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## STATE OF NEBRASKA

DEPARTMENT OF ROADS

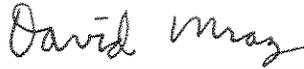
Kyle Schneeweis, P.E., Director

1500 Highway 2 • PO Box 94759 • Lincoln NE 68509-4759

Phone (402) 471-4567 • FAX (402) 479-4325 • www.roads.nebraska.gov

The Nebraska Department of Roads Roadway Design Manual Chapter Twelve, "Cost Estimating & Funding", August 2017, has been approved for use.

Approved by:  1 8/16/17  
Mike Owen, Roadway Design Engineer, P.E. Date

Approved by:  1 8-16-2017  
David Mraz, FHWA Date



The information contained in Chapter Twelve: Cost Estimating and Funding, dated December 16, 2017, has been updated to reflect the December 2018 Errata. The errata addresses errors, changes in procedure, changes in NDOR department titles, changes in other Roadway Design Manual chapters and other reference material citations occurring since the latest publication of this chapter.

Chapter Twelve presents guidance for the design of new, reconstructed and 3R projects; additional design guidance for 3R projects is provided in Chapter Seventeen. This chapter replaces Chapter Twelve: Cost Estimating & Funding, dated July 2006. The Nebraska Division of the FHWA approved this chapter for use on the National Highway System and other federal projects on August 16, 2017.

## Chapter Twelve

# Cost Estimating & Funding

Cost estimating is an integral part of a roadway project. The roadway designer is responsible for providing the project quantity computations to the **Cost Estimating Unit** of the **Construction Division (Cost Estimating)** for their use in the production of accurate, reliable, and up-to-date cost estimates.

### 1. USES OF COST ESTIMATES

The degree of detail and accuracy required for each estimate increases throughout the design process. Estimates, therefore, vary from general approximations at the early stages of a project to very detailed cost estimates at the bid letting stage. Cost estimates are used for a variety of purposes, including:

- Planning, allocation, and funding (See Section 1.A)
  - Distribution of funds to the **Districts**
  - Program decisions (State and local)
- Design alternative comparisons (See Section 1.B)
- Bid comparison and analysis (See Section 1.C)
- Agreements (See Section 1.D)
- Railroad protective liability insurance (See Section 1.E)
- NEPA (See Section 1.F)
- Public meetings (See Section 1.G)

#### 1.A Planning, Allocation, and Funding

Estimated project costs, inflated to account for costs in the year of construction, are used in determining the distribution of funds to the **Districts** and in developing State and local programs.

Estimated project costs may be supplied to **City** and/ or **County** governments (with **Assistant Design Engineer (ADE)** approval) with the understanding that the information contained in the estimate is to remain confidential. Cost estimates are used by the **City** and **County** governments to plan and program their roadway improvements. **Cities** and **Counties** may also provide matching funds or participate in the **Nebraska Department of Transportation (NDOT)** projects (See Section 2 of this chapter).

### 1.B Design Alternative Comparisons

Designers in the **Roadway Design Division (Roadway Design)** may use cost estimates to compare design strategy alternatives. **Cost Estimating** can provide scratch cost estimates for these comparisons.

### 1.C Bid Comparison and Analysis

Advance planning with reliable cost estimates and updates is important for the timely letting and construction of roadway projects. Cost estimates are also used to compare and review bids.

### 1.D Agreements

Cost estimates are required for the financial portion of agreements regarding municipal utility relocation, participation by other agencies in the project, etc.

### 1.E Railroad Protective Liability Insurance (% of Work Near Railroad)

The **Construction Division** must provide the contractor with the percentage of work, by cost, within 50 feet of the centerline of the nearest railroad track on railroad right-of-way and the percentage of work within the railroad right-of-way that is further than 50 feet from the centerline of the nearest railroad track. The contractor needs this information to obtain railroad protective liability insurance. The roadway designer will calculate these percentages for the PS&E package using the following equations:

% of work on RR ROW within 50 feet of the centerline of the nearest track (Group \_) = [(The cost of Group \_ on RR ROW within 50 feet of the centerline of the nearest track) ÷ (The cost of Group \_ total)] x 100%.

% of work on RR ROW outside of 50 feet of the centerline of the nearest track (Group\_) = [(The cost of Group \_ on RR ROW beyond 50 feet of the centerline of the nearest track) ÷ (The cost of Group \_ total)] x 100%.

**Cost Estimating** can assist the roadway designer in calculating costs.

### 1.F NEPA

The amount of Federal funding, based on the cost estimate, is one threshold in determining the need and level of NEPA documentation for a project.

### 1.G Public Meetings

The cost estimate is used to both to inform and solicit feedback about the project at public meetings.

## 2. FUNDING AND COST SHARING

Funding for projects may come from a variety of sources (e.g. Federal, other State Agencies, Municipal).

### 2.A Federal Funding Programs

As stated in the Nebraska Revised Statutes, Chapter 39, Section 1365.02 “The Department of Roads shall apply for and make maximum use of available federal funding, including discretionary funding, on all highway construction projects which are eligible for assistance.” Federal funding available to the **NDOT** includes the following programs.

#### 2.A.1 **National Highway Performance Program (NHPP)** (<https://www.fhwa.dot.gov/fastact/factsheets/nhppfs.cfm>)

The NHPP provides funding for the operational performance and condition of the National Highway System (NHS) and for the construction of new facilities on the NHS. Funding is provided as a lump sum for each state, which is then divided among apportioned programs including a 2% set-aside for planning and research. The NHPP also ensures that federal-aid funds for highway construction are used to meet State established targets.

#### 2.A.2 **Surface Transportation Block Grant Program (STBG)** (<https://www.fhwa.dot.gov/fastact/factsheets/stbgfs.cfm>)

The STBG is a funding program that includes public roads (including the NHS) which *are not* functionally classified as minor rural collectors, local roads, or streets. It includes some collector routes that were not previously on the federal-aid system. In addition to being a funding source for these routes, the program specifies some set-aside funds for obstacle elimination projects and for transportation alternatives.

#### 2.A.3 **Highway Safety Improvement Program (HSIP)** (<https://www.fhwa.dot.gov/fastact/factsheets/hsipfs.cfm>)

The HSIP utilizes a data driven approach for improving highway safety. The purpose of HSIP funding is the reduction of traffic fatalities and serious injuries on all public roads. HSIP funds are provided to the States as a lump sum which is then divided among apportioned programs, including Safety Improvement Projects (See Chapter One: Roadway Design Standards, Section 5.D).

#### 2.A.4 **Rail Highway Crossings (RRZ)** (<https://www.fhwa.dot.gov/fastact/factsheets/railwayhwycrossingsfst.cfm>)

The RRZ program provides funds for the elimination of railway-highway crossings on all public roads. They are usually matched with State Train Mile Tax (TMT) funds and the NDOT only uses the funds to build new viaducts.

## 2.B Statewide Transportation Improvement Program (STIP) (<http://dot.nebraska.gov/projects/publications/stip/>)

A STIP is a key document in the Federal transportation planning and programming process. States are required to develop STIPs covering at least four years of federally-funded surface transportation projects in consultation with **Metropolitan Planning Organizations' (MPOs)**, Tribal governments, and local governments in nonmetropolitan areas, and with the participation of the public and interested parties. Projects contained in the STIP must be consistent with the statewide transportation plan and when applicable **MPO** transportation plans. The STIP includes the projects and project phases in approved **MPOs** Transportation Improvement Programs (TIPs) by reference. The **Program Management Division** develops the STIP and must demonstrate fiscal constraint, ensuring that there are sufficient revenue sources available to construct the listing of projects contained in the STIP. The STIP can be amended throughout the fiscal year when projects need to be added, removed, cost estimates updated, or change substantially in scope while still demonstrating fiscal constraint of the STIP.

Estimate updates trigger the majority of STIP amendments and, when in **MPO** areas, potentially the transportation plan. The **NDOT** is required to submit an amendment any time there is a change in federal funds that exceeds 20% or \$2 million, whichever is greater. The **FHWA** and the **Federal Transit Administration (FTA)** must approve the amendments and the approval process may take up to two months. For this reason, it is important to notify the **ADE** and/ or **Program Management Division** when the project estimate changes significantly. This is especially critical as the project nears letting because the project cannot be advertised for letting until it is listed correctly in the STIP.

## 2.C Federal Funding - Participating

Many projects use multiple types of federal funding. For example, surface transportation funds may be used for the roadway portion of a project while bridge replacement and rehabilitation funds may be used for the structures. Project costs for participating projects must be itemized by funding types (See Section 2.G of this chapter).

### 2.C.1 Salvaging Items

The determination to salvage an item should be made prior to or on the plan-in-hand. If the **District** or another **Division** (e.g. **Materials and Research**) request that an item be salvaged, the roadway designer will note this on the plans and in the **PS&E** package to inform the contractor of the item(s) disposition. The roadway designer will quantify and provide a listing of the salvage items to **Cost Estimating** who will estimate a salvage value for the item(s) so that either the **NDOT** (on delegated projects) or the **FHWA** (on PODI) can determine if reinvestment back to the Federal-aid (FA) program is required. The value of salvaged items greater than \$5000 total for a FA project would need to be documented and reinvested back to the FA program. A note will be placed in the contract (PS&E) documents that items to be salvaged need to be stored on the project site for removal by the **NDOT**. Examples of salvaged items include:

- Guardrail
- Delineators
- Culverts
- Millings
- Crushed concrete

## **2.D Federal Funding – Nonparticipating Items**

A project using federal funding may include nonparticipating items. For example, a new and reconstructed project on the National Highway System may include federal funding while an overlay of a State Spur which is a part of the same project involves state funds only. The reason for work being nonparticipating will be documented in the project file. The nonparticipating pay items, including their stationing, will be indicated as such on the quantity sheet in the computation file (See Section 2.G of this chapter).

## **2.E State of Nebraska Funding**

The **State of Nebraska** may fund roadway projects from a variety of state agency funding sources (e.g. **Game and Parks**).

## **2.F Participation by Others**

Some roadway projects may be joint ventures between the **NDOT** and local government agencies (e.g. **City** or **County**) or other **States**. When other governmental agencies are sharing the cost of the improvement these costs should be split out in the cost estimate (See Section 2.G of this Chapter). However, if the agreement with the other governmental entity indicates that their participation is to be a lump sum amount, it is not necessary to break out or split quantities on the segments in which they are participating. Cost sharing guidelines are outlined in NDOT Operating Instruction 60-11, "Municipal Cost Sharing" (Appendix B, "Selected NDOT Operating Instructions"). Guidelines for agreements are found in NDOT Operating Instruction 45-5, "Agreements" (Appendix B, "Selected NDOT Operating Instructions").

### **2.F.1 Utilities**

If utilities need to be adjusted or relocated due to a roadway project, the utility owner will complete the relocation of the facility unless otherwise specified. The **NDOT** will pay the utility owner directly for the eligible non-betterment expenditures. If utility work results in a betterment of the facility, the utility owner will be responsible for those costs. See Section 7.C of this chapter, Chapter Ten: Miscellaneous Design Issues, Section 11, and NDOT Operating Instruction 45-1, "Utility Rehabilitation Negotiations" (Appendix B, "Selected NDOT Operating Instructions") for further information.

### **2.F.2 Railroad**

Railroad owners will perform the necessary work associated with their property and will be reimbursed by the **NDOT**. See Sections 1.E and 7.D of this chapter; Chapter Ten: Miscellaneous Design Issues, Section 1; and NDOT Operating Instruction 45-2, "Utility and Railroad Payments" (Appendix B, "Selected NDOT Operating Instructions") for further discussion.

## **2.G      Funding Splits Defined by Stations**

There are times when other governmental agencies share the cost of only a segment of a project (for example a project on the NHS, with Federal participation, which includes a State spur built with State funds only or a project which includes both rural and municipal segments). The quantities for that segment will be split out and the limits of the segment will be identified by station. For example, if a project includes municipal cost sharing the quantities for that portion of the project which lies within the corporate limits, as identified by project stationing, will be tabulated separately from the remainder of the project; the pay items and quantities within these limits will be separated out on individual computation sheets for each funding type. Funding splits will not be shown on the project plan sheets.

When a plan revision results in a change in project quantities, the funding source(s) of the affected pay items will be identified in the revision letter to the **Construction Engineer** (See Chapter Eleven: Highway Plans Assembly, Section 7.A.4). Questions regarding funding split(s) on a project should be directed to **Cost Estimating**.

For additional information, see the NDOT Operating Instruction 60-11, "Municipal Cost Sharing" (Appendix B, "Selected NDOT Operating Instructions").

### **2.G.1      Lump Sum Funding Splits**

If another entity is contributing funds to a project based on a lump sum agreement, quantities do not have to be split out (unless the lump sum dollar amount is to be determined based on the quantities).

## **3.            SOURCES OF PROJECT INFORMATION**

### **3.A            Integrated Highway Inventory System**

The "Integrated Highway Inventory System", found in the CICS1 program on the computer mainframe, provides on-line project facts and funding information. To enter the "Integrated Highway Inventory System":

1. Click on the "Mainframe Sessions" icon.
2. Enter CICS1 by entering C1 and your DR# and password.
3. Select 2 – "Dept. of Transportation".
4. Select 4 – "Integrated Highway Inventory System".

The roadway designer will notify the **Program Management Division (Program Management)** if discrepancies are found between the information listed in the inventory and the information presented on other project forms, such as Form DR-73, "Highway Improvement Programming Request".

### **3.B            Highway Improvement Programming Request (Form DR-73)**

Form DR-73, the "Highway Improvement Programming Request Form", should be reviewed by the roadway designer to obtain information about the project. Normally this form is initiated by the **District**.

## 4. SCHEDULE OF ESTIMATES IN ACTIVITY SEQUENCE

### 4.A General

Cost estimating activities must be coordinated with the participating parties (**Project Development Division (PDD)**, **Roadway Design**, **Bridge Division (Bridge)**, **Right-of-Way (ROW)**, **Roadway Design Utilities Unit (Utilities)**, **Intermodal Planning**, **Agreements**, etc.). The originator of the change will notify the **Divisions/ Sections/ Units** involved in the project of altered conditions, scope changes, or new requirements related to the project. EXHIBIT 12.1 summarizes the cost estimate schedule, including the timing and the responsible party.

The Initial Estimate (Status Code 05, "Program Phase") is developed by **Program Management**. At this early stage, the project costs are estimated on average per mile construction costs provided by the **Materials and Research Division (M&R)** together with estimated costs for preliminary engineering, construction engineering, contingencies, utility costs, right-of-way costs, and costs for bridge work, as required by the project (See Section 7 of this chapter). The roadway designer should verify that utility, right-of-way, bridge, and other items that are part of the project are included in the cost estimate from the earliest stages of design.

Cost estimates are required throughout the planning and design process and generally coincide with project milestone activities, such as Plan Details. Estimates should be updated at least annually up through Cost Update 3 (Status Code 45, "Plan Details Phase") and will also be updated whenever changes in the concept or in the scope of the project occur outside of the normal estimate activity schedule.

### 4.B Level of Detail

As part of the planning process, average costs per mile of construction are used to estimate the project cost. As the project's design develops in greater detail cost estimates begin to reflect the actual quantities of materials that are to be used.

Estimates should be as detailed as possible. Items necessary for the construction of the project will be included in each estimate, even though detailed quantities may not have been developed for some of the items. **Cost Estimating** will be informed of special conditions that would affect a bid estimate, such as tight work schedules, restricted working hours, incentives/ disincentives, etc.

Approximately 80% of a project's cost is usually found in 20% of the pay items. The roadway designer should allocate his/ her time accordingly, not spending an inordinate amount of time developing detailed quantities for minor items.

Status Code	Estimate Name	Time Frame	Level of Detail	Source of Estimate
<b>Prior to Roadway Design Division Involvement</b>				
05	Initial	Program Phase (5100)	Average per mile construction costs (from <b>M&amp;R</b> ) and estimated preliminary engineering, engineering construction and contingencies, utilities, right-of-way, and bridge costs.	<b>Program Management</b> , based on Initial DR-73 information provided by the <b>District</b>
10	Initial Estimate Update	Planning Phase (5200)	The Initial Estimate refined by the results of a review of the project location/ corridor for any deficiencies, as well as inputs from other <b>Divisions</b> and the <b>District</b> .	<b>PDD</b> based on DR-73/ Planning Document
<b>Roadway Design Division Involvement</b>				
30	Cost Update 1 (Pre-Plan-in-Hand)	Design Phase (5300): After the preliminary plans are complete and just before the plan-in-hand (accompanies the plan-in-hand report). Updated annually up to Status Code 45 and if there is a change in project scope or concept.	Quantities from preliminary plans, special plans, etc. Includes preliminary bridge estimate and estimated preliminary engineering, engineering construction and contingencies, utilities, and right-of-way costs.	Roadway Designer and <b>Cost Estimating</b>
40	Cost Update 2 (Post-Plan-in-Hand) <i><b>Only required when a Public Hearing will be held</b></i>	Environ. Approval Phase (5400): After the plan-in-hand report is approved.	Project quantities from functional plans, updated special plans, approved pavement determination, utilities, right-of-way, etc.	Roadway Designer and <b>Cost Estimating</b>
45	Cost Update 3 (Post Roadway Design Details)	Plan Details Phase (5500): After design is complete and Design Plans have been distributed.	Project quantities from the Design Plans including right-of-way, bridge quantities, utilities, etc.	Roadway Designer and <b>Cost Estimating</b>
50	Plans, Specifications and Estimates (PS&E)	Plan Package Phase (5700): Just prior to bid letting.	Estimated plan quantities.	Roadway Designer and <b>Cost Estimating</b>
60	Awarded Bid	Bid Letting.	Actual contract cost from awarded bid.	<b>Contractor</b>

**Exhibit 12.1 Cost Estimate Submittals**

## 5. ESTIMATE REQUEST FORMS

The roadway designer will submit Form DR-342 (“Project Information Sheet”) and Form DR-343 (“Project Quantity Sheet”) to **Cost Estimating** for each cost estimate request.

### 5.A Project Information Sheet (Form DR-342)

Using Form DR-342, the roadway designer provides **Cost Estimating** with a summary of right-of-way needed, utility costs, preliminary engineering costs, data about the type of construction to be performed for the roadway surface and shoulders, and the type of bridge construction needed. This form also provides space for notes about traffic control and other elements of the project.

### 5.B Project Quantity Sheet (Form DR-343)

Form DR-343 lists standard pay items by standard item number and name. This form also lists the unit of measurement for each item. Quantities for each of the appropriate items should be calculated and listed on this sheet for each project. The quantities for some sections of this form (e.g. bridges, electrical, signing) may be supplied by other **Divisions/ Sections/ Units** and submitted to the roadway designer before it is sent to **Cost Estimating**.

## 6. COST ESTIMATE REQUEST PROCEDURES

Coordination, communication, and cooperation are essential elements in the cost estimating process. The roadway designer needs to coordinate with the parties involved with the project for the process to be most efficient and effective. If consultants are hired for design work the **Roadway Design Consultant Coordinator** assigned to the project is responsible for reviewing, communicating, and coordinating activities between the consultant and the **NDOT**.

### 6.A Routing from the Roadway Designer

The roadway designer will obtain input from the **Divisions/ Sections/ Units** involved in the project to verify that the cost estimate request includes the items required to build the project. **Bridge**, the **Traffic Engineering Division (Traffic Engineering)**, **PDD**, **ROW**, **M&R**, etc. provide information to the roadway designer, who compiles the necessary information and then submits the cost estimate request to **Cost Estimating**.

The roadway designer should review the previous cost update request and cost estimate for needed changes before requesting a cost update. The previous cost estimate request form may be submitted to **Cost Estimating** with changes noted in red. The roadway designer should perform a careful review of the cost estimate request, verifying that the construction items needed to build the project are included.

### 6.B Timeliness

It is essential that the roadway designer submit cost estimate requests to **Cost Estimating** as early as possible. The time allocated to produce the cost estimate includes the time needed for **Roadway Design** review and for resulting corrections to be made to the cost estimate.

### 6.C Change in Project Scope or Concept

The roadway designer will request an updated cost estimate from **Cost Estimating** and will inform any other **Division/ Section/ Unit** which is involved in the project (e.g. **Environmental, ROW**) whenever a change is identified in the project scope, project concept, or when special conditions arise during design (e.g. a change in pavement determination, a change in bridge determination, removal of unsuitable material). A change in cost affects the project budget and schedule; the change in project scope shall be vetted by the appropriate **Divisions** (e.g. **Roadway Design Engineer, ROW, Project Development, Program Management**).

### 6.D Estimate Review

**Cost Estimating** routes the completed cost estimate to the roadway designer through the appropriate **ADE** and **Roadway Design Division Unit Head (Unit Head)**. The roadway designer and the **Unit Head** will review the cost estimate carefully for possible omissions, incorrect information, coding errors, deletions, etc. A comparison with the previous estimate can be a good check for mistakes. Cost estimating is an iterative process, intended to produce the best possible estimate.

## 7. CONTENTS OF COST ESTIMATES

Cost estimates basically consist of quantities and prices. Roadway designers provide the quantities and cost estimators provide the prices. Inaccurate or incomplete quantities and/ or prices will produce cost estimates which are both inaccurate and inadequate. Project costs are subdivided into the following categories:

- Preliminary Engineering
- Right-of-Way
- Utilities
- Railroad Items
- Construction Costs
- Construction Engineering
- Contingencies
- Relinquishments (See Chapter Fifteen: Right-of-Way, Section 7.D)

### 7.A Preliminary Engineering

Preliminary engineering costs are normally estimated as a percentage of the construction costs. Various factors may affect the actual costs of preliminary engineering, such as unusual site conditions for the project. The cost factors presented in EXHIBIT 12.2 are provided for the roadway designer's information, showing the percentages used by **Cost Estimating** in calculating the preliminary engineering costs for a project for Cost Update 1 (Status Code 30, "Design Phase") and Cost Update 2 (Status Code 40, "Environmental Approval Phase"), and Cost Update 3 (Status Code 45, "Plan Details Phase").

Chapter Section	Project Cost Category	Cost/Cost Factor
7.A	<b>Preliminary Engineering</b>	Calculated by <b>Cost Estimating</b>
7.A	Resurfacing Projects	0.5% of base Construction Costs
7.A	New and Reconstructed Projects	4.4% of base Construction Costs
7.A	Consultant Projects	8.0% of base Construction Costs
7.B	<b>Right-of-Way</b>	
7.B.1	Rural Land Values	<a href="http://digitalcommons.unl.edu/agecon_farmrealestate/">http://digitalcommons.unl.edu/agecon_farmrealestate/</a>
7.B.1	Urban Land Values	Contact <b>ROW Appraisal</b> for urban land values
7.B.2	Fencing	<a href="http://www.roads.nebraska.gov/media/5346/fence-schedule.pdf">http://www.roads.nebraska.gov/media/5346/fence-schedule.pdf</a>
7.B.3	Improvement Values	Contact <b>ROW Appraisal</b> for costs of damages to improvements
7.B.4	Relocation Assistance	Contact <b>ROW Relocation Unit</b> for relocation costs
7.B.5	Other R.O.W. Costs	40% of the cost of right-of-way land acquisition
7.C	<b>Utilities</b>	Calculated by <b>Cost Estimating</b> 2.9% of base Construction Costs
7.D	<b>Railroad</b>	Contact <b>Railroad Liaison</b> in <b>Intermodal Planning</b>
7.E	<b>Construction Engineering</b>	Calculated by <b>Cost Estimating</b> 12% of base Construction Costs if ≤ \$2 million 5% of base Construction Costs if > \$2 million
7.F	<b>Contingencies</b>	Calculated by <b>Cost Estimating</b> Contingency Costs may vary yearly
7.G.7	<b>Bridge</b> (to be included in <b>Construction Costs</b> )	Calculated by <b>Cost Estimating</b> or supplied by <b>Bridge</b> Based on Bridge Size and Type as supplied by the roadway designer (See <u>EXHIBIT 12.4</u> )

**Exhibit 12.2 Preliminary Cost Estimate Values/ Cost Factors**

## 7.B Right-of-Way

The roadway designer will prepare a preliminary right-of-way cost estimate for inclusion with Cost Update 1 (Status Code 30, "Design Phase"), Cost Update 2 (Status Code 40, "Environmental Approval Phase"), and Cost Update 3 (Status Code 45, "Plan Details Phase"). The roadway designer should coordinate these cost estimates with **ROW Appraisal**, informing them of items which will affect the right-of-way cost estimate (such as clear tract, remove building, remove sign base) and requesting preliminary costs. The total right-of-way costs consist of five main elements:

1. Land Values (See Section 7.B.1)
2. Fences (See Section 7.B.2)
3. Improvements (See Section 7.B.3)
4. Relocation Assistance (See Section 7.B.4)
5. Other Right-of-Way Costs (See Section 7.B.5)

See the **NDOT** Right-of-Way Manual (<http://www.roads.nebraska.gov/media/5012/row-manual.pdf>) (Ref. 12.1) and Chapter Fifteen: Right-of-Way for additional information.

### 7.B.1 Land Values

Preliminary land value estimates for Cost Update 1 (Status Code 30, "Design Phase"), Cost Update 2 (Status Code 40, "Environmental Approval Phase"), and Cost Update 3 (Status Code 45, "Plan Details Phase") are based on the approximate number of acres of land to be acquired for right-of-way, as calculated by the roadway designer, multiplied by the average per acre cost of the type of land being acquired. **ROW Appraisal** develops actual area figures for the PS&E Estimate (Status Code 50, "Plan Package Phase").

#### 7.B.1.a Rural

The average values of farmland, classified by agricultural usage, are compiled annually by the University of Nebraska. This information may be viewed on the Internet at ([http://digitalcommons.unl.edu/agecon\\_farmrealestate/](http://digitalcommons.unl.edu/agecon_farmrealestate/)).

#### 7.B.1.b Urban

Land values in urban and suburban areas exhibit greater fluctuation than rural land values. Variations in land values for different land uses, and variations among those values for different cities, make it impossible to generalize cost figures for urban land. The **ROW Appraiser** should be consulted for non-agricultural land values.

### 7.B.2 Fences

The roadway designer will include fencing costs For Cost Update 1 (Status Code 30, "Design Phase"), Cost Update 2 (Status Code 40, "Environmental Approval Phase"), and Cost Update 3 (Status Code 45, "Plan Details Phase") based on the average cost per mile for two sides of the roadway (See the Fencing Schedule at <http://www.roads.nebraska.gov/media/5346/fence-schedule.pdf>). Fence costs are usually included in the **ROW** cost estimate for the PS&E Estimate (Status Code 50, "Plan Package Phase"). Privately owned fencing is generally not built as part of the project, the property owner is paid to replace the fence, but this amount will be included in the right-of-way cost estimate.

Certain fencing items may be included in the construction items (typically Interstate and freeway fencing, deer fence, wetland fencing, and pedestrian fencing). The roadway designer should check with **ROW Appraisal** to ascertain whether fencing has been included in the **ROW** estimate or if it is to be handled as a construction cost. If fencing is a construction item, the roadway designer shall include this fencing in the **Roadway Design** PS&E Estimate (Status Code 50, "Plan Package Phase"). See Chapter Ten: Miscellaneous Design Issues, Section 6, for further information.

### 7.B.3 Improvements

Improvements on property which may be acquired for right-of-way will be identified by size and type (homes, business structures, outbuildings, parking lots, parking spaces, center pivots, wells, etc.). **ROW Appraisal** maintains average values of improvements on property and should be consulted for costs for damages to an improvement or costs to purchase the improvement.

### 7.B.4 Relocation Assistance

Relocation costs are payments beyond the purchase cost. A person or business displaced by a construction project is eligible to participate in the Relocation Assistance Program; this program is designed to help pay the expenses for relocating residential occupants, businesses, farm/ranch buildings, and non-profit organizations if they are displaced as a result of a highway improvement. The roadway designer should contact the **ROW Relocation Unit** for relocation assistance costs.

### 7.B.5 Other Right-of-Way Costs

Other right-of-way costs, covering such items as appraisals and legal fees, are included in a project cost estimate as a factor of the sum of the previously described right-of-way costs (e.g. land, fences, improvements, and relocation assistance). Currently a factor of 40% (based on historical project costs) is used to estimate "Other Right-of-Way Costs".

### 7.C Utilities

**Cost Estimating** generally calculates preliminary utilities costs at 2.9% of construction costs. For projects with very minor utility work this figure may be lower while on projects with major utility work costs may be higher. The roadway designer will work with **Cost Estimating**, updating project costs as the scope and complexity of the utility work required for the project become apparent. For example, projects involving fiber optic cable or major overhead power lines will generally have greater utility costs, as will projects with major water line and/ or sanitary sewer work. The roadway designer should coordinate the utilities impacts with **Utilities** during the preparation of the Plan-in-Hand Report. When actual utility costs are received (typically during Cost Update 3, Status Code 45, "Plan Details Phase") the roadway designer will verify that the 2.9% cost factor has been removed from the cost estimate.

If a contractor is to perform water main and/ or sanitary sewer work as part of the state contract, these items will be included in the construction items estimate. If, however, this work is to be performed by someone else, the costs will be accounted for in the utilities cost estimate

See Section 2.F.1 of this chapter, Chapter Ten: Miscellaneous Design Issues, Section 11, and the Nebraska Dept. of Transportation Operating Instruction 60-11, "Municipal Cost Sharing" (Appendix B, "Selected NDOT Operating Instructions") for additional information.

### 7.D Railroad

The **Railroad Liaison Office** in the **Intermodal Planning Division** reviews the design plans and coordinates the project with the railroad companies. See Sections 1.E and 2.D.2 of this chapter; Chapter Ten: Miscellaneous Design Issues, Section 1 for further discussion on railroad-involved projects.

### 7.E Construction Engineering

The estimate for the construction engineering cost is based on a percentage of the base construction costs. At present, construction engineering is estimated by **Cost Estimating** to be 12% of the base construction cost when it is less than or equal to \$2 million and 5% of the base construction cost when it is over \$2 million.

### 7.F Contingencies

Contingencies are included in the cost estimate by **Cost Estimating** to account for possible cost overruns; contingency costs may vary yearly.

## 7.G Construction Items

Construction items are those items that will be let to contract. The roadway designer is responsible for providing accurate quantities and specifications so that **Cost Estimating** may produce accurate cost estimates for the roadway items required for the project. The “Cost Estimate Checklist” (**EXHIBIT H** of the Design Process Outline (DPO), Ref. 12.2) (<http://www.roads.nebraska.gov/business-center/design-consultant/>) lists many of the standard construction items used on a roadway project.

The roadway designer and the **Unit Head** should refer to this checklist, making sure that every item required for the construction of a roadway project is included in the cost estimate request and cost estimate. While the roadway designer is not responsible for calculating the quantities for every construction item (e.g. **M&R** calculates the final quantities for flexible pavement), he/she is responsible for verifying that the items required for the construction of the project are included in the various cost estimate updates and in the PS&E turn-in packet.

### 7.G.1 **Mobilization**

Several categories in the “Cost Estimate Checklist” (**EXHIBIT H** of the *DPO*, Ref. 12.2) have a mobilization item. Mobilization is the costs associated with startup activities such as movement of personnel, equipment, supplies, and other incidentals to the project site. Mobilization is a separate pay item for those categories where it is listed separately and is an incidental item subsidiary to other work when it is not listed separately. Mobilization costs are calculated by **Cost Estimating**.

### 7.G.2 **Specifications and Special Provisions**

The Standard Specifications for Highway Construction (Spec Book) (Ref. 12.3) (<http://dot.nebraska.gov/media/10343/2017-specbook.pdf>) defines the scope and control of work in a standard pay item, including an item description, listing of material requirements, equipment, hauling and distributing materials description, method of measurement, and basis of payment. An item which is not covered by, or that differs from, the *Spec Book* (Ref. 12.3) will require a special provision. Special provisions should be initiated during “Functional Design” and finalized during the “Final Plans Package & Review for PS&E” (See the *DPO* (Ref. 12.2), Clarity Task Codes 5428 and 5790).

### 7.G.3 Standard Pay Items

Construction items have been standardized for ease of identification and clarity in communication. There is a current listing of the standard pay items located on the **NDOT** website (<http://www.roads.nebraska.gov/business-center/business-opp/hwy-bridge-lp/item-history/>). The standard pay item listing may be explored using the search function on the screen. An item may be identified in a variety of ways; for example, a search for the item “reinforcing steel” may be made using any of the following criteria:

- REINFORCING STEEL
- REINF
- STEEL
- 4163.25
- LB

All items which meet the criteria will be listed. A general term search will result in a very long listing of items (e.g. a search using “TON” will locate every pay item which is measured in tons).

If a pay item is required that does not appear in the standard pay item listing, **Cost Estimating** should be contacted for assistance.

### 7.G.4 New Materials

Construction projects sometimes require special treatments or solutions to problems that have not been encountered previously and for which standards have not been developed. At times new construction materials, which have not been included in previous projects, are accepted for use. The use of a new material may require a special provision (See Section 7.G.2 of this chapter).

Costs and/ or special provisions for new materials must be researched both for their suitability and for their incorporation into the specifications and cost estimates. As early as possible in the design process, the roadway designer will provide the cost estimator with sufficient information regarding what the work consists of so that a reliable cost estimate may be made.

#### 7.G.4.a Sole Sourcing

By law and regulation (23 cfr 635.411, <http://www.gpo.gov/fdsys/pkg/CFR-2011-title23-vol1/pdf/CFR-2011-title23-vol1-sec635-411.pdf>) a designer may not specify only one product for use on a project unless a Certification or Public Interest Finding is completed. Specifying only one product without requisite justification on Federal-aid projects may lead to non-participation of federal funds. A Certification or Public Interest Finding must be written by the **Unit Head** and processed, based on project type and location, as follows:

- For any Federal-aid project on the NHS or Project of Division Interest (PoDI) on the NHS: The Certification or Public Interest Finding will be signed by the **ADE** and the **Federal Highway Administration (FHWA)**
- For a PoDI which is not on the NHS: The Certification or Public Interest Finding shall be signed by the **ADE** and transmitted to the appropriate **FHWA Transportation Engineer** for review and comment
- For a Federal-aid project which is not on the NHS: The Certification or Public Interest Finding will be signed by the **ADE** (the document does not need to be transmitted to the **FHWA**; per MAP-21 (<https://www.fhwa.dot.gov/map21/>) and the **FHWA/NDOR Stewardship and Oversight Agreement** (<http://roads.nebraska.gov/media/6796/steward-oversight-agr.pdf>) **NDOT** has assumed the responsibility to process the document in accordance with applicable Federal-aid requirements)

In each of these cases, the signed document will be copied to the **Construction Engineer** and placed into the project file.

#### Certifications

Certifications are completed when the product specified is either necessary for synchronization with existing facilities (for function, aesthetics or logistics) or a unique product is being used for which there is no equally suitable alternative. Certifications must include a statement from the **Unit Head** attesting that the specified product is essential for synchronization with existing facilities or that no equally suitable alternative exists. The Certification should contain detailed information and supporting documentation upon which it was based. Such documentation may include:

- A detailed description of how the product will benefit the public
- The unique needs that are being addressed with either synchronization or that no equally suitable alternative exists
- Specific details on why other products could not meet the need
- An estimate of additional costs due to the item being used

Certifications may cover multiple related products.

### **Public Interest Findings**

Public Interest Findings are completed when requiring the use of a specific product is in the public interest even though other equally acceptable products are available. The Public Interest Finding shall contain information and supporting documentation upon which it was based. Such documentation may include:

- A detailed description of the need of the product
- A detailed description on how the product required will benefit the public
- An evaluation of the pool of equally acceptable products
- An estimate of additional costs incurred as a result of the required product
- An engineering and economic analysis supporting the claim that the specified product will benefit the public

The **NDOT** (or the appropriate **City**) will commit to a yearly review of the industry to determine if new technology has been developed which would satisfy the criteria or need addressed in the Certification or Public Interest Finding.

Certifications and Public Interest Findings should be used sparingly and will be coordinated with the **Highway Contracts Manager** in the **Construction Division**. The majority of approved Certifications and Public Interest Findings have been used for context sensitive design purposes. For example, on the West Dodge projects in Omaha multiple suppliers were initially considered for the retaining wall finishes. However, once the wall finish was selected for the first project a Public Interest Finding was approved on the ensuing projects so that the entire continuum of projects presented a uniform appearance in the retaining wall finish. Certifications and Public Interest Findings will be sent to the **Highway Contracts Manager** and to **PS&E**.

#### **7.G.5 Quantities**

Pay items may be specified and described in several ways. For example, based on weigh scale location and availability, **Districts 1, 2, and 3** pay for aggregate by the Ton while **Districts 4 through 8** pay for aggregate by the cu. yd. The appropriate standard pay item unit of measurement will be used based on the project location. The units of measurement for items specified on the project plans should be consistent with the units of measurement of the standard pay items. The degree of accuracy applied to each unit of measure can be found in EXHIBITS 12.6 & 12.7.

The roadway designer should keep notes regarding the development of the quantities and lump sum items for each estimate. The notes should include the assumptions made in producing the quantities, for example the roadway designer may include the assumption that the project will be built under traffic. That assumption should be recorded in the project file and also should be shared with the cost estimator so that conflicting assumptions are not made at a later date and/or by others involved.

Quantities will be calculated for every construction pay item pertaining to a given project. EXHIBIT 12.3 presents a partial listing of quantity calculation guidance found in this manual and in the Drainage Design and Erosion Control Manual (Drainage Manual) (Ref. 12.4) (<http://www.roads.nebraska.gov/business-center/design-consultant/rd-manuals/>). The "Cost Estimate Checklist" (EXHIBIT H of the *DPO*, Ref. 12.2), and the "Pavement Item Checklist" (EXHIBIT 12.8) are helpful references for items to be included in the cost estimate.

<b>Roadway Design Manual</b>		
<b>Item</b>	<b>Chapter</b>	<b>Section</b>
Bridge Channel Work	13	4.B.6.a
Cold Milling	8	5.B.1
Crossovers	14	6.A.1
Delineators	14	3
Earthwork	7	1
Guardrail Quantities	9	3.H
Mailbox Turnouts/ Supports	10	10
Old Road Obliteration	10	8
Pavement Patching	8	5.C
Re-establishing Land Monuments and Property Corners	15	7.B
Right-of-Way Markers	15	7.A
Shoulder Construction	8	4.C
Surfacing Quantities	8	6
Temporary Road Pay Items	14	6.B
Temporary Surfacing	14	6.A.2
<b>Drainage Design and Erosion Control Manual</b>		
<b>Item</b>	<b>Chapter</b>	<b>Section</b>
Culvert Excavation	1	8.R
Culvert Lengths	1	8.D
Permanent Erosion and Sediment Control Measures	2	6
Riprap	2	8.A
Stormwater Treatment	3	7
Temporary Erosion and Sediment Control Measures	2	5
Temporary Slope Drain	2	7

**Note:** This is not a complete listing. The roadway designer should refer to the Standard Specifications for Highway Construction (Ref. 12.3) and the appropriate Sections of the Roadway Design Manual and the Drainage Design and Erosion Control Manual (Ref. 12.4) for guidance when computing project quantities.

### Exhibit 12.3 Quantity Calculation Guidance Locations

### 7.G.6 Traffic Control Items

For Cost Update 1 (Status Code 30, "Design Phase"), Cost Update 2 (Status Code 40, "Environmental Approval Phase"), and Cost Update 3 (Status Code 45, "Plan Details Phase") a lump sum amount is used for temporary traffic control items. **Cost Estimating** calculates this sum based on the type of work involved. This lump sum estimate includes the following items:

- Barricades Type III
- Temporary Signs
- Flashing Arrow Panels
- Flagging

The **Construction Division** provides the roadway designer with quantities for the above items for the PS&E Estimate (Status Code 50, "Plan Package Phase").

The items found below are not included in the **Construction Division** cost estimate. Quantities must be furnished for these items when they are needed on a project. The roadway designer will coordinate with **Traffic Engineering** on quantities for the below items for Cost Update 1 (Status Code 30, "Design Phase"), Cost Update 2 (Status Code 40, "Environmental Approval Phase"), and Cost Update 3 (Status Code 45, "Plan Details Phase").

- Temporary Traffic Signals
- Concrete Protection Barriers
- Temporary Pavement Markings
- Impact Attenuators
- Inertial Barrier Systems
- Temporary Safety Lighting

**Traffic Engineering** will review the traffic control plans and provide final quantities and special provisions for items in the traffic signals, permanent signing, and the permanent pavement marking categories (Group #8) for the PS&E Estimate (Status Code 50, "Plan Package Phase"). For additional information see Chapter Fourteen: Traffic.

### 7.G.7 Bridge Items

Bridge construction may involve building a new bridge, widening, rehabilitating or repairing an existing structure. The type of structure must be included in the detailed cost estimate (e.g. Deck Steel Girder Bridge) because the type affects the cost for new and rehabilitated bridges. The preliminary bridge cost estimates are calculated based on the bridge dimensions (as shown in [EXHIBIT 12.4](#)) until detailed bridge item quantities are available. The area of the bridge structure is based on out-to-out measurements, not the clear roadway width except for overlays, which are based on the clear width.

The following bridge items are included in the preliminary bridge cost estimate:

- The bridge materials
- Preparation of the existing structure
- Excavation and backfill for abutments and piers
- Riprap
- Slope protection
- Painting of structures

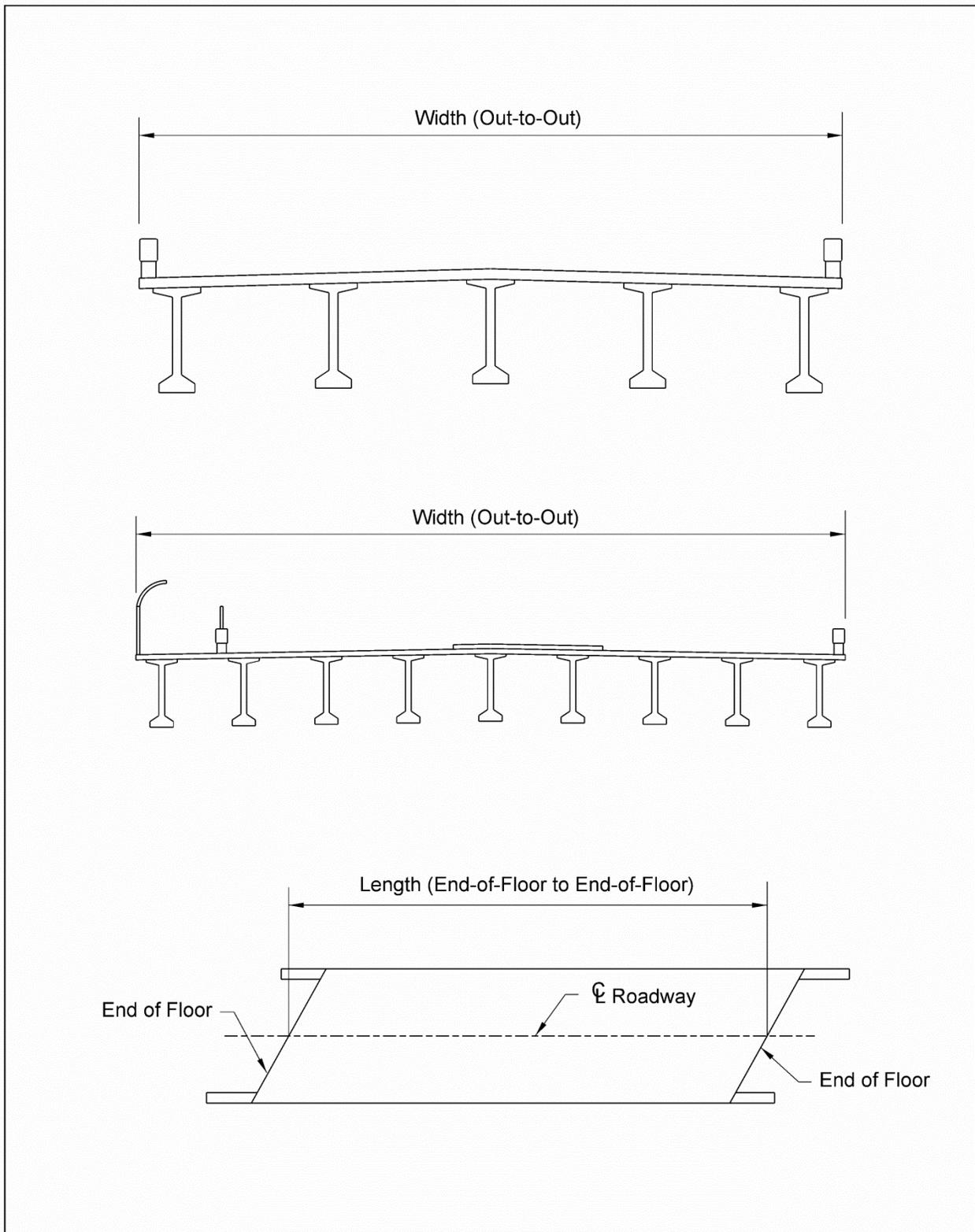
The preliminary bridge cost estimate will also include items that are ultimately the responsibility of **Roadway Design** (e.g. guardrail, temporary roadway grading and surfacing, excavation for Concrete Box Culverts). When assigned a project which includes bridge and bridge-sized structures the roadway designer will review the “Planning Bridge Determination”, placed in OnBase by the **Bridge Management Section**, for a detailed breakdown of the items included in the preliminary bridge cost estimate from **Bridge**. As the design of the project progresses and the roadway designer establishes quantities for the roadway items that have been included in the preliminary bridge cost estimate the roadway designer will remove those items, and their cost, from the preliminary bridge cost estimate. When submitting an estimate request, the roadway designer will inform **Cost Estimating** of the reduction in the preliminary bridge cost estimate and its cause.

The bridge designer will provide the roadway designer with detailed bridge construction quantities for inclusion in the PS&E turn-in packet.

The following items *are not* included in the detailed bridge construction estimate, the roadway designer shall include these items in the PS&E Estimate (Status Code 50, “Plan Package Phase”) as required:

- Channel work (See Chapter Thirteen: [Planning and Project Development](#), Section 4.B.6)
- Retaining walls
- Mechanically stabilized earth (MSE) walls

For additional information see Chapter Ten: [Miscellaneous Design Issues](#), Sections 2 and 8.



**Exhibit 12.4 Dimensions to Use in Calculating Area of Bridge Structures**

### 7.G.8 Other Construction Items

**PDD** will provide information for cost items related to wetlands and noise walls (See Chapter Thirteen: Planning and Project Development, Sections 4.B and 4.D), for landscaping items (such as tree and shrub plantings), and for erosion control items (See Chapter Ten: Miscellaneous Design Issues, Section 4, and the *Drainage Manual* (Ref. 12.4), Chapter Two: Erosion Control).

The **Lighting Unit (Lighting)** in **Roadway Design** will provide the roadway designer with specifications and estimates if lighting is included in the project. For further information, see Chapter Ten: Miscellaneous Design Issues, Section 12.

## 8. ITEMS AFFECTING CONSTRUCTION COSTS

Construction costs are affected by a variety of factors, such as supply and demand for individual items of material and the cost of labor. The following items are provided for the designer's information. If these items impact a project, the designer should verify that the effects on project costs have been included in the cost estimate received from **Cost Estimating**.

### 8.A Construction Schedule

The construction schedule may affect the cost of construction. For example, complicated work sequences or wintering a project may increase the construction costs while economies of scale (e.g. buying materials in bulk, keeping workers occupied by shifting crews between projects) may reduce the construction cost if projects in close proximity are combined.

### 8.B Construction Location

The location of the project, accessibility to the site, and the availability of materials also affect the project cost.

#### 8.B.1 Site-Specific Features

Site-specific features will impact the cost. For example:

- Rock Excavation
- Sandhills Vegetation (Fertilizer)
- De-watering
- Storm Water Treatment
- Environmental Considerations

#### 8.B.2 Urban/ Rural

Urban locations often have higher construction costs than rural sites due to higher costs of right-of-way acquisition, greater traffic control requirements, pedestrian accessibility, pedestrian accessibility during construction, utility relocations, more access points, etc. Congestion may necessitate nighttime construction scheduling, which would also impact costs.

### **8.C      Maintaining Traffic During Construction**

Phasing - The phasing of construction activities while maintaining reasonable traffic flow and pedestrian access is an important design consideration and an added cost to the project. Phasing for a project is preferably determined during the “Planning Phase” (Activity 5200) prior to the plan-in-hand field inspection. Traffic control measures (e.g. barricades, signs, markings, flaggers) are an integral part of the project and add to its cost. Additional temporary surfacing may be needed for lane or shoulder widening or to provide access to properties. These surfacing quantities will be included in the cost estimate and paid for separately.

Detours - If detours require temporary improvements to the geometry and surfacing of the route, the construction and maintenance of the improvements are project costs. Pavement needed for detour improvements is paid for under a separate pay item group. Signage, public notification, and other costs associated with detours also impact the total project cost.

Temporary Roads – If temporary roads are built to route traffic around construction, the costs associated with the temporary road (e.g. surfacing quantities, culverts, erosion control, traffic control measures) will add to the total project cost.

Night Work – When phasing of projects causes significant impact to traffic operations, night work may be needed for construction. Cost for construction may need to be inflated and should be noted in the cost estimate.

For additional information see Chapter Fourteen: Traffic, Section 6 and Chapter Sixteen: Pedestrian and Bicycle Facilities, Section 11.

## **9.            ITEMS OFTEN OVERLOOKED OR OMITTED**

Requests for cost estimates should only be made after a careful review of the items included in the request. The roadway designer should understand which elements are included in each pay item and how the items relate to one another. Failure to include the proper information in a cost estimate may result in costly delays and extra work while the changes are made. EXHIBIT 12.5 is a partial listing of estimate items which are often omitted and items subject to misinterpretation.

<b>Changes in Pavement Determination:</b>	These changes require updating the quantities.
<b>Covercrop Seeding:</b>	This should be used when there is a major grading project and the permanent seeding is to be done at a later date. In the Sandhills Region, Slope Protection is used in lieu of Covercrop and Types A & B Seeding.
<b>Detour Group (#2, 2A, or 9A):</b>	This group should not be overlooked. Consult with the <b>DE</b> to determine if gravel surfacing is required. Include temporary road surfacing and temporary connections. Additionally, some projects will require winter gravel. Contact <b>Traffic Engineering</b> regarding the need for temporary signals.
<b>Engineering and Contingencies:</b>	See Sections 7.E and 7.F of this chapter.
<b>Erosion Control and Temporary Erosion Control:</b>	These costs are frequently underestimated. The roadway designer should compare erosion control with the items on the Erosion Control Plan-in-Hand Checklist (See <b>EXHIBIT F</b> of the <i>DPO</i> , Ref. 12.2), and coordinate the design with the <b>Roadside Development Unit</b> in <b>PDD</b> and with the <b>District</b> . Temporary erosion control must be placed at the end of each working day. Even though the actual placement will be determined by the contractor and the <b>District</b> as the situation warrants, the roadway designer shall include a total for the project in the estimate.
<b>Flared End Sections:</b>	Split out those flared end sections that must be metal or concrete (e.g. if extending a concrete pipe with Culvert Pipe Type 2, the appropriate pay item is Concrete Flared End Sections). Some projects will have three FES quantities, for example: 24 inch Metal FES, 24 inch Concrete FES, and 24 inch FES.
<b>Foundation Course:</b>	This is equal to the sq. yd. of surfacing.
<b>General Clearing and Grubbing:</b>	“General Clearing and Grubbing” may be used by itself in a few cases (e.g. Sandhills areas) where no trees or stumps could be found over 24 inches in diameter. In these cases the “Grading Item Summary Sheet” will be submitted to <b>PS&amp;E</b> stating that “No large trees or stumps were found”.
<b>Gravel Embedment:</b>	This item should be used for gravel frontage roads, county roads, and driveways (drive returns are not included). This pay item does not include furnishing the gravel.

**Exhibit 12.5 Estimate Items Often Overlooked or Omitted**

<b>Hydrated Lime for Warm Mix Asphalt:</b>	This item will be used with asphaltic concrete projects.
<b>Items Done by Other Governmental Agencies:</b>	Sometimes some construction items are performed by other governmental agencies (e.g. surfacing of a detour). These items are still project costs and will be included in the estimate.
<b>Jacking Pipes:</b>	This is used on phased projects where new culvert is at a new location. Jacking pipe does not include the cost of the culvert pipe and a higher class of pipe may be required for jacking (See Chapter One, Section 13.C of the <i>Drainage Manual</i> , Ref. 12.5).
<b>Large Tree Removal:</b>	Required on projects where the trees or stumps to be removed are larger than 80 inches in circumference. The number of trees should be estimated, even if a tree count survey is not available. "One Each" should not be listed; this can produce unbalanced bids where a contractor will use a very large unit price, knowing that the quantity will be much higher. This item is in addition to "General Clearing and Grubbing".
<b>MSE Walls:</b>	This item is the responsibility of the roadway designer; it is not included in the <b>Bridge</b> estimate.
<b>MS4 Community Stormwater Treatment Installations:</b>	In many cases stormwater treatment for MS4 Communities (See Chapter Three of the <i>Drainage Manual</i> , Ref. 12.5) will be included in other project costs (i.e. "Grass Swales" quantities are integral to grading and seeding). For unique installations, such as a "Principal Spillway", the roadway designer will coordinate with the <b>Environmental Liaison Engineer</b> in <b>Roadway Design</b> to determine the necessary pay items to be included in the project estimate.
<b>Preliminary Engineering:</b>	See <a href="#">EXHIBIT 12.2</a> for the appropriate cost factor. Please check the appropriate box on the "Project Information Sheet" (See Section 5.A of this chapter).
<b>Railroad Involvement:</b>	A project which is adjacent to or crosses railroad property may require estimate items for such items as right-of-way easements, surfacing, railroad crossings, signals and communication lines. The roadway designer should coordinate with the <b>Intermodal Planning Division</b> regarding the necessary estimate items. If a detour crosses a railroad, the roadway designer should contact the <b>Intermodal Planning Division</b> regarding the need for temporary signalization.

Exhibit 12.5 Estimate Items Often Overlooked or Omitted (Continued)

<b>Related Construction Items:</b>	<p>Be sure that related items are included. For example:</p> <p>“Concrete Pavement” should be accompanied by “Subgrade Preparation” and “Foundation Course”.</p> <p>“Subgrade Preparation” should be accompanied by “Water, Applied”.</p> <p>Excavation pay items should be accompanied by “General Clearing and Grubbing”, “Large Tree Removal”, and “Water, Applied”.</p>
<b>Relocation Costs:</b>	<p>The roadway designer will verify that relocation costs are included in the <b>ROW Division</b> estimate before submitting the project to <b>PS&amp;E</b>.</p>
<b>Remove Sign, Post, and Footing:</b>	<p>The relocation of most signs is paid for by the <b>ROW Division</b> but the removal of the footing is usually a contract item requiring a build note and a project quantity. The pay item “Clear Tract” covers the removal of the sign, post, and footing. When “Clear Tract” is not used, the pay item “Remove Sign, Post, and Footing” will be added to the quantities.</p>
<b>Salvage and Place Topsoil:</b>	<p>This will be used when the embankment is, or could be, granular material. If the contractor is to furnish borrow and it is likely that he/ she will furnish granular embankment, the Special Provisions will state that the contractor must salvage and place topsoil. This would also be a special circumstance and the unit price should account for this.</p>
<b>Shoulder Construction:</b>	<p>Pay for “Shoulder Construction” when overlaying an existing roadway. This will not be calculated when “Shoulder Subgrade Preparation” is a pay item.</p>
<b>Shoulder Subgrade Preparation:</b>	<p>“Shoulder Subgrade Preparation” will be paid for when adding surfaced shoulders to an existing roadway. Do not calculate “Shoulder Construction” when this is a pay item.</p>
<b>Sign Supports:</b>	<p>Contact <b>Traffic Engineering</b> to determine if sign supports will be required on the project. Sign supports are often included in interchange designs. The roadway designer should also check for other traffic items, such as traffic signals.</p>
<b>Subgrade Preparation:</b>	<p>This is equal to the sq. yd. of surfacing.</p>
<b>Subgrade Stabilization:</b>	<p>This item is a replacement for “Subgrade Preparation”. The same segment of roadway should not have both items in the estimate.</p>

Exhibit 12.5 Estimate Items Often Overlooked or Omitted (Continued)

<b>Temporary Access:</b>	On rural and urban new and reconstructed projects which disrupt access to adjacent property, the roadway designer should discuss the use of gravel, crushed rock, or millings with the <b>DE</b> at the plan-in-hand and include a lump sum quantity for temporary access in the cost estimate. The quantities should vary between 100 to 200 tons per mile, depending on the size of the access and the type of roadway (two-lane vs four-lane, rural vs urban). These quantities are for design purposes only. The quantities should be shown to the nearest ton.
<b>Temporary Shoring:</b>	Temporary shoring is sheet piling used to hold the embankment when the earthwork operation is being phased in close proximity to traffic. It is also used when new bridge construction is too close to an existing bridge.
<b>Traffic Control, Field Office, Mobilization:</b>	These items will be added by <b>Cost Estimating</b> .
<b>Traffic Control Items:</b>	See Section 7.G.6 of this chapter for those items which <i>are not</i> included in the estimate provided by the <b>Construction Division</b> for the PS&E Estimate (Status Code 50, "Plan Package Phase").
<b>Traffic Signals, Permanent Signing, Roadway Lighting, etc.:</b>	The roadway designer will verify that these items are included in the estimate if they are a part of the project.
<b>Trenched Widening:</b>	Paid for when widening a roadway from an existing 24 feet wide to 28 feet.
<b>Unusual Circumstances:</b>	Known special circumstances that will affect the contractor's bids should be noted. For example, rock excavation, long hauls, unsuitable materials, phased construction, etc. will affect the contractor's bids.
<b>Utilities:</b>	Utilities can be a major project cost. The roadway designer should take this into account when designing and try to avoid the need for expensive rehabilitation. A major utility rehabilitation must be included in the estimate, <i>do not</i> use the standard 2.9% of project cost.
<b>Utilities – City Owned:</b>	Generally, utilities located within corporate limits will be a project cost and must be included in the estimate. Reimbursement of a city-owned utility located outside of corporate limits depends on whether or not the utility is located within state right-of-way. This should also be accounted for during design to avoid possible conflicts.
<b>On-Site Wetland Mitigation:</b>	This item can be very costly and may necessitate the purchase of additional right-of-way. The roadway designer should coordinate with the <b>Environmental Section</b> in <b>PDD</b> on an approximate area of wetlands involved and on the cost.

Exhibit 12.5 Estimate Items Often Overlooked or Omitted (Continued)

UNIT	APPLIES TO	ACCURACY
Each	Contract items with a unit of each	Whole number
Cu. Yd.	Contract items with a unit of cubic yard except: 1. Aggregate surfacing items 2. Concrete 3. Base course material, granular foundation course material, sand soil binder, filler & material aggregates	Nearest cu. yd. Nearest 5 cu. yd. 0.01 cu. yd. Nearest 10 cu. yd.
Sq. Yd.	Contract items with a unit of square yard	Nearest 1 sq. yd.
Sq. Ft.	Contract items with a unit of square foot	Nearest 1 sq. ft.
Mile	Contract items with a unit of mile	0.001 Mile
Station	Contract items with a unit of station	0.001 Sta.
Lin. Ft.	Contract items with a unit of linear foot except: 1. Safety beam guardrail 2. Cable guardrail 3. Bridge railing, handrail, etc. 4. Wood sign supports 5. Concrete protection barriers 6. Culvert Pipe	Nearest 1 lin. ft. Nearest 0.5 lin. ft. Nearest 1 lin. ft. Nearest 0.01 lin. ft. Nearest 0.5 lin. ft. Nearest 1 lin. ft. Nearest 1 lin. ft.
Vert. Ft.	Contract items with a unit of vertical foot	0.1 ft
Day	Contract items with a unit of day	Nearest 0.5 day
Ton	Contract items with a unit of ton except: Asphaltic concrete	Nearest 1 ton Nearest 10 tons
Cu. Yd. Sta.	Contract items with a unit of cubic yard station	Nearest 1 cu. yd. Sta.
Acre	Contract items with a unit of acre	Nearest 1 acre
M Sq. Yd.	Contract items with a unit of thousand square yards	Nearest M sq. yd.
Hour	Contract items with a unit of hour	Nearest 1 hour
Lb.	Contract items with a unit of pound	Nearest 1 lb.
Gal.	Contract items with a unit of gallon	Nearest 10 gal.
MGal.	Contract items with a unit of thousand gallons	Nearest MGal

**Exhibit 12.6 Pay Item Accuracy**

ITEM	ENGLISH
Subgrade Preparation	0.001 STA
Subgrade Preparation	1 SY
Subgrade Stabilization	0.001 STA
Water	1 Mgal
Soil Binder	10 CY
Asphaltic Concrete	10 Ton
Asphalt Cement	0.005 Ton
Tack Coat	10 Gal
Shoulder Constructions	0.001 STA
Preparation of Intersections and Driveways	1 SY
Placement of Asphaltic Concrete for Driveways and Intersections	1 SY
Concrete Pavement	1 SY
Foundation Course	10 Ton
Foundation Course	1 SY
Concrete Driveway	1 SY
Cold Milling	0.001 STA
Salvaging and Stockpiling Bituminous Material	10 Ton
Gravel Surface Course	10 CY
Gravel Surface Course	10 Ton
Gravel Embedment	0.001 STA
Removing, Crushing, Screening and Stockpiling old Concrete Pavement	1 SY

**Exhibit 12.7 Rounding of Surfacing Item Quantities**

**Asphaltic Concrete Surfacing**

Asphaltic Concrete, Type "\*\*\*"  
Performance Graded Binder (xx\_xx)  
Hydrated Lime for Asph. Mixtures  
Cold Milling, Class "\*\*\*"  
Tack Coat  
Earth Shoulder Construction  
Shoulder Subgrade Preparation (Includes Shoulder Construction)  
Water

**Asphaltic Concrete Full Depth Construction**

Asphaltic Concrete, Type "\*\*\*"  
Performance Graded Binder (xx\_xx)  
Hydrated Lime for Asph. Mixtures  
Tack Coat  
Earth Shoulder Construction  
Shoulder Subgrade Preparation (Includes Shoulder Construction)  
Subgrade Construction  
Subgrade Preparation  
Water

**Bituminous Sand Base Course**

Asphaltic Oil or Emulsified Asphalt  
Mineral Filler  
Fog Seal  
Water

**Bituminous Surface Course**

Bituminous Surface Course  
Fog Seal

**Portland Cement Concrete Full Depth Construction**

Foundation Course (Aggregate, Bituminous, Crushed Conc., etc.) - optional, see pavement determination  
Drainage (Subgrade)  
Subgrade Preparation  
Earth Shoulder Construction  
Shoulder Subgrade Preparation (Includes Shoulder Construction)  
Water

**Temporary Road or Detour**

Gravel Embedment  
Gravel Surface Course  
Calcium Chloride, Applied - use if required by District  
Subgrade Preparation  
Earth Shoulder Construction  
Water  
Temporary Surfacing

**Exhibit 12.8 Pavement Item Checklist**

QUANTITY AND AREA COMPUTATIONS FOR GRAVEL AND CRUSHED ROCK																	
The table below gives the area (in sq. yds.) and quantities (in cu. yds.) for various roadway widths, distances, and depths.																	
Width of Roadway	Sq. Yds		1 in. Depth			1 1/2 in. Depth			2 in. Depth			2 1/2 in. Depth			3 in. Depth		
	Per Sta.	Per Mile	1 Cu. Yd. covers Lin. Ft.	Per Sta	Cu. Yds.	1 Cu. Yd. covers Lin. Ft.	Per Sta	Cu. Yds.	1 Cu. Yd. covers Lin. Ft.	Per Sta	Cu. Yds.	1 Cu. Yd. covers Lin. Ft.	Per Sta	Cu. Yds.	1 Cu. Yd. covers Lin. Ft.	Per Sta	Cu. Yds.
10	111.11	5866.7	32.40	3.09	162.96	21.00	4.63	244.44	16.20	6.17	325.93	12.96	7.72	407.41	10.80	9.26	488.59
11	122.22	6453.3	29.45	3.40	179.26	19.64	5.09	268.89	14.73	6.79	358.52	11.78	8.49	448.15	9.82	10.19	537.78
12	133.33	7040.0	27.00	3.70	195.56	18.00	5.56	293.33	13.50	7.41	391.11	10.80	9.26	488.89	9.00	11.11	586.67
13	144.44	7526.7	24.92	4.01	211.85	16.62	6.02	317.78	12.45	8.02	423.70	9.97	10.03	529.63	8.31	12.04	635.56
14	55.56	8213.3	23.14	4.32	228.15	15.43	6.48	342.22	11.57	8.64	456.30	9.26	10.80	570.37	7.72	12.96	684.44
15	166.67	8800.0	21.60	4.63	244.44	14.40	6.94	366.67	10.80	9.26	488.89	8.64	11.57	611.11	7.20	13.89	733.33
16	177.78	9335.7	20.25	4.94	260.74	13.50	7.41	391.11	10.13	9.88	521.48	8.10	12.35	651.85	6.75	14.81	782.22
17	188.89	9973.3	19.06	5.25	277.04	12.71	7.37	415.56	9.53	10.49	554.07	7.62	13.12	692.59	6.35	15.74	831.11
18	200.00	10560.0	18.00	5.56	293.33	12.00	8.33	440.00	9.00	11.11	586.67	7.20	13.89	733.33	6.00	16.67	880.00
19	211.11	11146.7	17.05	5.86	309.63	11.37	8.80	464.44	8.53	11.73	619.26	6.82	14.66	774.07	5.69	17.59	928.89
20	222.22	11733.3	16.20	6.17	325.93	10.80	9.25	488.89	8.10	12.35	651.85	6.48	15.43	814.81	5.40	18.52	977.78
21	233.33	12320.0	15.43	6.48	342.22	10.29	9.72	513.33	7.72	12.96	684.44	8.17	16.20	855.56	5.14	19.44	1026.67
22	244.44	12905.7	14.73	6.79	353.52	9.82	10.19	537.78	7.36	13.58	717.04	5.89	16.98	895.30	4.91	20.37	1075.56
23	255.56	13493.3	14.09	7.10	374.81	9.39	10.65	562.22	7.04	14.20	749.63	5.63	17.75	937.04	4.70	21.30	1124.44
24	266.67	14080.0	13.50	7.41	391.11	9.00	11.11	586.67	6.75	14.81	782.22	5.40	18.52	977.78	4.50	22.22	1173.33
25	277.78	14666.7	12.95	7.72	407.41	8.64	11.57	611.11	6.48	15.43	814.81	5.18	19.29	1018.52	4.32	23.15	1222.22
26	288.89	15253.3	12.45	8.02	423.70	8.31	12.04	635.56	6.23	16.05	847.41	4.98	20.06	1059.26	4.15	24.07	1271.11
27	300.00	15840.0	12.00	8.33	440.00	8.00	12.50	660.00	6.00	16.67	880.00	4.80	20.83	1100.00	4.00	25.00	1320.00
28	311.11	16426.7	11.57	8.64	456.30	7.71	12.96	684.44	5.79	17.28	912.59	4.63	21.60	1140.74	3.86	25.93	1368.89

Crushed Rock for Surfacing = 1.25 Tons / Cu. Yd.

# 2 Gravel for Surfacing = 1.35 Tons / Cu. Yd.

Exhibit 12.9 Quantity Computations for Gravel and Crushed Rock

<b>ESTIMATING QUANTITIES - 3/20/2018</b>	
<i>(Referenced to the 2017 NDOT Standard Specifications for Highway Construction)</i>	
<b>General Information</b>	
Items are listed in alphabetical order.	
RAP is an acronym for Recycled Asphalt Pavement, other term used is Bituminous Millings	
Weight of RAP = 144 lbs/ ft <sup>3</sup>	
One gallon of emulsified asphalt or water weighs 8.333 lbs.	
Beveled edges in asphalt and concrete pavements are subsidiary. The required material is included in asphalt tons or concrete square yards.	
<b>Asphaltic Concrete Projects</b> –Add the following equipment rental items and hours.	
“Rental of Loader, Fully Operated” – 15 Hour	
“Rental of Motor Grader, Fully Operated” – 15 Hour	
“Rental of Dump Truck, Fully Operated” – 15 Hour	
“Rental of Skid Loader, Fully Operated” – 15 Hour	
<b>Armor Coat – Section 515</b>	
“Armor Coat Aggregate” – Cubic Yard	23 lbs/ yd <sup>2</sup> (conversion factor 1.3 ton = 1 yd <sup>3</sup> )
“Armor Coat Emulsified Asphalt” - Gallon	0.34 Gal/ yd <sup>2</sup>
<b>Asphaltic Concrete – Section 503, Section 1028, &amp; Special Provision</b>	
“Asphaltic Concrete, Type ____” – Ton	(See EXHIBITS 12.11 & 12.13 for types and weight)
Include material required for beveled edge.	
“Hydrated Lime/WMA” – Each	(See EXHIBIT 12.12)
“RAP Incentive Payment” - Each	Asphaltic Concrete Type “***” tons x 1.7 = Each
<b>Asphaltic Concrete Curb – Section 505</b>	
“Constructing Asphaltic Concrete Curb” – Linear Foot	
Factor for 3” Curb	1.35 Ton/ Sta.
Factor for 4” Curb	2.00 Ton/ Sta.
Factor for 6” Curb	2.10 Ton/ Sta.
Factor for Tack Coat	1.0 Gal/ Sta.
<b>Asphaltic Concrete for Patching – Section 516</b>	
“Asphaltic Concrete for Patching, Type “____” - Ton	
<b>Asphaltic Pavement Smoothness Testing ID – Section 502 &amp; Special Provision</b>	
“Asphaltic Pavement Smoothness Testing ID” - Mile	
<b>Bituminous Patching of Concrete Pavement – Section 520</b>	
“Bituminous Patching” - Ton	
<b>Bituminous Sand Base Course – Section 509</b>	
“Bituminous Sand Base Course Asphaltic Oil” – Gallon	1000 Gal./ Sta. for (5” x 24’)
“Bituminous Sand Base Course Emulsified Asphalt” – Gallon	1200 Gal./ Sta. for (5” x 24’)
	6% residual
“Bituminous Sand Base Course” - Station	
“Mineral Filler for Bituminous Sand Base Course – Cubic Yard	**10 Cu Yds/ Sta. for (5” x 24’)
	** Quantity of Mineral Filler will vary depending on type of soil.
“Mineral Aggregate” – Cubic Yard	Do not use for estimate
“Water” – MGallon	1 MGal/ Sta.
“Fog Seal” – Gallon	0.15 Gal./ yd <sup>2</sup>
<b>Bituminous Surface Course – Section 512</b>	
“Bituminous Surface Course” – Square Yard	
“Fog Seal” – Gallon	0.6 Gal./ yd <sup>2</sup>
<b>Calcium Chloride, Applied – Section 309</b>	
“Calcium Chloride Applied” – Ton	3 lbs/ yd <sup>2</sup>

**Exhibit 12.10 Estimating Quantities**

<b>Cement Stabilized Bituminous – Special Provision</b>	
“Cement Stabilized Bituminous” - Station	
“Cement” – Ton	5% weight of RAP
“Water for Cement Stabilization” – MGallon	5% weight of RAP & Cement (convert to MGal)
“Cold Milling, Class 2” – Station	Use if required in the “Pavement Determination”
“Fog Seal” – Gallon (See Note)	0.24 Gal/ yd <sup>2</sup>
Note: One application after the “CSB”, Second application after the “Cold Milling, Class 2” if required.	
<b>Chip Seal – Section 515</b>	
“Chip Seal Aggregate” – Cubic Yard	25 lbs/ yd <sup>2</sup> (aggregate weight 1.4 tons = 1 yd <sup>3</sup> )
“Chip Seal Emulsified Asphalt” – Gallon	0.36 Gal/ yd <sup>2</sup>
<b>Cold In-Place Recycling (W/ Foamed Asphalt) – Special Provision</b>	
“Cold In-Place Recycling with Foamed Asphalt” - Station	
“Performance Graded Binder (58-28)” – Ton	2% RAP (4”x24’ – 1.5 Tons/ Sta.) (4”x28’ – 1.34 Tons/ Sta.)
“Fog Seal” – Gallon	0.10 Gal/ yd <sup>2</sup>
<b>Cold Milling – Section 510</b>	
“Cold Milling, Class _____” – Station, Square Yard	
<b>Concrete Pavement Repair, Flexible Polymer Modified”</b>	
“Concrete Pavement Repair, Flexible Polymer Modified” – Square Yard	
Note: Special Provision describes depth of repair. Preparation of concrete, primer, bulking aggregate, and surfacing aggregate are subsidiary.	
<b>Concrete Sealer – Special Provision</b>	
“Penetrating Concrete Sealer” – Gallons	300 Square Feet per Gallon
<b>Concrete Surfacing Milling – Section 510</b>	
“Concrete Surface Milling” – Square Yard or Station	
<b>Cracking &amp; Seating Concrete Pavement – Special Provision</b>	
“Cracking & Seating” – Square Yard	
<b>Diamond Grinding and Texturing Pavement – Special Provision</b>	
“Diamond Grinding and Texturing Pavement” – Square Yard	
<b>Earth Shoulder Construction – Section 304</b>	
“Earth Shoulder Construction” – Station	<i>Shoulders are measured separately</i>
“Water” – MGallon	0.25 MGal/ Sta.
<b>Earth Shoulder Restoration – Special Provision</b>	
<i>Use this item when the project has “Trenched Widening 1 ft.” and a 1-inch grade raise or less.</i>	
<i>Use this item when the project has “Trenched Widening 3 ft.” and a 2-inch grade raise or less.</i>	
“Earth Shoulder Restoration – Station	<i>Shoulders are measured separately</i>
“Seeding, Type B” - Acre (Use 8’ wide x length)	1 Acre = 43,560 sq. ft.
“Mulch” (Hay or Straw) – Ton	2.25 Tons/ Acre
<b>Fabric Reinforcement Crack Repair – Section 518</b>	
“Fabric Reinforcement Crack Repair” – Linear Feet (FT)	
<b>Fly Ash Stabilized – Special Provision</b>	
“Fly Ash Stabilized Bituminous” - Station	
“Fly Ash” – Ton	12% weight of RAP
“Water for Fly Ash Stabilization” – MGallon	5% weight of RAP & Fly Ash
“Cold Milling, Class 2” – Station	Use if required in the “Pavement Determination”
Note: One application after the “FSAB”, Second application after the “Cold Milling, Class 2” if required.	

Exhibit 12.10 Estimating Quantities (Continued)

<b>Fog Seal – Section 513</b>	
“Fog Seal” – Gallon / CSS-1 & CSS-1H	
Factor for mainline & shoulder	0.12 Gal/ yd <sup>2</sup>
Factor for open graded friction course	0.16 Gal/ yd <sup>2</sup>
Factor for milled surface of Asph. Conc.	0.07 Gal/ yd <sup>2</sup>
Factor for milled surface of Bit. Sand	0.10 Gal/ yd <sup>2</sup>
<b>Foundation Course – Section 307</b>	
“Foundation Course ____” – Square Yard	Note: Use this item for estimates.
<i>Note: Foundation Course calculated as total pavement footprint including bevel. Water calculated for pavement footprint plus 3’ beyond. Plans show Foundation Course 3’ beyond pavement footprint.</i>	
“Bituminous Foundation Course ____” – Square yard	
In place weight = 123 lbs/ ft <sup>3</sup> or 1.66 Ton/ yd <sup>3</sup>	
Stockpiled Bituminous = 1.43 Ton/ yd <sup>3</sup>	
“Crushed Concrete Foundation Course ____” – Square Yard	
In place weight for 4” + ¼” trimming = 0.19 Ton/ yd <sup>2</sup>	
Stockpiled crushed concrete = 1.35 Ton/ yd <sup>3</sup>	
Concrete Pavement in Place = [yd <sup>3</sup> x 1.94 Ton/ yd <sup>3</sup> x 90% (10% loss)] = tons of crushed concrete available	
“Aggregate Foundation Course “D” ____” – Square Yard	
“Aggregate Foundation Course ____” – Square Yard or Ton	
In place weight for 4” + ¼” trimming = (yd <sup>2</sup> x 0.2222 Ton/ yd <sup>2</sup> ) = Tons	
<b>Gravel Embedment – Special Provision</b>	
“Gravel Embedment” - Station	
“Gravel” – Cubic Yard (Designer’s item)	
<i>Note: Design is usually 2” gravel embedded in the upper 4” &amp; cap with 1”</i>	
<b>Granular Subdrains – Section 915</b>	
“Granular Subdrains” - Each	
<b>High Friction Surface Treatment – Special Provision</b>	
“High Friction Surface Treatment (1-Layer)”	Square Yard
“High Friction Surface Treatment (2-Layer)”	Square Yard
<b>Hot In-Place Recycling – Special Provision</b>	
“Hot In-Place Recycling” - Station	
“Emulsified Asphalt for Hot In-Place Recycling” – Gal 1% of RAP	
	(2” x 24’ = 69 Gal/ Sta.) (2” x 28’ = 81 Gal/ Sta.)
<b>Hydrated Lime Slurry Stabilization – Special Provision</b>	
“Hydrated Lime Slurry Stabilization” - Station	
“Hydrated Lime” – Ton	1.5% weight of RAP
	(4” x 24’ = 0.9 Tons / Sta.) (5” x 24’ = 1.1 Tons/ Sta.)
“Emulsified Asphalt for HLSS” – Gal	1.75% weight of RAP & Lime
	(4” x 24’ = 245 Gal/ Sta.) (5” x 24’ = 307 Gal/ Sta.)
“Fog Seal” – Gallon	0.10 Gal/ yd <sup>2</sup>
<i>Note: Growth factor Approx. ¾” for a depth of 3” to 5”. 1” for a depth of 6”.</i>	

Exhibit 12.10 Estimating Quantities (Continued)

<b>Intersections and Driveways – Section 302 &amp; Section 503</b>	
“Preparation of Intersections and Driveways” – Square Yards	
“Placement of Asphaltic Concrete for Intersections and Driveways” – Square Yards	
<i>Note: Asphaltic concrete paid for by roadway tonnage.</i>	
<b>Joint Sealing Asphalt to Concrete – Section 508</b>	
“Joint Sealing – Asphalt to Concrete” – Station (one side)	
<b>Mail Box Turnouts – Section 912 &amp; Special Provision</b>	
“Preparation of Intersections and Drives” – Square Yard	
“Placement of Drives and Intersections” – Square Yard	
<b>Microsurfacing – Section 514</b>	
“Microsurfacing Placement” - Station	
“Emulsified Asphalt for Microsurfacing – Gallon	12% of total tons
“Aggregate for Microsurfacing” – Ton	83.8% of total tons
“Mineral Filler for Microsurfacing” – Ton	1.7% of total tons
<i>Note: Weight Factor is 6.6 Ton/ 100 ft<sup>3</sup></i>	
<i>Note: Lift thicknesses are ¼” and calculate rut depth if applicable.</i>	
<b>Milling Concrete for Inlays – Section 510</b>	
“Milling Concrete for Inlays” - Each	
<b>Non-Woven Pavement Overlay Fabric – Special Provision</b>	
“Non-Woven Pavement Overlay Fabric” – Square Yard	
<b>Performance Graded Binder (**-**) – Special Provision</b>	
Use EXHIBIT 12.11 to estimate the tons.	
<b>Perforated Pipe – Section 914</b>	
“_____ Perforated Pipe” – Linear Foot (LF)	
“_____ Non-Perforated Pipe” – Linear Foot (LF)	
<b>Removal and Processing of Concrete Pavement – Section 312</b>	
<b>Shoulder Subgrade Preparation – Section 302</b>	
“Shoulder Subgrade Preparation” - Station	
“Water” – MGallon	0.5 MGal/ Sta.
<i>Note: Shoulders are measured separately</i>	
<b>Special Surface Course – Special Provision</b>	
<i>Note: Use this item if placing millings on driveways or under guardrail</i>	
“Special Surface Course” – Square Yard	
“Fog Seal” – Gallon      2 applications, 0.20 Gal/ yd <sup>2</sup> for soil and 0.30 Gal/ yd <sup>2</sup> for the surface	
<b>Stress Absorbing Fiberglass Layer with Emulsified Asphalt (SAFLEA)- Special Prov.</b>	
(Added item Summer 2017)	
“Stress Absorbing Fiberglass Layer with Emulsified Asphalt” – Square Yard	
“Armor Coat Emulsified Asphalt” – Gallon	0.44 Gal/ yd <sup>2</sup>
“Armor Coat Aggregate” – Cubic Yard	32 lbs/ yd <sup>2</sup> (conversion factor 1.3 ton = 1 yd <sup>3</sup> )
<b>Subgrade Preparation – Section 302</b>	
“Subgrade Preparation” – Station or Square Yard	
“Water” – MGallon	1.0 MGal/ Sta. or 0.003 MGal/ yd <sup>2</sup>
<i>Note: Subgrade Preparation calculated as total pavement footprint including bevel. Water calculated for pavement footprint plus 3’ beyond. Plans show Subgrade Preparation 3’ beyond pavement footprint.</i>	
<b>Subgrade Preparation for Widening – Special Provision</b>	
<i>Note: Use for concrete pavement widening</i>	
“Subgrade Preparation for Widening” – Station (one side)	
“Water” – MGallon	0.5 MGal/ Sta.

Exhibit 12.10 Estimating Quantities (Continued)

<b>Subgrade Stabilization – Section 303</b>	
“Subgrade Stabilization” – Station or Square Yard	
“Soil Binder” – Cubic Yard	12.5 yd <sup>3</sup> / Sta. (for 6” x 30’)
“Water” – MGallon	1 MGal/ Sta. or 0.003 MGal/ yd <sup>2</sup>
<i>Subgrade Stabilization calculated as total pavement footprint including bevel. Soil Binder and Water calculated for pavement footprint plus 3’ beyond. Plans show Subgrade Stabilization 3’ beyond pavement footprint.</i>	
<b>Surfacing – Special Provision</b>	
“Surfacing “_____” – Square Yard	
<i>Note: Contractor’s choice for pavement type, asphaltic concrete or Portland cement concrete.</i>	
<b>Surfacing Under Guardrail – Special Provision</b>	
“Surfacing Under Guardrail” – Square Yards	
<i>Note: Pay Item includes asphalt or concrete surface (contractor’s option) and subgrade prep.</i>	
<b>Stabilized Subgrade (8” Depth) – Special Provision</b>	
“Stabilized Subgrade Type Cement” – Square Yard	use if PI of soil is 20 or more
“Cement” – Ton	46 lbs/ yd <sup>2</sup> (cement quantity is **7% of soil tons)
“Stabilized Subgrade Type Fly Ash” – Square Yard	use if PI of soil is 19 or less
“Fly Ash” – Ton	66 lbs/ yd <sup>2</sup> (fly ash quantity is **10% of soil tons)
“Stabilized Subgrade Type Lime” – Square Yard	use if PI of soil is 20 or more
“Hydrated Lime” – Ton	33 lbs/ yd <sup>2</sup> (hydrated lime quantity is **5% of soil tons)
“Water” – MGallon	1 MGal/ Sta. or 0.003 MGal/ yd <sup>2</sup>
<i>** Soil weight compacted in place, 110 lbs/ ft<sup>3</sup></i>	
<i>Note: Stabilized Subgrade Type _____ calculated as total pavement footprint including bevel. Cement, Fly Ash, Hydrated Lime, and Water calculated for pavement footprint plus 3’ beyond. Plans show Stabilized Subgrade Type “_____” 3’ beyond pavement footprint.</i>	
<b>Tack Coat - Section 504</b>	
“Tack Coat” – Gallon	
Factor for existing surface	0.15 Gal/ yd <sup>2</sup>
Factor for between lifts	0.05 Gal/ yd <sup>2</sup>
<b>Temporary Surfacing – Special Provision</b>	
“Temporary Surfacing “_____” – Station or Square Yard	
<i>Note: Contractor’s choice for pavement type, asphaltic concrete or Portland cement concrete.</i>	
<i>Note: Subgrade Preparation, earth shoulder construction, water applied and removal are subsidiary.</i>	
<b>Trenched Widening 1’ – Special Provision</b>	
“Trenched Widening 1’ ” – Station	<i>Measured separately</i>
<i>Note: Include “Earth Shoulder Construction” or “Earth Shoulder Restoration”</i>	
<b>Trenched Widening 3’ – Special Provision</b>	
“Trenched Widening 3’ ” – Station	<i>Measured separately</i>
<i>Note: Include “Earth Shoulder Construction” or “Earth Shoulder Restoration”</i>	
<b>Widening – Special Provision</b>	
“Widening” – Station	<i>Measured separately</i>
<b>Ultra Thin Bonded Asphalt Wearing Course – Special Provision</b>	
“Ultra Thin Bonded Asphalt Wearing Course” - Ton	
“Performance Graded Binder **_** - Ton	
“UTBWC” will be SLX, SPR (Fine) or SPH (0.375) as noted in the “Pavement Determination”	
<i>Note: Do not pay for Tack Coat</i>	

Exhibit 12.10 Estimating Quantities (Continued)

<b>Performance Graded Binder (**-**) Table</b> (Renaming PG Binder Types, beginning with the January 2017 letting)				
Asph. Conc. Type	PG Binder (**-**) Type	Gradation Bands (0.5) multiply Asph. Conc. Tonnage by	Gradation Bands (0.375) multiply Asph. Conc. Tonnage by	Gradation Bands (0.19) multiply Asph. Conc. Tonnage by
GGCRM	(58-28)	8.5%	NA	NA
GGCRMLV	(58-28)	8.5%	NA	NA
LC	(58V-34)	NA	NA	5.2%
SLX	(58V-34)	NA	4.2%	NA
SPR	(58H-34) (58V-34) if Current TADT > 150	3.4%	NA	NA
SPR (Fine)	Same as SPR	NA	3.4%	NA
SPS	(58S-34)	3.2%	NA	NA
SPH	(58V-34)	3.8%	3.8%	NA
SRM	(58H-34)	2.8%	NA	NA

1" SLX thin lifts – add 15% to asphalt tons for slope and profile correction.

**Exhibit 12.11 Performance Graded Binder Table**

<b>Hydrated Lime / Warm Mix Asphalt</b>	
Asph. Conc. Type	"Hydrated Lime/WMA" Pay item is "Each" multiply tons of asphalt by
GGCRM	1
GGCRNLV	1
LC	1
SLX	1
SPR	1
SPR (Fine)	1
SPS	NA
SPH	1
SRM	1

Example: If you have 10,534 tons of Asphaltic Concrete Type "SPR", there will be 10,534 Each of "Hydrated Lime/WMA"

**Exhibit 12.12 Hydrated Lime / Warm Mix Asphalt**

### Asphaltic Concrete Tonnage Table Asphaltic Concrete Types

Inches	Bit Sand Base Crse	Bit Fnd Crse	OGFCCRMM	GGCRM	GGCRMLV	LC	SLX	SPS SPH	SPR (Fine) SPR SRM	
	<b>Tons per 100 Cubic Feet</b>									
	6.0	6.2	6.3	6.75	6.95	7.15	7.25	7.30	7.35	7.40
<b>Pounds per Cubic Foot</b>										
	120	124	126	135	139	143	145	146	147	148
<b>Tons/ SqYd/ Inch</b>										
<b>1</b>	<u>0.045</u>	<u>0.050</u>	<u>0.050</u>	<u>0.051</u>	<u>0.052</u>	<u>0.054</u>	<u>0.054</u>	<u>0.055</u>	<u>0.055</u>	<u>0.055</u>
<b>1.5</b>										
<b>2</b>	<u>0.090</u>	<u>0.093</u>	<u>0.095</u>	<u>0.101</u>	<u>0.104</u>	<u>0.107</u>	<u>0.109</u>	<u>0.110</u>	<u>0.110</u>	<u>0.111</u>
<b>2.5</b>										
<b>3</b>	<u>0.135</u>	<u>0.140</u>	<u>0.141</u>	<u>0.151</u>	<u>0.156</u>	<u>0.161</u>	<u>0.163</u>	<u>0.164</u>	<u>0.165</u>	<u>0.166</u>
<b>3.5</b>										
<b>4</b>	<u>0.180</u>	<u>0.186</u>	<u>0.189</u>	<u>0.202</u>	<u>0.208</u>	<u>0.214</u>	<u>0.218</u>	<u>0.219</u>	<u>0.221</u>	<u>0.222</u>
<b>4.5</b>										
<b>5</b>	<u>0.225</u>	<u>0.233</u>	<u>0.236</u>	<u>0.253</u>	<u>0.260</u>	<u>0.268</u>	<u>0.272</u>	<u>0.274</u>	<u>0.276</u>	<u>0.278</u>
<b>5.5</b>										
<b>6</b>	<u>0.270</u>	<u>0.279</u>	<u>0.284</u>	<u>0.303</u>	<u>0.313</u>	<u>0.322</u>	<u>0.326</u>	<u>0.329</u>	<u>0.331</u>	<u>0.333</u>
<b>6.5</b>										
<b>7</b>	<u>0.315</u>	<u>0.326</u>	<u>0.331</u>	<u>0.354</u>	<u>0.365</u>	<u>0.375</u>	<u>0.381</u>	<u>0.383</u>	<u>0.386</u>	<u>0.388</u>
<b>8</b>	<u>0.360</u>	<u>0.372</u>	<u>0.378</u>	<u>0.405</u>	<u>0.417</u>	<u>0.429</u>	<u>0.435</u>	<u>0.438</u>	<u>0.441</u>	<u>0.444</u>
<b>9</b>	<u>0.405</u>	<u>0.419</u>	<u>0.425</u>	<u>0.456</u>	<u>0.469</u>	<u>0.483</u>	<u>0.489</u>	<u>0.493</u>	<u>0.496</u>	<u>0.500</u>
<b>10</b>	<u>0.450</u>	<u>0.465</u>	<u>0.473</u>	<u>0.506</u>	<u>0.521</u>	<u>0.536</u>	<u>0.544</u>	<u>0.548</u>	<u>0.551</u>	<u>0.555</u>

**Exhibit 12.13 Asphaltic Concrete Tonnage Table**

**10. REFERENCES**

- 12.1 Nebraska Department of Transportation, Right-of-Way Manual, Current Edition.  
(<http://www.roads.nebraska.gov/media/5012/row-manual.pdf>)
- 12.2 Nebraska Department of Transportation, Design Process Outline (DPO), Current Edition.  
(<http://www.roads.nebraska.gov/business-center/design-consultant/>)
- 12.3 Nebraska Department of Transportation, Standard Specifications for Highway Construction (Spec Book), 2017.  
(<http://dot.nebraska.gov/media/10343/2017-specbook.pdf>)
- 12.4 Nebraska Department of Transportation, Drainage Design and Erosion Control Manual (Drainage Manual), Current Edition.  
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