STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

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APR 2 5 2007
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April 23, 2007

MEMORANDUM TO: PDEA Project Engineers
Roadway Design Project Engineers

FROM: Gregory J. Thorpe, Ph.D.
Branch Manager, PDEA

Art McMillan, PE
State Highway Design Engineer

SUBJECT: Scope of Preliminary Designs

The purpose of this memo is to clarify the scope of work involved in the development of Functional and Preliminary Designs during project development, whether being done in-house or by a Private Engineering Firm (PEF). A tremendous amount of design work occurs during the Functional Design stage of a project and this effort is typically not duplicated due to the receipt of an additional mapping product type. The following information is to offer some guidance on the distinction between Functional and Preliminary Designs to insure the consistency of in-house design work and to insure that contract scopes and workday estimates accurately reflect the true effort required.

Functional Designs are prepared for new location Merger projects on each preliminary study corridor under consideration prior to Concurrence Point 2. Functional designs are prepared on orthophotography utilizing a Digital Elevation Model (DEM). **Preliminary Designs** are prepared for new location Merger projects on Detailed Study Alternatives between Concurrence Point 2 and 2A and are used for Concurrence Points 2A, 3, & 4A. Preliminary Designs are also prepared for widening projects. Preliminary Designs are prepared on preliminary mapping utilizing a Digital Terrain Model (DTM). Orthophotography and preliminary mapping are usually prepared from ground information gathered from the same flight. The exception to this would be when substantial growth in the study area since the first flight necessitates a new flight for preliminary mapping.

The following applies to Preliminary Design work performed by the Roadway Design Unit or by PEFs as part of a PDEA contract:

- The scope of work for the Preliminary Design should only be a *refinement* to the Functional Design, in keeping with the NCDOT Preliminary Design Guidelines (see page 3 of the attached document).

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- The preliminary mapping (based on the same flight as the orthophotography) is attached to the Functional Design before the "*refinements*" begin. In other words, the design work does not start over due to the receipt of an additional mapping product. Preliminary mapping in urban areas or when the orthophotography is older than two years may require updating. How this impacts the Preliminary Design scope and workday estimate would have to be determined on a project by project basis.

- The "*refinements*" involved in the transition between Functional Designs to Preliminary Designs consist of adjusting the alignment to avoid and/or minimize impacts to resources whose locations were not known during the development of the Functional Designs (e.g., delineated streams and wetlands).

- These "*refinements*" also involve adding design details to the Functional Designs, as outlined in the NCDOT Preliminary Design Guidelines, Section A.1.a.

- The scope of work ***should not*** include starting all the design activities over due to the transition between orthophotography to preliminary mapping, or in other words, from Functional Designs to Preliminary Designs.

Please be sure that PEF Preliminary Design work is being scoped consistently with these guidelines. Everyone is reminded that all Functional and Preliminary Design work in PDEA contracts is to be scoped in coordination with the Roadway Design Unit. The Roadway Design Project Engineer should review the design scope of work, prepare the design workday estimate, and assist in the negotiation of this portion of the fee estimate. This is imperative to keep the cost of Preliminary Designs from escalating unnecessarily.

If there are any questions, contact Ron Allen at 919-250-4016 or Missy Dickens at 919-733-7844, Ext. 293.

GLT/AM/mad

cc: Debbie Barbour
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FUNCTIONAL DESIGN GUIDELINES

Functional designs are required when several new location alternatives are being studied. These designs are accomplished between concurrence points 1 & 2 in the NEPA Merger 01 process on orthophotographic mapping. All designs shall be in accordance with the 2001 AASHTO Green Book or latest edition thereof.

The following items outline the guidelines for functional designs.

1) The private engineering firm will submit the proposed functional designs, with corridor boundaries, on orthophotographic mapping.

2) The design on the orthophotography will enable the Roadway Design Project Engineer to review the alternatives from a topographic and design perspective.

3) Functional designs will be neat and legible in their presentation. Each design alternative will be clearly identified on the orthophotography, as well as on the profiles. All roads including secondary roads will be identified with route numbers as well as road names.

4) Items shown on the functional designs will include the following:

   a. The centerline of the L-Line, ramps and Y-lines. (no service roads or detours will be designed);

   b. Typical Sections for the L-Line and Y-Lines

   c. No superelevation;

   d. Construction limits for all alignments;

   e. Stationing along the mainline in 500 or 1000 foot intervals as appropriate;

   f. Approximate right of way limits on L-Line, Ramps and Y-lines;

   g. Cross-sections will be computer generated and plotted as requested

h. Control of access limits on L-Line, Ramps and Y-lines;

i. Lane lines and proposed number of lanes on L-Line, Ramps and Y-lines (no turn lanes will be designed);

j. Radius of horizontal curvature;

k. Profiles will show existing ground line, proposed grades, length of vertical curvature and rate of vertical curvature (K factor);

l. Bridge and R.C. box culvert locations and their approximate lengths and widths;

m. Interchange designs and configurations;

n. Current and design year average daily traffic (ADT) volumes for the L-Line and Y-Lines with turning movements at all intersections and interchanges.

o. Environmentally sensitive areas (wetlands, historic sites and boundaries, etc.); and

p. Location of any significant future or planned development.

5) The scale of the functional designs will be determined on a project-by-project basis.

6) The horizontal scale of centerline profiles will be the same as the functional design plan view. The vertical scale will be determined on a project-by-project basis.

7) Functional designs shall include a preliminary capacity analysis.

8) An estimate of all major quantities (including structure lengths and widths, etc.) shall be provided by the private engineering firm.

PRELIMINARY DESIGN GUIDELINES

Preliminary designs are required on all new location and widening projects. These designs are to be accomplished between concurrence points 2 & 2A in the NEPA Merger 01 process on preliminary mapping. (On widening projects, consideration may also be given to the use of preliminary plan sheet mapping or final survey information, as appropriate, on a project-by-project basis.) All designs shall be in accordance with the 2001 AASHTO Green Book or latest edition thereof.

Design hearing maps shall be prepared in accordance with Chapter 4 of the Roadway Design Policy Manual and Chapter 21 of the Roadway Design Manual and the 2001 AASHTO Green Book or latest edition thereof. However, if corridor protection will be established for the project, then the Corridor Protection/Design Public Hearing Map will be prepared in accordance with the regulations set forth in the official rules and regulations which will be provided by NCDOT.

A. Preliminary Design

Preliminary designs are a refinement of the functional designs and are prepared on all alternates that are carried forward after NEPA Merger 01 concurrence point 2.

1. Scope of Work

   a. Preliminary designs shall include all items required of functional designs as well as, but not limited to, the following:

      1. Detailed design of all intersections and interchanges, with required turn lanes.

      2. Profiles will show existing ground line, proposed grades, length of vertical curvature and rate of vertical curvature (K factor) for all alignments including service roads and temporary detours. The

profile shall normally be plotted at 1" = 20' vertical and 1" = 200' horizontal scales on roll paper. (Other scales may be discussed on a project-by-project basis.) Structures shall be sketched on all grade profiles.

3. Typical Sections for the L-Line and Y-Lines.
4. Cross-sections will be computer generated and plotted as requested.
5. All existing right of way lines of public roads within the project limits.
6. The location and size of all major drainage structures required for drainage of the project area (pipes 54" and over, R.C. box culverts, box culvert extensions and bridges.)
7. Construction limits including channel changes.
8. All property lines within the right of way limits and immediately adjacent to the proposed right of way.
9. The property owner names for all affected or nearby parcels.
10. Proposed right of way and easement requirements including control of access limits. Temporary and permanent drainage easements are to be so labeled on the plans. Easements may be shown as R/W on some projects. This will be determined on a project-by-project basis.
11. A summary of earthwork.
12. Any detour design required for traffic maintenance.

13. A traffic maintenance plan shall be prepared and coordinated with NCDOT. NCDOT will coordinate and refine this plan with Division personnel.

14. Complete capacity analysis.

15. Obvious service roads, road closures and major relocated driveways.

16. Coordinated alignments for the L-line suitable for staking.

17. Floodplains and historic sites.

18. Quantities to include major items such as but not limited to:

    Earthwork

    Paving quantities (based on preliminary pavement design)

    Clearing and grubbing

    Major drainage (pipes 54" and over, box culverts, and structures).

    Bridges (length and width)

    Guardrail

    Erosion control

    Traffic control

    Other quantities that would be considered major items for the project.

19. Additional requirements for Roadway Official Corridor Protection Map are covered in the Official Rules and Regulations and will be provided by NCDOT, if applicable.

b. The Engineer shall utilize the hydrological studies performed for the preparation of the planning document to determine a preliminary estimate of drainage structure quantities and define right of way requirements for drainage structures.

c. The estimate shall be revised to incorporate all bridging decisions made at the NEPA Merger 01 concurrence point 2A stage.

B. Work Standards

All plans and designs shall conform to NCDOT's standard practices for highway construction which are based on: "A Policy on Geometric Design of Highways and Streets, 2001" or later approved editions or as directed by NCDOT; and "Geometric Design Standards for Highways Other Than Freeways" as amended. These are published by the American Association of State Highway and Transportation Officials. In addition, the Highway Design Branch "Policy and Procedure Manual for Roadway Design" and "Design Manual for Roadway Design" published January 2. 2002 by the North Carolina Department of Transportation shall be used as guides, including any modifications as directed by NCDOT during the life of this Agreement. Where alternate designs may be warranted, the Engineer shall prepare designs sufficient to identify the optimum alternative.

All design assumptions shall be prepared, submitted to NCDOT and approved prior to beginning preliminary designs.

C. The Engineer shall furnish the following data to NCDOT:

1. Prints of the plans as necessary for review of work throughout the life of the contract.

2. Any estimate as requested by NCDOT.

3. Public hearing maps.

D. Miscellaneous

A responsible member of the firm shall attend all meetings, consultations, public hearings and field inspections deemed necessary by NCDOT or the Engineer. All meetings held will be in the vicinity of the project or in Raleigh, North Carolina.