FDM 9-43-1 Minimum Data Requirements

June 19, 2013

This procedure lists development surveying operations[1] typically needed to meet the minimum data requirements for each of seven types of highway improvement projects. Surveying operations needed to meet the minimum data requirements for a major project will be similar to the minimum data requirements for one, or more, of the seven types of projects listed. The seven types of projects have been grouped into only four different parts for this procedure (see Attachment 1.1 for surveying operations in each part.)

The text of each part is complete and independent of any other part. The types of projects in the four parts are:

- Reconstruction, reconditioning, or expansion project
- Pavement replacement project
- Resurfacing project
- Bridge replacement or bridge rehabilitation project

In some regions, staff outside the survey unit may do some of the surveying operations listed in this procedure. After the scoping meeting, the project designer or project manager should meet with the survey unit coordinator and specify which of the listed surveying operations are needed for the project, and which surveying operations are to be performed by the survey unit. Some projects do not need all the surveying operations listed. Before deleting any surveying operations, designers should consider the possible need for each of the surveying operations to avoid inefficient project visits caused by scope creep.

1.1 Reconstruction, Reconditioning, or Expansion Project

A reconstruction project and an expansion project will usually need all of the following listed surveying operations. A reconditioning project may not need all of the following listed surveying operations. The project designer or project manager should determine the surveying operations needed for a project. Often a bridge rehabilitation or bridge replacement project is part of a reconstruction project but may also require those surveying operations listed later in this procedure for a bridge rehabilitation project or a bridge replacement project. Surveying operations usually needed for a reconstruction, reconditioning, or expansion project are listed below.

1. Find existing horizontal and vertical control, and select geodetic references. [1] Review existing documentation for the project area to identify potential existing horizontal and vertical control including, but not limited to, as-built plans, the National Geodetic Survey Database, department and county data files, and right-of-way and transportation project plats. Reconnoiter the project area to recover existing control and determine what additional control is needed. Select for the project the:
    - Horizontal Datum
    - Vertical Datum
    - Horizontal Coordinate System and Zone
2. Provide mapping, imagery, or other spatial data. Select the needed product(s) from the following:
    - Aerial mapping/digital terrain model (DTM) data [2] (designer to cut cross sections in design software).
    - Aerial expedient planimetric mapping, and field DTM or field cross sections.
    - Field mapping (radial topography), and field DTM or field cross sections.
    - Digital ortho imagery, and field DTM or field cross sections.
    - Georeferenced imagery, and field DTM or field cross sections.
    - Scanned aerial imagery.
    - Aerial imagery.
    - Aerial mosaic.
3. Field locate[2] and document the existing pavement centerline, horizontal and vertical control monuments, and right-of-way monuments.

[1] See glossary in FDM 9-80-1 for a definition of the term “surveying operations.”
[2] Here the word “locate” means to determine a horizontal, vertical, or three-dimensional position of a feature.

- Review as-built plans, plats (check with the region Plat Unit for the most recent plat), and existing horizontal and vertical control documentation for the project area.
- Locate new horizontal and vertical control monuments.
- Locate existing right-of-way monuments.
- Find existing Public Land Survey System (PLSS) monuments (section corners).
- Find and locate the existing highway alignment.
- Compute alignment and compare to the as-built plan, right-of-way plat, and transportation project plat. Make adjustment if necessary.
- Evaluate relative location of centerline and right-of-way.
- Check if existing right-of-way monuments are in platted locations.
- Place witness posts or lath about landmarks (property boundary monuments including PLSS monuments) and control monuments to protect them.

When determining the existing centerline of pavement, be alert to migration of asphalt pavement which is likely to move from the original alignment with each pass of the paver and with traffic. Concrete pavement is less likely to migrate. If an asphalt overlay has been placed on concrete pavement, dig to find the edge or joint of the concrete. Also be alert to widening of the pavement on only one side of the original centerline.

Centerline information may be available from either the region Real Estate Section or from the Plat Unit in the form of plat information. Information is also available from town road records, or from previous design plans. The project designer or project manager should coordinate who will merge the data for a best-fit centerline. Also, see Chapter 12 and Wisconsin Administrative Code A-E 7.03. http://www.legis.state.wi.us/rsb/

4. Field locate and describe topographic features to supplement aerial mapping data.
   - Locate underground utilities. See FDM 18-10-15.
   - Locate easily recoverable existing property boundary monuments. Depending upon the specifics of the project, the project designer or project manager may request all property boundary monuments to be located. Researching to find all certified survey maps, plats, and associated documents for the project area may or may not be necessary for a project, and may or may not be considered surveying operations.
   - Locate features not identifiable on the photographs.
   - Describe features including size and material; e.g., a 24-inch diameter corrugated metal culvert pipe or a 30-foot tall blue spruce tree.
   - Fill in obscure areas on the photographs as requested by the project designer; e.g., ground elevations in an area of conifer trees.
5. Field locate environmentally sensitive areas.
   - Locate delineated wetlands.
   - Locate other environmental features as needed to meet requirements of Chapter 21.
6. Field locate critical points of structures and pipes.
   - Locate pipe inverts.
   - Measure overhead clearances.
   - Measure other site specific dimensions.
7. Field locate (during final design) features shown on the aerial mapping.

   At all project limits for aerial mapping projects, horizontal and vertical alignments should be adjusted to meet field conditions due to inherent errors in aerial mapping/DTM data. In addition, all surveys (aerial and field) should extend at least 300 feet beyond project limits so that smooth horizontal and vertical alignments can be developed between existing and proposed conditions.
8. Locate section corners for plat preparation.

   Establish coordinates for all section corners in or near the project area[3]. If existing section corner coordinate values are the basis for the project control (because the section corners are the best readily available monumentation with coordinates), those coordinate values must be listed in the project documentation. If existing section corner coordinates differ from the section corner coordinates determined by using the horizontal control for the project, then the coordinate values used must be

clearly listed and accompanied by the associated metadata.

9. Field mark proposed right-of-way acquisition for appraisal and monument right-of-way as early as practical.
10. Perpetuate monuments of record[4].

    Ensure that the county surveyor has been notified of the proposed design as approved in the Design Study Report. Notification should occur at the same time as notification to utility [5] companies. Also, provide a copy of the horizontal and vertical project control to the county surveyor.

1.2 Pavement Replacement Project

A pavement replacement project may not need all of the following listed surveying operations. The project designer or project manager should determine the surveying operations needed for a project. Surveying operations typically needed for a pavement replacement project are listed below.

1. Find existing horizontal and vertical control, and select geodetic references [1]. Review existing documentation for the project area to identify potential existing horizontal and vertical control including—but not limited to—as-built plans, the National Geodetic Survey Database, department and county data files, and right-of-way and transportation project plats. Reconnoiter the project area to recover existing control and determine what additional control is needed. Select for the project the:
    - Horizontal Datum
    - Vertical Datum
    - Horizontal Coordinate System and Zone
2. Provide mapping, imagery, or other spatial data. Select the needed product(s) from the following:
    - Aerial mapping/digital terrain model (DTM) data[2] (designer to cut cross sections in design software).
    - Aerial expedient planimetric mapping, and field DTM or field cross sections.
    - Field mapping (radial topography), and field DTM or field cross sections.
    - Digital ortho imagery, and field DTM or field cross sections.
    - Georeferenced imagery, and field DTM or field cross sections.
    - Scanned aerial imagery.
    - Aerial imagery.
    - Aerial mosaic.
3. Field locate and document existing pavement centerline, and horizontal and vertical control.
    - Review as-built plans, and existing horizontal and vertical control documentation for the project area.
    - Locate new horizontal and vertical control monuments.
    - Find existing Public Land Survey System (PLSS) monuments (section corners).
    - Find and locate the existing highway alignment.
    - Compute alignment, compare to the as-built plan, and make adjustment if necessary.
    - Place witness posts or lath about landmarks (property boundary monuments including PLSS monuments) and control monuments to protect them.

    When determining the existing centerline of pavement, be alert to migration of asphalt pavement, which is likely to move from the original alignment with each pass of the paver and with traffic. Concrete pavement is less likely to migrate. If an asphalt overlay has been placed on concrete pavement, dig to locate the edge or joint of the concrete. Also, be alert to widening of the pavement on only one side of the original centerline.

    Centerline information may be available from either the region Real Estate Section or from the Plat Unit in the form of plat information. Information is also available from town road records, or from previous design plans. The project designer or project manager should coordinate who will merge the data for a best-fit centerline. Also, see Chapter 12 and Wisconsin Administrative Code A-E 7.03. http://www.legis.state.wi.us/rsb/
4. Field locate and describe topographic features to supplement mapping data.
    - Locate underground utilities. See FDM 18-10-15.
    - Locate easily recoverable existing property boundary monuments. Depending upon the

specifics of the project, the project designer or project manager may request all property boundary monuments to be located. Researching to locate all certified survey maps, plats, and associated documents in the project area may or may not be necessary for a project, and may or may not be considered surveying operations.

- Locate other features not identifiable on the photographs.
- Describe features including size and material; e.g., a 24-inch diameter corrugated metal culvert pipe or a 30-foot tall blue spruce tree.
- Fill in obscure areas on the photographs as requested by the project designer; e.g., ground elevations in an area of conifer trees.

5. Field locate critical points of structures and pipes.
   - Locate pipe inverts.
   - Measure overhead clearances.
   - Measure other site-specific dimensions.
6. Field locate (during final design) features shown on the aerial mapping. At all project limits for aerial mapping projects, horizontal and vertical alignments should be adjusted to meet field conditions due to inherent errors in aerial mapping/DTM data. In addition, all surveys (aerial and field) should extend at least 300 feet beyond project limits so that smooth horizontal and vertical alignments can be developed between existing and proposed conditions.
7. Perpetuate monuments of record. See FDM 9-5-1 and FDM 9-25-1. Ensure that the county surveyor has been notified of the proposed design as approved in the Design Study Report. Notification should occur at the same time as notification to utility companies[5]. Also, provide a copy of the horizontal and vertical project control to the county surveyor.

1.3 Resurfacing Project

A resurfacing project may not need all of the following listed surveying operations. The project designer or project manager should determine the surveying operations needed for a project. Surveying operations typically needed for a resurfacing project are listed below.

1. Find existing horizontal and vertical control, and select geodetic references[1]. Review existing documentation for the project area to identify potential existing horizontal and vertical control including—but not limited to—as-built plans, the National Geodetic Survey Database, department and county data files, and right-of-way and transportation project plats. Reconnoiter the project area to recover existing control and determine what additional control is needed. Select for the project the:
   - Horizontal Datum
   - Vertical Datum
   - Horizontal Coordinate System and Zone
2. Provide mapping, imagery, and/or other spatial data. Select the needed product(s) from the following.
   - Aerial expedient planimetric mapping, and field digital terrain model (DTM)[2] or field cross sections.
   - Field mapping (radial topography), and field DTM or field cross sections.
   - Digital ortho imagery, and field DTM or field cross sections.
   - Georeferenced imagery, and field DTM or field cross sections.
   - Scanned aerial imagery.
   - Aerial imagery.
   - Aerial mosaic.
   - Line diagram of centerline.
3. Field locate and document existing pavement centerline, and horizontal and vertical control. The project designer or project manager should decide early in the project if a best-fit alignment is needed and if so who will be responsible for performing the surveying operations.
   - Review as-built plans, and existing horizontal and vertical control documentation for the project area.
   - Locate new horizontal and vertical control monuments.
   - Find existing Public Land Survey System (PLSS) monuments (section corners).
   - Find and locate the existing highway alignment.

- Compute alignment, compare to the as-built plan, and make adjustment if necessary.
- Place witness posts or lath about landmarks (property boundary monuments including PLSS monuments) and control monuments to protect them.

When determining the existing centerline of pavement, be alert to migration of asphalt pavement which is likely to move from the original alignment with each pass of the paver and with traffic. Concrete pavement is less likely to migrate. If an asphalt overlay has been placed on concrete pavement, dig to locate the edge or joint of the concrete. Also be alert to widening of the pavement on only one side of the original centerline.

Centerline information may be available from the district Real Estate Section or the Plat Unit in the form of historical and/or the most recent plat information, from Town Road Records, or from previous design plans. The project designer or project manager should coordinate who will merge the data for a best-fit centerline. Also, see Chapter 12 and Wisconsin Administrative Code A-E 7.03. http://www.legis.state.wi.us/rsb/

4. Field locate and describe topographic features to supplement mapping data in areas where spot improvements are proposed.
   - Locate underground utilities. See FDM 18-10-15.
   - Locate easily recoverable existing property boundary monuments.
   - Locate other features not identifiable on the photographs.
   - Describe features including size and material; e.g., a 24-inch diameter corrugated metal culvert pipe or a 30-foot tall blue spruce tree.
   - Fill in obscure areas on the photographs as requested by the projector designer; e.g., ground elevations in an area of conifer trees.
5. Field locate critical points of structures and pipes.
   - Locate pipe inverts.
   - Measure beam guard heights.
   - Measure overhead clearances.
   - Measure other site specific dimensions.
6. Field locate (during final design) features shown on the aerial mapping. At all project limits for aerial mapping projects, horizontal and vertical alignments should be adjusted to meet field conditions due to inherit errors in aerial mapping/DTM data. In addition, all surveys (aerial and field) should extend at least 300 feet beyond project limits so that smooth horizontal and vertical alignments can be developed between existing and proposed conditions.
7. Perpetuate monuments of record. Ensure that the county surveyor has been notified of the proposed design as approved in the Design Study Report [4]. Notification should have occurred at the same time as notification to utility companies [5]. Also, provide a copy of the horizontal and vertical project control to the county surveyor.

1.4 Bridge Replacement or Bridge Rehabilitation Project

If bridge replacement or bridge rehabilitation is a part of a reconstruction project, perform the surveying operations for the reconstruction project and provide the requested field information for the appropriate structure survey report. For more information regarding Structure Survey Reports (SSRs), refer to FDM 3-20-30. If the bridge replacement or bridge rehabilitation project is not part of a reconstruction project, the following listed surveying operations will usually be required. The project designer or project manager should determine the surveying operations needed for a project.

1. Provide field information for the appropriate Structure Survey Report. Select one of the structure survey report forms (DT1694, DT1696, DT1698) available online from the WisDOT Internet forms catalog.
2. Find existing horizontal and vertical control, and select geodetic references. [1] Review existing documentation for the project area to identify potential existing horizontal and vertical control including—but not limited to—as-built plans, the National Geodetic Survey Database, Department and county data files, and right-of-way and transportation project plats. Reconnoiter the project area to recover existing control and determine what additional control is needed. Select for the project the:
   - Horizontal Datum
   - Vertical Datum

- Horizontal Coordinate System and Zone
- Units

3. Field locate and document the existing pavement centerline, horizontal and vertical control monuments, and right-of-way monuments.
   - Review as-built plans, plats (check with the region Plat Unit for the most recent plat), and existing horizontal and vertical control documentation for the project area.
   - Locate new horizontal and vertical control monuments.
   - Locate existing right-of-way monuments.
   - Find existing Public Land Survey System (PLSS) monuments (section corners).
   - Find and locate existing highway alignment.
   - Compute alignment and compare to the as-built plan, right-of-way plat, and transportation project plat; make adjustment if necessary.
   - Evaluate relative location of centerline and right-of-way.
   - Check if existing right-of-way monuments are in platted locations.
   - Place witness posts or lath about landmarks (property boundary monuments including PLSS monuments) and control monuments to protected them.

   When determining the existing centerline of pavement, be alert to migration of asphalt pavement which is likely to move from the original alignment with each pass of the paver and with traffic. Concrete pavement is less likely to migrate. If an asphalt overlay has been placed on concrete pavement, dig to locate the edge or joint of the concrete. Also be alert to widening of the pavement on only one side of the original centerline.

   Centerline information may be available from either the region Real Estate Section or from the Plat Unit in the form of plat information. It is also available from town road records, or from previous design plans. The project designer or project manager should coordinate who will merge the data for a best-fit centerline. Also, see Chapter 12 and Wisconsin Administrative Code A-E 7.03 http://www.legis.state.wi.us/rsb/.

4. Field locate and describe topographic features.
   - Locate underground utilities. See FDM 18-10-15.
   - Locate easily recoverable existing property boundary monuments. Depending upon the specifics of the project, the project designer or project manager may request all property boundary monuments be located. Researching to find all certified survey maps, plats, and associated documents for the project area may or may not be necessary for a project and may or may not be considered surveying operations.

5. Field locate environmentally sensitive areas.
   - Locate delineate wetlands.
   - Locate other environmental features as needed to meet the requirements.

6. Field locate critical points of structures and pipes.
   - Locate pipe inverts.
   - Measure overhead clearances.
   - Measure other site specific dimensions.

7. Field locate features during final design. All surveys should extend at least 300 feet beyond project limits so that smooth horizontal and vertical alignments can be developed between existing and proposed conditions.

8. Perpetuate monuments of record. See FDM 9-5-1 and FDM 9-25-1. Ensure that the county surveyor has been notified of the proposed design as approved in the Design Study Report. Notification should have occurred at the same time as notification to utility companies. Also, provide a copy of the horizontal and vertical project control to the county surveyor.

1.5 References

[1] See FDM 9-5-10.

[2] See FDM 9-45-2, Aerial Projects, Image Products. For more information on DTMs see Section 9-65.

[3] See FDM 9-5 Attachment 5.1.

[4] See FDM 9-5-1 and FDM 9-25-1.

[5] See FDM 18-10-1.

LIST OF ATTACHMENTS

Attachment 1.1 Surveying Operations to Meet Minimum Data Requirements

FDM 9-43-5 Survey Time Frame

October 25, 2002

The time span from a request for a survey to plans ready for letting will vary depending on the length, complexity, and scope of an improvement project. It can range from less than a year to many years for a complex reconstruction project. Factors such as environmental impact, right-of-way acquisitions, and complexity of project should be considered.

The following lead times for requesting surveys should be incorporated into project schedules.

Two Years

The survey should be requested 2 years before the start of preliminary design for reconstruction, reconditioning, expansion, pavement replacement, or bridge replacement highway improvement projects which will use:

- Aerial survey products,
- Consultant services, or
- Traditional ground survey methods.

This much lead time is needed to prepare for and to acquire the aerial imagery (3 to 14 months), and to compile the data after the flight (2 to 12 months). The most significant reason for planning ahead is that adequate aerial imagery can be acquired only in the spring (after the snow melts and before the trees have leaves, see FDM 9-45-10). A request for imagery received by December allows sufficient time to schedule aerial imagery for the following spring flight, 3 months later. A request for imagery received after December may result in the aerial imagery acquisition not being scheduled until the next spring, 15 months later. A request for a consultant survey needs to allow time to prepare the contract. A request for consultant or department ground survey should be submitted sufficiently early to allow performing the survey during a time of year that is most efficient for surveying. Survey costs can escalate when surveying in a densely foliated area or in deep snow. Even a light covering of snow can hide significant features from the surveyor.

Seven Months

For highway improvement projects that will not use aerial survey products, the survey should be requested at least 7 months before the start of preliminary design. The time needed to bring engineering control to a project varies significantly from project to project and ample time should be allowed to accomplish this survey activity. Surveying work is affected by seasonal conditions and is usually conducted most expeditiously during periods of no leaves on the trees and no snow on the ground.

Two Months

Permanent right-of-way monumentation should be requested a minimum of 2 months before the desired completion date. An additional 2 weeks should be allowed for every 5 miles of project length beyond 5 miles. Additional time should be allowed for urban areas or otherwise complex areas. Permanent right-of-way monuments should be placed in accordance with FDM 9-25-6.

One Month

Temporary right-of-way staking for appraisal purposes only should be requested 1 month before the desired completion date. An additional 1 week should be allowed for every 5 miles of the project length beyond 5 miles. Additional time should be allowed for urban areas, if the project is in an area without a recent project, or if no existing right-of-way monuments are in the immediate vicinity of the project.

For more information on:

- Highway improvement projects and the survey activities needed for each, refer to FDM 9-43-1, Minimum Data Requirements.
- Aerial imagery products and services, refer to FDM 9-45-2, Image Products, and FDM 9-45-3, Mapping Products.
- Products and services available from the Surveying & Mapping Section, refer to the online Surveying & Mapping Catalog at intranet URL http://dotnet/dtid_survmap/acrobat_link.htm.