To:		New York State Department of Transportation	EI
Superseded By EI 14-021 **Effective 1/8/15**		**ENGINEERING INSTRUCTION**	**09-030**

Title: **REVISION TO STANDARD SPECIFICATIONS: §105-10 SURVEY AND STAKEOUT**

Distribution:
- ☐ Manufacturers (18)
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- ☒ Surveyors (33)
- ☒ Consultants (34)
- ☒ Contractors (39)
- ☐ _____( )

Approved:

12-3-09

James F. Tynan, P.E.
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Date

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of May 6, 2010.
- This EI does not supersede any other issuances.
- The information transmitted in this EI will be incorporated into a future revision of the Standard Specifications.

PURPOSE: The purpose of this EI is to revise Standard Specification §105-10 *Survey and Stakeout.*

TECHNICAL INFORMATION:

This EI is being issued concurrently with EI 09-031 *Revision to Standard Specifications: Section 625 Survey Operations*

Standard Specification §105-10 *Survey and Stakeout* was separated from Section 625 and is being reissued separately with only minor editorial changes from the version issued via EI 06-007.

IMPLEMENTATION:

- The Main Office Design Quality Assurance Bureau will insert the standard specification shelf notes beginning with projects submitted for the letting of May 6, 2010.

TRANSMITTED MATERIALS:

- Standard Specifications shelf note *Survey and Stakeout* in Metric and US customary units.

BACKGROUND:

- New types of survey related technologies are changing the construction industry's field operations by how project related work is laid out or geospatially positioned in the field. There has been an identified need for the specification to allow additional survey services after the award of a project. These services are needed either to augment available resources for special site specific situations which are identified after the letting of a contract, or to address major changes in field conditions on a contract.
- Tools used for inspection of capital projects are advancing the efficiency and accuracy of inspection operations. GPS provides Inspectors with the ability to independently verify geospatial positions without dependence on contractor control, and also inspect and quantify completed work at a much faster rate with fewer staff and with greater accuracy compared with traditional survey hand-tool methods.

CONTACT: Direct questions regarding this EI to Steve Roden of the Design Services Bureau via e-mail at SRoden@dot.state.ny.us or at (518) 485-1385.

SURVEY AND STAKEOUT

Make the following changes to the Standard Specifications dated May 4, 2006 and May 1, 2008:

May 4, 2006, Page 88 (as modified by EI 06-007) and May 1, 2008, Page 85;
Delete §105-10 *Survey and Stakeout* in its entirety and **Replace** it with the following:

105-10 SURVEY AND STAKEOUT.

Prior to the start of construction work, all right of way markers, property line markers and survey control markers located in or adjacent to areas which may be disturbed during construction shall be properly protected and tied to fixed reference points or located from established contract control. Upon completion of the work, all right of way or property line markers or survey markers that have been disturbed by the Contractor, shall be reset under the direction of a Land Surveyor. Field location notes shall be recorded and made available to the Engineer upon request at no additional cost to the State.

All survey control and boundary location work shall be performed in accordance with the Department's *Land Surveying Standards and Procedures Manual* under the direction of a Land Surveyor.

All survey work performed for quality control by the Contractor and for quality assurance by the Department should both utilize: (1) similar levels of measurement precision and methods to perform positional measurements, (2) the same control network from which measurements are made, and (3) the same survey measurement procedures to ensure consistency of results.

Terrain features are measured and positioned by various methods relative to the contract control network established for each contract. The precision with which an instrument or equipment positions a point is related to the quality of the method by which measurements are made, and the ability to duplicate the same measurement. The local accuracy of a located point is the closeness of the measured or computed value to a standard or accepted value (actual spatial position on the earth). Positional tolerance is the allowable spatial difference between making measurements by two different methods or by the same method at separate times, all of which have the same level of precision.

Horizontal coordinates and vertical elevations of existing features provided as part of the contract are located in the field based on accuracies achievable for each positional point relative to the contract control. Positional accuracies are directly related to the strength of the contract control network, the methods used to make the measurements, the precision of the instruments used to measure to the feature, and how definable the feature is which is being located. Point feature locations represent a single position (for example: property line marker, sign post, utility pole, or fire hydrant) and can be re-identified or verified in the field to within a small variation (high confidence level) from where they were initially positioned. Linear feature locations define the alignment of that feature. That alignment can be verified to within a specific tolerance depending on the spacing or frequency at which the points were originally measured to define that alignment. Straight or uniformly curved linear features (for example: curbline, edge of roadway, or edge of sidewalk) which can be easily defined in the field should have a relatively small positional variation from their designed location when compared to a verified field location. Irregular shaped or not as clearly defined linear features (for example: break lines, ditchlines, treelines, or environmental area perimeters) which are sometimes difficult to define or delineate precisely in the field, could have a larger variation from where they were initially positioned when compared to a field-verified location.

SURVEY AND STAKEOUT

Digital terrain model (DTM) surfaces, when provided by the Department, are made up of a combination of point and linear features. The precision of a data collection instrument does not necessarily indicate what positional tolerance should be expected of any feature verified from an existing DTM. The location or elevation of a feature selected from a DTM surface can, at best, be determined by interpolating the horizontal position or elevation between previously located points. The verification of any specific elevation on the DTM surface is directly related to: (1) the spacing of collected data or breaklines used to produce that surface; (2) the uniformity of the surface being measured; (3) the steepness of the slope of that surface; and (4) how obscured the surface is from the measuring technique used to originally locate the surface. Standardized procedures for determining the spacing/frequency of point and linear features (including break lines), are critical to providing consistent results. Department standardized procedures for determining feature locations are described in both the "Land Surveying Standards and Procedures Manual", and the "Specifications for Photogrammetric Stereocompilation".

Verification of the positional tolerance of the DTM surface elevation requires a comparison of the original collected point data with recollected point data measured at the same horizontal locations. Field comparisons to interpolated DTM surfaces or recreated surface information (from other information sources) shall not be used for verification of the positional tolerance of a feature. Comparisons of re-measured point data can only be made with the original collected point data, not to interpolated positions. Measurements for verification of DTM point data shall also be made from the same contract control network, and by instruments capable of an equal or greater precision.