74.59 | OTHER ST# | |
| F 54 | -12.68 | 18.47 | 75.87 | 75.87 | OTHER ST | |
| G 54 | -5.56 | 18.64 | 77.23 | 77.23 | XXXXXXXX | |
| H 54 | 20.53 | 19.14 | 81.42 | 81.42 | CON POST | |
| W 54 | -4.95 | 19.35 | 82.30 | 83.27 | XXXXXXXX | @ |
| J 54 | 11.78 | 19.77 | 86.91 | 86.91 | CON POST | |
| T 54 | -24.85 | 20.34 | 91.98 | 91.98 | BUILDING | |
| U 54 | -15.93 | 20.37 | 91.98 | 92.23 | BUILDING# | @ |
| V 54 | -13.35 | 20.41 | 91.98 | 92.59 | BUILDING# | @ |
| 235 USGS | -13.79 | 20.40 | 92.49 | 92.52 | MET PIPE# | @ |
| MAG STA | 1.99 | 20.41 | 92.62 | 92.62 | XXXXXXXX# | |
| K 54 | -17.25 | 20.74 | 95.64 | 95.64 | CON POST | |
| L 54 | -24.15 | 21.02 | 98.17 | 98.17 | OTHER ST | |
| M 54 | -11.84 | 21.39 | 101.72 | 101.72 | CON POST | |
| N 54 | -22.27 | 22.05 | 108.06 | 108.06 | OTHER ST | |
| S 54 | -19.15 | 22.28 | 110.32 | 110.32 | OTHER ST | |
| P 54 | -23.16 | 22.32 | 110.69 | 110.69 | OTHER ST# | |
| R 54 | -24.33 | 22.32 | 110.69 | 110.72 | OTHER ST# | @ |
| O 12 | -23.95 | 22.41 | 111.59 | 111.59 | XXXXXXXX | |

SD = 2.121 * SQRT(DSD) MM
\# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION

@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: L-176 1930 1ST

NEWPORT to ALBANY 1941 - 1930 -0.198 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -6.34
Pr greater abs T = 0.0001



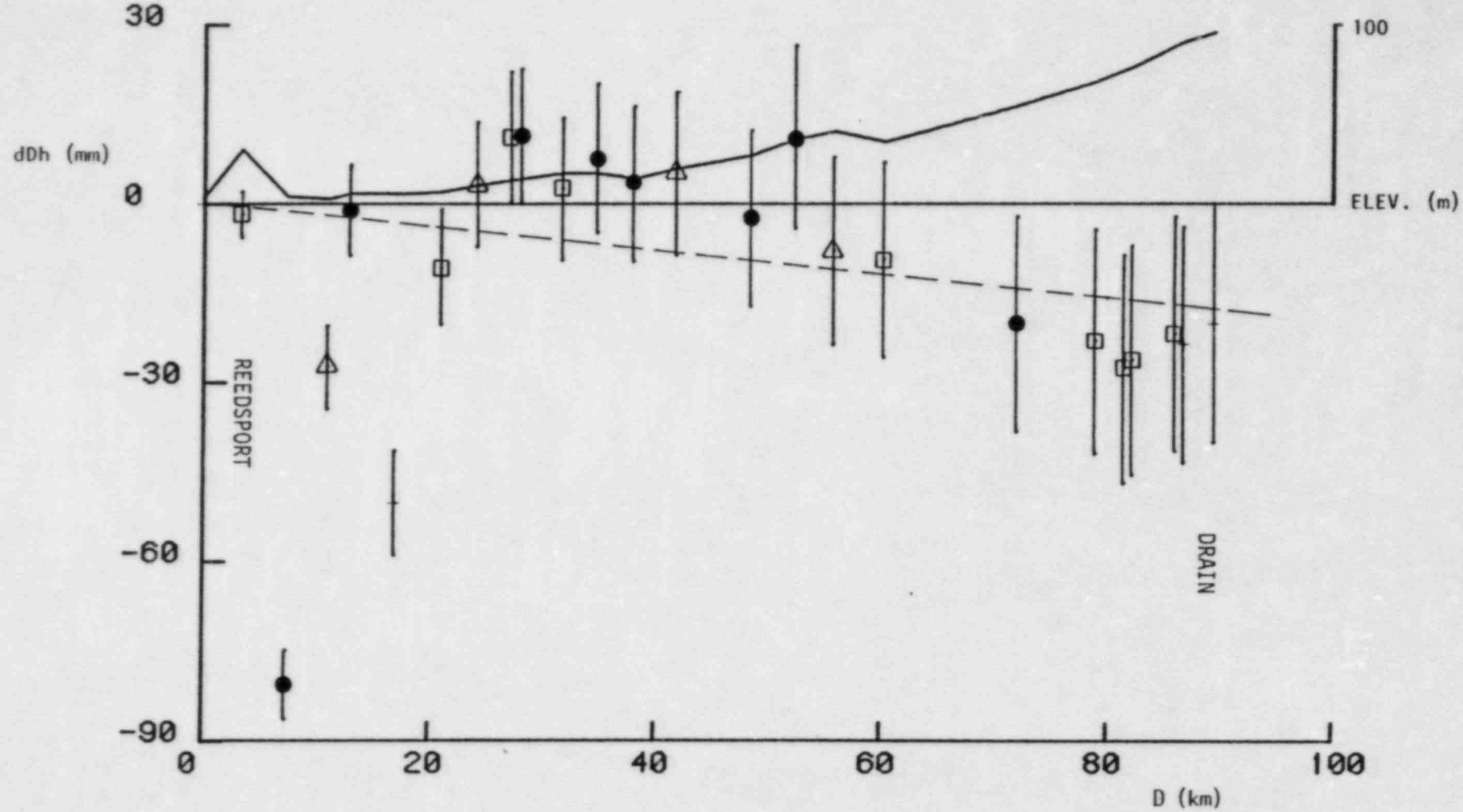
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| C 56 | P1P2 | 3.66821 | 3.64094 | 0.00000 | 0.00000 | 0.00 |
| A 56 | P1P2 | 30.28117 | 30.25582 | 26.61296 | 26.61488 | -1.92 |
| Z 55 | | 3.59700 | 3.65045 | -0.07121 | 0.00951 | -80.72 |
| Y 55 | | 2.37852 | 2.37872 | -1.28969 | -1.26222 | -27.47 |
| X 55 | | 5.65833 | 5.63219 | 1.99012 | 1.99125 | -1.13 |
| W 55 | | 5.24884 | 5.27193 | 1.58063 | 1.63099 | -50.36 |
| V 55 | | 6.57293 | 6.55632 | 2.90472 | 2.91538 | -10.66 |
| U 55 | | 10.18896 | 10.15855 | 6.52075 | 6.51761 | 3.14 |
| T 55 | | 13.26364 | 13.22521 | 9.59543 | 9.58427 | 11.16 |
| 32 USGS | | 9.76404 | 9.72347 | 6.09583 | 6.08253 | 13.30 |
| 40 USGS | | 12.13347 | 12.09335 | 8.46526 | 8.45241 | 12.85 |
| S 55 | | 14.03209 | 13.99345 | 10.36388 | 10.35251 | 11.37 |
| R 55 | | 17.08920 | 17.05950 | 13.42099 | 13.41856 | 2.43 |
| P 55 | | 16.68587 | 16.65097 | 13.01766 | 13.01003 | 7.63 |
| N 55 | | 13.91209 | 13.88151 | 10.24388 | 10.24057 | 3.31 |
| 65 USGS | | 19.79272 | 19.76039 | 16.12451 | 16.11945 | 5.06 |
| L 55 | | 27.30423 | 27.27945 | 23.63602 | 23.63851 | -2.49 |
| K 55 | | 36.43808 | 36.39955 | 32.76987 | 32.75861 | 11.26 |
| 133 USGS | | 40.50477 | 40.48551 | 36.83656 | 36.84457 | -8.01 |
| 118 USGS | | 35.68592 | 35.66743 | 32.01771 | 32.02649 | -8.78 |
| J 55 | | 34.60072 | 34.58293 | 30.93251 | 30.94199 | -9.48 |
| E 55 | | 54.81584 | 54.80887 | 51.14763 | 51.16793 | -20.30 |
| A 55 | | 68.64726 | 68.64325 | 64.97905 | 65.00231 | -23.26 |
| Z 54 | | 74.93662 | 74.93721 | 71.26841 | 71.29627 | -27.86 |
| Y 54 | | 76.72024 | 76.71933 | 73.05203 | 73.07839 | -26.36 |
| X 54 | P1P2 | 88.70751 | 88.70213 | 85.03930 | 85.06119 | -21.89 |
| T 10 | | 90.95762 | 90.95408 | 87.28941 | 87.31314 | -23.73 |
| U 10 | P1P2 | 95.72920 | 95.72200 | 92.06099 | 92.08106 | -20.07 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: L-188 1930 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: L-9117 1941 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE |
|---|---|---|---|---|---|
| C 56 | 0.00 | 0.00 | 0.00 | 0.00 | XXXXXXXX |
| A 56 | -1.92 | 3.87 | 3.33 | 3.33 | OTHER ST |
| Z 55 | -80.72 | 5.76 | 7.39 | 7.39 | CON POST |
| Y 55 | -27.47 | 7.03 | 10.99 | 10.99 | BOULDER |
| X 55 | -1.13 | 7.63 | 12.95 | 12.95 | CON POST |
| W 55 | -50.36 | 8.74 | 16.97 | 16.97 | XXXXXXXX |
| V 55 | -10.66 | 9.70 | 20.93 | 20.93 | OTHER ST |
| U 55 | 3.14 | 10.41 | 24.11 | 24.11 | BOULDER |
| T 55 | 11.16 | 11.04 | 27.09 | 27.09 | OTHER ST |
| 32 USGS | 13.30 | 11.21 | 27.91 | 27.91 | BOULDER # |
| 40 USGS | 12.85 | 11.21 | 27.94 | 27.94 | BOULDER # |
| S 55 | 11.37 | 11.23 | 28.01 | 28.01 | CON POST |
| R 55 | 2.43 | 11.93 | 31.66 | 31.66 | OTHER ST |
| P 55 | 7.63 | 12.50 | 34.72 | 34.72 | CON POST |
| N 55 | 3.31 | 13.07 | 37.99 | 37.99 | CON POST |
| 65 USGS | 5.06 | 13.69 | 41.69 | 41.69 | BOULDER |
| L 55 | -2.49 | 14.75 | 48.35 | 48.35 | CON POST |
| K 55 | 11.26 | 15.34 | 52.30 | 52.30 | CON POST |
| 133 USGS | -8.01 | 15.83 | 55.70 | 55.70 | BOULDER |
| 118 USGS | -8.78 | 16.41 | 59.88 | 59.88 | BOULDER # |
| J 55 | -9.48 | 16.45 | 60.17 | 60.17 | OTHER ST |
| E 55 | -20.30 | 18.00 | 72.02 | 72.02 | CON POST |
| A 55 | -23.26 | 18.85 | 78.96 | 78.96 | OTHER ST |
| Z 54 | -27.86 | 19.15 | 81.51 | 81.51 | OTHER ST |
| Y 54 | -26.36 | 19.24 | 82.26 | 82.26 | OTHER ST |
| X 54 | -21.89 | 19.68 | 86.05 | 86.05 | OHTER ST |
| T 10 | -23.73 | 19.76 | 86.79 | 86.79 | XXXXXXXX |
| U 10 | -20.07 | 20.06 | 89.49 | 89.49 | XXXXXXXX |

SD = 2.121 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: L-188 1930 1ST

REEDSPORT to DRAIN 1941 - 1930 -0.197 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -2.48
Pr greater abs T = 0.0199



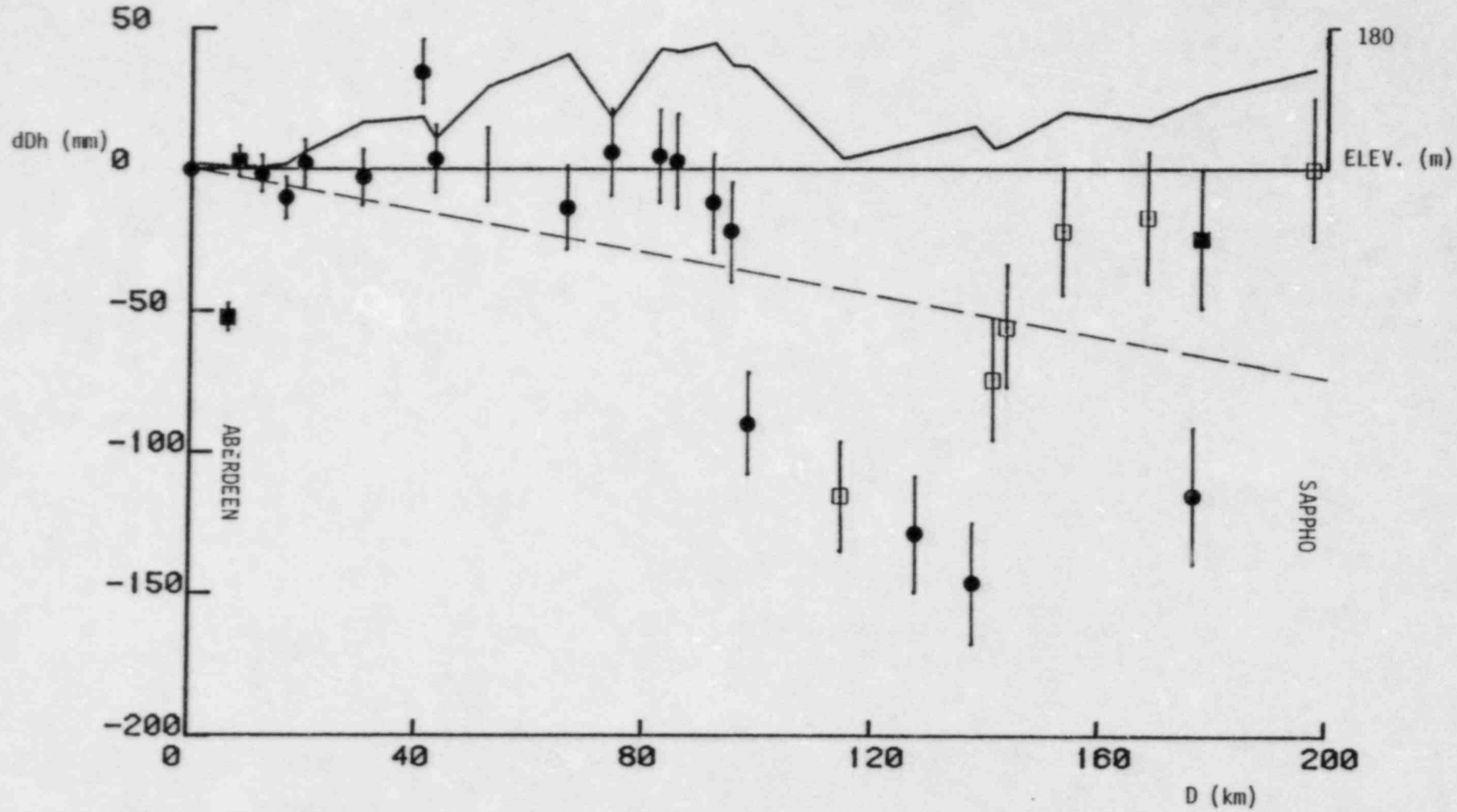
| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| ABERDEEN | P1P2 | 5.88815 | 6.03216 | 0.00000 | 0.00000 | 0.00 |
| TIDAL 2 | | 3.18168 | 3.55953 | -2.70647 | -2.47263 | -233.84 |
| X 25 | P1P2 | 3.40738 | 3.60373 | -2.48077 | -2.42843 | -52.34 |
| Y 25 | | 3.83938 | 3.98051 | -2.04877 | -2.05165 | 2.88 |
| Z 25 | P1P2 | 3.08767 | 3.23343 | -2.80048 | -2.79873 | -1.75 |
| A 26 | | 5.57999 | 5.73445 | -0.30816 | -0.29771 | -10.45 |
| B 26 | | 21.56128 | 21.70329 | 15.67313 | 15.67113 | 2.00 |
| E 26 | | 60.47808 | 60.62508 | 54.58993 | 54.59292 | -2.99 |
| G 26 | | 67.11135 | 67.22077 | 61.22320 | 61.18861 | 34.59 |
| L 8 USGS | | 40.03291 | 40.17344 | 34.14476 | 34.14128 | 3.48 |
| K 26 | | 106.04090 | 106.18324 | 100.15275 | 100.15108 | 1.67 |
| N 26 | P1P2 | 147.25830 | 147.41596 | 141.37015 | 141.38380 | -13.65 |
| Q 26 | | 66.85395 | 66.99206 | 60.96580 | 60.95990 | 5.90 |
| T 26 | | 154.56386 | 154.70325 | 148.67571 | 148.67109 | 4.62 |
| U 26 | | 150.23073 | 150.37184 | 144.34258 | 144.33968 | 2.90 |
| W 26 | | 161.79545 | 161.95153 | 155.90730 | 155.91937 | -12.07 |
| X 26 | | 132.80403 | 132.97059 | 126.91588 | 126.93843 | -22.55 |
| Y 26 | | 131.19998 | 131.43409 | 125.31183 | 125.40193 | -90.10 |
| D 27 | | 13.64364 | 13.90367 | 7.75549 | 7.87151 | -116.02 |
| H 27 | P1P2 | 36.40142 | 36.67470 | 30.51327 | 30.64254 | -129.27 |
| L 27 | | 54.44200 | 54.73265 | 48.55385 | 48.70049 | -146.64 |
| M 27 | | 26.75473 | 26.97307 | 20.86658 | 20.94091 | -74.33 |
| N 27 | | 33.13869 | 33.33828 | 27.25054 | 27.30612 | -55.58 |
| R 27 | | 72.58898 | 72.75503 | 66.70083 | 66.72287 | -22.04 |
| W 27 | | 62.05168 | 62.21294 | 56.16353 | 56.18078 | -17.25 |
| Y 27 | | 87.24926 | 87.50883 | 81.36111 | 81.47667 | -115.56 |
| Z 27 | | 92.67128 | 92.84030 | 86.78313 | 86.80814 | -25.01 |
| H 28 | P1P2 | 127.40897 | 127.55323 | 121.52082 | 121.52107 | -0.25 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR6 L-751 1933 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR2 L-23527 1974 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE |
|---|---|---|---|---|---|
| ABERDEEN | 0.00 | 0.00 | 0.00 | 0.00 | CON POST @ |
| TIDAL 2 | -233.84 | 3.54 | 3.48 | 3.86 | OTHER ST#?@ |
| X 25 | -52.34 | 4.77 | 6.66 | 6.99 | BUILDING |
| Y 25 | 2.88 | 5.31 | 8.34 | 8.68 | BUILDING |
| Z 25 | -1.75 | 6.42 | 12.34 | 12.68 | CON POST |
| A 26 | -10.45 | 7.41 | 16.55 | 16.89 | CON POST |
| B 26 | 2.00 | 8.10 | 19.84 | 20.17 | CON POST |
| E 26 | -2.99 | 9.93 | 29.99 | 30.32 | CON POST |
| G 26 | 34.59 | 11.52 | 40.52 | 40.85 | CON POST |
| L 8 USGS | 3.48 | 11.83 | 42.75 | 43.08 | CON POST |
| K 26 | 1.67 | 13.06 | 51.95 | 52.48 | XXXXXXXX @ |
| N 26 | -13.65 | 14.68 | 65.98 | 66.31 | CON POST |
| Q 26 | 5.90 | 15.52 | 73.74 | 74.07 | CON POST |
| T 26 | 4.62 | 16.38 | 82.21 | 82.55 | CON POST |
| U 26 | 2.90 | 16.69 | 85.40 | 85.73 | CON POST |
| W 26 | -12.07 | 17.31 | 91.79 | 92.13 | CON POST |
| X 26 | -22.55 | 17.61 | 95.02 | 95.36 | CON POST |
| Y 26 | -90.10 | 17.90 | 98.26 | 98.59 | CON POST |
| D 27 | -116.02 | 19.33 | 114.60 | 114.94 | OTHER ST |
| H 27 | -129.27 | 20.41 | 127.76 | 128.09 | CON POST |
| L 27 | -146.64 | 21.19 | 137.79 | 138.13 | CON POST |
| M 27 | -74.33 | 21.46 | 141.31 | 141.65 | OTHER ST |
| N 27 | -55.58 | 21.65 | 143.78 | 144.12 | OTHER ST |
| R 27 | -22.04 | 22.37 | 153.64 | 153.97 | OTHER ST |
| W 27 | -17.25 | 23.43 | 168.61 | 168.94 | OTHER ST |
| Y 27 | -115.56 | 24.02 | 176.72 | 177.52 | CON POST @ |
| Z 27 | -25.01 | 24.10 | 178.07 | 178.60 | BUILDING @ |
| H 28 | -0.25 | 25.36 | 197.52 | 197.86 | OTHER ST |

SD = 1.803 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR6 L-751 1933 1ST

ABERDEEN to 0.5 mi S of SAPPHO 1974 - 1933 -0.366 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -4.16
Pr greater abs T = 0.0001



| BM | POS | OHT2 (M) | OHT1 (M) | DLT2 (M) | DLT1 (M) | DDH (MM) |
|---|---|---|---|---|---|---|
| K 17 | | 35.14813 | 35.14062 | 0.00000 | 0.00000 | 0.00 |
| J 17 | | 34.59440 | 34.59330 | -0.55373 | -0.54732 | -6.41 |
| H 17 | | 29.24774 | 29.25117 | -5.90039 | -5.88945 | -10.94 |
| M 10 | P1P2 | 8.30113 | 8.30399 | -26.84700 | -26.83663 | -10.37 |
| G 17 | | 10.66304 | 10.66493 | -24.48509 | -24.47569 | -9.40 |
| F 17 | | 59.58528 | 59.58275 | 24.43715 | 24.44213 | -4.98 |
| E 17 | | 4.73833 | 4.73254 | -30.40980 | -30.40808 | -1.72 |
| C 17 | P1P2 | 21.44547 | 21.45159 | -13.70266 | -13.68903 | -13.63 |
| B 17 | | 12.48393 | 12.47791 | -22.66420 | -22.66271 | -1.49 |
| A 17 | | 49.24881 | 49.24431 | 14.10068 | 14.10369 | -3.01 |
| TIDAL 1 | | 12.44550 | 12.46440 | -22.70263 | -22.67622 | -26.41 |
| TIDAL 2 | | 9.36829 | 9.36739 | -25.77984 | -25.77323 | -6.61 |
| Y 16 | | 8.55179 | 8.54043 | -26.59634 | -26.60019 | 3.85 |
| X 16 | | 30.76866 | 30.76075 | -4.37947 | -4.37987 | 0.40 |
| V 16 | | 33.47568 | 33.46097 | -1.67245 | -1.67965 | 7.20 |
| U 16 | | 5.63216 | 5.65970 | -29.51597 | -29.48092 | -35.05 |
| T 16 | | 11.39892 | 11.41612 | -23.74921 | -23.72450 | -24.71 |
| S 16 | | 15.56115 | 15.56248 | -19.58698 | -19.57814 | -8.84 |
| R 16 | | 84.37968 | 84.38187 | 49.23155 | 49.24125 | -9.70 |
| N 16 | | 14.38913 | 14.38339 | -20.75900 | -20.75723 | -1.77 |
| M 16 | | 11.14544 | 11.14423 | -24.00269 | -23.99639 | -6.30 |
| L 16 | | 6.39440 | 6.38369 | -28.75373 | -28.75693 | 3.20 |
| K 16 | | 5.60294 | 5.59758 | -29.54519 | -29.54304 | -2.15 |
| J 16 | | 2.15361 | 2.16332 | -32.99452 | -32.97730 | -17.22 |
| H 16 | | 5.17487 | 5.18157 | -29.97326 | -29.95905 | -14.21 |
| G 16 | | 2.79106 | 2.79826 | -32.35707 | -32.34236 | -14.71 |
| F 16 | | 4.58897 | 4.59370 | -30.55916 | -30.54692 | -12.24 |
| E 16 | | 4.17061 | 4.17268 | -30.97752 | -30.96794 | -9.58 |
| D 16 | | 7.76993 | 7.77156 | -27.37820 | -27.36906 | -9.14 |
| C 16 | | 5.87050 | 5.87698 | -29.27763 | -29.26364 | -13.99 |
| Y 15 | | 5.66406 | 5.66480 | -29.48407 | -29.47582 | -8.25 |
| X 15 | P1P2 | 4.02593 | 4.02141 | -31.12220 | -31.11921 | -2.99 |

LINE 1 OH DATA FROM REDUC4 OUTPUT: WASHOR11 L-293 1931 1ST
LINE 2 OH DATA FROM REDUC4 OUTPUT: WASHOR19 L-23140 1973 1ST

| BM | DDH (MM) | SD (MM) | D (KM) | DSD (KM) | TYPE | |
|---|---|---|---|---|---|---|
| K 17 | 0.00 | 0.00 | 0.00 | 0.00 | BUILDING | |
| J 17 | -6.41 | 0.48 | 0.07 | 0.07 | BUILDING# | |
| H 17 | -10.94 | 1.19 | 0.43 | 0.43 | BUILDING | |
| M 10 | -10.37 | 1.99 | 1.22 | 1.22 | XXXXXXXX | |
| G 17 | -9.40 | 2.73 | 2.29 | 2.29 | OTHER ST | |
| F 17 | -4.98 | 3.75 | 4.32 | 4.32 | CON POST | |
| E 17 | -1.72 | 5.24 | 8.43 | 8.43 | OTHER ST | |
| C 17 | -13.63 | 5.72 | 10.05 | 10.05 | OTHER ST | |
| B 17 | -1.49 | 6.13 | 11.55 | 11.55 | CON POST | |
| A 17 | -3.01 | 7.15 | 15.74 | 15.74 | CON POST | |
| TIDAL 1 | -26.41 | 9.00 | 21.93 | 24.94 | XXXXXXXX | @ |
| TIDAL 2 | -6.61 | 9.02 | 21.93 | 25.02 | XXXXXXXX | @ |
| Y 16 | 3.85 | 8.83 | 23.97 | 23.97 | OTHER ST | |
| X 16 | 0.40 | 9.09 | 25.40 | 25.40 | OTHER ST | |
| V 16 | 7.20 | 10.15 | 31.71 | 31.71 | OTHER ST | |
| U 16 | -35.05 | 10.54 | 34.15 | 34.15 | OTHER ST | |
| T 16 | -24.71 | 10.69 | 35.17 | 35.17 | BUILDING | |
| S 16 | -8.84 | 10.74 | 35.49 | 35.49 | BUILDING | |
| R 16 | -9.70 | 11.32 | 39.42 | 39.42 | CON POST | |
| N 16 | -1.77 | 12.60 | 48.88 | 48.88 | OTHER ST | |
| M 16 | -6.30 | 13.01 | 52.09 | 52.09 | CON POST | |
| L 16 | 3.20 | 13.50 | 56.05 | 56.05 | OTHER ST | |
| K 16 | -2.15 | 13.65 | 57.29 | 57.29 | CON POST | |
| J 16 | -17.22 | 14.01 | 60.38 | 60.38 | OTHER ST | |
| H 16 | -14.21 | 14.04 | 60.68 | 60.68 | OTHER ST# | |
| G 16 | -14.71 | 14.14 | 61.55 | 61.55 | OTHER ST | |
| F 16 | -12.24 | 14.38 | 63.60 | 63.60 | OTHER ST | |
| E 16 | -9.58 | 14.53 | 64.97 | 64.97 | OTHER ST | |
| D 16 | -9.14 | 14.67 | 66.19 | 66.19 | BEDROCK | |
| C 16 | -13.99 | 14.86 | 67.94 | 67.94 | OTHER ST | |
| Y 15 | -8.25 | 16.14 | 80.14 | 80.14 | OTHER ST | |
| X 15 | -2.99 | 16.33 | 82.03 | 82.03 | OTHER ST | |

SD = 1.803 * SQRT(DSD) MM
# BM NOT PLOTTED ON PROFILE
? BM NOT USED IN REGRESSION
@ BM ON SPUR
D & DSD CALC. FROM REDUC4 OUTPUT: WASHOR11 L-293 1931 1ST

OLYMPIA to 1.7 mi N of ELDON 1973 - 1931 -0.169 mm/km
refraction - corrected
length of bars = ±1 standard deviation
T = -4.19
Pr greater abs T = 0.0002