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SCOPE:

SURVEY SEQUENCE

The survey is carried out from the starting point to the end point by following the sequence given below:

- Deriving of coordinates through DGPS.
- Running of traverse line between two known DGPS points.
- Reducing the relative levels between two known DGPS points.
- Staking in of topographical details in three-dimensional coordinates.
- Depicting of structural cross road details.
- Layout of reference line for roads and structures.
- Netting of original ground levels.

REFERENCE

MoRTH Clause No: 109 and technical specifications of the project shall be followed.

EQUIPMENTS

For the above task, the following precision survey instruments are used to maintain the required accuracy:

- DGPS (Dual Global Positioning System).
- Electronic Total Station with inbuilt programs (1" least count accuracy).
- Auto Level with graduated vertical scale of 5 mm interpolation accuracy.
- Compass (to indicate North direction or true meridian) with 1 mm precision as directed by the Engineer.

TOOLS

- Measuring Tape

- Pegs



- Safety Boards

PROCEDURE

Project reference center line of the proposed cross-section shall be fixed by the surveyor and marked on the ground using nails. Chainage shall be clearly marked on the existing road using paint.

This marking shall be carried out at an interval of 20 m on straight portions and 10 m on curved portions. Offsets shall also be marked on the existing road wherever applicable.

Further, prior to the commencement of earthwork or structural work, as per MoRTH specification Clause 109.3 and 109.5, the centerline shall be referenced by providing chainage pillars at the Right of Way (ROW) edge.

INITIAL SURVEY (SATELLITE AND TOPOGRAPHICAL)

The survey is carried out for fixing of the control network. The following methodology is based on the measurement of angles and distances on a horizontal plane along with satellite geometry.

GTS (GREAT TRIGONOMETRICAL SURVEY)

Great Trigonometrical Survey (GTS) points are already established by the Survey of India with reference to Mean Sea Level (MSL).

DGPS DATA (DUAL FREQUENCY GLOBAL POSITIONING SYSTEM)

Initially, pairs of ground control points are established at every 5 km interval. These points are connected to the DGPS network to obtain accurate X, Y, Z coordinates for the entire project.

TRAVERSE

- Traversing is carried out by measuring a set of horizontal angles in different quadrants between two straight points.

- Reciprocal horizontal distances between two points are measured by establishing traverse

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to maintain the required accuracy.

FORMULA

- $\Delta \text{Easting} = \sin(\text{North Bearing}) \times \text{Horizontal Distance}$
- $\Delta \text{Northing} = \cos(\text{North Bearing}) \times \text{Horizontal Distance}$

DOUBLE TERRITORY LEVEL LINE

Auto level instruments are used to determine the relative difference in elevation between two points. The survey is carried out between fixed DGPS datum points to identify misclosure in height.

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Precision automatic levels, conforming to MoRTH Clause 900 and fitted with micrometer attachments, shall be used for all double run and TBM transfer works to ensure accuracy.

TEMPORARY BENCH MARKS (TBM)

Precast pillars of size 150 mm × 150 mm × 750 mm, reinforced with 6 mm bars and provided with a central 8 mm rod (marked with a dot on the top surface), are used as TBM pillars.

These pillars are embedded such that 300 mm remains above ground level. Yellow, black, and red paints are used for marking their identification name and number.

TRAVERSE STATION

Traverse stations are marked by fixing a nail at the center and highlighting it with a yellow paint mark on one edge of the existing carriageway surface at every 250 m interval. Each station is assigned a unique identification number.

ORIGINAL GROUND LEVEL (OGL)

The laid out reference line is taken as “0”. On the longitudinal section (L-section), cross-sections are

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another known station to ensure accuracy.

CALIBRATION

Internal calibration shall be carried out once every month for leveling instruments and total stations in specified formats.

Calibration certificates for level instruments and total stations must be submitted with valid certification from the manufacturer.

A “Survey File” containing necessary data such as DGPS details, traversing details, horizontal and vertical control points, reference pillars, survey monuments, and horizontal alignment setting-out details shall be submitted to the Client/Engineer.

RESPONSIBILITY

The responsibility for implementation of this procedure lies with the surveyors deployed at various sections for different activities, along with the Survey Engineer and Section In-Charge.

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SAFETY PRECAUTIONS

- Do not aim the telescope at the sun, as it may damage the EDM of the instrument.
- Never place the instrument directly on the ground, as it may damage the base.
- Do not carry instruments along with the stand from one station to another.
- All safety measures shall be followed as per HIRA (Hazard Identification and Risk Assessment).
- Avoid heavy shocks and vibrations to the instruments.
- Remove the battery before storing the instrument in its case.
- Do not store wet instruments inside the case; allow them to dry before storage.
- Before removing the instrument from the case, note the layout position to place it back correctly.
- All staff and workmen shall wear reflective jackets and PPE at the work area.

- A minimum of 6 cones and a “Men at Work” signboard shall be used during survey work on

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