Provisional MNRF Specifications for Digital Levelling

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Additional Information

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Definitions

For the purposes of this document, the following definitions shall apply.

- Single Level Run – A run starting and ending on a COSINE Geodetic Control Marker (3-D), COSINE Bench Mark, bench mark or temporary point as shown on the approces vertical network design plot.
- Double Level Run – Two single runs levelling in opposite directions and separated by at least one hour to ensure an independent check.
- Triple Level Run – Three single level runs, two of which are in opposite directions and, if appropriate, the third on a different day.

First Order

- All junction points must be monumented.
- Monuments shall be caps set in stable rock or stable concrete structures or 10 ft. Round Iron Bars (RIBs) driven below grade in the soil.
- Levelling networks shall consist of at least 4 loops of 25kms in length (or less) in order to check for systematic errors inherent in digital levelling.
- At least 3 levelling connections must eminate from each new benchmark.
- New benchmarks should be spaced no more than 3km apart.
- Stability check consists of at least three BMs 2kms apart in total levelling distance where the observed elevation difference matches the published elevation difference to the required order for the stability check/survey at both ends of a linear type of network.
- At least two valid stability checks (at both ends of the network) involving 6 stable existing BMs is required.
- A pair of calibrated invar rods must be used for all levelling.
- Any existing BMs within 3kms of the levelling line are to be integrated.
- Each reading of the rod (sighting) must be repeated at least three times.
- Each levelling line between benchmarks must be repeated three times (triple level run).
- A two-peg test must be performed daily and recorded in the field notes.
- The collimation error shall not be greater than 0.05mm per metre.
- Unless a shorter observation (sight) distance is recommended by the manufacturer, 60 metres is the maximum sight distance.
- Lines of sight must not be less than 0.4 metres above the ground throughout the entire length of the line.
- All level runs must have an even number of set-ups to minimize the effects of mis-matched rods. A single set-up will be allowed when the distance between markers is less than 100m and the same rod is used at both stations. All rod pairs should have supporting documentation indicating that they have been calibrated.
- The difference between backsight and foresight distances at each set-up must not exceed 5 metres and the sum of the differences for all set-ups in each run should not exceed 10 metres.

Second Order

- All junction points must be monumented.
- Monuments shall be caps set in stable rock or stable concrete structures or 6 ft. Round Iron Bars (RIBs) driven below grade in the soil.
- Levelling networks shall consist of at least 4 loops of 25kms in length (or less) in order to check for systematic errors inherent in digital levelling; if 4 contiguous loops are not possible, as many closed loops with common levelling sections as possible are required.
- At least 2 levelling connections must eminate from each new benchmark.
- New benchmarks should be spaced no more than 3km apart.
- Stability check consists of at least two BMs 2kms apart in total levelling distance where the observed elevation difference matches the published elevation difference to the required order for the stability check/survey at both ends of a linear type of network.
- At least two valid stability checks (at both ends of the network) involving 4 stable existing BMs is required.
- A pair of invar rods must be used for all levelling.
- Any existing BMs within 3kms of the levelling line are to be integrated.
- Each reading of the rod (sighting) must be repeated at least two times.
- Each levelling line between benchmarks must be repeated two times (double level run).
- A two-peg test must be performed daily and recorded in the field notes. The collimation error shall not be greater than 0.05mm per metre.
- Unless a shorter observation (sight) distance is recommended by the manufacturer, 60 metres is the maximum sight distance.
- Lines of sight must not be less than 0.4 metres above the ground throughout the entire length of the line.
- All level runs must have an even number of set-ups to minimize the effects of mis-matched rods. A single set-up will be allowed when the distance between markers is less than 100m and the same rod is used at both stations. All rod pairs should have supporting documentation indicating that they have been calibrated.

- The difference between backsight and foresight distances at each set-up must not exceed 5 metres and the sum of the differences for all set-ups in each run should not exceed 10 metres.

Third Order

- All junction points must be monumented.
- Monuments shall be caps set in stable rock or stable concrete structures or 6 ft. Round Iron Bars (RIBs) driven below grade in the soil.
- Levelling networks shall consist of at least 4 loops of 25kms in length (or less) in order to check for systematic errors inherent in digital levelling; if 4 contiguous loops are not possible, as many closed loops with common levelling sections as possible are required.
- At least 2 levelling connections must eminate from each new benchmark.
- New benchmarks should be spaced no more than 3km apart.
- Stability check consists of at least two BMs 2kms apart in total levelling distance where the observed elevation difference matches the published elevation difference to the required order for the stability check/survey at both ends of a linear type of network.
- At least two valid stability checks (at both ends of the network) involving 4 stable existing BMs is required.
- A pair of invar rods should be used for all levelling (single-piece rods made of fibreglass or other materials may be substituted if required).
- Any existing BMs within 3kms of the levelling line are to be integrated.
- Each reading of the rod (sighting) must be repeated at least two times.
- Each levelling line between benchmarks should be repeated two times (double level run) – if the level line is part of a closed loop, and the length of the loop is less than 25km – single level run is permitted if required.
- A two-peg test must be performed daily and recorded in the field notes. The collimation error shall not be greater than 0.05mm per metre.
- Unless a shorter observation (sight) distance is recommended by the manufacturer, 60 metres is the maximum sight distance.
- Lines of sight must not be less than 0.4 metres above the ground throughout the entire length of the line.

- All level runs must have an even number of set-ups to minimize the effects of mis-matched rods. A single set-up will be allowed when the distance between markers is less than 100m and the same rod is used at both stations. All rod pairs should have supporting documentation indicating that they have been calibrated.
- The difference between backsight and foresight distances at each set-up must not exceed 5 metres and the sum of the differences for all set-ups in each run should not exceed 10 metres.