

# **NCDOT**

## **MAPPING GUIDELINES FOR PLANNING AND DESIGN ACTIVITIES**

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## **INTRODUCTION**

These mapping guidelines were developed to assist planning and design personnel with the determination of the correct mapping products to order in support of their work. Product definitions are presented with a brief explanation of their make up and use for planning and design activities. The NEPA Merger 01 Process is referenced where pertinent. Next, the guidelines identify when and how the mapping products should be requested. A basic description of the three distinct levels of design is also given. Representative examples of these three design types, shown on their corresponding mapping products, are attached at the end of the guidelines.

In conjunction with this update of the mapping guidelines, a new process has been established for requesting mapping products. The purpose of this new process is twofold; first, to assure appropriate mapping limits are identified for all projects and, second, to help eliminate overlap and duplication of requests. To this end, beginning in August of each year Photogrammetry will take steps to initiate a master list of anticipated mapping needs for the upcoming winter flight season. This list, in spreadsheet form, will be finalized by mid-October through coordination with PDEA and Roadway Design. To aid in preparation of the spreadsheet the guidelines present a timeline and general steps to follow to prepare the *Mapping Needs Request Spreadsheet*. Note that when mapping needs are discovered outside of the timeframe for preparation of this list, the new process is not intended to prohibit individual mapping requests from being made at other times throughout the year. In addition, requests for mapping on bridge replacement projects will not change and are to be handled outside of this new process.

These guidelines were assembled through a cooperative effort of Photogrammetry, PDEA and Roadway Design representatives. For clarification of issues not directly addressed by the guidelines, or for specific questions related to the request of mapping products, contact your respective Unit representative identified on the front cover of this package.

# **Mapping Products for Roadway Design and PDEA**

*(Mapping products are listed in order of increasing accuracy and detail.)*

**Digital Mosaic** – Digital Aerial Photograph that is “warped” to correspond to the curvature of the earth’s surface. No surveyed ground control is used. No elevation data is delivered. **This product is not accurate for design use.** A variety of scales are available from 1”=100’ to 1”=400’. Digital Mosaics are requested by PDEA and most often used to delineate flight limits for Shell Mapping requests on bridge replacement projects. They are occasionally used as exhibits at Scoping Meetings and to identify project study areas for acquisition of environmental impacts.

**Orthophotography** – Digital Aerial Photograph that is rectified to the earth’s surface by use of surveyed ground control. A Digital Elevation Model (DEM) is delivered. The DEM will consist of mass points and breaklines on most roads and all bodies of water. A variety of scales are obtainable, with 1”=200’ or 1”=400’ being typical. Requested by PDEA, after coordination with Roadway Design. Used by PDEA as photography for Scoping Meetings and public involvement and to define project study areas. Orthophotos are **used by Roadway Design for functional design work.** (Photography from this product can be supplemented and transformed into *Preliminary Mapping* to be used by Roadway Design for preliminary design work on new location projects.)

**Shell Mapping** - Microstation design files. Surveyed ground control is used. A Digital Terrain Model (DTM) is delivered. The DTM will consist of mass points and breaklines on all slope changes. No field survey information or classification is provided at this stage. Mapping scales of 1”=50’ or 1”=20’ are typical. Requested by PDEA Bridge Unit, after coordination with Roadway Design. **Used by Roadway Design for preliminary design work on bridge replacement projects.** [Location and Surveys “finishes” this mapping with full ground surveys (property, pavement DTM’s, utilities, obscured areas, etc.) and converts it into plan sheets (*Final Surveys*) for use by Roadway Design in R/W and Final Plans design.]

**Preliminary Mapping** – Microstation design files. Surveyed ground control is used. A Digital Terrain Model (DTM) is delivered. The DTM will consist of mass points and breaklines on all slope changes. County property data and field classification are incorporated into the mapping. Level “D” underground utilities are usually included in this mapping. Mapping scales of 1”=100’ or 1”=200’ are possible. Requested by Roadway Design, after coordination with PDEA, and **used for preliminary design work on new location and large scale widening projects.** Preliminary designs are to begin after Concurrence Point #2 is achieved.

**Preliminary Plan Sheet Mapping** – (Similar to Shell Mapping) Microstation design file. Surveyed ground control is used. A Digital Terrain Model (DTM) is delivered. The DTM will consist of mass points and breaklines on all slope changes. No field surveys are done, but mapping is classified to final plan sheet specifications and includes county property line information. Mapping scales of 1"=50' or 1"=20' are normally utilized. Requested by Roadway Design, after coordination with PDEA, and **used for preliminary designs on average widening projects.** Preliminary designs are to begin after Concurrence Point #2 is achieved. [Location and Surveys will complete this mapping following Concurrence Point #3, or upon approval of the Highway Design Branch Manager, and convert it into plan sheets (Final Surveys).]

**Final Surveys** – Microstation design files. Surveyed ground control is used. A Digital Terrain Model (DTM) is delivered. The DTM will consist of mass point and breaklines on all slope changes. Field surveys of utilities, pavement DTM's, obscured areas, property, and field classification are incorporated into the mapping. Mapping scales of 1"=50' or 1"=20' are achievable. Requested by Roadway Design and **used for preliminary designs on small scale widening projects and for R/W and Final Plans design on all projects.**

# Steps For Requesting Mapping Products

## New Location Projects

- In August and September of each year PDEA will coordinate with Roadway Design and Photogrammetry and add **Orthophotography** needs to the *Mapping Needs Request Spreadsheet*. Orthophotos should be requested for projects in the fall prior to the Scoping Meeting. If scoping is to occur in early spring, it may be necessary to request mapping two flight seasons prior to the Scoping Meeting. By October 15 of each year, PDEA will submit one letter to Photogrammetry requesting all Orthophotography needed for the upcoming flight season. Mapping limits for each project will be attached to this letter.
- Likewise, during August and September, Roadway Design will coordinate with PDEA and Photogrammetry and add projects that require **Preliminary Mapping** to the *Mapping Needs Request Spreadsheet*. When appropriate, the Preliminary Mapping will be converted from previously supplied Orthophotos after alternates are selected for detailed study (Concurrence Point #2). By October 15 of each year, Roadway Design will submit individual request letters for Preliminary Mapping to Photogrammetry. Each letter will include a sketch of the required mapping limits.
- Roadway Design will also include **Final Survey** needs for new location projects for the upcoming year in the *Mapping Needs Request Spreadsheet* each fall. Roadway Design will then submit an individual request for Final Surveys on each of these projects after LEDPA is achieved (Concurrence Point #3).

## Widening and Other Improvement Projects

- In August and September of each year PDEA will coordinate with Roadway Design and Photogrammetry and add **Orthophotography** needs to the *Mapping Needs Request Spreadsheet*. Orthophotos should be requested for projects in the fall prior to the Scoping Meeting. If scoping is to occur in early spring, it may be necessary to request mapping two flight seasons prior to the Scoping Meeting. By October 15 of each year, PDEA will submit one letter to Photogrammetry requesting all Orthophotography needed for the upcoming flight season. Mapping limits for each project will be attached to this letter. In addition, mapping requests from Roadway Design will be based on project type, project complexity and project schedule. These criteria are interrelated in that longer, more involved projects typically have more protracted schedules than small, clearly defined projects. For the purposes of requesting mapping, widening projects will be identified as large, average or small. The types of mapping products requested can vary as listed in the following sections:

### **Large Widening Projects**

- On large widening projects with some realignment considerations, in addition to the Orthophotos PDEA requests, Roadway Design will identify these projects on the *Mapping Needs Request Spreadsheet* as needing **Preliminary Mapping**. Typically the Preliminary Mapping will use the same photography as the Orthophotos. By October 15 of each year, Roadway Design will submit individual request letters for Preliminary Mapping to Photogrammetry. Each letter will include a sketch of the required mapping limits.
- Roadway Design will also include **Final Survey** needs on large widening projects for the upcoming year in the *Mapping Needs Request Spreadsheet* each fall. Roadway Design will then submit an individual request for Final Surveys on each of these projects after LEDPA is achieved (Concurrence Point #3).

### **Average Widening Projects**

- On average widening projects with very little or no realignment, in addition to the Orthophotos PDEA requests, Roadway Design will add a request for **Preliminary Plan Sheet Mapping** to the *Mapping Needs Request Spreadsheet*. Typically, the Preliminary Plan Sheet Mapping will use the same photography as the Orthophotos. By October 15 of each year, Roadway Design will submit individual request letters for Preliminary Plan Sheet Mapping to Photogrammetry. Each letter will include a sketch of the required mapping limits.
- Roadway Design will also include **Final Survey** needs on average widening projects for the upcoming year in the *Mapping Needs Request Spreadsheet*. Roadway Design will then submit an individual request for Final Surveys on each of these projects after Concurrence Point #2 is reached and public involvement has been initiated (Citizens Information Workshop). Usually the surveys will be based on previous photography used for the Preliminary Plan Sheet Mapping.

### **Small Widening Projects**

- On small widening projects with a very well defined scope, in addition to the Orthophotos PDEA requests, Roadway Design will add **Final Survey** needs to the *Mapping Needs Request Spreadsheet*. No survey groundwork will be started until the public involvement has been initiated (Citizens Information Workshop) and a Request for Surveys, with survey limits, is submitted by Roadway Design.

\*\*\* (For New Location and Widening projects, refer to the **Yearly Mapping Needs Request** description and time line for additional explanation of this process. A copy is included in this package.) \*\*\*

## **Bridge Replacement Projects**

- PDEA will request a ***Digital Mosaic*** well in advance of a project's Scoping Meeting.
- PDEA will coordinate with Roadway Design to determine the study area and then request ***Shell Mapping*** in the fall prior to the Scoping Meeting. If scoping is to occur in early spring, it may be necessary to request mapping two flight seasons prior to the Scoping Meeting. Roadway Design will establish a date in the StaRS scheduling program to identify when Shell Mapping is to be delivered - typically 24 months before the R/W date.
- Roadway Design will request ***Final Surveys*** after the preferred alternate is selected.

\*\*\* (Bridge replacement projects will continue to be handled outside of the new *Mapping Needs Request Spreadsheet* process.) \*\*\*

# Types of Designs

**Functional Design** is a very general design that includes horizontal and vertical alignments, EP's, slope stakes and R/W limits for all study alternatives. These designs should also include general layouts for proposed interchanges. Details like turn lanes or superelevation are not usually included. Functional designs are done on Orthophotos between Concurrence Points 1 and 2, within the study area, on new location projects. Functional designs are intended to establish basic line and grade for comparative alternatives. Initial cost estimates are also established based on these fundamental design elements.

**Preliminary Design** is a very specific design that includes horizontal and vertical alignments, EP's, slope stakes, turn lanes, superelevation and R/W limits. Preliminary designs are done on preliminary mapping between Concurrence Points 2 and 3 on all corridors that are carried forward for detailed study. This type of design is done on new location, widening and bridge projects. Preliminary design is a refinement of the functional design. These refinements generally consist of adjusting the alignment and grade to avoid or minimize impacts to resources, such as delineated streams and wetlands, whose locations were not known at the functional design stage. The scope of work in this phase should not include starting the design over just because of a transition between mapping types.

**Final Design** is a very detailed design done on the most accurate form of mapping - final surveys. Final design work also includes computing and summarizing all contract quantities, incorporating R/W revisions, receiving plans from various Units (Traffic Engineering Branch, Roadside Environmental Unit, Utilities, etc.) and incorporating them into the final plan package. These final plans are used to construct the project. This type of design is usually begun after Concurrence Point 4A. Consistent with the previous design stages, final designs are a further refinement of the preliminary designs and are not intended to be a point to start the design process over again.

## YEARLY MAPPING NEEDS REQUEST

- **1<sup>st</sup> week of August - PHOTOGRAMMETRY INITIATES MAPPING REQUEST PROCESS**

*Photogrammetry e-mails a blank Mapping Needs spreadsheet to both the PDEA Staff Engineer and the Roadway Design Assistant Unit Heads.*

- **Month of August PDEA & RDU CO-PMs COORDINATE MAPPING NEEDS**

*The PDEA and Roadway Design Co-Project Managers coordinate their mapping needs thru June, two years ahead, excluding bridge replacement projects. For example, during mapping needs coordination in July 2007, the assumption is that the flight season will begin October 2007. The Co-PMs need to look at their schedules to determine if mapping products are needed prior to June 2009 for scoping meetings, functional and preliminary design work, etc. If there are needs, mapping should be requested for the upcoming flight season.*

- **1<sup>st</sup> week of September - PDEA REQUESTS ALL ORTHOPHOTOS & DIGITAL MOSAICS. ROADWAY DESIGN REQUESTS ALL OTHER MAPPING PRODUCTS.**

*Each PDEA Co-PM completes their spreadsheet and sends to PDEA Staff Engineer, who compiles into a single Mapping Needs spreadsheet for PDEA and forwards to Photogrammetry. Each Roadway Design Co-PM completes their spreadsheet and sends to the Assistant Unit Head, who compiles into a single Roadway Design spreadsheet and forwards to Photogrammetry. Upon receipt of both spreadsheets, Photogrammetry compiles into a single "DRAFT Mapping Needs Request" spreadsheet.*

- **Month of September- PHOTOGRAMMETRY COORDINATES WITH PDEA & RDU**

*From the "DRAFT Mapping Needs Request" spreadsheet, Photogrammetry will start coordinating with both the PDEA and Roadway Design Co-PMs. This coordination may consist of individual meetings to use GIS information to streamline the process of Orthophoto requests by immediately delineating the mapping limits. Additional coordination may be needed to discuss discrepancies found on the "DRAFT Mapping Needs Request" spreadsheet.*

- **October 1 FINAL MAPPING NEEDS SPREADSHEET DEVELOPED**

*After the coordination has ended, Photogrammetry will issue a FINAL Mapping Needs Spreadsheet to both PDEA and Roadway Design.*

- **October 15 ALL MAPPING REQUESTS DUE**

*Mapping request letters with location maps, excluding final surveys and orthophotos requested using GIS information, are due by this date; however, requests may be submitted earlier.*