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Implementation of Conductive Concrete for Deicing (Roca Bridge)

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IMPLEMENTATION OF CONDUCTIVE CONCRETE FOR DEICING (ROCA BRIDGE)

Nebraska Department of Roads
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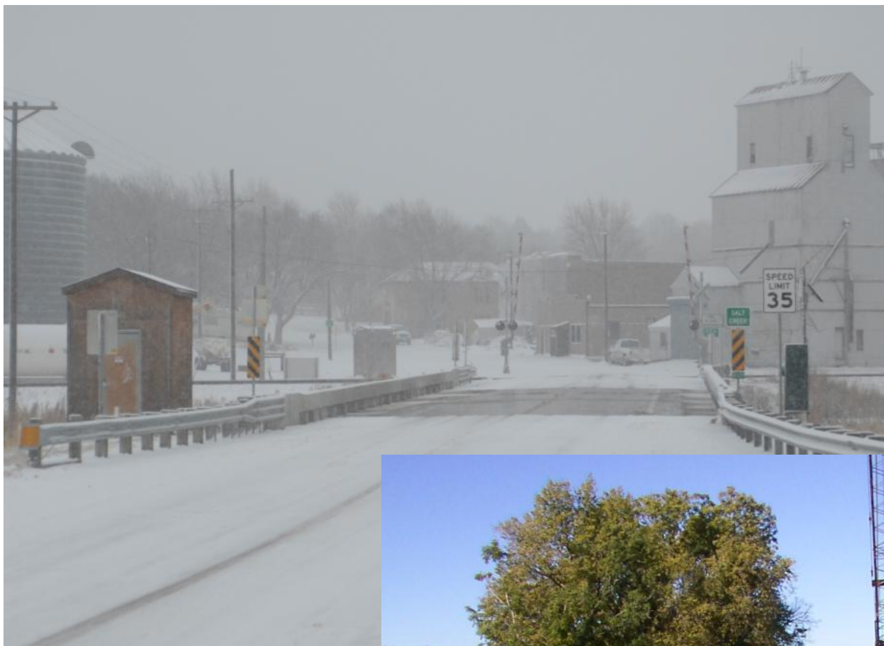

Nebraska Department of Roads

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IMPLEMENTATION OF CONDUCTIVE CONCRETE FOR DEICING (ROCA BRIDGE)

A Final Report

Submitted to

Nebraska Department of Roads

For

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by

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16. Abstract

The search for improved deicing methods has been a research focus for quite some time. Existing technologies perform deicing by chemical, electrical or thermal energy sources. Electrically conductive concrete is produced by adding electrically conductive components to a regular concrete mix to attain stable electrical conductivity to enable conduction of electricity through the concrete. In the application for bridge deck deicing, a thin layer of conductive concrete can generate enough heat due to its electrical resistance to prevent ice formation on the pavement surface when connected to a power source.

The heated deck of Roca Spur Bridge is the first implementation in the world using conductive concrete for deicing. The Roca Spur Bridge is a 150-ft long and 36-ft wide, three-span highway bridge over the Salt Creek at Lincoln, Nebraska, located near U.S. Route 77 South. This experimental bridge deck, after 5 years of evaluation, has shown that using conductive concrete has the potential to become a very cost-effective bridge deck deicing method. The technology provides an environment-friendly solution to address the looming crisis of water supply contamination by road salts, particularly on bridge decks over streams and rivers in the cold regions.

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CHAPTER 1

INTRODUCTION

1.1 Background

Electrically conductive concrete is an emerging concrete technology that has many practical applications, including bridge deck deicing, radiant heating, roadway health monitoring, electromagnetic wave shielding, cathodic rebar protection, just to name a few. Electrically conductive concrete is produced by adding electrically conductive components to a regular concrete mix to attain stable electrical conductivity to enable conduction of electricity through the concrete. In the application for bridge deck deicing, a thin layer of conductive concrete can generate enough heat due to its electrical resistance to prevent ice formation on the pavement surface when connected to a power source.

Under a previous research sponsored by Nebraska Department of Roads, a concrete mix containing steel fibers and steel shavings[1] was developed specifically for concrete bridge deck deicing. Steel shavings are industrial waste from metal fabrications. Several drawbacks were noted about using steel shavings during development of the conductive concrete: (1) there was a lack of consistency of sizes and compositions from various sources of steel shavings; (2) steel shavings acquired were usually contaminated with oil, which required cleaning; and (3) steel shavings required a specialized mixing procedure to ensure uniform dispersal in the concrete.

As a follow-up effort, carbon and graphite products were used to replace steel shavings in the conductive concrete mix design. Seven carbon and graphite products were evaluated experimentally[2].

The electrical conductivity and the associated heating rate were improved with the carbon products. A concrete mix containing 1.5 percent of steel fibers and about 15 percent of carbon powder by volume was developed specifically for concrete bridge deck deicing. Crushed limestone of 0.5 in. maximum size and Nebraska 47B fine aggregate were also used in the mix. The mix has adequate strength and is able to provide adequate thermal power density for deicing under subfreezing temperature.

1.2 The Roca Spur Bridge

Based on promising laboratory testing results, the Nebraska Department of Roads approved a demonstration project at Roca, located about 15 miles south of Lincoln, Nebraska. The heated deck of Roca Spur Bridge is the first implementation in the world using conductive concrete for deicing. The Roca Spur Bridge is a 150-ft long and 36-ft wide, three-span highway bridge over the Salt Creek at Roca, Nebraska, located near U.S. Route 77 South. The Roca Bridge project was let in December 2001 and construction was completed in November 2002. The bridge deck consists of a 115-ft by 28-ft, 4-in thick conductive concrete inlay. The inlay has been instrumented with temperature and current sensors to provide data for monitoring deicing operations during winter storms. The deicing performance has been satisfactory and consistent for the past five years. The average energy cost was about $250 per snow storm. Conductive concrete has the potential to become a very cost-effective bridge deck deicing method when compared with other deicing technologies.

The successful deicing demonstration at the Roca Spur Bridge has attracted much attention from the transportation industry and researchers from all over the world. The project has been featured in numerous national as well as international news media and publications.

For instance, the **Discovery Channel** aired a technology report featuring this innovative deicing technology, which can be viewed at http://www.exn.ca/dailyplanet/view.asp?date=2/20/2004. The Roca Bridge project won the **2003 Award of Excellence** bestowed by the Nebraska Chapter of the American Concrete Institute (ACI) for the innovative use of concrete.

This demonstration project has national and international implications. Statistics indicate that 10 to 15 percent of all roadway accidents are directly related to weather conditions. This percentage alone represents thousands of human injuries and deaths and millions of dollars in property damage annually. Ice accumulation on paved surfaces is not merely a concern for motorists; ice accumulation on pedestrian walkways accounts for numerous personal injuries, due to slipping and falling. The conductive concrete deicing technology is readily available for implementation at accident-prone areas such as bridge overpasses, exit ramps, airport runways, street intersections, sidewalks, and driveways.

1.3 Organization of the Report

This report documents the details of a demonstration project at Roca, Nebraska, to implement a 4 in. deck inlay using conductive concrete for deicing.

Chapter 2 provides a review of existing pavement surface deicing technologies. The advantages and disadvantages of the various systems are presented. The construction and operating costs are compared. Chapter 3 documents the development of a conductive concrete mix at the University of Nebraska especially for bridge deck deicing and anti-icing. Chapter 4 discusses the construction sequence and the integration of an instrumented conductive concrete inlay for bridge deck deicing. Chapter 5 presents the heating performance and operational costs during a five-year long evaluation. Chapter 6 summarizes the lessons learned during the operations of the Roca Spur Bridge deicing system. Chapter 7 provides conclusions and recommendations.

CHAPTER 2

REVIEW OF DEICING TECHNOLOGIES

2.1 Deicing Technologies

Most highway winter maintenance depends upon using chemicals and fine granular particles as a primary means for deicing and anti-icing[3]. The use of road salts and chemicals for deicing is an effective method for ice removal but causes damage to concrete and corrosion of reinforcing steel in concrete bridge decks. This problem is a major concern to transportation and public works officials due to rapid degradation of existing concrete pavements and bridge decks. The search for improved deicing methods has been a research focus for quite some time.

Many deicing technologies exist and have been previously reviewed by Yehia and Tuan[1,4]. These technologies can be categorized as deicing by chemical, electrical or thermal energy sources. The use of electric cables and heated fluid in pipes has been attempted. Deicing technologies using microwave have also been under development by Long et al.[5] and Hopstock and Zanko[6]. The various types of deicing systems are summarized as follows.

2.2 Fixed Automated Spray Systems

Since the use of road salt has contaminated ground water to a harmful level and caused leaching of heavy metals from the soils, especially in the northeastern U.S. and Canada, expensive but "green" deicing chemicals, such as potassium acetate, are used. Fixed automated systems of spraying deicing chemicals have been used by many states, including Colorado, Maryland, Minnesota, North Dakota, Oregon, and Wisconsin. Installation of spray systems is site-specific and requires large storage tanks, large spaces and pumping hardware, resulting in an initial cost of about $600,000[7]. Pinet et al.[8] reported that annual chemical cost was about $12,000 for a system installed for the Ontario Ministry of Transportation. Annual maintenance for a spray system consists of draining and rinsing the system and storage tank at the end of the winter season and preventive maintenance to the system pump, with an estimated cost of $32,800[7]. In addition, the service life of a pump is about 5 years, and the cost for pump and control software replacement is estimated at $3,500.

Based on a research conducted for the National Cooperative Highway Research Program (NCHRP) Project 20-7/Task 200, Shi et al.[9] reported that the experience with these spray systems in North America and Europe has revealed mixed findings. Several studies have indicated significant reductions in accident frequency and in mobile operations costs, while others reported many problems related to system activation, maintenance and training. For instance, the Denver International Airport had one system installed in 1998 but it has not functioned as anticipated.

2.3 Pavement Heating Systems

2.3.1 Electric Heating Cables

Heating systems for bridge decks and ramps have typically been embedded resistive electrical cables or pipes containing heated fluid. Electric heating cables were installed on the approach to a highway drawbridge in Newark, New Jersey, in 1961[10]. The heat generated was sufficient to melt 1 in. of snow per hour. However, this installation was later abandoned because the electric cables were pulled out of the asphaltic concrete overlay due to traffic movement. A similar system was installed in two ramps and a bridge deck in Teterboro, New Jersey, in 1964[11]. This system was reported to have been deicing satisfactorily. The power consumption was about 35 W/ft^2 and the annual operating cost was approximately \$0.45/ft^2. Electric heating cables were also embedded in a concrete bridge deck in Omaha, Nebraska, in 1970[11]. However, the sensing elements activating the heating unit were unreliable and manual operation was necessary.

2.3.2 Hydronic Systems

Gravity-operated heat pipes with a geothermal heat exchanger were implemented in a bridge deck in Laramie, Wyoming, in 1981[12]. This system utilized the latent heat of vaporization released from condensation of an evaporated liquid (e.g., ammonia) to heat the bridge deck. The heated surface was about 4°F to 25°F warmer than the unheated portion of the bridge during operation. The heating was sufficient to prevent freezing of the deck surface and to melt snow. The main disadvantages were the complication of the construction and the assembly of the heat pipes. Approximately 40 percent of the total cost was related to drilling and grouting the pipes. Copper pipes containing heated anti-freeze by a geothermal source were installed in a canal bridge deck in Oregon in 1950[11]. The system successfully kept the deck free of ice. Rubber hoses containing heated anti-freeze by a gas boiler were embedded in a concrete pedestrian overpass in Lincoln, Nebraska, in 1993[13]. The fluid used was propylene glycol with water at a flow rate of 454 L/min. to deliver 473 W/m^2 heat flux to the deck, sufficient to keep the walkway ice free. However, the system has not been in service due to a leak in the polyvinyl chloride (PVC) supply and return lines. The installation cost of the heating system was \$15/ft^2, and the operating cost per storm was about \$250 to melt 3 in. of snow. Steel pipes carrying Freon heated up to 300°F by a propane boiler were installed in the deck of Buffalo River Bridge in Amherst, Virginia, in 1996[14]. However, the freon cooled off and condensed before it could reach the upper third of the bridge deck. Several different working fluids were being tested to identify a replacement for Freon. The installation cost was about $181,000 and the estimated operating cost was about $1000 annually. Similar hydronic systems have been installed in Ohio, Oregon, Pennsylvania, South Dakota, Texas and West Virginia. High construction costs and frequent maintenance were reported[11] about these systems.

2.4 Others

Other ice control schemes which were attempted but found to be ineffective included using infrared heat lamps[11] and insulating bridge deck with urethane foam[15].

CHAPTER 3

ELECTRICALLY CONDUCTIVE CONCRETE

3.1 Electric Conduction Mechanism

Using electrically conductive concrete for deicing is an emerging material technology. Conventional concrete is not electrically conductive. The electric resistivity of normal weight concrete ranges between 6 – 11 kΩ•m[16]. Conduction of electricity through concrete may take place in two ways: electronic and electrolytic. Electronic conduction occurs through the motion of free electrons in the conductive media, while electrolytic conduction takes place by the motion of ions in the pore solution. In fresh concrete and during hydration, conduction of electricity is achieved by the motion of ions. However, in hardened concrete where little moisture is available, conduction can only take place by free electrons. Therefore, metallic or other conductive fibers and particles must be added to the concrete matrix to achieve stable and relatively high electrical conductivity.

Whittington et al.[16] investigated conduction of electricity through conventional concrete using cement paste and concrete specimens. The electric resistivity was found to increase with time for both specimens because conduction in these specimens depended on the ions motion in the pore solution. In addition, the electric resistivity of the concrete specimens was higher than that of the cement paste specimens, due to the restricted ions movement from non-conductive aggregates used in the concrete specimens. Farrar[17] in 1978 used "Marconite," a carbon by-product from oil refining, to replace sand in a conductive concrete mix. The electric resistivity of the conductive concrete using Marconite ranges between 0.5 to 15 Ω•cm. The use of Marconite was limited to small-scale applications such as electromagnetic shielding and antistatic flooring because it was expensive. Conduction of electricity in this case was through the movement of electrons, and the particles must be in continuous contact within the concrete. This phenomenon is called “electrical percolation” in concrete[17,18].

Heating tests have been conducted using both AC and DC power to study the conduction of electricity through the conductive concrete mix developed at the University of Nebraska. The conductive concrete behaved like a semiconductor or a capacitor[19]. As electrical current flows through the conductive concrete, its temperature rises and the heating rate increases. The electrical conductivity of the conductive concrete will increase as its temperature rises. The increase in electrical conductivity will cause more current to flow through under a constant voltage. Hence, the applied voltage must be controlled to maintain a gradual heating rate to avoid thermal shock to the conductive concrete.

Since the conductive components added only amounted to about 20 percent by volume of the total materials, there are probably not enough conductive fibers and particles to form a fully interconnected electronic circuit within the concrete. Instead, these dispersed conductive materials would act as capacitors when a voltage is applied across the material. Electrical current will flow through the material if the applied voltage is high enough to cause dielectric breakdown of the material. There is a critical threshold of voltage, above which large current will go through the material like a short circuit. If the applied voltage is kept below this “break down” voltage, a “controllable” amount of current proportional to the voltage will go through the material. This behavior is similar to that of a surge protector used in computers[19].

3.2 Concrete Mixes with Steel Fibers and Steel Shavings

Under a previous research sponsored by Nebraska Department of Roads, a conductive concrete mix specifically for bridge deck deicing[1] was developed in 1998. In this mix, steel fibers of variable lengths and steel shavings with different particle sizes were added to the concrete mix to provide conductive materials. More than 150 trial mixes were tested[19] to quantify the volumetric ratios of the steel fibers and steel shavings for optimum performance. The mechanical and physical properties of the optimized mix are given in Table 1. The compressive strength, flexural strength, modulus of elasticity, and rapid freeze-thaw resistance of the conductive concrete mixes tested have met or exceeded the American Association of State Highway and Transportation Officials (AASHTO) requirements for bridge deck construction.

Table 1. Properties of Conductive Concrete with Steel Fibers and Shavings

Properties	Test Result
Unit weight	150 pcf
Compressive strength	5000 psi
Flexural strength	670 psi
Modulus of Elasticity	527 ksi
Rapid Freeze-thaw Resistance	no failure during 312 cycles
Shrinkage	less than ACI-209 by 20~30%
Permeability	0.004~0.007 cm^3/sec
Thermal Conductivity	7.8 W/m-^oK
Electrical Resistivity	500~1000 Ω-cm

A 4-in. thick conductive concrete layer was cast on the top of a 6-in. thick, 4 ft by 12 ft conventional reinforced concrete slab for conducting deicing experiments during three winters (1998-2000). As shown in Fig.1, the overlay was preheated before and heated during a storm, which is more energy efficient than heating the overlay after snow has accumulated. The applied voltage and the associated current as well as the climatic data were recorded in each experiment.

Figure 1. Deicing Experiment

For a deicing chemical, there is an "effective temperature" below which the amount of chemical required to melt the snow and ice will be unreasonably excessive. The effective temperatures of common deicing chemicals[20] are given in Table 2.

Table 2. Eutectic and Effective Temperatures of various Deicing Chemicals

Deicing Chemical	Eutectic Temp (^oC)	Effective Temp (^oC)
Sodium chloride (NaCl)	-6	+15
Calcium chloride (CaCl)	-60	-20
Magnesium chloride (MgCl)	-28	+5
Potassium acetate (KAc)	-76	-15
Calcium magnesium acetate (CMA)	-17	+21
Urea	+10	+25

In the winter of 2000, most of the experiments were conducted while the initial overlay temperature was about 16^{o}F. Most deicing chemicals would become ineffective at this temperature. The heating rate of the conductive concrete depends upon the amount of current going through, which, in turn, depends upon the ambient temperature, humidity, wind speed and time of day. The deicing performance of the conductive concrete was satisfactory, as demonstrated by Fig. 1. Typical data from deicing experiments are summarized in Table 3.

Table 3. Deicing Data of Conductive Concrete with Steel Fibers and Shavings

Date	**Snow accumulation (in.)**	**Wind speed (mph)**	**Air temperature (°F)**	**Power consumption (kW-hr)**	**Unit Energy Cost ($/ft^2)**
Feb. 11, 1999	3	6	24	32.48	0.052
Feb. 17, 1999	8	4	34	42.64	0.068
Feb. 20, 1999	2	4	37	9.84	0.016
Feb. 22, 1999	11	19	26	33.76	0.054
Mar. 8, 1999	10	15	32	46.16	0.074

3.3 Concrete Mixes with Steel Fibers and Carbon Particles

Steel shavings are waste materials produced by steel fabricators in the form of small particles of random shapes. Several drawbacks were noted about using steel shavings during development of the conductive concrete: (1) there was a lack of consistency of sizes and compositions from various sources of steel shavings; (2) steel shavings acquired were usually contaminated with oil and required cleaning; and (3) steel shavings required a specialized mixing procedure to ensure uniform dispersal in the concrete mix.

In the spring of 2001, carbon products were used to replace the steel shavings in the conductive concrete mixes. Seven commercial carbon and graphite products were tested[2]. Ten trial mixes were prepared from the seven products as follows:

1. 20% Black Diamond
2. 25 % Earth Link
3. 41 % Earth Link - Replacing all cement content
4. 25% EC- 98C 10×0
5. 25% EC- 100 10×0
6. 25% EC- 97 3/8×0
7. 25% EC-100 3/8×0
8. 25% FP-428 100×0
9. 25% ALL - All graphite products were used in this mix except Black Diamond
10. 25% Earth Link + Slag aggregate

Black Diamond (BD) is the trade name of a natural graphite crystalline in the form of pellets. Earth Link (EL) is the trade name of graphite cement, which contains approximately 70 percent of portland cement and 30 percent of graphite powder. The EC designations are used to distinguish carbon products of different particle sizes. FP-428 is a product of small carbon particles. Crushed limestone of 0.5 in. maximum size was used in the trial mixes. However, 0.5-in. 25A-BF blast furnace slag was used in one trial mix to replace the limestone with an intent to improve the electrical conductivity. Coarse blast furnace slag is the co-product of molten iron production in a blast furnace. When molten, slags float on the metal. Separating the two is not exact and there is some iron residue in the slags. All mixes contained 1.5 percent of steel fibers per unit volume. The added carbon amounted to 20 percent per volume of the conductive concrete. The criteria used for evaluating of one cubic feet of each trial batch were workability and finishability, compressive strength, heating rate, and electric resistivity.

3.3.1 Workability and Finishability

Workability and finishability were the two primary criteria used in the preliminary evaluation of the trial mixes, and the observations are summarized in Table 4.

Table 4. Workability and finishability of the trial mixes with carbon and graphite products

Product	Workability	Finishability	Comments
1.Black Diamond	Good	Good	Gas release during hydration causes increase in volume
2.Earth Link	Good	Good	Mixes with 41% “EL” require more Superplasticizer
3.EC- 98C 10X0	Good	Good	
4.EC- 100 10X0	Good	Good	
5.EC- 97 3/8X0	Good	Good	
6.EC-100 3/8X0	Good	Good	
7.FP-428 100X0	Good	Good	Requires more Superplasticizer

3.3.2 Compressive Strength

Three cylinders from each trial mix were tested after 28 days. The average compressive strength is summarized in Table 5.

Table 5. Average 28-day compressive strength

Trial Mix	Average 28-day Compressive Strength (psi)
1. 20% Black Diamond	3483
2. 25% Earth Link	5770
3. 41% Earth Link	4735
4. 25% EC- 98C 10X0	6811
5. 25% EC- 100 10X0	5870
6. 25% EC- 97 3/8X0	6061
7. 25% EC-100 3/8X0	5416
8. 25% FP-428 100X0	3817
9. 25% All	4997
10. 25% Earth Link with Slag aggregate	6750

3.3.3 Heating Rate

Small-scale heating tests using 18 in. × 13 in. × 2.5 in. slabs were conducted to measure the electrical resistivity. Two steel plates were embedded in a slab as the electrodes. A thermocouple was embedded in the middle of each test slab to monitor the temperature. Alternate current was applied under constant voltage, and the resulting current and temperature from each slab were recorded. The slabs were kept inside a freezer during the tests to maintain constant ambient temperature. Fig. 2 shows a slab under heating test. Heating tests were conducted with two initial temperatures, 25°F and 35°F. Alternate current (AC) power with a constant voltage of 140 volts was applied while the current and slab temperature were recorded for 30 minutes. The results are summarized in Table 6.

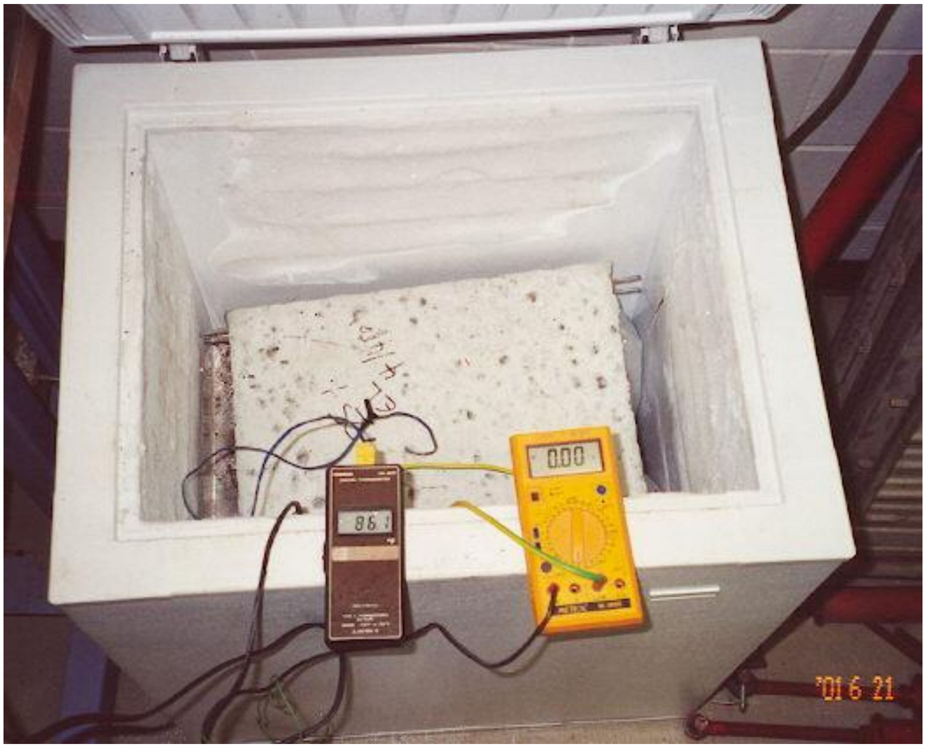


Figure 2. Heating tests conducted with slabs in the freezer

Table 6. Comparisons of heating rate, operating voltage, and average current for conductive concrete mixes

Specimen	Condition	Heating Rate	Breakdown Voltage	Operating Voltage	Average Current
EC-100(3/8x0)	25^{o}F	0.45	N/A	140	0.93
EC-100(3/8x0)	35^{o}F	0.48	N/A	140	1.13
EC-100(10x0)	25^{o}F	0.46	N/A	140	0.67
EC-100(10x0)	35^{o}F	0.68	N/A	140	0.95
EC-98C(10x0)	25^{o}F	0.16	N/A	140	0.48
EC-98C(10x0)	35^{o}F	0.19	N/A	140	0.61
EC-97(3/8x0)	25^{o}F	0.69	N/A	140	0.89
EC-97(3/8x0)	35^{o}F	0.68	N/A	140	1.00
FP-428(100x0)	25^{o}F	0.25	N/A	140	0.43
FP-428(100x0)	35^{o}F	0.13	N/A	140	0.47
EC-all	25^{o}F	**2.80**	N/A	140	4.26
EC-all	35^{o}F	**3.08**	N/A	140	4.82
41% EL	25^{o}F	0.65	140	84	0.62
41% EL	35^{o}F	0.56	140	84	0.69
BD 20%	25^{o}F	0	N/A	140	0.11
BD 20%	35^{o}F	0.16	N/A	140	0.17
Slag + 25% EL	25^{o}F	**5.88**	N/A	140	2.39
Slag + 25% EL	35^{o}F	**4.11**	N/A	140	1.97
25% EL	25^{o}F	0.69	N/A	140	0.8
25% EL	35^{o}F	0.67	N/A	140	1.13

3.3.4 Electric resistivity

Approximate values of the impedance and the electric resistivity were calculated for each trial mix using the following equations:

$$\boldsymbol{R = \frac{V}{I}} \tag{1}$$

and

$$\rho = \frac{RA}{L} = \frac{VA}{IL} = \frac{1}{\textbf{Conductivity}} \qquad (2)$$

where ***R*** is the resistance, ***V*** is the applied AC voltage, ***I*** is the AC current, ρ is the average electrical resistivity of the conductive concrete, ***L*** is the spacing between the electrodes, and ***A*** is the area of the conductive concrete cross-section parallel to the electrodes. The electrical conductivity of a material is the reciprocal of the electrical resistivity of that material. Since ***V***, ***A***, and ***L*** are constants in this application, the electrical conductivity is proportional to ***I***. The electrical resistivity (or conductivity) of conductive concrete is temperature dependent, as illustrated below. A range of the electrical resistivity with respect to the initial temperature is given in Table 7.

Table 7. Electrical resistivity for carbon concrete mixes

Specimen	**Initial Temperature**	**Temperature Range (°F)**	**Electrical Resistivity (Ohm.cm)**
EC-100 (3/8×0)	25°F	25° - 40°	564 -381
EC-100 (3/8×0)	35°F	35° - 50°	451 - 323
EC-100 (10×0)	25°F	25° - 40°	721 - 576
EC-100 (10×0)	35°F	35° - 60°	519 - 392
EC-98C (10×0)	25°F	25° - 30°	939 - 853
EC-98C (10×0)	35°F	35° - 40°	733 - 669
EC-97 (3/8×0)	25°F	25° - 50°	564 - 403
EC-97 (3/8×0)	35°F	35° - 60°	518 - 357
FP-428 (100×0)	25°F	25° - 35°	1048 - 958
FP-428 (100×0)	35°F	35° - 40°	902 - 900
EC-all	**25°F**	**25° - over 100°**	**435 - 208**
EC-all	**35°F**	**35° - over 100°**	**395 - 184**
41% EL	25°F	25° - 45°	789 - 600
41% EL	35°F	35° - 55°	665 - 580
BD 20%	25°F	25° - 25°	3507 - 3911

BD 20%	35°F	35° - 45°	2481 - 2533
slag + 25% EL	**25°F**	**25° - over 100°**	**808 - 207**
slag + 25% EL	**35°F**	**35° - over 100°**	**705 - 206**
25% EL	25°F	25° - 40°	847 - 346
25% EL	35°F	35° - 40°	394 - 369

Two trial mixes, EC-All and Slag+25% EL showed high electrical conductivity and heating rates. Experimental data from the heating tests of these two mixes are presented in Figs. 3 and 4, respectively. The electric resistivity of these materials is a function of temperature. As temperature increases, the materials become more electrically conductive. The higher electrical conductivity is probably due to the good gradation of carbon particles in the EC-All and the added slag in the Slag+25%EL mix. The heating rates of all the trial mixes are compared in Fig.5.

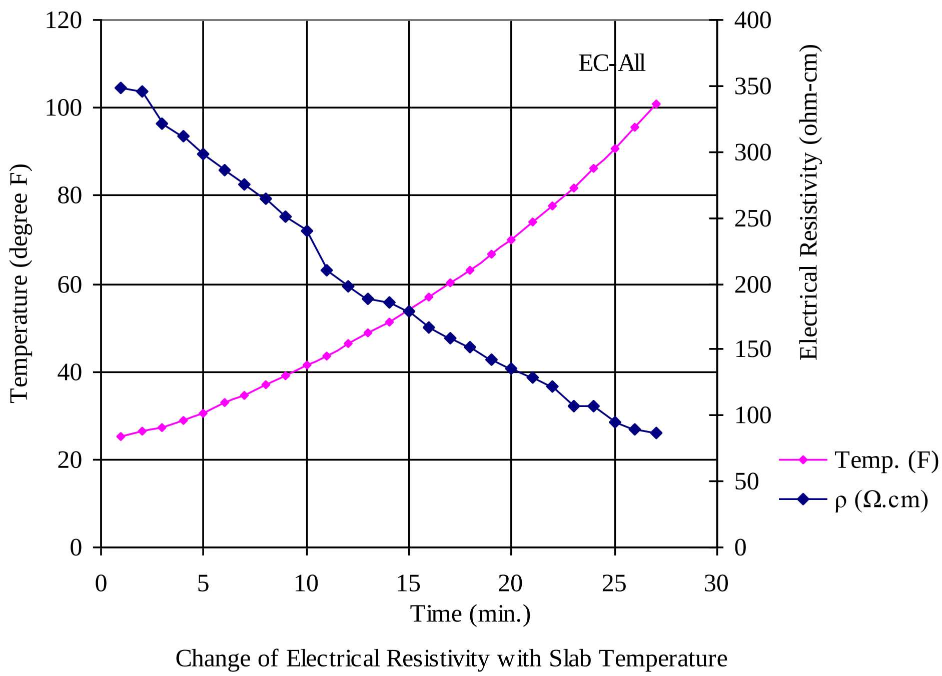
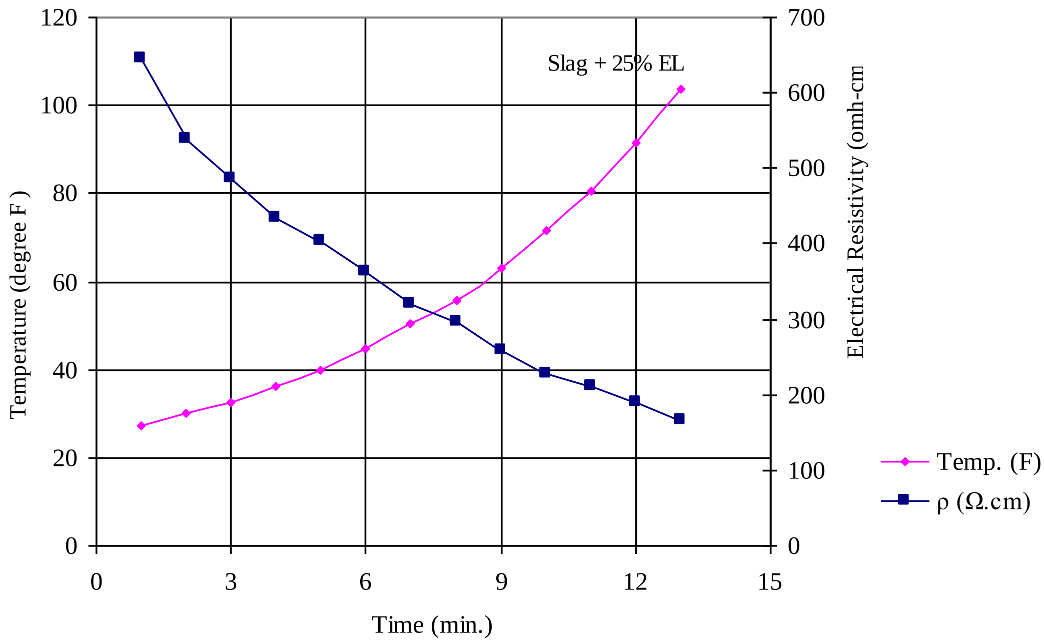


Figure 3. Electric Resistivity vs. Temperature – EC-All Mix



Change of Electrical Resistivity with Slab Temperature

Figure 4. Electric Resistivity vs. Temperature – Slag+25% EL Mix

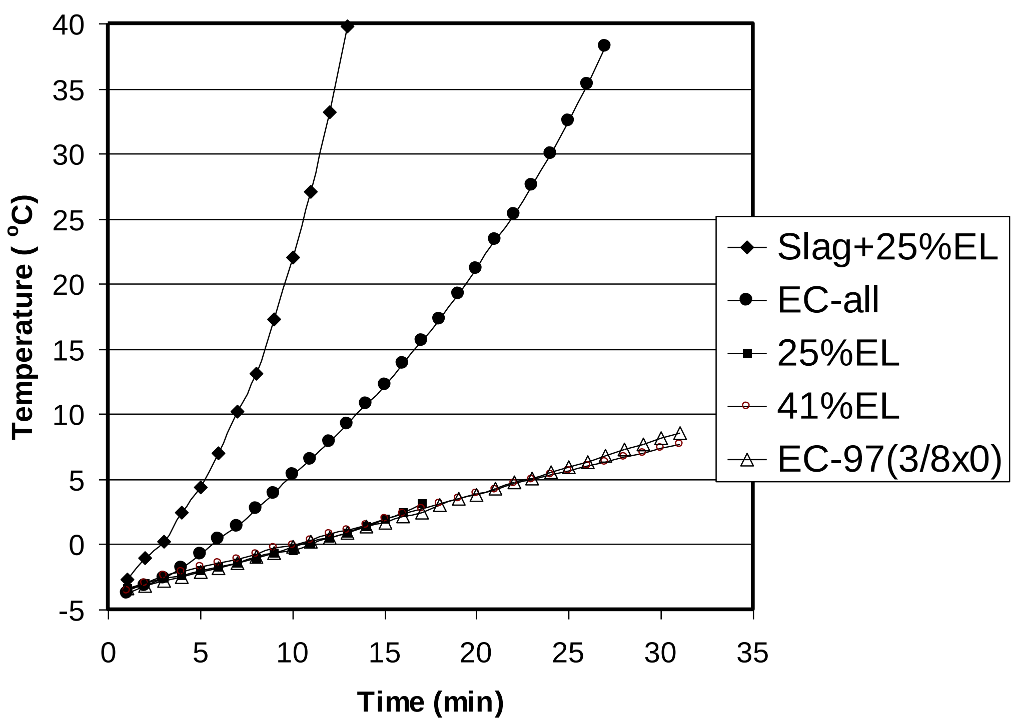


Figure 5. Comparison of Heating Rates of Trial Mixes

3.3.4.1 Long-term Stability of Electric Resistivity

The electric resistivity of the conductive concrete is relatively low during hydration, due to the ionic conduction in the pore solution. The breakdown voltage would thus depend upon the moisture content in the material. However, Yehia and Tuan[1] showed that there exists a stable but higher breakdown voltage after the moisture in the conductive concrete has completely dried out. For instance, no degradation in the heating performance has been observed after 5 years of deicing experiment with the 4 ft × 12 ft conductive concrete test slab using steel fibers and steel shavings. To prove the same is true with the carbon concrete, a heating test was conducted on the EC-All test slab two years later. The data from the two tests are compared in Fig. 6. The lower electric resistivity and higher heating rate are probably due to the higher moisture content in the specimen during the earlier test.

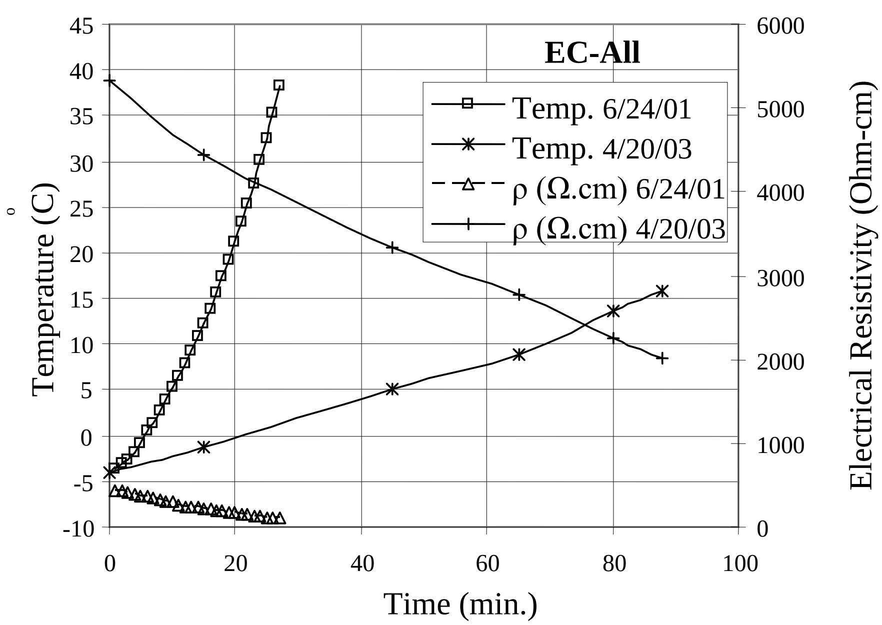


Figure 6. Time Effect on Electric Resistivity

Material testing was also conducted, and the results are presented in Table 8. Due to its superior strength and electrical conductivity, this conductive concrete was used for the Roca Spur Bridge project.

Table 8. Properties of Conductive Concrete with Steel Fibers and Carbon Particles

Properties	Test Result
Unit weight	145 pcf
Compressive strength	6950 psi
Flexural strength	820 psi
Rapid freeze-thaw resistance	no failure during 300 cycles
Electrical resistivity	300~500 Ω-cm

CHAPTER 4

THE ROCA SPUR BRIDGE – DESIGN AND CONSTRUCTION

Roca Spur Bridge is a 150-ft long and 36-ft wide, three-span highway bridge over the Salt Creek at Roca, located about 15 miles south of Lincoln, Nebraska. A railroad crossing is located immediately following the end of the bridge, making it a prime candidate for deicing application. The bridge deck has a 117 ft by 28 ft and 4 in. thick conductive concrete inlay, which is instrumented with thermocouples to provide data for monitoring deicing operations during winter storms.

The Roca Spur Bridge was designed by the Bridge Division of the Nebraska Department of Roads, as a conventional reinforced concrete slab bridge. However, a 117 ft by 28 ft by 4 in. thick space was reserved in the bridge deck for a conductive concrete inlay, as shown in Fig. 7. The conductive concrete inlay was cast after the reinforced concrete bridge had reached the 28-day strength. The design details are provided in the construction drawings, which are given in the Appendix A.

4.1 Construction Sequence

The Roca Bridge project was let in December 2001 and construction began in the summer of 2002. The bridge construction was completed in November 2002. A 4-in. thick inlay of conductive concrete inlay was cast on top of a 10.5-in. thick regular reinforced concrete deck. The inlay consists of 52 individual 4 ft × 14 ft conductive concrete slabs. In each slab, two 3-1/2 ×3-1/2 ×1/4 in. angle irons spaced 3.5 ft apart were embedded for electrodes, as shown in Fig. 8. Threaded sleeves were welded to one end of the angle irons for making electrical connection.

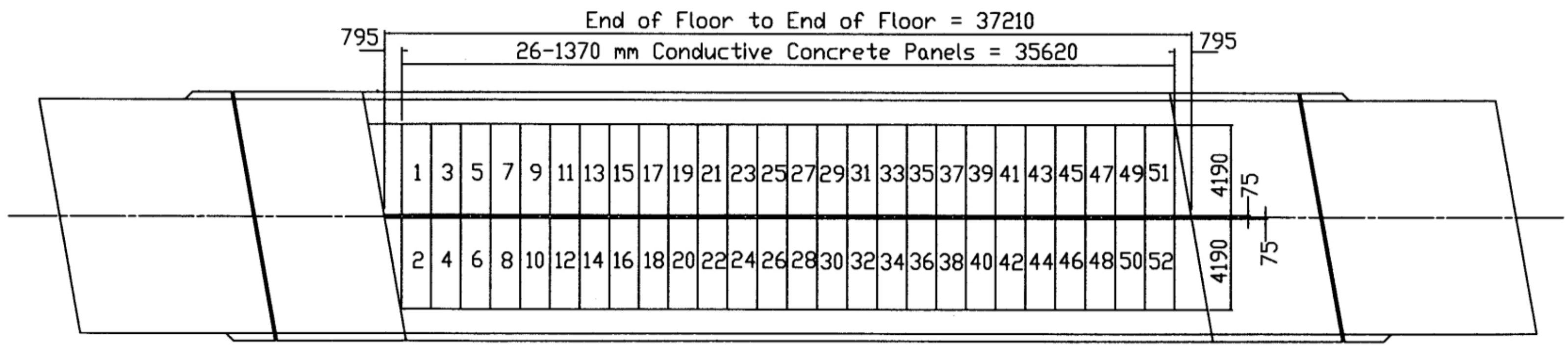


Figure 7. CONDUCTIVE CONCRETE PANEL LAYOUT
(Dimensions in mm)

Figure 8. Angle iron electrodes and thermocouple wiring layout

A Type TX thermocouple was installed at the center of each slab at about 0.5 in. below the surface to measure the slab temperature. The power chords and thermocouple wiring for each slab were secured in two PVC conduits and are accessible from junction boxes along the centerline of the bridge deck, as shown in Fig. 9.

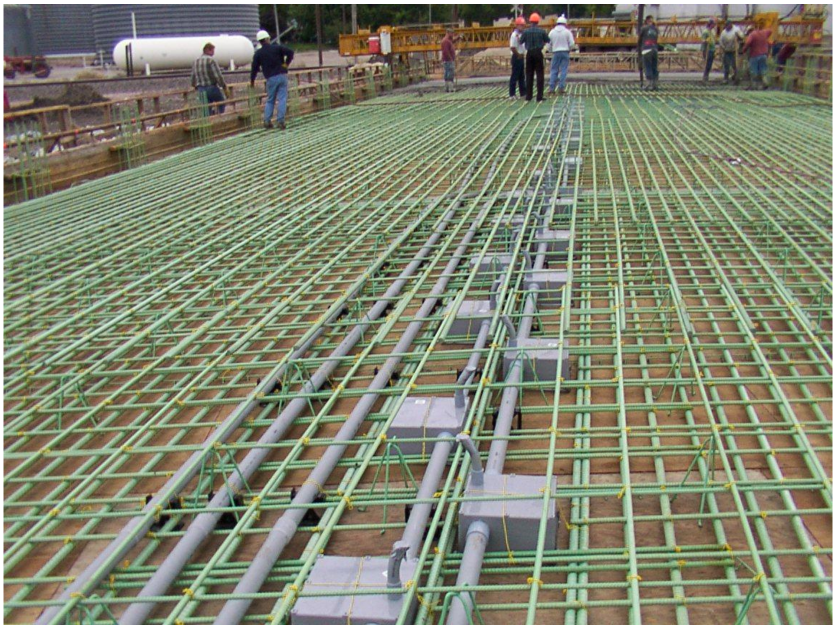


Figure 9. PVC Conduits and Junction Boxes pre-positioned in the Regular Reinforced Concrete Bridge Deck

The conductive concrete inlay was cast after the regular bridge deck had been cured for 30 days. The westbound lane was poured first and the eastbound lane next. After hardening, the conductive concrete inlay was saw cut to a 4 in. depth along the perimeters of the individual slabs and the gaps were filled with polyurethane sealant. There was a 6 in. gap along the centerline of the bridge to allow power chord connections with the threaded sleeves of the angle irons, as shown in Fig. 10. The gap was filled with a non-shrink, high-strength grout afterwards.

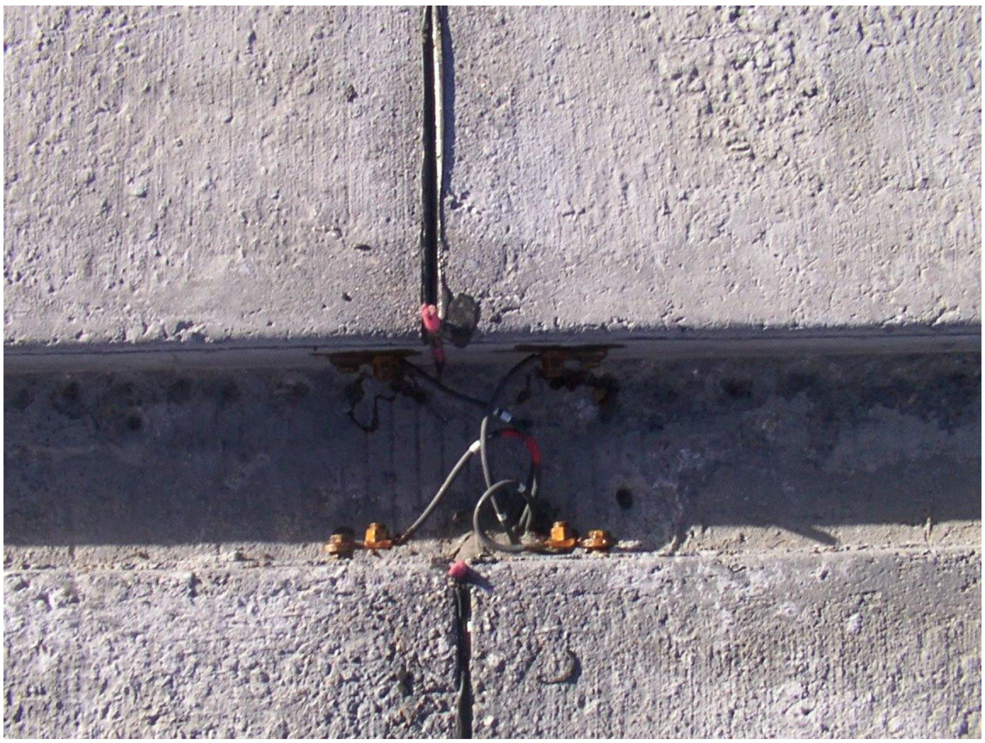


Figure 10. Electrodes connection to power chords

4.2 Integration of Power Supply, Sensors and Control Circuit

A three-phase, 600 A and 220 V AC power is available from a power line nearby. A microprocessor-based controller system was installed in a control room to monitor and control the deicing operation of the 52 slabs. The system includes four main elements: a temperature-sensing unit, a power-switching unit, a current-monitoring unit, and an operator-interface unit. The temperature-sensing unit takes and records the thermocouple readings of the slabs every 15 minutes. A slab's power will be turned on by the controller if the temperature of the slab is below 40^{o}F and turned off if the temperature is above 55^{o}F. The power-switching unit will control power relays to perform the desired on/off function. To ensure safety, a current-monitoring unit will limit the current going through a slab to a user-specified amount. The operator-interface unit will allow a user to connect to the controller with a PC or laptop via a phone modem. The operator interface displays all the temperature and electrical current readings of every slab in real time. A user also has the option of using a PC or laptop to download the controller-stored data into a spreadsheet.

4.2.1 Software Requirements

To remotely control the deicing operations via a phone modem, the software **RSLinx**™ by Rockwell Software is required to establish a communication link with the deicing control module. The software for controlling the power on/off and monitoring the sensors was developed by Teamwork Technology Integration (TTI), Clear Lake, Iowa. To run the bridge control software, it is necessary to run **RSLinx**™ first to activate the modem communication. A user's guide for the bridge control software is given in Appendix B.

4.3 Construction Costs

The construction costs of the conductive concrete inlay are itemized as follows:

- Placing, finishing, curing and saw cutting conductive concrete – $50,020
- Procuring conductive concrete materials – $80,620
- Building and installing control cabinet with sensors and power relays – $43,685
- Integrating and programming the deicing operation controller – $18,850

The total construction cost of the Roca Spur Bridge deicing system was therefore \$193,175. The cost per unit surface area of the conductive concrete inlay is \$59/ft^2. Life-cycle costs, including system maintenance costs and deck repair costs and vehicle depreciation caused by deicing chemicals, should be used as the basis for cost-effectiveness comparisons of different deicing systems. The construction costs of conductive concrete overlay/inlay are expected to drop significantly when the technology becomes widely accepted. The construction costs of the various deicing systems are compared in Table 9.

Table 9. Comparison of different deicing systems

Deicing System	Initial cost*	Annual operating cost*	Power consumption
Automated Spray System, 2004	\$600,000	\$12,000	Not applicable
Electric heating cable, 1961	\$54/m^2	\$4.8/m^2	323 - 430 W/m^2
Hot water, 1993	\$161/m^2	\$250/storm [76 mm snow]	473 W/m^2
Heated gas, 1996	\$378/m^2	\$2.1/m^2	Not available
Conductive concrete, 2003	\$635/m^2	\$0.80/m^2 /storm	350 W/m^2

*Cost figures were quoted directly from the literature, and conversion to present worth was not attempted.

CHAPTER 5

THE ROCA SPUR BRIDGE – DEICING PERFORMANCE

5.1 Deicing Operations

The deicing controller system at the Roca Spur Bridge was completed in March 2003. Although major snow storms of 2002 were missed, the system was tested successfully under freezing temperature.

On December 9, 2003, the 52 slabs were energized in an alternating fashion during a storm. Groups of every other two slabs (1, 2, 5, 6, 9, 10,…, 49 and 50 first, then 3, 4, 7, 8, 11, 12,…, 51 and 52) (see Fig. 7) with a total of 26 slabs were powered for 30 minutes. This alternating powering scheme could not keep up with the low temperature, high wind and a snow rate of 25 mm/hr. As a result, the bridge deck was partially covered with snow and ice. The operating scheme has thus been changed and all the slabs are powered if the ambient temperature drops below 40^{o}F. This revised powering scheme has worked well in many major storms. Fig. 11 shows an ice-free deck surface during the February 6, 2008 storm.

Figure 11. Ice-free Bridge Deck

5.2 Deicing Performance

The controller could store data for a 3-day period. Air temperature, slab temperatures and the current going through each slab (at 208 V) were recorded at 15-min intervals during each storm. The deicing data from eleven major storms has been analyzed for the past four winters. The climatic data of these storms were obtained for a weather station in Lincoln, Nebraska, from the National Climatic Data Center[21] (NCDC). The weather data downloaded from the NCDC site for the snow/ice storms for the past 5 years are given in Appendix C. Generally, a major snow storm would last about 3 days and is followed by colder temperature. The Roca Spur Bridge deicing system has performed satisfactorily under these adverse conditions. However, the applicability of the conductive concrete deicing technology has not been tested in regions with sustained low temperature during winter, such as Alaska, Canada and Northern Europe. The deicing performance of the Roca Spur Bridge is summarized in Table 10. The temperature and current readings acquired by the controller are in Excel spreadsheet format. A computer CD containing the Excel spreadsheets obtained during the winter storms of the past 5 years is attached to this report.

Table 10. Deicing Performance of Roca Spur Bridge

Storm Date	Snow depth (in.)	Air temp. (^oF)	Wind speed (mph)	Energy (kW-hr)	Unit Cost ($/ft^2)	Power Density (W/ft^2)
Dec 8-9, '03	6.5	20.7	16.2	2,023	0.050	40.04
Jan 25-26, '04	10.1	14.9	14.4	2,885	0.070	30.74
Feb 1-2, '04	5.7	14.4	11.1	2,700	0.066	26.57
Feb 4-6, '04	7.8	19.2	11.5	3,797	0.093	35.94
Jan 2-5, '05	8.5	15.6	14.3	3,128	0.076	33.01
Feb 6-8, '05	4.6	17.3	12.7	3,327	0.081	32.25
Mar 18-21, '06	9.9	32.5	16.2	2,786	0.068	29.97
Jan 13-14, '07	3.3	10.9	21.7	2,366	0.058	18.86
Jan 20-21, '07	6.0	19.4	17.4	2,573	0.063	30.19
Feb 12-13, '07	3.8	17.6	16.2	2,653	0.065	33.54
Mar 1-3, '07	7.1	29.8	19.9	2,893	0.071	36.79
Dec 5-7, '07	3.5	22.5	20.5	2,866	0.070	35.02
Jan 15-18, '08	3.8	18.1	24.8	2,445	0.059	34.56
Feb 4-7, '08	4.6	21.9	22.4	3,046	0.074	36.98

*Average ambient temperature readings during deicing at the bridge site.
**Energy cost: $0.08/kW-hr.

5.3 Relationship between Electrical Conductivity and Temperature

The conductive concrete behaves like a semiconductor[19]. When the applied voltage exceeds a threshold value, the conductive concrete becomes electrically conductive. The electrical conductivity of the conductive concrete is a function of the temperature. As the concrete temperature increases, the concrete becomes more electrically conductive. When the amount of current going through the concrete increases, the heating rate will increase and the concrete temperature rises. Thus, the electrical resistivity (or conductivity) of conductive concrete is temperature dependent.

Based on the current and temperature data acquired from the 52 slabs at the Roca Spur Bridge, a relationship between the averaged slab temperature and the averaged electrical current can be established, as shown in Fig. 12. Since the data have been collected over the past 5 years, the results also indicate that the long-term electrical conductivity of the conductive concrete has been very stable. A significant shift to the right of the curves would have indicated a decrease in electrical conductivity over time. The temperature readings from the 52 individual slabs have indicated uniform heating over the bridge deck. The average slab temperature was consistently about 18^{o}F higher than the ambient temperature at any point in time during the storms. The energy consumption from powering the slabs simultaneously averaged about 3000 kW-hr with an associated unit cost of \$0.07/ft^2 per storm. The operating cost for the Roca Bridge deicing system would thus be about \$250 for each major storm.

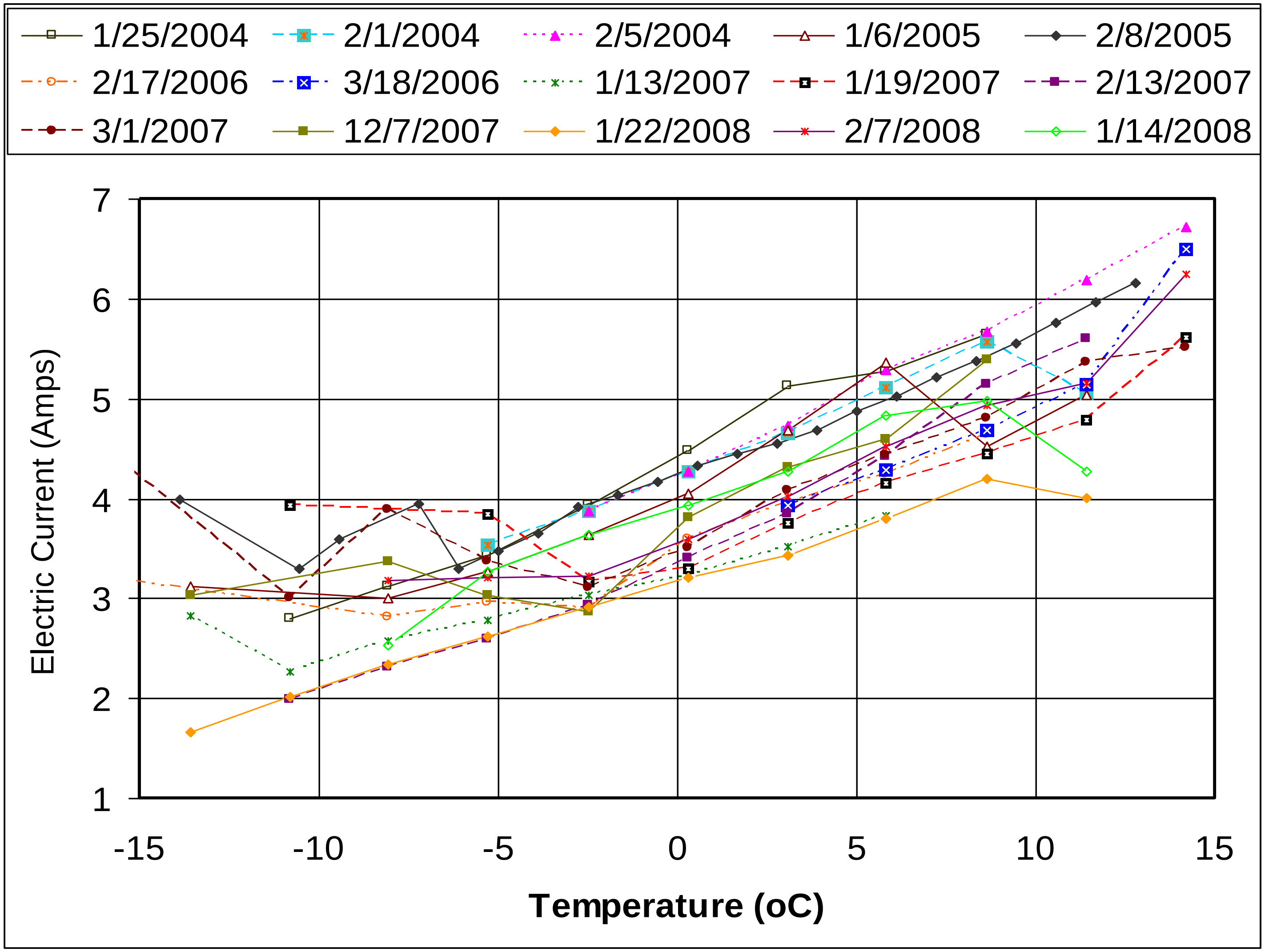


Figure 12. Average Slab Current vs. Slab Temperature Relationship

CHAPTER 6

LESSONS LEARNED

6.1 Electrical Wiring Scheme

During the December 9, 2003 snow storm, hot spots were reported at several locations along the centerline of the bridge deck (see Fig. 13). Engineers from Nebraska Department of Roads inspected the conductive concrete slabs after the storm and reported that there was tinkling sensation when touching the slab at one location, indicating potential electric shock hazard.

Figure 13. Hot spots along the Centerline of the Bridge Deck

The step potential and stray current levels were measured on December 12, 2003. All 52 slabs were powered at the time, and the temperature and current readings of the slabs were monitored on site with a laptop computer. The peak step potential measured across an 8-ft distance (i.e., two slabs widths) was 175 V, given that the applied voltage across the electrodes the same distance apart was 208 V. The maximum stray current level was about 0.6 A.

6.1.1 Diagnostics of stray current and remedy

An inspection of the current levels of the 52 slabs revealed that only slabs No. 20, 26, 42 and 44 had much higher values (11, 14, 15 and 18 Amps, respectively) while the rest of the slabs had current in the range of 4 to 5 Amps. These 4 slabs are exactly where the hot spots were reported. The small number of hot spots indicated the wiring of these slabs may be incorrect. It was suspected some adjacent electrodes (across the 6-in. gap along the centerline) had opposite polarities due to incorrect wiring. Water from melted snow filled voids under the polyurethane sealant at those 4 slabs and provided a path for stray current, thus explaining the high current readings. Steam was coming out of saw cut gaps with burning plastic smell, indicating high temperature due to electric current going through the water in saw cut gap.

The wiring of a three-phased, AC source is quite different from that of a two-phased power source. The wiring of the slabs was reconfigured such that the four electrodes located along a saw cut line will have the same voltage, thus completely eliminate any possible stray current path. There was no need to pull wires in the PVC conduits, except that power wiring connected to some slabs was simply switched at the control panel. The corrected wiring scheme is shown in Table 11. A series of tests was conducted on the electrical wiring of the “tagged-out” slabs on January 7, 2004. All 52 slabs were powered and the temperature and current readings of the slabs were monitored with a laptop computer. A digital current meter was used to measure the return current from each slab. A hand-held temperature gun was also used to monitor the temperature along the centerline of the bridge where hotspots had been observed. It was confirmed that the previous high current readings in slabs 20, 26, 42 and 44 were eliminated after reconfiguration of the wiring.

Table 11 Power Chord Wiring Reconfiguration

	Power Panel 1						Power Panel 2						Power Panel 3					
Phase	**Circuit**	**New Slab**	**Old Slab**	**Circuit**	**New Slab**	**Old Slab**	**Circuit**	**New Slab**	**Old Slab**	**Circuit**	**New Slab**	**Old Slab**	**Circuit**	**New Slab**	**Old Slab**	**Circuit**	**New Slab**	**Old Slab**
A	1	1	1	2	2	2	1	25	21	2	26	22	1	43	41	2	44	42
B	3	1	1	4	2	2	3	25	21	4	26	22	3	43	41	4	44	42
C	5	5	3	6	6	4	5	23	23	6	24	24	5	41	43	6	42	44
A	7	5	3	8	6	4	7	23	23	8	24	24	7	41	43	8	42	44
B	9	3	5	10	4	6	9	21	25	10	22	26	9	45	45	10	46	46
C	11	3	5	12	4	6	11	21	25	12	22	26	11	45	45	12	46	46
A	13	7	7	14	8	8	13	31	27	14	32	28	13	49	47	14	50	48
B	15	7	7	16	8	8	15	31	27	16	32	28	15	49	47	16	50	48
C	17	11	9	18	12	10	17	29	29	18	30	30	17	47	49	18	48	50
A	19	11	9	20	12	10	19	29	29	20	30	30	19	47	49	20	48	50
B	21	9	11	22	10	12	21	27	31	22	28	32	21	51	51	22	52	52
C	23	9	11	24	10	12	23	27	31	24	28	32	23	51	51	24	52	52
A	25	13	13	26	14	14	25	37	33	26	38	34	25			26		
B	27	13	13	28	14	14	27	37	33	28	38	34	27			28		
C	29	17	15	30	18	16	29	35	35	30	36	36	29			30		
A	31	17	15	32	18	16	31	35	35	32	36	36	31			32		
B	33	15	17	34	16	18	33	33	37	34	34	38	33			34		
C	35	15	17	36	16	18	35	33	37	36	34	38	35			36		
A	37	19	19	38	20	20	37	OPEN	39	38	OPEN	40	37			38		
B	39	19	19	40	20	20	39	39	39	40	40	40	39			40		
C	41			42			41	39		42	40		41			42		

The slabs that had been identified previously to have high levels of stray currents were rewired first according to the revised scheme. The surface step potentials and currents were then monitored along the bridge centerline after soaking it with more than 5 gallons of water. The measured peak voltage across a slab width was 172 V, and the measured peak surface current was 12 mA. This is a significant reduction from the previously measured current level that was as high as 0.6 A. No hot spots were observed with the surface temperature probe.

6.2 Concerns for Electric Shock

The use of high voltage and high current causes a safety concern, even though the conductive concrete behaves as a semi-conductor. A model commonly used to describe the behavior of a diode[19] as a resistor in parallel with a variable resistor and a capacitor, may be used to describe the electrical conduction behavior of the conductive concrete. The isolated conductive particles within the concrete act as capacitors when a voltage is applied across the material. The current flows through the material due to dielectric breakdown. The summation of the potential drops of all the viable current paths between the two electrodes is equal to the applied voltage. Likewise, the total current going through all the viable paths is equal to the current corresponding to the applied voltage. This behavior has been confirmed by field measurements. Several measurements were taken at different locations on the inlay surface under 208 V during heating experiments, and “step potential” readings at 2 ft apart were in the range of 10 to 20 volts. The current readings were in the range of 15 to 30 mA. These voltage and current levels pose no hazard to the human body. On another occasion, the researchers touched the surface of a 4 ft by 12 ft conductive concrete slab containing steel fibers and shavings during deicing experiment without feeling any electric shock, while the slab was energized with 410 V of AC power and had about 10 Amps of current going through it. Although the power will be turned on only when snow/ice storms are anticipated, it may be prudent to check the step potential and stray current whenever the power is turned on to ascertain that there is no electric shock hazard to the public. There are effective ways to eliminate the potential stray current and the associated electric shock hazard.

6.2.1 Applying Epoxy Coating

An effective measure to eliminate potential stray current on the surface is to apply 1/16 to 1/8 in. coating of a low-modulus and low-viscosity epoxy on the conductive concrete surface. Nebraska 47B sand and gravel or fine aggregate will then be spread on before the epoxy sets to form a skid-resistant surface. The centerline of the Roca Spur Bridge deck was coated with two layers of Unitex Pro-poxy Type III DOT epoxy on July 23, 2003. Fig. 14 shows the application of epoxy coating along the centerline of Roca Spur Bridge. The two-part epoxy material was donated by Unitex.

Figure 14. Application of Epoxy Coating and utility sand

6.2.2 Adding a Regular Concrete Layer

Regular concrete is not electrically conductive. Using a thin layer of regular concrete on top of a conductive concrete pavement can be an effective way to minimize stray current. Heating tests showed that a 0.25 to 0.5-in. thick topping would only reduce the heating rate slightly. Silica fume should be added to make the regular concrete topping less permeable.

6.2.2.1 Effect on Heating Rate

Regular concrete toppings of 0.25 in., 0.50 in. and 0.75 in. were added to 1 ft by 1 ft by 2 in. conductive concrete test slabs for heating tests in a freezer. A conductive concrete test slab without a regular concrete topping was used for reference. The effect of adding a regular concrete topping on the heating rates is illustrated in Fig. 15. It can be seen that adding a regular concrete topping of 0.25 to 0.50 in. will have about the same heating rate, with 6% reduction in 2 hours compared to having no topping.

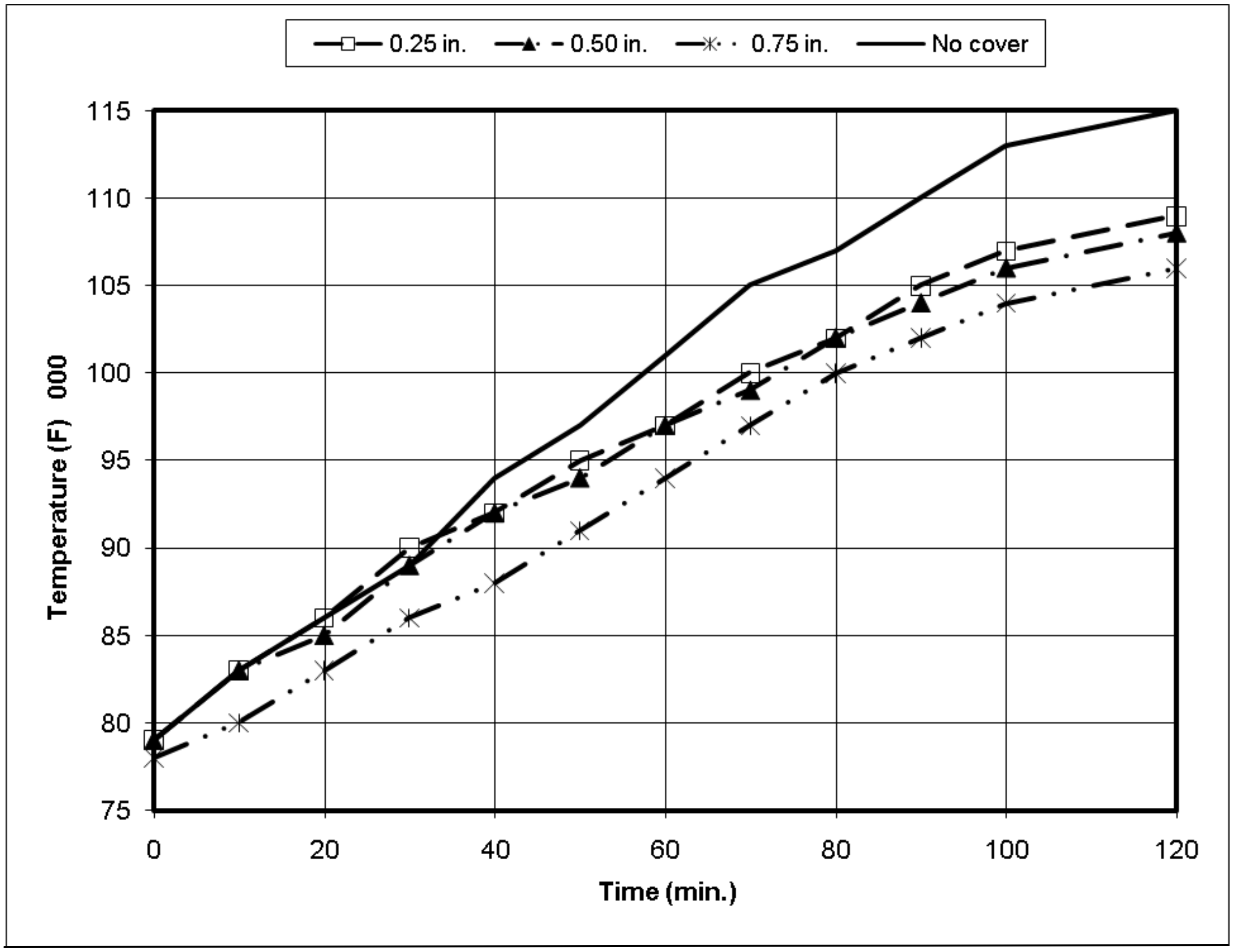


Figure 15. Effects of Concrete Cover on Heating Rate

6.2.2.2 Effect on Stray Current

The effect of adding a 0.25 in. regular concrete topping to reduce the electrical stray current on the test slabs was also evaluated. Measurements of stray currents on the slab surfaces were taken under both dry and soaked conditions. Under soaked condition, a test slab was submerged in water for one hour before testing. Fig. 16 shows a conductive concrete test slab with 0.25 in. concrete topping under soaking.

Figure 16. Conductive concrete test slab submerged in water

Before stray current measurements, the excess water on the surface was wiped off and pieces of wet paper towel were used to ensure good contact of the probes with the slab surface. The stray currents were then measured with a multimeter and recorded as a function of the distance between the two probes, as shown in Fig. 17. The effectiveness of adding a 0.25 in. concrete topping for minimizing stray current is presented in Fig. 18. The reduction from 0.6 mA to 0.15 mA for the soaked test slabs is very significant.

Step potential and stray current levels at the Roca Bridge deck were monitored during the fall when the bridge was powered up. Measurements were either taken after a rain storm or gallons of water were poured on the deck to simulate wet pavement. On the average, the peak step potential measured at the electrode locations (8 ft apart) was about 172 V with peak stray current of about 12 mA. Even though the Roca Bridge deck does not have a regular concrete topping, there is no electric shock hazard when the conductive concrete is energized. No injuries of people or small animals attributable to the conductive concrete deck have been reported for the past 5 years.

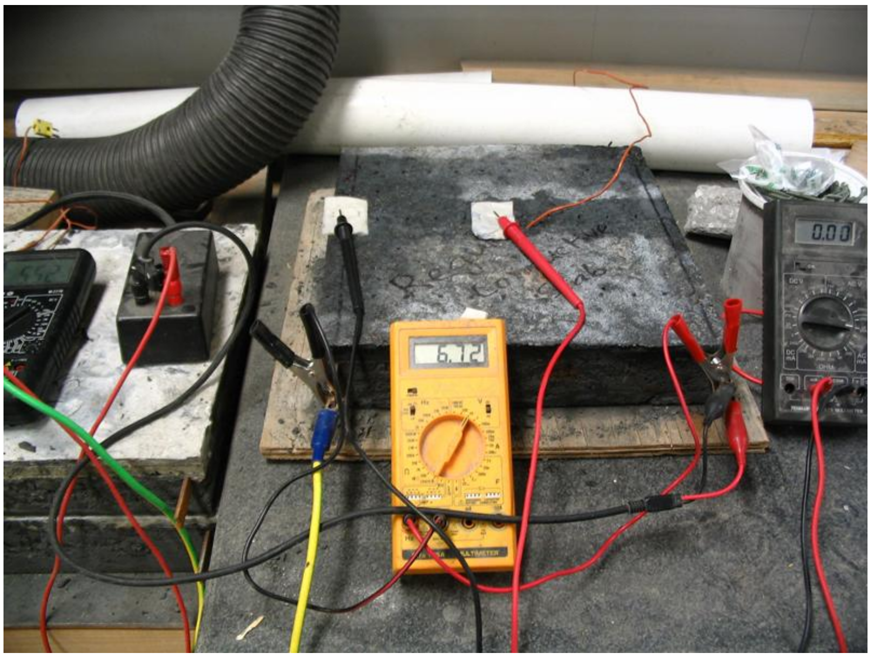


Figure 17. Stray Current Measurements

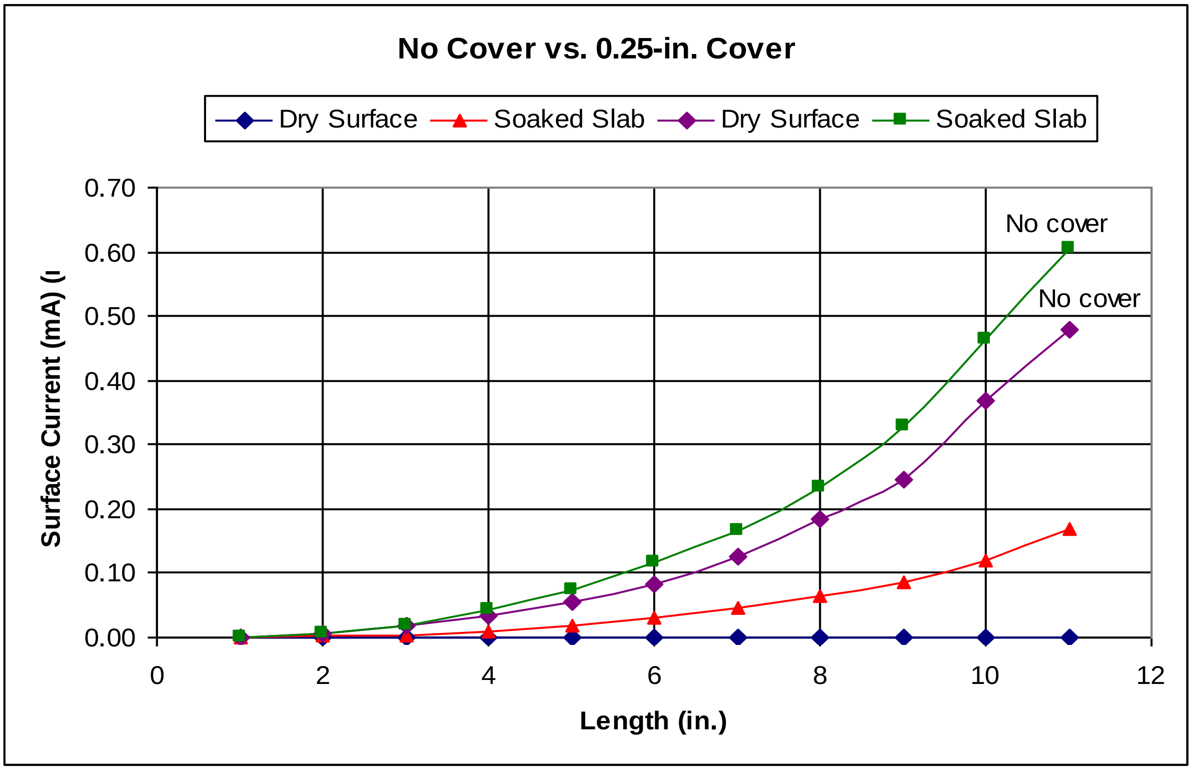


Figure 18. Reduction of Stray Current by adding a 0.25 in. topping

6.3 Bridge Smoothness Tests and Surface Grinding

Shortly after Roca Bridge was open to traffic in December 2002, the bridge pavement was considered too bumpy for a ride at the speed limit of 35 mph. Nebraska Department of Roads ran a profilometer to determine the surface roughness, and rough spots were milled. As a result, portions of cement paste cover on top of the conductive concrete deck were ground off and some steel fibers were exposed. The profilograph showed excessive milling especially in the eastbound lane, when comparing the surface roughness results before and after surface grinding.

6.4 Bridge Deck Inspections

The bridge deck was routinely inspected once in the fall before the winter season and once in mid-summer each year. The cracks, if any, would be sealed using epoxy before deicing operation. On October 24, 2003, Roca Bridge was inspected for cracks and none were found. The bridge deck was saturated with water by a water tanker. No short circuits were detected. Roca Bridge was inspected on April 15, 2004 after four successful deicing operations during the 2003 winter storms. No cracks in the slabs were visible by the naked eye. The Roca bridge deck was inspected for cracks on November 18, 2004. No visible cracks or severe rusting were observed. The power relays were turned on manually for selected panels to check surface stray current. The measured current level was about 0.3~0.4 mA, which posed no shock hazard.

An inspection of the Roca Bridge deck was conducted on May 19, 2006. Several areas of surface spalls were noticed. The spalls in the eastbound lane were severe compared to the westbound lane. The spalls were probably caused by a combination of using deicing salt and snow plows. NDOR maintenance crew was asked not to spray salt on bridge, since NDOR maintained the bridge approach leading to Roca. It was suspected that deicing salt was tracked on the bridge in the eastbound lane by the traffic. The epoxy coating along the centerline of the bridge deck also showed chips and cracks, possibly by snow plows during snow removal. NDOR engineers independently inspected the bridge deck on June 16, 2005, and the exposed steel fibers were found significantly rusted and many spalls in the conductive concrete deck became visible, as shown in Figs. 19 and 20. The rust from steel fibers was suspected to cause delamination and concrete spalls. It was also noted the epoxy coating along the centerline of the bridge deck was chipped or damaged (see Fig. 21).

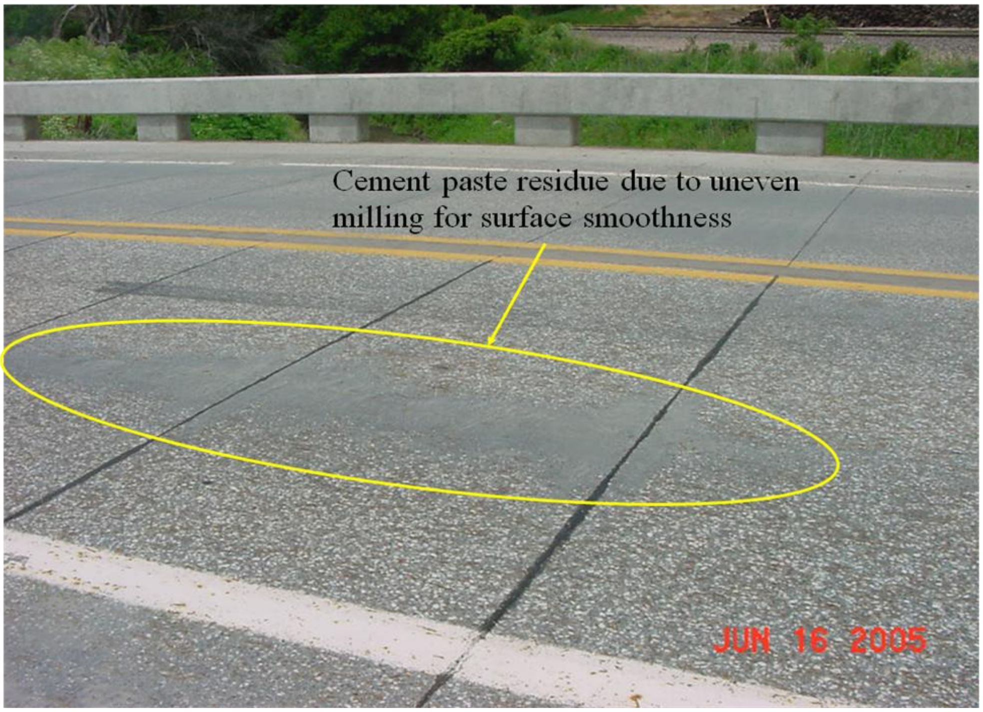


Figure 19. Cement paste cover was milled off leaving steel fibers exposed

Figure 20.   Close-up of exposed steel fibers and spalls

Figure 21. Damage to the Epoxy Coating along Bridge Centerline

6.4.1 Mapping of Spalls

Slabs 1, 12, 14, 16, 18, 23, 24, 26, 28, 30, 34, 38, 40, 42, 44, 46, 47, 48, 50 and 52 had most significant spalls. All the even-numbered slabs are in the eastbound lane (south side) of the bridge, where the surface was milled to a much greater extent than the westbound lane (north side). Slabs 16, 28, 30 and 46 had the worst deterioration in terms of the numbers and sizes of spalls. The sizes and shapes of the spalls were traced onto transparencies on July 15, 2005, for future reference.

6.4.2 Samples Coring and Locations

Nebraska Department of Roads engineers cored samples from the conductive concrete deck to investigate the deterioration. The locations of the cored samples are marked in Fig. 22.

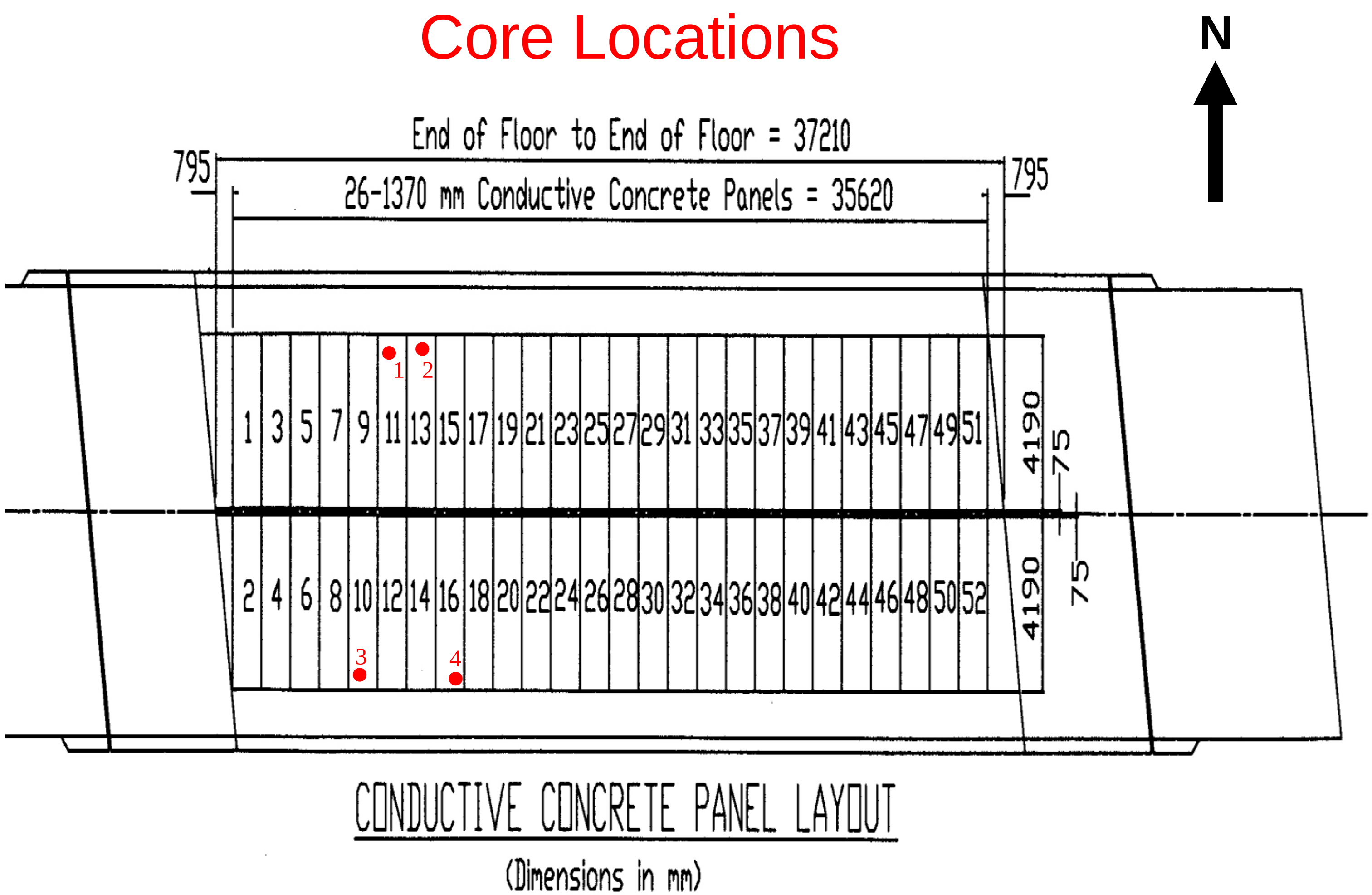


Figure 22. Locations of Cored Samples

The cored samples were inspected by the Nebraska Department of Roads engineers and found the rust of the steel fibers was limited to less than 1/16 in. of the top layer of the bridge deck. Fig. 23 shows the cored samples. It was concluded that the conductive concrete mix was sound and had adequate freeze-thaw resistance. The concrete spalls and extensive steel fiber rusting were most likely due to excessive surface milling. It was also noted that the westbound lane (north side) did not have noticeable amount of spalls as did the eastbound lane.

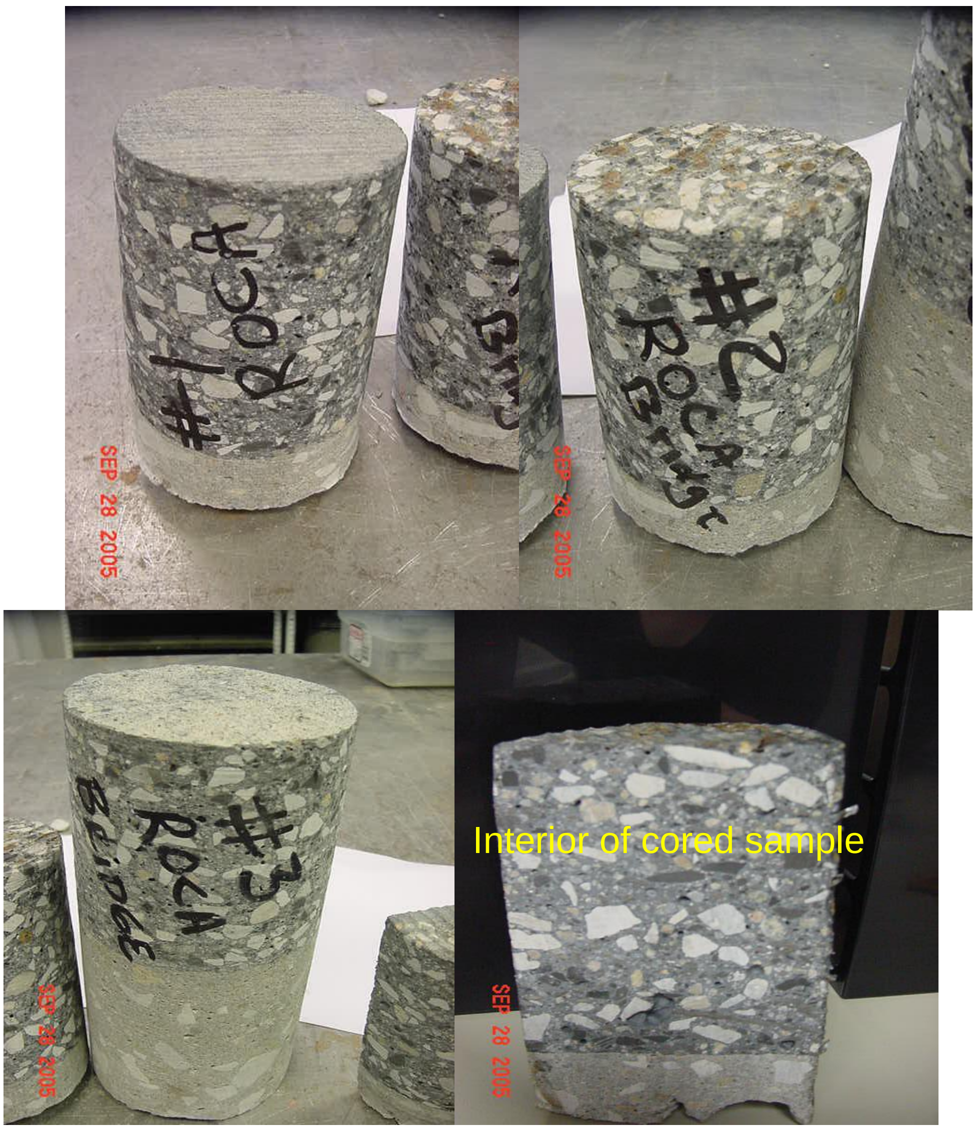


Figure 23. Cored Samples from Roca Bridge Deck

6.4.3 Epoxy Patching

On Oct 17, 2005, the damaged epoxy coating along the centerline of the bridge deck was removed by two passes of bead/shot blasting conducted by Trafcon, Inc., Lincoln, Nebraska. The centerline was recoated with the Unitex Pro-poxy Type III DOT epoxy and fine sand afterwards. The spalled areas in pavement were also patched with the same epoxy and fine sand. The bead blasting cost $250 and the epoxy material cost $220.80, with a total maintenance cost of $470.80 incurred during 2 years of service.

6.4.4 Further Inspections

The bridge deck was further inspected on September 27, 2006 and July 17, 2007. No further deterioration was observed after the spalls were patched with epoxy. However, during a post-project inspection on June 16, 2008, significant deterioration in many even-numbered slabs (i.e., eastbound lane) was noticeable, as shown in Fig. 24.

Figure 24. Deterioration of Eastbound Lane Slabs

A close-up of the surface spalls on slabs 28 and 30 is shown in Fig. 25. The rust condition of the exposed steel fibers also worsened significantly. It was surprising to see the rapid deterioration that took place in one year. It is surmised that most spalls occurred during thawing in the late March-early April timeframe. There were 25 days below freezing during January and February 2008, so the freeze-thaw action was severe this winter.

Figure 25. Close-up of Surface Spalls in Eastbound Lane

On the other hand, the westbound lane was also closely scrutinized and there was hardly any noticeable deterioration since the surface grinding. The exposed steel fibers in the odd-number slabs (i.e., westbound lane) did not show deterioration, as evidenced in Fig. 26. It is evident that the surface milling really did a lot of damage to the eastbound lane when compared the progress of the deterioration against that in the westbound lane. The excessive milling has compromised the durability of the conductive concrete deck.

Figure 26. No Noticeable Deterioration in Westbound Lane Slabs

6.5 Public Awareness

Current operation of the Roca Bridge deicing system relies on a manual switch to turn the power on/off via a phone modem and on weather forecast to determine the probability of icing. The power to the bridge will be turned on if the probability is deemed high. The effectiveness of this system is seriously limited by manual operation, since the personnel may not always be available to turn the power on and the weather forecast may not always provide accurate weather information at the bridge site. Therefore, local residents driving over the Roca Spur Bridge should be aware that the bridge may still be icy. A kiosk may be used to inform the drivers if the bridge is powered.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

- The Roca Bridge deicing system using an implemented conductive concrete deck has been functional for the past 5 years (2003-2008). Data recorded from 15 major winter storms has indicated excellent deicing performance with no signs of deterioration.
- The conductive concrete technology is very energy-efficient when used against freezing rain, since the air temp usually is close to the freezing point (see Fig. 27).

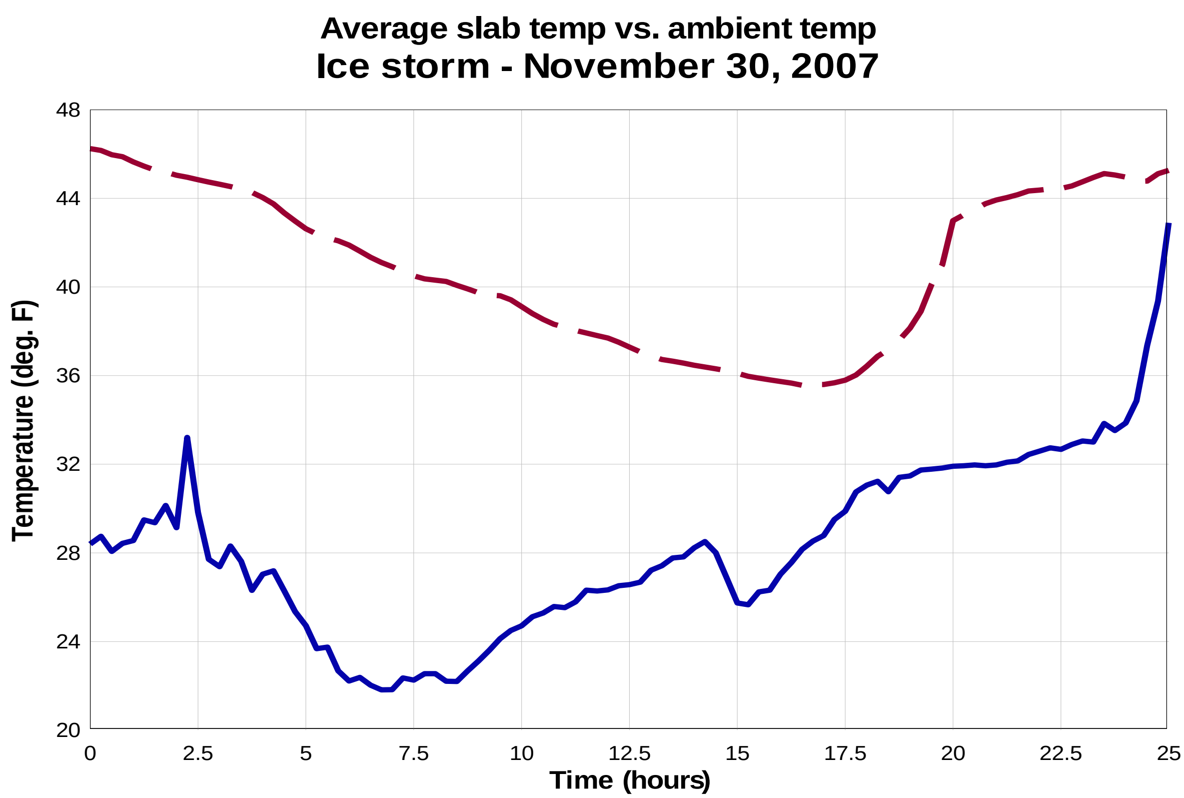


Figure 27. Deicing Performance in an Ice Storm – November 30, 2007

- Due to the use of steel fibers in the conductive concrete mix design, concrete cover is essential for durability of a bridge deck made of conductive concrete.

- The deck surface inspections should be made in the fall before the system is powered and soon after the winter is over. The spring inspection should be conducted preferably in late March or early April.
- The electrical conductivity of the conductive concrete has been very stable over a 5-year period, as evidenced by Fig. 12. The most challenging task in the mix design was to achieve the long-term stability of the electrical conductivity.
- The operating cost of the Roca Bridge deicing system was about $250 per major snow storm. Comparisons of conductive concrete technology against other deicing technologies are provided in Table 9.
- Using a 1/16-in. epoxy or a 0.25 in. regular concrete topping on a conductive concrete deck can significantly reduce the electric shock potential without compromising heating rate.
- The success of the Roca Bridge demonstration project has attracted much attention from the transportation industry and researchers from all over the world. The project has been featured in numerous national as well as international news media and publications, including the **Discovery Channel**. The heated deck has worked very well for the past 5 winter seasons, as evidenced by Fig. 28.

Figure 28. Roca Spur Bridge Deicing Operation

- The conductive concrete deicing technology is readily deployable at any accident-prone roadways, bridge decks and interstate exit ramps.

7.2 Recommendations for Future Research

7.2.1 Automation of the Deicing System

Current operation of the deicing system relies on a manual switch to turn the power on/off using a phone modem. Icing sensors and a weather station may be integrated into the control circuitry to fully automate the system. It has long been recognized that icing on the deck may take place in early mornings under freezing temperature. Since it is more energy efficient to preheat the conductive concrete before an icing occurrence, a weather monitoring system could be developed to automatically control the power delivered to the bridge deck based on local and regional weather forecast. Energy consumption costs due to "false alarm" as well as undetected icing events would be greatly reduced.

7.2.2 Adjustable Power Source

The combination of low temperature, high wind and heavy snow rate (e.g., 1~2 in./hr), usually caused the pavement to be covered by snow and ice. This is due to the fact that heat generated in conductive concrete is slower than the heat dissipation from the bridge deck surface. Therefore, it is desirable to have an adjustable transformer to increase electric current under a higher applied voltage.

7.2.3 Implementation Plan

This project provided an opportunity for Nebraska Department of Roads and University of Nebraska-Lincoln to jointly monitor the operations of this new technology. There were many valuable lessons learned throughout the life of this project which will enhance future applications of the technology. The Nebraska Department of Roads will continue to monitor the condition of the deck surface in Roca and conduct maintenance as needed. At this time, there are no plans to duplicate the conductive concrete system which was implemented in Roca, on the state highway system.

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Appendix A – Construction Drawing

- ROCA SPUR -

- NOTES -

This structure is designed in accordance with the 16th edition of the AASHTO "Standard Specifications for Highway Bridges".

The superstructure of this bridge is designed by load factor design method. The structure is designed for a future wearing surface of 900 Pa.

The contractor may substitute any one of the alternate designs shown on the plans for the original design. All quantities are based on the original design and no additions or deductions will be allowed for the use of an alternate design.

Concrete for slab, approach slabs and rails shall be Class "47BD", with a 28-day strength of 30 MPa.

All other cast-in-place concrete shall be Class "47B" concrete, with a 28-day strength of 20 MPa.

All reinforcing steel shall be epoxy coated and conform ot the requirements of ASTM A615/A615M, Grade 420 steel.

The minimum clearance, measured from the face of the concrete of any reinforcing bar, shall be 50 mm, except where otherwise noted.

All structural steel shall conform to the requiremetns of ASTM A709/A709M, Grade 250.

The item, "STRUCTURAL STEEL FOR SUBSTRUCTURE", shall include nose angles at the bents.

All dimensions shown are in horizontal plane only. No allowance have been made for vertical curve or roadway cross slope.

Alltel Communications shall furnish all conduit and hardware for the telephone attachments; and coordinate the installation with the contractor. The cost of installation shall be subsidiary to the item CLASS 47BD-30 CONCRETE FOR BRIDGES. When the materials furnished by the utility are required, the contractor shall notify the utility company at least 72 hours in advance. Contact: Mr. Bruce Wood at 402-436-5944.

The cost of furnishing and installing all items related to the installation and operation of the conductive concrete deck surface, including, but not limited to, conduit, junction boxes, electrodes, FRP reinforcement, epoxy adhesive, temperature sensors, wiring and data cables, will not be paid for directly, but will be considered subsidiary to the item "CONDUCTIVE CONCRETE".

The cost for furnishing and installing the concrete pad for the Conductive Concrete equipment building, non-shrink grout, and saw cuts and saw cut sealant in the Conductive Concrete, will not be paid for directly, but will be considered subsidiary to the item "PLACING, FINISHING, AND CURING CONDUCTIVE CONCRETE".

The non-shrink grout shall be from the Approved Product List, conforming to the requirements of ASTM C1107.

- QUANTITIES -

ABUTMENT NO. 1 EXCAVATION		1 Lump Sum
BENT NO. 1 EXCAVATION		1 Lump Sum
BENT NO. 2 EXCAVATION		1 Lump Sum
ABUTMENT NO. 2 EXCAVATION		1 Lump Sum
CLASS 47B-20 CONCRETE FOR BRIDGES		139.0 m^3
ABUTMENTS	45.0 m^3	
BENTS	94.0 m^3	
CLASS 47BD-30 CONCRETE FOR BRIDGES		179.6 m^3
SLAB	167.0 m^3	
CONCRETE RAILS	12.6 m^3	
EPOXY COATED REINFORCING STEEL		35215 kg
SLAB	26130 kg	
CONCRETE RAILS	1577 kg	
ABUTMENTS	3230 kg	
BENT	4278 kg	
STRUCTURAL STEEL FOR SUBSTRUCTURE		490 kg
STEEL SHEET PILING		243.3 m^2
HP 250mm x 62kg STEEL PILING		274.0 m
GRANULAR BACKFILL		94.0 m^3
CONCRETE FOR PAVEMENT APPROACHES CLASS 47BD-30		126.2 m^3
SLAB	119.2 m^3	
CONCRETE RAILS	7.0 m^3	
EPOXY COATED REINFORCING STEEL FOR PAVEMENT APPROACHES		9022 kg
SLAB	7684 kg	
CONCRETE RAILS	1338 kg	
DRILLED SHAFT		39.2 m
ROCK SOCKET		19.2 m
CONDUCTIVE CONCRETE		31.2 m^3
PLACING, FINISHING, AND CURING CONDUCTIVE CONCRETE		311.8 m^2

- INDEX -

-BILL OF BARS INDEX-

ALL STATIONS AND ELEVATIONS ARE IN METERS (m). ALL DIMENSIONS ARE IN MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

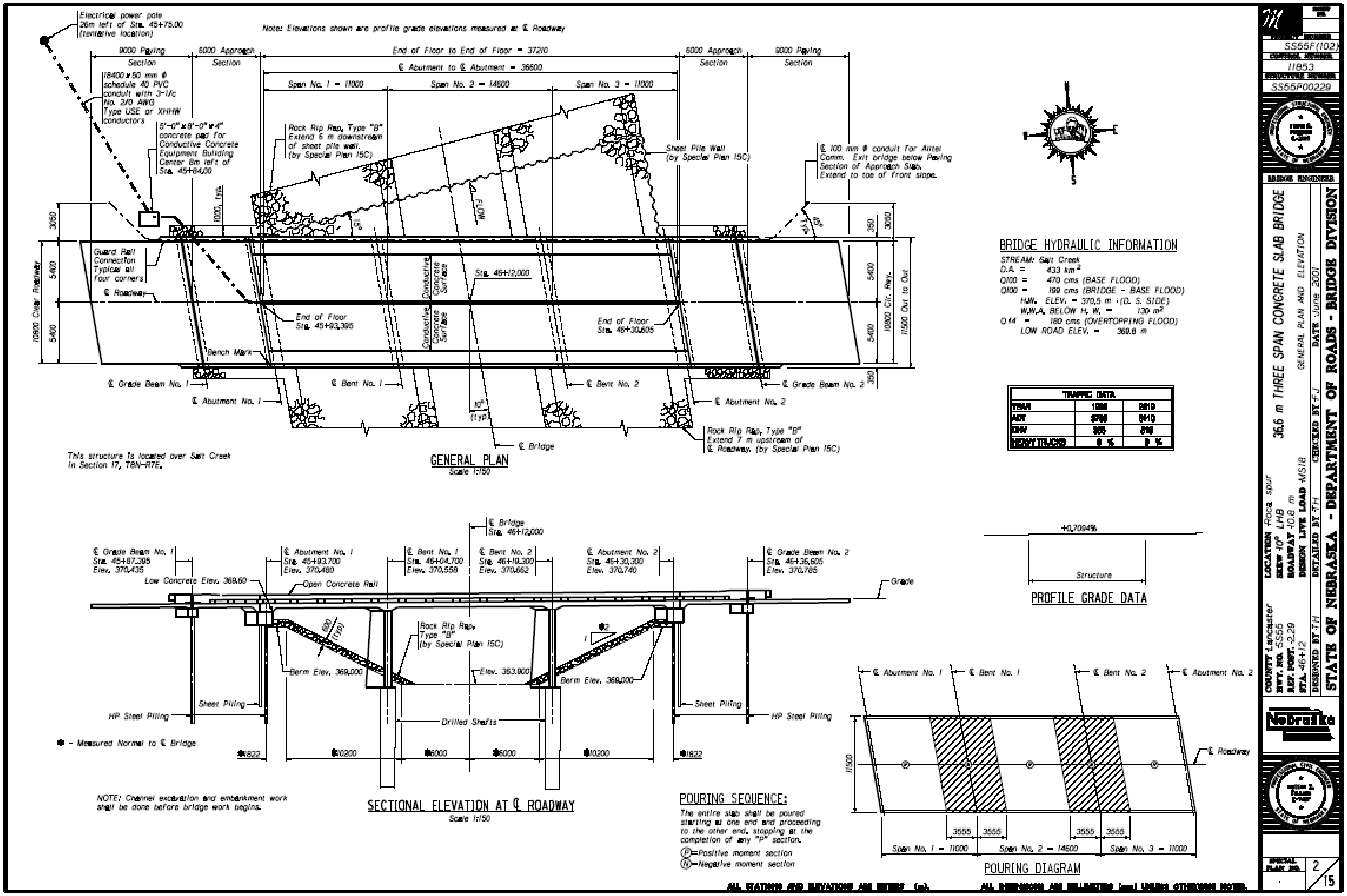
PROJECT NUMBER SS55F(102)
CONTROL NUMBER 11953
STRUCTURE NUMBER S55F00229
BRIDGE ENGINEER

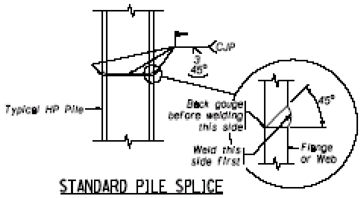
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
GENERAL NOTES, QUANTITIES AND INDEX

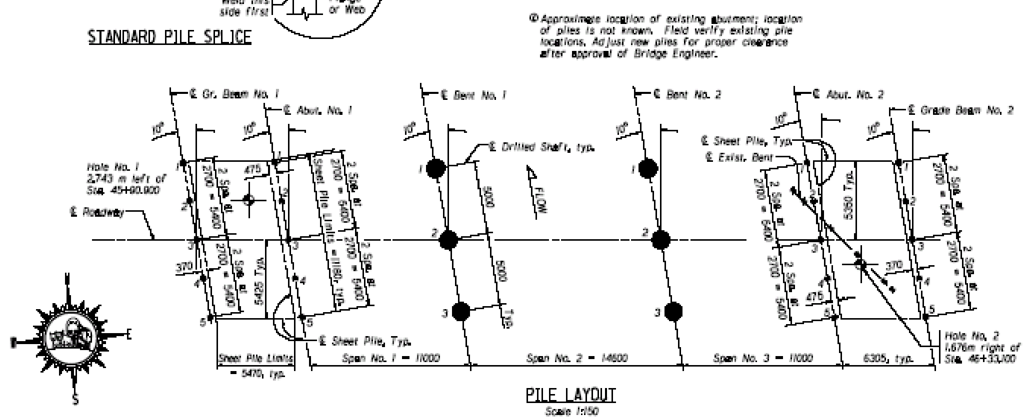
COUNTY Lancaster
HWY. NO. S55
REF. POST 2.29
STA. 46+12
LOCATION Roca spur
SKEW 10° LHB
ROADWAY 10.8 m
DESIGN LIVE LOAD MS18
DESIGNED BY TH
DETAILED BY TH
CHECKED BY FJ
DATE June 2001

STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION

SPECIAL PLAN NO.
SHEET 1/15


GENERAL PLAN
Scale 1:150
SECTIONAL ELEVATION AT ℄ ROADWAY
Scale 1:150
BRIDGE HYDRAULIC INFORMATION
PROFILE GRADE DATA
POURING SEQUENCE:
POURING DIAGRAM
Note: Elevations shown are profile grade elevations measured at ℄ Roadway
This structure is located over Salt Creek in Section 17, T8N-R7E.
NOTE: Channel excavation and embankment work shall be done before bridge work begins.
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
GENERAL PLAN AND ELEVATION
STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION





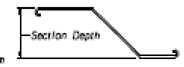
PILE DATA

LOCATION	PILE NUMBER	CUT-OFF ELEVATION	MINIMUM PENETRATION BELOW CUT-OFF (meters)	PILE ORDER LENGTH (meters)	DESIGN PILE BEARING (kN/PILE)	PILE TYPE
Grade Beam No. 1	1 - 5	368.540	11.0	12.2	400	HP250 x 62
Abutment No. 1	1 - 5	368.300	11.0	13.7	534	HP250 x 62
Abutment No. 2	1 - 5	368.560	12.5	15.2	534	HP250 x 62
Grade Beam No. 2	1 - 5	368.890	12.5	13.7	400	HP250 x 62

Bents are designed for scour to elevation 361.10 m.

All steel sheet piling shall conform to ASTM A328 steel and meet the following minimum requirements :

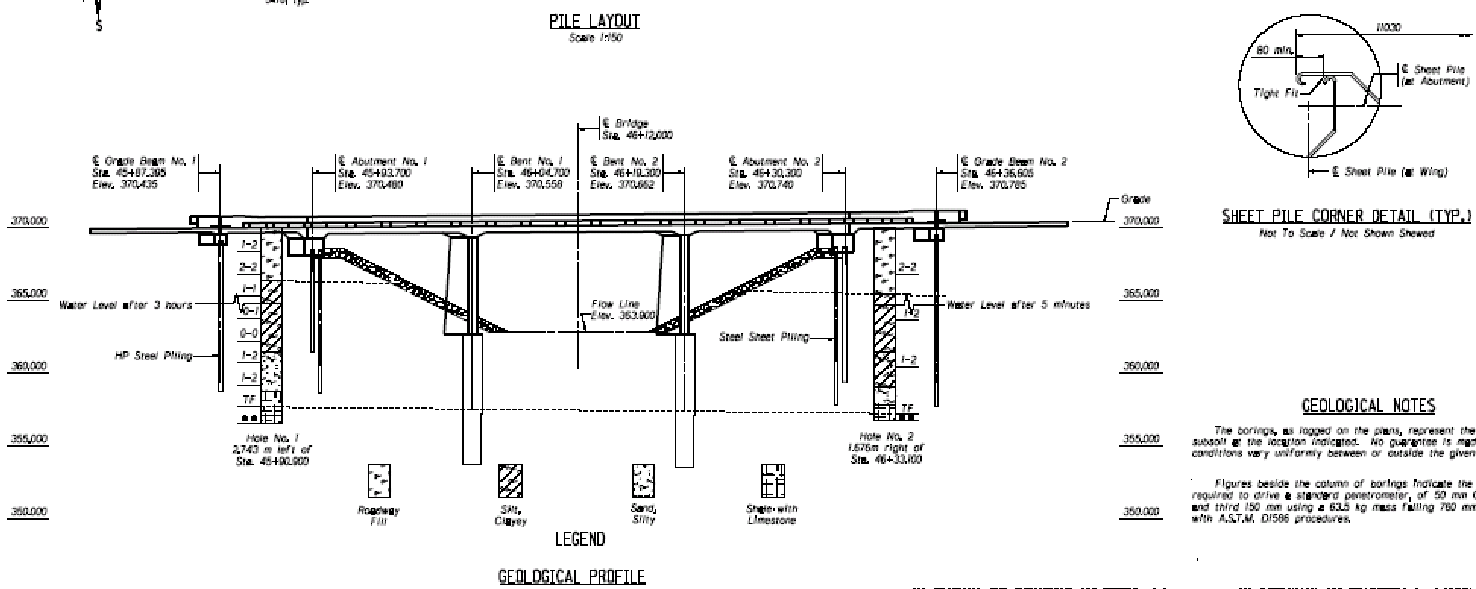
Section length	5.8 m
Maximum section depth	250 mm
Minimum section thickness	8 mm
Section modulus	290 x10³mm³/m



The contractor shall submit for approval a shop plan of the sheet pile layout showing all pertinent dimensions, details and section properties.

The pay quantity will be based on the sheet pile wall dimensions shown. The constructed wall length will be within ±500 mm of the sheet pile wall dimensions shown.

Prefabricated cast steel points will be required on all HP pile in this structure in accordance with the 1997 NDR Standard Specifications, Division 703. Approved manufacturers of prefabricated pile points are shown on the NDR Approved Products List.

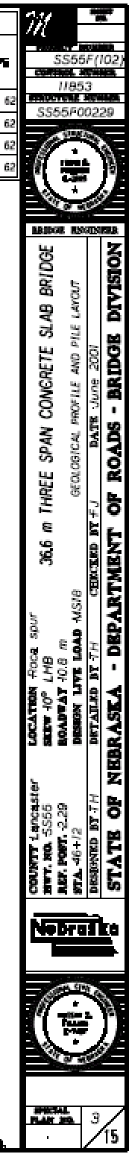


GEOLOGICAL NOTES

The borings, as logged on the plans, represent the character of the subsoil at the location indicated. No guarantee is made that the subsoil conditions vary uniformly between or outside the given location.

Figures beside the column of borings indicate the number of blows required to drive a standard penetrometer, of 50 mm O. D., the second and third 150 mm using a 63.5 kg mass falling 760 mm, in accordance with A.S.T.M. D1586 procedures.

ALL STATIONS AND ELEVATIONS ARE METERS (m). ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.



	BILL OF BARS						MASS
	MARK	NO.	LENGTH	TYPE	"A"	"B"	kg
DRILLED SHAFTS at Bent No. 1	DS2901	72	5100	STR.	·	·	1868
	DS2902	72	9530	STR.	·	·	3472
	·	·	·	·	·	·	·
	DS1301	96	3790	116	1060	460	362
					SUBTOTAL =		5692 Kg
DRILLED SHAFTS at Bent No. 2	DS2901	72	5100	STR.	·	·	1868
	DS2902	72	9790	STR.	·	·	3567
	·	·	·	·	·	·	·
	DS1301	99	3790	116	1060	460	373
					SUBTOTAL =		5798 Kg
					TOTAL =		11490 Kg

NOTE: FOR BENDING DIAGRAM SEE SHEET 13 OF 13.

Notes:

For Geological Profile and Pile Layout, see sheet no. 3 of 13.

The elevations shown for the bottom of the permanent casing are not guaranteed to seal the hole from the entrance of water. The elevations shown were determined from the borings shown on the geological profile: Sheet 3 of 16 and are considered to be appoximate.

Concrete for "Drilled Shaft" and "Rock Socket" shall be "47B" concrete.

All work and materials within the limits of pier foundation shall be paid for per linear meter for the items "Drilled Shaft" and "Rock Socket".

Permanent casing shall have cutting teeth on its leading edge to permit it to seat into the limestone resulting in a water tight seal.

Once the permanent casing is seated in the shale and the hole is sealed, the contractor shall cut the permanent casing so that the top is at elevation shown. After cutting, the casing shall be ground smooth.

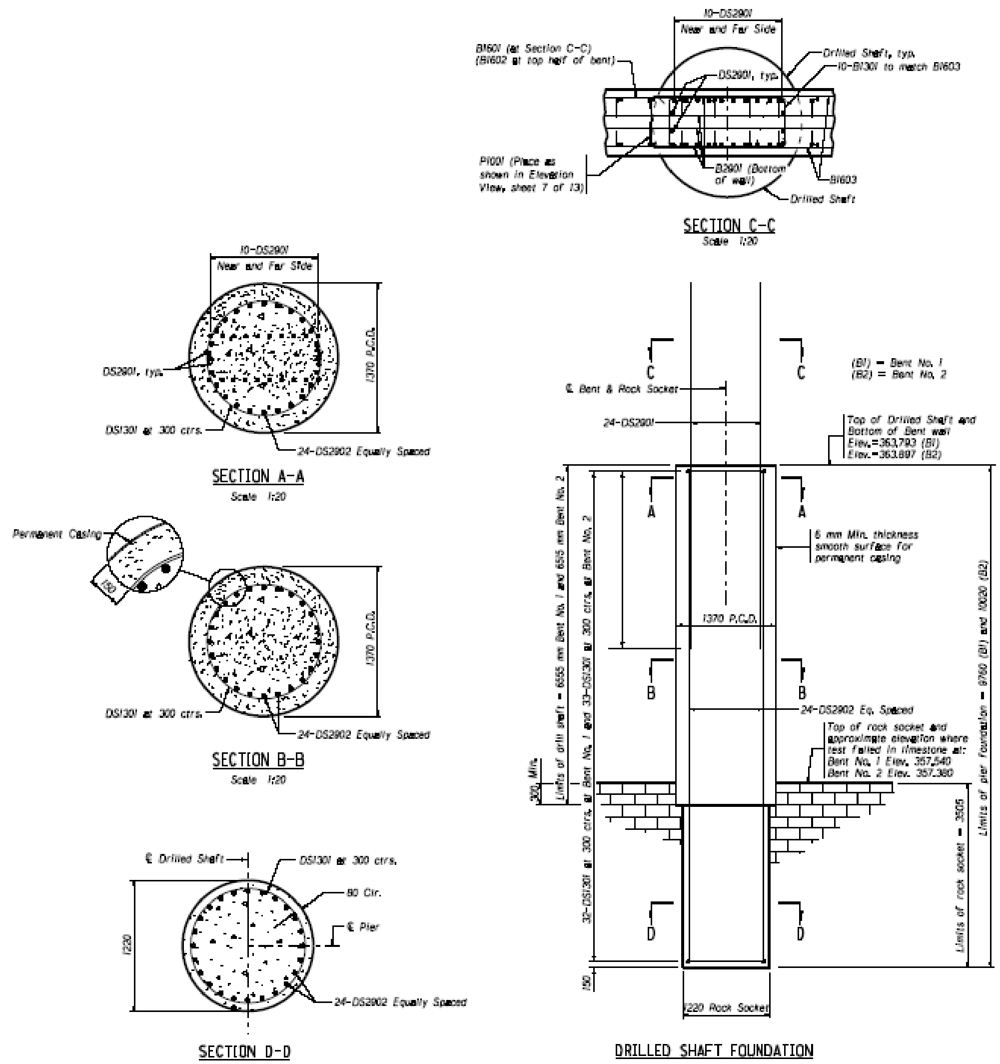
The Geotechnical Section shall be notified prior to excavation of the first "Drilled Shaft".

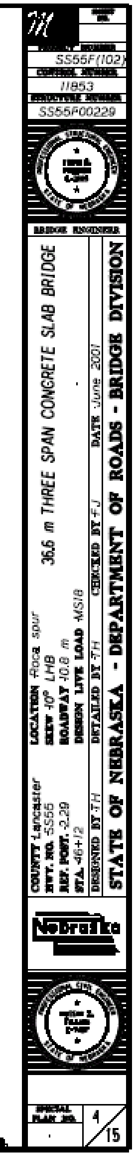
P.C.D. denotes permanent casing diameter.

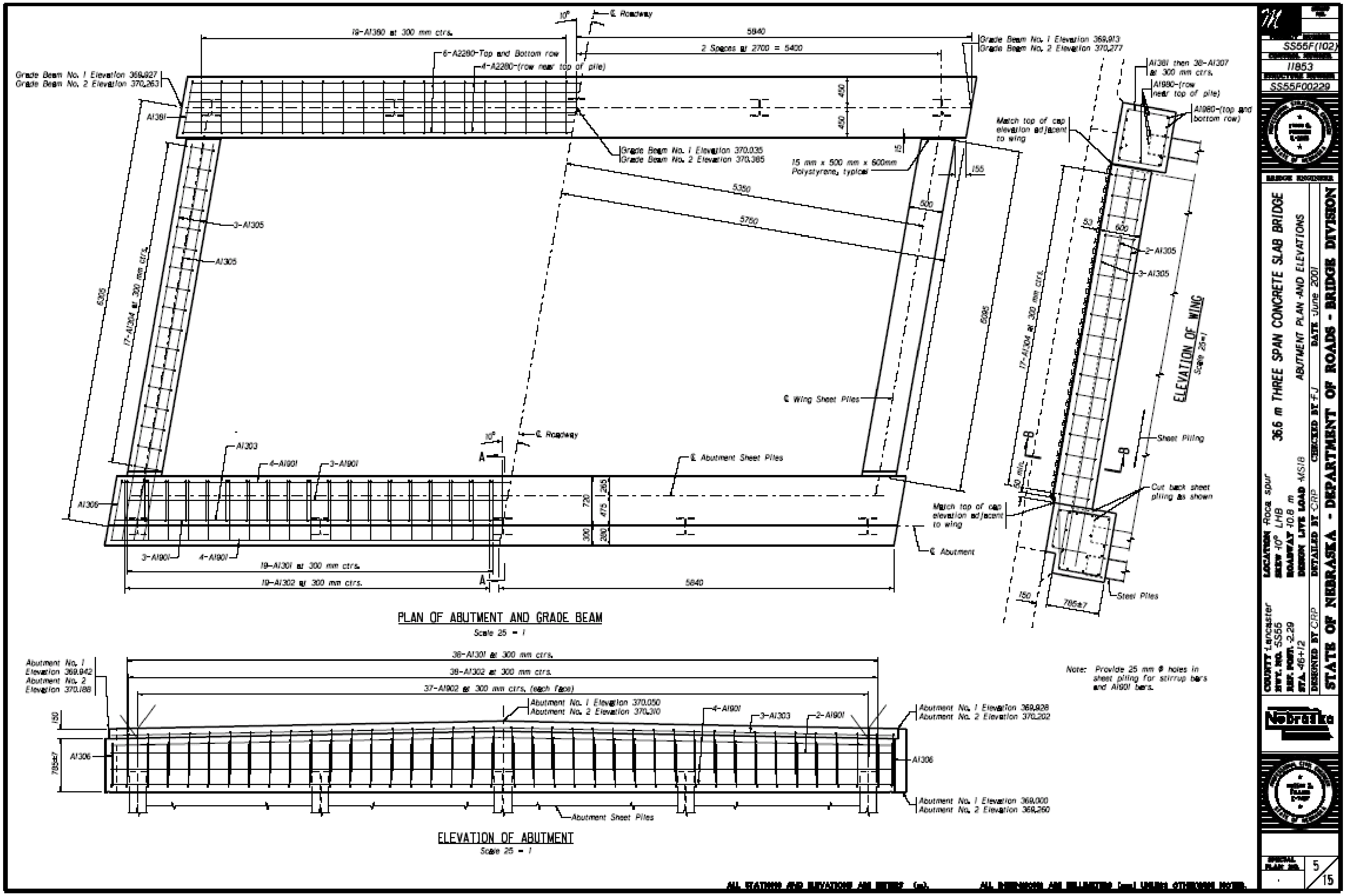
During the excavation of the rock socket, the contractor will encounter solid shale containing limestone.

Design capacity of drilled shaft = 2135 kN

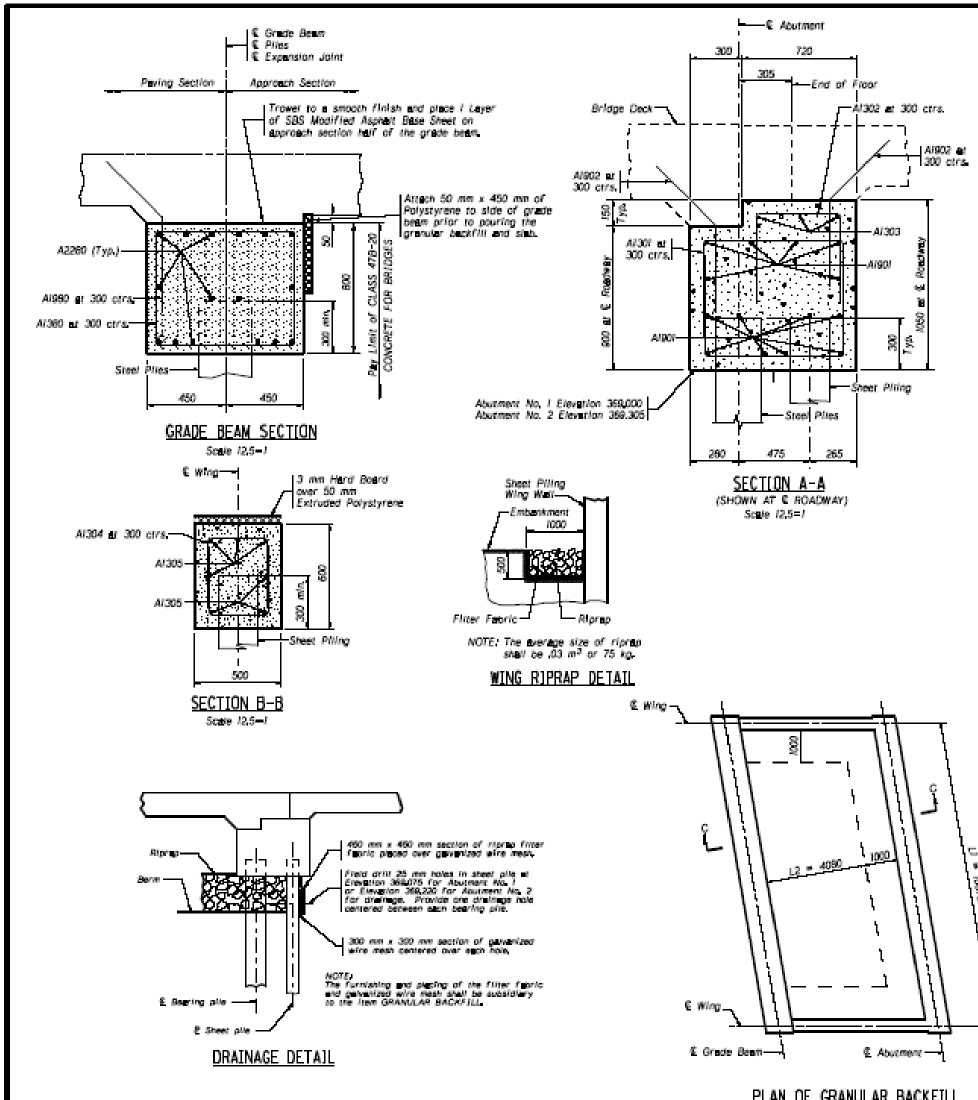
DRILLED SHAFT DATA			
LOCATION	SHAFT NUMBER	DESIGN BEARING (kN/SHAFT)	SHAFT TYPE
BENT NO. 1	1, 2, & 3	2135	SEE DRILLED SHAFT DETAILS
BENT NO. 2	1, 2, & 3	2135	







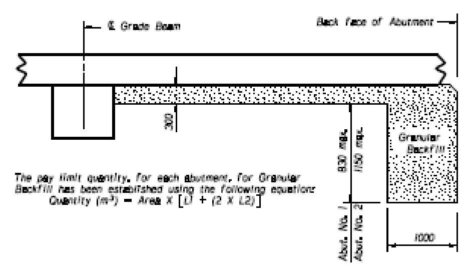
PLAN OF ABUTMENT AND GRADE BEAM
Scale 25 = 1
ELEVATION OF ABUTMENT
Scale 25 = 1
ELEVATION OF WING
Scale 25=1
℄ Roadway
19-A1380 at 300 mm ctrs.
5840
2 Spaces @ 2700 = 5400
6-A2280-Top and Bottom row
4-A2280-(row near top of pile)
Grade Beam No. 1 Elevation 369.827
Grade Beam No. 2 Elevation 370.263
Grade Beam No. 1 Elevation 369.913
Grade Beam No. 2 Elevation 370.277
Grade Beam No. 1 Elevation 370.035
Grade Beam No. 2 Elevation 370.385
15 mm x 500 mm x 600mm Polystyrene, typical
3-A1305
A1305
17-A1304 at 300 mm ctrs.
℄ Wing Sheet Piles
℄ Abutment Sheet Piles
℄ Abutment
19-A1301 at 300 mm ctrs.
19-A1302 at 300 mm ctrs.
Match top of cap elevation adjacent to wing
A1381 then 38-A1307 at 300 mm ctrs.
A1980-(row near top of pile)
A1980-(top and bottom row)
2-A1305
Sheet Piling
Cut back sheet piling as shown
Steel Piles
38-A1301 at 300 mm ctrs.
38-A1302 at 300 mm ctrs.
37-A1902 at 300 mm ctrs. (each face)
Abutment No. 1 Elevation 369.942
Abutment No. 2 Elevation 370.188
Abutment No. 1 Elevation 370.050
Abutment No. 2 Elevation 370.310
Abutment No. 1 Elevation 369.928
Abutment No. 2 Elevation 370.202
Abutment No. 1 Elevation 369.000
Abutment No. 2 Elevation 369.260
Abutment Sheet Piles
Note: Provide 25 mm ∅ holes in sheet piling for stirrup bars and A1901 bars.
SS55F(102)
11853
SS55F00229
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
ABUTMENT PLAN AND ELEVATIONS
COUNTY Lancaster
LOCATION Roca spur
SKEW 10° LHB
ROADWAY 10.8 m
DESIGN LIVE LOAD MS18
DATE June 2001
STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION
ALL STATIONS AND ELEVATIONS ARE METERS (m).
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.
5/15



	BILL OF BARS													MASS
	MARK	NO.	LENGTH	TYPE	"A"	"B"	"C"	"D"	"E"	"F"		PIN	HOOK	kg
ABUTMENT NO. 1	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	A2260	16	11510	STR.	·	·	·	·	·	·	·	·	·	560
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	A1901	14	11510	STR.	·	·	·	·	·	·	·	·	·	360
	A1902	74	720	106	360	360	255	·	·	·	·	115	·	119
	A1960	87	680	106	360	330	233	·	·	·	·	115	·	57
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	A1301	38	4160	108	620	860	600	480 min.	·	·	·	59	·	157
	A1302	38	1560	109	510	560	510	·	·	·	·	59	·	60
	A1303	-3	11510	STR.	·	·	·	·	·	·	·	·	·	34
	A1304	34	1790	107	440	340	·	·	·	·	·	59	115	60
	A1305	14	5960	STR.	·	·	·	·	·	·	·	·	·	83
	A1306	-2	3210	107	620	870	·	·	·	·	·	59	115	6
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	A1380	38	2990	107	640	740	·	·	·	·	·	59	115	113
	A1381	-2	3010	107	640	750	·	·	·	·	·	59	115	6
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
ABUTMENT NO. 2	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	A2260	16	11510	STR.	·	·	·	·	·	·	·	·	·	560
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	A1901	14	11510	STR.	·	·	·	·	·	·	·	·	·	360
	A1902	74	720	106	360	360	255	·	·	·	·	115	·	119
	A1960	87	680	106	360	330	233	·	·	·	·	115	·	57
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	A1301	38	4160	108	620	860	600	480 min.	·	·	·	59	·	157
	A1302	38	1560	109	510	560	510	·	·	·	·	59	·	60
	A1303	-3	11510	STR.	·	·	·	·	·	·	·	·	·	34
	A1304	34	1790	107	440	340	·	·	·	·	·	59	115	60
	A1305	14	5960	STR.	·	·	·	·	·	·	·	·	·	83
	A1306	-2	3210	107	620	870	·	·	·	·	·	59	115	6
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	A1380	38	2990	107	640	740	·	·	·	·	·	59	115	113
	A1381	-2	3010	107	640	750	·	·	·	·	·	59	115	6
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
												SUBTOTAL =		1615 Kg

NOTE: FOR PIN DIAMETERS, HOOK LENGTHS, AND BENDING DIAGRAMS, SEE SHEET 15 OF 15.

TOTAL = 3230 Kg



SECTION C-C

SS55F(102)

11853

SS55F00229

36.6 m THREE SPAN CONCRETE SLAB BRIDGE

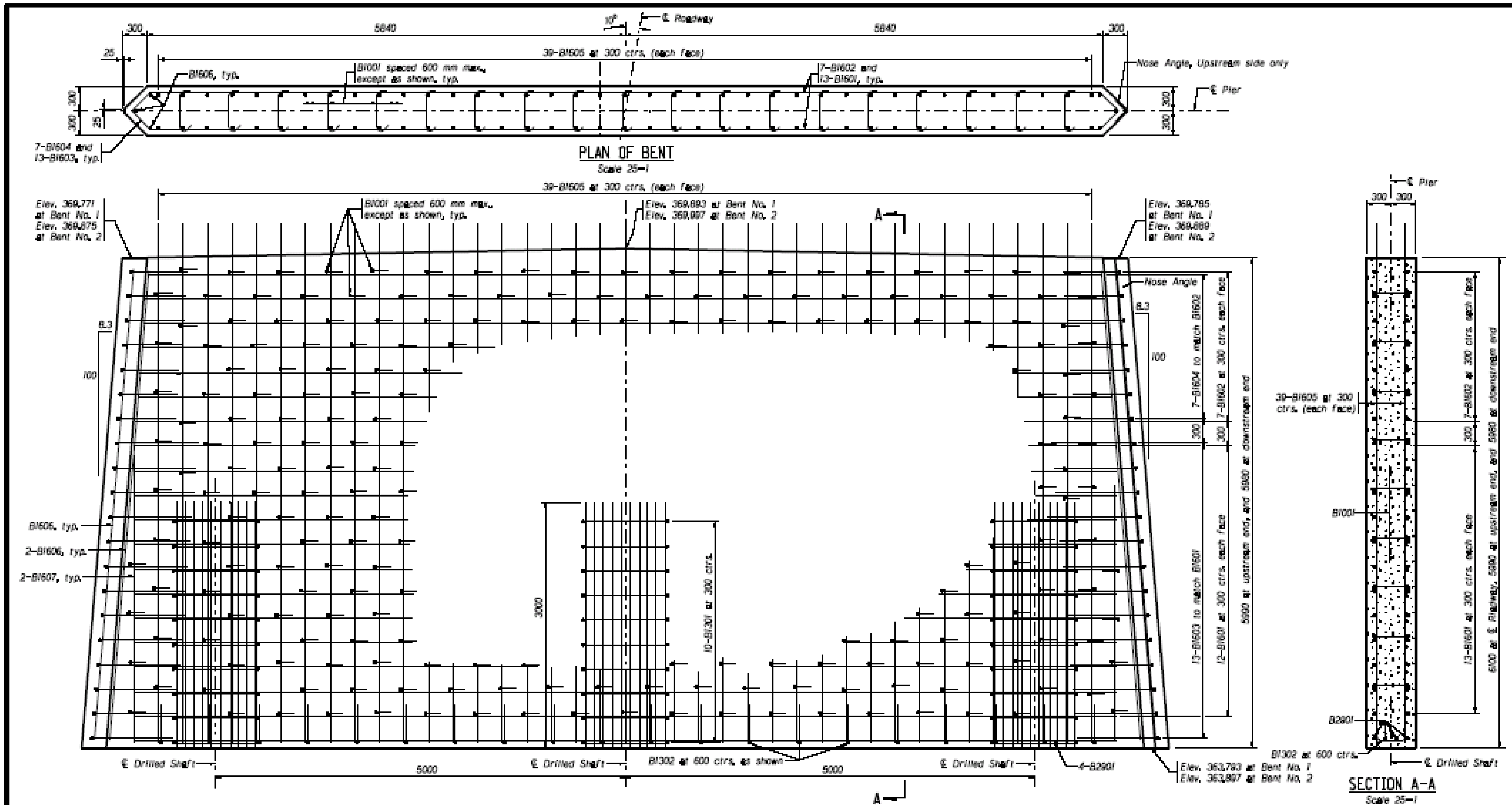
ABUTMENT SECTIONS, BILL OF BARS, AND GRANULAR BACKFILL DETAILS

DATE June 2001

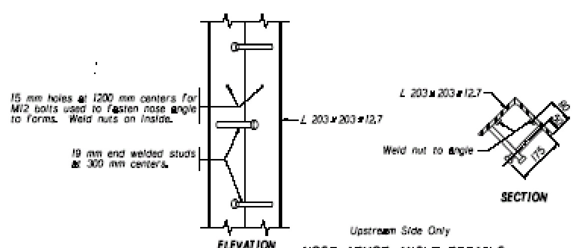
COUNTY Lancaster
LOCATION Roca spur
SKEW 10° LHB
ROADWAY 10.8 m
DESIGN LIVE LOAD MS18
STA. 46+12
REF. POST. 2.29
HWY. NO. S55
DESIGNED BY CRP
DETAILED BY CRP
CHECKED BY FJ

STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION

6 / 15



Note: For detail of Drilled Shaft reinforcing embedded in Bent wall, see "SECTION C-C" on sheet 4 of 13.



NOSE ARMOR ANGLE DETAILS

BAR SETS				
MARK	MAX. LENGTH	MIN. LENGTH	NO. OF SETS	BARS PER SET
B1602	11950	11650	2	7
·	·	·	·	·
·	·	·	·	·

BILL OF BARS

	MARK	NO.	LENGTH	TYPE	"A"	"B"	"C"	"D"	"E"	"F"		PIN	HOOK	MASS kg
BENT	B2901	4	12800	STR.	·	·	·	·	·	·	·	·	·	243
	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	B1601	24	12800	STR.	·	·	·	·	·	·	·	·	·	447
	B1602	14	11800 Avg.	STR.	·	·	·	·	·	·	·	·	·	256
	B1603	26	2190	128	786	310	310	220	220	·	·	50	·	88
	B1604	14	1620	128	500	310	310	220	220	·	·	50	·	35
	B1605	78	6320	STR.	·	·	·	·	·	·	·	·	·	765
	B1606	6	5750	STR.	·	·	·	·	·	·	·	·	·	54
	B1607	4	3160	STR.	·	·	·	·	·	·	·	·	·	20
	B1301	30	3260	197	450	1065	·	·	·	·	·	40	105	97
	B1302	20	1310	193	450	410	450	·	·	·	·	40	·	26
	B1001	321	680	118	·	440	·	·	·	·	·	40	70/90	108

SUBTOTAL (for one bent) = 2139 Kg

NOTE: FOR PIN DIAMETERS, HOOK LENGTHS, & BENDING DIAGRAMS, SEE SHEET 15 OF 15.

TOTAL (for both bents) = 4278 Kg

ALL STATIONS AND ELEVATIONS ARE METERS (m). ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

SS55F(102)
11853
SS55F00229

36.6 m THREE SPAN CONCRETE SLAB BRIDGE
BENT DETAILS AND BILL OF BARS

COUNTY Lancaster
HWY. NO. SS55
REF. POST. 2.29
STA. 46+12
LOCATION Roca spur
SKEW 10° LHB
ROADWAY 10.8 m
DESIGN LIVE LOAD MS18
DESIGNED BY CRP
DETAILED BY CRP
CHECKED BY FJ
DATE June 2001

STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION

Nebraska

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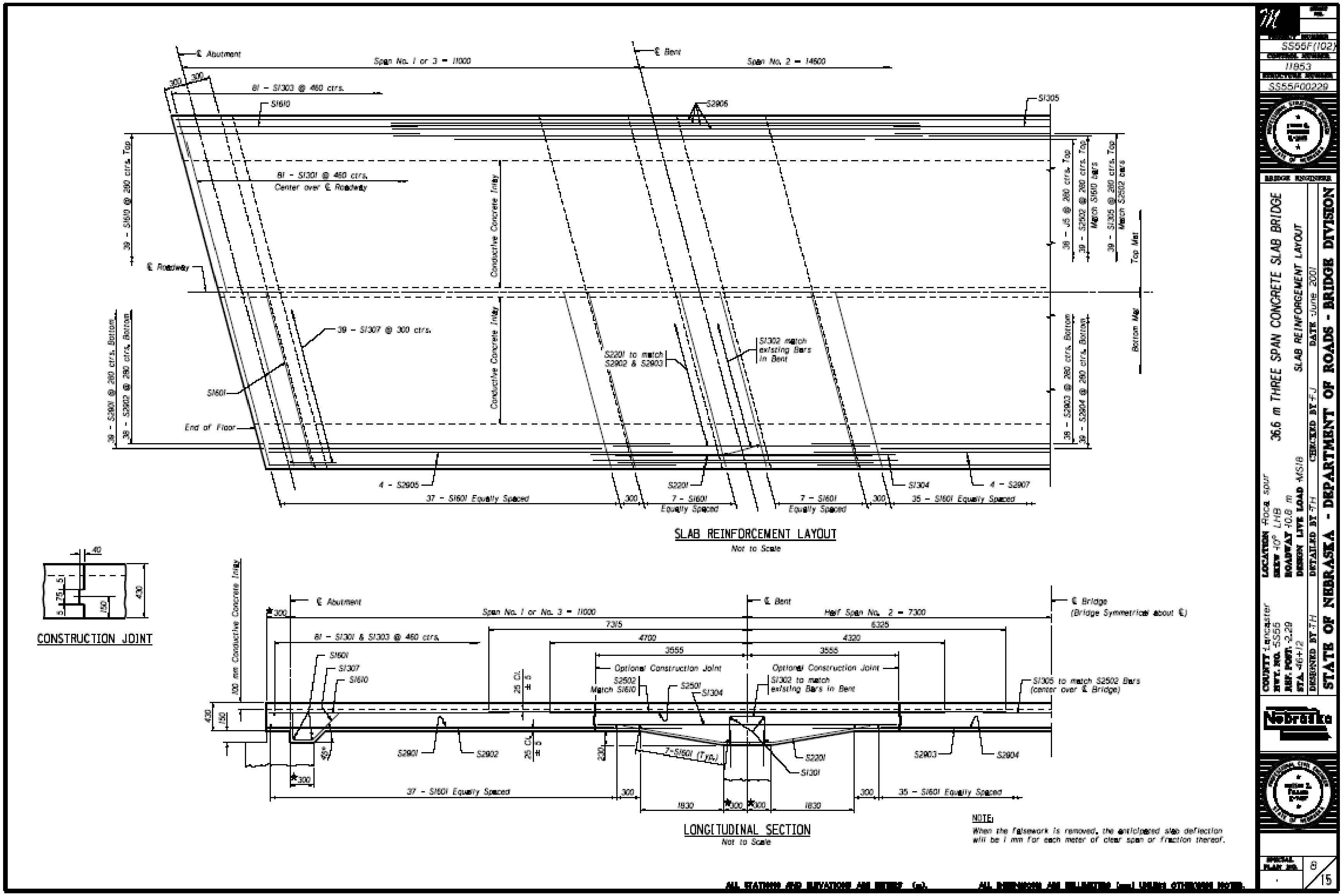
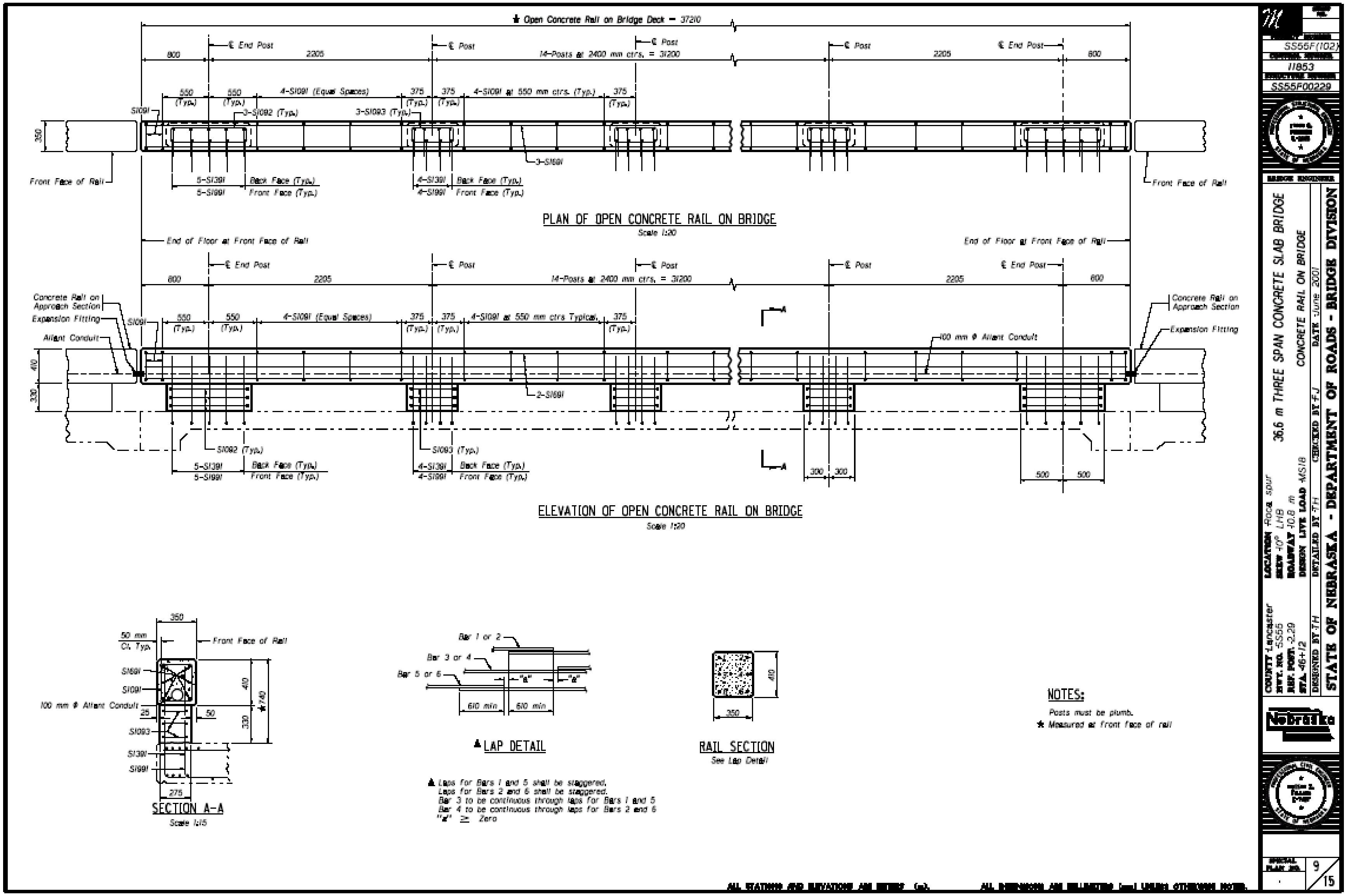
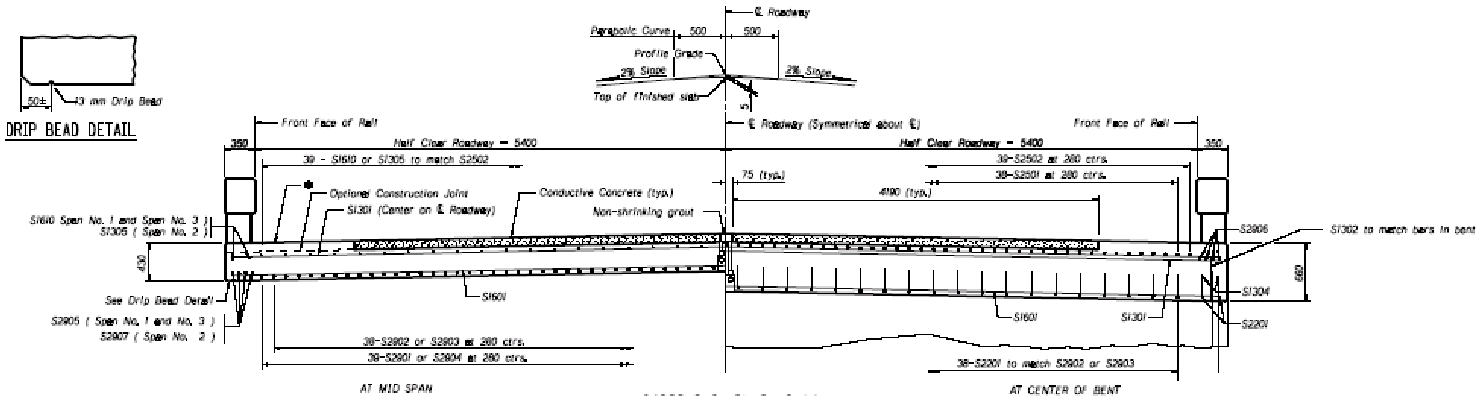

SLAB REINFORCEMENT LAYOUT
Not to Scale
CONSTRUCTION JOINT
LONGITUDINAL SECTION
Not to Scale
NOTE:
When the falsework is removed, the anticipated slab deflection will be 1 mm for each meter of clear span or fraction thereof.
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
SLAB REINFORCEMENT LAYOUT
STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION
SS55F(102)
11853
S55F00229



PLAN OF OPEN CONCRETE RAIL ON BRIDGE
Scale 1:20
ELEVATION OF OPEN CONCRETE RAIL ON BRIDGE
Scale 1:20
SECTION A-A
Scale 1:15
LAP DETAIL
RAIL SECTION
See Lap Detail
NOTES:
Posts must be plumb.
★ Measured at front face of rail
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
CONCRETE RAIL ON BRIDGE
STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION
SS55F(102)
11853
SS55F00229



CROSS SECTION OF SLAB

BILL OF BARS													MASS
MARK	NO.	LENGTH	TYPE	"A"	"B"	"C"	"D"	"E"	"F"		PIN	HOOK	kg
S2901	78	8740	STR	·	·	·	·	·	·	·	·	·	3450
S2902	76	9525	STR	·	·	·	·	·	·	·	·	·	3863
S2903	38	11560	STR	·	·	·	·	·	·	·	·	·	2227
S2904	39	8740	STR	·	·	·	·	·	·	·	·	·	1725
S2905	16	9520	STR	·	·	·	·	·	·	·	·	·	771
S2906	16	13640	STR	·	·	·	·	·	·	·	·	·	1104
S2907	8	11560	STR	·	·	·	·	·	·	·	·	·	469
·	·	·	·	·	·	·	·	·	·	·	·	·	·
S2601	76	9020	STR	·	·	·	·	·	·	·	·	·	2724
S2602	78	13640	STR	·	·	·	·	·	·	·	·	·	4227
·	·	·	·	·	·	·	·	·	·	·	·	·	·
S2201	86	4710	186	2065	580	260	260	2065	·	·	135	·	1202
·	·	·	·	·	·	·	·	·	·	·	·	·	·
S1991	132	1660	184	1060	600	·	·	·	·	·	115	·	487
·	·	·	·	·	·	·	·	·	·	·	·	·	·
S1601	141	11510	STR	·	·	·	·	·	·	·	·	·	2519
S1610	86	4750	STR	·	·	·	·	·	·	·	·	·	694
·	·	·	·	·	·	·	·	·	·	·	·	·	·
S1691	12	38940	STR	·	Includes	3 - 610	mm Laps	·	·	·	·	·	725
·	·	·	·	·	·	·	·	·	·	·	·	·	·
S1301	85	11510	STR	·	·	·	·	·	·	·	·	·	973
S1302	78	1440	183	580	440	560	·	·	·	·	50	·	112
·	·	·	·	·	·	·	·	·	·	·	·	·	·
S1304	8	7000	STR	·	·	·	·	·	·	·	·	·	56
S1305	43	3710	STR	·	·	·	·	·	·	·	·	·	159
S1307	78	1095	119	250	350	485	350	·	·	·	50	·	85
·	·	·	·	·	·	·	·	·	·	·	·	·	·
S1391	132	1360	184	1060	400	·	·	·	·	·	80	·	178
·	·	·	·	·	·	·	·	·	·	·	·	·	·
S1091	136	1300	187	310	250	·	·	·	·	·	40	90	99
S1092	12	2330	187	990	175	·	·	·	·	·	40	90	16
S1093	84	1530	187	580	175	·	·	·	·	·	40	90	72
·	·	·	·	·	·	·	·	·	·	·	·	·	·
·	·	·	·	·	·	·	·	·	·	·	·	·	·
·	·	·	·	·	·	·	·	·	·	·	·	·	·
·	·	·	·	·	·	·	·	·	·	·	·	·	·
										SUBTOTAL =		27707	Kg
										TOTAL =		27707	Kg

NOTE: FOR PIN DIAMETERS, HOOK LENGTHS & BENDING DIAGRAMS SEE SHEET 15 OF 15.

● As an alternate, the contractor may extend the 100 mm Conductive Concrete surface to the edge of the deck.
If the Conductive Concrete is extended to the edge of the deck, a continuous saw cut is required 4265 mm left and right of center line of roadway, extending the entire length of the bridge deck. The saw cut must penetrate completely through the Conductive Concrete and be filled with joint sealant.

ALL STATIONS AND ELEVATIONS ARE METERS (m). ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

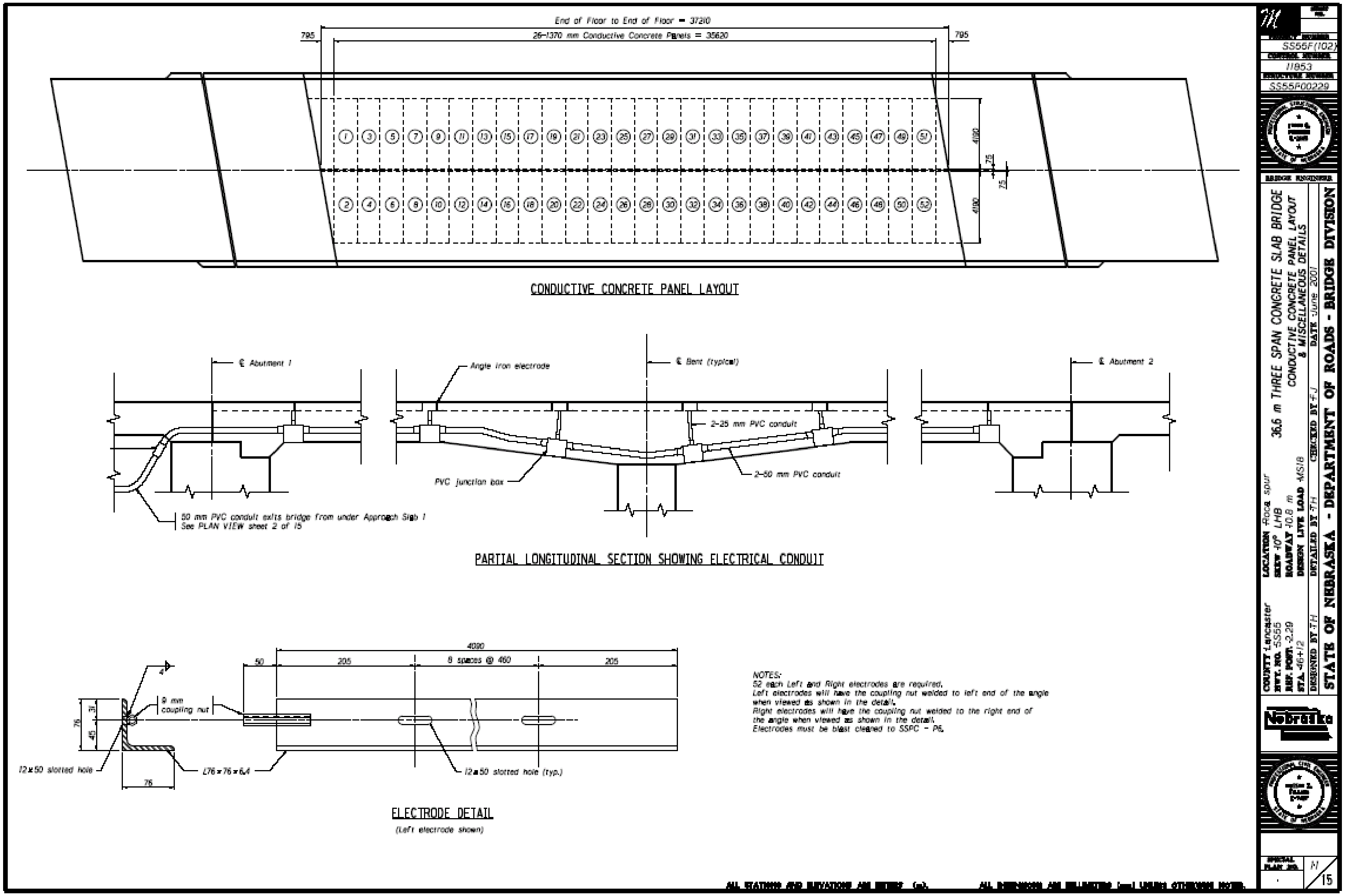
PROJECT NUMBER SS55F(102)
CONTROL NUMBER 11853
STRUCTURE NUMBER S55F00229

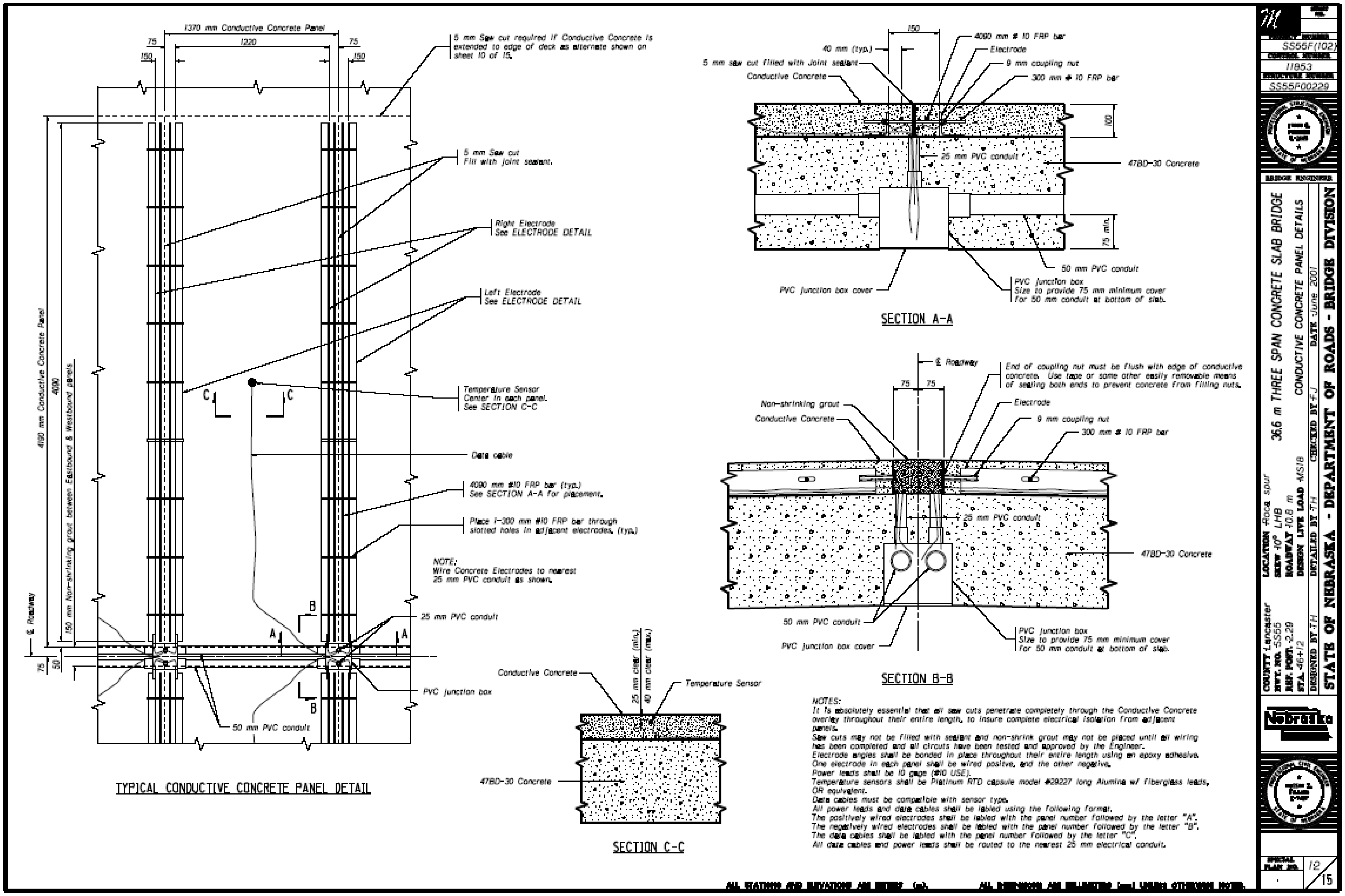
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
CROSS SECTION OF SLAB & BILL OF BARS

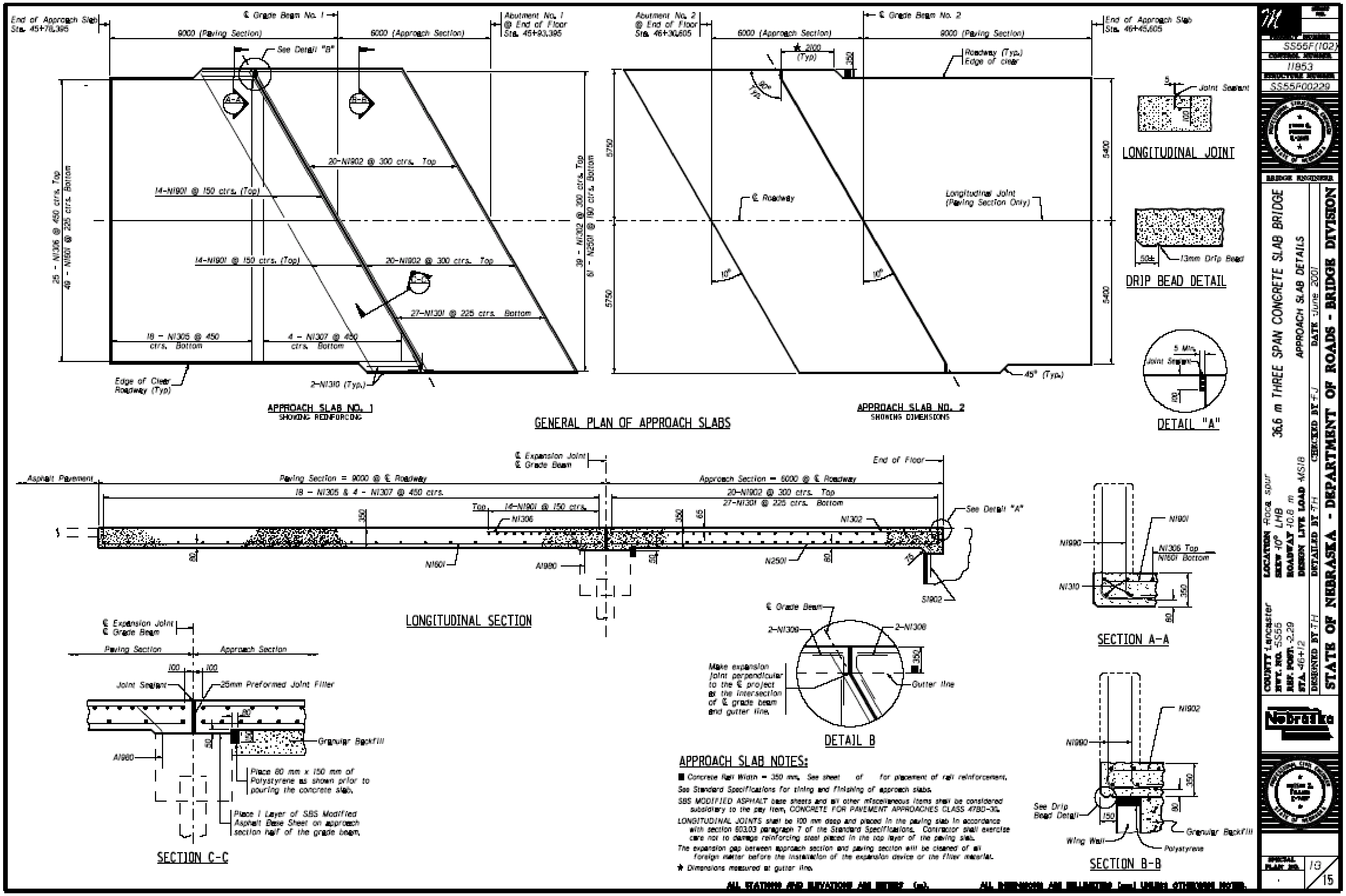
COUNTY Lancaster | LOCATION Roca spur
HWY. NO. S55 | SKEW 10° LHB
REF. POST 2.29 | ROADWAY 10.8 m
STA. 46+12 | DESIGN LIVE LOAD MS18
DESIGNED BY TH | DETAILED BY TH | CHECKED BY FJ | DATE June 2001

STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION

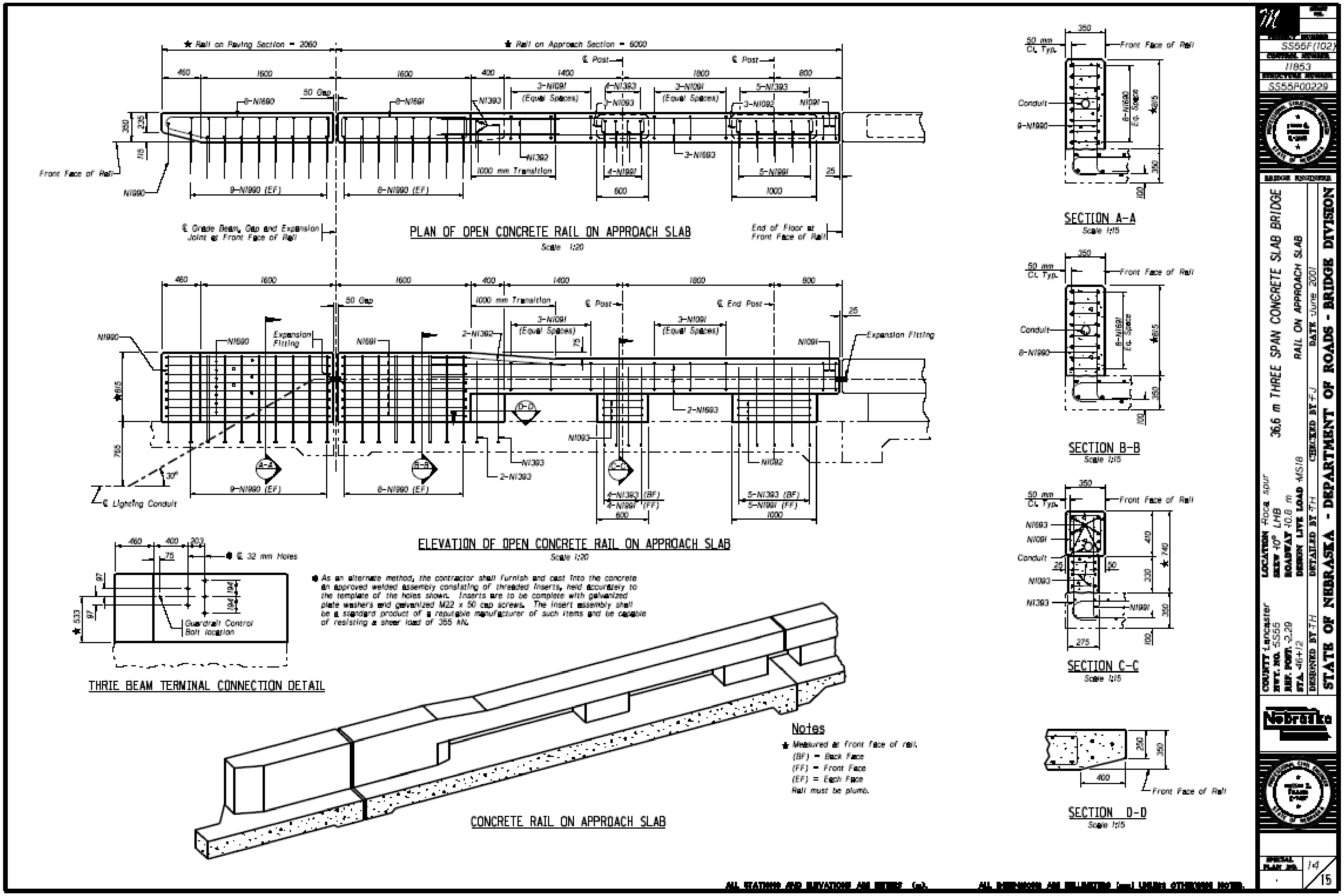
SHEET NO. 10/15


End of Floor to End of Floor = 37210
795
26-1370 mm Conductive Concrete Panels = 35620
795
CONDUCTIVE CONCRETE PANEL LAYOUT
℄ Abutment 1
Angle iron electrode
℄ Bent (typical)
℄ Abutment 2
2-25 mm PVC conduit
PVC junction box
2-50 mm PVC conduit
50 mm PVC conduit exits bridge from under Approach Slab 1
See PLAN VIEW sheet 2 of 15
PARTIAL LONGITUDINAL SECTION SHOWING ELECTRICAL CONDUIT
4090
50
205
8 spaces @ 460
205
9 mm coupling nut
12 x 50 slotted hole
L76 x 76 x 6.4
12 x 50 slotted hole (typ.)
76
ELECTRODE DETAIL
(Left electrode shown)
NOTES:
52 each Left and Right electrodes are required.
Left electrodes will have the coupling nut welded to left end of the angle when viewed as shown in the detail.
Right electrodes will have the coupling nut welded to the right end of the angle when viewed as shown in the detail.
Electrodes must be blast cleaned to SSPC - P6.
SS55F(102)
11853
SS55F00229
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
CONDUCTIVE CONCRETE PANEL LAYOUT
& MISCELLANEOUS DETAILS
DATE June 2001
COUNTY Lancaster
LOCATION Roca spur
STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION
11
15


1370 mm Conductive Concrete Panel
75
1220
75
150
150
5 mm Saw cut required if Conductive Concrete is extended to edge of deck as alternate shown on sheet 10 of 15.
5 mm Saw cut
Fill with joint sealant.
Right Electrode
See ELECTRODE DETAIL
Left Electrode
See ELECTRODE DETAIL
Temperature Sensor
Center in each panel.
See SECTION C-C
Data cable
4090 mm #10 FRP bar (typ.)
See SECTION A-A for placement.
Place 1-300 mm #10 FRP bar through slotted holes in adjacent electrodes. (typ.)
NOTE:
Wire Concrete Electrodes to nearest 25 mm PVC conduit as shown.
25 mm PVC conduit
PVC junction box
50 mm PVC conduit
4090 mm Conductive Concrete Panel
4090
150 mm Non-shrinking grout between Eastbound & Westbound panels
℄ Roadway
TYPICAL CONDUCTIVE CONCRETE PANEL DETAIL
150
40 mm (typ.)
5 mm saw cut filled with joint sealant
Conductive Concrete
4090 mm # 10 FRP bar
Electrode
9 mm coupling nut
300 mm # 10 FRP bar
100
25 mm PVC conduit
47BD-30 Concrete
75 min.
50 mm PVC conduit
PVC junction box
Size to provide 75 mm minimum cover for 50 mm conduit at bottom of slab.
PVC junction box cover
SECTION A-A
℄ Roadway
75
75
End of coupling nut must be flush with edge of conductive concrete. Use tape or some other easily removable means of sealing both ends to prevent concrete from filling nuts.
Non-shrinking grout
Conductive Concrete
Electrode
9 mm coupling nut
300 mm # 10 FRP bar
25 mm PVC conduit
47BD-30 Concrete
50 mm PVC conduit
PVC junction box cover
PVC junction box
Size to provide 75 mm minimum cover for 50 mm conduit at bottom of slab.
SECTION B-B
Conductive Concrete
25 mm clear (min.)
40 mm clear (max.)
Temperature Sensor
47BD-30 Concrete
SECTION C-C
NOTES:
It is absolutely essential that all saw cuts penetrate completely through the Conductive Concrete overlay throughout their entire length, to insure complete electrical isolation from adjacent panels.
Saw cuts may not be filled with sealant and non-shrink grout may not be placed until all wiring has been completed and all circuits have been tested and approved by the Engineer.
Electrode angles shall be bonded in place throughout their entire length using an epoxy adhesive.
One electrode in each panel shall be wired positive, and the other negative.
Power leads shall be 10 gage (#10 USE).
Temperature sensors shall be Platinum RTD capsule model #29227 long Alumina w/ fiberglass leads, OR equivalent.
Data cables must be compatible with sensor type.
All power leads and data cables shall be labled using the following format.
The positively wired electrodes shall be labled with the panel number followed by the letter "A".
The negatively wired electrodes shall be labled with the panel number followed by the letter "B".
The data cables shall be labled with the panel number followed by the letter "C".
All data cables and power leads shall be routed to the nearest 25 mm electrical conduit.
SS55F(102)
11853
SS55F00229
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
CONDUCTIVE CONCRETE PANEL DETAILS
COUNTY Lancaster
LOCATION Roca spur
DATE June 2001
STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION
12
15



APPROACH SLAB NO. 1
SHOWING REINFORCING
GENERAL PLAN OF APPROACH SLABS
APPROACH SLAB NO. 2
SHOWING DIMENSIONS
LONGITUDINAL JOINT
DRIP BEAD DETAIL
DETAIL "A"
LONGITUDINAL SECTION
SECTION A-A
SECTION C-C
DETAIL B
SECTION B-B
APPROACH SLAB NOTES:
See Standard Specifications for tining and finishing of approach slabs.
★ Dimensions measured at gutter line.
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
APPROACH SLAB DETAILS
STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION
Nebraska


PLAN OF OPEN CONCRETE RAIL ON APPROACH SLAB
Scale 1:20
ELEVATION OF OPEN CONCRETE RAIL ON APPROACH SLAB
Scale 1:20
THRIE BEAM TERMINAL CONNECTION DETAIL
CONCRETE RAIL ON APPROACH SLAB
SECTION A-A
Scale 1:15
SECTION B-B
Scale 1:15
SECTION C-C
Scale 1:15
SECTION D-D
Scale 1:15
Notes
★ Measured at front face of rail.
(BF) = Back Face
(FF) = Front Face
(EF) = Each Face
Rail must be plumb.
36.6 m THREE SPAN CONCRETE SLAB BRIDGE
RAIL ON APPROACH SLAB
STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION
SS55F(102)
11853
S55F00229
COUNTY Lancaster
DATE June 2001

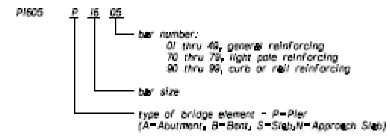
B I L L O F B A R S

Section	MARK	NUMBER OF BARS AP SLAB	NUMBER OF BARS CN RAIL	LENGTH	TYPE	"A"	"B"	"C"	"D"	"E"	"F"		PIN	HOOK	MASS kg
APPROACH 1	N2601	61	·	5815	STR.	·	·	·	·	·	·	·	·	·	1409
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	N1901	28	·	5910	111	·	5700	·	·	·	·	·	125	210	370
	N1802	40	·	6365	111	·	6145	·	·	·	·	·	125	210	568
	N1890	·	70	1640	104	820	820	·	·	·	·	·	·	·	257
	N1991	·	19	1500	104	900	600	·	·	·	·	·	·	·	60
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	N1601	49	·	6815 · Avg.	STR.	·	·	·	·	·	·	·	·	·	670
	N1690	·	16	4430	125	1520	420	1910	250	380	·	·	135/65	140	110
	N1691	·	16	3740	107	1480	250	·	·	·	·	·	65	140	93
	N1693	·	12	4700	STR	·	·	·	·	·	·	·	·	·	88
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	N1301	27	·	11510	STR.	·	·	·	·	·	·	·	·	·	389
	N1302	39	·	5845	STR.	·	·	·	·	·	·	·	·	·	227
	N1305	18	·	10640	STR.	·	·	·	·	·	·	·	·	·	190
	N1306	26	·	2000	STR.	·	·	·	·	·	·	·	·	·	50
	N1307	4	·	5565 · Avg.	STR.	·	·	·	·	·	·	·	·	·	22
	N1308	4	·	1460	119	260	600	690	·	580	·	·	·	·	6
	N1309	4	·	1200	104	660	600	·	·	·	·	·	·	·	5
	N1310	8		1965	STR.	·	·	·	·	·	·	·	·	·	16
						·	·	·	·	·	·	·	·	·	·
	N1392	·	4	1460	181	1160	300	25	·	·	·	·	65	·	6
	N1393	·	24	1300	104	900	250	·	·	·	·	·	80	·	31
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	N1091	·	16	1300	107	310	250	·	·	·	·	·	40	90	12
	N1892	·	6	2330	107	960	175	·	·	·	·	·	40	90	8
	N1893	·	6	1530	107	500	175	·	·	·	·	·	40	90	5
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
APPROACH 2	N2601	61	·	5815	STR.	·	·	·	·	·	·	·	·	·	1409
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	N1901	28	·	5910	111	·	5700	·	·	·	·	·	125	210	370
	N1802	40	·	6365	111	·	6145	·	·	·	·	·	125	210	568
	N1890	·	70	1640	104	820	820	·	·	·	·	·	·	·	257
	N1991	·	19	1500	104	900	600	·	·	·	·	·	·	·	60
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	N1601	49	·	6815 · Avg.	STR.	·	·	·	·	·	·	·	·	·	670
	N1690	·	16	4430	125	1520	480	1910	250	380	·	·	135/65	140	110
	N1691	·	16	3740	107	1480	250	·	·	·	·	·	65	140	93
	N1693	·	12	4700	STR	·	·	·	·	·	·	·	·	·	88
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	N1301	27	·	11510	STR.	·	·	·	·	·	·	·	·	·	389
	N1302	39	·	5845	STR.	·	·	·	·	·	·	·	·	·	227
	N1305	18	·	10640	STR.	·	·	·	·	·	·	·	·	·	190
	N1306	26	·	2000	STR.	·	·	·	·	·	·	·	·	·	50
	N1307	4	·	5565 · Avg.	STR.	·	·	·	·	·	·	·	·	·	22
	N1308	4	·	1460	119	260	600	690	·	580	·	·	·	·	6
	N1309	4	·	1200	104	660	600	·	·	·	·	·	·	·	5
	N1310	8		1965	STR.	·	·	·	·	·	·	·	·	·	16
						·	·	·	·	·	·	·	·	·	·
	N1392	·	4	1460	181	1160	300	25	·	·	·	·	65	·	6
	N1393	·	24	1300	104	900	250	·	·	·	·	·	80	·	31
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	N1091	·	16	1300	107	310	250	·	·	·	·	·	40	90	12
	N1892	·	6	2330	107	960	175	·	·	·	·	·	40	90	8
	N1893	·	6	1500	107	500	175	·	·	·	·	·	40	90	5
	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

SUBTOTAL = 4512 Kg

TOTAL = 9024 Kg

B A R M A R K



BAR SETS

MARK	MAX. LENGTH	MIN. LENGTH	NO. OF SETS	BARS PER SET
N1601	9755	7890	2	49
·	·	·	·	·
N1307	9395	1735	2	4
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·
·	·	·	·	·

STANDARD HOOK LENGTH

PRIMARY STRESS BARS BAR SIZE	HOOK H 90°	HOOK H 180°	STIRRUPS AND TIES BAR SIZE	HOOK H 90°	HOOK H 135°
13	170	155	10	70	90
16	215	180	13	90	115
19	260	210	16	115	140
22	305	250	19	260	200
25	345	280	22	305	230
29	410	380	25	345	260
32	460	425			
36	510	470			

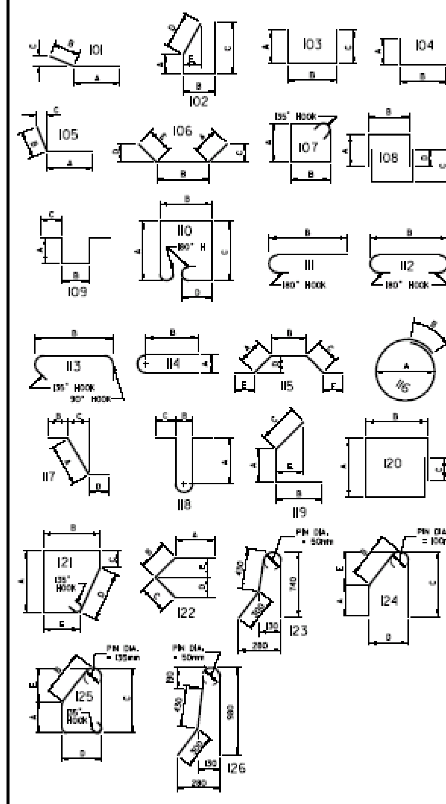
d = BAR SIZE
Dp = PIN DIAMETER

PIN DIAMETER

PRIMARY STRESS BAR SIZE	Dp	STIRRUP & TIES BAR SIZE	Dp
13	80	10	40
16	95	13	50
19	115	16	65
22	135	19	115
25	155	22	135
29	230	25	155
32	260		
36	285		

B E N D I N G D I A G R A M S

ALL DIMENSIONS ARE OUT TO OUT & NOT TO SCALE
ALL REINFORCING STEEL SHALL BE EPOXY COATED



ALL STATIONS AND ELEVATIONS ARE METERS (m). ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

SS55F(102)
11853
SS55F00229

36.6 m THREE SPAN CONCRETE SLAB BRIDGE
APPROACH SLAB BILL OF BARS AND BRIDGE BENDING DIAGRAMS

COUNTY Lancaster
HWY. NO. SS55
REF. POST. 2.29
STA. 46+12
LOCATION Roca spur
SKEW 10° LHB
ROADWAY 10.8 m
DESIGN LIVE LOAD MS18
DESIGNED BY TH
DETAILED BY TH
CHECKED BY FJ
DATE June 2001

STATE OF NEBRASKA - DEPARTMENT OF ROADS - BRIDGE DIVISION

15/15

APPENDIX B – Bridge Software User's Guide

Nebraska DOR

Roca Spur Bridge Application User's Guide

Teamwork Technology & Integration

Billing & Acc. Receivable:
TTI, Inc.
P.O. Box 307
Wellsburg, IA 50680-0307
Phone: 641-869-3704
Fax: 641-869-3651

Office Address:
TTI, Inc.
805 Buddy Holly Pl.
Clear Lake, IA 50428
Phone: 641-357-1406
Fax: 641-357-0739

1. Before Starting the Roca Spur Bridge Application

a. Connect the laptop to the ControlLogix with a null modem DB9 female-to-female cable.
b. Start RSLinx

i. Click: Start ⊠ Programs ⊠ Rockwell Software ⊠ RSLinx ⊠ RSLinx

2. Start The Roca Spur Bridge Application

a. Click: Start ⊠ Programs ⊠ Roca Spur Bridge ⊠ Roca Spur Bridge

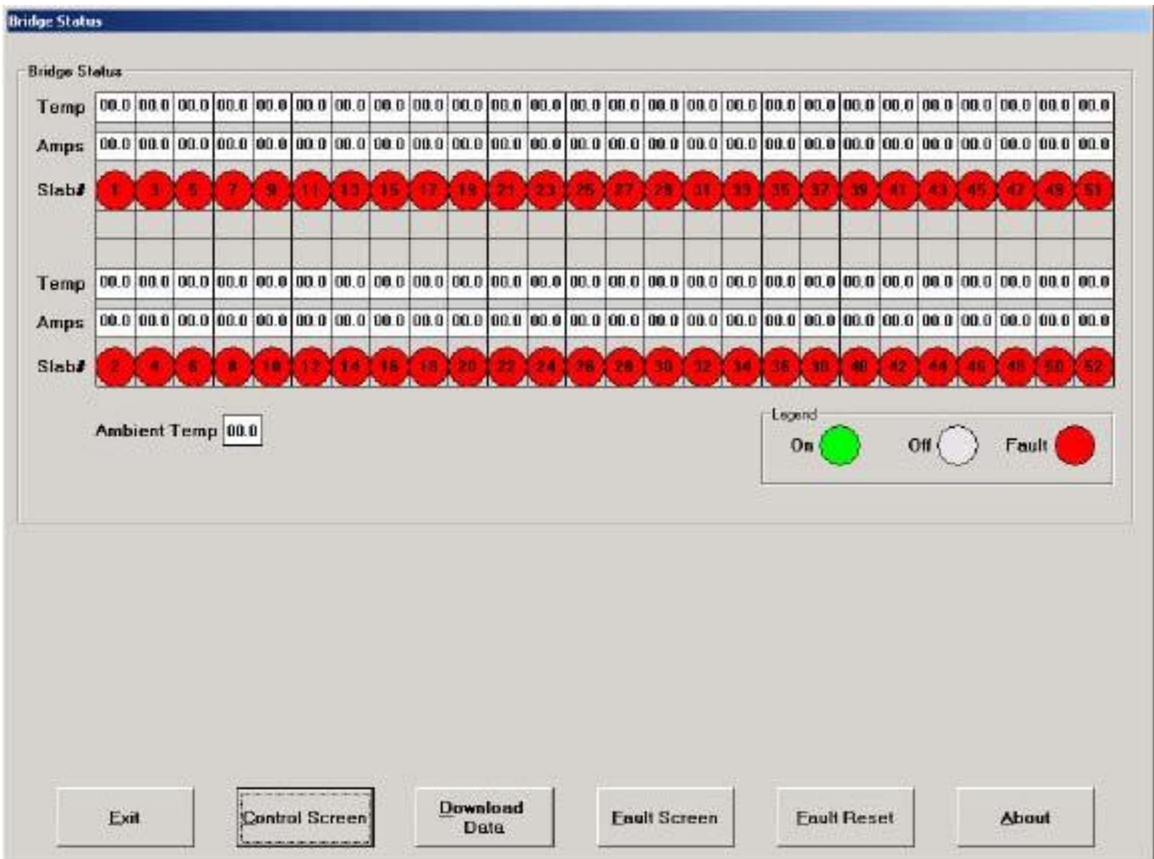
Note: The program will take a few moments to load and establish communication; please be patient. If the following message appears, the program is not communicating to the ControlLogix.

Check your cable connections, verify that RSLinx is running, and try opening the program again.

3. The Status Screen

a. The first screen that appears when the application is launched.
b. Features of the Status Screen:

i. Temperature reading of each slab
ii. Amperage reading of each slab
iii. Ambient temperature reading
iv. Status indicator for each slab
v. Function and navigation buttons



4. Control Screen

a. Features of the Control Screen
i. On/Off control buttons
ii. Temperature setpoints
iii. Amperage setpoints
b. Navigate to the Control Screen by clicking the “Control Screen” button on the Status Screen.
c. On/Off Control
i. Clicking the “Start” button will turn on the bridge.
ii. Clicking the “Stop” button will turn off the bridge.
iii. If the bridge is running, the “Start” button will be gray, and the “Stop”

button will be red.

iv. If the bridge is not running, the “Start” button will be green, and the “Stop” button will be gray.

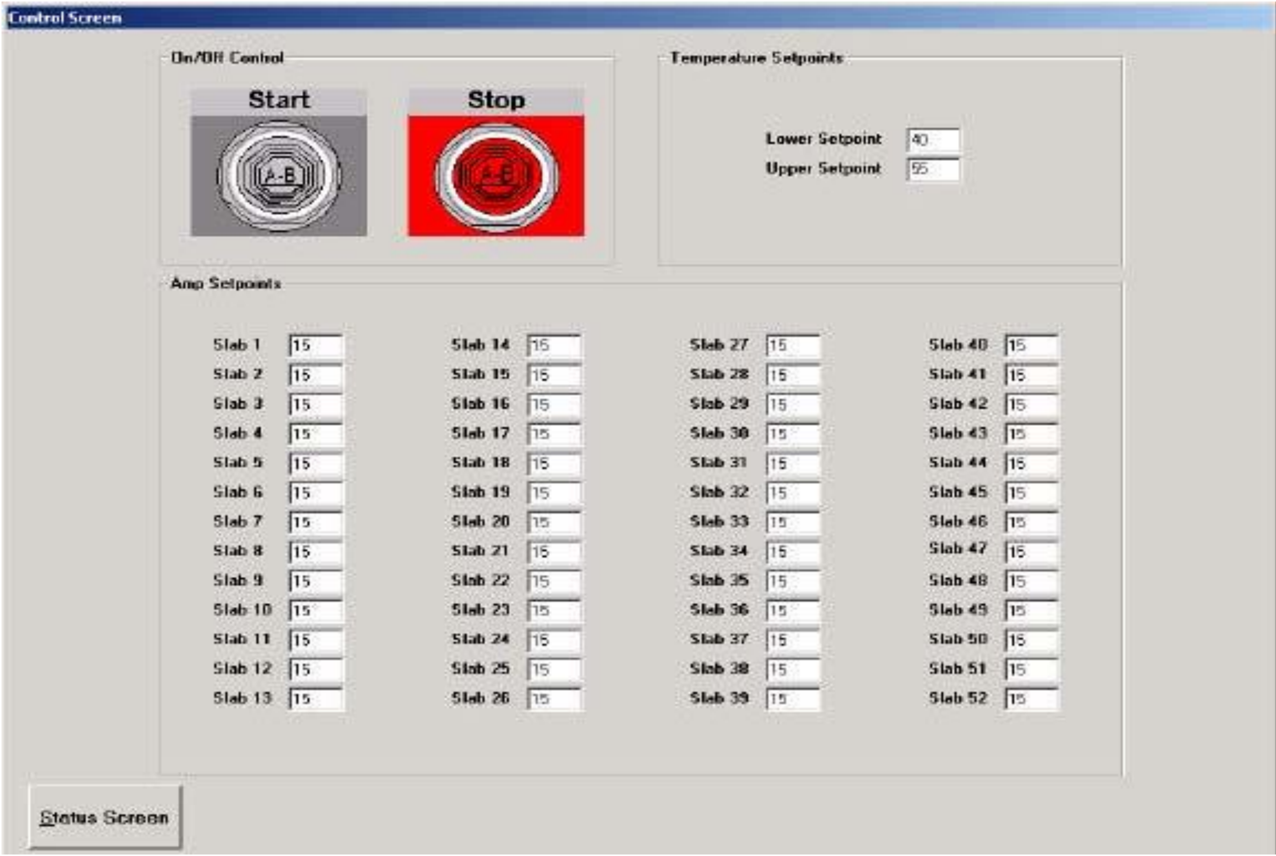
d. Adjusting Setpoints

i. Type a value into a temperature or amperage field.

ii. New settings will not take effect until the “Status Screen” button is pressed.

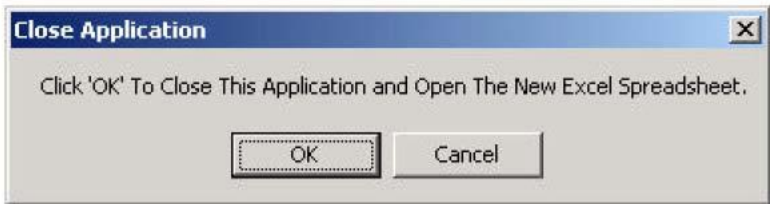
Screen appearance when the bridge is not running

Screen appearance when the bridge is running



5. Download Data

a. Clicking the "Download Data" button will download the previous 3 days of temperature and amperage data to an Excel spreadsheet.
b. This process will take between 10 and 20 minutes.
c. Text on the Status Screen will indicate the progress of the download.
d. A message box, confirming a completed download, will appear when the download is finished.
e. The new Excel file will be located in the "C:\Program Files\Bridge\Data' directory.
f. The new Excel file will be named 'Bridge Data MMDDYY HHmm'. For example: If the download finished on April 8, 2003 at 8:33 AM, the file will be called 'Bridge Data 040803 0833'.
g. Before the excel file can be opened, the Bridge Application must be closed. The user will be prompted to do this.

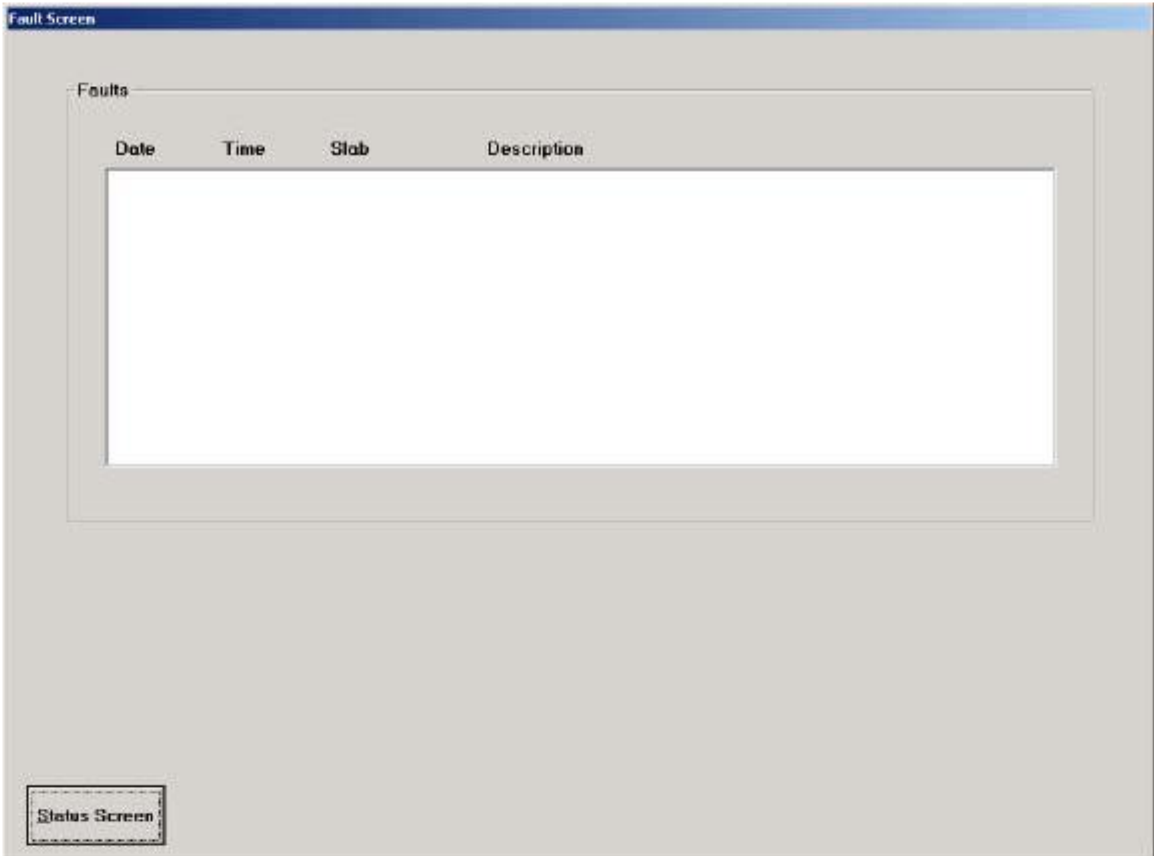


6. Fault Screen

a. Displays a list of the last 25 faults that occurred in the operation of the bridge.

i. Date of fault
ii. Time of fault
iii. Slab number of fault
iv. Description of fault

b. Navigate to the Fault Screen by clicking the “Fault Screen” button.
c. The faults may take a few minutes to download.
d. Exit by clicking the “Status Screen” button.



7. Resetting Faults

a. Clicking the "Fault Reset" button on the Status Screen will reset faults.
b. Faults will be reset, but they will still appear in the fault history list in the Fault Screen.

8. Closing Your Bridge Session

a. Click the "Exit" button on the Status Screen.
b. Close RSLinx.

APPENDIX C – Weather Data

STATION: LINCOLN
MONTH: DECEMBER
YEAR: 2003
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	43	30	37	6	28	0	0.00	0.0	0	5.0	12	350	M	M	6		14	350
2	43	25	34	3	31	0	0.09	0.0	0	10.4	22	130	M	M	6	1	25	140
3	35	31	33	3	32	0	T	T	T	7.5	14	70	M	M	10	1	16	80
4	37	31	34	4	31	0	0.01	T	0	9.2	31	330	M	M	10	18	43	350
5	31	19	25	-5	40	0	0.00	0.0	0	17.0	38	330	M	M	10	1	45	330
6	32	18	25	-4	40	0	0.00	0.0	0	10.3	20	170	M	M	5	1	24	170
7	47	29	38	9	27	0	0.00	0.0	0	10.5	22	190	M	M	0	1	24	170
8	46	21	34	5	31	0	T	T	0	9.9	22	20	M	M	4	1	25	20
9	33	18	26	-2	39	0	0.40	6.5	0	22.4	31	340	M	M	10	128	37	350
10	23	6	15	-13	50	0	0.00	0.0	6	14.3	28	340	M	M	1	8	32	340
11	19	5	12	-16	53	0	T	T	6	4.2	12	70	M	M	6	1	13	70
12	20	-2	9	-18	56	0	0.00	0.0	5	1.9	8	180	M	M	1	18	9	170
13	28	13	21	-6	44	0	T	0.1	5	6.7	15	160	M	M	10	18	16	170
14	32	23	28	1	37	0	0.00	0.0	2	13.0	22	200	M	M	5	18	26	190
15	35	26	31	4	34	0	0.01	0.2	1	15.6	33	330	M	M	8	189	41	320
16	37	17	27	1	38	0	0.00	0.0	1	13.2	39	340	M	M	4		44	340
17	43	15	29	3	36	0	0.01	0.0	1	10.3	37	330	M	M	3		47	330
18	47	33	40	14	25	0	0.00	0.0	T	17.2	35	330	M	M	1		41	330
19	42	24	33	8	32	0	0.00	0.0	0	6.9	16	330	M	M	0		20	310
20	46	22	34	9	31	0	0.00	0.0	0	11.7	22	190	M	M	0		25	200
21	53	35	44	19	21	0	0.00	0.0	0	6.3	18	210	M	M	0		22	210
22	50	28	39	14	26	0	0.00	0.0	0	8.8	20	10	M	M	6		22	360
23	37	15	26	2	39	0	0.00	0.0	0	7.9	15	310	M	M	0		20	320

```
24  40  12  26   2  39   0 0.00  0.0    0  5.6 15 200   M    M   0 1     17 190
25  48  23  36  12  29   0 0.00  0.0    0 11.2 20 160   M    M   0       23 160
26  50  34  42  18  23   0 0.00  0.0    0 15.6 25 160   M    M   6 8     31 160
27  56  33  45  21  20   0 0.00  0.0    0 15.6 29 180   M    M   2 1     37 180
28  43  24  34  11  31   0 0.00  0.0    0 10.7 22 290   M    M   3       26 280
29  42  22  32   9  33   0    T    T    0  7.6 18 310   M    M   3       23 320
30  49  19  34  11  31   0 0.00  0.0    0  9.8 23 210   M    M   1       26 190
31  39  15  27   4  38   0 0.00  0.0    0  6.7 13 120   M    M   0       16 100
================================================================================
SM 1226  664      1065   0  0.52     6.8 323.1          M      121
================================================================================
AV 39.5 21.4                              10.4 FASTST  PSBL  %   4    MAX(MPH)
                                 MISC ---->    39 340                 47  330
================================================================================
NOTES:
# LAST OF SEVERAL OCCURRENCES
COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2
                                          STATION:  LINCOLN
                                          MONTH:    DECEMBER
                                          YEAR:     2003
                                          LATITUDE:   40 50 N
                                          LONGITUDE:  96 45 W
[TEMPERATURE DATA]      [PRECIPITATION DATA]       SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY: 30.5   TOTAL FOR MONTH:   0.52    1 = FOG
DPTR FM NORMAL:   4.0   DPTR FM NORMAL:   -0.34    2 = FOG REDUCING VISIBILITY
HIGHEST:    56 ON 27    GRTST 24HR  0.40 ON  9- 9      TO 1/4 MILE OR LESS
LOWEST:     -2 ON 12                               3 = THUNDER
                        SNOW, ICE PELLETS, HAIL    4 = ICE PELLETS
                        TOTAL MONTH:   6.8 INCHES  5 = HAIL
                        GRTST 24HR   6.5 ON  9- 9  6 = GLAZE OR RIME
                        GRTST DEPTH:   6 ON 11,10  7 = BLOWING DUST OR SAND:
                                                       VSBY 1/2 MILE OR LESS
```

```
                                                          8 = SMOKE OR HAZE
[NO. OF DAYS WITH]       [WEATHER - DAYS WITH]            9 = BLOWING SNOW
                                                          X = TORNADO
MAX 32 OR BELOW:   7     0.01 INCH OR MORE:   5
MAX 90 OR ABOVE:   0     0.10 INCH OR MORE:   1
MIN 32 OR BELOW:  27     0.50 INCH OR MORE:   0
MIN  0 OR BELOW:   1     1.00 INCH OR MORE:   0
[HDD (BASE 65) ]
TOTAL THIS MO.  1065     CLEAR  (SCALE 0-3)  16
DPTR FM NORMAL  -123     PTCLDY (SCALE 4-7)   9
SEASONAL TOTAL  2314     CLOUDY (SCALE 8-10)  6
DPTR FM NORMAL  -163
[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0     [PRESSURE DATA]
SEASONAL TOTAL  1132     HIGHEST SLP 30.68 ON  1
DPTR FM NORMAL   -22     LOWEST  SLP 29.40 ON 15
```

STATION: LINCOLN
MONTH: JANUARY
YEAR: 2004
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	56	21	39	16	26	0	0.00	0.0	0	5.8	14	260	M	M	0		16	260
2	63	26	45	22	20	0	0.00	0.0	0	7.4	23	10	M	M	2	12	26	10
3	31	19	25	3	40	0	0.01	0.2	0	17.7	24	30	M	M	9		29	30
4	19	10	15	-7	50	0	0.28	4.8	2	18.1	29	10	M	M	10	1	35	20
5	10	-6	2	-20	63	0	T	T	5	11.8	21	360	M	M	4		24	10
6	13	-9	2	-20	63	0	0.00	0.0	5	6.0	15	230	M	M	0		18	270
7	29	-5	12	-10	53	0	0.00	0.0	4	5.3	21	180	M	M	0		25	180
8	31	15	23	1	42	0	0.00	0.0	4	7.2	21	350	M	M	5	18	24	360
9	27	13	20	-2	45	0	0.00	0.0	3	3.7	14	340	M	M	6	18	17	340
10	40	9	25	3	40	0	0.00	0.0	3	5.7	18	210	M	M	0	18	24	200
11	52	22	37	15	28	0	0.00	0.0	2	5.5	13	310	M	M	0		16	310
12	47	18	33	11	32	0	0.00	0.0	T	3.2	12	230	M	M	0	1	14	240
13	44	19	32	10	33	0	0.00	0.0	0	4.6	14	210	M	M	0	1	17	210
14	47	19	33	11	32	0	0.00	0.0	0	11.4	29	330	M	M	0		33	330
15	51	18	35	13	30	0	0.00	0.0	0	8.8	21	210	M	M	0	18	26	220
16	47	31	39	17	26	0	0.04	0.0	0	3.4	9	340	M	M	7	12	12	340
17	42	24	33	11	32	0	T	0.0	0	14.1	25	10	M	M	6	1	32	350
18	28	7	18	-4	47	0	0.00	0.0	0	13.9	24	10	M	M	0		30	20
19	23	3	13	-9	52	0	0.00	0.0	0	5.5	13	170	M	M	3		15	160
20	33	22	28	6	37	0	0.00	0.0	0	7.0	15	180	M	M	10		17	170
21	52	19	36	14	29	0	0.00	0.0	0	11.0	25	20	M	M	2		30	20
22	26	14	20	-2	45	0	0.00	0.0	0	9.9	23	360	M	M	6		26	20

23	62	26	44	22	21	0	0.00	0.0	0	12.5	24	300	M	M	0		29	310
24	34	23	29	6	36	0	0.00	0.0	0	12.7	18	110	M	M	5	18	22	80
25	26	21	24	1	41	0	0.28	4.5	0	10.6	16	100	M	M	10	16	21	100
26	21	2	12	-11	53	0	0.19	5.6	5	18.0	29	340	M	M	10	128	36	340
27	7	-8	0	-23	65	0	0.00	0.0	10	7.4	25	340	M	M	0		29	350
28	3	-8	-2	-25	67	0	0.00	0.0	10	10.1	20	10	M	M	2		23	10
29	3	-8	-2	-25	67	0	0.00	0.0	9	9.9	18	30	M	M	6		21	30
30	6	-7	0	-24	65	0	0.00	0.0	9	6.8	13	80	M	M	3		15	70
31	19	4	12	-12	53	0	0.01	0.2	9	7.8	15	70	M	M	6	18	17	80
SM	992	354			1333	0	0.81	15.3		282.7			M		112			
AV	32.0	11.4								9.1	FASTST		PSBL	%	4		MAX(MPH)	
								MISC ---->			29	330					36	340

NOTES:

LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: JANUARY
YEAR: 2004
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]
AVERAGE MONTHLY: 21.7
DPTR FM NORMAL: -0.7
HIGHEST: 63 ON 2
LOWEST: -9 ON 6

[PRECIPITATION DATA]
TOTAL FOR MONTH: 0.81
DPTR FM NORMAL: 0.14
GRTST 24HR 0.28 ON 25-25

SNOW, ICE PELLETS, HAIL
TOTAL MONTH: 15.3 INCHES
GRTST 24HR 5.6 ON 26-26
GRTST DEPTH: 10 ON 28,27

SYMBOLS USED IN COLUMN 16
1 = FOG
2 = FOG REDUCING VISIBILITY
TO 1/4 MILE OR LESS
3 = THUNDER
4 = ICE PELLETS
5 = HAIL
6 = GLAZE OR RIME
7 = BLOWING DUST OR SAND:

```
                                                                   VSBY 1/2 MILE OR LESS
                                                               8 = SMOKE OR HAZE
[NO. OF DAYS WITH]        [WEATHER - DAYS WITH]                9 = BLOWING SNOW
                                                               X = TORNADO
MAX 32 OR BELOW:  17      0.01 INCH OR MORE:   6
MAX 90 OR ABOVE:   0      0.10 INCH OR MORE:   3
MIN 32 OR BELOW:  31      0.50 INCH OR MORE:   0
MIN  0 OR BELOW:   7      1.00 INCH OR MORE:   0
[HDD (BASE 65) ]
TOTAL THIS MO.  1333      CLEAR  (SCALE 0-3)  17
DPTR FM NORMAL     5      PTCLDY (SCALE 4-7)   9
SEASONAL TOTAL  3647      CLOUDY (SCALE 8-10)  5
DPTR FM NORMAL  -158
[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0      [PRESSURE DATA]
SEASONAL TOTAL     0      HIGHEST SLP 30.76 ON  5
DPTR FM NORMAL     0      LOWEST  SLP 29.61 ON  2
```

STATION: LINCOLN
MONTH: FEBRUARY
YEAR: 2004
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	20	16	18	-6	47	0	0.30	4.6	8	9.4	15	20	M	M	10	12	18	20
2	18	8	13	-11	52	0	0.05	1.1	13	12.7	23	340	M	M	7	189	30	330
3	19	-7	6	-19	59	0	0.00	0.0	13	3.9	10	170	M	M	0	18	13	170
4	26	10	18	-7	47	0	0.02	0.4	12	9.8	17	130	M	M	9	1	22	120
5	26	22	24	-1	41	0	0.38	7.0	13	9.5	15	100	M	M	10	128	20	110
6	22	9	16	-10	49	0	0.02	0.4	18	15.0	25	330	M	M	9	18	29	330
7	13	-5	4	-22	61	0	T	T	17	8.1	18	320	M	M	2	8	21	330
8	34	-7	14	-12	51	0	T	0.0	15	15.7	36	230	M	M	2	168	44	240
9	34	13	24	-2	41	0	0.00	0.0	13	7.8	15	240	M	M	2		18	280
10	32	13	23	-4	42	0	0.00	0.0	12	9.1	16	210	M	M	1		20	220
11	36	12	24	-3	41	0	T	T	11	14.5	30	320	M	M	4		36	320
12	15	1	8	-19	57	0	0.00	0.0	10	10.3	21	330	M	M	1		23	330
13	32	4	18	-10	47	0	0.00	0.0	9	9.0	20	240	M	M	0		22	230
14	22	4	13	-15	52	0	0.00	0.0	9	11.1	24	20	M	M	0	18	26	20
15	17	-6	6	-22	59	0	0.00	0.0	9	5.2	10	10	M	M	0		12	10
16	36	9	23	-6	42	0	0.00	0.0	9	3.0	10	180	M	M	0	18	12	180
17	40	7	24	-5	41	0	0.00	0.0	8	5.7	17	190	M	M	1	18	20	190
18	43	30	37	8	28	0	0.00	0.0	7	10.1	24	210	M	M	0	18	30	200
19	50	28	39	9	26	0	0.00	0.0	6	7.6	23	340	M	M	2	18	28	340
20	47	33	40	10	25	0	T	0.0	5	17.7	31	330	M	M	4	18	37	340
21	49	22	36	6	29	0	T	0.0	2	6.4	15	170	M	M	2		17	170
22	56	28	42	11	23	0	0.00	0.0	T	9.1	18	190	M	M	5		22	180

```
23  40  26  33   2  32   0 0.00  0.0    T 12.9 21  20   M    M   7 18      26  50
24  34  31  33   2  32   0 0.00  0.0    T  9.6 15  70   M    M  10 18      17  70
25  40  22  31  -1  34   0 0.00  0.0    0  6.2 13 110   M    M   7 18      15 130
26  50  17  34   2  31   0 0.00  0.0    0  8.6 20 170   M    M   0 18      24 170
27  59  34  47  14  18   0 0.00  0.0    0 17.0 29 170   M    M   0         35 170
28  57  39  48  15  17   0 0.00  0.0    0 17.0 28 180   M    M   2         32 180
29  49  44  47  14  18   0 0.40  0.0    0 16.8 41 160   M    M  10 18      47 170
================================================================================
SM 1016  457      1142   0  1.17    13.5 298.8          M      107
================================================================================
AV 35.0 15.8                             10.3 FASTST  PSBL  %   4    MAX(MPH)
                                 MISC ---->    41 160                 47  170
================================================================================
NOTES:
# LAST OF SEVERAL OCCURRENCES
COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2
                                         STATION:  LINCOLN
                                         MONTH:    FEBRUARY
                                         YEAR:     2004
                                         LATITUDE:   40 50 N
                                         LONGITUDE:  96 45 W
[TEMPERATURE DATA]      [PRECIPITATION DATA]       SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY: 25.4   TOTAL FOR MONTH:   1.17    1 = FOG
DPTR FM NORMAL:  -2.9   DPTR FM NORMAL:    0.51    2 = FOG REDUCING VISIBILITY
HIGHEST:    59 ON 27    GRTST 24HR  0.40 ON 29-29      TO 1/4 MILE OR LESS
LOWEST:     -7 ON  8, 3                            3 = THUNDER
                        SNOW, ICE PELLETS, HAIL    4 = ICE PELLETS
                        TOTAL MONTH:  13.5 INCHES  5 = HAIL
                        GRTST 24HR   7.0 ON  5- 5  6 = GLAZE OR RIME
                        GRTST DEPTH:  18 ON  6     7 = BLOWING DUST OR SAND:
                                                       VSBY 1/2 MILE OR LESS
                                                   8 = SMOKE OR HAZE
```

```
[NO. OF DAYS WITH]       [WEATHER - DAYS WITH]       9 = BLOWING SNOW
                                                     X = TORNADO
MAX 32 OR BELOW:  12     0.01 INCH OR MORE:   6
MAX 90 OR ABOVE:   0     0.10 INCH OR MORE:   3
MIN 32 OR BELOW:  25     0.50 INCH OR MORE:   0
MIN  0 OR BELOW:   4     1.00 INCH OR MORE:   0
[HDD (BASE 65) ]
TOTAL THIS MO.  1142     CLEAR  (SCALE 0-3)  17
DPTR FM NORMAL    67     PTCLDY (SCALE 4-7)   6
SEASONAL TOTAL  4789     CLOUDY (SCALE 8-10)  6
DPTR FM NORMAL   -59
[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0     [PRESSURE DATA]
SEASONAL TOTAL     0     HIGHEST SLP 30.61 ON 12
DPTR FM NORMAL     0     LOWEST  SLP 29.36 ON 29
```

STATION: LINCOLN
MONTH: MARCH
YEAR: 2004
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	47	34	41	8	24	0	0.11	T	0	19.3	38	180	M	M	10	18	45	180
2	39	33	36	2	29	0	0.00	0.0	0	8.6	16	310	M	M	10	8	21	320
3	41	33	37	3	28	0	0.04	T	0	5.1	12	320	M	M	9	18	13	320
4	38	32	35	0	30	0	0.72	T	0	12.5	26	10	M	M	10	12	31	10
5	41	32	37	2	28	0	0.26	T	0	13.6	25	340	M	M	10	1	30	340
6	63	25	44	9	21	0	0.00	0.0	0	14.7	36	330	M	M	0	1	43	320
7	52	30	41	5	24	0	0.00	0.0	0	14.8	32	330	M	M	0		40	310
8	68	27	48	12	17	0	0.00	0.0	0	12.9	32	340	M	M	0		38	330
9	57	33	45	8	20	0	0.00	0.0	0	8.6	17	330	M	M	0		22	330
10	58	33	46	9	19	0	0.01	0.0	0	15.1	36	340	M	M	2	1	40	340
11	44	21	33	-4	32	0	0.00	0.0	0	15.0	32	330	M	M	0		38	330
12	59	15	37	-1	28	0	0.00	0.0	0	9.4	20	170	M	M	1		23	160
13	62	43	53	15	12	0	T	0.0	0	17.4	32	210	M	M	6	8	41	180
14	54	32	43	4	22	0	0.00	0.0	0	11.5	28	320	M	M	1		35	320
15	47	30	39	0	26	0	0.56	T	0	14.2	28	150	M	M	10	1	33	130
16	42	29	36	-3	29	0	T	T	T	7.2	17	210	M	M	7	18	20	220
17	58	29	44	4	21	0	T	T	0	4.9	15	50	M	M	4		17	50
18	56	38	47	7	18	0	T	0.0	0	10.9	21	360	M	M	3	1	24	350
19	74	34	54	13	11	0	0.00	0.0	0	17.1	32	200	M	M	3	18	38	200
20	61	34	48	7	17	0	0.00	0.0	0	18.3	31	10	M	M	0	18	38	20
21	44	23	34	-7	31	0	0.00	0.0	0	9.6	18	360	M	M	1		21	10
22	56	32	44	2	21	0	0.00	0.0	0	11.9	23	180	M	M	4		28	190

23	65	37	51	9	14	0	T	0.0	0	8.6	21	190	M	M	2	8	26	190
24	76	53	65	22	0	0	0.00	0.0	0	13.8	22	210	M	M	1	8	26	230
25	72	60	66	23	0	1	0.00	0.0	0	13.2	22	200	M	M	9	18	28	190
26	77	58	68	25	0	3	0.00	0.0	0	9.0	22	170	M	M	8	18	26	160
27	67	45	56	12	9	0	0.98	0.0	0	17.9	33	170	M	M	9	138	44	160
28	59	39	49	5	16	0	0.02	0.0	0	8.4	33	310	M	M	3	3	40	320
29	58	34	46	1	19	0	0.13	0.0	0	8.2	24	270	M	M	3	3	31	290
30	47	29	38	-7	27	0	0.00	0.0	0	9.3	21	10	M	M	3		25	330
31	54	23	39	-6	26	0	0.00	0.0	0	2.3	13	80	M	M	0	18	15	80
SM	1736	1050			619	4	2.83	T		363.4			M		129			
AV	56.0	33.9								11.7	FASTST		PSBL	%	4		MAX(MPH)	
								MISC ---->			38	180					45	180

NOTES:
LAST OF SEVERAL OCCURRENCES
COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2
STATION: LINCOLN
MONTH: MARCH
YEAR: 2004
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]
AVERAGE MONTHLY: 44.9
DPTR FM NORMAL: 5.5
HIGHEST: 77 ON 26
LOWEST: 15 ON 12

[PRECIPITATION DATA]
TOTAL FOR MONTH: 2.83
DPTR FM NORMAL: 0.62
GRTST 24HR 0.98 ON 27-27

SNOW, ICE PELLETS, HAIL
TOTAL MONTH: T
GRTST 24HR T ON 17-17
GRTST DEPTH: 0

SYMBOLS USED IN COLUMN 16
1 = FOG
2 = FOG REDUCING VISIBILITY
TO 1/4 MILE OR LESS
3 = THUNDER
4 = ICE PELLETS
5 = HAIL
6 = GLAZE OR RIME
7 = BLOWING DUST OR SAND:

VSBY 1/2 MILE OR LESS
8 = SMOKE OR HAZE
9 = BLOWING SNOW
X = TORNADO

[NO. OF DAYS WITH]		[WEATHER - DAYS WITH]	
MAX 32 OR BELOW:	0	0.01 INCH OR MORE:	9
MAX 90 OR ABOVE:	0	0.10 INCH OR MORE:	6
MIN 32 OR BELOW:	15	0.50 INCH OR MORE:	3
MIN 0 OR BELOW:	0	1.00 INCH OR MORE:	0
[HDD (BASE 65)]			
TOTAL THIS MO.	619	CLEAR (SCALE 0-3)	18
DPTR FM NORMAL	-180	PTCLDY (SCALE 4-7)	4
SEASONAL TOTAL	5408	CLOUDY (SCALE 8-10)	9
DPTR FM NORMAL	-239		
[CDD (BASE 65)]			
TOTAL THIS MO.	4		
DPTR FM NORMAL	3	[PRESSURE DATA]	
SEASONAL TOTAL	4	HIGHEST SLP M ON M	
DPTR FM NORMAL	3	LOWEST SLP M ON M	

STATION: LINCOLN
MONTH: DECEMBER
YEAR: 2004
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

	TEMPERATURE IN F:						:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	39	17	28	-3	37	0	0.00	0.0	T	2.0	8	330	M	M	0		9	340
2	45	21	33	2	32	0	0.00	0.0	T	4.7	17	260	M	M	0		23	270
3	47	19	33	3	32	0	0.00	0.0	0	6.8	15	260	M	M	1		18	280
4	57	25	41	11	24	0	0.00	0.0	0	5.2	17	250	M	M	0		25	250
5	39	25	32	2	33	0	0.42	0.0	0	4.4	12	140	M	M	5	12	14	140
6	39	34	37	8	28	0	0.00	0.0	0	3.7	13	190	M	M	10	12	14	220
7	35	27	31	2	34	0	0.00	0.0	0	6.9	20	310	M	M	9	12	22	310
8	47	25	36	7	29	0	0.00	0.0	0	1.9	14	150	M	M	1	12	18	150
9	54	23	39	11	26	0	T	0.0	0	7.8	23	340	M	M	5	12	30	340
10	40	25	33	5	32	0	0.00	0.0	0	17.3	29	330	M	M	8		36	320
11	48	17	33	5	32	0	0.00	0.0	0	6.9	18	180	M	M	1	1	22	180
12	51	32	42	15	23	0	0.00	0.0	0	19.0	37	340	M	M	1		40	330
13	32	11	22	-5	43	0	0.00	0.0	0	13.0	28	350	M	M	1		31	350
14	39	8	24	-3	41	0	0.00	0.0	0	7.5	16	190	M	M	0		21	200
15	44	26	35	8	30	0	0.00	0.0	0	11.9	24	220	M	M	0		32	210
16	51	21	36	10	29	0	0.00	0.0	0	4.7	17	340	M	M	0		20	320
17	49	19	34	8	31	0	0.00	0.0	0	4.2	13	280	M	M	2		15	290
18	49	20	35	9	30	0	0.00	0.0	0	11.5	31	340	M	M	3		37	340
19	20	2	11	-14	54	0	0.00	0.0	0	6.5	22	360	M	M	1		26	20
20	52	19	36	11	29	0	0.01	0.0	0	11.7	28	320	M	M	2		32	320
21	37	9	23	-2	42	0	0.00	0.0	0	13.0	25	310	M	M	0		33	300
22	18	3	11	-14	54	0	0.00	0.0	0	8.1	14	20	M	M	0		18	350

23	13	-4	5	-19	60	0	0.00	0.0	0	8.1	22	350	M	M	2		26	350
24	32	-4	14	-10	51	0	0.00	0.0	0	14.8	31	220	M	M	4		38	220
25	55	20	38	14	27	0	0.00	0.0	0	7.0	22	320	M	M	3		26	330
26	36	16	26	2	39	0	0.00	0.0	0	8.5	17	120	M	M	4	1	20	110
27	47	23	35	11	30	0	0.00	0.0	0	5.8	14	140	M	M	0	18	17	130
28	49	18	34	11	31	0	0.00	0.0	0	1.8	12	360	M	M	0	18	14	360
29	57	14	36	13	29	0	0.00	0.0	0	7.3	20	190	M	M	0	18	22	160
30	65	44	55	32	10	0	T	0.0	0	14.7	30	210	M	M	1		37	220
31	50	21	36	13	29	0	0.00	0.0	0	7.2	13	320	M	M	0		M	M
SM	1336	576			1051	0	0.43		0.0	253.9			M		64			

AV 43.1 18.6 8.2 FASTST PSBL % 2 MAX(MPH)

MISC ----> 37 340 40 330

NOTES:

\# LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: DECEMBER
YEAR: 2004
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]
AVERAGE MONTHLY: 30.8
DPTR FM NORMAL: 4.3
HIGHEST: 65 ON 30
LOWEST: -4 ON 24,23

[PRECIPITATION DATA]
TOTAL FOR MONTH: 0.43
DPTR FM NORMAL: -0.43
GRTST 24HR 0.42 ON 4- 5

SNOW, ICE PELLETS, HAIL
TOTAL MONTH: 0.0 INCH
GRTST 24HR 0.0
GRTST DEPTH: 0

SYMBOLS USED IN COLUMN 16
1 = FOG
2 = FOG REDUCING VISIBILITY
TO 1/4 MILE OR LESS
3 = THUNDER
4 = ICE PELLETS
5 = HAIL
6 = GLAZE OR RIME
7 = BLOWING DUST OR SAND:

VSBY 1/2 MILE OR LESS
8 = SMOKE OR HAZE
9 = BLOWING SNOW
X = TORNADO

[NO. OF DAYS WITH]		[WEATHER - DAYS WITH]	
MAX 32 OR BELOW:	5	0.01 INCH OR MORE:	2
MAX 90 OR ABOVE:	0	0.10 INCH OR MORE:	1
MIN 32 OR BELOW:	29	0.50 INCH OR MORE:	0
MIN 0 OR BELOW:	2	1.00 INCH OR MORE:	0
[HDD (BASE 65)]			
TOTAL THIS MO.	1051	CLEAR (SCALE 0-3)	24
DPTR FM NORMAL	-137	PTCLDY (SCALE 4-7)	4
SEASONAL TOTAL	2111	CLOUDY (SCALE 8-10)	3
DPTR FM NORMAL	-366		
[CDD (BASE 65)]			
TOTAL THIS MO.	0		
DPTR FM NORMAL	0	[PRESSURE DATA]	
SEASONAL TOTAL	992	HIGHEST SLP 30.78 ON 14	
DPTR FM NORMAL	-162	LOWEST SLP 29.44 ON 20	

STATION: LINCOLN
MONTH: JANUARY
YEAR: 2005
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

	TEMPERATURE IN F:					:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	45	23	34	11	31	0	T	0.0	0	13.3	21	340	M	M	10	1	24	350
2	29	15	22	-1	43	0	0.04	T	0	10.9	20	20	M	M	6	6	24	10
3	25	18	22	0	43	0	0.03	0.1	0	11.5	18	20	M	M	10	16	23	10
4	20	11	16	-6	49	0	0.34	2.5	T	16.6	29	20	M	M	10	16	32	20
5	11	4	8	-14	57	0	0.49	5.9	4	18.1	29	10	M	M	10	126	32	10
6	11	-8	2	-20	63	0	T	T	8	8.8	17	210	M	M	1	1	21	200
7	25	-1	12	-10	53	0	0.00	0.0	8	8.1	17	340	M	M	8	1	18	340
8	29	-9	10	-12	55	0	0.00	0.0	7	6.9	18	170	M	M	4	1	21	170
9	35	14	25	3	40	0	0.00	0.0	6	9.9	26	330	M	M	6	1	32	340
10	20	11	16	-6	49	0	0.00	0.0	5	10.0	16	20	M	M	7	18	21	60
11	22	17	20	-2	45	0	T	0.0	5	7.0	16	20	M	M	10	16	18	20
12	29	19	24	2	41	0	T	T	4	5.6	17	340	M	M	9	12	20	340
13	25	-6	10	-12	55	0	0.00	0.0	4	14.6	29	340	M	M	1		33	340
14	2	-7	-2	-24	67	0	0.10	2.0	5	7.6	14	10	M	M	10	1	16	10
15	4	-18	-7	-29	72	0	T	T	6	3.2	9	30	M	M	3		10	30
16	11	-18	-3	-25	68	0	0.00	0.0	6	1.2	6	20	M	M	1		6	330
17	24	-2	11	-11	54	0	0.00	0.0	6	6.4	16	170	M	M	4	18	18	170
18	39	6	23	1	42	0	0.00	0.0	6	15.0	31	210	M	M	1	18	39	200
19	41	26	34	12	31	0	0.00	0.0	4	6.2	14	310	M	M	0		16	310
20	48	27	38	16	27	0	0.00	0.0	2	4.9	16	30	M	M	1	1	20	30
21	38	27	33	11	32	0	0.00	0.0	T	13.9	41	340	M	M	10	1	52	340
22	27	5	16	-6	49	0	T	T	0	17.8	39	340	M	M	2	19	45	340

23	30	10	20	-2	45	0	0.00	0.0	0	13.3	25	190	M	M	3		29	210
24	55	22	39	16	26	0	0.00	0.0	0	2.7	13	210	M	M	0		15	210
25	58	26	42	19	23	0	0.00	0.0	0	5.4	14	350	M	M	0	1	16	350
26	36	26	31	8	34	0	0.00	0.0	0	11.3	20	20	M	M	8		25	20
27	32	25	29	6	36	0	0.00	0.0	0	10.9	16	130	M	M	10	18	21	140
28	36	27	32	9	33	0	T	T	0	8.8	15	150	M	M	8	18	17	150
29	39	26	33	10	32	0	T	T	0	2.6	8	40	M	M	9	18	9	40
30	36	32	34	10	31	0	0.03	T	0	2.1	7	150	M	M	10	1	7	130
31	40	32	36	12	29	0	T	0.0	0	1.5	9	140	M	M	10	128	13	120
SM	922	380			1355	0	1.03	10.5		276.1			M		182			
AV	29.7	12.3								8.9	FASTST		PSBL	%	6	MAX(MPH)		
							MISC ---->				41	340					52	340

NOTES:
LAST OF SEVERAL OCCURRENCES
COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: JANUARY
YEAR: 2005
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]
AVERAGE MONTHLY: 21.0
DPTR FM NORMAL: -1.4
HIGHEST: 58 ON 25
LOWEST: -18 ON 16,15

[PRECIPITATION DATA]
TOTAL FOR MONTH: 1.03
DPTR FM NORMAL: 0.36
GRTST 24HR 0.49 ON 5- 5

SNOW, ICE PELLETS, HAIL
TOTAL MONTH: 10.5 INCHES
GRTST 24HR 5.9 ON 5- 5
GRTST DEPTH: 8 ON 7, 6

SYMBOLS USED IN COLUMN 16
1 = FOG
2 = FOG REDUCING VISIBILITY
TO 1/4 MILE OR LESS
3 = THUNDER
4 = ICE PELLETS
5 = HAIL
6 = GLAZE OR RIME
7 = BLOWING DUST OR SAND:

VSBY 1/2 MILE OR LESS
8 = SMOKE OR HAZE
9 = BLOWING SNOW
X = TORNADO

[NO. OF DAYS WITH]		[WEATHER - DAYS WITH]	
MAX 32 OR BELOW:	18	0.01 INCH OR MORE:	6
MAX 90 OR ABOVE:	0	0.10 INCH OR MORE:	3
MIN 32 OR BELOW:	31	0.50 INCH OR MORE:	0
MIN 0 OR BELOW:	8	1.00 INCH OR MORE:	0
[HDD (BASE 65)]			
TOTAL THIS MO.	1355	CLEAR (SCALE 0-3)	11
DPTR FM NORMAL	27	PTCLDY (SCALE 4-7)	5
SEASONAL TOTAL	3466	CLOUDY (SCALE 8-10)	15
DPTR FM NORMAL	-339		
[CDD (BASE 65)]			
TOTAL THIS MO.	0		
DPTR FM NORMAL	0	[PRESSURE DATA]	
SEASONAL TOTAL	0	HIGHEST SLP 30.97 ON 15	
DPTR FM NORMAL	0	LOWEST SLP 29.54 ON 12	

STATION: LINCOLN
MONTH: FEBRUARY
YEAR: 2005
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	41	28	35	11	30	0	0.00	0.0	0	5.0	10	150	M	M	10	18	12	170
2	47	23	35	11	30	0	0.00	0.0	0	4.6	15	180	M	M	1	18	17	180
3	61	23	42	17	23	0	0.00	0.0	0	6.3	15	230	M	M	0	18	17	240
4	63	23	43	18	22	0	0.00	0.0	0	9.3	21	220	M	M	0		25	210
5	62	38	50	25	15	0	0.00	0.0	0	19.7	38	200	M	M	1		44	190
6	49	23	36	10	29	0	0.87	2.2	0	15.5	26	10	M	M	10	1	31	10
7	23	10	17	-9	48	0	0.04	1.0	3	13.5	28	10	M	M	9	1	32	10
8	15	9	12	-14	53	0	0.18	1.4	3	9.2	18	40	M	M	10	12	20	40
9	22	-5	9	-17	56	0	0.00	0.0	4	3.1	12	240	M	M	2	128	13	240
10	35	5	20	-7	45	0	0.00	0.0	4	4.3	16	250	M	M	1	1	20	250
11	46	12	29	2	36	0	0.00	0.0	3	3.6	14	220	M	M	0	1	16	220
12	42	23	33	6	32	0	0.64	0.0	2	5.3	12	120	M	M	4	128	14	150
13	45	39	42	14	23	0	0.43	0.0	0	10.3	24	310	M	M	10	1	28	320
14	66	27	47	19	18	0	0.00	0.0	0	6.7	21	360	M	M	1	18	25	10
15	40	25	33	5	32	0	0.00	0.0	0	10.4	20	10	M	M	6		25	20
16	45	17	31	2	34	0	0.00	0.0	0	7.1	25	290	M	M	1	1	29	320
17	49	18	34	5	31	0	0.00	0.0	0	5.2	17	290	M	M	0		21	270
18	45	16	31	2	34	0	0.00	0.0	0	5.8	18	10	M	M	1		22	10
19	43	35	39	9	26	0	0.01	T	0	11.2	18	150	M	M	10	1	21	150
20	47	32	40	10	25	0	0.03	0.0	0	10.2	23	310	M	M	10	12	28	310
21	42	29	36	6	29	0	T	0.0	0	7.7	16	80	M	M	9	18	18	90
22	50	28	39	8	26	0	0.00	0.0	0	6.4	15	30	M	M	6	18	17	30

23	42	25	34	3	31	0	0.00	0.0	0	4.5	9	190	M	M	7	18	12	50
24	43	25	34	3	31	0	0.00	0.0	0	8.1	22	340	M	M	3	8	26	330
25	60	25	43	11	22	0	0.00	0.0	0	5.5	15	10	M	M	0		18	10
26	60	21	41	9	24	0	0.00	0.0	0	8.8	20	170	M	M	1	18	23	180
27	50	24	37	4	28	0	0.02	0.0	0	11.8	26	340	M	M	2	18	30	330
28	29	17	23	-10	42	0	T	0.0	0	14.4	29	340	M	M	5	18	32	330
SM	1262	615			875	0	2.22	4.6		233.5			M		120			
AV	45.1	22.0								8.3	FASTST		PSBL	%	4		MAX(MPH)	
								MISC ---->			38	200					44	190

NOTES:
LAST OF SEVERAL OCCURRENCES
COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2
STATION: LINCOLN
MONTH: FEBRUARY
YEAR: 2005
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]	[PRECIPITATION DATA]	SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY: 33.5	TOTAL FOR MONTH: 2.22	1 = FOG
DPTR FM NORMAL: 5.2	DPTR FM NORMAL: 1.56	2 = FOG REDUCING VISIBILITY
HIGHEST: 66 ON 14	GRTST 24HR 1.07 ON 12-13	TO 1/4 MILE OR LESS
LOWEST: -5 ON 9		3 = THUNDER
	SNOW, ICE PELLETS, HAIL	4 = ICE PELLETS
	TOTAL MONTH: 4.6 INCHES	5 = HAIL
	GRTST 24HR 2.2 ON 6- 6	6 = GLAZE OR RIME
	GRTST DEPTH: 4 ON 10, 9	7 = BLOWING DUST OR SAND:
		VSBY 1/2 MILE OR LESS
		8 = SMOKE OR HAZE
[NO. OF DAYS WITH]	[WEATHER - DAYS WITH]	9 = BLOWING SNOW

X = TORNADO

```
MAX 32 OR BELOW:   4    0.01 INCH OR MORE:   8
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   4
MIN 32 OR BELOW:  25    0.50 INCH OR MORE:   2
MIN  0 OR BELOW:   1    1.00 INCH OR MORE:   0
[HDD (BASE 65) ]
TOTAL THIS MO.   875    CLEAR  (SCALE 0-3)  15
DPTR FM NORMAL  -168    PTCLDY (SCALE 4-7)   5
SEASONAL TOTAL  4341    CLOUDY (SCALE 8-10)  8
DPTR FM NORMAL  -507
[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0    [PRESSURE DATA]
SEASONAL TOTAL     0    HIGHEST SLP 30.44 ON 18
DPTR FM NORMAL     0    LOWEST  SLP 29.44 ON 13
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STATION: LINCOLN
MONTH: MARCH
YEAR: 2005
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	43	13	28	-5	37	0	0.00	0.0	0	4.8	10	340	M	M	0		13	360
2	58	21	40	6	25	0	0.00	0.0	0	4.4	12	40	M	M	2		14	190
3	57	21	39	5	26	0	0.00	0.0	0	4.1	12	40	M	M	3	18	12	40
4	64	22	43	8	22	0	0.00	0.0	0	9.0	28	330	M	M	0		31	340
5	61	22	42	7	23	0	0.00	0.0	0	6.7	13	240	M	M	0		18	260
6	73	36	55	20	10	0	0.00	0.0	0	15.3	35	220	M	M	1		40	200
7	54	22	38	2	27	0	0.00	0.0	0	20.5	35	340	M	M	6		41	360
8	40	20	30	-6	35	0	T	0.0	0	3.3	12	30	M	M	7		13	20
9	45	28	37	0	28	0	T	T	0	8.5	16	200	M	M	7		20	190
10	58	32	45	8	20	0	T	0.0	0	24.5	48	340	M	M	3		56	320
11	64	27	46	9	19	0	0.00	0.0	0	10.6	31	290	M	M	4		38	290
12	47	27	37	-1	28	0	0.00	0.0	0	9.2	28	20	M	M	1		32	20
13	48	17	33	-5	32	0	0.00	0.0	0	7.5	26	330	M	M	3		32	320
14	44	16	30	-9	35	0	0.00	0.0	0	4.3	15	260	M	M	6		18	270
15	54	14	34	-5	31	0	0.00	0.0	0	7.9	23	230	M	M	3		30	190
16	62	20	41	2	24	0	T	0.0	0	9.8	22	250	M	M	1		25	200
17	64	36	50	10	15	0	0.00	0.0	0	16.2	29	200	M	M	3		36	200
18	49	29	39	-1	26	0	0.00	0.0	0	18.9	28	340	M	M	6	8	33	330
19	48	25	37	-4	28	0	0.00	0.0	0	11.3	28	340	M	M	5		33	350
20	55	26	41	0	24	0	0.01	0.0	0	12.1	20	100	M	M	4	8	25	90
21	54	40	47	6	18	0	0.05	0.0	0	18.5	30	100	M	M	10	8	40	80
22	42	33	38	-4	27	0	0.30	T	0	13.2	24	80	M	M	10	18	29	90

23	54	32	43	1	22	0	0.00	0.0	0	7.8	14	150	M	M	5	18	18	160
24	43	35	39	-4	26	0	0.19	0.0	0	10.1	16	20	M	M	10	1	18	20
25	39	34	37	-6	28	0	0.08	T	0	10.0	18	10	M	M	10	1	22	10
26	49	28	39	-4	26	0	0.00	0.0	0	3.2	12	310	M	M	7	18	15	320
27	61	24	43	-1	22	0	0.00	0.0	0	5.1	15	260	M	M	0	18	18	240
28	75	36	56	12	9	0	0.00	0.0	0	11.6	26	210	M	M	0		31	170
29	78	53	66	21	0	1	0.00	0.0	0	13.9	22	170	M	M	1		28	210
30	62	35	49	4	16	0	0.02	0.0	0	14.2	38	350	M	M	5	13	46	360
31	61	29	45	0	20	0	0.00	0.0	0	10.3	21	360	M	M	0		26	20
SM	1706	853			729	1	0.65	T		326.8			M		123			
AV	55.0	27.5								10.5	FASTST		PSBL	%	4		MAX(MPH)	
								MISC ---->			48	340					56	320

NOTES:
LAST OF SEVERAL OCCURRENCES
COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2
STATION: LINCOLN
MONTH: MARCH
YEAR: 2005
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]
AVERAGE MONTHLY: 41.3
DPTR FM NORMAL: 1.9
HIGHEST: 78 ON 29
LOWEST: 13 ON 1

[PRECIPITATION DATA]
TOTAL FOR MONTH: 0.65
DPTR FM NORMAL: -1.56
GRTST 24HR 0.30 ON 22-22

SNOW, ICE PELLETS, HAIL
TOTAL MONTH: T
GRTST 24HR T ON 25-25
GRTST DEPTH: 0

SYMBOLS USED IN COLUMN 16
1 = FOG
2 = FOG REDUCING VISIBILITY
TO 1/4 MILE OR LESS
3 = THUNDER
4 = ICE PELLETS
5 = HAIL
6 = GLAZE OR RIME
7 = BLOWING DUST OR SAND:

VSBY 1/2 MILE OR LESS
8 = SMOKE OR HAZE
9 = BLOWING SNOW
X = TORNADO

[NO. OF DAYS WITH]		[WEATHER - DAYS WITH]	
MAX 32 OR BELOW:	0	0.01 INCH OR MORE:	6
MAX 90 OR ABOVE:	0	0.10 INCH OR MORE:	2
MIN 32 OR BELOW:	22	0.50 INCH OR MORE:	0
MIN 0 OR BELOW:	0	1.00 INCH OR MORE:	0
[HDD (BASE 65)]			
TOTAL THIS MO.	729	CLEAR (SCALE 0-3)	16
DPTR FM NORMAL	-70	PTCLDY (SCALE 4-7)	11
SEASONAL TOTAL	5070	CLOUDY (SCALE 8-10)	4
DPTR FM NORMAL	-577		
[CDD (BASE 65)]			
TOTAL THIS MO.	1		
DPTR FM NORMAL	0	[PRESSURE DATA]	
SEASONAL TOTAL	1	HIGHEST SLP 30.32 ON	5
DPTR FM NORMAL	0	LOWEST SLP 29.21 ON	30

STATION: LINCOLN
MONTH: DECEMBER
YEAR: 2005
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	23	12	18	-13	47	0	0.00	0.0	1	7.3	26	340	M	M	2	189	32	340
2	26	18	22	-9	43	0	0.00	0.0	1	11.0	21	110	M	M	6		25	110
3	21	5	13	-17	52	0	0.23	2.8	1	9.7	16	350	M	M	5	1289	20	340
4	17	-2	8	-22	57	0	0.00	0.0	2	5.4	15	10	M	M	5	18	16	10
5	28	-3	13	-17	52	0	0.09	1.8	2	12.2	35	290	M	M	3	1289	45	290
6	9	-4	3	-26	62	0	T	T	3	7.9	22	340	M	M	2	8	24	340
7	9	-6	2	-27	63	0	0.07	1.1	3	8.5	13	360	M	M	6	1	14	20
8	12	-5	4	-25	61	0	0.02	0.3	4	5.9	14	290	M	M	4	18	16	300
9	21	-10	6	-22	59	0	0.00	0.0	4	7.1	16	210	M	M	0		22	210
10	40	16	28	0	37	0	T	0.0	4	12.1	25	310	M	M	7		32	310
11	46	29	38	10	27	0	0.00	0.0	1	10.5	20	270	M	M	2		23	280
12	45	24	35	8	30	0	0.00	0.0	T	8.1	16	310	M	M	0	1	20	310
13	44	23	34	7	31	0	0.06	0.0	T	12.7	28	170	M	M	4	12	37	150
14	42	32	37	10	28	0	0.01	T	0	13.2	26	290	M	M	8	1	33	300
15	33	27	30	3	35	0	T	T	0	18.3	33	300	M	M	6	1	39	320
16	28	17	23	-3	42	0	T	T	0	12.3	28	310	M	M	5		35	300
17	27	16	22	-4	43	0	0.00	0.0	0	5.8	14	10	M	M	7		16	20
18	22	7	15	-11	50	0	0.00	0.0	0	7.1	15	20	M	M	2		17	310
19	31	5	18	-7	47	0	0.00	0.0	0	7.3	17	230	M	M	2		21	220

20	37	11	24	-1	41	0	0.00	0.0	0	3.3	12	220	M	M	1	18	13	220
21	44	11	28	3	37	0	0.00	0.0	0	6.3	10	190	M	M	0	18	12	190
22	58	25	42	17	23	0	0.00	0.0	0	9.2	20	210	M	M	0	18	22	200
23	49	28	39	15	26	0	0.01	0.0	0	7.4	23	320	M	M	2		29	330
24	49	28	39	15	26	0	0.02	0.0	0	14.7	26	340	M	M	6		32	340
25	36	18	27	3	38	0	0.00	0.0	0	3.8	9	160	M	M	6	12	10	70
26	58	26	42	18	23	0	0.00	0.0	0	5.9	14	160	M	M	3	1	16	160
27	40	21	31	7	34	0	0.00	0.0	0	8.1	18	360	M	M	4	128	23	10
28	53	23	38	15	27	0	0.00	0.0	0	9.6	21	330	M	M	5	8	25	340
29	37	23	30	7	35	0	0.01	0.0	0	6.5	17	130	M	M	8	12	21	130
30	41	24	33	10	32	0	0.00	0.0	0	13.1	30	290	M	M	5	1	36	300
31	46	18	32	9	33	0	0.00	0.0	0	5.7	16	170	M	M	0		18	170
SM	1072	457			1241	0	0.52		6.0	276.0			M		116			
AV	34.6	14.7								8.9	FASTST		PSBL	%	4		MAX(MPH)	
								MISC	---->		35	290					45	290

NOTES:
LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: DECEMBER
YEAR: 2005
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA] [PRECIPITATION DATA] SYMBOLS USED IN COLUMN 16

AVERAGE MONTHLY: 24.7 TOTAL FOR MONTH: 0.52 1 = FOG OR MIST

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DPTR FM NORMAL:  -1.8   DPTR FM NORMAL:   -0.34    2 = FOG REDUCING VISIBILITY
HIGHEST:    58 ON 26,22 GRTST 24HR  0.23 ON  3- 3      TO 1/4 MILE OR LESS
LOWEST:    -10 ON  9                               3 = THUNDER
                        SNOW, ICE PELLETS, HAIL    4 = ICE PELLETS
                        TOTAL MONTH:   6.0 INCHES  5 = HAIL
                        GRTST 24HR   2.8 ON  3- 3  6 = FREEZING RAIN OR DRIZZLE
                        GRTST DEPTH:   4 ON 10, 9  7 = DUSTSTORM OR SANDSTORM:
                                                       VSBY 1/2 MILE OR LESS
                                                   8 = SMOKE OR HAZE
[NO. OF DAYS WITH]      [WEATHER - DAYS WITH]      9 = BLOWING SNOW
                                                   X = TORNADO
MAX 32 OR BELOW:  13    0.01 INCH OR MORE:   9
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   1
MIN 32 OR BELOW:  31    0.50 INCH OR MORE:   0
MIN  0 OR BELOW:   6    1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.  1241    CLEAR  (SCALE 0-3)  14
DPTR FM NORMAL    53    PTCLDY (SCALE 4-7)  15
TOTAL FM JUL 1  2319    CLOUDY (SCALE 8-10)  2
DPTR FM NORMAL  -158

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0    [PRESSURE DATA]
TOTAL FM JAN 1  1432    HIGHEST SLP 30.80 ON 18
DPTR FM NORMAL   278    LOWEST  SLP 29.57 ON 29
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STATION: LINCOLN
MONTH: JANUARY
YEAR: 2006
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	54	29	42	19	23	0	0.01	0.0	0	12.2	23	20	M	M	3	18	28	10
2	39	22	31	8	34	0	0.21	T	0	11.2	32	350	M	M	7	18	37	350
3	51	28	40	18	25	0	0.00	0.0	0	10.5	29	320	M	M	5	128	33	320
4	54	36	45	23	20	0	0.00	0.0	0	14.2	24	320	M	M	2		29	320
5	45	20	33	11	32	0	0.00	0.0	0	9.0	24	340	M	M	0	1	28	340
6	49	14	32	10	33	0	0.00	0.0	0	5.4	23	230	M	M	0	1	26	240
7	54	26	40	18	25	0	0.00	0.0	0	4.5	10	10	M	M	0		12	10
8	38	20	29	7	36	0	0.00	0.0	0	12.2	26	330	M	M	6	18	31	330
9	35	21	28	6	37	0	0.00	0.0	0	9.1	24	10	M	M	10	18	32	20
10	45	16	31	9	34	0	0.00	0.0	0	6.4	14	170	M	M	0	18	16	180
11	62	24	43	21	22	0	0.00	0.0	0	8.7	17	220	M	M	0		20	220
12	55	24	40	18	25	0	T	0.0	0	15.0	37	340	M	M	3		43	10
13	43	20	32	10	33	0	0.00	0.0	0	13.0	31	330	M	M	5		38	330
14	59	17	38	16	27	0	0.00	0.0	0	8.6	20	180	M	M	0		23	170
15	69	33	51	29	14	0	0.00	0.0	0	6.1	13	160	M	M	0		15	220
16	44	31	38	16	27	0	T	T	0	20.0	33	340	M	M	8		38	340
17	40	18	29	7	36	0	0.00	0.0	0	9.5	26	330	M	M	1		32	340
18	63	17	40	18	25	0	0.00	0.0	0	6.9	21	200	M	M	2		23	200
19	46	24	35	13	30	0	0.00	0.0	0	9.1	24	340	M	M	2		28	340
20	34	20	27	5	38	0	0.01	T	0	8.1	17	10	M	M	8	18	20	350

21	52	16	34	12	31	0	0.00	0.0	0	9.5	28	200	M	M	0	1	32	190
22	36	17	27	5	38	0	0.00	0.0	0	8.4	21	10	M	M	5	18	24	10
23	50	23	37	15	28	0	0.00	0.0	0	11.6	24	210	M	M	5	18	30	210
24	54	18	36	13	29	0	0.00	0.0	0	11.9	33	310	M	M	0		41	310
25	55	15	35	12	30	0	0.00	0.0	0	7.1	18	180	M	M	0		21	180
26	62	30	46	23	19	0	T	0.0	0	21.4	37	190	M	M	3		44	190
27	60	37	49	26	16	0	0.00	0.0	0	10.3	26	190	M	M	1		33	200
28	48	38	43	20	22	0	0.68	0.0	0	8.6	20	310	M	M	9	138	22	310
29	48	27	38	15	27	0	0.00	0.0	0	7.8	18	300	M	M	2		22	300
30	41	23	32	8	33	0	0.00	0.0	0	7.8	18	330	M	M	2	1	23	330
31	63	24	44	20	21	0	0.00	0.0	0	8.5	28	330	M	M	1	1	33	320
SM	1548	728			870	0	0.91	T		312.6			M		90			
AV	49.9	23.5								10.1	FASTST		PSBL	%	3	MAX(MPH)		
								MISC ---->		#	37	190				44	190	

NOTES:
LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: JANUARY
YEAR: 2006
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA] [PRECIPITATION DATA] SYMBOLS USED IN COLUMN 16

AVERAGE MONTHLY: 36.7 TOTAL FOR MONTH: 0.91 1 = FOG OR MIST
DPTR FM NORMAL: 14.3 DPTR FM NORMAL: 0.24 2 = FOG REDUCING VISIBILITY

```
HIGHEST:    69 ON 15    GRTST 24HR  0.68 ON 28-28       TO 1/4 MILE OR LESS
LOWEST:     14 ON  6                                  3 = THUNDER
                        SNOW, ICE PELLETS, HAIL       4 = ICE PELLETS
                        TOTAL MONTH:    T             5 = HAIL
                        GRTST 24HR    T  ON 20-20     6 = FREEZING RAIN OR DRIZZLE
                        GRTST DEPTH:   0              7 = DUSTSTORM OR SANDSTORM:
                                                          VSBY 1/2 MILE OR LESS
                                                      8 = SMOKE OR HAZE
[NO. OF DAYS WITH]      [WEATHER - DAYS WITH]         9 = BLOWING SNOW
                                                      X = TORNADO
MAX 32 OR BELOW:   0    0.01 INCH OR MORE:   4
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   2
MIN 32 OR BELOW:  27    0.50 INCH OR MORE:   1
MIN  0 OR BELOW:   0    1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.   870    CLEAR  (SCALE 0-3)  21
DPTR FM NORMAL  -458    PTCLDY (SCALE 4-7)   6
TOTAL FM JUL 1  3189    CLOUDY (SCALE 8-10)  4
DPTR FM NORMAL  -616

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0    [PRESSURE DATA]
TOTAL FM JAN 1     0    HIGHEST SLP 30.54 ON 25
DPTR FM NORMAL     0    LOWEST  SLP 29.59 ON 28
```

STATION: LINCOLN
MONTH: FEBRUARY
YEAR: 2006
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:		SNOW:	WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	53	28	41	17	24	0	0.00	0.0	0	7.8	14	240	M	M	2		16	230
2	59	26	43	19	22	0	0.00	0.0	0	6.0	20	330	M	M	1		23	340
3	40	20	30	5	35	0	0.00	0.0	0	13.1	28	340	M	M	3		35	340
4	36	14	25	0	40	0	0.00	0.0	0	9.4	20	340	M	M	0		22	10
5	36	13	25	0	40	0	0.00	0.0	0	6.9	15	70	M	M	5		17	80
6	44	12	28	2	37	0	0.00	0.0	0	6.1	20	320	M	M	6		23	330
7	46	21	34	8	31	0	0.00	0.0	0	7.2	16	10	M	M	8		20	20
8	34	13	24	-2	41	0	T	T	0	10.9	22	10	M	M	5	8	24	20
9	41	14	28	2	37	0	0.00	0.0	0	10.8	24	200	M	M	2		32	200
10	39	24	32	5	33	0	T	T	0	16.5	32	330	M	M	5	8	39	310
11	27	15	21	-6	44	0	T	0.1	T	15.8	26	340	M	M	9	18	32	340
12	30	11	21	-6	44	0	T	T	T	12.1	29	340	M	M	6		35	340
13	61	11	36	8	29	0	0.00	0.0	T	9.9	24	330	M	M	0		31	300
14	68	20	44	16	21	0	0.00	0.0	0	10.3	28	340	M	M	0		33	340
15	41	26	34	6	31	0	0.00	0.0	0	16.4	28	60	M	M	4		33	60
16	26	10	18	-11	47	0	0.07	0.6	0	17.4	28	350	M	M	7	168	32	340
17	11	0	6	-23	59	0	T	T	T	16.1	24	10	M	M	5		29	10
18	14	-4	5	-24	60	0	0.00	0.0	T	4.8	16	10	M	M	1		18	20
19	28	1	15	-15	50	0	0.00	0.0	T	8.4	15	210	M	M	3		17	220
20	47	9	28	-2	37	0	0.00	0.0	T	9.5	22	250	M	M	0		25	260

```
21  51  12  32   2  33   0 0.00  0.0    T  5.8 18 220   M    M   1        23 210
22  53  13  33   2  32   0 0.00  0.0    0  8.5 29 290   M    M   0        36 300
23  48  21  35   4  30   0 0.00  0.0    0  5.7 15  70   M    M   0        16  80
24  65  18  42  11  23   0 0.00  0.0    0 11.3 30  10   M    M   0        36  10
25  36  18  27  -5  38   0 0.00  0.0    0 12.2 29  10   M    M   7        35  10
26  53   9  31  -1  34   0 0.00  0.0    0  8.6 22 200   M    M   0        26 200
27  71  27  49  16  16   0 0.00  0.0    0  5.1 13 210   M    M   0 8      15 210
28  73  26  50  17  15   0 0.00  0.0    0  4.1 12 160   M    M   0 8      14 160
================================================================================
SM 1231  428       983   0  0.07     0.7 276.7         M       80
================================================================================
AV 44.0 15.3                              9.9 FASTST  PSBL  %   3    MAX(MPH)
                                 MISC ---->    32 330                39  310
================================================================================
NOTES:
# LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

                                          STATION:  LINCOLN
                                          MONTH:    FEBRUARY
                                          YEAR:     2006
                                          LATITUDE:   40 50 N
                                          LONGITUDE:  96 45 W

[TEMPERATURE DATA]       [PRECIPITATION DATA]       SYMBOLS USED IN COLUMN 16

AVERAGE MONTHLY: 29.6    TOTAL FOR MONTH:   0.07    1 = FOG OR MIST
DPTR FM NORMAL:   1.3    DPTR FM NORMAL:   -0.59    2 = FOG REDUCING VISIBILITY
HIGHEST:    73 ON 28     GRTST 24HR  0.07 ON 16-16      TO 1/4 MILE OR LESS
LOWEST:     -4 ON 18                                3 = THUNDER
                         SNOW, ICE PELLETS, HAIL    4 = ICE PELLETS
```

```
                                TOTAL MONTH:   0.7 INCH    5 = HAIL
                                GRTST 24HR   0.6 ON 16-16  6 = FREEZING RAIN OR DRIZZLE
                                GRTST DEPTH:   0           7 = DUSTSTORM OR SANDSTORM:
                                                               VSBY 1/2 MILE OR LESS
                                                           8 = SMOKE OR HAZE
[NO. OF DAYS WITH]              [WEATHER - DAYS WITH]      9 = BLOWING SNOW
                                                           X = TORNADO
MAX 32 OR BELOW:   6            0.01 INCH OR MORE:   1
MAX 90 OR ABOVE:   0            0.10 INCH OR MORE:   0
MIN 32 OR BELOW:  28            0.50 INCH OR MORE:   0
MIN  0 OR BELOW:   2            1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.   983            CLEAR  (SCALE 0-3)  17
DPTR FM NORMAL   -60            PTCLDY (SCALE 4-7)   9
TOTAL FM JUL 1  4172            CLOUDY (SCALE 8-10)  2
DPTR FM NORMAL  -676

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0            [PRESSURE DATA]
TOTAL FM JAN 1     0            HIGHEST SLP 30.96 ON 17
DPTR FM NORMAL     0            LOWEST  SLP 29.54 ON  2
```

STATION: LINCOLN
MONTH: MARCH
YEAR: 2006
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F: :PCPN: SNOW: WIND :SUNSHINE: SKY :PK WND

1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	76	35	56	23	9	0	0.00	0.0	0	10.4	31	330	M	M	0	8	37	330
2	47	21	34	0	31	0	0.00	0.0	0	12.4	23	360	M	M	0		29	340
3	49	14	32	-2	33	0	T	0.0	0	5.9	14	120	M	M	2		17	120
4	47	36	42	7	23	0	0.04	T	0	14.8	25	140	M	M	9	138	30	140
5	60	28	44	9	21	0	0.25	0.0	0	9.2	28	340	M	M	2	138	31	340
6	56	23	40	5	25	0	0.00	0.0	0	7.7	16	130	M	M	0		18	140
7	70	34	52	16	13	0	0.00	0.0	0	12.2	23	150	M	M	2	1	28	150
8	44	30	37	1	28	0	0.07	0.0	0	13.3	25	20	M	M	7	18	30	20
9	56	34	45	8	20	0	0.00	0.0	0	6.1	17	340	M	M	4		22	340
10	62	29	46	9	19	0	0.00	0.0	0	11.4	26	150	M	M	1		32	140
11	55	30	43	6	22	0	0.00	0.0	0	10.0	24	310	M	M	1	1	29	310
12	42	34	38	0	27	0	0.16	T	0	12.7	21	10	M	M	8	135	25	40
13	40	24	32	-6	33	0	0.05	T	0	17.9	35	330	M	M	6	1	40	330
14	56	17	37	-2	28	0	0.00	0.0	0	6.9	22	290	M	M	0	18	28	310
15	66	20	43	4	22	0	T	0.0	0	15.4	37	180	M	M	1		43	170
16	50	30	40	1	25	0	0.00	0.0	0	20.3	37	310	M	M	7		47	310
17	44	28	36	-4	29	0	0.00	0.0	0	7.3	18	20	M	M	7		22	10
18	41	32	37	-3	28	0	0.07	T	0	12.8	25	120	M	M	10	1	29	120
19	40	31	36	-5	29	0	0.43	2.6	T	15.0	29	90	M	M	10	12	33	90
20	34	30	32	-9	33	0	0.75	6.5	3	17.4	28	90	M	M	10	12	35	90

21	32	23	28	-13	37	0	0.09	0.8	9	11.8	21	40	M	M	10	168	24	30
22	31	23	27	-15	38	0	0.00	0.0	8	6.7	10	330	M	M	5	18	13	330
23	34	17	26	-16	39	0	0.00	0.0	6	10.5	17	330	M	M	0		20	320
24	35	17	26	-17	39	0	0.00	0.0	4	7.0	14	10	M	M	2		16	300
25	39	20	30	-13	35	0	0.00	0.0	3	2.6	9	90	M	M	6	1	10	90
26	53	29	41	-2	24	0	0.04	0.0	1	16.4	32	130	M	M	2		40	130
27	46	38	42	-2	23	0	0.05	0.0	T	13.9	26	330	M	M	8	18	33	140
28	53	37	45	1	20	0	0.00	0.0	0	7.6	16	320	M	M	6	18	20	320
29	75	39	57	12	8	0	0.04	0.0	0	19.9	32	170	M	M	3	18	39	180
30	67	50	59	14	6	0	0.99	0.0	0	16.3	44	210	M	M	6	1238	55	240
31	59	38	49	4	16	0	0.00	0.0	0	16.2	32	290	M	M	4		39	300
SM	1559	891			783	0	3.03	9.9		368.0			M		139			
AV	50.3	28.7								11.9	FASTST		PSBL	%	4		MAX(MPH)	
							MISC ---->				44	210					55	240

NOTES:
LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: MARCH
YEAR: 2006
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]		[PRECIPITATION DATA]		SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY:	39.5	TOTAL FOR MONTH:	3.03	1 = FOG OR MIST
DPTR FM NORMAL:	0.1	DPTR FM NORMAL:	0.82	2 = FOG REDUCING VISIBILITY

```
HIGHEST:     76 ON  1    GRTST 24HR  0.99 ON 30-30       TO 1/4 MILE OR LESS
LOWEST:      14 ON  3                                3 = THUNDER
                         SNOW, ICE PELLETS, HAIL     4 = ICE PELLETS
                         TOTAL MONTH:   9.9 INCHES   5 = HAIL
                         GRTST 24HR   6.5 ON 20-20   6 = FREEZING RAIN OR DRIZZLE
                         GRTST DEPTH:   9 ON 21      7 = DUSTSTORM OR SANDSTORM:
                                                         VSBY 1/2 MILE OR LESS
                                                     8 = SMOKE OR HAZE
[NO. OF DAYS WITH]       [WEATHER - DAYS WITH]       9 = BLOWING SNOW
                                                     X = TORNADO
MAX 32 OR BELOW:   2     0.01 INCH OR MORE:  13
MAX 90 OR ABOVE:   0     0.10 INCH OR MORE:   5
MIN 32 OR BELOW:  21     0.50 INCH OR MORE:   2
MIN  0 OR BELOW:   0     1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.   783     CLEAR  (SCALE 0-3)  14
DPTR FM NORMAL   -16     PTCLDY (SCALE 4-7)  10
TOTAL FM JUL 1  4955     CLOUDY (SCALE 8-10)  7
DPTR FM NORMAL  -692

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL    -1     [PRESSURE DATA]
TOTAL FM JAN 1     0     HIGHEST SLP 30.55 ON 17
DPTR FM NORMAL    -1     LOWEST  SLP 29.34 ON  9
```

STATION: LINCOLN
MONTH: DECEMBER
YEAR: 2006
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	42	3	23	-8	42	0	0.00	0.0	0	4.6	18	310	M	M	1		22	310
2	30	10	20	-11	45	0	0.00	0.0	0	9.8	24	330	M	M	0		28	310
3	24	4	14	-16	51	0	0.00	0.0	0	8.0	22	210	M	M	0		26	200
4	44	19	32	2	33	0	0.00	0.0	0	7.1	22	210	M	M	3		26	210
5	61	21	41	11	24	0	0.00	0.0	0	8.6	21	230	M	M	0		24	220
6	51	15	33	4	32	0	0.00	0.0	0	13.9	33	350	M	M	1		39	350
7	21	4	13	-16	52	0	0.00	0.0	0	8.4	26	360	M	M	1		33	360
8	44	10	27	-2	38	0	0.00	0.0	0	11.9	18	200	M	M	0		22	210
9	58	27	43	15	22	0	0.00	0.0	0	12.5	25	200	M	M	0		32	210
10	54	30	42	14	23	0	0.00	0.0	0	13.3	24	190	M	M	0	1	30	180
11	51	21	36	8	29	0	0.03	0.0	0	6.9	17	340	M	M	8	18	20	330
12	42	27	35	8	30	0	0.00	0.0	0	8.1	15	320	M	M	6	18	18	320
13	60	23	42	15	23	0	0.00	0.0	0	7.4	20	210	M	M	0		25	220
14	59	33	46	19	19	0	0.00	0.0	0	8.3	21	210	M	M	2		25	270
15	52	23	38	11	27	0	0.00	0.0	0	6.1	16	170	M	M	2		18	180
16	52	32	42	16	23	0	0.00	0.0	0	7.0	20	10	M	M	0	18	23	10
17	42	22	32	6	33	0	0.00	0.0	0	6.2	20	20	M	M	5		23	20
18	44	14	29	3	36	0	0.00	0.0	0	1.6	8	350	M	M	2	8	10	350
19	47	13	30	5	35	0	0.00	0.0	0	4.2	13	180	M	M	3		15	180
20	41	32	37	12	28	0	0.37	T	0	10.3	22	30	M	M	10	18	25	30

21	45	35	40	15	25	0	0.21	0.0	0	5.6	13	330	M	M	9	128	15	340
22	38	30	34	9	31	0	0.06	T	0	10.5	16	320	M	M	8	1	20	320
23	45	21	33	9	32	0	0.00	0.0	0	5.1	14	300	M	M	0		17	300
24	48	19	34	10	31	0	0.00	0.0	0	8.9	23	340	M	M	2		28	340
25	38	20	29	5	36	0	0.00	0.0	0	10.9	22	330	M	M	1		26	340
26	47	16	32	8	33	0	0.00	0.0	0	5.8	17	260	M	M	3		21	260
27	53	25	39	15	26	0	0.00	0.0	0	9.0	20	200	M	M	1		23	190
28	45	23	34	11	31	0	0.00	0.0	0	4.3	13	100	M	M	2		14	100
29	42	37	40	17	25	0	0.36	0.0	0	9.2	18	10	M	M	10	1	22	10
30	52	35	44	21	21	0	1.17	T	0	11.1	22	350	M	M	10	1	26	360
31	35	26	31	8	34	0	0.85	7.5	T	21.7	32	350	M	M	8	1268	40	330
SM	1407	670			970	0	3.05	7.5		266.3			M		98			
AV	45.4	21.6								8.6	FASTST		PSBL	%	3		MAX(MPH)	
								MISC ---->			# 33	350					# 40	330

NOTES:
LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: DECEMBER
YEAR: 2006
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]		[PRECIPITATION DATA]		SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY:	33.5	TOTAL FOR MONTH:	3.05	1 = FOG OR MIST
DPTR FM NORMAL:	7.0	DPTR FM NORMAL:	2.19	2 = FOG REDUCING VISIBILITY

```
HIGHEST:    61 ON  5    GRTST 24HR  1.28 ON 30-31       TO 1/4 MILE OR LESS
LOWEST:      3 ON  1                               3 = THUNDER
                        SNOW, ICE PELLETS, HAIL    4 = ICE PELLETS
                        TOTAL MONTH:   7.5 INCHES  5 = HAIL
                        GRTST 24HR   7.5 ON 31-31  6 = FREEZING RAIN OR DRIZZLE
                        GRTST DEPTH:  -1 ON M      7 = DUSTSTORM OR SANDSTORM:
                                                       VSBY 1/2 MILE OR LESS
                                                   8 = SMOKE OR HAZE
[NO. OF DAYS WITH]      [WEATHER - DAYS WITH]      9 = BLOWING SNOW
                                                   X = TORNADO
MAX 32 OR BELOW:   3    0.01 INCH OR MORE:   7
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   5
MIN 32 OR BELOW:  27    0.50 INCH OR MORE:   2
MIN  0 OR BELOW:   0    1.00 INCH OR MORE:   1

[HDD (BASE 65) ]
TOTAL THIS MO.   970    CLEAR  (SCALE 0-3)  22
DPTR FM NORMAL  -218    PTCLDY (SCALE 4-7)   3
TOTAL FM JUL 1  2281    CLOUDY (SCALE 8-10)  6
DPTR FM NORMAL  -196

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0    [PRESSURE DATA]
TOTAL FM JAN 1  1327    HIGHEST SLP 30.95 ON  7
DPTR FM NORMAL   173    LOWEST  SLP 29.59 ON 16
```

STATION: LINCOLN
MONTH: JANUARY
YEAR: 2007
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F: :PCPN: SNOW: WIND :SUNSHINE: SKY :PK WND

1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	AVG SPD	MX SPD	2MIN DIR	MIN	PSBL	S-S	WX	SPD	DR
1	34	15	25	2	40	0	0.00	0.0	4	5.9	22	310	M	M	0	1	26	310
2	37	13	25	2	40	0	0.00	0.0	3	8.3	17	190	M	M	0	1	21	200
3	43	25	34	12	31	0	0.00	0.0	2	14.4	25	220	M	M	0		30	200
4	52	36	44	22	21	0	0.00	0.0	1	10.6	20	200	M	M	1	1	23	220
5	44	29	37	15	28	0	0.01	0.0	0	9.6	20	340	M	M	3		24	10
6	44	25	35	13	30	0	0.00	0.0	0	8.4	22	230	M	M	0		26	230
7	39	28	34	12	31	0	0.00	0.0	0	13.3	30	330	M	M	2		35	330
8	53	28	41	19	24	0	T	0.0	0	17.3	33	300	M	M	1		40	310
9	38	21	30	8	35	0	0.00	0.0	0	13.8	33	310	M	M	2		45	310
10	53	24	39	17	26	0	0.00	0.0	0	15.5	30	200	M	M	0		35	210
11	45	13	29	7	36	0	T	T	0	15.8	30	350	M	M	5	8	36	350
12	17	5	11	-11	54	0	T	T	0	17.4	25	350	M	M	6		29	340
13	13	5	9	-13	56	0	0.09	1.4	T	3.4	22	10	M	M	10	18	24	10
14	17	12	15	-7	50	0	0.15	1.9	1	9.2	22	10	M	M	10	128	25	10
15	15	-9	3	-19	62	0	T	T	3	11.4	24	350	M	M	2	8	26	340
16	16	-15	1	-21	64	0	0.00	0.0	3	3.9	12	160	M	M	0		15	160
17	28	5	17	-5	48	0	0.00	0.0	2	14.4	24	180	M	M	2		28	160
18	34	18	26	4	39	0	0.00	0.0	2	11.7	30	330	M	M	1		37	330
19	39	11	25	3	40	0	0.00	0.0	1	2.6	13	290	M	M	0		15	290
20	36	7	22	0	43	0	0.12	2.0	1	7.5	17	190	M	M	4	18	20	180
21	29	15	22	0	43	0	0.25	4.0	7	8.0	18	360	M	M	10	128	21	10

22	24	10	17	-5	48	0	0.00	0.0	7	7.6	14	250	M	M	6	8	15	260
23	41	6	24	2	41	0	0.00	0.0	6	6.5	15	330	M	M	5		18	330
24	38	20	29	6	36	0	0.00	0.0	4	7.7	17	340	M	M	3	1	20	340
25	40	16	28	5	37	0	0.00	0.0	4	4.1	10	190	M	M	1	128	12	180
26	46	23	35	12	30	0	0.00	0.0	4	10.2	23	350	M	M	0	18	26	350
27	27	12	20	-3	45	0	T	T	2	16.6	32	330	M	M	3		39	330
28	27	5	16	-7	49	0	0.00	0.0	2	8.2	15	210	M	M	0		21	340
29	36	8	22	-1	43	0	T	T	2	14.5	32	320	M	M	2		38	310
30	17	3	10	-14	55	0	0.00	0.0	2	10.0	24	330	M	M	0		28	330
31	28	4	16	-8	49	0	0.02	0.7	2	9.1	17	250	M	M	6	18	21	230
SM	1050	418			1274	0	0.64	10.0		316.9			M		85			
AV	33.9	13.5								10.2	FASTST		PSBL	%	3	MAX(MPH)		
								MISC ---->		#	33	300				#	45	310

NOTES:

LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: JANUARY
YEAR: 2007
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]		[PRECIPITATION DATA]		SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY:	23.7	TOTAL FOR MONTH:	0.64	1 = FOG OR MIST
DPTR FM NORMAL:	1.3	DPTR FM NORMAL:	-0.03	2 = FOG REDUCING VISIBILITY
HIGHEST:	53 ON 10, 8	GRTST 24HR	0.37 ON 20-21	TO 1/4 MILE OR LESS

```
LOWEST:    -15 ON 16                                3 = THUNDER
                        SNOW, ICE PELLETS, HAIL     4 = ICE PELLETS
                        TOTAL MONTH:  10.0 INCHES   5 = HAIL
                        GRTST 24HR   4.0 ON 21-21   6 = FREEZING RAIN OR DRIZZLE
                        GRTST DEPTH:   7 ON 22,21   7 = DUSTSTORM OR SANDSTORM:
                                                        VSBY 1/2 MILE OR LESS
                                                    8 = SMOKE OR HAZE
[NO. OF DAYS WITH]      [WEATHER - DAYS WITH]       9 = BLOWING SNOW
                                                    X = TORNADO
MAX 32 OR BELOW:  12    0.01 INCH OR MORE:   6
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   3
MIN 32 OR BELOW:  30    0.50 INCH OR MORE:   0
MIN  0 OR BELOW:   2    1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.  1274    CLEAR  (SCALE 0-3)  21
DPTR FM NORMAL   -54    PTCLDY (SCALE 4-7)   7
TOTAL FM JUL 1  3555    CLOUDY (SCALE 8-10)  3
DPTR FM NORMAL  -250

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0    [PRESSURE DATA]
TOTAL FM JAN 1     0    HIGHEST SLP 30.78 ON 16
DPTR FM NORMAL     0    LOWEST  SLP 29.52 ON  4
```

STATION: LINCOLN
MONTH: FEBRUARY
YEAR: 2007
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	30	3	17	-7	48	0	T	T	3	12.3	31	340	M	M	2	8	38	340
2	21	2	12	-12	53	0	0.00	0.0	3	13.5	26	240	M	M	0		32	230
3	15	0	8	-17	57	0	0.00	0.0	3	9.0	21	310	M	M	0		24	310
4	17	-1	8	-17	57	0	0.00	0.0	3	6.6	16	310	M	M	1		20	310
5	21	12	17	-8	48	0	0.00	0.0	3	10.1	16	70	M	M	8		17	70
6	43	14	29	3	36	0	0.00	0.0	3	12.0	25	350	M	M	3		30	350
7	18	11	15	-11	50	0	0.04	0.6	3	9.6	20	10	M	M	8	8	21	10
8	19	15	17	-9	48	0	0.01	0.1	3	6.3	13	40	M	M	10		14	40
9	17	10	14	-12	51	0	0.01	0.3	3	7.4	13	20	M	M	9	18	16	10
10	27	2	15	-12	50	0	T	T	3	5.1	13	210	M	M	7		15	200
11	37	27	32	5	33	0	0.00	0.0	3	10.3	20	180	M	M	10	18	22	190
12	34	21	28	1	37	0	0.18	2.3	2	11.5	23	20	M	M	10	16	26	20
13	21	0	11	-17	54	0	0.16	1.5	4	20.4	28	10	M	M	7	189	33	10
14	9	-6	2	-26	63	0	T	T	4	9.1	15	350	M	M	2	8	17	340
15	8	-4	2	-26	63	0	T	T	4	8.1	15	340	M	M	3	8	16	340
16	44	-3	21	-8	44	0	T	0.1	4	18.5	41	320	M	M	5	1	52	310
17	35	22	29	0	36	0	T	T	2	12.5	37	340	M	M	7	18	43	340
18	46	16	31	2	34	0	0.00	0.0	2	7.9	15	180	M	M	0	1	20	200
19	48	30	39	9	26	0	0.00	0.0	1	10.2	24	340	M	M	1		26	340
20	52	28	40	10	25	0	0.09	0.0	0	5.7	20	250	M	M	3	1	22	260
21	59	27	43	13	22	0	0.00	0.0	0	9.0	23	310	M	M	0		26	310

22	48	23	36	5	29	0	0.00	0.0	0	7.7	15	110	M	M	0		20	110
23	62	34	48	17	17	0	0.00	0.0	0	18.3	29	150	M	M	3		33	160
24	53	32	43	12	22	0	0.82	1.5	0	15.6	32	100	M	M	10	1345	38	130
25	33	25	29	-3	36	0	T	T	2	18.1	29	320	M	M	9	1	36	310
26	35	17	26	-6	39	0	0.00	0.0	1	5.1	14	340	M	M	5		15	340
27	37	19	28	-5	37	0	0.00	0.0	1	6.2	16	100	M	M	2	18	23	90
28	41	34	38	5	27	0	T	T	0	12.5	24	350	M	M	10	18	29	340
SM	930	410			1142	0	1.31	6.4		298.6			M		135			

AV 33.2 14.6 10.7 FASTST PSBL % 5 MAX(MPH)

MISC ----> # 41 320 # 52 310

NOTES:

LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: FEBRUARY
YEAR: 2007
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]

AVERAGE MONTHLY: 23.9
DPTR FM NORMAL: -4.4
HIGHEST: 62 ON 23
LOWEST: -6 ON 14

[PRECIPITATION DATA]

TOTAL FOR MONTH: 1.31
DPTR FM NORMAL: 0.65
GRTST 24HR 0.82 ON 24-24

SNOW, ICE PELLETS, HAIL
TOTAL MONTH: 6.4 INCHES

SYMBOLS USED IN COLUMN 16

1 = FOG OR MIST
2 = FOG REDUCING VISIBILITY
TO 1/4 MILE OR LESS
3 = THUNDER
4 = ICE PELLETS
5 = HAIL

```
                          GRTST 24HR   2.3 ON   M     6 = FREEZING RAIN OR DRIZZLE
                          GRTST DEPTH:   4 ON 16,15  7 = DUSTSTORM OR SANDSTORM:
                                                         VSBY 1/2 MILE OR LESS
                                                     8 = SMOKE OR HAZE
[NO. OF DAYS WITH]        [WEATHER - DAYS WITH]      9 = BLOWING SNOW
                                                     X = TORNADO
MAX 32 OR BELOW:  12      0.01 INCH OR MORE:   7
MAX 90 OR ABOVE:   0      0.10 INCH OR MORE:   3
MIN 32 OR BELOW:  26      0.50 INCH OR MORE:   1
MIN  0 OR BELOW:   6      1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.  1142      CLEAR  (SCALE 0-3)  14
DPTR FM NORMAL    99      PTCLDY (SCALE 4-7)   6
TOTAL FM JUL 1  4697      CLOUDY (SCALE 8-10)  8
DPTR FM NORMAL  -151

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0      [PRESSURE DATA]
TOTAL FM JAN 1     0      HIGHEST SLP 30.61 ON 14
DPTR FM NORMAL     0      LOWEST  SLP 29.31 ON 24
```

STATION: LINCOLN
MONTH: MARCH
YEAR: 2007
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F: :PCPN: SNOW: WIND :SUNSHINE: SKY :PK WND

1 DY	2 MAX	3 MIN	4 AVG	5 DEP	6A HDD	6B CDD	7 WTR	8 SNW	9 DPTH	10 AVG SPD	11 MX SPD	12 2MIN DIR	13 MIN	14 PSBL	15 S-S	16 WX	17 SPD	18 DR
1	34	28	31	-2	34	0	0.60	6.6	4	20.2	31	310	M	M	5	1289	40	310
2	32	18	25	-9	40	0	T	0.1	6	23.9	37	300	M	M	5	128	44	300
3	28	17	23	-11	42	0	0.02	0.4	6	16.2	30	330	M	M	3	8	37	340
4	50	8	29	-6	36	0	0.00	0.0	6	5.6	17	310	M	M	0		21	340
5	43	24	34	-1	31	0	0.00	0.0	1	9.7	21	20	M	M	0		22	60
6	44	20	32	-3	33	0	0.00	0.0	T	6.7	14	80	M	M	0	18	17	80
7	31	26	29	-7	36	0	0.00	0.0	0	9.4	21	20	M	M	9	18	24	10
8	56	28	42	6	23	0	0.00	0.0	0	11.4	18	190	M	M	5	18	21	170
9	60	30	45	8	20	0	0.09	0.0	0	8.0	22	20	M	M	3	138	26	10
10	61	28	45	8	20	0	0.00	0.0	0	5.6	14	130	M	M	2		17	150
11	63	32	48	11	17	0	0.00	0.0	0	7.6	17	180	M	M	4	18	20	180
12	78	41	60	22	5	0	0.00	0.0	0	11.6	21	220	M	M	3	18	24	260
13	80	50	65	27	0	0	0.00	0.0	0	13.8	26	240	M	M	0		30	210
14	60	33	47	8	18	0	0.00	0.0	0	16.2	32	30	M	M	2		38	30
15	55	29	42	3	23	0	0.00	0.0	0	11.2	20	20	M	M	4		24	10
16	48	21	35	-4	30	0	0.00	0.0	0	8.8	16	120	M	M	5	18	20	120
17	52	35	44	4	21	0	0.00	0.0	0	11.8	20	120	M	M	3	8	22	120
18	66	31	49	9	16	0	0.00	0.0	0	13.8	28	180	M	M	3	18	33	180
19	61	37	49	8	16	0	0.00	0.0	0	13.4	30	20	M	M	1	18	35	10
20	57	34	46	5	19	0	T	0.0	0	12.7	22	130	M	M	8	18	26	140
21	80	47	64	23	1	0	0.02	0.0	0	15.4	31	190	M	M	7	18	36	200

22	61	35	48	6	17	0	0.00	0.0	0	8.5	18	140	M	M	3		22	140
23	74	40	57	15	8	0	0.00	0.0	0	5.7	15	180	M	M	3	18	22	180
24	77	56	67	24	0	2	0.21	0.0	0	12.8	35	200	M	M	5	138	40	210
25	78	55	67	24	0	2	0.00	0.0	0	16.9	31	220	M	M	0		36	220
26	80	57	69	26	0	4	0.00	0.0	0	11.6	20	200	M	M	2	18	25	220
27	66	50	58	14	7	0	0.17	0.0	0	8.1	18	190	M	M	5	138	22	200
28	76	55	66	22	0	1	0.00	0.0	0	11.6	23	150	M	M	5	18	28	170
29	71	60	66	21	0	1	0.23	0.0	0	8.3	21	120	M	M	5	138	26	120
30	74	51	63	18	2	0	0.86	0.0	0	7.0	22	10	M	M	5	13	26	10
31	58	44	51	6	14	0	0.59	0.0	0	13.1	28	290	M	M	10	13	37	270
SM	1854	1120			529	10	2.79	7.1		356.6			M		115			

```
================================================================================
AV 59.8 36.1                               11.5 FASTST  PSBL  %   4    MAX(MPH)
                                 MISC ---->  # 37 300              # 44  300
================================================================================
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NOTES:
LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: MARCH
YEAR: 2007
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]	[PRECIPITATION DATA]	SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY: 48.0	TOTAL FOR MONTH: 2.79	1 = FOG OR MIST
DPTR FM NORMAL: 8.6	DPTR FM NORMAL: 0.58	2 = FOG REDUCING VISIBILITY
HIGHEST: 80 ON 26,21	GRTST 24HR 0.86 ON 30-30	TO 1/4 MILE OR LESS

```
LOWEST:       8 ON  4                                         3 = THUNDER
                        SNOW, ICE PELLETS, HAIL    4 = ICE PELLETS
                        TOTAL MONTH:   7.1 INCHES  5 = HAIL
                        GRTST 24HR   6.6 ON   M    6 = FREEZING RAIN OR DRIZZLE
                        GRTST DEPTH:   6 ON  4, 3  7 = DUSTSTORM OR SANDSTORM:
                                                       VSBY 1/2 MILE OR LESS
                                                   8 = SMOKE OR HAZE
[NO. OF DAYS WITH]      [WEATHER - DAYS WITH]      9 = BLOWING SNOW
                                                   X = TORNADO
MAX 32 OR BELOW:   3    0.01 INCH OR MORE:   9
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   6
MIN 32 OR BELOW:  14    0.50 INCH OR MORE:   3
MIN  0 OR BELOW:   0    1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.   529    CLEAR  (SCALE 0-3)  12
DPTR FM NORMAL  -270    PTCLDY (SCALE 4-7)  17
TOTAL FM JUL 1  5226    CLOUDY (SCALE 8-10)  2
DPTR FM NORMAL  -421

[CDD (BASE 65) ]
TOTAL THIS MO.    10
DPTR FM NORMAL     9    [PRESSURE DATA]
TOTAL FM JAN 1    10    HIGHEST SLP 30.12 ON 30
DPTR FM NORMAL     9    LOWEST  SLP 29.40 ON 31
```

STATION: LINCOLN
MONTH: DECEMBER
YEAR: 2007
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	57	27	42	11	23	0	0.87	T	T	10.6	22	170	M	M	10	126	26	180
2	35	16	26	-5	39	0	0.01	0.2	T	13.1	26	330	M	M	5	18	33	320
3	49	14	32	2	33	0	0.00	0.0	T	6.9	29	220	M	M	0		35	230
4	54	23	39	9	26	0	0.00	0.0	0	3.5	13	320	M	M	1	18	17	320
5	46	17	32	2	33	0	T	T	0	13.9	35	350	M	M	7	8	44	340
6	29	17	23	-6	42	0	0.33	3.3	0	5.7	14	190	M	M	9	128	16	180
7	29	23	26	-3	39	0	T	T	3	6.0	12	20	M	M	9	18	14	20
8	26	13	20	-9	45	0	T	T	3	15.8	23	20	M	M	10	168	25	30
9	17	8	13	-15	52	0	0.02	0.5	3	8.1	20	20	M	M	9	18	24	30
10	29	2	16	-12	49	0	0.34	0.0	3	4.6	14	30	M	M	5	168	15	30
11	30	25	28	0	37	0	0.16	0.1	2	11.5	23	30	M	M	10	168	26	30
12	28	23	26	-1	39	0	0.00	0.0	2	6.7	18	220	M	M	10	18	22	210
13	39	16	28	1	37	0	0.00	0.0	2	5.2	18	230	M	M	1		22	230
14	26	13	20	-7	45	0	0.10	1.5	1	7.7	16	20	M	M	5	18	18	20
15	24	3	14	-13	51	0	0.25	3.1	5	6.6	14	20	M	M	6	128	15	10
16	23	0	12	-14	53	0	0.00	0.0	6	2.4	8	260	M	M	0	18	9	210
17	34	5	20	-6	45	0	0.00	0.0	6	5.5	17	190	M	M	0	18	21	200
18	41	15	28	2	37	0	0.00	0.0	5	2.9	12	300	M	M	0	18	15	300
19	41	13	27	2	38	0	0.00	0.0	3	3.0	13	160	M	M	0	18	14	180
20	38	14	26	1	39	0	0.00	0.0	2	2.0	8	160	M	M	3	128	8	160
21	42	14	28	3	37	0	T	0.0	2	4.9	22	330	M	M	1	18	26	330

22	35	10	23	-2	42	0	0.00	0.0	2	16.4	33	350	M	M	4	8	41	330
23	30	14	22	-2	43	0	0.00	0.0	2	12.4	25	290	M	M	2		32	290
24	35	16	26	2	39	0	0.00	0.0	1	5.9	14	190	M	M	0		18	200
25	43	28	36	12	29	0	0.00	0.0	1	9.4	17	190	M	M	1	18	21	190
26	33	12	23	-1	42	0	T	T	1	9.0	17	360	M	M	6	18	21	350
27	24	10	17	-7	48	0	T	T	1	6.0	15	50	M	M	8	128	18	50
28	28	17	23	0	42	0	0.01	0.2	1	7.4	16	20	M	M	5	18	20	30
29	32	10	21	-2	44	0	0.00	0.0	1	6.2	15	200	M	M	0	18	18	200
30	26	8	17	-6	48	0	0.00	0.0	1	4.3	12	230	M	M	0	18	13	270
31	32	22	27	4	38	0	0.00	0.0	1	11.4	32	310	M	M	7		39	310
SM	1055	448			1254	0	2.09	8.9		235.0			M		134			
AV	34.0	14.5								7.6	FASTST		PSBL	%	4		MAX(MPH)	
							MISC ---->				# 35	350					# 44	340

NOTES:
LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: DECEMBER
YEAR: 2007
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]	[PRECIPITATION DATA]	SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY: 24.2	TOTAL FOR MONTH: 2.09	1 = FOG OR MIST
DPTR FM NORMAL: -2.3	DPTR FM NORMAL: 1.23	2 = FOG REDUCING VISIBILITY
HIGHEST: 57 ON 1	GRTST 24HR 0.87 ON 1- 1	TO 1/4 MILE OR LESS

```
LOWEST:      0 ON 16                                   3 = THUNDER
                        SNOW, ICE PELLETS, HAIL        4 = ICE PELLETS
                        TOTAL MONTH:   8.9 INCHES      5 = HAIL
                        GRTST 24HR   3.3 ON   M        6 = FREEZING RAIN OR DRIZZLE
                        GRTST DEPTH:   6 ON 17,16      7 = DUSTSTORM OR SANDSTORM:
                                                           VSBY 1/2 MILE OR LESS
                                                       8 = SMOKE OR HAZE
[NO. OF DAYS WITH]      [WEATHER - DAYS WITH]          9 = BLOWING SNOW
                                                       X = TORNADO
MAX 32 OR BELOW:  16    0.01 INCH OR MORE:   9
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   6
MIN 32 OR BELOW:  31    0.50 INCH OR MORE:   1
MIN  0 OR BELOW:   1    1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.  1254    CLEAR  (SCALE 0-3)  14
DPTR FM NORMAL    66    PTCLDY (SCALE 4-7)   9
TOTAL FM JUL 1  2343    CLOUDY (SCALE 8-10)  8
DPTR FM NORMAL  -134

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0    [PRESSURE DATA]
TOTAL FM JAN 1  1431    HIGHEST SLP 30.58 ON  2
DPTR FM NORMAL   277    LOWEST  SLP 29.42 ON  1
```

STATION: LINCOLN
MONTH: JANUARY
YEAR: 2008
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F: :PCPN: SNOW: WIND :SUNSHINE: SKY :PK WND

1 DY	2 MAX	3 MIN	4 AVG	5 DEP	6A HDD	6B CDD	7 WTR	8 SNW	9 DPTH	10 AVG SPD	11 MX SPD	12 2MIN DIR	13 MIN	14 PSBL	15 S-S	16 WX	17 SPD	18 DR
1	23	7	15	-8	50	0	0.00	0.0	1	13.0	26	330	M	M	3		32	300
2	23	-1	11	-12	54	0	0.00	0.0	1	4.9	12	170	M	M	0		13	170
3	37	14	26	4	39	0	0.00	0.0	1	18.1	30	200	M	M	0		39	200
4	37	25	31	9	34	0	0.00	0.0	1	11.0	20	200	M	M	0		25	180
5	44	20	32	10	33	0	0.00	0.0	1	7.0	15	150	M	M	0	18	18	160
6	47	28	38	16	27	0	0.00	0.0	1	3.2	12	280	M	M	0	1	14	290
7	44	28	36	14	29	0	0.09	0.0	1	4.2	16	110	M	M	2	18	18	110
8	40	25	33	11	32	0	0.00	0.0	1	9.5	22	330	M	M	3		26	320
9	41	23	32	10	33	0	0.00	0.0	T	7.8	22	170	M	M	1		26	170
10	37	23	30	8	35	0	0.02	0.3	T	12.2	25	340	M	M	6	18	29	320
11	39	17	28	6	37	0	0.00	0.0	T	1.8	12	230	M	M	1		16	220
12	32	25	29	7	36	0	0.00	0.0	T	11.1	20	340	M	M	7	8	23	340
13	39	17	28	6	37	0	0.00	0.0	T	7.3	17	10	M	M	4	18	21	360
14	26	11	19	-3	46	0	0.00	0.0	0	6.5	16	330	M	M	3	8	18	10
15	39	13	26	4	39	0	0.00	0.0	0	9.7	23	170	M	M	1		29	180
16	32	16	24	2	41	0	0.21	3.0	0	14.1	29	360	M	M	8	1	36	350
17	17	9	13	-9	52	0	0.05	0.5	4	7.6	16	360	M	M	3	18	18	350
18	25	-1	12	-10	53	0	0.02	0.3	4	10.3	32	360	M	M	4	189	36	350
19	13	-9	2	-20	63	0	T	T	4	3.5	10	310	M	M	3		13	310
20	19	-1	9	-13	56	0	0.00	0.0	4	9.8	21	100	M	M	7		28	100
21	19	8	14	-8	51	0	0.01	0.1	4	12.7	22	340	M	M	6	8	26	340

22	20	-1	10	-12	55	0	0.00	0.0	4	7.9	18	250	M	M	0		23	250
23	30	-3	14	-8	51	0	0.02	0.5	4	8.8	33	350	M	M	4	9	38	350
24	19	-10	5	-18	60	0	0.00	0.0	4	7.0	18	180	M	M	0	8	21	190
25	36	15	26	3	39	0	T	T	4	11.0	23	180	M	M	4		29	170
26	45	14	30	7	35	0	0.00	0.0	2	7.6	17	290	M	M	0		24	290
27	54	21	38	15	27	0	0.00	0.0	1	7.2	17	180	M	M	0		21	200
28	60	32	46	23	19	0	T	0.0	T	11.6	29	290	M	M	2		36	290
29	39	5	22	-1	43	0	0.02	0.2	0	18.3	37	350	M	M	5	189	44	350
30	19	4	12	-12	53	0	0.00	0.0	T	11.3	23	80	M	M	4		26	80
31	21	9	15	-9	50	0	0.00	0.0	T	9.3	20	30	M	M	4		23	20
SM	1016	383			1309	0	0.44	4.9		285.3			M		85			
AV	32.8	12.4								9.2	FASTST		PSBL	%	3		MAX(MPH)	
							MISC ---->			#	37	350					# 44	350

NOTES:
LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: JANUARY
YEAR: 2008
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]	[PRECIPITATION DATA]	SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY: 22.6	TOTAL FOR MONTH: 0.44	1 = FOG OR MIST
DPTR FM NORMAL: 0.2	DPTR FM NORMAL: -0.23	2 = FOG REDUCING VISIBILITY
HIGHEST: 60 ON 28	GRTST 24HR 0.21 ON 16-16	TO 1/4 MILE OR LESS

```
LOWEST:    -10 ON 24                                        3 = THUNDER
                        SNOW, ICE PELLETS, HAIL             4 = ICE PELLETS
                        TOTAL MONTH:   4.9 INCHES           5 = HAIL
                        GRTST 24HR   3.0 ON 16-16           6 = FREEZING RAIN OR DRIZZLE
                        GRTST DEPTH:   4 ON 25,24           7 = DUSTSTORM OR SANDSTORM:
                                                                VSBY 1/2 MILE OR LESS
                                                            8 = SMOKE OR HAZE
[NO. OF DAYS WITH]      [WEATHER - DAYS WITH]               9 = BLOWING SNOW
                                                            X = TORNADO
MAX 32 OR BELOW:  15    0.01 INCH OR MORE:   8
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   1
MIN 32 OR BELOW:  31    0.50 INCH OR MORE:   0
MIN  0 OR BELOW:   7    1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.  1309    CLEAR  (SCALE 0-3)  18
DPTR FM NORMAL   -19    PTCLDY (SCALE 4-7)  13
TOTAL FM JUL 1  3652    CLOUDY (SCALE 8-10)  0
DPTR FM NORMAL  -153

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0    [PRESSURE DATA]
TOTAL FM JAN 1     0    HIGHEST SLP 30.97 ON  2
DPTR FM NORMAL     0    LOWEST  SLP 29.16 ON 28
```

STATION: LINCOLN
MONTH: FEBRUARY
YEAR: 2008
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	40	6	23	-1	42	0	0.00	0.0	T	7.3	21	160	M	M	1	18	24	150
2	38	18	28	4	37	0	0.00	0.0	T	2.6	15	340	M	M	0	18	17	340
3	39	18	29	4	36	0	0.07	0.3	T	7.2	17	110	M	M	8	18	20	120
4	36	32	34	9	31	0	0.00	0.0	0	10.0	18	10	M	M	10	128	23	10
5	33	19	26	1	39	0	0.32	4.5	0	20.4	31	10	M	M	10	128	38	360
6	24	5	15	-11	50	0	0.01	0.1	4	7.8	23	350	M	M	5	89	28	350
7	32	6	19	-7	46	0	0.00	0.0	4	3.4	12	300	M	M	3	18	14	290
8	43	15	29	3	36	0	0.00	0.0	3	8.5	22	320	M	M	0		29	310
9	40	15	28	2	37	0	T	T	2	12.6	24	360	M	M	5		29	350
10	16	8	12	-15	53	0	T	T	1	11.8	24	350	M	M	3		28	350
11	20	7	14	-13	51	0	T	T	1	10.0	17	120	M	M	4		21	120
12	21	9	15	-12	50	0	0.00	0.0	1	7.2	14	310	M	M	3	8	18	320
13	47	13	30	2	35	0	0.00	0.0	1	9.4	22	160	M	M	1	18	28	160
14	39	9	24	-4	41	0	T	T	T	15.3	33	360	M	M	5	1689	40	360
15	32	7	20	-8	45	0	0.00	0.0	T	4.7	14	190	M	M	0		17	190
16	44	16	30	1	35	0	0.00	0.0	T	7.9	21	180	M	M	2		24	180
17	42	29	36	7	29	0	T	T	0	21.6	39	340	M	M	7	1	53	320
18	29	11	20	-9	45	0	0.00	0.0	T	12.3	28	330	M	M	0		33	330
19	46	7	27	-3	38	0	0.00	0.0	0	9.9	28	10	M	M	3		32	10
20	15	-3	6	-24	59	0	T	T	0	13.3	28	360	M	M	0	8	32	360
21	20	8	14	-16	51	0	0.00	0.0	0	4.0	13	120	M	M	9		15	120

22	41	7	24	-7	41	0	0.00	0.0	0	3.0	10	160	M	M	1	18	14	180
23	50	17	34	3	31	0	0.00	0.0	0	7.9	18	180	M	M	0	18	22	180
24	55	25	40	9	25	0	0.00	0.0	0	8.7	17	250	M	M	4	18	21	240
25	42	23	33	1	32	0	0.11	0.2	0	18.5	39	350	M	M	9	18	44	350
26	32	19	26	-6	39	0	0.00	0.0	T	13.0	26	340	M	M	4		31	350
27	46	16	31	-2	34	0	0.00	0.0	T	2.8	12	290	M	M	1		15	290
28	46	33	40	7	25	0	0.04	0.0	0	8.8	20	170	M	M	7	1	24	160
29	51	29	40	7	25	0	0.00	0.0	0	8.4	20	310	M	M	0	8	24	280
SM	1059	424			1138	0	0.55	5.1		278.3			M		105			
AV	36.5	14.6								9.6	FASTST		PSBL	%	4		MAX(MPH)	
								MISC ---->			# 39	340				# 53		320

NOTES:
LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: FEBRUARY
YEAR: 2008
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]

AVERAGE MONTHLY: 25.6
DPTR FM NORMAL: -2.7
HIGHEST: 55 ON 24
LOWEST: -3 ON 20

[PRECIPITATION DATA]

TOTAL FOR MONTH: 0.55
DPTR FM NORMAL: -0.11
GRTST 24HR 0.32 ON 5- 5

SNOW, ICE PELLETS, HAIL

SYMBOLS USED IN COLUMN 16

1 = FOG OR MIST
2 = FOG REDUCING VISIBILITY
TO 1/4 MILE OR LESS
3 = THUNDER
4 = ICE PELLETS

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                        TOTAL MONTH:   5.1 INCHES  5 = HAIL
                        GRTST 24HR   4.5 ON  5- 5  6 = FREEZING RAIN OR DRIZZLE
                        GRTST DEPTH:   4 ON  7, 6  7 = DUSTSTORM OR SANDSTORM:
                                                       VSBY 1/2 MILE OR LESS
                                                   8 = SMOKE OR HAZE
[NO. OF DAYS WITH]      [WEATHER - DAYS WITH]      9 = BLOWING SNOW
                                                   X = TORNADO
MAX 32 OR BELOW:  10    0.01 INCH OR MORE:   5
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   2
MIN 32 OR BELOW:  28    0.50 INCH OR MORE:   0
MIN  0 OR BELOW:   1    1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.  1138    CLEAR  (SCALE 0-3)  14
DPTR FM NORMAL    95    PTCLDY (SCALE 4-7)  11
TOTAL FM JUL 1  4790    CLOUDY (SCALE 8-10)  4
DPTR FM NORMAL   -90

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL     0    [PRESSURE DATA]
TOTAL FM JAN 1     0    HIGHEST SLP M ON M
DPTR FM NORMAL     0    LOWEST  SLP 29.48 ON 17
```

STATION: LINCOLN
MONTH: MARCH
YEAR: 2008
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

TEMPERATURE IN F:							:PCPN:	SNOW:		WIND			:SUNSHINE:		SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18
										AVG	MX	2MIN						
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR
1	69	32	51	18	14	0	0.00	0.0	0	10.6	24	230	M	M	0		31	230
2	60	34	47	13	18	0	0.11	0.1	0	18.5	33	360	M	M	5	18	44	350
3	34	19	27	-7	38	0	0.00	0.0	T	15.3	33	350	M	M	2		41	350
4	41	15	28	-7	37	0	0.00	0.0	0	8.8	18	160	M	M	2		23	190
5	36	19	28	-7	37	0	0.00	0.0	0	15.0	33	340	M	M	5		43	340
6	44	14	29	-6	36	0	0.04	1.0	0	4.0	23	10	M	M	2	1	28	10
7	27	1	14	-22	51	0	T	T	1	14.0	31	10	M	M	3	1	37	10
8	45	5	25	-11	40	0	0.00	0.0	T	7.3	20	190	M	M	1		24	190
9	43	18	31	-6	34	0	0.00	0.0	T	5.5	16	30	M	M	2	18	21	20
10	49	14	32	-5	33	0	0.00	0.0	0	4.5	M	M	M	M	0		M	M
11	71	29	50	13	15	0	0.00	0.0	0	7.5	22	240	M	M	0	8	26	240
12	67	27	47	9	18	0	0.00	0.0	0	8.1	36	330	M	M	0	8	41	330
13	64	27	46	8	19	0	0.00	0.0	0	4.6	14	180	M	M	0		17	170
14	54	30	42	3	23	0	0.00	0.0	0	11.4	24	30	M	M	6		30	30
15	43	24	34	-5	31	0	0.00	0.0	0	11.4	18	20	M	M	5	8	24	30
16	40	17	29	-10	36	0	0.01	T	0	8.7	17	100	M	M	3	18	22	100
17	42	36	39	-1	26	0	0.14	T	0	6.3	15	110	M	M	10	18	21	120
18	58	25	42	2	23	0	0.00	0.0	0	10.0	28	350	M	M	2	128	32	10
19	61	22	42	1	23	0	0.01	0.0	0	5.8	21	170	M	M	2	1	25	170
20	68	26	47	6	18	0	0.00	0.0	0	13.7	24	120	M	M	0	18	32	120
21	56	32	44	3	21	0	0.00	0.0	0	15.0	30	330	M	M	3		37	330

22	45	30	38	-4	27	0	T	0.0	0	11.9	26	350	M	M	9	18	31	350
23	45	21	33	-9	32	0	0.00	0.0	0	10.3	23	310	M	M	3		29	340
24	64	19	42	-1	23	0	0.00	0.0	0	18.4	31	170	M	M	0		38	210
25	61	31	46	3	19	0	0.00	0.0	0	11.5	25	350	M	M	0		32	350
26	60	33	47	4	18	0	0.00	0.0	0	9.8	18	100	M	M	8		23	90
27	49	34	42	-2	23	0	T	0.0	0	14.7	22	30	M	M	10	18	26	40
28	51	28	40	-4	25	0	0.00	0.0	0	3.6	12	360	M	M	5	18	15	90
29	58	38	48	3	17	0	0.00	0.0	0	15.7	25	160	M	M	6	8	33	170
30	53	40	47	2	18	0	T	0.0	0	12.2	25	10	M	M	10	18	30	10
31	42	35	39	-6	26	0	0.82	0.0	0	18.1	28	350	M	M	10	13	31	350
SM	1600	775			819	0	1.13	1.1		332.2			M		114			
AV	51.6	25.0								10.7	FASTST		PSBL	%	4		MAX(MPH)	
								MISC	---->	#	36	330				#	44	350

NOTES:
LAST OF SEVERAL OCCURRENCES

COLUMN 17 PEAK WIND IN M.P.H.

PRELIMINARY LOCAL CLIMATOLOGICAL DATA (WS FORM: F-6) , PAGE 2

STATION: LINCOLN
MONTH: MARCH
YEAR: 2008
LATITUDE: 40 50 N
LONGITUDE: 96 45 W

[TEMPERATURE DATA]		[PRECIPITATION DATA]		SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY:	38.3	TOTAL FOR MONTH:	1.13	1 = FOG OR MIST
DPTR FM NORMAL:	-1.1	DPTR FM NORMAL:	-1.08	2 = FOG REDUCING VISIBILITY
HIGHEST:	71 ON 11	GRTST 24HR	0.82 ON 31-31	TO 1/4 MILE OR LESS

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LOWEST:       1 ON  7                                     3 = THUNDER
                        SNOW, ICE PELLETS, HAIL           4 = ICE PELLETS
                        TOTAL MONTH:   1.1 INCHES         5 = HAIL
                        GRTST 24HR   1.0 ON  6- 6         6 = FREEZING RAIN OR DRIZZLE
                        GRTST DEPTH:   1 ON  7            7 = DUSTSTORM OR SANDSTORM:
                                                              VSBY 1/2 MILE OR LESS
                                                          8 = SMOKE OR HAZE
[NO. OF DAYS WITH]      [WEATHER - DAYS WITH]             9 = BLOWING SNOW
                                                          X = TORNADO
MAX 32 OR BELOW:   1    0.01 INCH OR MORE:   6
MAX 90 OR ABOVE:   0    0.10 INCH OR MORE:   3
MIN 32 OR BELOW:  24    0.50 INCH OR MORE:   1
MIN  0 OR BELOW:   0    1.00 INCH OR MORE:   0

[HDD (BASE 65) ]
TOTAL THIS MO.   819    CLEAR  (SCALE 0-3)  18
DPTR FM NORMAL    20    PTCLDY (SCALE 4-7)   8
TOTAL FM JUL 1  5609    CLOUDY (SCALE 8-10)  5
DPTR FM NORMAL   -38

[CDD (BASE 65) ]
TOTAL THIS MO.     0
DPTR FM NORMAL    -1    [PRESSURE DATA]
TOTAL FM JAN 1     0    HIGHEST SLP 30.55 ON 10
DPTR FM NORMAL    -1    LOWEST  SLP 29.40 ON  2
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