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CHAPTER TWENTY-FOUR

AERIAL PHOTO CONTROL SURVEY

An aerial survey of a highway project produces a long, thin photographic mosaic that encompasses the survey limits of the project. Ground control points (i.e., panel points) and GPS technology are used to establish and maintain survey control during project development. A GPS survey is ideal as the traverse angles of a conventional survey do not close on a long highway project. This Chapter provides guidelines and procedures for implementing an aerial photo control survey.

24-1.0 GUIDELINES AND PROCEDURES

24-1.01 Research

The Engineer's Report includes information pertaining to the aerial-photo control survey (i.e., project location and flight information). The Report specifies the size of the panel points that are necessary for ground control during the aerial survey. It also specifies control location and the distance between successive controls. Upon receipt and review of the Engineer's Report, research should be performed to establish project-control monumentation.

Traditional research entails a review of the USGS quadrangle maps that encompass the project. A supplement to this base is the use of geodetic-control diagrams. Unfortunately, the availability of these diagrams is limited as they are no longer published by NGS. There are some, however, that are still maintained by NGS.

It is desirable to tie the aerial-photo control into the USC&GS triangulation network, especially if GPS is utilized. For example, if GPS is used, only one horizontal monument should be tied into the network. As practical, the vertical control should be based on NGS or USC&GS NAVD 1988 datum. The accuracy of another agency's datum (e.g., USGS, INDOT) is not as reliable because some of its recorded bench marks were based upon an estimated project elevation or were established by trigonometric observations. At least two vertical benchmarks should be used. A third is desired in order to resolve conflicts in elevation and to verify elevation transfers. If additional right of way is required, section corners should be tied into the survey as well. Chapter Twenty-two provides additional information pertaining to section corners, subdivision corners, and property corners.

24-1.02 Field Work

The located centerline control points, section corners, and property corners should be used as ground control points. Do not set road nails randomly, near the centerline or near property lines, as they may be confused with centerline and property-corner monumentation. If a panel point location is desired near the centerline, position it on or beyond the pavement edge. If the panel point must be located near the centerline, set the panel point without a road nail. Instead, use a non-standard marker such as a roofing nail.

A cross shape has been traditionally used as the configuration of the panel point. However, a chevron shape is preferred by the Department. A non-standard marker should be driven either at the center of the cross or at the tip of the chevron panel point. This point should be referenced if the road is chipped and sealed before control can be run.

If a conventional survey is being conducted, panel points may be established with a side shot. However, ensure that two sets of angles are taken as a verification check. Elevations may be carried with the traverse as long as the elevations close to third-order accuracy. The necessary measurements and computations should be made to substantiate the validity of results.

24-1.03 Accuracy and Precision

Unless GPS technology is used during the survey, a horizontal circuit should be run and closed with an unadjusted precision that is more accurate than 1:20 000.

Elevations should be run to third-order accuracy as discussed in Chapter Twenty-two. As practical, the elevations should be tied to an NGS or USC&GS NAVD 1988 datum benchmark to achieve a more-reliable source of elevations.

24-1.04 Supplemental Survey Data

An aerial-photo control survey is conducted in conjunction with, and not in place of, a project's ground survey (i.e., electronic or conventional), as an INDOT project requires survey control and information beyond that which can be provided by aerial photographs alone. For example, a project may depend on information that is either relative to topographic features that are not distinguishable from the air or not directly related to ground topography (e.g., owner names, company names, addresses). The following should be considered where an aerial-photo control survey is necessary.

1. Survey Equation. Where an equation to another survey is necessary, it is impractical to expect that the required degree of accuracy will be obtained from aerial photography. Ground-survey operations should be conducted to satisfy this objective.

2. Feature Proximity. It is beneficial to detail the topography of features that are in close proximity to the proposed right of way. For example, ground-survey details may reveal that a building can be saved by steepening the backslope or by constructing a retaining wall.

3. Utility Pole. As an aerial photograph is shot normal to the prevailing terrain surface, utility poles rarely appear in the photograph. Where they do appear, however, it is difficult to identify the type of pole. This information must be obtained in the field.

4. Underground Utility. The location of a subsurface feature such as an underground utility, cannot be determined aerially using conventional photographic-film media. A ground survey must be employed to verify the location of such an item. Section 22-2.0 discusses the appropriate procedures for coordinating with utility companies during the survey.

5. Body of Water. It is difficult to determine the elevation of an underwater feature such as a stream bed or lake bottom by employing the methods of conventional aerial photography. If water is involved, determine underwater elevations during the ground survey.

6. Substantially-Valued Tree. A tree of substantial value (e.g., fruit tree, hardwood tree, shade tree) that is close to the right-of-way line may become the subject of negotiation between the owner and the Department. The location of such an item is critical and should be determined by the ground-survey party.

7. Obscured Visibility. There may be a need to determine the topography of an area that is obscured from an aerial view (i.e., under tree canopy, building overhang). Such topography should be collected using ground-survey techniques.

Other information that is required during the project survey but cannot be adequately obtained from an aerial observation includes the following:

1. physical evidence of researched section, property lines, and corners;

2. drawings of section plats and key maps;

3. descriptions of bearing sources;

4. city or corporation limits;

5. field-tile locations;

6. storm- or sanitary-drainage-structure locations;

7. locations of utility lines;

8. utility company names and addresses;

9. present-structure profile drawings;

10. profile of project baseline;

11. edges of pavement;

12. temporary benchmarks that are set and described;

13. completed level circuit;

14. elevations of drainage structures including headwalls, tops of openings, flowlines, tops of manhole rims, etc.;

15. elevations of overhead lines that are in close proximity to the project limits;

16. profile of railroad tracks;

17. high-water elevations; and

18. other features that do not appear in an aerial observation and are critically located to the project.