LTAP

Plan Reading

Study Guide

Companion to the Friend South Saline County Plans

650 J Street
Lincoln, NE 68508
(402) 472-5748
www.ltap.unl.edu

Table of Contents

Reading & Understanding Construction Plans

- Fulfills your job duties
- Professionalism to your position
- Interpret the project information
- Answer questions from public, contractor and governing body
- Monitor material quantities
- Act as a liaison between the contractor and the governing body and the public
- Explain and obtain Right of Way from landowners
- Monitor progress

Parts of the Construction Contract Documents

1. CONTRACT

- Proposal Forms
  - ► Includes items of work
  - ► Unit prices
  - ► Bidder's signature
- Contract Agreement
  - ► Specifies the completion date
  - ► Guarantee provisions, if any
- Special Provisions
  - ► Modifies the Standard Specifications

2. PLANS

- Construction Drawings
  - ► Plan and profile sheets
  - ► Grade sheets
  - ► Utility sheets
  - ► Special Plans
  - ► Detailed items unique to the project
- Standard Plans
  - ► Typical construction details

3. SPECIFICATIONS

- General Requirements
  - ► Describe and define terms and conditions of contract
- Construction Details
  - ► Describe the work to be performed
  - ► The basis for payment
- Material Specifications
  - ► Provide detailed technical descriptions of all material

Project Location Descriptions

Municipal projects use street names and numbers for location description.

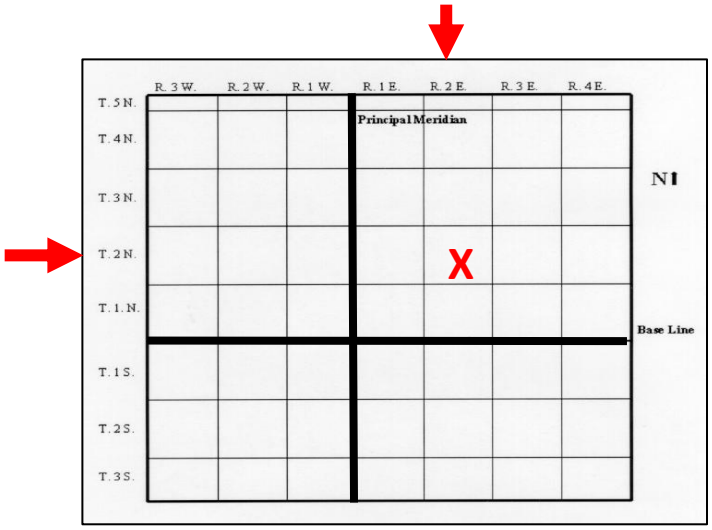
Example *1234 Main St., Lincoln, NE*

County projects use Section, Township and Range.

Example *"Between Sec. 15 and 22, Twp. 15 North, Rg. 47 West."*

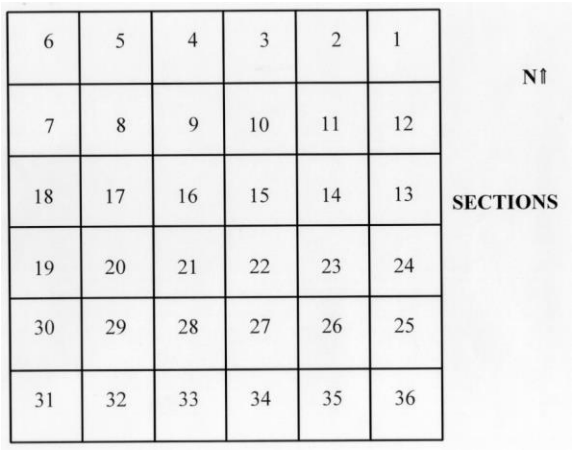
TOWNSHIP measures the distance NORTH or SOUTH from the BASE LINE and usually measures 6 MILES by 6 MILES.

RANGE measures EAST or WEST from the PRINCIPAL MERIDIAN and usually measures 6 MILES by 6 MILES



The "X" in the diagram to the left is in

Township 2N – Range 2E



Townships are subdivided into SECTIONS.

Since each township is six miles by six miles, townships USUALLY contain 36 square miles, each one forming a section

Plan Abbreviations

℄ = Centerline

R. or R.P. = Radius or Radius Point

4 : 1 = Slope (Ratio of "rise" to "run", or as a fraction, "rise over run", in which *run* is the horizontal distance and *rise* is the vertical distance)

W = Width

H = Height

No. 4 Bar = 1/2" Diameter Concrete Reinforcing Bar

Sec. = Section

Twp. = Township

Rg. = Range

ADT = Average Daily Traffic

AADT = Average Annual Daily Traffic

R.O.W. = Right of Way

D.A. = Drainage Area

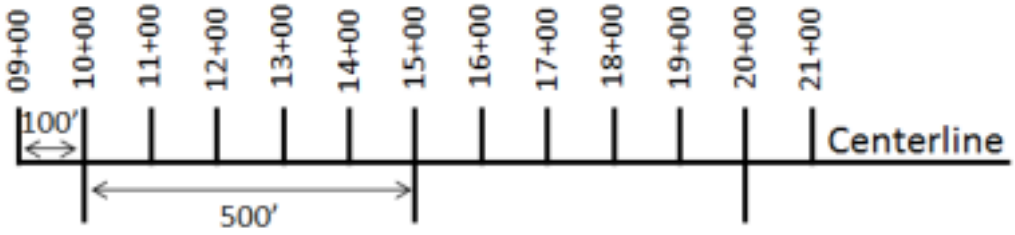
L.F. = Linear Feet

Curve Data

- D. = Degree of Curve
- L. = Length of Curve
- T. = Tangent Length of Curve

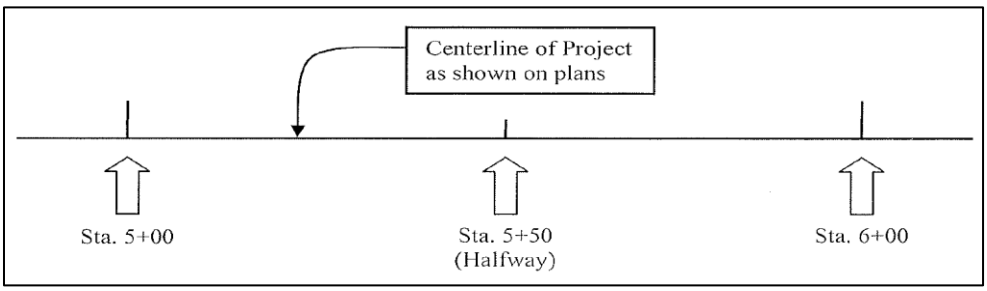
Stationing

A station is a unit of horizontal measurement that always follows along the centerline of the project. Stationing information can be found on the top and bottom of Plan and Profile sheets.
Just as 12 inches makes 1 foot, so 100 feet makes 1 station. It is 100 feet from Station 1 to Station 2.



+00 after a station number indicates that a point is exactly on a "whole" station

Example, Sta. 30+00 means Station 30 plus zero, or exactly on Station 30.



50 feet is *halfway* from one station to the next. To show this location, write +50 after the station number.

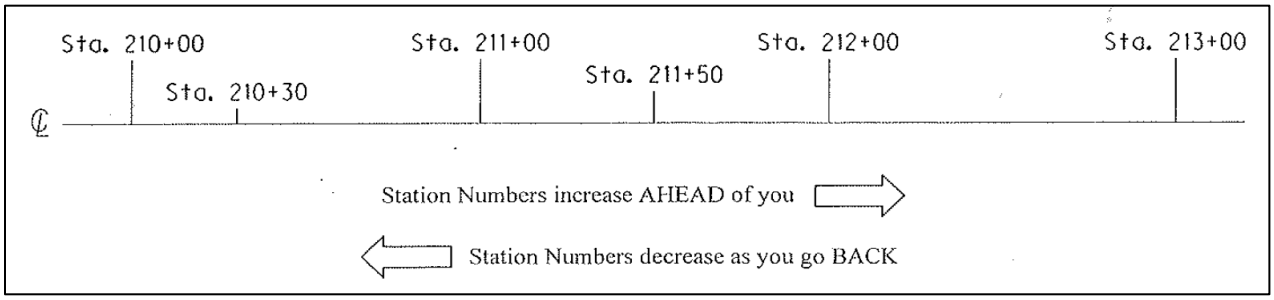
Examples: **Sta. 5+50** is halfway between stations 5+00 and 6+00
2 feet ahead of Sta. 30 is written **Sta. 30+02**
2.75 feet ahead of Sta. 30 is written **Sta. 30+02.75**

To convert stationing *to feet*, drop the plus sign. This is useful when you want to know the distance between stations.

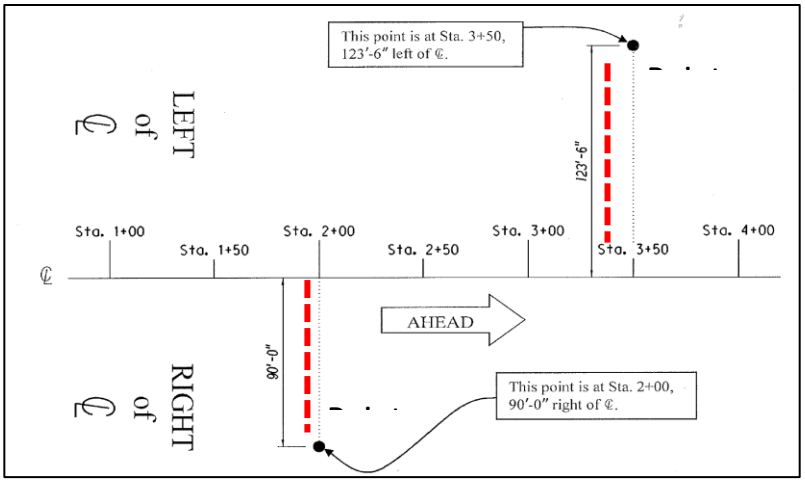
Sta. 30+02 = 3,002 feet
Sta. 1+50 = 150 feet

AHEAD means moving in the direction of *increasing* stationing on a project and the station numbers get larger.

BACK means moving in the direction of *decreasing* stationing on a project and the station numbers get smaller.



Any point pertaining to a project may also be located to the **LEFT** or **RIGHT** of the centerline (as you are standing on the centerline facing AHEAD).



PLANS - CONTENTS

Title Sheet – identify all of these elements on your set of plans

- Project name
- Project number
- Project control number
- County Project location map
- Box containing revisions
- Project limits and length
- Route number
- Signature box – design
- Signature box – chief engineer or official
- Date plans completed
- Groups
- Professional Engineer's stamp
- Index of all sheets

General Notes clarify items not completely covered elsewhere in specifications or plan details. They instruct the Contractor on

- Incidental items of work
- Tack coat application requirements
- ROW access restrictions
- Pavement smoothness requirements
- Soil compaction requirements, etc.

Summary of Quantities shows all the pay items of work included in the contract. The Items are listed in numerical order by item code, and each section specifies item, quantity of item, & item units (see example below).

CULVERT ITEMS
GROUP 4

ITEM	QUANTITY	UNITS	
MOBILIZATION	1.000	LS	← Lump Sum
REMOVE HEADWALLS FROM CULVERTS	2.000	EACH	
REMOVE CULVERT PIPE	24.000	LF	
EXCAVATION FOR PIPE, PIPE-ARCH CULVERTS, AND HEADWALLS	350.000	CY	← Cubic Yard
24" METAL FLARED-END SECTION	1.000	EACH	
42" METAL FLARED-END SECTION	1.000	EACH	
60" METAL FLARED-END SECTION	2.000	EACH	
42" CULVERT PIPE, TYPE 3,4 OR 5	184.000	LF	← Linear Feet
60" CULVERT PIPE, TYPE 3,4 OR 5	60.000	LF	
24" CULVERT PIPE, TYPE 3,4,5 OR 6	90.000	LF	

View Angles

PLAN VIEW: A drawing depicting a section of the road from a bird's eye view.

PROFILE VIEW: A drawing depicting the vertical plane along the longitudinal centerline of the road, expressed in elevation or gradient.

CROSS-SECTION VIEW: A drawing depicting a section of the road viewed vertically, as if cut across the width of the road.

TYPICAL VIEW: A drawing depicting features of a particular design, installation, construction or methodology.

Drainage Structures include

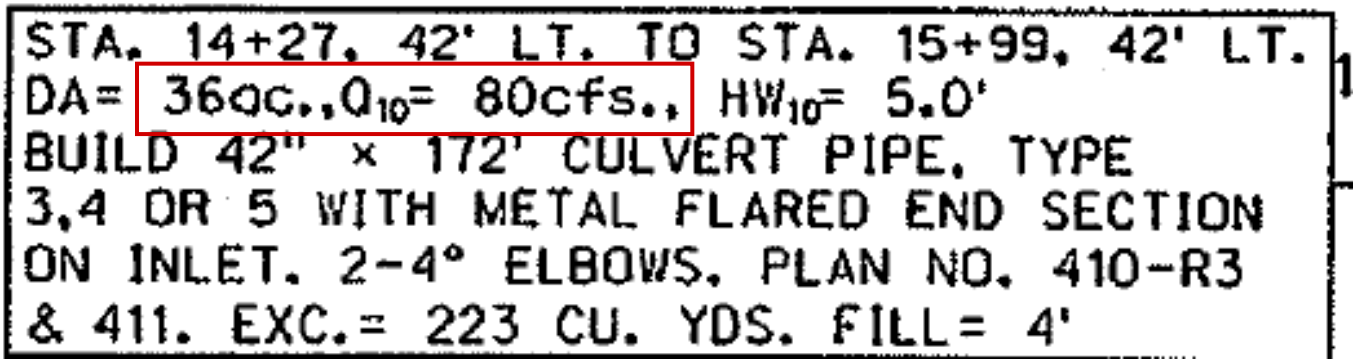
- Bridges
- Pipe Culverts
- Box Culverts
- Drop Inlets
- Headwalls
- Dikes
- Ditches

Q = ciA

Rational Method Equation is the method used to determine peak discharge from drainage basin runoff.
Rational Equation: **Q = ciA**
The Rational Equation requires the following units:

Q = Peak discharge, cubic feet per second (CFS)
c = Rational method runoff coefficient (see table below)
i = Rainfall intensity, inches/hour
A = Drainage area, acres

Ground Cover	Runoff Coefficient, c
Lawns	0.05 - 0.35
Forest	0.05 - 0.25
Cultivated land	0.08-0.41
Meadow	0.1 - 0.5
Parks, cemeteries	0.1 - 0.25
Unimproved areas	0.1 - 0.3
Pasture	0.12 - 0.62
Residential areas	0.3 - 0.75
Business areas	0.5 - 0.95
Industrial areas	0.5 - 0.9
Asphalt streets	0.7 - 0.95
Brick streets	0.7 - 0.85
Roofs	0.75 - 0.95
Concrete streets	0.7 - 0.95



Here is an example of what you might see on a set of plans on the Drainage page. From the area inside the red box (above) we can find the following information:

Drainage Area (DA) = 36 acres

Q_{10} = 80 cubic feet per second

- Q_{10} means the culvert is designed for a **10-year storm**

Design Year Storm

A 100-year storm refers to rainfall totals that have a one percent probability of occurring at that location in that year. Encountering a "100-year storm" on one day does not decrease the chance of a second 100-year storm occurring in that same year or any year to follow. In other words, there is a 1 in 100 or 1% chance that a storm will reach this intensity in any given year. Likewise, a 50-year rainfall event has a 1 in 50 or 2% chance of occurring in a year. See table below.

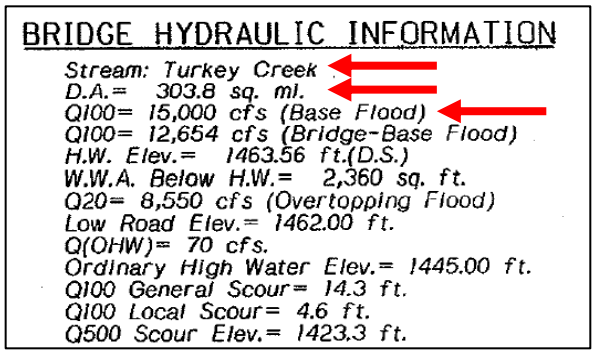
Recurrence intervals and probabilities of occurrences

Recurrence interval, in years	Probability of occurrence in any given year	Percent chance of occurrence in any given year
100	1 in 100	1
50	1 in 50	2
25	1 in 25	4
10	1 in 10	10
5	1 in 5	20
2	1 in 2	50

Bridge Plans

Hydraulic Information

- Waterway (stream)
- Drainage Area (D.A.)
- Peak Discharge (Q)
- Design Year Storm (100)



Bridge Plans (cont.)

Pile Data

- Pile Location
- Pile Number
- Cut-Off Elevation
- Minimum Penetration
- Pile Length
- Design Bearing
- Type

PILE DATA

PROJECT N
BRO-70

LOCATION	PILE NUMBER	CUT-OFF ELEVATION	MINIMUM PENETRATION BELOW CUT- OFF (feet)	PILE ORDER LENGTH (feet)	DESIGN PILE BEARING (tons/PILE)	PILE TYPE
Abutment No. 1	1&2	1451.49	40	45	20	Pipe
	3,4,5,6,7&8	1451.49	60	70	45	Pipe
	9,10&11	1451.49	40	45	20	Pipe
Bent No. 1	1B,4,7&10B	1459.52	70	80	45	Pipe
	2,3,5,6,8&9	1444.52	55	65	45	Pipe
Bent No. 2	1B,4,7&10B	1459.50	65	75	45	Pipe
	2,3,5,6,8&9	1444.50	50	60	45	Pipe
Abutment No. 2	1&2	1451.43	40	45	20	Pipe
	3,4,5,6,7&8	1451.43	55	65	45	Pipe
	9,10&11	1451.43	40	45	20	Pipe

Right of Way terms and definitions

ACQUISITION OR TAKING: The acquiring of a property in its entirety or a portion thereof, for highway purposes.

PARCEL NUMBER: The number designated on the plans, generally enclosed by a circle, which designates a parcel or tract of land.

PERMANENT EASEMENT: An easement in perpetuity that gives the Department the right to utilize property for an unlimited time.

RIGHT OF WAY: This is a term denoting land, interest therein, or property which is acquired for highway purposes.

TEMPORARY EASEMENT: An easement granted to the Transportation Department on a temporary basis for construction usually for a specified time and specified purpose.

Property owners and corresponding tract numbers/information can be found in a table like the one below.

TRACT NO.	OWNER	DESCRIPTION	TOTAL TAKING	NEW TAKING	EXCESS LAND	EASEMENT		REMAINDER	
						PERM.	TEMP.	LT.	RT.
1	STEWART REVOCABLE TRUST, JL & JM	PART OF SE ¼ SEC. 35-T8N-R1E	3.15ac.	1.94ac.			0.30ac.		
2	RONALD COMBS	PART OF SE ¼ SEC. 35-T8N-R1E	0.45ac.	0.19ac.					
3	ROY T. SCHRUNK	PART OF NE ¼ SEC. 35-T8N-R1E	0.35ac.	0.16ac.					
4	STEWART REVOCABLE TRUST, JL & JM	PART W½ SW¼ & PART OF SW¼ NW¼ SEC. 36-T8N-R1E	2.71ac.	1.39ac.			0.23ac.		
5	ROGER COMBS	PART W½ SW¼ & PART OF SW¼ NW¼ SEC. 36-T8N-R1E	0.29ac.	0.10ac.			0.11ac.		

Traffic Control

The Traffic Control Plan (TCP) complements the Traffic Control Specifications and the Manual on Uniform Traffic Control Devices (MUTCD). The TCP tells the contractor how traffic will be maintained while construction is being performed.

When traffic is maintained during construction, the plan will normally require a number of Traffic Control notes that include details such as

- Sequence of operations
- Section details for maintaining traffic
- Plan insert sheets
- Crossover details
- Temporary barrier details

When through -traffic is detoured, the detour route is shown on the title sheet, location map, schematic plan, or within the general notes. Traffic Control Plan (TCP) consists of the plans and specifications developed for each individual construction project and is supplemented by detailed plans as required by the contract.

Additional Misc. Information...just in case you're asked.

SURCHARGE is a *pile of earth whose weight serves as a load to accelerate the compression of softer soils beneath a construction site.* This compression reduces or eliminates the settlement of any structure subsequently built at the site. Preloading surcharge soil with other soil temporarily causes the soil to densify under the temporary weight. This information is usually located on the Plan and Profile Sheet.

Compacting soil -

Increases soil strength
Increases bearing capacity
Improves slope stability
Increases pavement system strength
Decreases amount of settlement
Reduces damage to structure from foundation movement (especially from differential settlement)
Decreases permeability – e.g. dams, levees, lagoon (liner) bottoms,
Improves site conditions for the construction process itself (working platform)
Decreases frost susceptibility (decreased voids, less water infiltration)

BRIDGE CAMBER

The term *camber* actually has several different meanings depending on the engineering principle involved. Generally, it is the amount of curving or arching used to counteract the effects of a load.

When a number of heavy trucks cross over a bridge at the same time the center would sag then spring back to level if the bridge was designed without camber. By adding a slight upward curve to the bridge, engineers can ensure that the bridge only flattens out to a level position when weight is added.

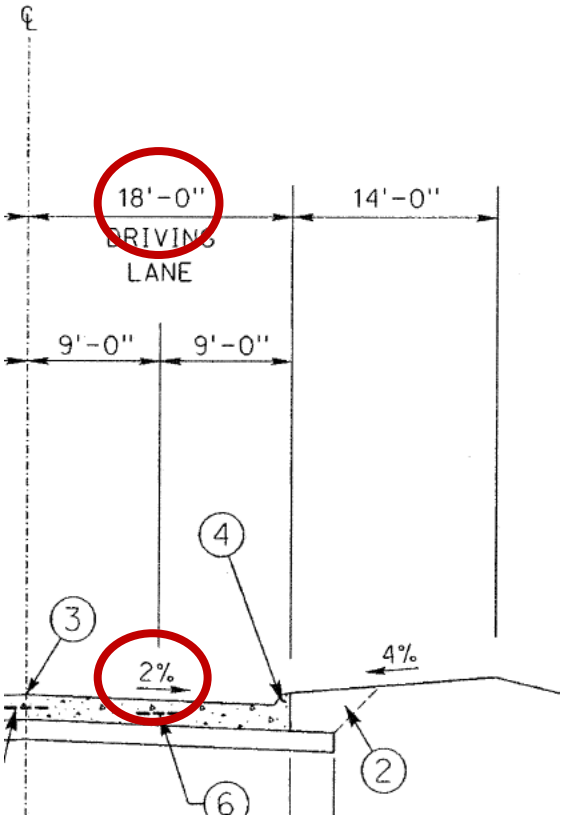
LANE CROSS SLOPE AND MINIMUM LANE WIDTH

Cross slope is usually expressed as a percentage:

Cross Slope = Rise/Run X 100%

It may also be expressed as a decimal fraction of a foot fall (or rise) per foot of run:

Cross Slope = 0.02'/Foot



- 18 Foot Lane
- 2% Slope
- 18 ft. X 2% = 18 ft. X .02
- 18Ft. X 0.02 = 0.36 ft. or 4.32 inches
- The lane slopes 4.32 inches from the centerline to the end of the 18 foot section
- The slope can be calculated for the remaining sections in the same manner

In the end…

- ✓ Become familiar with project construction plans.
- ✓ Be able to locate specific items on the plans related to the project.
- ✓ Be able to write a narrative on why it is important that a County Highway or City Street Superintendent can read and interpret a set of construction plans.
- ✓ Call in or email Don Neary @ Nebraska LTAP with any questions.

(402) 472-2180 dneary1@unl.edu

Your Notes