Chapter 11 - Survey Report

A survey report must be submitted for each project that requires survey work.

11.1 General

Prior to commencing any field work the Consultant and/ or Sub-Consultant /Designer /Surveyor must:

- Research the published geodetic control from the National Spatial Reference System (NSRS) / National Geodetic Survey (NGS) database at: https://geodesy.noaa.gov/
- Contact the New Jersey Geodetic Survey (NJGS) Unit if further information is necessary.
- Evaluate the Geodetic Survey information and incorporate it into the field survey work.
- Research and recover the NGS data.
- Submit to NGS directly, using the on-line recovery form (https://geodesy.noaa.gov/surveys/mark-recovery/index.shtml), the condition of your pertinent researched published NGS data used in your project.
- Contact the Regional Survey Office(s) for information that is available for existing alignment, monumentation and Right of Way (ROW) plans and survey information.
- Contact the Engineering Document Unit in the Main Complex in Ewing, NJ should be contacted for additional documentation.
- Provide copies of NJDOT Survey Manual related, BDCs, CANs, NJDOT Photogrammetric Guidelines (if applicable), and materials related to the Survey portion of the work to the Sub-contractor. The Survey Team Leader and crew chief must have a copy of this manual and be made aware of the content.

Immediately after collecting field data the Consultant and /or Sub-Consultant /Designer /Surveyor must furnish to the NJDOT, before the submission and acceptance of base maps, and survey control schematic plans, a list and description of the location and coordinate values of each control survey point, a copy of the original field notes showing the horizontal distance, angular measurements, and vertical measurements and a copy of the original computations for the adjustment of horizontal distance, angular measurements, and vertical measurements for proper closure of each control survey and level loop or line.

This preliminary data submission shall be electronically forwarded to Geodetic Survey Office, DOT.GeodeticSurvey@dot.nj.gov for control reports, and to the appropriate Regional Survey Office (North-973-770-5151) DOT-FieldRequest.Survey@dot.nj.gov ; (South-856-486-6777) DOT-FieldRequest.Survey@dot.nj.gov) for general survey reports.

Update submission data electronically with email address?

Include all survey control, baseline, and ROW monumentation in the Survey Report that was used. Prior to submittal, it must be field verified by the Consultant, and discrepancies shall be addressed in the report.

Prior written approval needs to be received from the Survey Services Manager in order to utilize the superseded North American Datum of 1927 (NAD27), and the National Geodetic Vertical Datum of 1929 (NGVD29), or an assumed datum.

The use of coordinates and elevations for final base mapping are to be adjusted to ground coordinates utilizing the appropriate scale factor(s). These adjusted coordinates shall be included in a tabular form in the survey report. These adjusted coordinates and elevations shall be identified as "Ground/Modified Coordinates".

Final coordinate values are to be produced and tabulated in the following four formats to satisfy NJDOT requirements. All coordinates will be based on the latest horizontal realization, currently: NAD83 (2011).

The geographic positions are based on the GRS80 Ellipsoid.

All orthometric heights are based on the NAVD88 adjustment datum using the latest geoid model, (currently: GEOID18).

- GEOGRAPHIC POSITIONS (Latitude, Longitude and Ellipsoidal Heights in meters).
- NJSPC (METRIC) (State Plane Coordinates in meters).
- NJSPC (U.S. SURVEY FEET) (State Plane Coordinates in U.S. Survey Feet).
- GROUND/MODIFIED (Ground Coordinates in U.S. Survey Feet).

All data, supporting data, and final survey report will be provided in a digital format (CD) that will be 100% compatible with NJDOT computer systems. PDF or DOC extensions are suitable for use in a "read only" format.

11.2. Projects Based on the New Jersey State Plane Coordinate System (NJSPCS)

The Consultant shall provide Project Survey Control based on the classification standards for Horizontal Control, Second Order, Class II accuracy and Vertical Control, Second Order, Class I accuracy. The standards of accuracy shall meet the requirement of the Federal Geodetic Control Committee Publication:

- Standards and Specifications for Geodetic Control Networks (September 1984) or its most recent revision.

  https://www.ngs.noaa.gov/FGCS/tech_pub/1984-stds-specs-geodetic-control-networks.pdf

Pertinent supplemental publications for Global Navigation Satellite System (GNSS) related positioning techniques, i.e. Static; Real Time Kinematic (RTK) and Real Time Network (RTN) to be used to complement the aforementioned publication are issued by NGS:

- User Guidelines For Single Base Real Time GNSS Positioning:

  (www.ngs.noaa.gov/PUBS_LIB/UserGuidelinesForSingleBaseRealTimeGNSSPositioningv.3.1APR2014-1.pdf)

- National Geodetic Survey Guidelines for Real Time GNSS Surveys:

  (www.ngs.noaa.gov/PUBS_LIB/NGS.RTN.Public.v2.0.pdf).

- RTN Field Procedures and Best Practices:

  (www.ngs.noaa.gov/web/science_edu/presentations_library/files/rtn_field_procedures.pptx)

- Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques, Version 5.0, dated May 11, 1988, reprinted with

corrections, August 1, 1989

(https://www.ngs.noaa.gov/PUBS_LIB/GeomGeod.pdf)

- Guidelines for Establishing GPS-derived ellipsoid heights (Standards: 2 cm and 5 cm), NOAA Technical Memorandum NOS NGS-58, version 4.3, November 1997, or most recent revisions.

  (https://www.ngs.noaa.gov/PUBS_LIB/NGS-58.pdf)

The horizontal datum will be the New Jersey State Plane Coordinate System of 1983 (NJSPCS 1983), which is based on the North American Datum of 1983 (NAD83) latest adjustment tag. The NJSPCS of 1927, which is based on the North American Datum of 1927 (NAD27), shall no longer be utilized unless prior written approval has been received from the Survey Services Manager.

The vertical datum will be the North American Vertical Datum of 1988 (NAVD88) or its most recent revision. The previous datum, National Geodetic Vertical Datum of 1929 (NGVD29), has been superseded by NAVD88 and shall no longer be utilized unless prior written approval has been received from the Survey Services Manager.

The survey traverse and the level bench runs shall originate and terminate on existing monuments and/or benchmarks that are part of, or directly established from the NSRS. These points meet or exceed Second Order, Class I, classifications and were directly established from the database that is maintained by NGS. These initial survey tie monuments have been previously established by US Coast and Geodetic Survey (USCGS), NGS, National Ocean Survey (NOS), NJGS and other approved agency or private Contractor.

Leveling runs not otherwise specified shall comply with requirements in the Federal Geodetic Control Committee publication for Third Order Geodetic Leveling. The Project Survey Control shall be tied to the New Jersey State Plane Coordinate System. The above standards apply to projects which require the establishment, determination or reestablishment of ground control, horizontal and vertical, which are based or tied into the N.J. State Plane Coordinate System.

11.3. Projects Based on Other Systems

Projects which do not require the establishment of horizontal and vertical control, such as Safety Improvements, Maintenance projects, Guide Rail Installations, and Street Intersection Improvement, are not required to meet the N.J. State Plane Coordinate System standards. Guide Rail projects may require horizontal and vertical Control. Survey provider should contact the Prime Consultant/Designer to determine if it is required. These projects should eliminate any reference to the NJSPCS. In projects such as street improvements, resurfacing, road widening and bridge rehabilitation, a local or assumed system may be used.

The local system shall meet the following requirements:

- Position Closure — 1:20,000 Minimum after adjustment
- Angles Accurate to — 5 Seconds or less
- Azimuth Closure — (8 Seconds) times (Sqrt of N), where N is the number of angle stations

The local control survey traverse shall be established and measured by accepted National Geodetic Survey methods with proper consideration of tape calibration, all equipment and instrumentation calibration, and all corrections. The error in position closure after distribution of azimuth errors will not exceed 1:20,000. The bench level runs will not exceed 0.05 of a foot times the square root length of the runs in miles or will not exceed 12 millimeters times the square root length of the run in kilometers. All bench runs should be based upon the North American Vertical Datum of 1988 (NAVD88). The use of any other vertical datum requires the approval of the Manager of Survey Services prior to work commencing.

11.4. Survey Report Content and Preparation

A survey report must be submitted for each project that requires survey work. There are **four** times during the project that a report or modification to the existing report may be needed.

- Aerial control portion,
- Project control portion (including how the existing baseline(s) was reestablished),
- Topographic survey portion
- Supplemental survey portion

The following format shall be used:

A. Introduction

1. Purpose - Describe the purpose for which the survey was conducted.
2. Point of Contact - Supply to the NJDOT Project Manager the name, phone number, and mailing address of the point of contact within the submitting organization, and the Professional Licensed Surveyor in responsible charge of the work. Supply the same information for all organizations that participated in the survey.
3. Accuracy Standards - Provide the accuracy standards (vertical and horizontal) specified for the project.
4. Signature and seal of the surveyor in responsible charge.
5. Prime Consultant certifies in writing that the report was reviewed and found to meet project requirements.

B. Location - Indicate briefly the geographic location and scope of the project in general terms.

C. Field Work

1. The Consultant shall describe the work performed to sufficiently research information to recover the existing monumentation on the highway project. Describe and delineate the existing baseline, right of way and center line monumentation and how it is tied into the project traverse and adjusted into the project survey network. The Consultant shall describe how the existing right of way line, and baseline were established.
2. Chronology - Give a brief description of the progression of the project. A narrative detailing the methodology utilized to establish all existing Baselines and ROW lines within the project limits is required.

3. Instrumentation - Describe the make, model and serial number of each instrument, and accessory equipment such as tripods, tribrachs, leveling rods, etc., age of all equipment, condition of equipment, and date of last calibration, collimation or repair work used on the project.
4. Deviation from instructions - Describe any deviation from the procedures and specifications stated in the project instructions.

D. Data Processing Performed

Describe the data processing that was performed. Include tasks such as transferring of data to different storage media, data quality checking, station descriptions, baseline determinations and closure computations.

Complete the following sections as appropriate:

1. Software Used - Specify all software by program name and version number which was used to acquire, manage, reduce, adjust, and submit field data. If the project data were reduced or acquired with different versions of a program, specify which version was used with which block of data.
2. Rejected Data - Specify any data which was rejected and re-surveyed. Include the reasons why the data from a particular field day were rejected.
3. Adjustment - Discuss in detail the type of adjustment performed. Indicate weighting technique used, and stations constrained. All analyses shall be reviewed and analyzed by the Licensed Professional Surveyor in responsible charge.
4. Closures - Tabulate the results of all loop mis-closure computations performed. Include the baselines used, base line length, maximum closure in each component, and average closure error in each component. Tabulate closure component error in terms of Cartesian coordinates and in terms of the local terrestrial system. Tabulate comparisons of repeat base lines observed indicating base line length, and maximum and average closure for each base line component. Closures will be stated in feet and parts per million including any scale factor applied.
5. The above data, supporting data, and **final** survey report will be provided in a digital format (pdf or doc read only files) on a CD that will be 100% compatible with NJDOT computer systems.

E. Attachments and Enclosures

1. The Consultant will provide a survey report including an alignment plan for all projects.
2. The Consultant shall include the previously furnished list and description of the location and coordinate values of each control survey point, the original field notes showing the horizontal and angular measurements, and vertical measurements and the original computations for the adjustment of horizontal and angular measurements, and vertical measurements for proper closure of each control survey and level loop or line.
3. Station List - Include a table, which lists the station name, coordinates, elevation and station type for all stations surveyed.

4. Field Project Sketch - Attach a copy of the project sketch. If there are multiple copies of the sketch showing different data, attach a copy of each. The project sketch shall include the following:
    - All stations occupied during survey.
    - A border drawn around the edge with grid ticks for latitude and longitude.

    In addition to the stations surveyed, the sketch should show other stations of the existing network located within or near the project area. Indicate in the survey report whether any attempt was made to recover these stations. The report and/or recovery notes must indicate why the recovered stations were not surveyed. To indicate a station that was not recovered use "NR" next to that station's symbol.

    Survey points will be shown in an inset sketch when they are too closely together to be depicted clearly on the network sketch.
5. Digital photo/ rubbings of monuments (control stations) shall be included in survey report.
6. Field Logs - Provide dated copies of field survey notes and record books.
7. Quality Control Checklists- Geodetic & General Report- (formats in Appendix C)
8. Quality Assurance Checklist- Geodetic and General Reports- (formats in Appendix C)

11.5. Right of Inspection

The State reserves the right to inspect at any time during or after the control survey each or any field or office phase of the work and to check each or any operation in the field or the office.

11.6. Survey Crews

The Consultant shall perform all field survey work in accordance with the latest NJDOT Safety Manual. Special attention shall be paid to the proper placement of traffic control devices and flag persons and the need for retro reflective vests. Perform all field survey services in accordance with the *NJDOT Design Manual, Roadway*, as revised.