

Departmental bench marks will be located at distances not greater than one-half mile apart along the course of the survey, and the letters D.P.H.O., and the actual elevation of the bench mark, shall be painted in white close to the above bench mark. Bench marks will be left on objects that should remain in place for some years, such as stone foundations of buildings, close to the road, bridge or culvert abutments or concrete work. Bench marks will not be left on trees, poles or other wooden objects.

For departmental purposes bench marks shall be left at every culvert and bridge along the course of the survey, and where such culvert or bridge is concrete or stone, the bench mark shall be left on end walls or abutments. A neat and legible system of making notes shall be used.

Departmental bench marks shall be cut in stonework or concrete carefully with a chisel and made as follows:—

An arrow pointing upward with a horizontal cut at point of arrow, cuts to be 3 ins. long,  $\frac{1}{2}$  in. wide and  $\frac{1}{4}$  in. deep and as regular as possible.

At bridges and culverts, the elevations of top of ballast walls, bridge seats, floor level at each end of bridge, water level on day of survey, high water level, low water level, bottom of culvert and top of culvert at each end of barrel are noted, and complete data of all bridges and culverts, such as clear width of roadway, kind of floor, kind and number of stringers, length of span centre to centre of bearings, distance face to face of ballast walls, distance of abutments under coping, and distance face to face of footings. At culverts, give size of opening, nature of construction, length of barrel, character of foundations, present condition of head walls, and note if present sized opening is sufficient.

Level shots will be taken at the 100-ft. stations and at all breaks in grade of road and cross sections to fence will be taken at each station. Shots will be taken on crown or at stake on real centre line of road for profile, and further shots shall be taken at edge of road in bottom of side ditch, on top of outside edge of ditch, and at fence. For each shot the distance from centre line as staked shall be noted.

Level books shall be marked on outside of cover with "Description of Survey and Date. Levels from Station.... to Station....," and the books shall be numbered consecutively, commencing with number one. The pages of each book shall be numbered consecutively with neat figures. A pencil no softer than 2 H shall be used for entering notes in field books.

### Monumenting

Standard survey monuments are to be planted at the points of intersection of each side road allowance limit, concession road allowance limit and any other public road allowance limits with the limits of the provincial highway, and at each angle and at each B.C. and E.C. of each curve in the limits of the highway.

It is important that these monuments be carefully and correctly placed with respect to the limits of the highway, and responsibility for such rests entirely with the surveyor in charge.

The distance from the said monuments planted upon side road and concession road allowance limits to the nearest township lot, corners measured along said limits shall be measured and recorded.

It is understood that although these monuments are planted as closely as can be satisfactorily ascertained to their correct position, they do not necessarily mark or define the position of the side road or concession road allowance limits or other public road limits, but are intended to define only the proposed final limits of the provincial highway. The monuments are to be planted 4 ft. below the surface of ground, heavy end down.

Each monument must be so set in the necessary excavation that before any earth is backfilled, and with the top in its proper position, there is no tendency for the monument to fall in any direction. The top must then be kept in place while the earth is being backfilled and thoroughly tramped.

A monument set carelessly by just dropping it into the excavation, filling around it irregularly and finally pushing the top of it to one side or another to bring it to its right position, is very likely to settle out of place after rains or frost. No one but a thoroughly reliable man familiar with the work should be trusted to set these monuments without supervision.

### General Instructions for Preparation of Plans

From the field notes of survey, plans are prepared for registration purposes. The title of the plan of a highway must give the name and description of the highway, its beginning and end, the township and county, the date of survey and the scale.

TABLE SHOWING "SPLIT ANGLE" MEASUREMENTS FOR STANDARD WIDTHS

Angle to right.					
180°	180°	39.5	43.0	45.0	50.5
177°-30'	182°-30'	39.51	43.01	45.01	50.51
175°-00'	185°-00'	39.54	43.05	45.05	50.55
172°-30'	187°-30'	39.58	43.10	45.10	50.60
170°-00'	190°-00'	49.65	43.16	45.17	50.70

### EXAMPLE OF METHOD OF REDUCTION OF AN AZIMUTH OBSERVATION

Date, November 22nd, 1916. Brighton, Ont.

Taken at Sta. 2267+53

Sighted St., 2270+07.9

Pt. Sighted.	Cir.	Hor. Cir. Rdg.	Watch.
Ref. point	L.	341° 43'	
Polaris	L.	359° 18' 30"	2 h. 57 m. 00 s.
Polaris	R.	179° 17'	2 h. 59 m. 05 s.
Ref. point	R.	161° 43'	

O Tauri Declin., N 8° 44' 24.6"

O Tauri R. A., 3 h. 20 m. 22.5 s.

Watch time of transit of O Tauri, 3 h. 13 m. 25 s.

Latitude, 44° 02'

Convergence, -0° 30", referred to Mer. Long. 77° 45'

Formula for reduction:—

$$A \frac{p \sin T}{\cos a} (1 + p \sin 1'' \tan a \cos T)$$

Watch 2 h. 58 m. 03 s.

Correction 6 m. 57 s.

$\Theta$  = 3 h. 05 m. 00 s. (Sidereal time of observation)

$a$  = 1 h. 31 m. 00 s. (R. A. of Polaris)

$T$  = 1 h. 34 m. 00 s. (Hour angle of Polaris)

Therefore,  $T = 23^\circ 30'$

$\log p = 3.6105537$

$\log \sin T = 9.6006997$

3.2112534

$\log \cos a = 9.8566900$

$\log 1st \text{ term} = 3.3545634$

$\log 1st \text{ term} = 3.3545634$

$\log p = 3.6105537$

$\log \sin 1'' = 6.6855700$

$\log \tan a = 9.9853428$

$\log \cos T = 9.9623978$

$\log 2nd \text{ term} = 1.5984277$

1st term = 2262.4"

2nd term = 39.7"

$A = 2302.1''$

$= 0^\circ 38' 22.1''$

Convergence = 00' 30.0"

Bearing of Polaris, 359° 21' 08"

H. C. R. on Polaris, 359° 17' 45"

Corr. to H. C. R., + 0° 03' 23"

H. C. R. on Ref. Line, 341° 43' 00"

Bearing of Ref. Line, 341° 46' 23"